

LOW COST GSM BASED AUTOMATED IRRIGATION SYSTEM USING ARDUINO AND SENSORS

Submitted in partial fulfillment of the requirements for the award of
Bachelor of Engineering in Electronics and Communication Engineering

By
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**DEPARTMENT OF ELECTRONICS AND
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SCHOOL OF ELECTRICAL AND ELECTRONICS ENGINEERING**

SATHYABAMA

**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

**Accredited with Grade "A" by NAAC | 12B Status by
UGC | Approved by AICTE**

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BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of **ANUMOLU SUJITH KUMAR(37130031)** and **KALISSETTI BALARAJU(37130043)**, who carried out the project entitled "**LOW COST GSM BASED AUTOMATED IRRIGATION SYSTEM USING ARDUINO AND SENSORS.**" under our supervision from October 2020 to April 2021.

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DECLARATION

We **ANUMOLU SUJITH KUMAR (37130031)** and **KALISSETTI BALARAJU (37130043)**, here by declare that the Project Report entitled **LOW COST GSM BASED AUTOMATED IRRIGATION SYSTEM USING ARDUINO AND SENSORS.** is done by us under the guidance of **Dr.V.BALAMURUGAN,.M.Tech.,Ph.D** is submitted in partial fulfillment of the requirements for the award of the degree in Electronics and Communication Engineering.

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ABSTRACT

The aim of this project presents a Low Cost GSM Based Automated Irrigation System Using Arduino, Sensors and GSM Module. We use GSM Module so the Module sending the data to the Thing-speak server where it acts as front end to observe the sensor dynamic values and we can check the status of the water pump. It also acts as back end to store the data. The prototype is design in such a way that it will pump the water into the field as per our requirement depending on the weather conditions. The sensors used in the system are DHT11 Sensor(for sensing both humidity and temperature), Water Flow Sensor, Soil Moisture Sensor and Rain Sensor.

CONTENTS

CHAPTER No.	DESCRIPTION	PAGE No.
	Abstract	V
	List of Figures	VIII
	List of Tables	X
	List of Abbreviations	X
1	Introduction	1-2
	1.1 Objective	2-3
	1.2 Existing System and Proposal System	3-6
	1.2.1 Existing system	3-4
	1.2.2 Proposed system	4-6
2	Literature survey	7-11
3	Aim and Problem Domain	12
	3.1 Aim	12
	3.2 Problem Domain	12
	3.3 Implementation	12
4	Materials and Methods Used	13-51
	4.1 System Requirement	13
	4.1.1 Functional requirements	13
	4.1.2 Non-Functional requirements	14-15
	4.2 Software Quality Attributes	15-16
	4.2.1 Feasibility Analysis	16
	4.2.2 Risk Analysis	16

CHAPTER No.	DESCRIPTION	PAGE No.
	4.3 External Interface Requirement	16
	4.3.1 Hardware Interface	16
	4.3.2 Software Interface	16
	4.4 Arduino and Micro-Controller	17-25
	4.5 Global System For Mobile Communication	25-33
	4.5.1 Sim800GSM/GPRS module	29-33
	4.6 Liquid Crystal Display	33-39
	4.7 Sensor's Description	39-42
	4.8 Arduino Software IDE	42-52
	4.9 Embedded C	52-54
	4.10 Thing-speak Server	54-57
5	Result And Limitations	58-63
	5.1 Result	58-63
	5.1.1 Sensor testing	58-60
	5.1.2 Sensor Values Displayed in Server	60-61
	5.1.3 Alert Messages	61-63
	5.2 Limitations.	63
6	Conclusion And Future Works	64
	References	65-66

LIST OF FIGURES

FIGURE No.	DESCRIPTION	PAGE No.
Fig 1.1	Experimental Flow Of The Project	5
Fig 4.1	Arduino UNO	20
Fig 4.2	Cellular Subscriber Growth Worldwide	26
Fig 4.3	GSM Network	27
Fig 4.4	GSM Module	29
Fig 4.5	LCD Display	33
Fig 4.6	Internal Structure Of a LCD	29
Fig 4.7	16x2 LCD pin out diagram	34
Fig 4.8	Pin Layout Diagram	37
Fig 4.9	Soil Moisture Sensor	39
Fig 4.10	DHT11 Sensor	40
Fig 4.11	Water Flow Sensor	40
Fig 4.12	Rain Sensor	41
Fig 4.13	Relay	41
Fig 4.14	Dc Pump	42
Fig 4.15	Open Arduino IDE	43
Fig 4.16	Select Required Board	43
Fig 4.17	Select The Port	44
Fig 4.18	Compile The Sketch	44
Fig 4.19	Upload The Sketch	45
Fig 4.20	Work Space	46
Fig 4.21	File In Arduino IDE	47
Fig 4.22	Edit In Arduino IDE	48

FIGURE No.	DESCRIPTION	PAGE No.
Fig 4.23	Sketch In Arduino IDE	48
Fig 4.24	Tools In Arduino IDE	48
Fig 4.25	Help In Arduino IDE	49
Fig 4.26	Upload In Arduino IDE	50
Fig 4.27	Managing Libraries	51
Fig 4.28	Embedded System Program Representation	52
Fig 4.29	Block Diagram Of Embedded c	53
Fig 4.30	Thing Speak Server	55
Fig 4.31	Create Account In Thing Speak	55
Fig 4.32	Create New Channel In Thing Speak	56
Fig 4.33	Select Required Fields	56
Fig 4.34	API Keys In Thing Speak	57
Fig 5.1	Soil Moisture Sensor Testing	58
Fig 5.2	Rain Sensor Testing	58
Fig 5.3	Water Flow Sensor Testing	59
Fig 5.4	DHT11 Sensor Testing	59
Fig 5.5	Relay Testing	60
Fig 5.6	Displaying Sensor Values In Server	61
Fig 5.7	Alert Messages	61
Fig 5.8	Developed Model	56

LIST OF TABLES

TABLE No.	DESCRIPTION	PAGE No.
TABLE 1.1	Comparison table for Existing System and Proposed System	6
TABLE 2.1	Comparisons Of Existing Systems	10
TABLE 4.1	Pin Specifications	31
TABLE 4.2	X2 LCD PIN OUT TABLE	35
TABLE 4.3	Important Command Codes For LCD	38
TABLE 4.4	Work Space Buttons Table	46
TABLE 5.1	Result Table	63

LIST OF ABBREVIATIONS

MSC	Mobile Services Switching Center
EIR	Equipment Identity Register
DC	Direct Current
LCD	Liquid Crystal Display
GUI	Graphical User Interface
OSS	Operation And Support System
MTBF	Mean time between failures
AMPS	Advanced Mobile Phone Service
SS	Switching System
GSM	Global System for Mobile Communications
VLR	Visitor Location Register
GPRS	General Packet Radio Service
HTTP	Hypertext Transfer Protocol
NMT	Nordic Mobile Telephone
BSS	Base Station System
AUC	Authentication Center
MQTT	Message Queuing Telemetry Transport.
SMS	Short Message Service

CHAPTER 1

INTRODUCTION

Day by day, the Smart Irrigation System Technology is getting advanced in its field. Worldwide, Agriculture is playing a main lead for mankind. Most of the people in India rely on vital part of agriculture. In previous days, farmers were dependent on the mills to irrigate the farm land by old methods where they irrigate without knowing the appropriate quantity of the crops. These old and conventional methods doesn't use natural resources like water properly and also destroy some crops due to lack of irrigating field properly.

Recent times in India, farmers are using irrigation technique where the person itself has to irrigate the land time to time. In such case, sometimes we may have wastage of water. If we have irrigation system which runs automatically, there we can supply required amount of water without any wastage. It requires more time to irrigate a farm land when we can save our time by making it automatic.

In recent times, advanced technologies are used to reduce the human efforts and also to reduce the time consumed to irrigate the farm lands. Water is one among them which is wasted excessively. One of the methods is Mass irrigation which is used to water the plant. By following this method there will be large amount of water loss. Through the holes of the pot, the excess amount of water gets discharged

In this project, we will rectify the problems faced by the farmers like error in irrigating sufficient amount of water and conservation of electricity. And the errors like irrigating excess amount of water during rainy season. We will also check whether the water is flowing through the motor during irrigation, if the water flow sensor detects that the water is not flowing through the motor, we stop it automatically , there increasing the efficiency of the motor and we save electricity.

We must have to make efficient ways in creating the system to get the desired

output. Therefore, we must have great efforts to achieve it. Here the farmers should play the main lead in the advancement of the Modern irrigation system.

The need for farming products is increasing day by day while increasing in population. Further, the potentiality and ability of the farmers are reducing day by day in the agricultural field. The income in agriculture needs to continue development regarding the prediction of world population increases from 7.8 billion in 2020 to over 10.5 billion by 2051. Efficiency has become an essential demand with the decrease in the farmer's potential.

Objectives of this project are facilitated and simplify the irrigating system by installing and designing the whole automatic irrigation system and to observe all the reading of the installed sensors from home, increases field performance by reducing excess watering from saturated soil. When it is not necessary it will stop watering the field with the help of relay which is programmed accordingly.

1.1 OBJECTIVE:

The main theme of the project is to create/make an irrigation system which is automatic with the use of devices like Arduino micro-controllers and sensors that solves most issues related to agriculture and irrigation, such as efficiently saving and controlling electricity and water. Using small quantities of water, increasing agricultural production, reduce intervention manually in operations related to watering with high increase in water speed. This automated system also provides an useful and very cost efficient irrigation system which is automated. Once the system has installed has no high cost for maintenance and it's use is easy. Parameters of Monitoring of Environment system based on wireless communication system technology had been created to be remotely controlled, which gives the temperature measurement, soil parameters and rainfall. These all features make the automated irrigation system good and efficient option to be kept in mind to increase the improvement of the irrigation efficiency and agriculture.

This study's goals are to find the perfect technique of automated irrigation system, which is controlled automatically through software in such a way, where the user allowed to operate all the server's information from home.

The objectives to consider are:

Create a Low Cost GSM Based Automated Irrigation System based on Arduino, Moisture, Temperature, humidity, rain sensor and water-flow sensors.

- For coding in Arduino device, use Arduino IDE and various dependencies.
- Have a perfect research for Arduino device and its circuit.
- Proper testing and debugging of the device configuration.
- The irrigation system must be simplified by installing and designing the whole irrigation system.
- Create proper prototype of Automated Irrigation System.
- Conducting a survey regarding the project.
- Provide the proper value of Moisture, Humidity, Temperature and Rain.
- We have to save energy, which allows the smart irrigation system's application to be used more than other applications.
- Reduce water consumption.
- System must be fully automated.
- Cost of operation must be reduced.
- System must be made easy to be used by farmers.

1.2 Existing System and Proposal System

1.2.1 Existing System

In the present system, to send the exact field condition GSM Module is used, and the data is transferred to the owner in SMS but we can't observe the dynamic sensor readings. It also controls the DC Pump with the help of soil moisture sensor,

but it couldn't able to detect the water flow, where there will be a loss in electricity if water is not flowing through the motor. They are programmed in such a way that, they will work according to the weather conditions with the help of DHT11 sensor(It can detects both temperature and humidity) but which are not accurate at some certain conditions.This system does not required any human effort but it fails the efficient consumption of electricity.

1.2.2 Proposal System

This project is actually an irrigation system which is worked automated, mainly focused to for use of water and electricity efficiently. It is programmed to sense the moisture, rain, humidity, temperature with the respective sensors. Here, if the reading of the moisture level is low than the predefined value, then the pump will automatically switches on with the help of Arduino to pump water to the farm field, when system detects moisture content in a sufficient amount in the soil, water pump gets OFF automatically. Whenever module switches the pump OFF or ON, a Data will be delivered to the thing speak server through the GSM module, the user can observe the sensor dynamic values and check the water pump status using thing-speak server and the notification send to the user in the form of SMS. So, it is an Automatic Plants Watering System. There already exist so many smart water system that irrigates.

plants, with supporting soil moisture. These types of system are very much essential for the high productivity of soil for Big Agricultural Industries. In future days, these types of system will play a great role in simple farm lands like in house premises, office premises and in garden areas, where the system waters the plant whenever it is required. We also install a water flow sensor to the motor, so when water doesn't flow through it, the motor will stop automatically.

BLOCK DIAGRAM

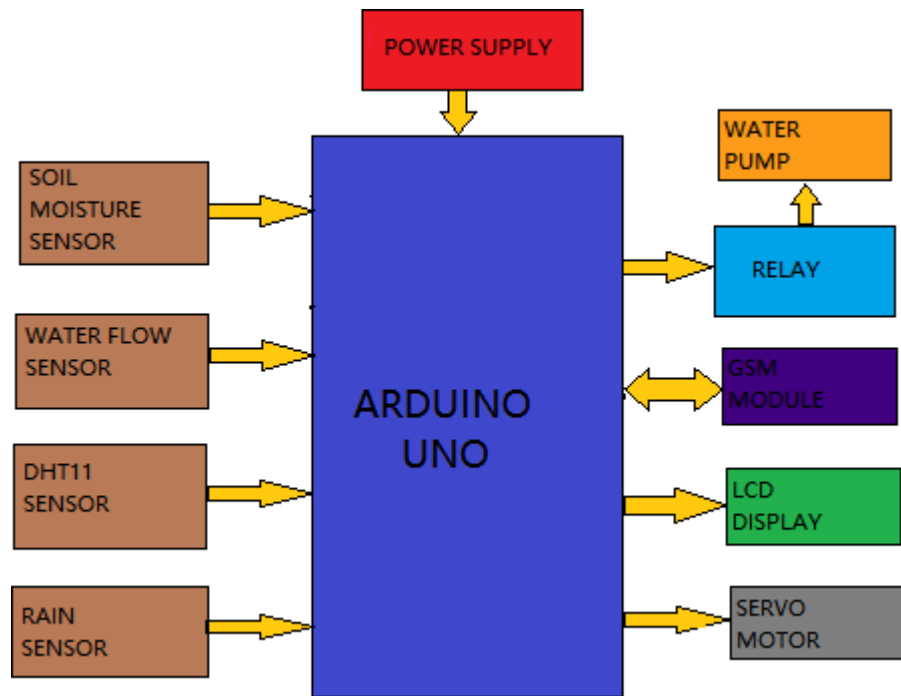


Fig 1.1 Experimental Flow of the Project

To achieve the exact project objectives we are shown that using Arduino as the operating system in this project is the best choice, it contains many open source hardware and software.

Hardware requirements:

- Arduino UNO
- LCD Display
- GSM Module
- Soil Moisture Sensor
- DHT11 Sensor
- Water Flow Sensor
- Rain Sensor
- Relay
- DC Pump

- Servo Motor

Software Requirements:

- Embedded C
- Arduino IDE
- Thing-Speak

Table 1.1 Comparison table for Existing System and Proposal System

EXISTING SYSTEM	PROPOSED SYSTEM
In the existing system they use only less number of sensors. So the accuracy is very low and the system we have now cannot detect the water flow and the PH value of water weather it is suitable for irrigation.	In the proposed system, we can monitor as well as control the system and check the status of the sensors. The system which implement to detection of water flow in DC pump.
Drawbacks of existing system	Advantages of proposed system
Water flow in DC pump check manually.	The system can be operated automatically using sensors.
The system didn't detect the weather	We can check the real time status of sensors.

CHAPTER 2

LITERATURE SURVEY

2.1 GSM Based Automated irrigation system: An Efficient Water management.

Author: Kushanav Das .

The system that presents a wise irrigation system appropriate to be used in places wherever water inadequacy could be a challenge. These kinds of typical irrigation system had many issues like increase in work of farm labor and infrequently it result in downside like excess-irrigation and activity of soil. good irrigation system is thereby believed to be a serious answer. therefore here creating GSM primarily based automatic Irrigation System victimization Arduino, that mechanically provides water to crop field and keep farmer updated by causation message to telephone.

2.2 GSM Based Irrigation System

Author:Arjun Dutta, Poulami Paul, Rahul Agarwala, Abhisikta Chakraborty.

The system which will irrigate the farm field automatically with the help of Arduino, which is pre-programmed. Here the Arduino board is connected to a moisture sensor of soil which will detect the level of moisture in soil. If the moisture sensor of soil detects a less moisture level in the soil, automatically the water pump will irrigate the soil at a accurate amount. A cellular communication system will be executed by GSM (Global System for Mobile Communications). Programmed messages are sent to the actual owner or the farmer whenever it is needed, where the farmer can observe the plant's condition from home.

2.3 Automatic Irrigation System Using Arduino

Author: Amisha Mishra, C. Ashwini, Shruti Duggal, Diparna Adhikary.

The system that relies on an automatic system that is employed for watering plants. The system provides water to the plant automatically once it's needed. The

soil moisture will sense the moisture content of the soil. Water conducts electricity, therefore less resistance implies that there's water present within the soil. Whenever there's additional resistance, it means that there's less water within the soil.

2.4 Arduino Based Water Irrigation System.

Author: Shruti Bansod, Rishita Jaiswal, Priyanka S, Prajakta S, Prof. Dr. Sachin Sawant

The system of automatic water irrigation system, wherever he has used 2 moisture sensors which is able to browse the moisture value of the soil by taking its resistance value. He has used the sensors in analogue mode therefore it'll reads the values from 0-1024. Then He has taken mean of the values reads by each the sensors, which is able to be then compared to threshold value. Threshold values area unit determined by testing the sensors many times. If the value reads by the sensors satisfies the condition for moisture, the relay can activate pump. If the value reads by the device satisfies the condition for moisture, the relay can shut down the pump.

2.5 Smart Irrigation System Using IOT And Raspberry Pi

Author: Prof. Priti Rajput, Prof. Asif Shaikh, Ms. Swapnali , B.Pawar .

The system wherever soil-moisture sensing element and temperature sensing element are installed within the root area of plants, system will distribute this data through the network. Here, main part of system is Raspberry pi where the digital camera is having a interface with it via Raspberry pi. Python artificial language is employed for automatic purpose. This system may be a wireless sensors network and a base station of wireless which might be accustomed offer the data of the sensors to irrigation system to be automated. The system will use the sensing elements like soil wetness sensing element and temperature of soil sensing element. This model is design in such a way that, if either wetness of soil or temperature readings cross a defined strength, the irrigation system is automatic, the relay connected to raspberry

pi can activate or OFF the motor. The planned paper gift AN economical, fairly low cost and straightforward automatic irrigation system. this technique once put in it's less of maintenance value and is simple to use. By exploitation the digital camera with appropriate application on itinerant we cansimply on-line observance the particular state of affairs of the sector and sensors like soil wetness and temperature are accustomed offer the knowledge concerning changes happens within the field. it's a lot of advantageous than the standard agriculture techniques.

2.6 Smart Water Dripping System for Agriculture/ Farming.

Author: Sushmita Mitkar, Deepali Javale, Sonal Mahajan, Priyanka Padalalu, Kartikee Dabir

The system to regulate the supply of water to the farm fields, to decrease human efforts, to create a smart irrigation system, efficient and autonomous. We found that the per capital availability of water in India has reducing trends, so, we must need a Smart irrigation system for efficient use of water.

2.7 Implementation of an Automated Irrigation System

Author: U N V P Rajendranath,Dr. V. Berlin Hency.

The system, where the sensors will start working when the Arduino is supplied with power. Temperature and Humidity of the roots of the plants will be sensed by DHT11 Sensor and on the other side wet sensor will detect the moisture level of the sensor. Micro-controller is programmed in such a way that it will run the system according to the weather conditions and work as per the requirement. When the value read by sensor is less than threshold value then the values will be displayed in the LCD Display through Micro-controller. When the value read by the sensor is not less than the threshold value then the user will get a alert message to his mobile phone through the micro-controller even if he is far away from the area.

Table 2.1 Comparisons Of Existing Systems

System	Moist ure Sens or	Temper ature & Humidit y Sensor	Wate r Flow Sens or	Rain Sens or	Rela y	GSM Modul e	OTHER S
Implementation of anAutomated IrrigationSystem	YES	YES	NO	NO	YES	YES	--
Arduino Based Water Irrigation System	YES	NO	NO	NO	YES	NO	--
Automatic Irrigation System Using Arduino.	YES	NO	NO	NO	YES	NO	WIFI MODU LE
Smart Water DrippingSystem For Agriculture/ Farming	YES	YES(O NLY TEMP)	NO	NO	YES	NO	IOT MODU LE
Smart Irrigation System Using IOT And Raspberry Pi	YES	YES (ONLY TEMP)	NO	NO	YES	NO	WIFI MODU LE, WEB CAMP
GSM Based	YES	YES	NO	NO	YES	YES	--

Automated IrrigationSystem: An Efficient Water Management		(ONLY TEMP)					
GSM Based IrrigationSystem	YES	NO	NO	NO	YES	YES	--
Low Cost GSM Based Automated Irrigation System Using Arduino And Sensors.	YES	YES	YES	YES	YES	YES	--

CHAPTER 3

AIM AND PROBLEM DOMAIN

3.1 AIM :

This project is to create Low Cost GSM Based Automated Irrigation System Using Sensors based on Arduino which help us to monitor moisture, humidity, temperature, water-flow and rain through server from home and irrigates accordingly.

3.2 PROBLEM DOMAIN :

Many country's economy depends on agriculture. If the best quality is to be achieved from this research, to focus on some important characteristics is important such as the use of electricity in appropriate way as well as a good schedule for crops to get irrigation and water supply. Problems are faced by farmers to reach these quality standards, mainly those who are living in poverty. This idea gives importance on developing an irrigation system which is automatic that could be observed through a server from home itself. The idea of the system is to minimize the workers in numbers in a field of crops, save and control electricity and water, Agricultural production needs to be increased using water in small quantity. These all features make the research a good sustainable option to consider to have good improvement in the irrigation efficiency and agriculture.

3.3 IMPLEMENTATION :

The Arduino connected with the required sensors, then run the system. First of all, the main screen of the system will be opened with thing-speak server where we can observe what's happening on the field. The system will check if all the device are connected and are at good condition. If they are on link then it notifies the user that device is linked properly or else notifies the user that the device is not connected or not working properly. The system must be properly installed in the field. In the Screen user can see all the details related to the system in whole Example, if it is raining today , user can able to see how much amount of water is flowing into the field, and if water is not flowing through the motor, did motor switched off or not.

CHAPTER 4

MATERIALS AND METHODS USED

4.1 SYSTEM REQUIREMENT

For a project, it is must that we should have right equipment at right cost to get the desired system. So, before that we should have a good idea and plan to implement the project.

4.1.1 FUNCTIONAL REQUIREMENTS:

Functionality and features of system will be described by the functional requirements. The operations recorded by the Functional requirements that must be done. The following are the Functional requirements.

If the condition of moisture is dry, the rain sensor will be checked if there is rain by the system, it will be in off state because when there is rain, we need not to irrigate, or else system will check the humidity sensor with the temperature sensor, if it is high temperature on the day and if there is low level of humidity as well, the system will be in off state because due to high temperature evaporation of water will take place.

If there is no rain and the temperature is low but the condition of moisture sensor is dry then the controller will get a signal to open the pump and valve. If there is high in humidity percentage then half of the water will be irrigated by the system, because there may be a case of rain on that day, and the remaining water on the next day depends upon the rain fall.

If water doesn't flow through the motor then the motor will shut down automatically as the water flow sensor doesn't detect any water flow and send notification to the user through the server and through message to mobile device.

4.1.2 NON-FUNCTIONAL REQUIREMENTS:

Easy to implement

There must be easy installation of the materials which are required for this project, to implement a successful project. To become more effective, the materials must be easy to each other to be connected. And also, there must be easy replacement of the materials, if any damage.

Open source

The open-source controller is used for this project, so the hardware used is of high price and has development software in free.

Strength

There must be strong tools needed for this project for long time operation to achieve the success we desire. We have to save money to reach a great goal.

Quality

There must be excellent quality of tools needs to be build this project to run for a long period of time. It is very much important to select quality materials to avoid wastage of money and to neglect the technical problems faced by the devices. To achieve the desired success of this project, excellent quality is required for this project.

Modifiablility

Based on its ease of modifiability, the materials are to be chosen, as its normal to come across connections and designs. Also, to be easy to modification required in the future replace.

Communication

To get a good communication of data of the crop field to home through a message, GSM module is used in this project.

Accuracy

There must be a detailed reading of all data because for analysis and research it will be delivered to display to a computer system .

Performance

This system should work in the real-time.

Operational

This system works automatic and it is connected to a server through wifi module so the user must have access to server to observe the readings.

Cost

Materials required for this system must not be expensive because we are targeting to reduce the workers where we can decrease the amount required for irrigation and solve the problem (decrease the water consumption and electricity) at the time.

Security

The agenda of the system which takes care that the system must be protected from the malignant harm.

Performance

The way in where the performance meet by the system targets, is clearly and explicitly is to be specified. It might not need anything specifically for its simple operation, but there may be a performance requirements for the complete system along with the components connected.

User-friendly

Here, the user-friendly device is Graphical User Interface (GUI).

Usability

It determines how hard it is to use the system and to learn.

Availability

Availability means for how much long the system will be operational and for how much long the system is available for the users.

Reliability

It says how the software often fails. The calculation is determined in Mean Time Between Failures (MTBF). Before the deployment, the system is completely tested. Data consistency is thus maintained with the module developed.

4.2 Software Quality Attributes:

Some added attribute and quality of system is very much important for the developer's a like test ability, correctness and usability. By developing the product usability can be obtained as user-friendly. Proper attention and correctness responsibility should be given during coding and design. For long life of the product,

Maintainability and testability plays an important role.

4.2.1 Feasibility Analysis:

The purpose of practically proposed system or project is called Feasibility analysis.

Schedule Feasibility:

By the beginning of the semester, the project's development was planned to reach designing phase which gives a three months duration. This was enough time to get the end product and the software in working version

4.2.2 Risk Analysis

One of the main factor we must consider is, we have to overcome the risks faced by the system in certain cases.

Performance Risk:

Whenever the system is ON, we may get a constant/different value if any sensor got damaged. It will effect the efficiency of the motor, mainly when Water Flow Sensor gets damage.

Safety Risk:

The risk is on the user data with the system. The data of the user may be depraved and/or lost due to improper storage and management. This needs to be handled by using the document which are dependable in the back end to store the data of the user.

4.3 EXTERNAL INTERFACE REQUIREMENT:

4.3.1 Hardware Interface:

People and Technology are connected through physical binding by Hardware interface. With the hardware resources, the system will collaborated. The design will shape the connection between the technology and user.

4.3.2 Software Interface:

The software which we used that's the Thing-speak server stores and displays the data. We have also used Embedded C to program the Arduino.

4.4 ARDUINO MICRO-CONTROLLER

INTRODUCTION TO ARDUINO

The Arduino is like FPGA we can upload any program and use it accordingly. It is a user-friendly the user can use one Arduino board for different purpose. Arduino uses different processor's the main processor used in most of the boards are ATmega328, this processor contains 28 pins and it is like a CPU for system.

The Arduino uses DC power supply 5v and the Arduino UNO micro-controller having 2 KB SRAM so the UNO board having limitations. According to your project you can choose different types of board. It has 32 KB flash memory when ever the program lode from IDE stored in flash memory.

The Arduino UNO has 1 KB of Electrical Erasable Programmable Read Only memory, and it stores the data whenever the device is reset. It has runtime memory of 2 KB.

The Arduino UNO having digital and analog pins. Digital pins is used for digital data and for displaying the data in LCD. The analog pins is used for reading the sensor data.

WHY ARDUINO ?

It is a user friendly the user can able to code on there own and dump the code to Arduino board for particular use Arduino is used in n number of projects and these Arduino can act as micro-controller so it works on particular task when the user wants to use the Arduino board in other project then the user needs to upload the different code in Arduino board. The Arduino IDE is very flexible to use and these IDE run on most of the platforms like Macintosh , Windows and Linux. The Arduino is use to build the projects and also build the scientific instruments for proving the principles in chemistry and physics and for creating a small robots and one can design and build a prototype for particular task. Arduino boards can install in musical instrument. Arduino is used to build many of of the projects exhibit Arduino kit is used for beginners having instructions and one can use their ideas to implement the project.

