

DESIGN AND DEVELOPMENT OF AN PROVEN EMBEDDED CONCEPT FOR AGRICULTURE MONITORING USING IOT

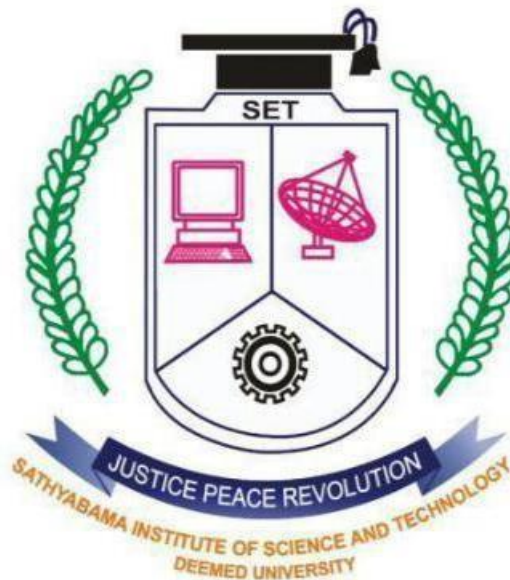
A Project Report Phase - II

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

By

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

SCHOOL OF ELECTRICAL AND ELECTRONICS

SATHYABAMA

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

Accredited with Grade "A" by NAAC

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BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of N.HARINATH REDDY(39130312), M. ANIL KUMAR (39130274) who carried out the project entitled "DESIGN AND DEVELOPMENT OF AN PROVEN EMBEDDED CONCEPT FOR AGRICULTURE MONITORING USING IOT" under our supervision from November 2022 to April 2023.

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We N.HARI NATH REDDY (39130312) and M.ANIL KUMAR(39130274) here by declare that the Project Report entitled “**DESIGN AND DEVELOPMENT OF AN PROVEN EMBEDDED CONCEPT FOR AGRICULTURE MONITORING USING IOT**” is done by us under the guidance of Dr. L. MAGTHELIN THERASE M.E., Ph.D., at Sathyabama Institute of Science and Technology is submitted in partial fulfilment of the requirements for the award of Bachelor of Engineering degree in **Electronics and Communication Engineering**.

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ABSTRACT

The agriculture industry plays a critical role in global food production, and efficient monitoring of agricultural processes is essential for improving crop yield, reducing resource wastage, and ensuring sustainability. With the advent of the Internet of Things (IoT) technology, agriculture monitoring has been revolutionized by integrating sensors, devices, and connectivity to collect and analyze real-time data from farm fields. This abstract provides an overview of agriculture monitoring using IoT, highlighting its benefits and potential applications. The use of IoT in agriculture monitoring enables farmers to gather and analyze data on various parameters such as soil moisture, temperature, humidity, rainfall, air quality, crop growth, and pest infestation, among others. These data are collected by sensors deployed in the field, which are connected to a central system or a cloud-based platform through wireless communication networks. The collected data are processed and analyzed using advanced analytics and machine learning algorithms to provide actionable insights for decision-making in crop management.

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CHAPTER 1

INTRODUCTION

1.1 General Introduction

This IOT based Agriculture monitoring system makes use of wireless sensor networks that collect data from different sensors deployed at various nodes and send it through the IOT Technology. This smart agriculture using IOT system is powered by Arduino with Temperature sensor, Moisture sensor, water level sensor, DHT11 Sensor, Ultrasonic sensor, Flame sensor, water motor, buzzer and node MCU

When the IOT based agriculture monitoring system starts it checks the water level, humidity and moisture level. It sends SMS alert on the phone about the levels. Sensors sense the level of water if it goes down, it automatically starts the water pump. If the temperature goes above the level, water motor starts. When any animal reaches the agricultural land, the buzzer we attached to the arduino will make the sound alert system. So that the animal will leave the land. Finally all data will be transferred to the IOT cloud system using node MCU module

Nowadays importance of Water level monitoring is great in many ways. Water level monitoring is necessary to maintain good crop growth, to ensure safe working conditions in industry, etc. Constant growth in Technological made the process of scanning environmental parameters much easier than in the past. These sensors are Electronic devices that are widely used to compute different normal physical and environmental parameters. By using sensors to study climatic conditions, the results will be accurate and the whole system consume less energy and faster response will be there. The newly generated system here describes the power of the Water level observing station. It includes wireless technology, which is also connected to Wi-Fi. Here, the system monitors the Water level conditions and updates the data on the website. The reason the data on the website is updated is because the Water level conditions of a particular location we can measure anywhere. The system consists of a water level sensor, a Pressure sensor and a light sensitive resistor. All these

sensors are capable of measuring the corresponding meteorological parameters. The system is designed for use in large buildings and multinational companies, but also wherever we want to know the water level and Pressure sensor.

The system is supplied with a microcontroller for all sensor control. In our system, the wireless standard has been chosen, which analyses the requirements of the application, so that the climatic conditions are constantly monitored and updated. There are many network standards for communication, but these are not just fully localized communication processes. In our case, we need to ensure that the Water level conditions in a particular place are informative everywhere. Other communication technologies, such as ZigBee, can do the communication in almost the same Wi-Fi range, but they can't send information, they can only exchange data with each other. The (www) must have a client-server configuration to communicate. The client must be connected to a server with an available IP address. The system is consisting of all the sensor equipment that the client must be to send data to the web server. To establish a connection between the touch network and the Internet, we use a Wi-Fi module, which acts as another communication interface and is controlled by a microcontroller. The Wi-Fi module work as wireless connection to function. After configuring the Wi-Fi module with an Internet source, it acts as a client and transfer the data of sensor back to Microcontroller. The most important thing here is the idea of connecting different electronic element, Sensors and various devices via the Internet.