There are many micro-controllers and platforms for computing the physically by the user can refer the MIT's Hand board, and Parallax stamps and we have many online resources. In the micro-controller the program is easy to understand and the Arduino simplify the processing while working with micro-controller. Due to this the user can use the Arduino IDE Freely and the user get interest while work with Arduino and the Arduino is user friendly.

Inexpensive - Comparing to all other boards the Arduino boards are very less expensive the Arduino micro-controller is very less expansive then other boards. The pre-assembled boards are cost is less around 1000Rs the UNO is the basic board the user can start with this board.

Cross-platform -The Arduino IDE is running on any platform like in Macintosh, windows & Linux. The other micro controllers are mostly limited to Windows in Macintosh and Linux those micro controllers are not worked.

Simple, clear program environment - The IDE is an open source and easy to use for beginner, the Arduino is most flexible for the advance users and the user can able to advantage for learning about Arduino. It is more use for students by learning these type of environment and familiar also student can learn how to work with IDE.

extensible software & Open source - The Arduino IDE is a Free software and it is user friendly. It is open source tool any one can use the tool and make it useful the language used in Arduino IDE is Embedded C. The Embedded c is extends from C and C++, they are numerous library files the user can access and make it useful the Arduino having AVR C programming language it is more similar to the AVR code directory

extensible hardware & Open source - The IDE or source is publish under a CCL. So the experienced designer can create their own Circuit design and use it accordingly. The inexperience user can the board using bread board and then if it works the the user can build standard board..

ARDUINO UNO:

Arduino UNO is one of the board in the Arduino boards. Arduino UNO can control the physical applications like Washing Machine and reduce the human effort. The Arduino is like FPGA we can upload any program and use it accordingly. It is a user-friendly the user can use one Arduino board for different purpose. Arduino uses different processor's the main processor used in most of the boards are ATmega328, this processor contains 28 pins and it is like a CPU for system.

The Arduino uses DC power supply 5v and the Arduino UNO micro-controller having 2 KB SRAM so the UNO board having limitations. According to your project

you can choose different types of board. It has 32 KB flash memory when ever the program lode from IDE stored in flash memory.

The Arduino UNO has 1 KB of Electrical Erasable Programmable Read Only memory, and it stores the data whenever the device is reset. It has runtime memory of 2 KB. The Arduino UNO having digital and analog pins. Digital pins is used for digital data and for displaying the data in LCD. The analog pins is used for reading the sensor data.

Overview

The Arduino micro-controller is an easy to use. The Arduino is like FPGA we can upload any program and use it accordingly. It is a user-friendly the user can use one Arduino board for different purpose. Arduino uses different processor's the main processor used in most of the boards are ATmega328, this processor contains 28 pins and it is like a CPU for system.

The Arduino uses DC power supply 5v and the Arduino UNO micro-controller having 2 KB SRAM so the UNO board having limitations. According to your project you can choose different types of board. It has 32 KB flash memory when ever the program lode from IDE stored in flash memory.

This is what the Arduino board looks like.



Fig 4.1 Arduino UNO

The Arduino UNO has 1 KB of Electrical Erasable Programmable Read Only memory, and it stores the data whenever the device is reset. It has runtime memory of 2 KB.

The Arduino UNO having digital and analog pins. Digital pins is used for digital data and for displaying the data in LCD. The analog pins is used for reading the sensor data.

The Arduino IDE is a free software, so anyone can use this software in this software we use embedded c for coding, and this software is user friendly and the user can check the output readings in a serial monitor.

This Arduino IDE software only interfaced with Arduino micro-controller boards. The IDE contain a code editor where the user can write the code and check for errors than the user need to check the port is connected or not then upload the code to Arduino micro-controller board.

In every Arduino boards having two LED's for TX and RX when the program is uploading both LED's blink. If the program upload then the LED's for RX and TX will stop blinking. If the program is not uploaded the we got an error message in below message box.

The Arduino(IDE) or Arduino Software when we write programs using IDE called as sketches. These programs written in Embedded C and in Arduino IDE Having a text editor where we write the programs and save these programs with the help of file extension called **.ino**.

4.4.1 Summary:

- The micro-controller is operated in 5 volts.
- Arduino can withstand 6-20 volts but in above 12 volts the board gets heated up.
- The Arduino UNO having Fourteen digital pins and Six analog pins.
- The Arduino board only work with DC voltage.
- The Arduino board having 32 kilo bites of memory with in these memory the boot loader takes 0.5 kilo bites of memory and it has 2 KB static RAM and EEPROM of 1 Kilo bites.
- The Arduino Clock Speed is 16 MHz.

4.4.2 Pin Configuration

The Arduino UNO is having a USB type A/B connector for powering the Arduino and we can use Vin pin for giving external input.

Most of the external power in AC so We have to convert Analog current to Direct current or we can directly use 5 volts battery positive in Vin pin and negative in ground pin. The type A/B is connected to board's power jack directly to the adaptor.

The Arduino board can operate from 6 to 20 volts. But the Vin pin is supply only 5 volts to board but when the sensors are more and these sensors are interfaced with Arduino then the performance gets decreases. If the user use more then 12 volts then the board get aver heated and burn the components on the board.

The Arduino Main pins are follow:

VIN. The Vin pin is an external power supply pin when the user use different Arduino Boards then few Arduino boards are not having USB port on that time the user can

use these Vin pin for power supply.

5V. The 5 volts pin is used for sensors and it is a output pin the board can supply only 5 volts to the sensors. Most of the sensors work in 5v so the 5 volts output pin is enough to supply the power to sensors.Few sensors can work in 3.3 volts the Arduino board having both 3.3 and 5 volts output pins.

3V3. the 3.3 volts is used for LED and Few sensors. The Arduino board having an on board regulator With the help of on board regulator the board supply 3.3 volts.

GND. The ground pin is used for connecting all the sensors as a common ground We have 3 ground pins in Arduino UNO.

IOREF. The IOREF pins is a input output voltage reference pins so the micro-controller operates and configured the shield so that the IOREF pin voltage read by shield and the user configure the required power source.so the outputs 5 volts and 3.3 volts work properly.

Memory. The processor ATmega328up has 32 kilo bites of memory and with in these 32 KB the boot loader uses 0.5 kilo bites of memory.The Arduino has 2 Kilo bites of static Ram and 1 kilo bite EPROM.

Output and input. The digital pins are used as both I/P and O/P pins with the help of functions like pin Mode(input/output), digital write and read. All the input and output pins are operated in 5 volts and the current receiving in these pins are maximum of 40 mA.These pins having resistance up to 50 kilo ohms. And some pins mark with tilde those are use for approximate values.

Serial:

These Serial pins used to transfer the data from one board to other board like TTL Serial chip to USB

Interrupts:(External 3 and 2). These pins are configure as trigger pins so these pins is used for triggered sensors like water flow sensor works in pulse. We have the edges for both rising and falling.

PWM: It Provide an analog wire function where it has 8 bit PWM.

SP: These SCK, MISO, MISI, SS pins support for SPI communication using library.

LED: 13. LED and 13 pin are inter connected as 13 pin is 1 then led is switches on and when the 13 pin is 0 then led pin is Switches off.

There are six analog pins in Arduino UNO and they are labile with the prefix “A” every analog pin has 10 bits resolution so these analog pins can read the values in bit range from 0 to 1023 bits. These analog pins by default they are low or 0 volts. Possible to change the values to upper end and we have a AREF pin and also having analog reference.

TWI: The TWI is used for communication and it used a wired library.

AREF. It is a analog input reference voltage.It gives the voltage for analog inputs.

Reset. This button is used to run the program from start. It is also used to restart the code when the code is not working.

APPLICATIONS:

- There is a game console using Arduino. The game console called as Arduboy
- Using Arduino there is a MIDI controller for mimics the Monome called Arduinome
- Using Arduino there is a drone called Ardupilot.
- Using Arduino there is a cube sat called ArduSat.
- There are many robots using Arduino boards and C-STEM studio is one of the platform for integrated learning.
- Most of the cars use Arduino for onboard diagnostics called OBDuino.

4.5 GLOBAL SYSTEM FOR MOBILE COMMUNICATION

The Global system for mobile communication (GSM) is a most popular mobile radio communication system. It is one of the exponentially developing telecommunication systems established in 1982. It will develop an European mobile standard and the basic communication system will operate in 900 MHz. Then many countries joined and partnership with GSM and started cellular radio communication.

THE EVOLUTION OF MOBILE TELEPHONE SYSTEMS:

The Mobile radio communication is one of the fastest growing telecommunication application. The percentage of telephone subscribers are increased day by day. In 2009 the article shows that there are 8.3 billion subscribers use cellular communication in world wide. The phones are evolving day by day. From 2010 onwards the phones are updated and more than 70 percentage use phones these will be increase further. The cellular communication is increased from past decay and now 4G with HD voice call.

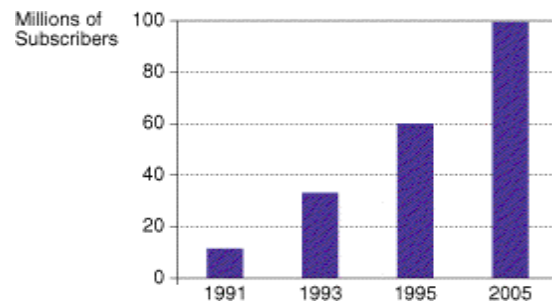


Fig 4.2 CELLULAR SUBSCRIBER GROWTH WORLDWIDE

The mobile service concept is using of transmitters of less-power where reuse of frequencies of geographic area can be within. The mobile radio idea of mobile-based service in the US was formulated in 1970 at Bell Labs. The countries of Nordic were the first to start mobile services for use in commercial with the Nordic Telephone's (NT) introduction in early 1980.

In 1983, the US the Cellular systems began through the introduction of the advance Telephone phone service (ATPS) system. By Asia, the ATPS standard was adopted, Latin Oceanic countries and America, create the market in a largest market in the cellular world.

In early times of introduction mobile and maximum of cellular telephones were analog but not digital, today's new technology of recent time systems. The main problem is to face systems in analog was unavailable to manage the efficient growth required in a manner in less-cost. So the result, welcoming the today's technology took place. The advance systems in digital is more then analog systems including signaling ease, lower standards of interference, integration

THE GSM NETWORK:

The GSM recommendations is provide,not requirements. The GSM specifications says that requirements and the functions of interface in detail but hardware need not

to be address. Main idea is to keep the creators limit as suitable but also do it that happens for the equipment to be bought by the operators from some other suppliers.

It is mainly divided into 3 major systems:

- 1) BSS
- 2) SS
- 3) OSS

These network elements are shown.

GSM NETWORK ELEMENTS:

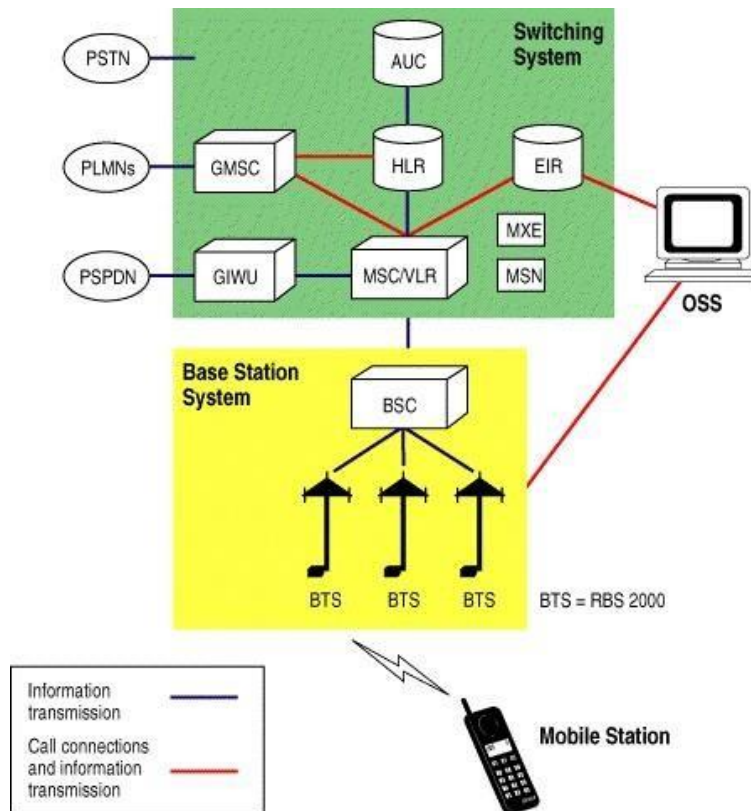


FIG 4.3 GSM NETWORK

THE SWITCHING SYSTEM:

It is required for subscriber-related functions & call processing to perform.

This system that includes the following units.

FUNCTIONAL UNITS:

The functional unit is a back end support used to manage the subscriptions and store the data. It is one of the main important databases, as it has the capability of storing the data permanently for users and store their profile of user and their status. When a person buys SIM from an operator of PCS, then the Home Location Registered.

Mobile services switching center (MSC)

The MSC makes the switching functions for telephones in the system. Calls are controlled by the MSC other data systems and telephone. Such functions are also performed as network interfacing, toll ticketing, channel of common signaling, and others.

visitor location register (VLR)

It is a back end support where non permanent details about users are contained that is required to service from the MSC users visit. The MSC is every time is related with the VLR. If there is a roaming in the station then it send to MSC areas, the MSC related to the particular VLR will ask data from the station in HLR. Later, we get a intimation from mobile station, the VLR have the exact details required from user to setup without a require to interrogate from the HLR.

Authentication center (AUC)

AUC gives encryption parameters, authentication that will verifying the identity of the users and make each call confidential. The AUC saves operators from various frauds in Mobile communication world of today.

Equipment identity register (EIR)

It is a Back end support that contain of the mobile equipment's that identify the fraud calls and prevent them, or the stations which are defective and unauthorized. The EIR and AUC are used as a combined EIR/AUC node or as nodes of stand-alone.

SIM 800 GSM/GPRS MODULE

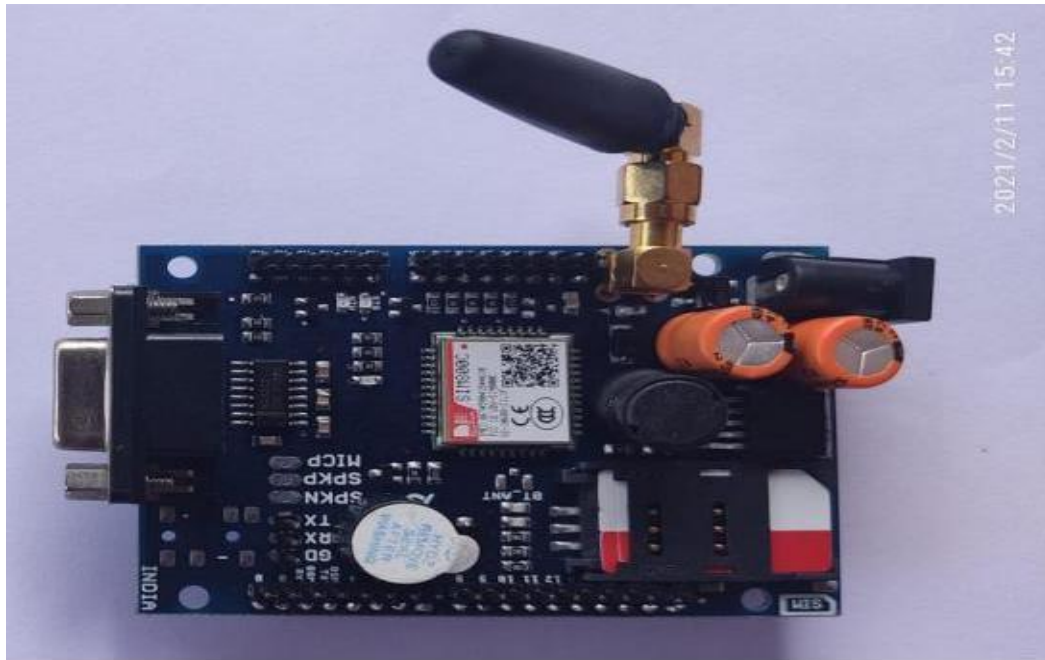


FIG 4.4 GSM MODULE

A GSM module works with the help of AT commands, and the GSM is mainly use for communication, an SMS and the data transfer. Here we use a gsm800c it has a Quad-band GSM/GPRS. The user can used for the custom applications. This module is a sub-system, and we can use it for the cellular IOT applications. With the help of different AT commands one can send the data and receive the data, and we can check the registration status, a pin code for the sim status, a connection status and check it is connected the single or multi IP connection. The GSM module uses the 12v power supply, and it has dual-band for GSM 900MHz and for GPRS 1800MHz. It has an inbuilt TCP/IP protocol so the data can transfer through internet over GPRS band. This module can connect with a micro-controller with the help of a trans-receiver pins.

FEATURES:

- The GSM module works 900 MHz and GPRS module works 1800 MHz.
- The RS232 interface is mainly used to for communication with computer or by using MCU kit and it can be configurable for baud rate.
- The GSM module can have power controller IC for ESD compliance.
- The GSM module having Earphone socket for answering calls.
- The GSM module having antenna so that the sim get signal.

POWER MODES:***Power down mode:***

- SIM800C having a commands like AT commands We use “AT+CPOWD=0” is used for power down mode.
- The GSM SIM800C having two modules for low consume power.

Minimum Functionality Mode:

- The GSM has Minimizes the current consume using minimum functionality mode.
- The command for minimum functionality is “AT+CFUN=0”.
- The command for full functionality is “AT+CFUN=1”.
- The command for disable both functionality is “AT+CFUN=4”.

Sleep mode:

The GSM can be controlled by user when the sleep mode is activated and when the sleep mode is disable by customer preferences. When the DTR is high then the GSM is Automatically goes to sleep mode but GSM can able to receive message from network but it is no use because the serial port is disable.

Wake up SIM800C from sleep mode:

The GSM can be Wake up using DTR pin. The DTR pin is very low then the GSM is Wake up. With the help of DTR signal is Wake up GSM from the power saving mode. When the DTR Pin change to low level then the serial port is activated.

There are other ways to wake up GSM from sleep by sending SMS or DATA or call to that particular network will wake up automatically.

Table 4.1 PIN SPECIFICATIONS:

Pin.No	Name	Details
1	GND	It is used for Ground
2	TX	It is used to transmit the data.
3	RX	It is used to receive the data
4	Line_r & Line_l	It is used for Line input
5	Spk_p & spk_n	It is used for Speaker positive and Speaker negative
6	Mic_p & mic_n	It is used for Mic positive and Mic negative.
7	DTR	It is used for data terminal is ready or not
8	CTS	It is used to send the data when it's clear.
9	RTS	It is used to Request the data when it's clear.

WORKING:

The GSM module don't have any external interfaces like keypad and display so it works only using AT commands. A GSM module works with the help of AT commands, and the GSM is mainly used for Communication, an SMS and the data transfer. Here we use a gsm800c it has a Quad-band GSM/GPRS. The user can used for the custom applications. This module is a sub-system, and we can use it for the cellular IOT applications.

TESTING YOUR GSM MODEM:

When in GSM Modem inserted sim then power on the GSM module then first the LED blink per second after few seconds the LED blink for every 3 sec. With the help of different AT commands one can send the data and receive the data, and we can check the registration status, a pin code for the sim status, a connection status and check it is connected the single or multi IP connection, etc.

The GSM module uses the 12v power supply, and it has dual-band for GSM 900MHz and for GPRS 1800MHz. It has an inbuilt TCP/IP protocol so the data can transfer through internet over GPRS band. This module can connect with a micro-controller with the help of a trans-receiver pins.

AT COMMANDS:

- The AT command for Text mode is "AT+CMGF=1".
- The AT command for Send SMS is "AT+CMGS=Phone_Number"
- The AT command for Read the first SMS is "AT+CMGR=1".
- The AT command for Read the second SMS is "AT+CMGR=2".
- The AT command for Read the all SMS is "AT+CMGR=ALL".
- The AT command to Call to a number is "ATDP+Phone_Number".

- The command for Hang up a call is “ATH”.
- The command for Receive an incoming call is “ATA”.

4.6 LIQUID CRYSTAL DISPLAY:

Liquid crystal display is used to see the output readings. It consists of two 16 rows in each row we can display 16 characters. The LCD having 8 data pins(the D0-D7) we need only 4 data pins, RS and enable pin to connect with Arduino. The anode and a cathode is used for a background light in the LCD. The LCD's are very economical. The user can easily program the LCD's. These LCD's can able to display the special character.

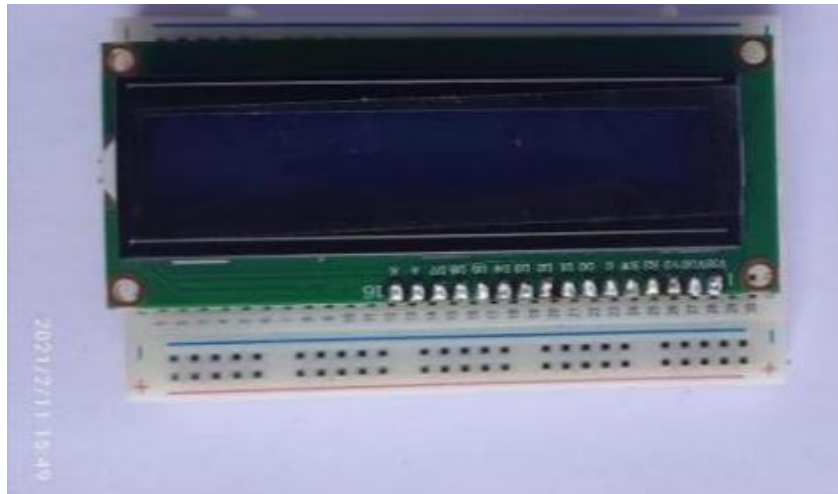


FIG 4.5 LCD DISPLAY

In the above Fig.4.5 It is a 16 x 2 LCD so it has consist of two 16 characters to display. When ever the character is displayed in the LCD these characters are displayed in the form of pixel matrix. These type of LCD are having two types of registers they are command register and data register. The command register use to store instruction like initializing. Some command instructions is use to clear the display and right the cursor position and control display.

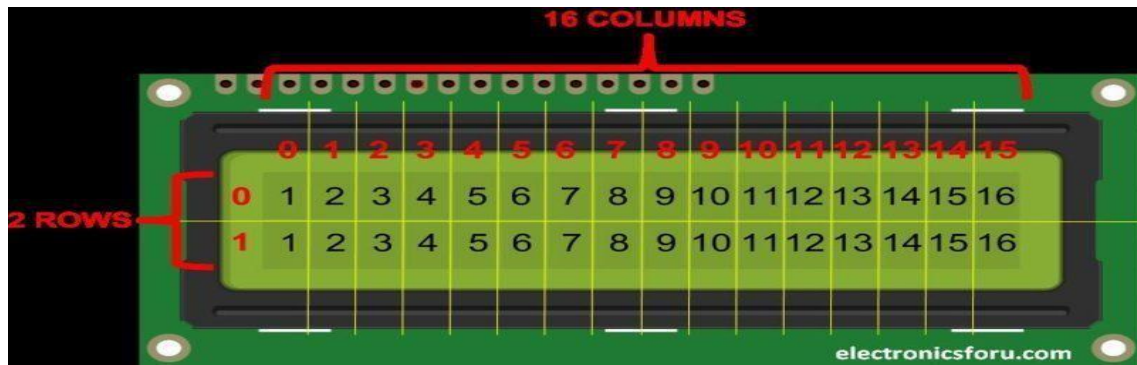


FIG 4.6 INTERNAL STRUCTURE OF A LCD

The data register is used to store the data which are displayed in the LCD. The data displayed in LCD are in the form of ASCII values. Whether it's number, string, character the data register can take only in ASCII values. Most of the displays used LCD in calculators, TV's, watches, etc.. LCD's is an electronic module and it can produce dark visible image. LCD works in black and white mode. These LCD's are mostly used in projects.

16X2 LCD PINOUT DIAGRAM:

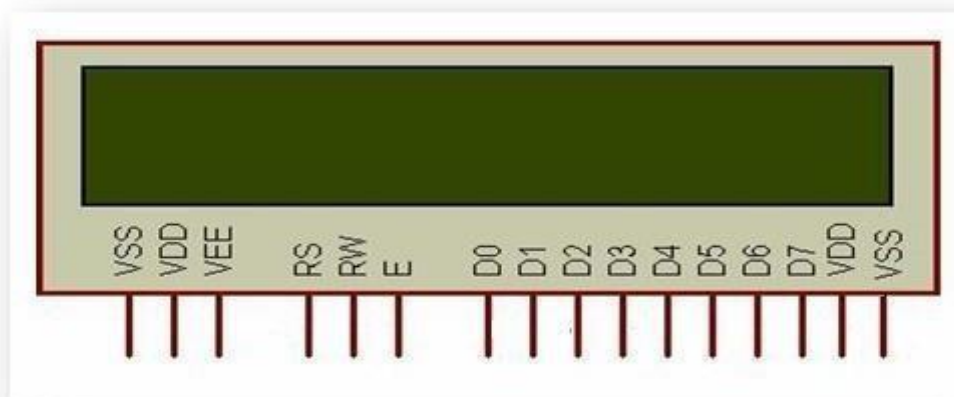


FIG 4.7 16X2 LCD PINOUT DIAGRAM

TABLE 4.2 X2 LCD PIN OUT TABLE

pin.No.	Function	Name
1	The pin 1 is the ground pin	Ground
2	The pin 2 is the Supply voltage. The LCD can operate in 5 volts.	VCC
3	The pin 3(V0) is use to contrast we can use potentiometer.With the help of potentiometer the user can adjust the contrast in LCD display by rotating Potentiometer adjust knob bu moving forward and backwards.	V0 or VEE
4	The pin 4 is used to command the register when there is low and command the register when there is high	RS
5	The pin 5 when the pin is low to write and when the pin is high to read.	Read/write
6	The pin 6 is enable pin it send data to data pins, the enable pin needs an extra voltage to the program Instruction when the pin 6 is 1 then the user can executes the instruction and when pin 6 is 0 the it acts as ground	Enable
7	The pin 7 is a data pin and it is a 8 bit data pin D0	DB0
8	The pin 8 is a data pin and it is a 8 bit data pin D1	DB1

9	The pin 9 is a data pin and it is a 8 bit data pin D2	DB2
10	The pin 10 is a data pin and it is a 8 bit data pin D3	DB3
11	The pin 11 is a data pin and it is a 8 bit data pin D4	DB4
12	The pin 12 is a data pin and it is a 8 bit data pin D5	DB5
13	The pin 13 is a data pin and it is a 8 bit data pin D6	DB6
14	The pin 14 is a data pin and it is a 8 bit data pin D7	DB7
15	The pin 15 is for back light for +VE	Led+
16	The pin 16 is for back light for -VE	Led-

RS(REGISTER SELECT)

These type of LCD are having two types of registers they are command register and data register. The user select RS to Low or 0 the command register work and when the user select RS to High or 1 then the data register is selected.

COMMAND REGISTER

The command register use to store instruction like initializing. Some command instructions is use to clear the display and right the cursor position and control display.

DATA REGISTER:

The data register is use to store the data Which are displayed in the LCD. The data displayed in LCD are in the form of ASCII values Weather it's number, string, character the data register can taken only in ASCII values. selected.

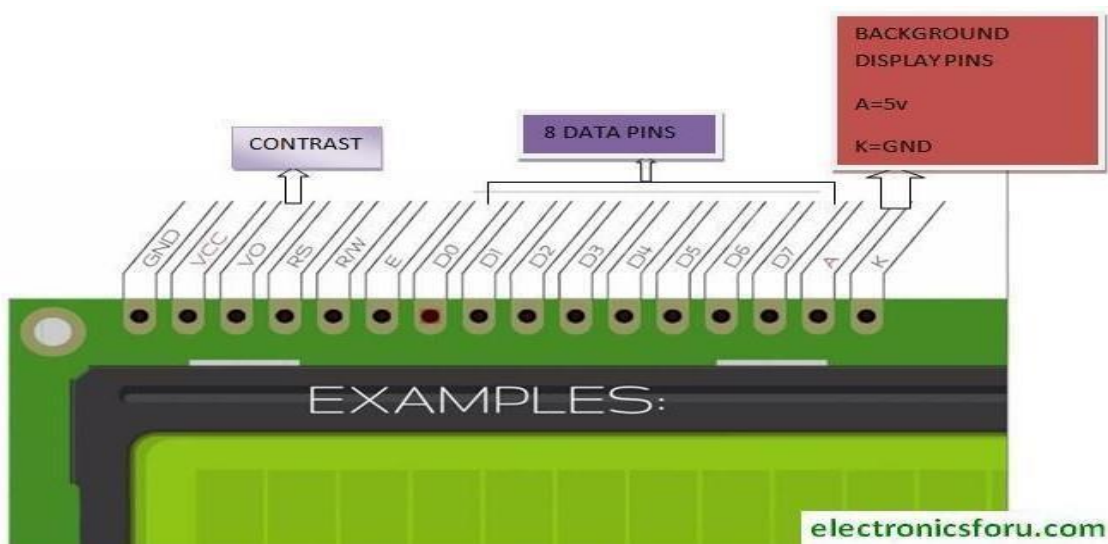


FIG 4.8 PIN LAYOUT DIAGRAM

TABLE 4.3 IMPORTANT LCD COMMANDS:

Sl.No.	Hex Code	LCD COMMANDS.
1	01	Screen display is cleared.
2	02	This command return to home.
3	04	This command Low the cursor.This command can shifts the cursor to left
4	06	This command High the cursor.This command can shifts the cursor to right
5	05	This command shifts the display to the right
6	07	This command shifts the display to the left
7	08	This command switch off both display and cursor
8	0A	This command switch off Display and switch on the cursor
9	0C	This command switch on Display and switch off the cursor
10	0E	This command switch off Display and the cursor is blinking.
11	0F	This command switch on Display and the cursor is blinking.
12	10	This command can shifts the cursor position to the left.
13	14	This command can shifts the cursor position to the right.

14	18	This command can shifting display to left.
15	1C	This command can shifting display to right.
16	80	This command is used to force the cursor from first line
17	C0	This command is used to force the cursor from second line
18	38	This command is used to display 2 line in matrix form(5x7)

4.7 SENSOR'S DESCRIPTION

Soil Moisture Sensor:

The soil moisture sensor work with analog pins of Arduino because of the soil moisture sensor read the data continuously and it sends the data int the form of a bit rate from 0 to 1024. The bit rate is converted in to the percentage with the help of the map function in Arduino IDE. The soil is dry then the power conductivity is very low and the resistance is very high so, it sends the data to Arduino as a soil moisture is very low. When the soil having enough moisture than the power conductivity is very high and the resistance is very low so, it sends the data to Arduino as a soil moisture is high.

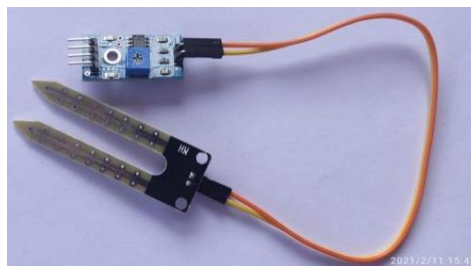


FIG 4.9 SOIL MOISTURE SENSOR

DHT11 Sensor:

The DHT11 sensor is used to detect both humidity & temperature, and it is a semiconductor device. The sensor has two electrodes and it can hold the moisture substrate in between dielectric. When the humidity level is changed then the capacitance values also change accordingly. The sensor has an IC; it can change the analog values into the digital form.

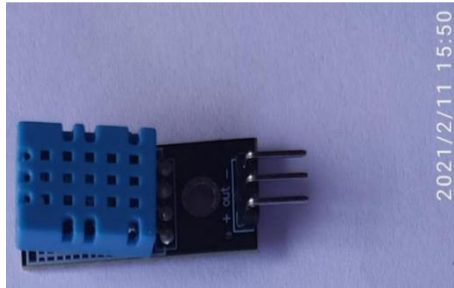


FIG 4.10 DHT11 SENSOR

Water Flow Sensor:

Water flow sensor is used to measure the water measure in liter per hour or we can measure in cubic meters. This sensor will work in only digital pin D2. So the water flow sensor output will be in the pulse form. The water flow sensor is made with plastic and inside water flow sensor having a rotor. The rotor is rotated when the water is flowing through it then the hall sensor is reading the values of the rotor. These water flow sensor interface with the micro-controller.

The water flow sensor works on hall-effect. It has three wires: the data wire is in yellow color, and the positive wire in red color, and the ground wire in black color.



FIG 4.11 WATER FLOW SENSOR

Rain Sensor:

The rain sensor is used to detect the rain it is also used a resistance phenomena of soil moisture. When the water drops fall in rain sensor the resistance is low and the conductivity is high so the sensor send the data to Arduino in a bit rate from 0 to 1024. We can change the sensor accuracy using a potentiometer.

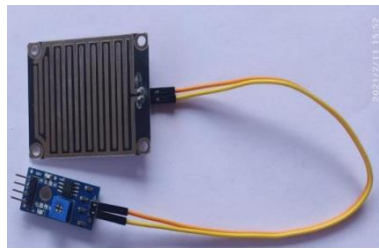


FIG 4.12 RAIN SENSOR

Relay:

A Relay is an electric switch it work with any micro-controller and it can control voltage and current with an Arduino. When the Arduino gives the input relay pin is low/high the relay is turned on/off accordingly. Relay has a coil with an electromagnet with the help of electromagnet the relay Turn on/off the switch. In Relay can isolated negative feedback.



FIG 4.13 RELAY

DC Pump:

The DC pump (or) a centrifugal pump having a motor and an impeller, and the impeller is connected the motor with the help of shaft. When the motor is ON then the impeller is rotated and the water can be pumped through the DC pump. The impeller is surrounded by air tight passage.



FIG 4.14 DC PUMP

4.8 ARDUINO SOFTWARE (IDE):

The Arduino IDE is a free software, so anyone can use this software in this software we use embedded c for coding, and this software is user friendly and the user can check the output readings in a serial monitor.

This Arduino IDE software only interfaced with Arduino micro-controller boards. The IDE contain a code editor where the user can write the code and check for errors than the user need to check the port is connected or not then upload the code to Arduino micro-controller board.

1. Open the Arduino IDE.

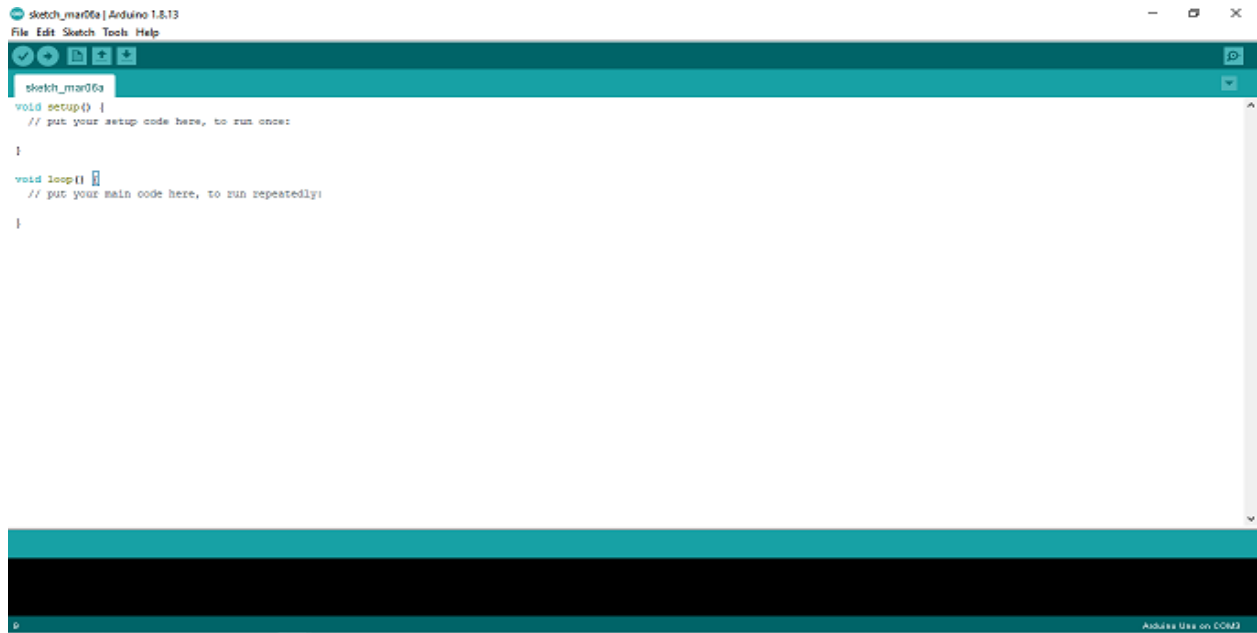


FIG 4.15 Open Arduino IDE

2. Select the required Arduino board from Tools as shown below

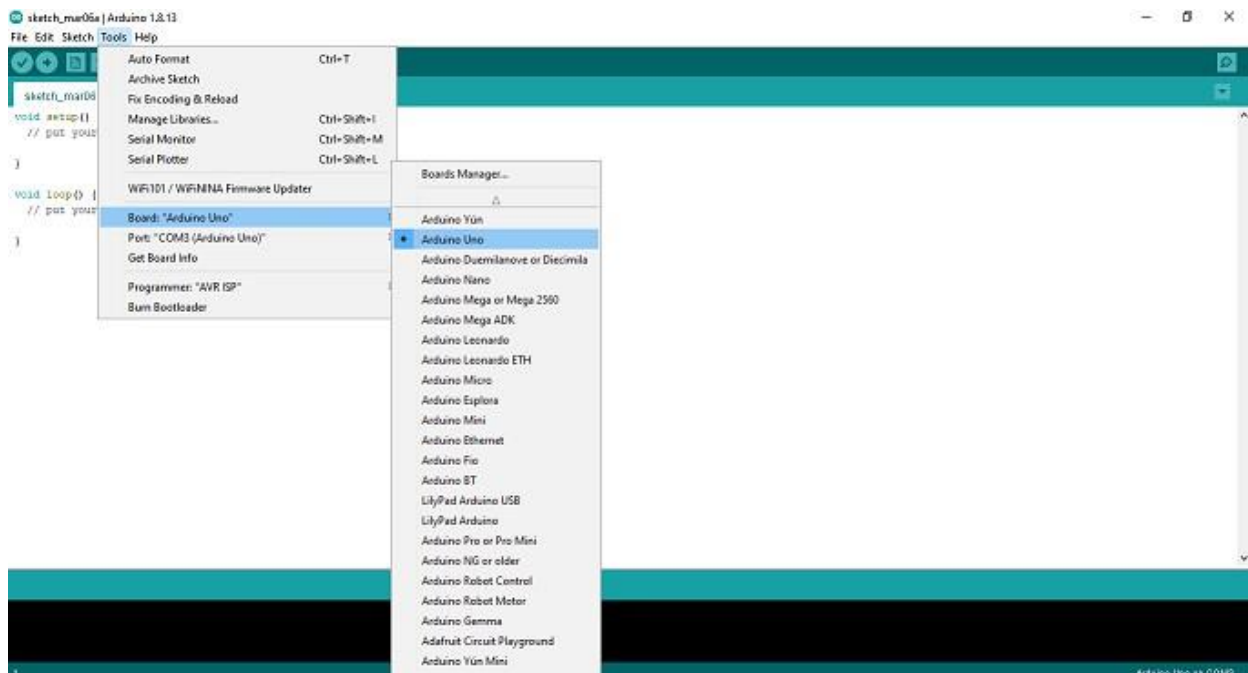


FIG 4.16 SELECT THE REQUIRED BOARD

3. Select the COM Port from tool

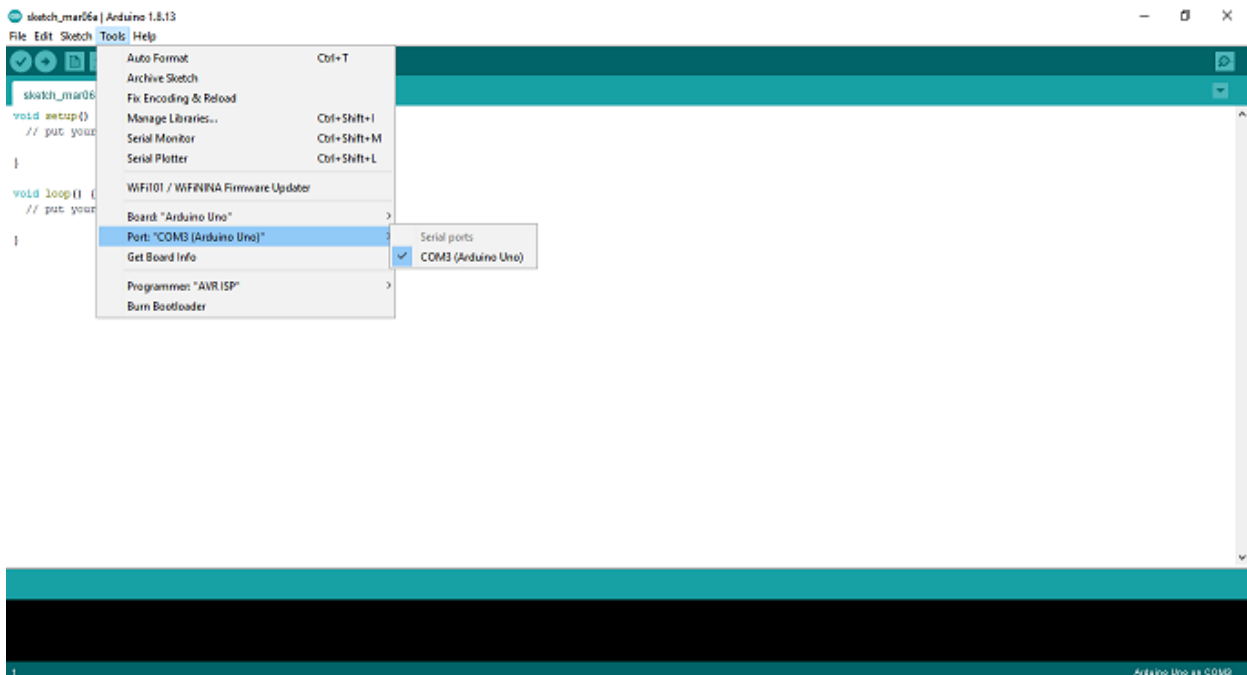


FIG 4.17 SELECT THE POART

4. Write the sketch in Arduino IDE and compile the sketch.

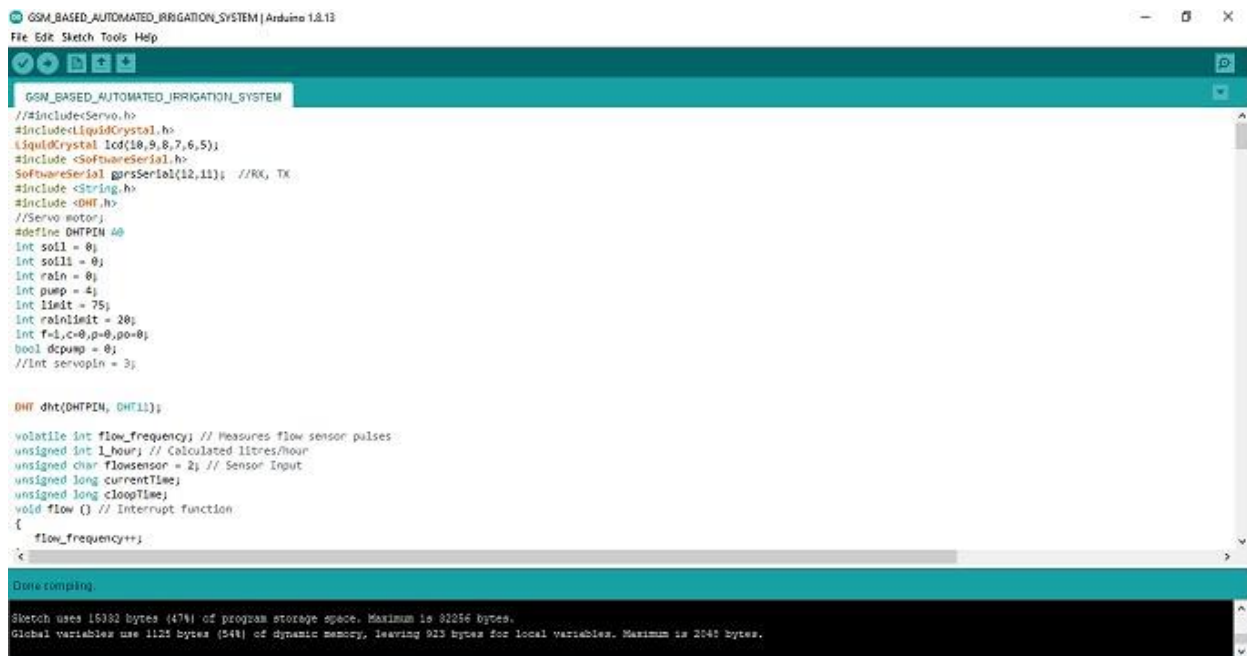


FIG 4.18 COMPILE THE SKETCH

5. upload the code to Arduino board using port.

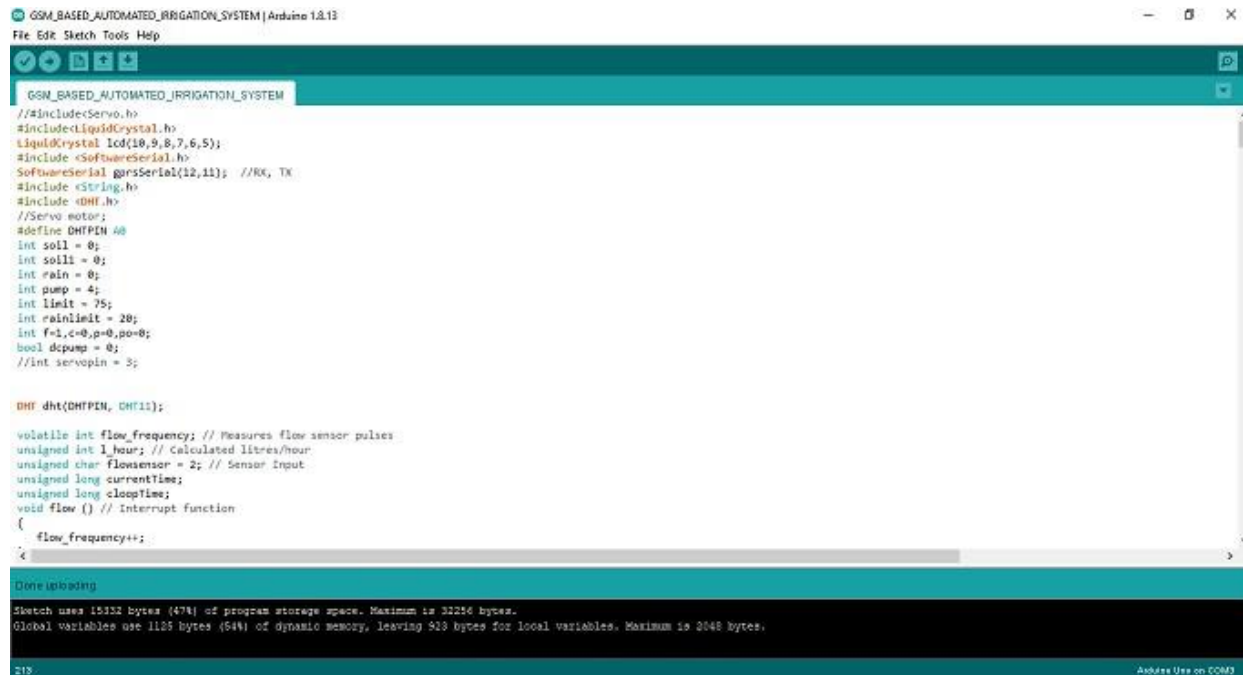


FIG 4.19 UPLOAD THE SKETCH

WRITING SKETCHES:

The Arduino(IDE) or Arduino Software when we write programs using IDE called as sketches. These programs are written in Embedded C and in Arduino IDE. Having a text editor where we write the programs and save these programs with the help of file extension called **.ino**. This text editor has a feature for searching the text, replacing the text and cut, copy and past the text. When we compile the text then we get an appropriate message displayed in the message feedback area and displaying the text output in the console including error messages & other information. In the top right corner IDE has a serial monitor for displaying with the help of serial port. In the top left corner we have buttons like compile, upload, open, create, save buttons. These buttons are called toolbar buttons.

NB: Arduino IDE has different versions and different file extensions. Like the prior version 1.0 program saved as **.pde**. Those prior version 1.0 programs can be saved as **.ino** extension files.

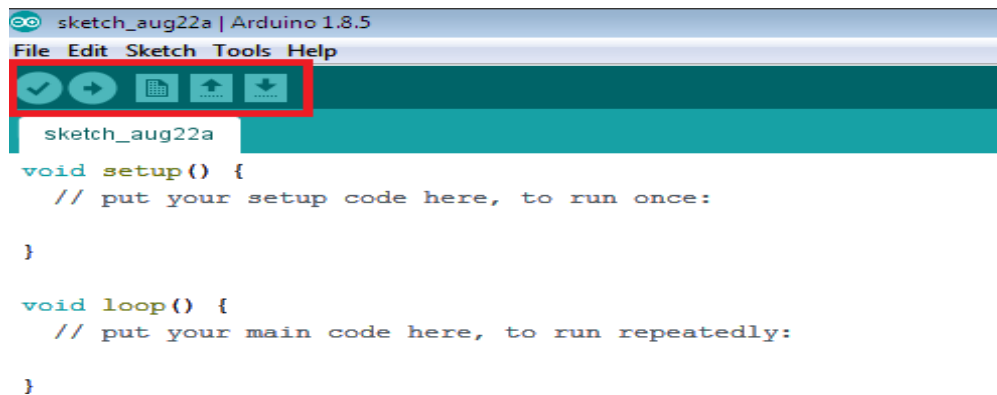


FIG 4.20 WORK SPACE

TABLE 4.4 WORK SPACE BUTTONS TABLE

	Verify When the user click the verify button then the code is compiling and find the errors.
	Upload When the user click on the Upload then the IDE compiles the code and upload the code to board with the help of port.. Note: If the user use any external program in the board then you can hold the “Shift” key then the text is converted in to code and “Upload using Programmer”.
	New When the user click on the New the new code editor is open

	Open It opens the menu of all the sketch in the sketch book. Note: In the back end in IDE software there is a bug in java code so the menu didn't scroll. If you want to open a sketch Which is not used long then the File is the Sketch book menu.
	Save It save the code.
	Serial Monitor It opens the serial monitor.

In Arduino IDE we have additional commands in menu bar. The menu bar having File, Sketch, Edit ,Help and Tools. These menus are having only relevant on current work when we write code these menus are work only for that code.

FILE:

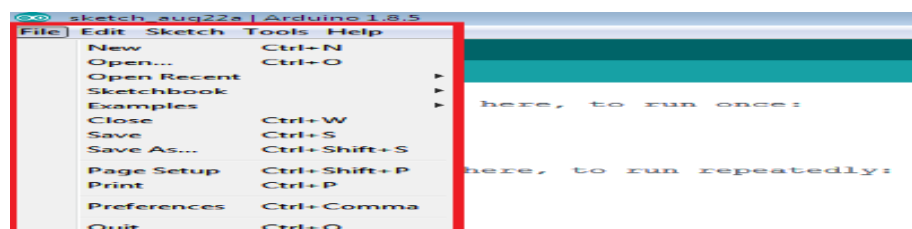


FIG 4.21 FILE IN ARDUINO IDE

EDIT:



FIG 4.22 EDIT IN ARDUINO IDE

SKETCH:

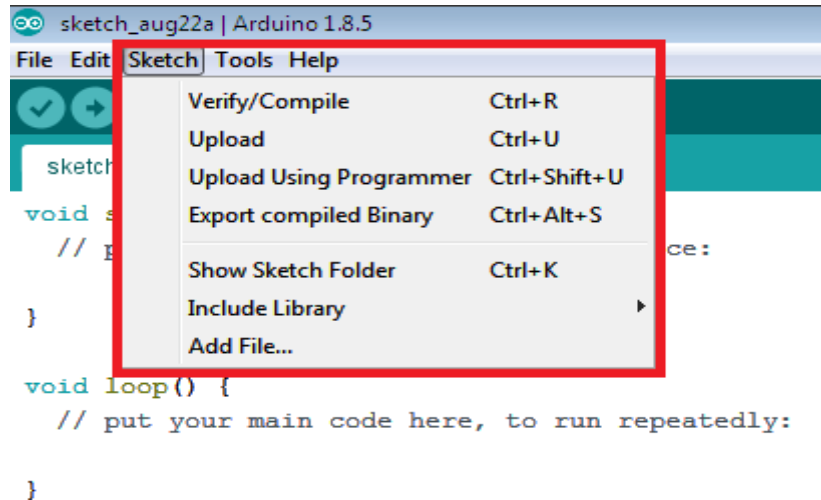


FIG 4.23 SKETCH IN ARDUINO IDE

TOOLS:

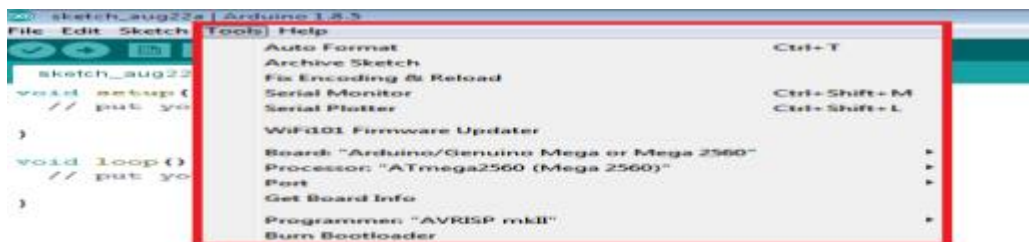


FIG 4.24 TOOLS IN ARDUINO IDE

- **Programmer:** While uploading a hardware programming in micro-controller or chips we don't need any serial connection like USB, but when ever we get a new micro-controller we using a burning a boot loader program in new board on that time we use serial connection.
- **Burn Boot loader:** Arduino boards needs to burn a boot loader in any new micro controller. When ever you buy a new AT mega micro controller(Which comes with out boot loader). We use a boot loader for that micro-controller but you have to select the correct the micro controller board for burning a boot loader in to a AT mega chip. When you select a right board you can target a right board for burning a boot loader.
- **Help:** The Arduino IDE. You have access to help window where you can trouble shooting and check the reference and you can also check the frequently asked questions and about the overview of Arduino we can check the reference with out network connection and these documents are having a local copy in IDE and these documents having a link back to online website.

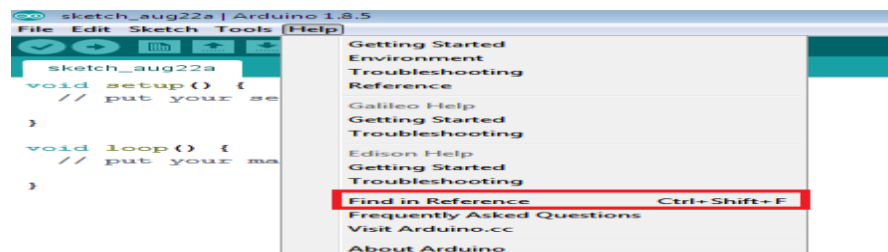


FIG 4.25 HELP IN ARDUINO IDE

UPLOADING:

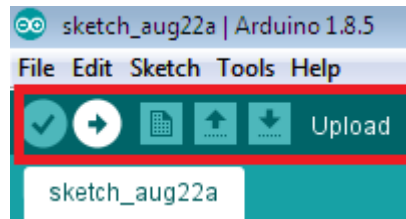


FIG 4.26 UPLOAD IN ARDUINO IDE

Before uploading the sketch, you need to check whether you have selected the correct board you can also check the board configuration in tools box. Inside tool box you have a port select, board select and board info.

On the Mac, the serial port is like `/dev/tty.usbmodem241` (it is used for an Mega2560 or UNO or Leonardo) or `/dev/tty.usbserial-1B1` (it is used for a USB board or earlier Duemilanove), or `/dev/tty.USA19QW1b1P1.1` (The key span is connected to serial board using USB to Serial adaptor).