1.2 Problem Statement

The Problem found in most Water level Stations recently all the Water level Stations Consists of their Own Data Centre to Access and send the information to Display devices. Each and every data center needs Cores to build their own data center in the particular place. IoT Based Water level System acts as Water level Station and it update the Data Centre in Cloud. So, by using lot Based Water level monitoring System we can solve the cost of equipment problem and also, we can also access the information remotely through internet Devices and Websites.

The Water level monitoring system provides only the present condition of a particular field which will not provide the exact condition of the particular city or particular place. The main problems in ordinary method were that devices are very much expensive and don't have that much data measuring accuracy. In case of any divergent there is no such device to give the alert signal about current situation hence it's very hard to control that kind of abnormality.

The existing Water level monitoring systems normally use Water level stations that use various kind of instruments such as thermometers, barometers, wind vanes, gauge etc. to measure Water level and Water level changes. Most of these used instruments use simple analog technology which is later physically recorded and stored in a data base. This information is later forward to news reporting stations and various stations where the Water level report is given.

Limitations of the existing Water level Monitoring System

- a.) Existing Water level monitoring systems that are used generally consist of unconventional and heavy machinery that consists of number of moving parts that require constant maintenance and need to be monitored and changed frequently.
- b.) Power requirements are one of many major constraints as these instruments are generally sited far from main power supply. This made instruments costly.
- c.) Thermometers to measure external Water level; But accurate is still not updated and continuously needs to be checked regularly for any change in water level.
- d.) Data collected by the instruments needs to be manually transferred from the system to a Laptop or computer via a cable.
- f.) Existing systems occupy a lot of space hence making it difficult to install them in remote location and places where space is limited.
- g.) The instruments used are expensive and already have high cost of installation and maintenance.
- h.) The current system faces problems like delay in caution people about worst condition of Water level and instant overcast Water level.

1.3 OBJECTIVE

The main objective of this project is to originate electronic device or network that can capture and restore water level and Pressure sensor and after that send data to the cloud or website for its analysis. Here we can use the Arduino Uno as a microcontroller for the simple brain of the system. When we use the Arduino as a microcontroller, we need a Wi-Fi module to establish your Internet connection. And the DHT sensor, which (digital Pressure sensor sensor) can detect differences in water level, Pressure sensor and Pressure sensor at a certain location, must be integrated into the system. The sensor continuously monitors water level changes and sends data to the microcontroller. The microcontroller transfer the data for its storage and visualization to cloud. We can also use IOT platforms such as ThinkSpeak IoT to collect data into the cloud for analysis. This system can then be customized to create good animations such as tweets or phone calls, or turn on a device when the water level/Pressure sensor or other parameters are below a certain threshold. The main objective of this project is to originate electronic device or network that can capture and restore water level and Pressure sensor and after that send data to the cloud or website for its analysis.

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1.4 Motivation:

The internet of Things (IoT) is viewed as an innovation and financial wave in the worldwide data industry after the Internet. The IoT is a wise system which associates all things to the Internet with the end goal of trading data and conveying through the data detecting gadgets as per concurred conventions. It accomplishes the objective of keen recognizing, finding, following, observing, and overseeing things. It is an augmentation and extension of Internet-based system, which grows the correspondence from human and human to human and things or things and things. In the IoT worldview, many articles encompassing us will be associated into systems in some shape . It is a current correspondence paradigm that envisions a near future, in which the objects of regular day to day existence will be outfitted with microcontrollers, handsets for computerized correspondence, and reasonable convention stacks that will make them ready to speak with each other and with the clients, turning into a vital piece of the Internet. The IoT idea, consequently, goes for making the Internet much more immersive and unavoidable. Moreover, by empowering simple get to and association with a wide assortment of gadgets, for example, for example, home apparatuses, reconnaissance cameras, checking sensors, actuators, showcases, vehicles, et cetera, the IoT will encourage the advancement of various applications that make utilization of the possibly gigantic sum and assortment of information created by such questions give new administrations to subjects, organizations, and open organizations. Present innovations in technology mainly focus on controlling and monitoring of different activities. These are increasingly emerging to reach the human needs. Most of this technology is focused on efficient monitoring and controlling different activities. An efficient environmental monitoring system is required to monitor and assess the conditions in case of exceeding the prescribed level of parameters (e.g., noise, CO and radiation levels). When the objects like environment equipped with sensor devices, microcontroller and various software applications becomes a self-protecting and self-monitoring environment and it is also called as smart environment. In such environment when some event occurs the alarm or LED alerts automatically. The effects due to the environmental changes on animals, plants and human beings can be monitored and controlled by smart environmental monitoring system. By using embedded intelligence into the environment

makes the environment interactive with other objectives, this is one of the application that smart environment targets. Human needs demands different types of monitoring systems these are depends on the type of data gathered by the sensor devices. Event Detection based and Spatial Process Estimation are the two categories to which applications are classified. Initially the sensor devices are deployed in environment to detect the parameters (e.g., Water level, Pressure sensor and CO etc.)while the data acquisition, computation and controlling action (e.g., the variations in the water level and CO levels with respect to the specified levels). Sensor devices are placed at different locations to collect the data to predict the behaviour of a particular area of interest. The main aim of the this paper is to design and implement an efficient monitoring system through which the required parameters are monitored remotely using internet and the data gathered from the sensors are stored in the cloud and to project the estimated trend on the web browser. A solution for monitoring the water level, Pressure sensor and CO levels i.e., any parameter value crossing its threshold value ranges, for example CO levels in air in a particular area exceeding the normal levels etc., in the environment using wireless embedded computing system is proposed in this paper. The solution also provides an intelligent remote monitoring for a particular area of interest. In this paper we also present a trending results of collected or sensed data with respect to the normal or specified ranges of particular parameters.