On Windows, it's probably COM4, COM5, COM7, or higher (used for USB board) or COM1 or COM2 (used for serial board) -the user need to find out the serial device in the Arduino board using USB port in device manager.

On Linux, it should be `/dev/ttyUSBx`, `/dev/ttyACMx` or similar. When you are select the serial port and selecting the correct board the you press the upload button in the sketch menu or you can select the upload button in tool bar then current program in Arduino will be reset and new program will be upload. In older boards are having problem with auto reset but in older board having reset button we need to press reset button before uploading new program .

In every Arduino boards having two LED's for TX and RX when the program is uploading both LED's blink. If the program upload then the LED's for RX and TX will stop blinking. If the program is not uploaded the we got an error message in below message box.

When you upload the program in Arduino board we use Arduino boot loader. When you want to uploaded the programs like small programs on that time we use boot loader on the Arduino micro-controller. The boot loader used to upload the program with out any additional hardware. Whenever we on the Arduino micro-controller then boot loader is active and run the recent uploaded code and when we give a power supply to the Arduino board then the light will blink in 13 pin LED for few seconds.

LIBRARIES:

Libraries are providing an extra functionalities for use of programs in Arduino IDE we have an example programs for the individual components. To use library we can import the library files from our own device or we can import the library files in online in Arduino web site. These library's are help full to reduce the code. Because these library files are uploaded to board with the help of `#include` statements. If we don't need the library file in the program simply delete the `#include` file.

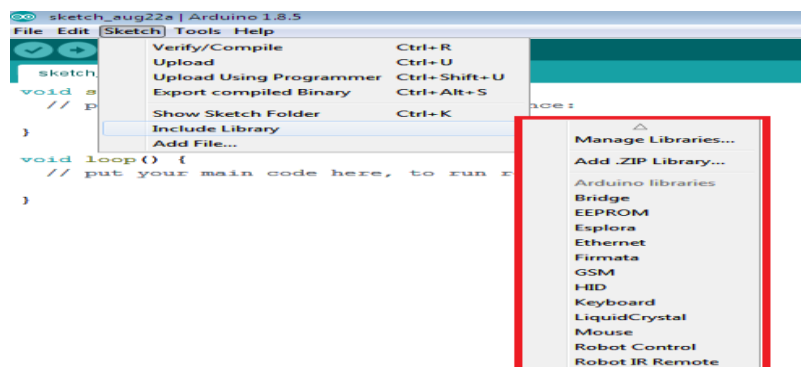


FIG 4.27 MANAGING LIBRARIES

We have list of library files in the Arduino IDE. Some basic libraries are included in Arduino and remaining we need to install in Arduino software using Sketch button in tool box inside sketch we have include library section in that we can either manage library's or we can import a zip library. So these Zip libraries can include the third party library's.

4.9 EMBEDDED C:

Embedded C is one of the programming language and it is more popular language in field of software for the electronic gadgets and every gadget have associated with embedded C software.

Embedded C program is mainly work with micro-controller and most of the electronic gadget's used micro-controllers in daily life. The main gadget we used day to day life is mobile phone, camera, washing machine, television, etc. Every gadget in the above mentioned are work with micro-controller programmed with embedded C.

The embedded system program representation:

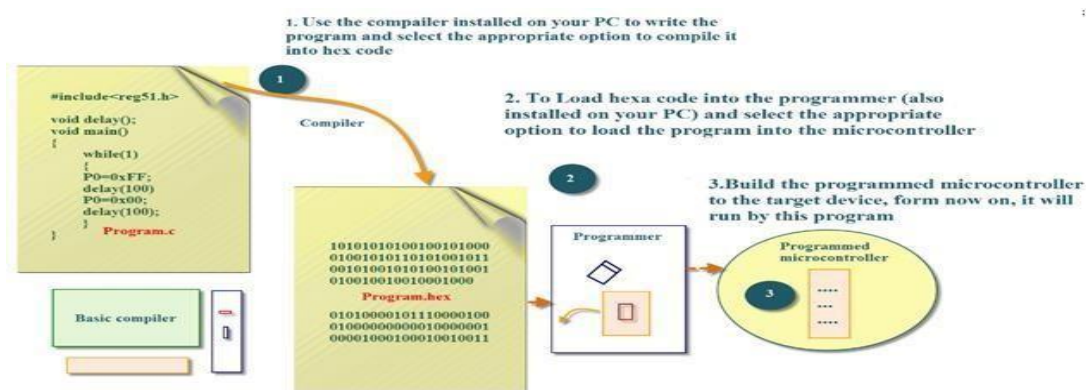


FIG 4.28 EMBEDDED SYSTEM PROGRAM REPRESENTATION

The Code in the above diagram is a blinking LED connected in the Port 0 of micro-

controller.

In the Micro-controllers the Embedded C code is preferred over other language. Due to the following reasons:

- Understanding is very easy.
- The user can run the Embedded code in different platforms (Portability).
- The Embedded code is High Reliable.
- Scalability

EMBEDDED SYSTEM PROGRAMMING:

Basic Declaration

The block diagram of Embedded C Programming development:

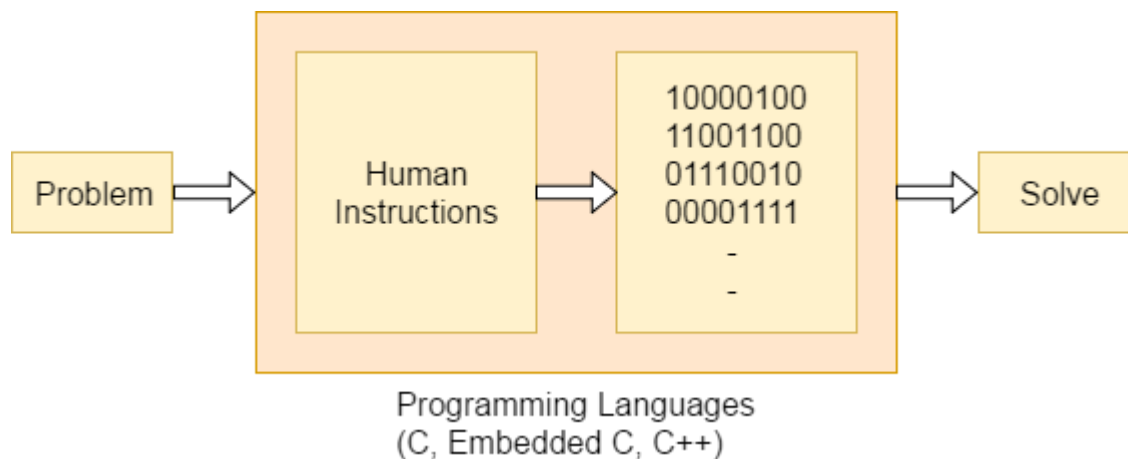


FIG 4.29 BLOCK DIAGRAM OF EMBEDDED C

In Embedded C we write a function used to perform the specific task. We can write N number of functions in a programming language. In every programming language having set of syntax's and basic elements. The embedded C is most likely

C programming and these are designed with function and variables, data types, expression, character set, keywords.

Embedded C program language is extend by using C program language. As comparing to C programming the embedded C program having additional features Keywords, data type and the header files etc is represented by `#include<micro-controller name.h>`.

4.10 THING-SPEAK SERVER

Thing-Speak is used for IOT(Internet of Things) applications and it is a open-source. Thing speak server is using Read and Write API to Store the data and to Retrieve the data from Thing-Speak server.It uses MQTT protocol and HTTP protocol over the Local area network.

Thing-Speak can able to log the sensor values and store these sensor values in database. Thing-Speak can able to tracking the application location and it can able to update the status in social networking sites.

Thing-Speak can supports MATLAB software for numerical computing and from Math Works allows Thing-Speak without any licence from Matlab. Thing-Speak can analyze the data and visualize the data using Matlab.

Thing-Speak Server can export the data to other website or we can download the data in the form of excel sheet so that the user can track the sensor data. Thing-Speak uses Math works for validating the user account for login to Thing-Speak server.

1. Open ThingSpeak Server

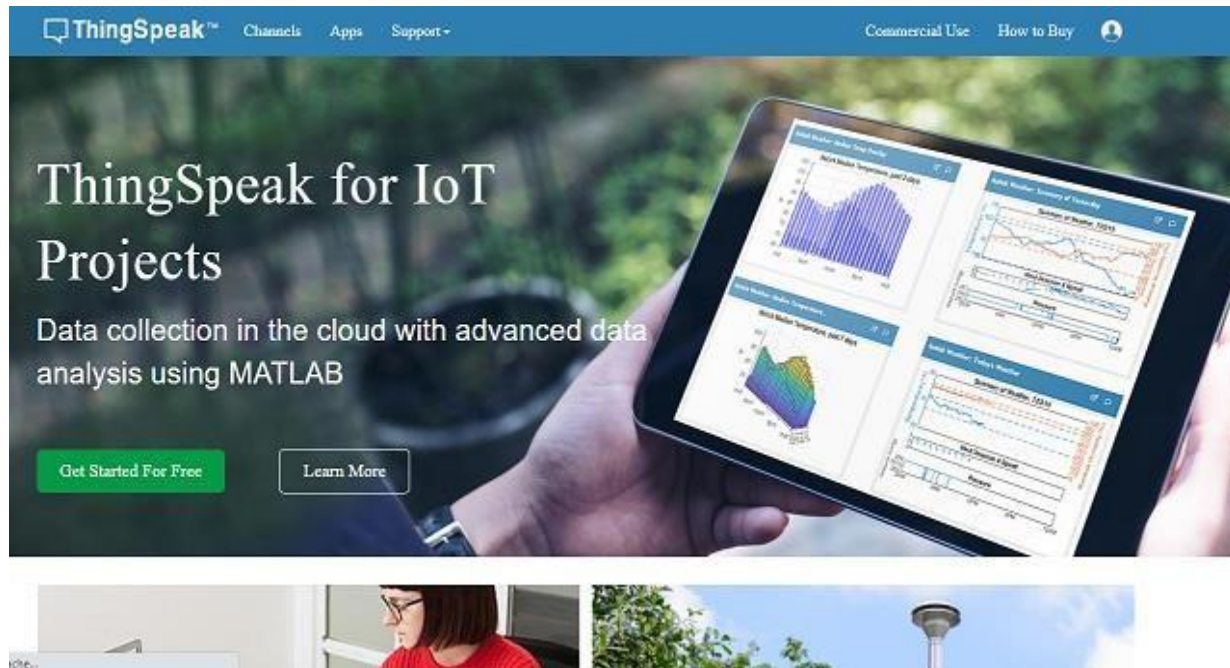


FIG 4.30 THING SPEAK SERVER

2. Create a MATHLAB account or Sign IN Thing Speak

The image shows the "Create MathWorks Account" page on the ThingSpeak website. The page has a blue header with the ThingSpeak logo and navigation links. Below the header, there is a paragraph of text explaining the requirements for using ThingSpeak, including the need to sign in with a MathWorks account and the availability of free accounts for non-commercial users. To the left of the page is a form with the following fields: "Email Address" (a text input field), "Location" (a dropdown menu with "United States" selected), "First Name" (a text input field), and "Last Name" (a text input field). Below these fields are two buttons: "Continue" in blue and "Cancel" in white. To the right of the form is a diagram illustrating the ThingSpeak architecture. It shows "SMART CONNECTED DEVICES" on the left, connected to a central cloud labeled "DATA AGGREGATION AND ANALYTICS ThingSpeak". The cloud is then connected to a "MATLAB" logo, which is further connected to a monitor displaying a bar chart, labeled "ALGORITHM DEVELOPMENT SENSOR ANALYTICS".

FIG 4.31 CREATE ACCOUNT IN THING SPEAK

3. Create a New channel

The screenshot shows the 'My Channels' page on the ThingSpeak website. At the top, there's a navigation bar with 'ThingSpeak™', 'Channels', 'Apps', and 'Support'. Below this, the 'My Channels' section features a 'New Channel' button and a search bar. A table lists existing channels:

Name	Created	Updated
DHT11 Humidity and temperature Private Public Settings Sharing API Keys Data Import / Export	2021-02-10	2021-02-10 22:10
GSM based irrigation monitoring Private Public Settings Sharing API Keys Data Import / Export	2021-02-20	2021-02-27 07:17

On the right, the 'Help' section provides instructions on how to create a new channel. Below it, the 'Examples' section lists various hardware examples like Arduino, ESP8265, and Raspberry Pi. The 'Upgrade' section offers options for users needing more data storage or commercial features.

FIG 4.32 CREATE NEW CHANNEL IN THING SPEAK

4. Select the Required Fields

The screenshot shows the 'Channel Settings' page for the 'GSM based irrigation monitoring' channel. The page header includes the channel name, ID (1309482), author (AnumoluSujithKumar), and access level (Private). Below this, there are tabs for 'Private View', 'Public View', 'Channel Settings', 'Sharing', 'API Keys', and 'Data Import / Export'. The 'Channel Settings' tab is active, showing fields for 'Percentage complete' (30%), 'Channel ID' (1309482), 'Name' (GSM based irrigation monitoring), and 'Description'. There are also sections for 'Field 1' (Temperature) and 'Field 2' (Humidity), each with a checkbox to enable it. On the right, the 'Help' section explains the purpose of each field. Below that, the 'Channel Settings' section provides detailed instructions for each field.

Channel Settings

- Percentage complete:** 30%
- Channel ID:** 1309482
- Name:** GSM based irrigation monitoring
- Description:**
- Field 1:** Temperature ☒
- Field 2:** Humidity ☒

Help

Channels store all the data that a ThingSpeak application collects. Each channel includes eight fields that can hold any type of data, plus three fields for location data and one for status data. Once you collect data in a channel, you can use ThingSpeak apps to analyze and visualize it.

Channel Settings

- Percentage complete:** Calculated based on data entered into the various fields of a channel. Enter the name, description, location, URL, video, and tags to complete your channel.
- Channel Name:** Enter a unique name for the ThingSpeak channel.
- Description:** Enter a description of the ThingSpeak channel.
- Field:** Check the box to enable the field, and enter a field name. Each ThingSpeak channel can have up to 8 fields.

FIG 4.33 SELECT REQUIRED FIELDS

5. Use API Read/Write Key in your Program For sending or receiving the data

The screenshot shows the ThingSpeak web interface for a channel titled "GSM based irrigation monitoring". The channel ID is 1309482, the author is Anumolu Sujith Kumar, and the access is private. The "API Keys" tab is selected in the top navigation bar. On the left, under "Write API Key", the key A78I2RY77QEWUBQ4 is displayed, with a "Generate New Write API Key" button below it. Under "Read API Keys", the key 0GSVUST39U75TA5C is displayed. On the right, a "Help" section explains that API keys enable writing to or reading from a channel, and a "API Keys Settings" section provides instructions for using write and read keys, along with a note about channel feed information. At the bottom right, there is a link to "Write a Channel Feed".

ThingSpeak™ Channels Apps Support Commercial Use How to Buy AS

GSM based irrigation monitoring

Channel ID: 1309482
Author: AnumoluSujithKumar
Access: Private

Private View Public View Channel Settings Sharing API Keys Data Import / Export

Write API Key

Key: A78I2RY77QEWUBQ4

[Generate New Write API Key](#)

Read API Keys

Key: 0GSVUST39U75TA5C

Help

API keys enable you to write data to a channel or read data from a private channel. API keys are auto-generated when you create a new channel.

API Keys Settings

- **Write API Key:** Use this key to write data to a channel. If you feel your key has been compromised, click [Generate New Write API Key](#).
- **Read API Keys:** Use this key to allow other people to view your private channel feeds and charts. Click [Generate New Read API Key](#) to generate an additional read key for the channel.
- **Note:** Use this field to enter information about channel read keys. For example, add notes to keep track of users with access to your channel.

API Requests

[Write a Channel Feed](#)

FIG 4.34 API KEYS IN THING SPEAK.

CHAPTER 5

RESULT AND LIMITATIONS

5.1 RESULT

5.1.1 SENSOR TESTING

1. Soil Moisture Sensor

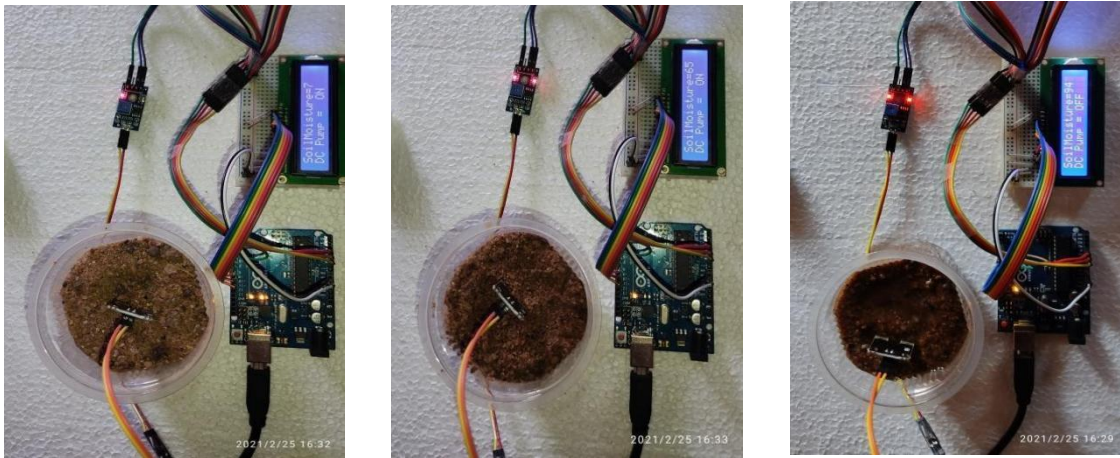


FIG 5.1 SOIL MOISTURE SENSOR TESTING

In the above fig's we can see that the moisture sensor is changing the threshold values according to the moisture content in the soil. So we can know that the soil moisture sensor is working.

2. Rain sensor

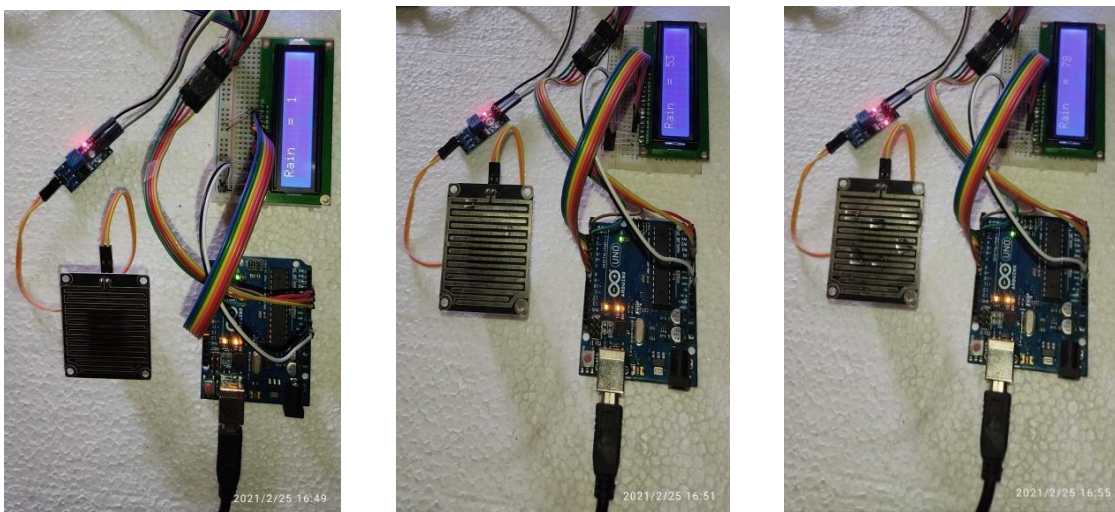


FIG 5.2 RAIN SENSOR TESTING

In the above fig's we can see that the rain sensor is changing it's threshold values when ever the water drop let's fell on the rain sensor. So we can know that the rain sensor is working.

3. Water flow sensor

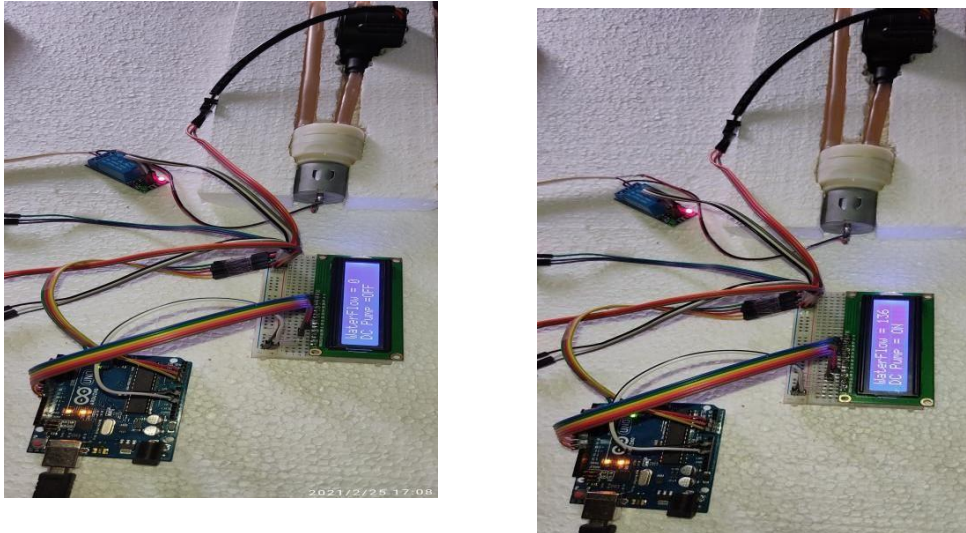


FIG 5.3 WATRE FLOW SENSOR TESTING

In the above fig's we check the water flow sensor when ever the pump is on the water flow sensor send the data to Arduino in the form of pulses. So we can know that the water flow sensor is working.

4. DHT11 sensor

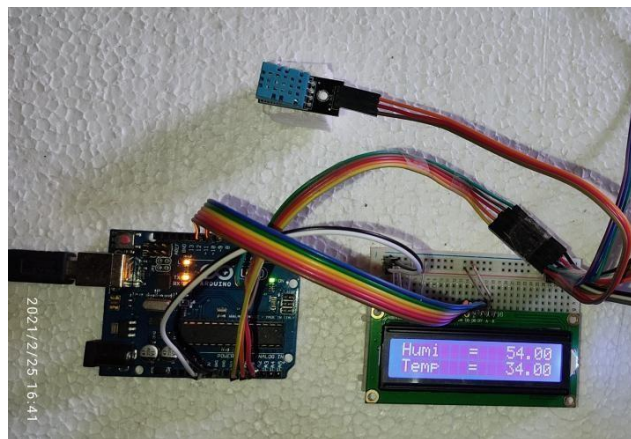


FIG 5.4 DHT11 SENSOR TESTING

In the above fig we can check the temperature & humidity with the DHT11 sensor. when the level of humidity is changed then the capacitance values also changed accordingly. The sensor having an IC it can change the analog values into the digital form. So the sensor is working.

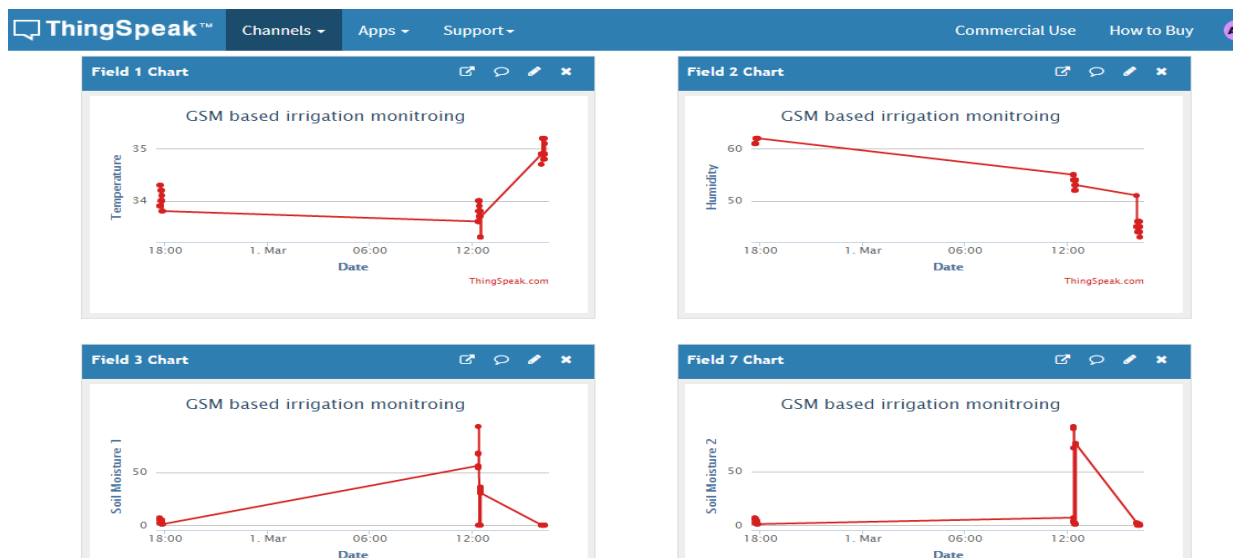
RELAY



FIG 5.5 RELAY TESTING

In the above fig's we are checking the relay when ever we give input LOW to the relay then the relay is ON and when ever we give input High to the relay then the relay is OFF with the help of these conditions we can check the relay is on/off.

5.1.2 SENSOR VALUES DISPLAYED IN SERVER



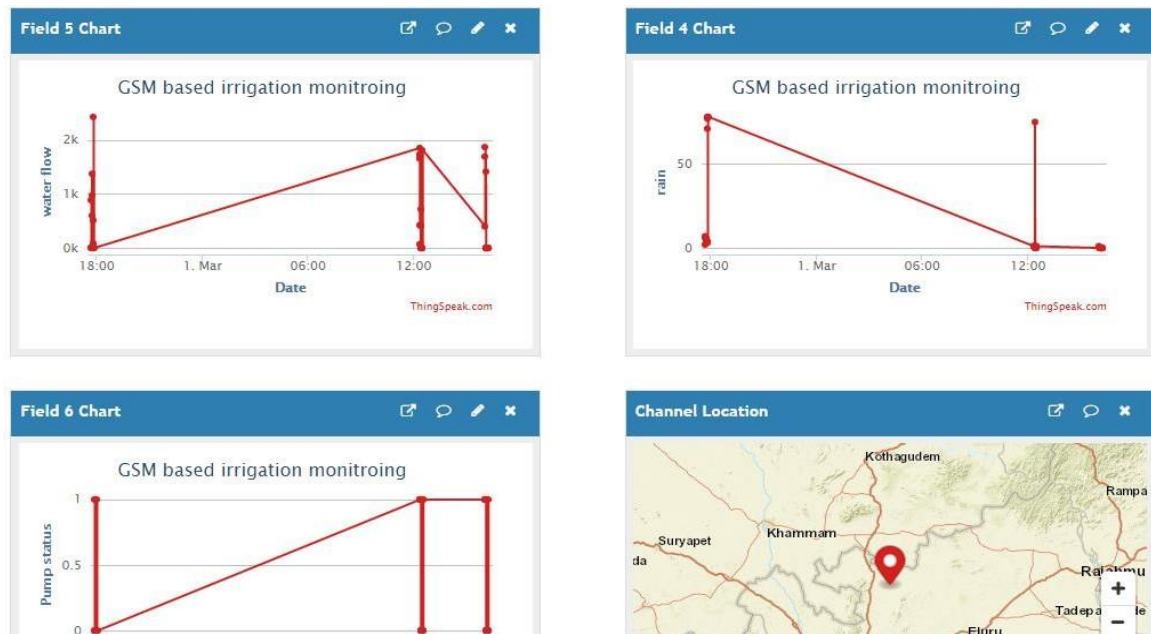


FIG 5.6 DISPLAYING SENSOR VALUES IN SERVER

In the above fig we can see that the sensor values can be monitored in the Thing-Speak server and these sensor values are stored in the cloud. Whenever the user need's the data the user can able to export the data from the server. The user can link this data to his one web site and the user can check the pump status.

5.1.3 ALERT MESSAGES

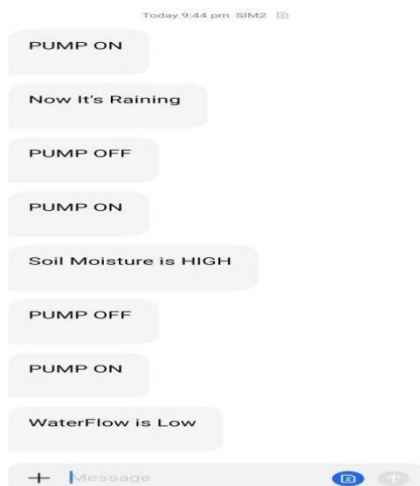
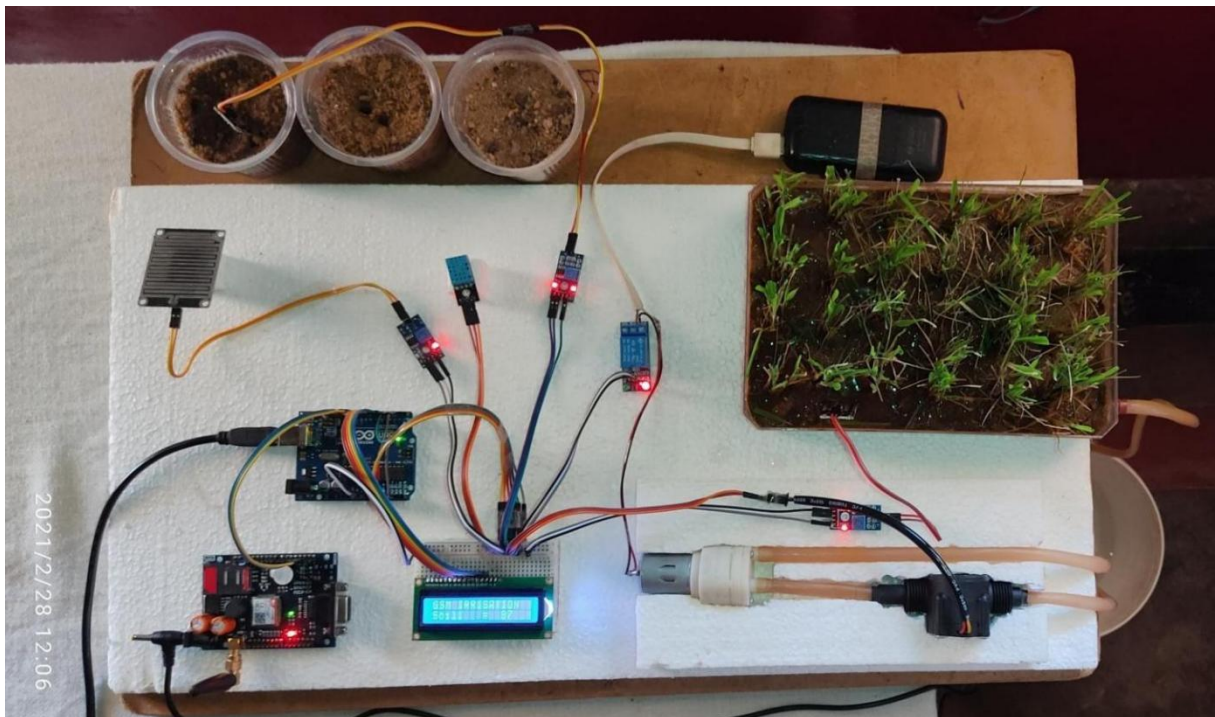


FIG 5.7 ALERT MESSAGES

In the above fig it is a screen short image of alert messages. The GSM send the status of the pump in the form of alert messages. Whenever sensor is not working then the user get an alert SMS.

DEVELOPED MODEL



***FIG 5.8 DEVELOPED MODEL FOR
AUTOMATIC IRRIGATION SYSTEM***

The Arduino is the heart of the system. It is connected with four sensors, and a GSM Module where they interact with the weather conditions and irrigate the land accordingly. We have also connected GSM module and Thing speak Server in such a way that, we can observe the dynamic sensor values from home itself, and also the Thing speak server stores the data in its back end. This feature of the system will reduce water and power consumption when water is not necessary at some weather conditions. We have also placed a water flow sensor, so when water doesn't flow through the motor, it will automatically switch off thereby reducing the electric consumption.

TABLE 5.1 RESULT TABLE

SI.NO	Temperature (°C)	Humidity (%)	Soil Moisture1 (<75%)	Soil Moisture2 (<75%)	Rain (<20%)	WaterFlow (>100)	Pump Status
1	35.2	55	4	5	1	2192	1
2	34.8	57	1	1	1	0	0
3	34	62	5	4	71	2432	0
4	29.2	72	97	98	3	2112	0
5	32.3	64	76	5	0	1984	1
6	NAN	NAN	3	2	2	1872	0

5.2 LIMITATIONS.

In spite of trying the best to rectify the errors, there are a few limitations under which the model has to be operated.

- We are using power supply instead of battery it should be continuously turned on whenever there is power. If power is not there then we cannot read the sensor data.
- If we don't have internet connection, we can't monitor the sensor values through the server but the system will run.
- If the sensor gets damaged, we get an alert message, where we have to manually check and replace with good one.
- This system is not fully automated in certain cases it requires human efforts.

CHAPTER 6

CONCLUSION AND FUTURE WORKS

CONCLUSION:

The system i.e., “Low Cost GSM Based Automated Irrigation System Using Arduino, Sensors and GSM Module” is highly essential, suitable, and low cost for advanced water irrigation technique and for production of agricultural. With the help of GSM Module the system will be sending data to the user through a Thing speak server where he can observe those sensor values in the farm field and irrigate accordingly from home. We can also include many more weather sensors that affect the crops. This prototype is designed in such a way that it will reduce the human effort and also manages the natural resources in a correct manner and give a good productive crops.

FUTURE WORKS:

The “Low Cost GSM Based Automated Irrigation System Using Arduino, Sensors and GSM Module” is simple and precise way of irrigation. Hence, this method is incredibly helpful because it reduces manual work of the farmers and additionally helps within the proper utilization of resources. It eliminates the manual switching mechanism employed by the farmers to ON/OFF the irrigation system. This project can be extended to a certain way that through AI the system will automatically detects the errors in the field and controls the field accordingly without being observed by the person at the home.

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LOW COST GSM BASED AUTOMATED IRRIGATION SYSTEM USING ARDUINO AND SENSORS

1

Submitted in partial fulfillment of the requirements for the award of

Bachelor of Engineering in Electronics and Communication Engineering

By

ANUMOLU SUJITH KUMAR(37130031)

KALISETTI BALARAJU(37130043)



1

**DEPARTMENT OF ELECTRONICS AND
COMMUNICATION ENGINEERING**

SCHOOL OF ELECTRICAL AND ELECTRONICS ENGINEERING

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BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of **ANUMOLU SUJITH KUMAR(37130031)** and **KALISETTI BALARAJU(37130043)**, who carried out the project entitled **"LOW COST GSM BASED AUTOMATED IRRIGATION SYSTEM USING ARDUINO AND SENSORS."** under our supervision from October 2020 to April 2021.

Internal Guide

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Submitted for Viva voce Examination held on

Internal Examiner

External Examiner

DECLARATION

We ANUMOLU SUJITH KUMAR (37130031) and KALISSETTI BALARAJU (37130043), here by declare that the Project Report entitled LOW COST GSM BASED AUTOMATED IRRIGATION SYSTEM USING ARDUINO AND SENSORS. is done by us under the guidance of Dr.V.BALAMURUGAN,.M.Tech.,Ph.D is submitted in partial fulfillment of the requirements for the award of the degree in Electronics and Communication Engineering.

DATE:

PLACE:

1.

2.

SIGNATURE OF THE CANDIDATES

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ABSTRACT

The aim of this project presents a Low Cost GSM Based Automated Irrigation System Using Arduino, Sensors and GSM Module. We use GSM Module so the Module sending the data to the Thing-speak server where it acts as front end to observe the sensor dynamic values and we can check the status of the water pump. It also acts as back end to store the data. The prototype is design in such a way that it will pump the water into the field as per our requirement depending on the weather conditions. The sensors used in the system are DHT11 Sensor(for sensing both humidity and temperature), Water Flow Sensor, Soil Moisture Sensor and Rain Sensor.

CONTENTS

CHAPTER No.	DESCRIPTION	PAGE No.
	Abstract	¹⁰ V
	List of Figures	VIII
	List of Tables	X
	List of Abbreviations	X
1	Introduction	1-2
	1.1 Objective	2-3
	1.2 Existing System and Proposal System	3-6
	1.2.1 Existing system	3-4
	1.2.2 Proposed system	4-6
2	Literature survey	7-11
3	Aim and Problem Domain	12
	3.1 Aim	12
	3.2 Problem Domain	12
	3.3 Implementation	12
4	Materials and Methods Used	13-51
	⁶ 4.1 System Requirement	13
	4.1.1 Functional requirements	13
	4.1.2 Non-Functional requirements	14-15
	4.2 Software Quality Attributes	15-16
	4.2.1 Feasibility Analysis	16
	4.2.2 Risk Analysis	16

CHAPTER No.	DESCRIPTION	PAGE No.
	4.3 External Interface Requirement	16
	4.3.1 Hardware Interface	16
	4.3.2 Software Interface	16
	4.4 Arduino and Micro-Controller	17-25
	4.5 Global System For Mobile Communication	25-33
	4.5.1 Sim800GSM/GPRS module	29-33
	4.6 Liquid Crystal Display	33-39
	4.7 Sensor's Description	39-42
	4.8 Arduino Software IDE	42-52
	4.9 Embedded C	52-54
	4.10 Thing-speak Server	54-57
5	Result And Limitations	58-63
	5.1 Result	58-63
	5.1.1 Sensor testing	58-60
	5.1.2 Sensor Values Displayed in Server	60-61
	5.1.3 Alert Messages	61-63
	5.2 Limitations.	63
6	Conclusion And Future Works	64
	References	65-66

LIST OF FIGURES

FIGURE No.	DESCRIPTION	PAGE No.
2 Fig 1.1	Experimental Flow Of The Project	5
Fig 4.1	Arduino UNO	20
Fig 4.2	Cellular Subscriber Growth Worldwide	26
Fig 4.3	GSM Network	27
Fig 4.4	GSM Module	29
Fig 4.5	LCD Display	33
Fig 4.6	Internal Structure Of a LCD	29
Fig 4.7	16x2 LCD pin out diagram	34
Fig 4.8	Pin Layout Diagram	37
Fig 4.9	Soil Moisture Sensor	39
Fig 4.10	DHT11 Sensor	40
Fig 4.11	Water Flow Sensor	40
Fig 4.12	Rain Sensor	41
Fig 4.13	Relay	41
Fig 4.14	Dc Pump	42
Fig 4.15	Open Arduino IDE	43
Fig 4.16	Select Required Board	43
Fig 4.17	Select The Port	44
Fig 4.18	Compile The Sketch	44
Fig 4.19	Upload The Sketch	45
Fig 4.20	Work Space	46
Fig 4.21	File In Arduino IDE	47
Fig 4.22	Edit In Arduino IDE	48

FIGURE No.	DESCRIPTION	PAGE No.
Fig 4.23	Sketch In Arduino IDE	48
Fig 4.24	Tools In Arduino IDE	48
Fig 4.25	Help In Arduino IDE	49
Fig 4.26	Upload In Arduino IDE	50
Fig 4.27	Managing Libraries	51
Fig 4.28	Embedded System Program Representation	52
Fig 4.29	Block Diagram Of Embedded c	53
Fig 4.30	Thing Speak Server	55
Fig 4.31	Create Account In Thing Speak	55
Fig 4.32	Create New Channel In Thing Speak	56
Fig 4.33	Select Required Fields	56
Fig 4.34	API Keys In Thing Speak	57
Fig 5.1	Soil Moisture Sensor Testing	58
Fig 5.2	Rain Sensor Testing	58
Fig 5.3	Water Flow Sensor Testing	59
Fig 5.4	DHT11 Sensor Testing	59
Fig 5.5	Relay Testing	60
Fig 5.6	Displaying Sensor Values In Server	61
Fig 5.7	Alert Messages	61
Fig 5.8	Developed Model	56

LIST OF TABLES

TABLE No.	DESCRIPTION	PAGE No.
TABLE 1.1	Comparison table for Existing System and Proposed System	6
TABLE 2.1	Comparisons Of Existing Systems	10
TABLE 4.1	Pin Specifications	31
TABLE 4.2	X2 LCD PIN OUT TABLE	35
TABLE 4.3	Important Command Codes For LCD	38
TABLE 4.4	Work Space Buttons Table	46
TABLE 5.1	Result Table	63

LIST OF ABBREVIATIONS

MSC	Mobile Services Switching Center
EIR	Equipment Identity Register
DC	Direct Current
LCD	Liquid Crystal Display
GUI	Graphical User Interface
OSS	Operation And Support System
MTBF	Mean time between failures
AMPS	Advanced Mobile Phone Service
SS	Switching System
GSM	Global System for Mobile Communications
VLR	Visitor Location Register
GPRS	General Packet Radio Service
HTTP	Hypertext Transfer Protocol
NMT	Nordic Mobile Telephone
BSS	Base Station System
AUC	Authentication Center
MQTT	Message Queuing Telemetry Transport.
SMS	Short Message Service

CHAPTER 1

INTRODUCTION

Day by day, the Smart Irrigation System Technology is getting advanced in its field. Worldwide, Agriculture is playing a main lead for mankind. Most of the people in India rely on vital part of agriculture. In previous days, farmers were dependent on the mills to irrigate the farm land by old methods where they irrigate without knowing the appropriate quantity of the crops. These old and conventional methods doesn't use natural resources like water properly and also destroy some crops due to lack of irrigating field properly.

Recent times in India, farmers are using irrigation technique where the person itself has to irrigate the land time to time. In such case, sometimes we may have wastage of water. If we have irrigation system which runs automatically, there we can supply required amount of water without any wastage. It requires more time to irrigate a farm land when we can save our time by making it automatic.

In recent times, advanced technologies are used to reduce the human efforts and also to reduce the time consumed to irrigate the farm lands. Water is one among them which is wasted excessively. One of the methods is Mass irrigation which is used to water the plant. By following this method there will be large amount of water loss. Through the holes of the pot, the excess amount of water gets discharged

In this project, we will rectify the problems faced by the farmers like error in irrigating sufficient amount of water and conservation of electricity. And the errors like irrigating excess amount of water during rainy season. We will also check whether the water is flowing through the motor during irrigation, if the water flow sensor detects that the water is not flowing through the motor, we stop it automatically , there increasing the efficiency of the motor and we save electricity.

We must have to make efficient ways in creating the system to get the desired

output. Therefore, we must have great efforts to achieve it. Here the farmers should play the main lead in the advancement of the Modern irrigation system.

The need for farming products is ²² increasing day by day while increasing in population. Further, the potentiality and ability of the farmers are reducing day by day in the agricultural field. The income in agriculture needs to continue development regarding the prediction of world population increases from 7.8 billion in 2020 to over 10.5 billion by 2051. Efficiency has become an essential demand with the decrease in the farmer's potential.

Objectives of this project are facilitated and simplify the irrigating system by installing and designing the whole automatic irrigation system and to observe all the reading of the installed sensors from home, increases field performance by reducing excess watering from saturated soil. When it is not necessary it will stop watering the field with the help of relay which is programmed accordingly.

1.1 OBJECTIVE:

The main theme of the project is to create/make an ²⁶ irrigation system which is automatic with the use of devices like Arduino micro-controllers and sensors that solves most issues related to agriculture and irrigation, such as efficiently saving and controlling electricity and water. Using small quantities of water, increasing agricultural production, reduce intervention manually in operations related to watering with high increase in water speed. This automated system also provides an useful and very cost efficient irrigation system which is automated. Once the system has installed has no high cost for maintenance and it's use is easy. Parameters of Monitoring of Environment system based on wireless communication system technology had been created to be remotely controlled, which gives the temperature measurement, soil parameters and rainfall. These all features make the automated irrigation system good and efficient option to be kept in mind to increase the improvement of the irrigation efficiency and agriculture.

This study's goals are to find the perfect technique of automated irrigation system, which is controlled automatically through software in such a way, where the user is allowed to operate all the server's information from home.

The objectives to consider are:

Create a Low Cost GSM Based Automated Irrigation System based on Arduino, Moisture, Temperature, humidity, rain sensor and water-flow sensors.

- For coding in Arduino device, use Arduino IDE and various dependencies.
- Have a perfect research for Arduino device and its circuit.
- Proper testing and debugging of the device configuration.
- The irrigation system must be simplified by installing and designing the whole irrigation system.
- Create proper prototype of Automated Irrigation System.
- Conducting a survey regarding the project.
- Provide the proper value of Moisture, Humidity, Temperature and Rain.
- We have to save energy, which allows the smart irrigation system's application to be used more than other applications.
- Reduce water consumption.
- System must be fully automated.
- Cost of operation must be reduced.
- System must be made easy to be used by farmers.

1.2 Existing System and Proposal System

1.2.1 Existing System

In the present system, to send the exact field condition GSM Module is used, and the data is transferred to the owner in SMS but we can't observe the dynamic sensor readings. It also controls the DC Pump with the help of soil moisture sensor,

but it couldn't able to detect the water flow, where there will be a loss in electricity if water is not flowing through the motor. They are programmed in such a way that, they will work according to the weather conditions with the help of DHT11 sensor(It can detects both temperature and humidity) but which are not accurate at some certain conditions.This system does not required any human effort but it fails the efficient consumption of electricity.

1.2.2 Proposal System

This project is actually an irrigation system which is worked automated, mainly focused to for use of water and electricity efficiently. It is programmed to sense the moisture, rain, humidity, temperature with the respective sensors. Here, if the reading of the moisture level is low than the predefined value, then the pump will automatically switches on with the help of Arduino to pump water to the farm field, when system detects moisture content in a sufficient amount in the soil, water pump gets OFF automatically. Whenever module switches the pump OFF or ON, a Data will be delivered to the thing speak server through the GSM module, the user can observe the sensor dynamic values and check the water pump status using thing-speak server and the notification send to the user in the form of SMS. So, it is an Automatic Plants Watering System. There already exist so many smart water system that irrigates.

plants, with supporting soil moisture. These types of system are very much essential for the high productivity of soil for Big Agricultural Industries. In future days, these types of system will play a great role in simple farm lands like in house premises, office premises and in garden areas, where the system waters the plant whenever it is required. We also install a water flow sensor to the motor, so when water doesn't flow through it, the motor will stop automatically.

BLOCK DIAGRAM

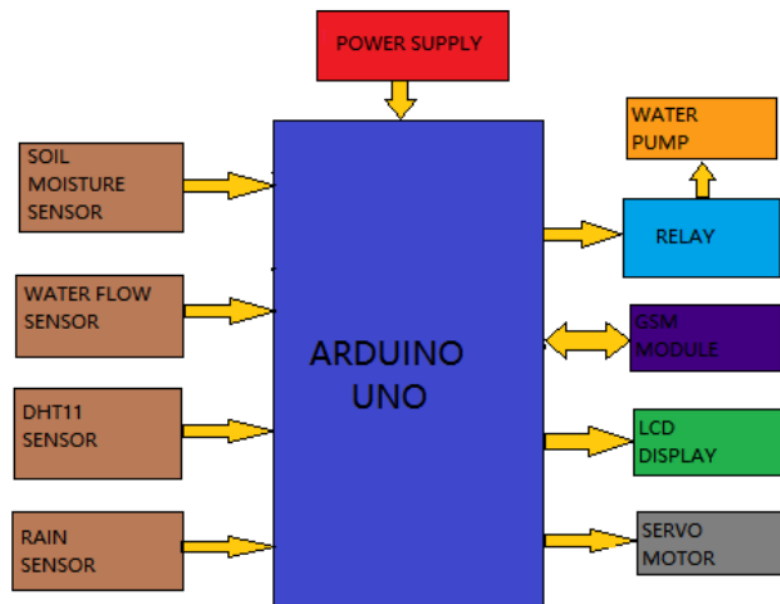


Fig 1.1 Experimental Flow of the Project

To achieve the exact project objectives we are shown that using Arduino as the operating system in this project is the best choice, it contains many open source hardware and software.

Hardware requirements:

- Arduino UNO
- LCD Display
- GSM Module
- Soil Moisture Sensor
- DHT11 Sensor
- Water Flow Sensor
- Rain Sensor
- Relay
- DC Pump

- Servo Motor

Software Requirements:

- Embedded C
- Arduino IDE
- Thing-Speak

Table 1.1 Comparison table for Existing System and Proposal System

EXISTING SYSTEM	PROPOSED SYSTEM
In the existing system they use only less number of sensors. So the accuracy is very low and the system we have now cannot detect the water flow and the PH value of water weather it is suitable for irrigation.	In the proposed system, we can monitor as well as control the system and check the status of the sensors. The system which implement to detection of water flow in DC pump.
Drawbacks of existing system	Advantages of proposed system
Water flow in DC pump check manually.	The system can be operated automatically using sensors.
The system didn't detect the weather	We can check the real time status of sensors.

CHAPTER 2

LITERATURE SURVEY

¹⁹ **2.1 GSM Based Automated irrigation system: An Efficient Water management.**

Author: Kushanav Das .

The system that presents a wise irrigation system appropriate to be used in places wherever water inadequacy could be a challenge. These kinds of typical irrigation system had many issues like increase in work of farm labor and infrequently it result in downside like excess-irrigation and activity of soil. good irrigation system is thereby believed to be a serious answer. therefore here creating GSM primarily based automatic Irrigation System victimization Arduino, that mechanically provides water to crop field and keep farmer updated by causation message to telephone.

2.2 GSM Based Irrigation System

Author:Arjun Dutta, Poulami Paul, Rahul Agarwala, Abhisikta Chakraborty.

The system which will irrigate the farm field automatically with the help of Arduino, which is pre-programmed. Here the Arduino board is connected to a moisture sensor of soil which will detect the level of moisture in soil. If the moisture sensor of soil detects a less moisture level in the soil, automatically the water pump will irrigate the soil at a accurate amount. A cellular communication system will be executed by GSM (Global System for Mobile Communications). Programmed messages are sent to the actual owner or the farmer whenever it is needed, where the farmer can observe the plant's condition from home.

2.3 Automatic Irrigation System Using Arduino

Author: Amisha Mishra, C. Ashwini, Shruti Duggal, Diparna Adhikary.

The system that relies on an automatic system that is employed for watering plants. The system provides water to the plant automatically once it's needed. The

soil moisture will sense the moisture content of the soil. Water conducts electricity, therefore less resistance implies that there's water present within the soil. Whenever there's additional resistance, it means that there's less water within the soil.

2.4 Arduino Based Water Irrigation System.

Author: Shruti Bansod, Rishita Jaiswal, Priyanka S, Prajakta S, Prof. Dr. Sachin Sawant

The system of automatic water irrigation system, wherever he has used 2 moisture sensors which is able to browse the moisture value of the soil by taking its resistance value. He has used the sensors in analogue mode therefore it'll reads the values from 0-1024. Then He has taken mean of the values reads by each the sensors, which is able to be then compared to threshold value. Threshold values area unit determined by testing the sensors many times. If the value reads by the sensors satisfies the condition for moisture, the relay can activate pump. If the value reads by the device satisfies the condition for moisture, the relay can shut down the pump.

2.5 Smart Irrigation System Using IOT And Raspberry Pi

Author: Prof. Priti Rajput, Prof. Asif Shaikh, Ms. Swapnali , B.Pawar .

The system wherever soil-moisture sensing element and temperature sensing element are installed within the root area of plants, system will distribute this data through the network. Here, main part of system is Raspberry pi where the digital camera is having a interface with it via Raspberry pi. Python artificial language is employed for automatic purpose. This system may be a wireless sensors network and a base station of wireless which might be accustomed offer the data of the sensors to irrigation system to be automated. The system will use the sensing elements like soil wetness sensing element and temperature of soil sensing element. This model is design in such a way that, if either wetness of soil or temperature readings cross a defined strength, the irrigation system is automatic, the relay connected to raspberry

pi can activate or OFF the motor. The planned paper gift AN economical, fairly low cost and straightforward automatic irrigation system. this technique once put in it's less of maintenance value and is simple to use. By exploitation the digital camera with appropriate application on itinerant we cansimply on-line observance the particular state of affairs of the sector and sensors like soil wetness and temperature are accustomed offer the knowledge concerning changes happens within the field. it's a lot of advantageous than the standard agriculture techniques.

2.6 Smart Water Dripping System for Agriculture/ Farming.

Author: Sushmita Mitkar, Deepali Javale, Sonal Mahajan, Priyanka Padalalu, Kartikee Dabir

The system to regulate the supply of water to the farm fields, to decrease human efforts, to create a smart irrigation system, efficient and autonomous. We found that the per capital availability of water in India has reducing trends, so, we must need a Smart irrigation system for efficient use of water.

2.7 Implementation of an Automated Irrigation System

Author: U N V P Rajendranath, Dr. V. Berlin Hency.

The system, where the sensors will start working when the Arduino is supplied with power. Temperature and Humidity of the roots of the plants will be sensed by DHT11 Sensor and on the other side wet sensor will detect the moisture level of the sensor. Micro-controller is programmed in such a way that it will run the system according to the weather conditions and work as per the requirement. When the value read by sensor is less than threshold value then the values will be displayed in the LCD Display through Micro-controller. When the value read by the sensor is not less than the threshold value then the user will get a alert message to his mobile phone through the micro-controller even if he is far away from the area.

Table 2.1 Comparisons Of Existing Systems

System	Moist ure Sens or	Temper ature & Humidit y Sensor	Wate r Flow Sens or	Rain Sens or	Rela y	GSM Modul e	OTHER S
Implementation of anAutomated IrrigationSystem	YES	YES	NO	NO	YES	YES	--
Arduino Based Water Irrigation System	YES	NO	NO	NO	YES	NO	--
Automatic Irrigation System Using Arduino.	YES	NO	NO	NO	YES	NO	WIFI MODU LE
Smart Water DrippingSystem For Agriculture/ Farming	YES	YES(O NLY TEMP)	NO	NO	YES	NO	IOT MODU LE
Smart Irrigation System Using IOT And Raspberry Pi	YES	YES (ONLY TEMP)	NO	NO	YES	NO	WIFI MODU LE, WEB CAMP
GSM Based	YES	YES	NO	NO	YES	YES	--

Automated IrrigationSystem: An Efficient Water Management		(ONLY TEMP)					
GSM Based IrrigationSystem	YES	NO	NO	NO	YES	YES	--
Low Cost GSM Based Automated Irrigation System Using Arduino And Sensors.	YES	YES	YES	YES	YES	YES	--

CHAPTER 3

AIM AND PROBLEM DOMAIN

3.1 AIM :

This project is to create Low Cost GSM Based Automated Irrigation System Using Sensors based on Arduino which help us to monitor moisture, humidity, temperature, water-flow and rain through server from home and irrigates accordingly.

3.2 PROBLEM DOMAIN :

Many country's economy depends on agriculture. If the best quality is to be achieved from this research, to focus on some important characteristics is important such as the use of electricity in appropriate way as well as a good schedule for crops to get irrigation and water supply. Problems are faced by farmers to reach these quality standards, mainly those who are living in poverty. This idea gives importance on developing an irrigation system which is automatic that could be observed through a server from home itself. The idea of the system is to minimize the workers in numbers in a field of crops, save and control electricity and water, Agricultural production needs to be increased using water in small quantity. These all features make the research a good sustainable option to consider to have good improvement in the irrigation efficiency and agriculture.

3.3 IMPLEMENTATION :

The Arduino connected with the required sensors, then run the system. First of all, the main screen of the system will be opened with thing-speak server where we can observe what's happening on the field. The system will check if all the device are connected and are at good condition. If they are on link then it notifies the user that device is linked properly or else notifies the user that the device is not connected or not working properly. The system must be properly installed in the field. In the Screen user can see all the details related to the system in whole Example, if it is raining today , user can able to see how much amount of water is flowing into the field, and if water is not flowing through the motor, did motor switched off or not.

CHAPTER 4

MATERIALS AND METHODS USED

4.1 SYSTEM REQUIREMENT

For a project, it is must that we should have right equipment at right cost to get the desired system. So, before that we should have a good idea and plan to implement the project.