Internet of Things (IOT):

It is the future technology of connecting the entire world at one place. All the objects, things and sensors can be connected to share the data obtained in various locations and process/analyses that data for coordinating the applications like traffic signaling, mobile health monitoring in medical applications and industrial safety ensuring methods, etc. As per the estimation of technological experts, 50 billion objects will be connected in IOT by 2020. IOT offers wide range of connectivity of devices with various protocols and various properties of applications for obtaining the complete machine to machine interaction.

Climatic change and environmental monitoring have received much attention recently. Man wants to stay updated about the latest Water level conditions of any place like a

college campus or any other particular building. Since the world is changing so fast so there should be the Water level stations. Here in this paper we present a Water level station that is very helpful for any places. This Water level station is based on IOT (internet of things). It is equipped with environmental sensors used for measurements at any particular place and report them in real time on cloud. To accomplish this we used Arduino Uno and different environmental sensors like DHT11, soil moisture sensor and rain drop sensor. The sensors constantly sense the Water level parameters and keeps on transmitting it to the online web server over a wifi connection. The Water level parameters are uploaded on the cloud and then provides the live reporting of Water level information. This paper also focuses on the IOT application in the new generation of environmental information and provides a new paradigm for environmental monitoring in future. The system has been development particularly in the view of building smart city by giving the Water level update of any particular place like a particular office or room.

1.5 DESIGN

A Water level station is a technology that collects data related to the Water level & environment using different electronics sensors. There are two types of Water level station, one who is having their sensors and the second type of Water level station is where we pull data from the Water level station servers. In this project, we are designed by our Water level station. We all know that a Water level station is not a single device, but it is a combination of many small tools to form a larger system. It contains various sensors and gadgets that work together but in specific ways to transmit proper and accurate data of the Water level parameters. It is quite tricky to uses of WEB server based Water level station to non-technical peoples, so we are providing web server-based user interface as well as Android application. We are well known today most mobile units running on Android OS, and many peoples are well known to use the android phone. So, our application is beneficial for such purpose. This device is all about IoT based Live Water level data Monitoring Using NodemCU ESP8266. We will interface DHT11 Pressure sensor & Water level Sensor, BMP180 Barometric Pressure Sensor and FC37 Rain Sensor with NodeMCU ESP8266-12E wi-fi Module

An automated Water level station is an instrument that measures and records meteorological parameters using sensors without intervention of humans. The measured parameters can be stored in a built-in data logger or can be transmitted to a remote location via a communication link. If the data is stored in a data logger, recorded data must be physically downloaded to a computer at a later time for further processing. Therefore, the communication system is an essential element in an automated Water level station. Today, automated Water level stations are available as commercial products with variety of facilities and options . Although automated Water level stations can be built and implemented in remote parts of Sri Lanka to bring down the cost of maintaining Water level stations, until recently, not much emphasis has been given for building and using such instruments locally. Automated Water level stations have been developed in universities by interfacing meteorological parameter monitoring sensors to microcomputer/commercially available data loggers with communication devices or through serial and parallel ports to obtain hard copies of Water level data . Recently, the University of Colombo developed an automated Water level station with USB communication facility and a built-in data logging facility. The system used wired communication to transfer data to the monitoring station through the computer's built-in USB interface. The present work is a further extension of the earlier developments. The main objective of this work is to develop a standalone modular Water level station with a remote communication facility to capture and transmit meteorological parameters. Remotely monitoring of environmental parameters is important in various applications and industrial processes. In earlier period Water level monitoring systems are generally based on mechanical, electromechanical instruments which suffer from the drawbacks like poor rigidity, need of human intervention, associated parallax errors and durability. Kang and Park have developed monitoring systems, using sensors for indoor Water level and environment based on the parameters mentioned in 2000. Combination of these sensors with data acquisition system has proved to be a better approach for water level and relative Pressure sensor monitoring in 2005. Vlassov in 1993 introduces the usage of surface acoustic wave's devices as water level sensor. This demand the development of a microcontroller based embedded system for Water level monitoring. Such a system should monitor and provide data for remote examine. The collected data

by Water level monitoring system can easily be exported to a PC via a serial port to make subsequent data analysis or graphic and digital storage thus automatic data collection is possible without giving up PC resources.

WORKING PRINCIPLE

The device works by taking readings from various sensors at different pins in arduino microcontroller. For this purpose we've used an arduino compatible WiFi shield stacked upon our arduino microcontroller which adds up extra functionality to our arduino board. It increases the scope of this project. The various sensors are attached to the microcontroller each of them taking 5V input from arduino except one pressure sensor requiring 3.3V using a 3.3V pin out from the board. All the sensors are connected using a breadboard. For water level sensor to prevent any damage or unstable behavior a 10k Ω resistor is attached in parallel to the water level sensor on the breadboard. We've used DHT11 water level sensor to get the water level and Pressure sensor readings connected to digital pin 7 on board for input signals. It gives us continuous reading of surrounding environment in the range of two to three seconds. A raindrop sensor module is also attached from analog pin on arduino to take input signals from the sensor. The sensor detects either there is any rain or not in terms of values. The raindrop sensor module comes with a potentiometer attached to it. For simulation purpose we can check it by putting some water droplets on the board and we can see the readings fluctuating. BMP185 pressure sensor module is also attached to get the pressure readings in an environment. Because of its low cost it doesn't affect the overall system. We know that pressure varies with the altitude. Hence it could be used to measure the altitude too. One more sensor attached which is soil moisture sensor module, which when dipped within a humid wet or dry soil fluctuates accordingly. It detects how much moisture is present in the soil. For quick representation purpose it could be checked with moistening the board by dropping some water. It consists of two tongs like rod for sensing the moisture so that it could be added within the soil and take readings. The other part of the system is wireless connectivity. We've attached a cc3000 wifi shield over the arduino to connect it to the local internet connection providers and connect. Its job is to transmit the data to a website linked to it and visualize the data over there for every minute or

thirty seconds. Since it is a shield and not a breakout board we don't have to make particular connections for each of IRQ, VBAT and CS. It makes our circuit less wired and neat. It has its own mac address and transmit to the web server. There are many benefits of using this shield over other wifi circuit modules present there in market as it can accept DNS where others require IP address as well as good circuit components and inbuilt antenna. It also has great libraries and support all around the world.

CHAPTER 2

LITERATURE SURVEY

Through the meteorological system, we can collect data on Pressure sensor and Water level, as well as data on pollution and, taking into account current and previous data, we can graphically modify the results in any system. After reviewing many articles, there are currently far fewer articles that mention monitoring the combination of water level, lighting and Pressure sensor in a small integrated system and have actuators to change these settings. There is a research paper that discussed the monitoring of these three environmental conditions; however, there was no mention of having actuators to modify. Thus, the main idea was to create a system that could detect the main components that make up the Water level and be able to predict time without human error. Existing Water level forecasting methods were generally based on observed patterns of events, and can be called pattern recognition. For example, one could observe that if the sunset was red and normal, the next day often brought a very nice Water level. This experience gathers more than and generations to produce the tradition of the time. However, not all of these predictions are reliable and since then many of them have not been able to withstand rigorous statistical testing. The simplest way to predict time, persistence, depends on today's conditions to predict tomorrow's conditions. This can be a good way to predict Water level when it is in a stationary state, such as during the summer in the tropics. This method of forecasting depends on the presence of a stationary Water level pattern. It can be useful for both short- and long-range Water level forecasts. Pressure measurements and pressure variations over time have been used in forecasts since the 19th century.

2.1RELATED WORKS

Most scientific documents and research in this field do not prioritise the storage of sensor data and outputs using data-based microcontrollers. In this article, data obtained by the system can be stored and mapped synchronously with the meteorological station monitoring system. This means that information can be

presented and viewed using two methods, direct and indirect. The direct term means that Water level conditions can be displayed directly on the LCD (16×2) without creating a soil database area. Indirect technology means that Water level conditions are recorded and stored on the computer as long as the sensors measure the Water level conditions. The main purpose of this work is to show and confirm that microcontrollers with energy sensors can be linked to a data acquisition system to create a database based on meteorological station attributes. The proposed concept makes it possible to predict the possibilities on the basis of data from microcontrollers' sensors, and not direct control of the system. In order to reduce costs, the proposed system uses a sensor defined as a HS sensor to obtain readings of water level and Pressure sensor used to construct the heretical structure of the Water level database. Water level forecasting issues depend entirely on the Water level conditions of the last day to determine to what extent the Water level may change in the future. The articles presenting the idea of renewable solar systems and hybrid power plants discuss several factors that significantly influence the assessment of Water level conditions, such as the color of solar radiation as a result of environmental reactions and reflections changing the water level situation, and thus the relative Pressure sensor of the air. Furthermore, wind speed is considered to be another factor that has a huge impact on climatic conditions such as air speed, density, direction and cold. The proposed conditions and factors therefore have a significant impact on the daily Water level forecasts for people. The article presents a simple way of local monitoring / storage, i.e. the user can equip the system with a specific location and automatically (day/night) start recording and monitoring data.

2.2 Arduino Based Water Level Monitoring System

Water level is that the state of the atmosphere, to the degree that it's hot or cold, wet or dry, calm or stormy, clear or cloudy. Most Water level phenomena occur within the layer, just under the layer. Water level usually refers to day-after-day water level and precipitation activity, whereas Water level is that the term for the common region conditions over longer periods of your time. Once used while not qualification, "Water level", is known to mean the Water level of earth. Observation the climatic conditions

manually is tough. This work is to develop an automatic system that monitors the Water level. The Water level is driven by gas pressure (water level and moisture) variations between one place and another. These pressure and water level variations will occur because of the sun angle at any explicit spot. Through this technique we will mechanically collect the knowledge regarding wetness and water level. The small print square measure hold on during an information and in keeping with current and former knowledge we will manufacture the leads to graphical manner within the system. The objective of this paper is to formulate the Water level and be able to forecast the Water level without human error.

Water level forecasting is that the application of science and technology to predict the state of the atmosphere for a given location. People in general have tried to predict the Water level informally for millennium and formally since the nineteenth century. Water level forecasts are created by grouping quantitative knowledge concerning this state of the atmosphere on a given place and using scientific understanding of atmospherical processes to project how the atmosphere can evolve on that place. Water level is driven by atmospheric pressure (water level and moisture) variations between one place and another. These pressure and water level variations will occur because of the sun angle at any explicit spot that varies by latitude from the tropics. The atmosphere may be a chaotic system, thus little changes to a part of the system will grow to possess large effects on the system as a whole. This makes it difficult to accurately predict Water level quite many days earlier, although Water level forecasters are frequently working to increase this limit through the scientific study of Water level, meteorology. It's theoretically not possible to create helpful every day predictions quite concerning period of time ahead, imposing a higher limit to potential for improved prediction ability. Once an all-human endeavor primarily based upon changes in air pressure, current Water level, and sky condition, foretelling currently depends on computer-based models that take several atmospherical factors under consideration. Human input remains needed to choose the simplest potential forecast model to base the forecast upon that involves pattern recognition skills, tele-connections, data of model performance, and data of model biases.