4.1.1 FUNCTIONAL REQUIREMENTS:

Functionality and features of system will be described by the functional requirements. The operations recorded by the Functional requirements that must be done. The following are the Functional requirements.

If the condition of moisture is dry, the rain sensor will be checked if there is rain by the system, it will be in off state because when there is rain, we need not to irrigate, or else system will check the humidity sensor with the temperature sensor, if it is high temperature on the day and if there is low level of humidity as well, the system will be in off state because due to high temperature evaporation of water will take place.

If there is no rain and the temperature is low but the condition of moisture sensor is dry then the controller will get a signal to open the pump and valve. If there is high in humidity percentage then half of the water will be irrigated by the system, because there may be a case of rain on that day, and the remaining water on the next day depends upon the rain fall.

If water doesn't flow through the motor then the motor will shut down automatically as the water flow sensor doesn't detect any water flow and send notification to the user through the server and through message to mobile device.

4.1.2 NON-FUNCTIONAL REQUIREMENTS:

Easy to implement

There must be easy installation of the materials which are required for this project, to implement a successful project. To become more effective, the materials must be easy to each other to be connected. And also, there must be easy replacement of the materials, if any damage.

Open source

The open-source controller is used for this project, so the hardware used is of high price and has development software in free.

Strength

There must be strong tools needed for this project for long time operation to achieve the success we desire. We have to save money to reach a great goal.

Quality

There must be excellent quality of tools needs to be build this project to run for a long period of time. It is very much important to select quality materials to avoid wastage of money and to neglect the technical problems faced by the devices. To achieve the desired success of this project, excellent quality is required for this project.

Modifiability

Based on its ease of modifiability, the materials are to be chosen, ¹²as its normal to come across connections and designs. Also, to be easy to modification required in the future replace.

Communication

To get a good communication of data of the crop field to home through a message, GSM module is used in this project.

Accuracy

There must be a detailed reading of all data because for analysis and research it will be delivered to display to a computer system .

Performance

This system should work in the real-time.

Operational

This system works automatic and it is connected to a server through wifi module so the user must have access to server to observe the readings.

Cost

Materials required for this system must not be expensive because we are targeting to reduce the workers where we can decrease the amount required for irrigation and solve the problem (decrease the water consumption and electricity) at the time.

Security

The agenda of the system which takes care that the system must be protected from the malignant harm.

Performance

The way in where the performance meet by the system targets, is clearly and explicitly is to be specified. It might not need anything specifically for its simple operation, but there may be a performance requirements for the complete system along with the components connected.

User-friendly

Here, the user-friendly device is Graphical User Interface (GUI).

Usability

It determines how hard it is to use the system and to learn.

Availability

Availability means for how much long the system will be operational and for how much long the system is available for the users.

Reliability

It says how the software often fails. The calculation is determined in Mean Time Between Failures (MTBF). Before the deployment, the system is completely tested. Data consistency is thus maintained with the module developed.

4.2 Software Quality Attributes:

Some added attribute and quality of system is very much important for the developer's a like test ability, correctness and usability. By developing the product usability can be obtained as user-friendly. Proper attention and correctness responsibility should be given during coding and design. For long life of the product,

Maintainability and testability plays an important role.

4.2.1 Feasibility Analysis:

The purpose of practically proposed system or project is called Feasibility analysis.

Schedule Feasibility:

By the beginning of the semester, the project's development was planned to reach designing phase which gives a three months duration. This was enough time to get the end product and the software in working version

4.2.2 Risk Analysis

One of the main factor we must consider is, we have to overcome the risks faced by the system in certain cases.

Performance Risk:

Whenever the system is ON, we may get a constant/different value if any sensor got damaged. It will effect the efficiency of the motor, mainly when Water Flow Sensor gets damage.

Safety Risk:

The risk is on the user data with the system. The data of the user may be depraved and/or lost due to improper storage and management. This needs to be handled by using the document which are dependable in the back end to store the data of the user.

1 4.3 EXTERNAL INTERFACE REQUIREMENT:

4.3.1 Hardware Interface:

People and Technology are connected through physical binding by Hardware interface. With the hardware resources, the system will collaborated. The design will shape the connection between the technology and user.

4.3.2 Software Interface:

The software which we used that's the Thing-speak server stores and displays the data. We have also used Embedded C to program the Arduino.

4.4 ARDUINO MICRO-CONTROLLER

INTRODUCTION TO ARDUINO

The Arduino is like FPGA we can upload any program and use it accordingly. It is a user-friendly the user can use one Arduino board for different purpose. Arduino uses different processor's the main processor used in most of the boards are ATmega328, this processor contains 28 pins and it is like a CPU for system.

The Arduino uses DC power supply 5v and the Arduino UNO micro-controller having 2 KB SRAM so the UNO board having limitations. According to your project you can choose different types of board. It has 32 KB flash memory when ever the program lode from IDE stored in flash memory.

The Arduino UNO has 1 KB of Electrical Erasable Programmable Read Only memory, and it stores the data whenever the device is reset. It has runtime memory of 2 KB.

The Arduino UNO having digital and analog pins. Digital pins is used for digital data and for displaying the data in LCD. The analog pins is used for reading the sensor data.

WHY ARDUINO ?

It is a user friendly the user can able to code on there own and dump the code to Arduino board for particular use Arduino is used in n number of projects and these Arduino can act as micro-controller so it works on particular task when the user wants to use the Arduino board in other project then the user needs to upload the different code in Arduino board. The Arduino IDE is very flexible to use and these IDE run on most of the platforms like Macintosh , Windows and Linux. The Arduino is use to build the projects and also build the scientific instruments for proving the principles in chemistry and physics and for creating a small robots and one can design and build a prototype for particular task. Arduino boards can install in musical instrument. Arduino is used to build many of of the projects exhibit Arduino kit is used for beginners having instructions and one can use their ideas to implement the project.

There are many micro-controllers and platforms for computing the physically by the user can refer the MIT's Hand board, and Parallax stamps and we have many online resources. In the micro-controller the program is easy to understand and the Arduino simplify the processing while working with micro-controller. Due to this the user can use the Arduino IDE Freely and the user get interest while work with Arduino and the Arduino is user friendly.

Inexpensive - Comparing to all other boards the Arduino boards are very less expensive the Arduino micro-controller is very less expansive then other boards. The pre-assembled boards are cost is less around 1000Rs the UNO is the basic board the user can start with this board.

Cross-platform -The Arduino IDE is running on any platform like in Macintosh, windows & Linux. The other micro controllers are mostly limited to Windows in Macintosh and Linux those micro controllers are not worked.

Simple, clear program environment - The IDE is an open source and easy to use for beginner, the Arduino is most flexible for the advance users and the user can able to advantage for learning about Arduino. It is more use for students by learning these type of environment and familiar also student can learn how to work with IDE.

extensible software & Open source - The Arduino IDE is a Free software and it is user friendly. It is open source tool any one can use the tool and make it useful the language used in Arduino IDE is Embedded C. The Embedded c is extends from C and C++, they are numerous library files the user can access and make it useful the Arduino having AVR C programming language it is more similar to the AVR code directory

extensible hardware & Open source - The IDE or source is publish under a CCL. So the experienced designer can create their own Circuit design and use it accordingly. The inexperience user can the board using bread board and then if it works the the user can build standard board..

ARDUINO UNO:

Arduino UNO is one of the board in the Arduino boards. Arduino UNO can control the physical applications like Washing Machine and reduce the human effort. The Arduino is like FPGA we can upload any program and use it accordingly. It is a user-friendly the user can use one Arduino board for different purpose. Arduino uses different processor's the main processor used in most of the boards are ATmega328, this processor contains 28 pins and it is like a CPU for system.

The Arduino uses DC power supply 5v and the Arduino UNO micro-controller having 2 KB SRAM so the UNO board having limitations. According to your project

you can choose different types of board. It has 32 KB flash memory when ever the program lode from IDE stored in flash memory.

The Arduino UNO has 1 KB of Electrical Erasable Programmable Read Only memory, and it stores the data whenever the device is reset. It has runtime memory of 2 KB. The Arduino UNO having digital and analog pins. Digital pins is used for digital data and for displaying the data in LCD. The analog pins is used for reading the sensor data.

Overview

The Arduino micro-controller is an easy to use. The Arduino is like FPGA we can upload any program and use it accordingly. It is a user-friendly the user can use one Arduino board for different purpose. Arduino uses different processor's the main processor used in most of the boards are ATmega328, this processor contains 28 pins and it is like a CPU for system.

The Arduino uses DC power supply 5v and the Arduino UNO micro-controller having 2 KB SRAM so the UNO board having limitations. According to your project you can choose different types of board. It has 32 KB flash memory when ever the program lode from IDE stored in flash memory.

This is what the Arduino board looks like.



Fig 4.1 Arduino UNO

The Arduino UNO has 1 KB of Electrical Erasable Programmable Read Only memory, and it stores the data whenever the device is reset. It has runtime memory of 2 KB.

The Arduino UNO having digital and analog pins. Digital pins is used for digital data and for displaying the data in LCD. The analog pins is used for reading the sensor data.

The Arduino IDE is a free software, so anyone can use this software in this software we use embedded c for coding, and this software is user friendly and the user can check the output readings in a serial monitor.

This Arduino IDE software only interfaced with Arduino micro-controller boards. The IDE contain a code editor where the user can write the code and check for errors than the user need to check the port is connected or not then upload the code to Arduino micro-controller board.

In every Arduino boards having two LED's for TX and RX when the program is uploading both LED's blink. If the program upload then the LED's for RX and TX will stop blinking. If the program is not uploaded the we got an error message in below message box.

The Arduino(IDE) or Arduino Software when we write programs using IDE called as sketches. These programs written in Embedded C and in Arduino IDE Having a text editor where we write the programs and save these programs with the help of file extension called **.ino**.

4.4.1 Summary:

- The micro-controller is operated in 5 volts.
- Arduino can withstand 6-20 volts but in above 12 volts the board gets heated up.
- The Arduino UNO having Fourteen digital pins and Six analog pins.
- The Arduino board only work with DC voltage.
- The Arduino board having 32 kilo bites of memory with in these memory the boot loader takes 0.5 kilo bites of memory and it has 2 KB static RAM and EEPROM of 1 Kilo bites.
- The Arduino Clock Speed is 16 MHz.

4.4.2 Pin Configuration

The Arduino UNO is having a USB type A/B connector for powering the Arduino and we can use Vin pin for giving external input.

Most of the external power in AC so We have to convert Analog current to Direct current or we can directly use 5 volts battery positive in Vin pin and negative in ground pin. The type A/B is connected to board's power jack directly to the adaptor.

The Arduino board can operate from 6 to 20 volts. But the Vin pin is supply only 5 volts to board but when the sensors are more and these sensors are interfaced with Arduino then the performance gets decreases. If the user use more then 12 volts then the board get aver heated and burn the components on the board.

The Arduino Main pins are follow:

VIN. The Vin pin is an external power supply pin when the user use different Arduino Boards then few Arduino boards are not having USB port on that time the user can

use these Vin pin for power supply.

5V. The 5 volts pin is used for sensors and it is a output pin the board can supply only 5 volts to the sensors. Most of the sensors work in 5v so the 5 volts output pin is enough to supply the power to sensors.Few sensors can work in 3.3 volts the Arduino board having both 3.3 and 5 volts output pins.

3V3. the 3.3 volts is used for LED and Few sensors. The Arduino board having an on board regulator With the help of on board regulator the board supply 3.3 volts.

GND. The ground pin is used for connecting all the sensors as a common ground We have 3 ground pins in Arduino UNO.

IOREF. The IOREF pins is a input output voltage reference pins so the micro-controller operates and configured the shield so that the IOREF pin voltage read by shield and the user configure the required power source.so the outputs 5 volts and 3.3 volts work properly.

Memory. The processor ATmega328p has 32 kilo bites of memory and with in these 32 KB the boot loader uses 0.5 kilo bites of memory.The Arduino has 2 Kilo bites of static Ram and 1 kilo bite EPROM.

Output and input. The digital pins are used as both I/P and O/P pins with the help of functions like pin Mode(input/output), digital write and read. All the input and output pins are operated in 5 volts and the current receiving in these pins are maximum of 40 mA.These pins having resistance up to 50 kilo ohms. And some pins mark with tilde those are use for approximate values.

Serial:

These Serial pins used to transfer the data from one board to other board like TTL Serial chip to USB

Interrupts:(External 3 and 2). These pins are configure as trigger pins so these pins is used for triggered sensors like water flow sensor works in pulse. We have the edges for both rising and falling.

PWM: It Provide an analog wire function where it has 8 bit PWM.

SP: These SCK, MISO, MISI, SS pins support for SPI communication using library.

LED: 13. LED and 13 pin are inter connected as 13 pin is 1 then led is switches on and when the 13 pin is 0 then led pin is Switches off.

There are six analog pins in Arduino UNO and they are labile with the prefix "A" every analog pin has 10 bits resolution so these analog pins can read the values in bit range from 0 to 1023 bits. These analog pins by default they are low or 0 volts. Possible to change the values to upper end and we have a AREF pin and also having analog reference.

TWI: The TWI is used for communication and it used a wired library.

AREF. It is a analog input reference voltage.It gives the voltage for analog inputs.

Reset. This button is used to run the program from start. It is also used to restart the code when the code is not working.

APPLICATIONS:

- There is a game console using Arduino. The game console called as Arduboy
- Using Arduino there is a MIDI controller for mimics the Monome called Arduinome
- Using Arduino their is a drone called Ardupilot.
- Using Arduino their is a cube sat called ArduSat.
- There are many robots using Arduino boards and C-STEM studio is one of the platform for integrated learning.
- Most of the cars uses Arduino for onboard diagnostics called OBDuino.

14 4.5 GLOBAL SYSTEM FOR MOBILE COMMUNICATION

The Global system for mobile communication (GSM) is a most popular mobile radio communication is one of the exponentially developing telecommunication system establish in 1982 It will develop an European mobile standard and the basic communication system will operate in 900 MHz. Then many countries joined and partnership with GSM and started cellular radio communication.

THE EVOLUTION OF MOBILE TELEPHONE SYSTEMS:

The Mobile radio communication is one fastest growing telecommunication application. The percentage of telephone subscribers are increased day by day in 2009 the article shows that shows that there are 8.3 billion subscribers uses cellular communication in world wide. The phones are evolving day by day from 2010 onwards the phones are updated and more then 70 percentage uses phones these will be increase further. The cellular communication is increased from past decay and now 4G with HD voice call.

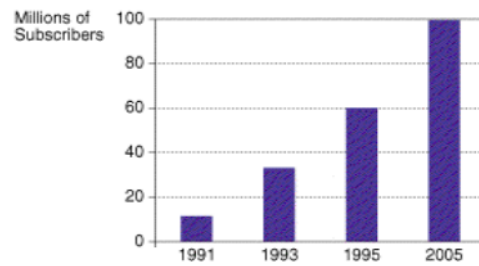


Fig 4.2 CELLULAR SUBSCRIBER GROWTH WORLDWIDE

The mobile service concept is using of transmitters of less-power where reuse of frequencies of geographic area can be within. The mobile radio idea of mobile-based service in the US was formulated in 1970 at Bell Labs. The countries of Nordic were the first to start mobile services for use in commercial with the Nordic Telephone's (NT) introduction in early 1980.

In 1983, the US the Cellular systems began through the introduction of the advance Telephone phone service (ATPS) system. By Asia, the ATPS standard was adopted, Latin Oceanic countries and America, create the market in a largest market in the cellular world.

In early times of introduction mobile and maximum of cellular telephones were analog but not digital, today's new technology of recent time systems. The main problem is to face systems in analog was unavailable to manage the efficient growth required in a manner in less-cost. So the result, welcoming the today's technology took place. The advance systems in digital is more then analog systems including signaling ease, lower standards of interference, integration

THE GSM NETWORK:

The GSM recommendations is provide,not requirements. The GSM specifications says that requirements and the functions of interface in detail but hardware need not

to be address. Main idea is to keep the creators limit as suitable but also do it that happens for the equipment to be bought by the operators from some other suppliers.

It is mainly divided into 3 major systems:

- 1) BSS
- 2) SS
- 3) OSS

These network elements are shown.

GSM NETWORK ELEMENTS:

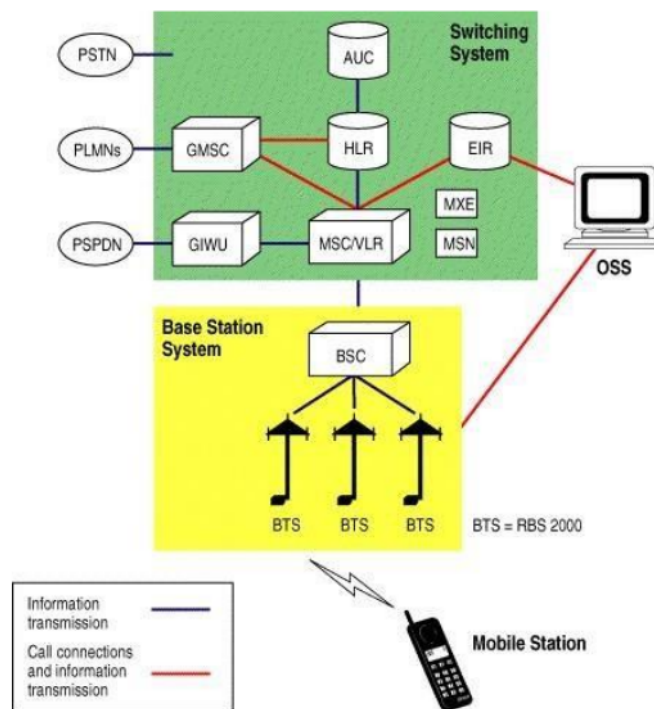


FIG 4.3 GSM NETWORK

THE SWITCHING SYSTEM:

It is required for subscriber-related functions & call processing to perform.

This system that includes the following units.

FUNCTIONAL UNITS:

The functional unit is a back end support used to manage the subscriptions and store the data. It is one of the main important databases, as it has the capability of storing the data permanently for users and store their profile of user and their status. When a person buys SIM from an operator of PCS, then the Home Location Registered.

11

Mobile services switching center (MSC)

The MSC makes the switching functions for telephones in the system. Calls are controlled by the MSC other data systems and telephone. Such functions are also performed as network interfacing, toll ticketing, channel of common signaling, and others.

visitor location register (VLR)

It is a back end support where non permanent details about users are contained that is required to service from the MSC users visit. The MSC is every time related with the VLR. If there is a roaming in the station then it send to MSC areas, the MSC related to the particular VLR will ask data from the station in HLR. Later, we get a intimation from mobile station, the VLR have the exact details required form user to setup without a require to interrogate from the HLR .

Authentication center (AUC)

AUC gives encryption parameters, authentication that will verifying the identity of the users and make each call confidential. The AUC saves operators from various frauds in Mobile communication world of today.

Equipment identity register (EIR)

It is a Back end support that contain of the mobile equipment's that identify the fraud calls and prevent them, or the stations which are defective and unauthorized. The EIR and AUC are used as a combined EIR/AUC node or as nodes of stand-alone.

SIM 800 GSM/GPRS MODULE

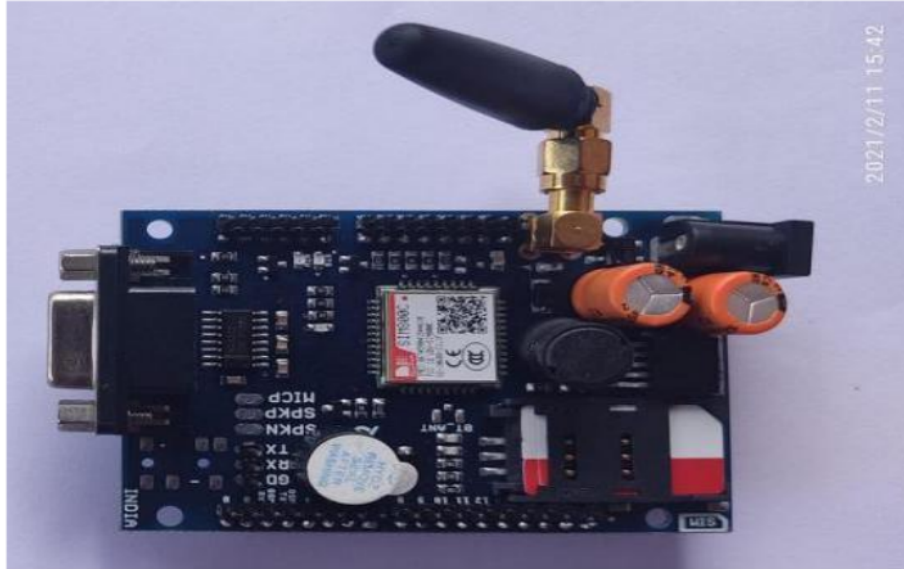


FIG 4.4 GSM MODULE

A GSM module works with the help of AT commands, and the GSM is mainly used for communication, an SMS and the data transfer. Here we use a gsm800c it has a Quad-band GSM/GPRS. The user can use it for the custom applications. This module is a sub-system, and we can use it for the cellular IOT applications. With the help of different AT commands one can send the data and receive the data, and we can check the registration status, a pin code for the sim status, a connection status and check it is connected the single or multi IP connection. The GSM module uses the 12v power supply, and it has dual-band for GSM 900MHz and for GPRS 1800MHz. It has an inbuilt TCP/IP protocol so the data can transfer through internet over GPRS band. This module can connect with a micro-controller with the help of a trans-receiver pins.

FEATURES:

- The GSM module works 900 MHz and GPRS module works 1800 MHz.
- The RS232 interface is mainly used to for communication with computer or by using MCU kit and it can be configurable for baud rate.
- The GSM module can have power controller IC for ESD compliance.
- The GSM module having Earphone socket for answering calls.
- The GSM module having antenna so that the sim get signal.

POWER MODES:**Power down mode:**

- SIM800C having a commands like AT commands We use "AT+CPOWD=0" is used for power down mode.
- The GSM SIM800C having two modules for low consume power.

Minimum Functionality Mode:

- The GSM has Minimizes the current consume using minimum functionality mode.
- The command for minimum functionality is "AT+CFUN=0".
- The command for full functionality is "AT+CFUN=1".
- The command for disable both functionality is "AT+CFUN=4".

Sleep mode:

The GSM can be controlled by user when the sleep mode is activated and when the sleep mode is disable by customer preferences. When the DTR is high then the GSM is Automatically goes to sleep mode but GSM can able to receive message from network but it is no use because the serial port is disable.

Wake up SIM800C from sleep mode:

The GSM can be Wake up using DTR pin. The DTR pin is very low then the GSM is Wake up. With the help of DTR signal is Wake up GSM from the power saving mode. When the DTR Pin change to low level then the serial port is activated.

There are other ways to wake up GSM from sleep by sending SMS or DATA or call to that particular network will wake up automatically.

Table 4.1 PIN SPECIFICATIONS:

Pin.No	Name	Details
1	GND	It is used for Ground
2	TX	It is used to transmit the data.
3	RX	It is used to receive the data
4	Line_r & Line_l	It is used for Line input
5	Spk_p & spk_n	It is used for Speaker positive and Speaker negative
6	Mic_p & mic_n	It is used for Mic positive and Mic negative.
7	DTR	It is used for data terminal is ready or not
8	CTS	It is used to send the data when it's clear.
9	RTS	It is used to Request the

		data when it's clear.
--	--	-----------------------

WORKING:

The GSM module don't have any external interfaces like keypad and display so it works only using AT commands. A GSM module works with the help of AT commands, and the GSM is mainly used for Communication, an SMS and the data transfer. Here we use a gsm800c it has a Quad-band GSM/GPRS. The user can used for the custom applications. This module is a sub-system, and we can use it for the cellular IOT applications.

TESTING YOUR GSM MODEM:

When in GSM Modem inserted sim then power on the GSM module then first the LED blink per second after few seconds the LED blink for every 3 sec. With the help of different AT commands one can send the data and receive the data, and we can check the registration status, a pin code for the sim status, a connection status and check it is connected the single or multi IP connection, etc.

The GSM module uses the 12v power supply, and it has dual-band for GSM 900MHz and for GPRS 1800MHz. It has an inbuilt TCP/IP protocol so the data can transfer through internet over GPRS band. This module can connect with a micro-controller with the help of a trans-receiver pins.

AT COMMANDS:

- The AT command for Text mode is "AT+CMGF=1".
- The AT command for Send SMS is "AT+CMGS=Phone_Number"
- The AT command for Read the first SMS is "AT+CMGR=1".
- The AT command for Read the second SMS is "AT+CMGR=2".
- The AT command for Read the all SMS is "AT+CMGR=ALL".
- The AT command to Call to a number is "ATDTP+Phone_Number".

- The command for Hang up a call is "ATH".
- The command for Receive an incoming call is "ATA".

4.6 LIQUID CRYSTAL DISPLAY:

Liquid crystal display is used to see the output readings. It consists of two 16 rows in each row we can display 16 characters. The LCD having 8 data pins(the D0-D7) we need only 4 data pins, RS and enable pin to connect with Arduino. The anode and a cathode is used for a background light in the LCD. The LCD's are very economical. The user can easily program the LCD's. These LCD's can able to display the special character.

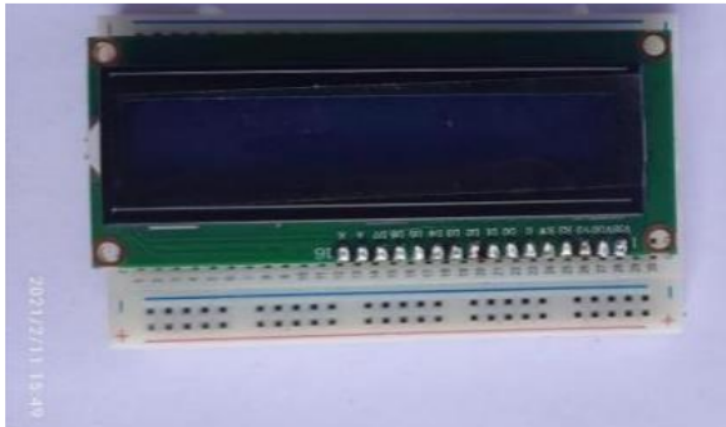


FIG 4.5 LCD DISPLAY

In the above Fig.4.5 It is a 16 x 2 LCD so it has consist of two 16 characters to display. When ever the character is displayed in the LCD these characters are displayed in the form of pixel matrix. These type of LCD are having two types of registers they are command register and data register. The command register use to store instruction like initializing. Some command instructions is use to clear the display and right the cursor position and control display.

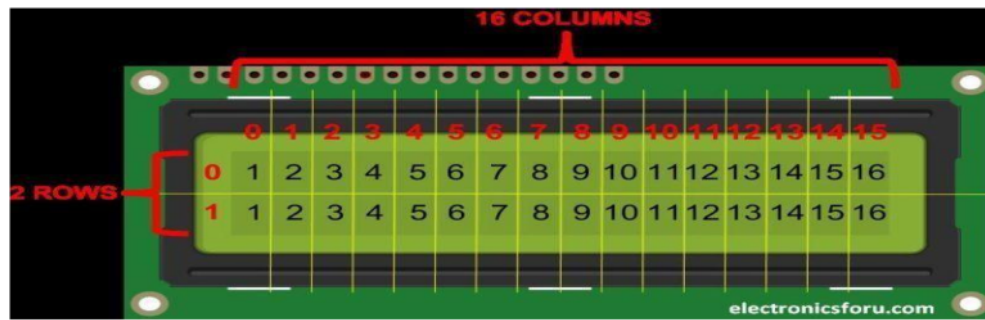


FIG 4.6 INTERNAL STRUCTURE OF A LCD

The data register is used to store the data which are displayed in the LCD. The data displayed in LCD are in the form of ASCII values. Whether it's number, string, character the data register can take only in ASCII values. Most of the displays used LCD in calculators, TV's, watches, etc.. LCD's is an electronic module and it can produce dark visible image. LCD works in black and white mode. These LCD's are mostly used in projects.