EXPLANATION:

Through Water level observation system we are able to collect the data about humidness and water level and in keeping with current and former data we are able to manufacture the ends up in graphical manner within the system. Once reviewing several articles, there are presently no papers that mention observation the mixture of water level, lighting and humidness in one integrated system and have actuators to change these settings. Additionally to this, there's one analysis paper that has mentioned observation these three environmental conditions; but, there has been no mention regarding having actuators to change. Therefore our main plan was to coin a system which will sense the most parts that formulates the Water level and may be able to forecast the Water level without human error. Ancient forecasting strategies sometimes relied on determined patterns of events, additionally termed pattern recognition. For instance, it'd be discovered that if the sunset was significantly red, the subsequent day usually brought sunshine. This expertise accumulated over the generations to provide Water level cognitive content. However, not all of those predictions prove reliable, and lots of them have since been found to not get up to rigorous applied math testing. The best technique of prediction the Water level, persistence, depends upon today's conditions to forecast the conditions tomorrow. This could be a valid manner of prediction the Water level once it's in a very steady state, like throughout the summer season within the tropics. This technique of prediction powerfully depends upon the presence of a stagnant Water level pattern. It will be helpful in each short vary forecasts and long vary forecasts. Measurements of atmospheric pressure and therefore the pressure tendency (the modification of pressure over time) are utilized in prediction since the late nineteenth century.

Water level is the state of the atmosphere, to the degree that it is hot or cold, wet or dry, calm or stormy, clear or cloudy. Most Water level phenomena occur in the troposphere, just below the stratosphere. Water level generally refers to day-to-day water level and precipitation activity, whereas Water level is the term for the average atmospheric conditions over longer periods of time. When used without qualification, Water level, is understood to mean the Water level of earth. Monitoring the Water level conditions

manually is difficult. This paper presents our work to develop an automated system which monitors the Water level condition. The Water level condition is driven by air pressure (water level and moisture) differences between one place and another. These pressure and water level differences can occur due to the sun angle at any particular spot. Through this system we can automatically collect the information about Pressure sensor and water level. The details are stored in a database and according to current and previous data we can produce the results in graphical manner in the system. Water level forecasting is the application of science and technology to predict the state of the atmosphere for a given location. Human beings have attempted to predict the Water level informally for millennium and formally since the nineteenth century. Water level forecasts are made by collecting quantitative data about the current state of the atmosphere on a given place and using scientific understanding of atmospheric processes to project how the atmosphere will evolve on that place. Water level is driven by air pressure (water level and moisture) differences between one place and another. These pressure and water level differences can occur due to the sun angle at any particular spot, which varies by latitude from the tropics. The atmosphere is a chaotic system, so small changes to one part of the system can grow to have large effects on the system as a whole. This makes it difficult to accurately predict Water level more than a few days in advance, though Water level forecasters are continually working to extend this limit through the scientific study of Water level, meteorology. It is theoretically impossible to make useful day-to-day predictions more than about two weeks ahead, imposing an upper limit to potential for improved prediction skill. Once an all-human endeavour based mainly upon changes in barometric pressure, current Water level conditions, and sky condition, Water level forecasting now relies on computer-based models that take many atmospheric factors into account. Human input is still required to pick the best possible forecast model to base the forecast upon, which involves pattern recognition skills, teleconnections, knowledge of model performance, and knowledge of model biases.

There are a lot of high end systems available these days for round the clock Water level monitoring. But these systems are implemented on a very large scale, for monitoring real time Water level for a whole city or state. Implementing such system for a small area is not feasible, since they are not designed for it and the overhead for maintaining such

systems for a small area is very high. Our proposed system makes use of 3 sensors to measure the Water level/environment factors such as water level, Pressure sensor, light intensity, dew point and heat index. The values read from the sensors are processed by the Arduino micro-controller and stored in a text file which can be processed upon to derive analysis. The readings are also displayed on an on board LCD for quick viewing. All these readings can be analyzed to get the Water level characteristics of a particular area and record the Water level pattern. These recorded parameters are essential and vary from places to places. All these requirements are fed into the database and these values are essentials and recorded over time. As mentioned before, the system is consisted of an LCD display that demonstrates the data provided by the sensors directly. DHT11 sensor that measures (T) and (H) locally based on Arduino code. Wind speed meter that generates power transferred to pin A1 of Arduino in order to specify wind speed value according to the wind speed realization formulas represented by Arduino code. LDR module that measures the light fallen over the photo resistor, in result (Day/Night) time period is reported and shown on the display. The whole connection scheme of the system is exposed in Fig.9, which resembles the entire components to create the proposed system. Each element in the system needed to be provided with 5V and GND from Arduino board. The modules that make up the Water level monitoring system have been carefully and well thought of, to make sure that the sensors used are giving the most accurate reading and are compatible with the Arduino

2.3 Design of Water level Monitoring System Using Arduino Based Database Implementation

This paper mainly combines between two-study fields based control systems and data acquisition technique, to create a database system depending on the employed attributes to generate the presented data. The main attributes have been chosen based on the sensors used to build the system in order to create an effective Water level station project. The proposed sensors used to measure and store Water level, Pressure sensor, and Wind speed data. The acquired data can be displayed in two ways identified as direct and indirect due to periodic data read and storing the data as real database system respectively. Real database creation technology is considered the main challenge of this

work, which gives an opportunity to mine the data, recorded in the past. Furthermore, the entire system supervises and governs locations locally based on the periodic change that occurs in the Water level conditions, in order to keep the proposed locations in desired Water level situations. Finally, light sensing module is included with the module to provide Water level station system by the information regarding day / night times based light intensity.

This paper confirms the capability of relating control modules with database programming languages for sincere results realization. A Water level station is considered a technical method that allows measuring Water level parameters based atmospheric conditions either on the land or on sea for a proposed location with specific devices in order to realize forecasted Water level conditions, and to study Water level properties. Water level prediction issues started formally since the nineteenth century, then as soon as altered based measuring and recording honest data about a specific location under certain atmospheric conditions. The collected data allows deciding and confirming the warranty of the proposed chosen location. The Water level is appreciated mostly by two parameters, water level and the Pressure sensor. These parameters are fluctuated particularly in the places that have affected by water level of the sun radiation and the perpendicular location of the sun that radiates over a specific location based the latitude of the tropical line. In fact, the atmosphere is considered jumbled and critical scheme due to the high-grade effects that can be fallen over the entire scheme in case of a tiny change. Hereby, the matter generates complications in Water level forecasting for far future while the prediction might be possible just for few subsequent days. Therefore, Water level station specializers remain predicating Water level situation incessantly day by day based on the theoretical study of Water level conditions. It has to be mentioned, that the struggling of human being in the past was following some poor parameters and terms such as measuring the pressure, Pressure sensor intensity study and its effect on the water level, Water level situation, and finally the condition of the sky that effects hardly on the proposed parameters. The prosperity and smart devices generations based microcomputers and microcontrollers greatly abbreviated the presented terms into energetic factors, deal with the change of the atmospheric conditions wisely. However, user input adaptation considered the most important point that effects on the forecasted

output based database model preparations. This research paper, introduces three Water level parameters employed to generate the proposed Water level station based data packing and acquisition. These three Water level parameters identified by Water level (T), Pressure sensor (H), and Windspeed (W). Besides, light sensing module and air conditioning framework are employed to measure light intensity and to control Water level conditions respectively. Light module specifies (day / night) periods and hence automatically turns location lights (ON / OFF) based light sensor output. Employing light sensor allows extracting the recorded data specified in a certain time without ambiguity. The measurement operation based (W) had shown few difficulties due to data structure circumstances based location area. Whereas, the other parameters had displayed sensible behaviors particularly due to the measurements recorded freely indoor or outdoor. Finally, the idea is considered perfect particularly for controlling the devices of a specific house based on sensors readings.

Most of the research papers and studies in this field do not give priorities to data storage and data acquisition based microcontroller sensor outputs. In this paper, the resultant data obtained by the system can be stored and charted synchronously with monitoring Water level station system at the same time . That is, the information can be demonstrated and seen in two techniques, direct and indirect. The term direct means that Water level condition can be shown over (16×2) LCD display directly without creating database ground area. Whereas, indirect technique means that Water level condition are recorded and stored in a pc as long as the sensors are measuring Water level conditions. The main challenge of this work is showing and confirming up that the microcontrollers with their energetic sensors can be linked with data acquisition system in order to create a database depending on Water level station attributes. The proposed idea allows forecasting opportunities based on the realized data by microcontroller sensors rather than monitoring the system directly. As a cost reduction, the proposed system uses one sensor identified as DHT sensor to provide both water level and Pressure sensor readings that employed to build the heretical structure of Water level database. Water level prediction issues completely depend on the last day Water level situation in order to specify how much the Water level might be changed in the future accordingly. The papers that present the idea of renewable solar systems and hybrid power plants have discussed several

factors that affect considerably on Water level condition appreciations such as the color of sun radiation due to the environmental reactions and the reflections that changes water level situation and hence proportionally changes Pressure sensor situation. Furthermore, wind speed is considered another factor that has huge influence on Water level conditions such as air velocity, air density, air direction and air coldness. Hereby, the proposed conditions and factors effect majorly on the daily Water level forecasting by human being. This paper presents a simple way to monitor / store the data locally that is, the user can equip the system in a specific location and starts recording and monitoring data with respect to (day / night) automatic system

A GSM based low cost Water level monitoring system for solar and wind energy generation

Renewable Energy is a pressing need in the 21st century as non-renewable sources are no longer fit for our energy needs. This is especially important in a country like India, where supply to demand ratio is very low. In this paper, we intend to identify the geographical areas for solar and wind energy generations at low cost. It is achieved by monitoring atmospheric Water level conditions, such as water level, Pressure sensor, wind speed and light intensity. Our design is based on remotely operated system with sensors, which gathers Water level information and transmits measured values to the ground. In our research, we have considered a number of options to device atmospheric Water level monitoring system at low cost, long lasting and durable for extreme Water level conditions. The cost of the system is estimated to be nearly thirty dollars. It is highly reliable and deployable, and is a very useful utility in a country like India. The system can be easily deployed at areas to keep track of continuous climatic changes. The system is operated by battery, and is expected to run with a long life span, because of the system optimizations done for maximum power savings. Our system weighs only less than 150 gm, and is easily floatable and recoverable with the help of a simple Hydrogen balloon.

Here we propose a Gsm based Water level sensing and reporting project. The system senses water level, as well as light and Pressure sensor and conveys this to the user wirelessly. Our system uses water level sensor to detect and record current water level. It uses a light sensor in order to detect current lighting conditions. Also a Pressure sensor

sensor is used to detect current Pressure sensor conditions. All this data from sensors is conveyed to the microcontroller. The microcontroller now processes this data and passes it on to a gsm modem interfaced to it. The gsm modem now encodes this data as sms message and sends this message to programmed user. Thus this puts forward a wireless gsm based Water level monitoring system where the person does not need to be near the equipment to constantly monitor Water level reports. The data is automatically sent to the user via a sms.