23

16X2 LCD PINOUT DIAGRAM:

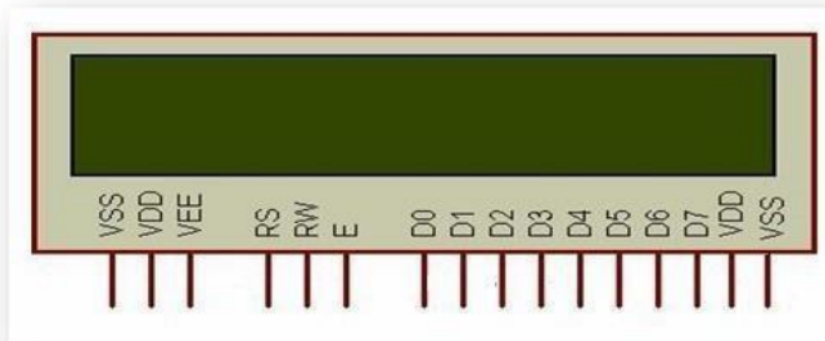


FIG 4.7 16X2 LCD PINOUT DIAGRAM

TABLE 4.2 X2 LCD PIN OUT TABLE

pin.No.	Function	Name
1	The pin 1 is the ground pin	Ground
2	The pin 2 is the Supply voltage. The LCD can operate in 5 volts.	VCC
3	The pin 3(V0) is use to contrast we can use potentiometer. With the help of potentiometer the user can adjust the contrast in LCD display by rotating Potentiometer adjust knob bu moving forward and backwards.	V0 or VEE
4	The pin 4 is used to command the register when there is low and command the register when there is high	RS
5	The pin 5 when the pin is low to write and when the pin is high to read.	Read/write
6	The pin 6 is enable pin it send data to data pins, the enable pin needs an extra voltage to the program Instruction when the pin 6 is 1 then the user can executes the instruction and when pin 6 is 0 the it acts as ground	Enable
7	The pin 7 is a data pin and it is a 8 bit data pin D0	DB0
8	The pin 8 is a data pin and it is a 8 bit data pin D1	DB1

9	The pin 9 is a data pin and it is a 8 bit data pin D2	DB2
10	The pin 10 is a data pin and it is a 8 bit data pin D3	DB3
11	The pin 11 is a data pin and it is a 8 bit data pin D4	DB4
12	The pin 12 is a data pin and it is a 8 bit data pin D5	DB5
13	The pin 13 is a data pin and it is a 8 bit data pin D6	DB6
14	The pin 14 is a data pin and it is a 8 bit data pin D7	DB7
15	The pin 15 is for back light for +VE	Led+
16	The pin 16 is for back light for -VE	Led-

RS(REGISTER SELECT)

These type of LCD are having two types of registers they are command register and data register. The user select RS to Low or 0 the command register work and when the user select RS to High or 1 then the data register is selected.

COMMAND REGISTER

The command register use to store instruction like initializing. Some command instructions is use to clear the display and right the cursor position and control display.

DATA REGISTER:

The data register is use to store the data Which are displayed in the LCD. The data displayed in LCD are in the form of ASCII values Weather it's number, string, character the data register can taken only in ASCII values. selected.

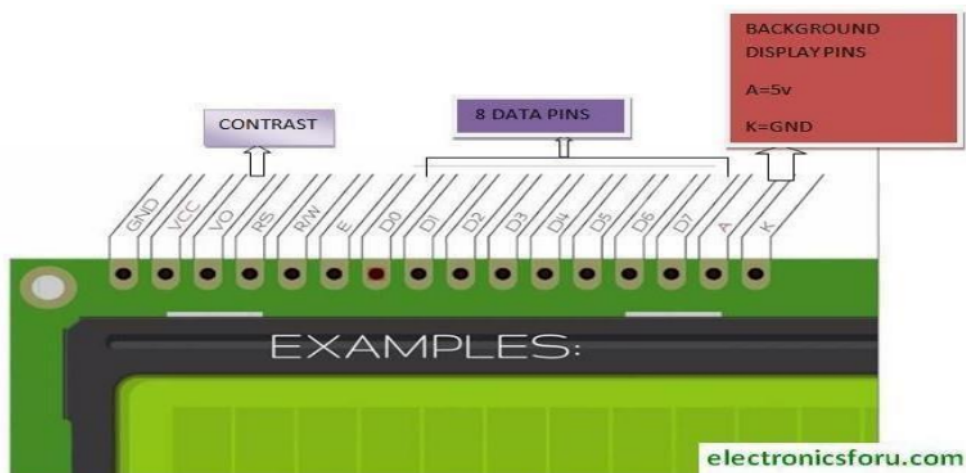


FIG 4.8 PIN LAYOUT DIAGRAM

TABLE 4.3 IMPORTANT LCD COMMANDS:

Sl.No.	Hex Code	LCD COMMANDS.
1	01	Screen display is cleared.
2	02	This command return to home.
3	04	This command Low the cursor.This command can shifts the cursor to left
4	06	This command High the cursor.This command can shifts the cursor to right
5	05	This command shifts the display to the right
6	07	This command shifts the display to the left
7	08	This command switch off both display and cursor
8	0A	This command switch off Display and switch on the cursor
9	0C	This command switch on Display and switch off the cursor
10	0E	This command switch off Display and the cursor is blinking.
11	0F	This command switch on Display and the cursor is blinking.
12	10	This command can shifts the cursor position to the left.
13	14	This command can shifts the cursor position to the right.

14	18	This command can shifting display to left.
15	1C	This command can shifting display to right.
16	80	This command is used to force the cursor from first line
17	C0	This command is used to force the cursor from second line
18	38	This command is used to display 2 line in matrix form(5x7)

4.7 SENSOR'S DESCRIPTION

25 **Soil Moisture Sensor:**

The soil moisture sensor work with analog pins of Arduino because of the soil moisture sensor read the data continuously and it sends the data int the form of a bit rate from 0 to 1024. The bit rate is converted in to the percentage with the help of the map function in Arduino IDE. The soil is dry then the power conductivity is very low and the resistance is very high so, it sends the data to Arduino as a soil moisture is very low. When the soil having enough moisture than the power conductivity is very high and the resistance is very low so, it sends the data to Arduino as a soil moisture is high.

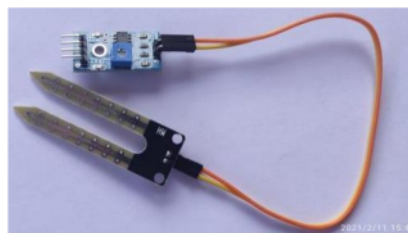


FIG 4.9 SOIL MOISTURE SENSOR

DHT11 Sensor:

The DHT11 sensor is use to detect both humidity & temperature, and it is a

semiconductor device. The sensor having two electrodes and it can hold the moisture substrate in between dielectric. when the humidity level is changed then the capacitance values also changed accordingly. The sensor having an IC it can change the analog values into the digital form.

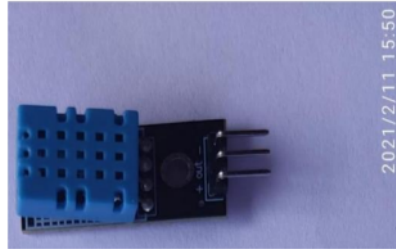


FIG 4.10 DHT11 SENSOR

18

Water Flow Sensor:

Water flow sensor is used to measuring the water measure in liter per hour or we can measure in cubic meters. This sensor will work in only digital pin D2. So the water flow sensor output will be in the pulse form. The water flow sensor is made with plastic and inside water flow sensor having a rotor. The rotor is rotated when the water is flowing through it then the hall sensor is reading the values of the rotor these water flow sensor interface with the micro-controller.

The water flow sensor works on hall-effect. It has three wires the data wire is in yellow color, and the positive wire in red color, and the ground wire in black color.



FIG 4.11 WATER FLOW SENSOR

Rain Sensor:

8

The rain sensor is used to detect the rain it is also used a resistance phenomena of soil moisture. When the water drops fall in rain sensor the resistance is low and the conductivity is high so the sensor send the data to Arduino in a bit rate from 0 to 1024. We can change the sensor accuracy using a potentiometer.

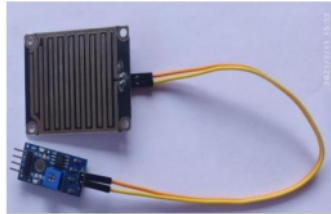


FIG 4.12 RAIN SENSOR

Relay:

A Relay is an electric switch it work with any micro-controller and it can control voltage and current with an Arduino. When the Arduino gives the input relay pin is low/high the relay is turned on/off accordingly. Relay has a small electromagnet with the help of electromagnet the relay Turn on/off the switch. In Relay can isolated negative feedback.



FIG 4.13 RELAY

DC Pump:

The DC pump (or) a centrifugal pump having a motor and an impeller, and the impeller is connected the motor with the help of shaft. When the motor is ON then the impeller is rotated and the water can be pumped through the DC pump. The impeller is surrounded by air tight passage.



FIG 4.14 DC PUMP

4.8 ARDUINO SOFTWARE (IDE):

The Arduino IDE is a free software, so anyone can use this software in this software we use embedded c for coding, and this software is user friendly and the user can check the output readings in a serial monitor.

This Arduino IDE software only interfaced with Arduino micro-controller boards. The IDE contain a code editor where the user can write the code and check for errors than the user need to check the port is connected or not then upload the code to Arduino micro-controller board.

1. Open the Arduino IDE.

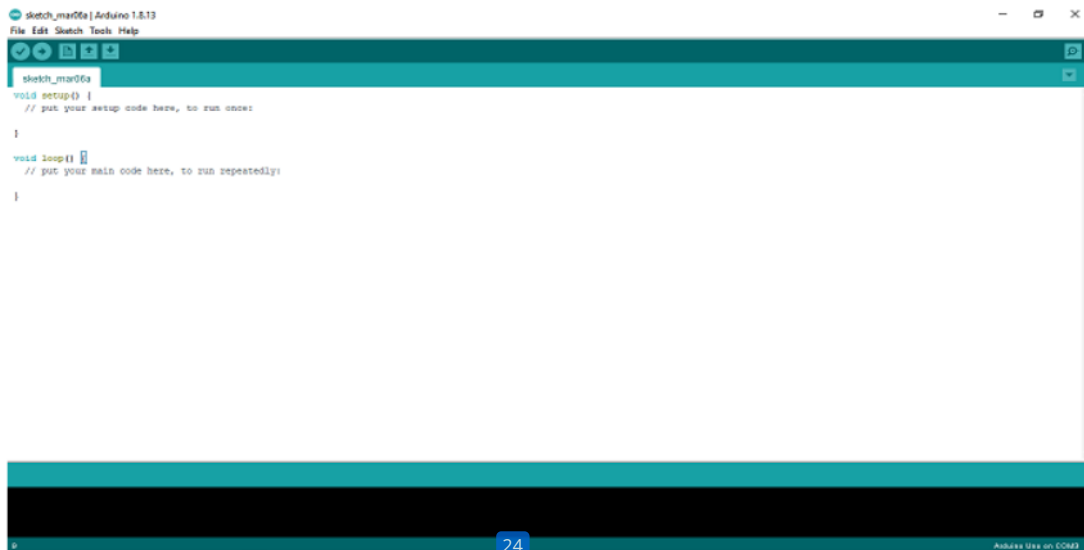


FIG 4.15 Open Arduino IDE

2. Select the required Arduino board from Tools as shown below

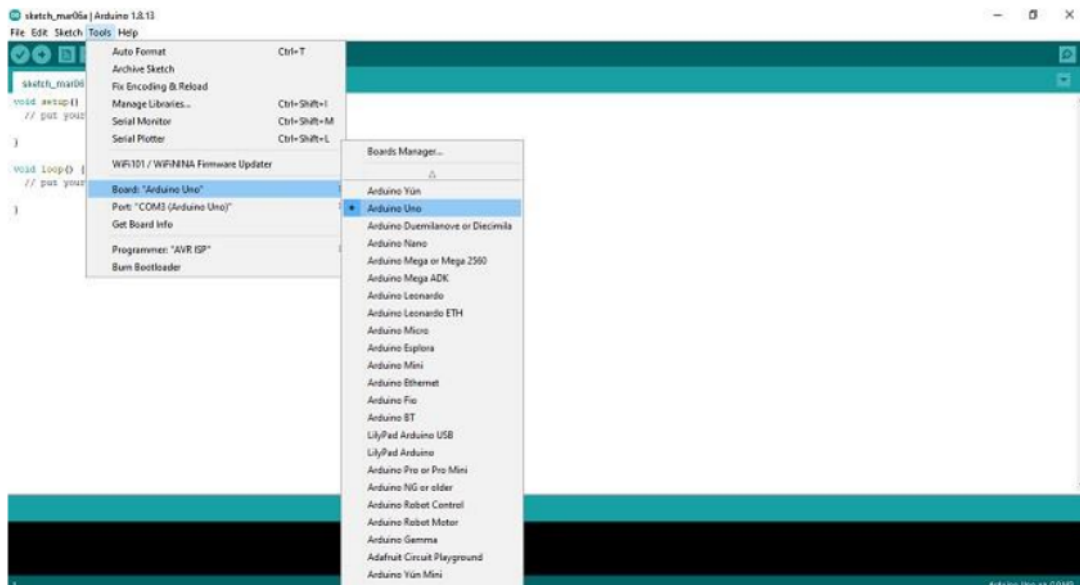


FIG 4.16 SELSECT THE REQUIRED BOARD

3. Select the COM Port from tool

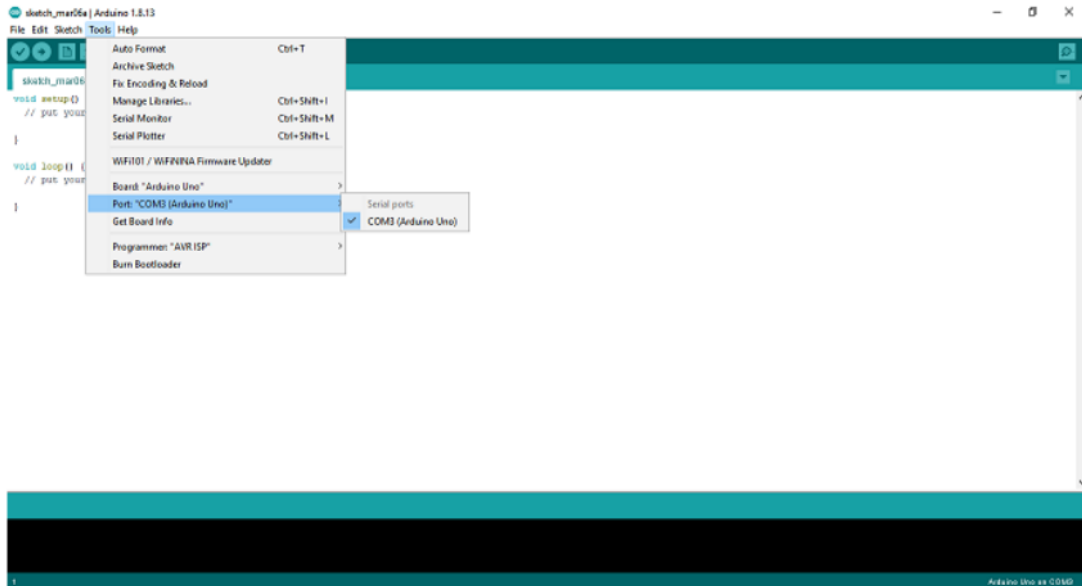


FIG 4.17 SELECT THE POART

4. Write the sketch in Arduino IDE and compile the sketch.



FIG 4.18 COMPILE THE SKETCH

5. upload the code to Arduino board using port.

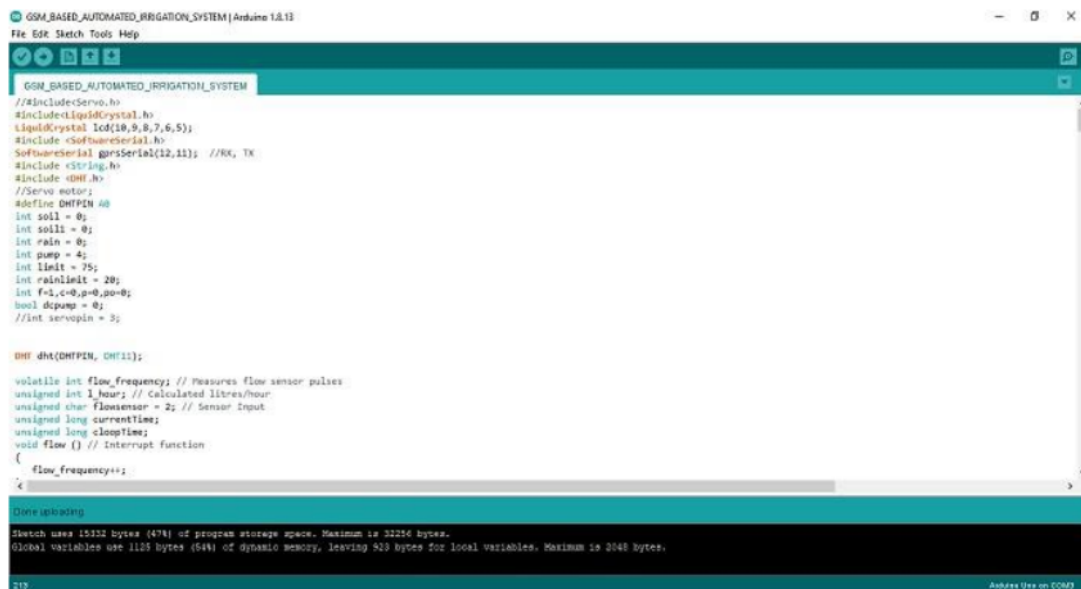


FIG 4.19 UPLOAD THE SKETCH

WRITING SKETCHES:

The Arduino(IDE) or Arduino Software when we write programs using IDE called as sketches. These programs written in Embedded C and in Arduino IDE Having a text editor where we write the programs and save these programs with the help of file extension called **.ino**. These text editor having a feature for searching the text, replacing the text and cut, copy and past the text. When we compiling the text then we get a appropriate message will displayed in message feedback area and displaying the text output in console including error messages & other information. In the top right corner IDE having a serial monitor for displaying with the help of serial port. In the top left corner we have buttons like compiling, upload, open, create, save buttons these buttons called toolbar buttons.

NB: Arduino IDE having a different versions and different file extension Like the prior version 1.0 program saved as **.pde**. Those prior version 1.0 programs can be saved as **.ino** extension files.

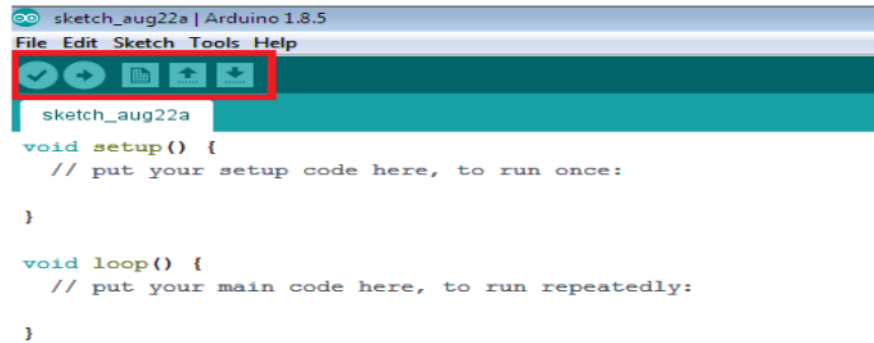


FIG 4.20 WORK SPACE

TABLE 4.4 WORK SPACE BUTTONS TABLE

 Verify When the user click the verify button then the code is compiling and find the errors.	
 Upload When the user click on the Upload then the IDE compiles the code and upload the code to board with the help of port.. Note: If the user use any external program in the board then you can hold the “Shift” key then the text is converted in to code and “Upload using Programmer”.	
 New When the user click on the New the new code editor is open	

	Open It opens the menu of all the sketch in the sketch book. Note: In the back end in IDE software there is a bug in java code so the menu didn't scroll. If you want to open a sketch Which is not used long then the File is the Sketch book menu.
	Save It save the code.
	Serial Monitor It opens the serial monitor.

In Arduino IDE we have additional commands in menu bar. The menu bar having File, Sketch, Edit ,Help and Tools. These menus are having only relevant on current work when we write code these menus are work only for that code.

FILE:

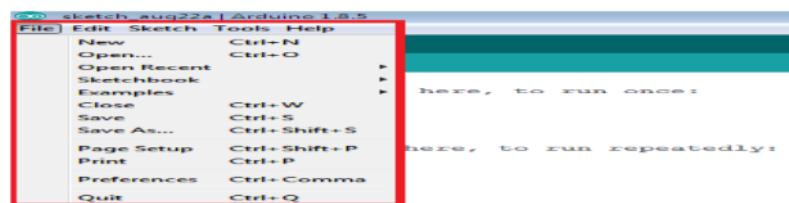


FIG 4.21 FILE IN ARDUINO IDE

EDIT:

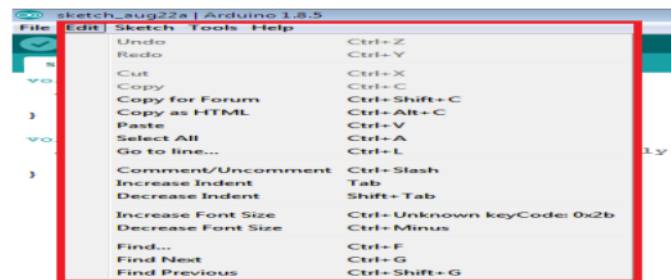


FIG 4.22 EDIT IN ARDUINO IDE

SKETCH:

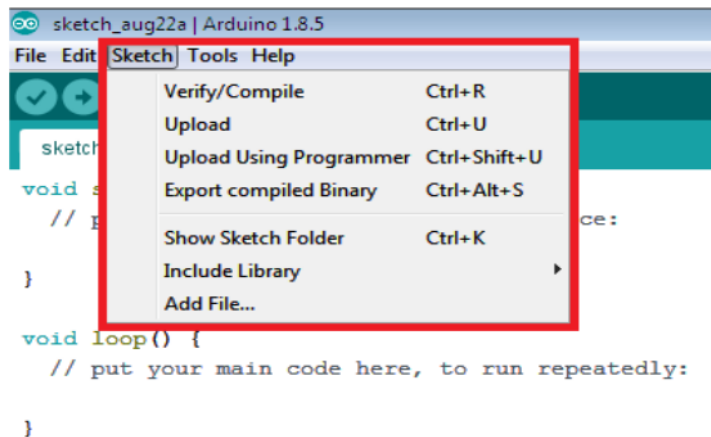


FIG 4.23 SKETCH IN ARDUINO IDE

TOOLS:

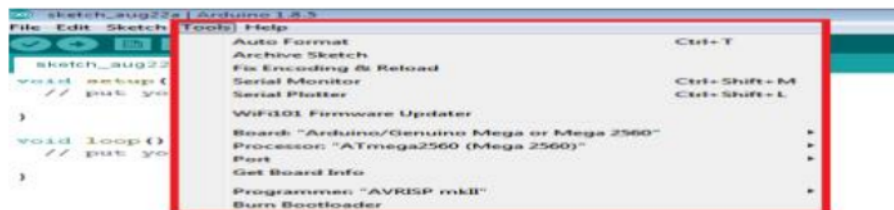


FIG 4.24 TOOLS IN ARDUINO IDE

- **Programmer:** While uploading a hardware programming in micro-controller or chips we don't need any serial connection like USB, but when ever we get a new micro-controller we using a burning a boot loader program in new board on that time we use serial connection.
- **Burn Boot loader:** Arduino boards needs to burn a boot loader in any new micro controller. When ever you buy a new AT mega micro controller(Which comes with out boot loader). We use a boot loader for that micro-controller but you have to select the correct the micro controller board for burning a boot loader in to a AT mega chip. When you select a right board you can target a right board for burning a boot loader.
- **Help:** The Arduino IDE. You have access to help window where you can trouble shooting and check the reference and you can also check the frequently asked questions and about the overview of Arduino we can check the reference with out network connection and these documents are having a local copy in IDE and these documents having a link back to online website.

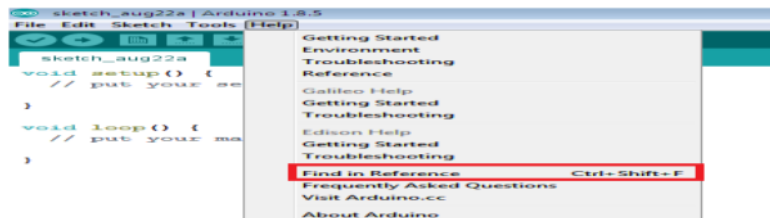


FIG 4.25 HELP IN ARDUINO IDE

UPLOADING:

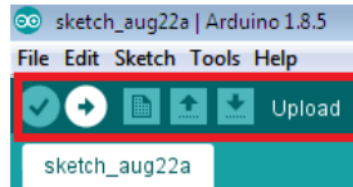


FIG 4.26 UPLOAD IN ARDUINO IDE

Before uploading the sketch, you need to check whether you have selected the correct board you can also check the board configuration in tools box. Inside tool box you have a port select, board select and board info.

3 On the Mac, the serial port is like `/dev/tty.usbmodem241` (it is used for an Mega2560 or UNO or Leonardo) or `/dev/tty.usbserial-1B1` (it is used for a USB board or earlier Duemilanove), or `/dev/tty.USA19QW1b1P1.1` (The key span is connected to serial board using USB to Serial adaptor).

On Windows, it's probably COM4, COM5, COM7, or higher (used for USB board) or COM1 or COM2 (used for serial board) -the user need to find out the serial device in the Arduino board using USB port in device manager.

On Linux, it should be `/dev/ttyUSBx`, `/dev/ttyACMx` or similar. When you are select the serial port and selecting the correct board the you press the upload button in the sketch menu or you can select the upload button in tool bar then current program in Arduino will be reset and new program will be upload. In older boards are having problem with auto reset but in older board having reset button we need to press reset button before uploading new program .

In every Arduino boards having two LED's for TX and RX when the program is uploading both LED's blink. If the program upload then the LED's for RX and TX will stop blinking. If the program is not uploaded then we got an error message in below message box.

When you upload the program in Arduino board we use Arduino boot loader. When you want to upload the programs like small programs on that time we use boot loader on the Arduino micro-controller. The boot loader used to upload the program with out any additional hardware. Whenever we on the Arduino micro-controller then boot loader is active and run the recent uploaded code and when we give a power supply to the Arduino board then the light will blink in 13 pin LED for few seconds.

LIBRARIES:

Libraries are providing an extra functionalities for use of programs in Arduino IDE we have an example programs for the individual components. To use library we can import the library files from our own device or we can import the library files in online in Arduino web site. These library's are help full to reduce the code. Because these library files are uploaded to board with the help of #include statements. If we don't need the library file in the program simply delete the #include file.

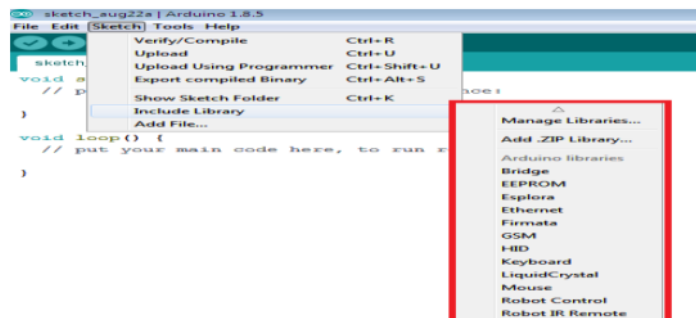


FIG 4.27 MANAGING LIBRARIES

We have list of library files in the Arduino IDE. Some basic libraries are included in Arduino and remaining we need to install in Arduino software using Sketch button in tool box inside sketch we have include library section in that we can either manage library's or we can import a zip library. So these Zip libraries can include the third party library's.

4.9 EMBEDDED C:

Embedded C is one of the programming language and it is more popular language in field of software for the electronic gadgets and every gadget have associated with embedded C software.

Embedded C program is mainly work with micro-controller and most of the electronic gadget's used micro-controllers in daily life. The main gadget we used day to day life is mobile phone, camera, washing machine, television, etc. Every gadget in the above mentioned are work with micro-controller programmed with embedded C.