2.4 AUTOMATIC WATER LEVEL STATION (AWS)

Automatic Water level station (AWS) is a system that enables the collection of meteorological observations automatically. An AWS comprises a number of sensors, a data logger (housed in a waterproof enclosure) and a power supply. Typically, an AWS has got sensors that measure various Water level parameters like rainfall, atmospheric water level, wind speed, Pressure sensor, pressure, and direction [3]. The advantage of AWS over a traditional manual Water level station is that it is far less labour-intensive. Provided an AWS is regularly checked to ensure that it is functioning properly, it does not need to be physically attended so that results can be manually recorded. Professional AWS such as the one depicted in the fig below are available online. However, the capital-intensive nature of AWS often means that it is too expensive to set up a large number of stations. Consequently, data-hungry forecasting models, which operate best when fed with a vast quantity of observations from a very dense network of AWS, cannot operate to their full capacity. In addition professional AWS are not available on the local market

WATER LEVEL MONITORING BY USING SIMPLE INSTRUMENTS

For many years simple instruments and techniques have been used in order to measure Water level changes. Basic Water level measuring instruments like cup anemometer and wind vane had been used to measure wind speed and direction. These instruments are still widely used in most common Water level monitoring technologies today. Barometers, thermometers, rain gauges and hygrometers, are the vital tools for Water level monitoring, from which more advanced technologies

used in Water level monitoring are developed [2]. However measuring Water level data using this traditional way has the disadvantage that the system requires constant intervention of the human being to record the data manually. Furthermore it is difficult to monitor the Water level station remotely as it cannot be easily integrated with modern technologies

DIGITAL WATER LEVEL STATION

This journal proposed to build a Water level station with a digital display. This Water level station is powered by a power supply. The analog signal from sensors is converted to a digital signal. This Water level station provides reading parameters for pressure, rainfall, water level, Pressure sensor, wind direction and wind speed and could only display one parameter from the Water level station at one time [2]. The limitations of this system are that it cannot be monitored remotely and requires the physical presence of the human being to take readings. Moreover the system lacks autonomous data logging capability which is crucial for future Water level forecasting and prediction

MONITORING SYSTEM OF A WATER LEVEL STATION VIA IP

From this journal, a monitoring system for Water level station was developed. They converted analog signal from sensor to digital signal to be read by computer via data acquisition card usb6009 and using LabView as application software to interface the data from Water level station [1]. This method is limited by availability of internet connection to access the remote Water level station. This system cannot be used in rural areas since internet access is limited and some areas are not covered at all.

CHAPTER 3

METHODOLOGY

3.1 EXISTING SYSTEM:

In today's world many pollution monitoring systems are designed by considering different environmental parameters. Existing system model is presented uses Zigbee based wireless sensor networks to monitor physical and environmental conditions with thousands of application in different fields. The sensor nodes directly communicated with the moving nodes deployed on the object of interest which avoided the use of complex routing algorithm but local computations are very minimal.

DISADVANTAGES OF EXISTING SYSTEM:

Existing Water level monitoring systems that are used generally consist of unconventional and heavy machinery that consists of number of moving parts that require constant maintenance and need to be monitored and changed frequently. Power requirements are one of many major constraints as these instruments are generally sited far from main power supply. This made instruments costly.

- By using Zigbee it transmit the data at very short distance
- And it never save any data for the future prediction of whether report
- There is no Accuracy in Water level report
- Hard to Implementation.

3.2 PROPOSED SYSTEM:

The proposed embedded device is for monitoring ground water level in the atmosphere to make the environment intelligent or interactive with the objects through wireless communication. The rain drop sensor and pressure are connected to detect the rain session and air pressure monitoring level.

The proposed model which is more adaptable and distributive in nature to monitor the environmental parameters.

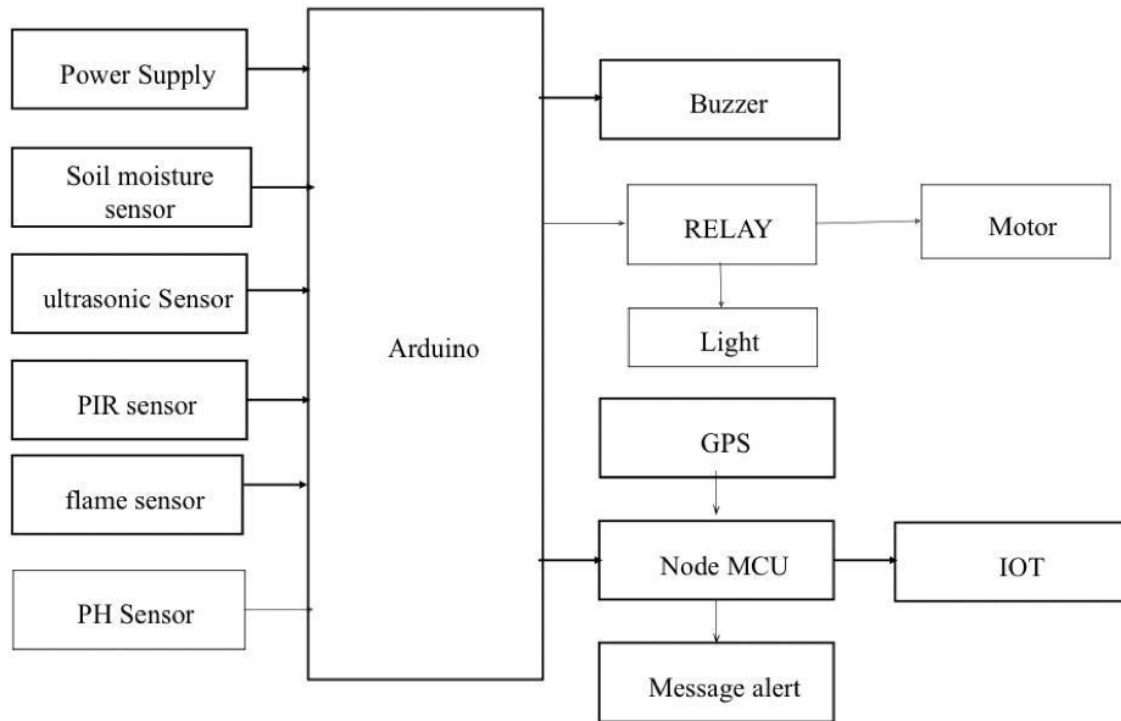
The implemented system consists of a microcontroller (ATmega328) as a main processing unit for the entire system and all the sensor and devices can be connected with the microcontroller.