The embedded system program representation:

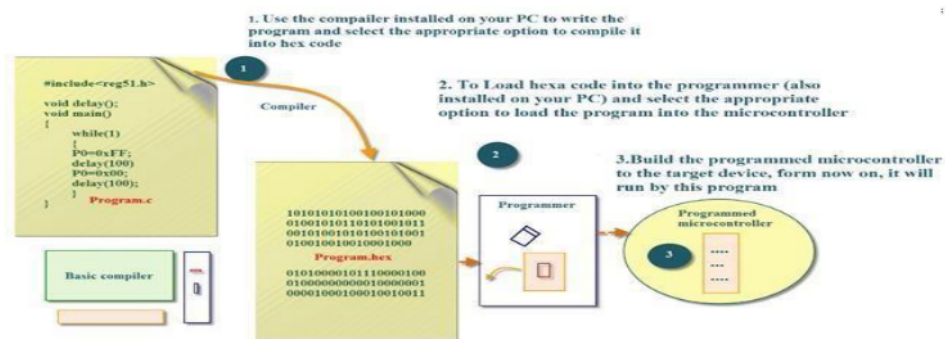


FIG 4.28 EMBEDDED SYSTEM PROGRAM REPRESENTATION

The Code in the above diagram is a blinking LED connected in the Port 0 of micro-

controller.

In the Micro-controllers the Embedded ⁷C code is preferred over other language. Due to the following reasons:

- Understanding is very easy.
- The user can run the Embedded code in different platforms (Portability).
- The Embedded code is High Reliable.
- ⁷Scalability

EMBEDDED SYSTEM PROGRAMMING:

Basic Declaration

The block diagram of Embedded C Programming development:

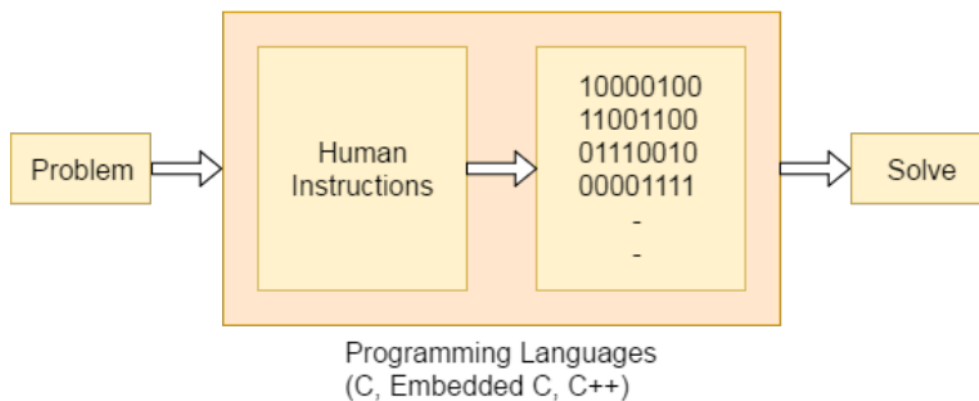


FIG 4.29 BLOCK DIAGRAM OF EMBEDDED C

In Embedded C we write a function used to perform the specific task. We can write N number of functions in a programming language. In every programming language having set of syntax's and basic elements. The embedded C is most likely

C programming and these are designed with function and variables, data types, expression, character set, keywords.

Embedded C program language is extend by using C program language. As comparing to C programming the embedded C program having additional features Keywords, data type and the header files etc is represented by `#include<micro-controller name.h>`.

4.10 THING-SPEAK SERVER

Thing-Speak is used for IOT(Internet of Things) applications and it is a open-source. Thing speak server is using Read and Write API to Store the data and to Retrieve the data from Thing-Speak server. It uses MQTT protocol and HTTP protocol over the Local area network.

Thing-Speak can able to log the sensor values and store these sensor values in database. Thing-Speak can able to tracking the application location and it can able to update the status in social networking sites.

Thing-Speak can supports MATLAB software for numerical computing and from Math Works allows Thing-Speak without any licence from Matlab. Thing-Speak can analyze the data and visualize the data using Matlab.

Thing-Speak Server can export the data to other website or we can download the data in the form of excel sheet so that the user can track the sensor data. Thing-Speak uses Math works for validating the user account for login to Thing-Speak server.

1. Open Thing-Speak Server

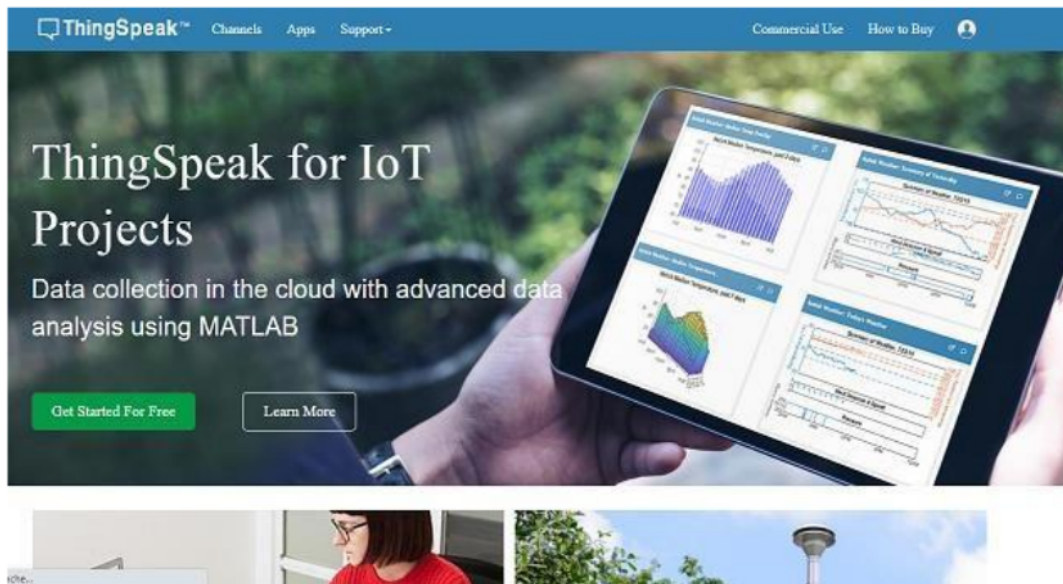


FIG 4.30 THING SPEAK SERVER

2. Create a MATHLAB account or Sign IN Thing Speak

The image shows the "Create MathWorks Account" form on the ThingSpeak website. The form includes fields for Email Address, Location (a dropdown menu currently showing "United States"), First Name, and Last Name. There are "Continue" and "Cancel" buttons at the bottom of the form. To the right of the form is a diagram illustrating the data flow. It shows "SMART CONNECTED DEVICES" sending data to a cloud labeled "DATA AGGREGATION AND ANALYTICS ThingSpeak". The cloud then sends data to a computer icon labeled "MATLAB", which is associated with "ALGORITHM DEVELOPMENT SENSOR ANALYTICS".

FIG 4.31 CREATE ACCOUNT IN THING SPEAK

3. Create a New channel

The screenshot shows the ThingSpeak 'My Channels' page. At the top, there's a navigation bar with 'ThingSpeak™', 'Channels', 'Apps', and 'Support'. Below this, the 'My Channels' section features a 'New Channel' button and a search bar. A table lists existing channels:

Name	Created	Updated
DHT11 Humidity and temperature	2021-02-10	2021-02-10 22:10
GSM based irrigation monitoring	2021-02-20	2021-02-27 07:17

Each channel entry has buttons for 'Private', 'Public', 'Settings', 'Sharing', 'API Keys', and 'Data Import / Export'. To the right, a 'Help' section provides instructions on how to create and manage channels. Below that, 'Examples' lists various microcontrollers like Arduino and Raspberry Pi. An 'Upgrade' section is also visible.

FIG 4.32 CREATE NEW CHANNEL IN THING SPEAK

4. Select the Required Fields

The screenshot shows the 'Channel Settings' page for a channel named 'GSM based irrigation monitoring'. The channel ID is 1309482, and the author is AnumoluSujithKumar. The page has tabs for 'Private View', 'Public View', 'Channel Settings', 'Sharing', 'API Keys', and 'Data Import / Export'. The 'Channel Settings' tab is active, showing a 'Percentage complete' of 30%. The 'Channel ID' is 1309482. The 'Name' field is 'GSM based irrigation monitoring'. The 'Description' field is empty. Under 'Fields', 'Field 1' is 'Temperature' and 'Field 2' is 'Humidity', both with checkboxes checked. To the right, a 'Help' section explains the channel settings. Below that, a 'Channel Settings' section lists instructions for completing the channel, including entering a name, description, and fields.

FIG 4.33 SELECT REQUIRED FIELDS

5. Use API Read/Write Key in your Program For sending or receiving the data

The screenshot shows the ThingSpeak web interface. At the top, there's a navigation bar with 'Channels', 'Apps', and 'Support' menus, and links for 'Commercial Use' and 'How to Buy'. The channel name 'GSM based irrigation monitoring' is displayed, along with its ID '1309482', author 'AnumoluSujithKumar', and access level 'Private'. Below this, a series of tabs includes 'Private View', 'Public View', 'Channel Settings', 'Sharing', 'API Keys' (which is selected), and 'Data Import / Export'. The 'API Keys' section is divided into two main areas: 'Write API Key' and 'Read API Keys'. The 'Write API Key' area shows a key 'A78I2RY77QEWUBQ4' and a 'Generate New Write API Key' button. The 'Read API Keys' area shows a key '0GSVUST39U75TA5C'. To the right, there's a 'Help' section explaining that API keys enable writing or reading data from a channel, and an 'API Keys Settings' section with instructions for using write and read keys, and a 'Note' about using the field for user access tracking. At the bottom right, there's an 'API Requests' section with a 'Write a Channel Feed' link.

ThingSpeak™ Channels Apps Support Commercial Use How to Buy AS

GSM based irrigation monitoring

Channel ID: 1309482
Author: AnumoluSujithKumar
Access: Private

Private View Public View Channel Settings Sharing API Keys Data Import / Export

Write API Key

Key A78I2RY77QEWUBQ4

Generate New Write API Key

Read API Keys

Key 0GSVUST39U75TA5C

Help

API keys enable you to write data to a channel or read data from a private channel. API keys are auto-generated when you create a new channel.

API Keys Settings

- **Write API Key:** Use this key to write data to a channel. If you feel your key has been compromised, click **Generate New Write API Key**.
- **Read API Keys:** Use this key to allow other people to view your private channel feeds and charts. Click **Generate New Read API Key** to generate an additional read key for the channel.
- **Note:** Use this field to enter information about channel read keys. For example, add notes to keep track of users with access to your channel.

API Requests

Write a Channel Feed

FIG 4.34 API KEYS IN THING SPEAK.

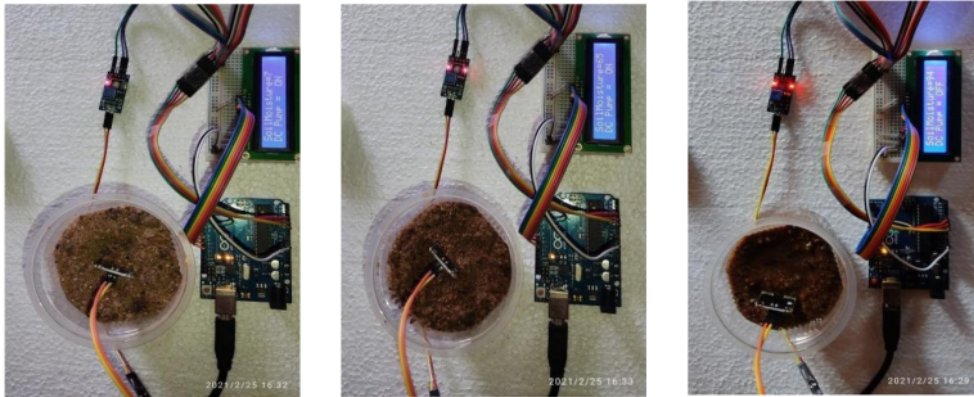
CHAPTER 5

RESULT AND LIMITATIONS

5.1 RESULT

5.1.1 SENSOR TESTING

1. Soil Moisture Sensor



27

FIG 5.1 SOIL MOISTURE SENSOR TESTING

In the above fig's we can see that the moisture sensor is changing the threshold values according to the moisture content in the soil. So we can know that the soil moisture sensor is working.

2. Rain sensor

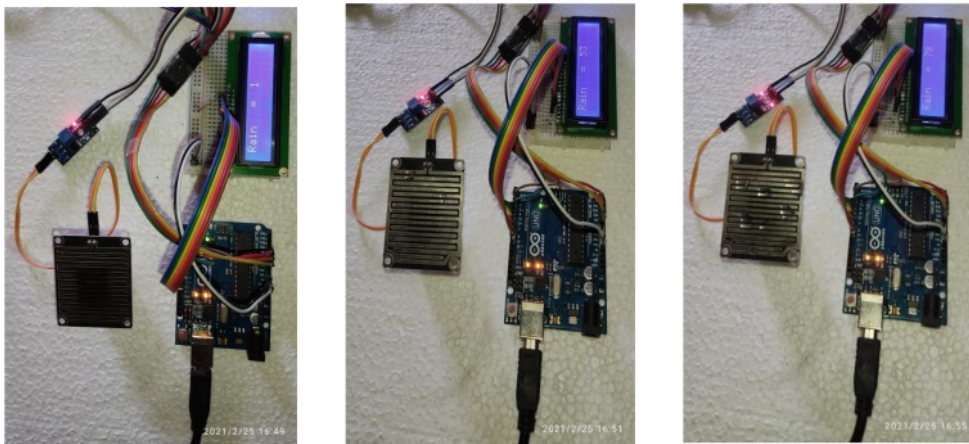


FIG 5.2 RAIN SENSOR TESTING

In the above fig's we can see that the rain sensor is changing it's threshold values when ever the water drop let's fell on the rain sensor. So we can know that the rain sensor is working.

3. Water flow sensor

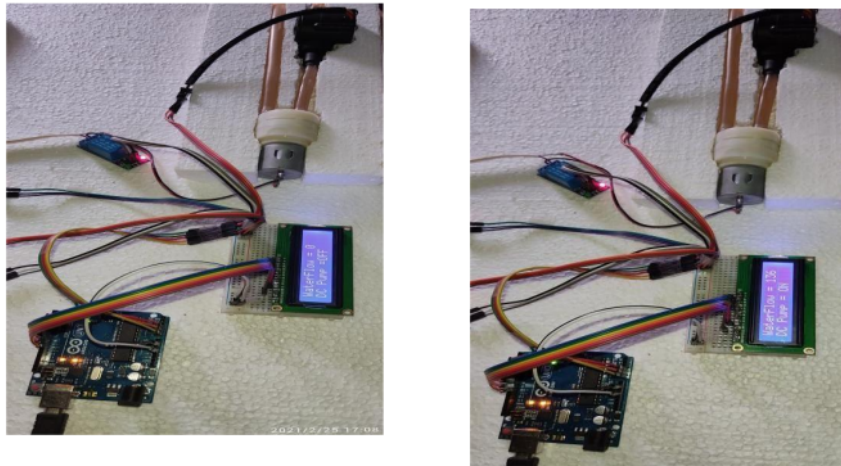


FIG 5.3 WATRE FLOW SENSOR TESTING

In the above fig's we check the water flow sensor when ever the pump is on the water flow sensor send the data to Arduino in the form of pulses. So we can know that the water flow sensor is working.

4. DHT11 sensor

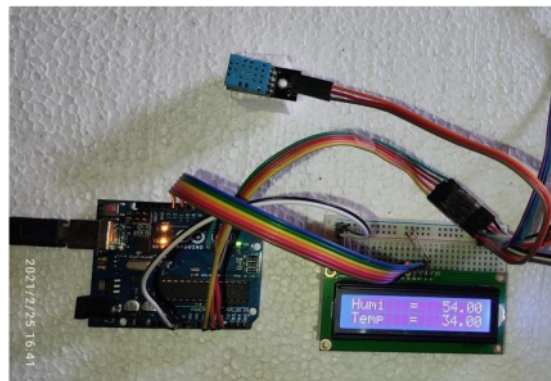


FIG 5.4 DHT11 SENSOR TESTING

In the above fig we can check the temperature & humidity with the DHT11 sensor. when the level of humidity is changed then the capacitance values also changed accordingly. The sensor having an IC it can change the analog values into the digital form. So the sensor is working.

RELAY

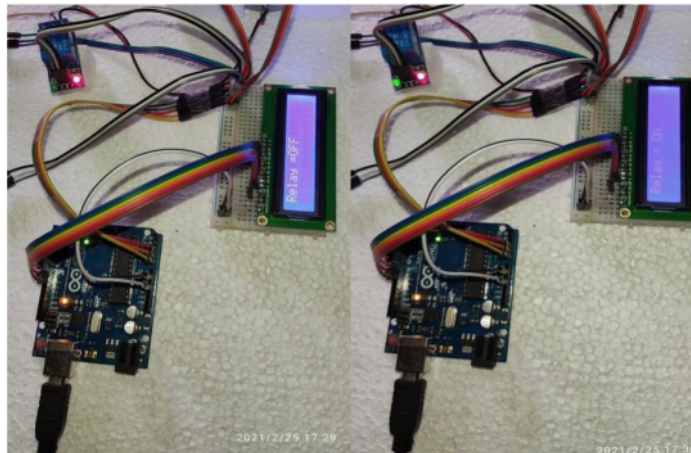
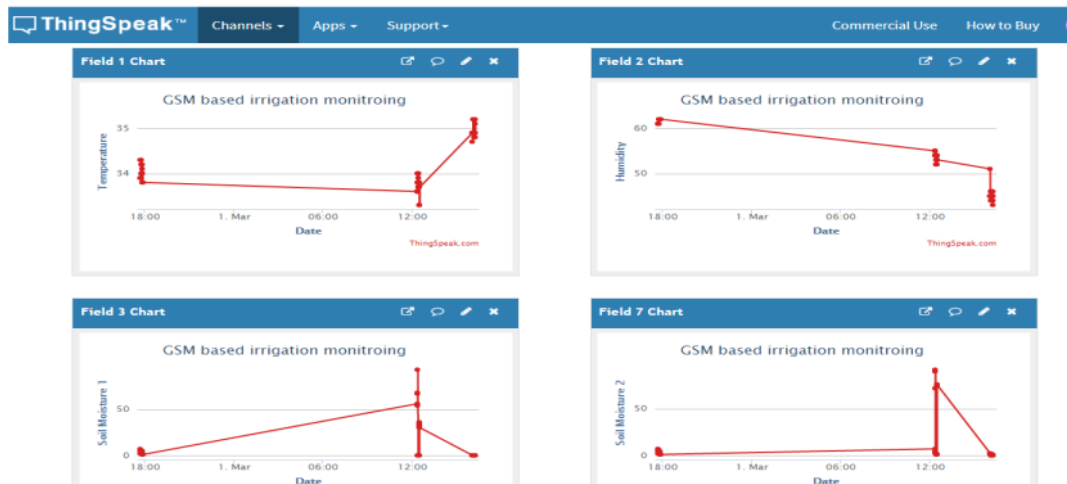


FIG 5.5 RELAY TESTING

In the above fig's we are checking the relay when ever we give input LOW to the relay then the relay is ON and when ever we give input High to the relay then the relay is OFF with the help of these conditions we can check the relay is on/off.

5.1.2 SENSOR VALUES DISPLAYED IN SERVER



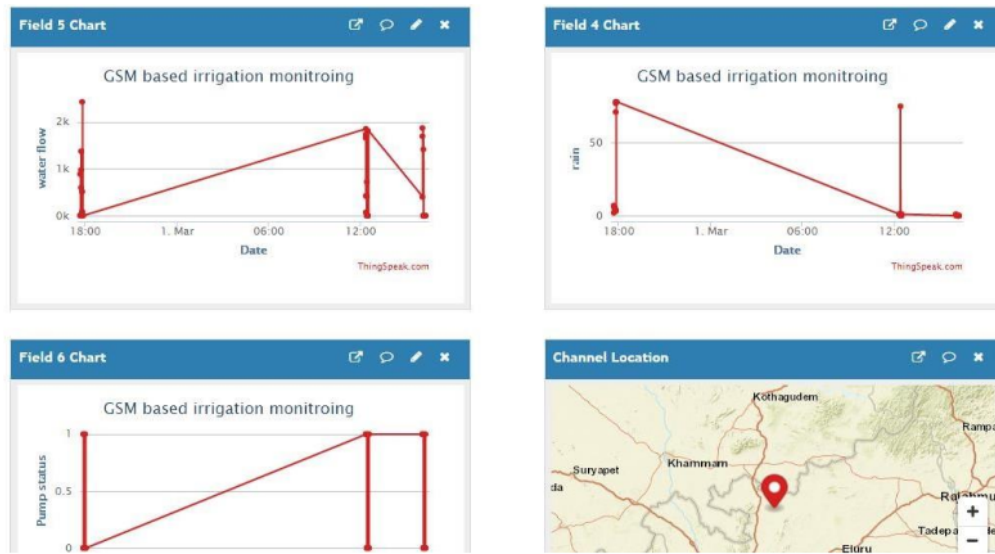


FIG 5.6 DISPLAYING SENSOR VALUES IN SERVER

In the above fig we can see that the sensor values can be monitored in the ThingSpeak server and these sensor values are stored in the cloud. Whenever the user need's the data the user can able to export the data from the server. The user can link this data to his one web site and the user can check the pump status.

5.1.3 ALERT MESSAGES

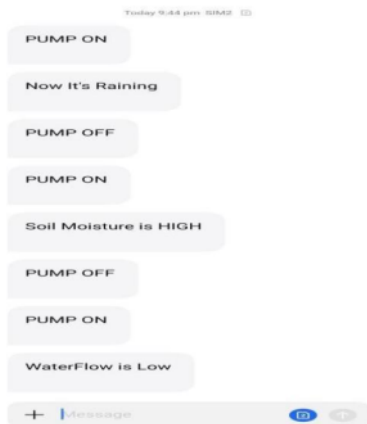
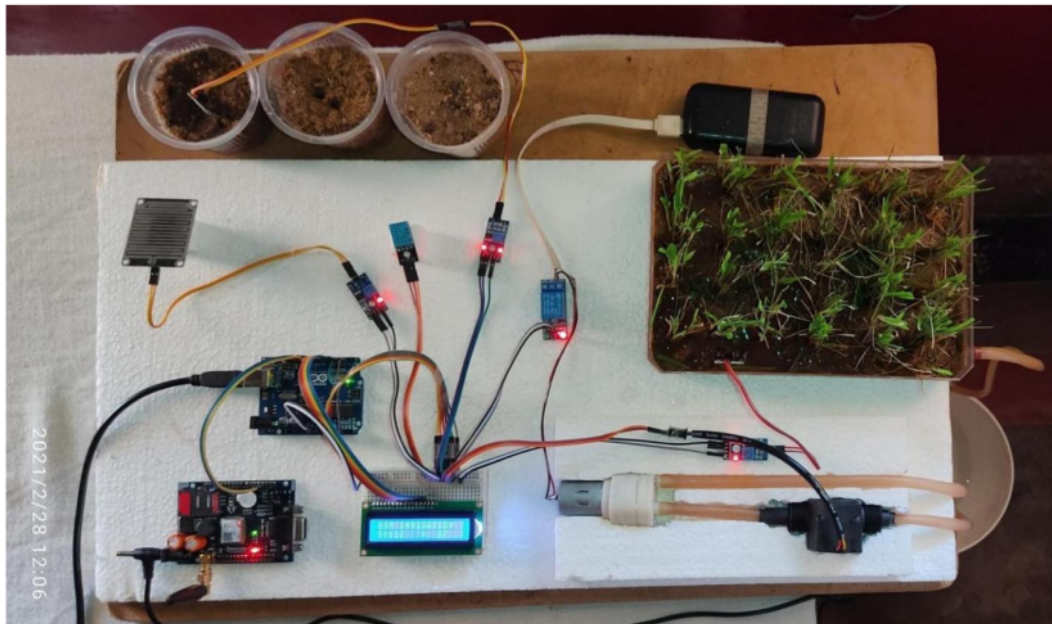


FIG 5.7 ALERT MESSAGES

In the above fig it is a screen short image of alert messages. The GSM send the status of the pump in the form of alert messages. Whenever sensor is not working then the user get an alert SMS.

DEVELOPED MODEL



***FIG 5.8 DEVELOPED MODEL FOR
AUTOMATIC IRRIGATION SYSTEM***

The Arduino is the heart of the system. It is connected with four sensors, and a GSM Module where they interact with the weather conditions and irrigate the land accordingly. We have also connected GSM module and Thing speak Server in such a way that, we can observe the dynamic sensor values from home itself, and also the Thing speak server stores the data in its back end. This feature of the system will reduce water and power consumption when water is not necessary at some weather conditions. We have also placed a water flow sensor, so when water doesn't flow through the motor, it will automatically switch off thereby reducing the electric consumption.

TABLE 5.1 RESULT TABLE

SI.NO	Temperature (°C)	Humidity (%)	Soil Moisture1 (<75%)	Soil Moisture2 (<75%)	Rain (<20%)	WaterFlow (>100)	Pump Status
1	35.2	55	4	5	1	2192	1
2	34.8	57	1	1	1	0	0
3	34	62	5	4	71	2432	0
4	29.2	72	97	98	3	2112	0
5	32.3	64	76	5	0	1984	1
6	NAN	NAN	3	2	2	1872	0

5.2 LIMITATIONS.

In spite of trying the best to rectify the errors, there are a few limitations under which the model has to be operated.

- We are using power supply instead of battery it should be continuously turned on whenever there is power. If power is not there then we cannot read the sensor data.
- If we don't have internet connection, we can't monitor the sensor values through thing-speak server but the system will run.
- If the sensor gets damaged, we get an alert message, where we have to manually check and replace with good one.
- This system is not fully automated in certain cases it requires human efforts.

CHAPTER 6

CONCLUSION AND FUTURE WORKS

CONCLUSION:

The system i.e., “Low Cost GSM Based Automated Irrigation System Using Arduino, Sensors and GSM Module” is highly essential, suitable, and low cost for advanced water irrigation technique and for production of agricultural. With the help of GSM Module the system will be sending data to the user through a Thing speak server where he can observe those sensor values in the farm field and irrigate accordingly from home. We can also include many more weather sensors that affect the crops. This prototype is designed in such a way that it will reduce the human effort and also manages the natural resources in a correct manner and give a good productive crops.

FUTURE WORKS:

The “Low Cost GSM Based Automated Irrigation System Using Arduino, Sensors and GSM Module” is simple and precise way of irrigation. Hence, this method is incredibly helpful because it reduces manual work of the farmers and additionally helps within the proper utilization of resources. It eliminates the manual switching mechanism employed by the farmers to ON/OFF the irrigation system. This project can be extended to a certain way that through AI the system will automatically detects the errors in the field and controls the field accordingly without being observed by the person at the home.

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PAGE 1

PAGE 2

PAGE 3

PAGE 4

PAGE 5

PAGE 6

PAGE 7

PAGE 8

PAGE 9

PAGE 10

PAGE 11

PAGE 12

PAGE 13

PAGE 14

PAGE 15

PAGE 16

PAGE 17

PAGE 18

PAGE 19

PAGE 20

PAGE 21

PAGE 22

PAGE 23

PAGE 24

PAGE 25

PAGE 26

PAGE 27

PAGE 28

PAGE 29

PAGE 30

PAGE 31

PAGE 32

PAGE 33

PAGE 34

PAGE 35

PAGE 36

PAGE 37

PAGE 38

PAGE 39

PAGE 40

PAGE 41

PAGE 42

PAGE 43

PAGE 44

PAGE 45

PAGE 46

PAGE 47

PAGE 48

PAGE 49

PAGE 50

PAGE 51

PAGE 52

PAGE 53

PAGE 54

PAGE 55

PAGE 56

PAGE 57

PAGE 58

PAGE 59

PAGE 60

PAGE 61

PAGE 62

PAGE 63

PAGE 64

PAGE 65

PAGE 66

PAGE 67

PAGE 68

PAGE 69

PAGE 70

PAGE 71

PAGE 72