The sensors can be operated by the microcontroller to retrieve the data from them and it processes the analysis with the sensor data and updates it to the internet through Wi-Fi module connected to it.

Advantages of proposed system:

- It transmit the data over long distance
- It save the data in cloud so it is highly useful predict the whether comparison over previous year to present year
- Easy to Implementation
- We can use internet platform for the analysis of Water level report data.
- Fully autonomous based system. No need man power to measure the data.

BLOCK DIAGRAM



3.1 Block Diagram of Agriculture Monitoring Using IoT

Project implementation

- The implemented system consists of a microcontroller (ESP8266) as a main processing unit for the entire system and all the sensor and devices can be connected with the microcontroller.
- The sensors can be operated by the microcontroller to retrieve the data from them and it processes the analysis with the sensor data and updates it to the internet through Wi-Fi module connected with it
- Here we used ESP8266 Wi-Fi module which is having TCP/IP protocol stack integrated on chip. So that it can provide any microcontroller to get connected with Wi-Fi network.

- These 2 sensors will measure the primary environmental factors. All this sensors will gives the analog voltage representing one particular Water level factor. The microcontroller will converts this analog voltage into digital
- The DHT11 is an essential, ultra-minimal effort computerized water level and Pressure sensor sensor.

Project Description:

There are loads of high end systems on the market lately for around the clock Water level monitoring. However these systems are enforced on a really large scale, for monitoring real time Water level for a full town or state. Implementing such system for a little space isn't possible, since they're not designed for it and therefore the overhead for maintaining such systems for a little space is extremely high. The values browse from the sensors are processed by the Arduino micro-controller and hold on during a computer file which might be processed upon to derive analysis. The readings also are displayed on an on board liquid crystal display for fast viewing. All these readings are often analyzed to get the Water level characteristics of a specific space and record the Water level pattern. These recorded parameters vary from places to places. All these necessities are fed into the database and these values are necessities and recorded over time. Using these values as input we are able to plot a map of a specific space over time. Based on this Water level factors and planned values the set actions are done. The set action will embrace turning on the heat once the water level is colder than the set price and turning on the cooling system once the water level is hot or wet on the far side the set values. The serial output from the Arduino micro-controller that are the values read from the sensors also can be hold on in a database. The database are often used as a supply for information if we would like to show values through an internet site or a standalone application. The modules that frame the Water level monitoring system are fastidiously and well thought of, to create certain that the sensors used are giving the foremost correct reading and are compatible with the Arduino micro-controller. The modules used for the Water level monitoring system are Pressure sensor sensor, water level sensor, light sensor, LCD, altitude sensor and atmospheric pressure sensor. The working rule of this work describes the dependent functionality of the parts and their output. Firstly, all the parts are initialized

by supplying the desired power of +5v. There are 2 water level sensors, lm35 and dht11; we are using 2 water level sensors to induce a correct value of water level reading and taking the typical of the two values. Looking on the water level, hot air or cool air introduced to keep up the water level threshold value that is planned. If the water level is too low for the actual space hot air is blown in to bring the water level to moderation. Otherwise, if the water level is too high, cold air is blown and thereby raising the water level to the desired level. This is often however water level is manipulated. Secondly, there's an LDR that work based on light intensity. Once the daylight is just too much or not enough for the plant to handle, the servo motor opens or closes the door of the glass box supported the readings of the LDR. This helps in recording and documenting the natural light incident on the area. The natural intensity level could wary from time to time. This is often vital in agricultural applications, wherever light is needed for the growth of plants and a few plants might not grow well in low light. On the other hand, once the sunshine intensity is high throughout the year, such areas or places are appropriate to line up solar energy stations. light intensity in conjunction with different parameters like water level and humidness may be employed in predicting forecast while not the employment of any satellite information. The gathered information is serially fed into a laptop, that uses the com port to communicate with the Arduino device and therefore the knowledge recorded is hold on during a computer file. The computer file may be directly foreign to an excel file with the functionality of a macro. The foreign information is then sorted and formatted, and charts are then planned with the foreign information. The charts present a visible illustration of the information that shows the Water level pattern over a recorded amount of your time. The visual patterns indicate the Water level behavior of the actual region. This is often the first objective of the current work. The DHT11 detector provides the present water level are humidness readings. The DHT11 offers out analog output and is connected to the analog input of the Arduino micro-controller A0. The dht11 detector has three pins. Along with water level and humidness the other values that are calculated or derived from the dht11 detector is that the water level, heat index etc. The water level is that the water level at that air within the atmosphere freezes to become water droplets and therefore the heat index is that the heat felt by the human skin from the atmosphere. This is often vital in places with high humidness. Even supposing the

water level perhaps lower, the body still feels heat. This is often because of the high humidness within the air. Humidness is that the wetness content within the air. High humidness within the air usually makes one to sweat or egest

The Im35 could be a general purpose water level detector. The necessity of this detector is to get a further reading of the water level. Along with the dht11 sensor's water level reading, we tend to calculate the Im35 sensors water level reading further and a mean of the two readings are taken to get a correct reading of the encircling water level. Bmp180 detector is employed to live the air pressure and therefore the water level further. The air pressure is employed to work out the relative atmospheric pressure practiced within the close. this is often be} terribly helpful if we tend to are mistreatment the system in high altitude atmosphere and a graduated price of the altitude along with different environmental readings provides an honest projection of the environment Water level pattern and that we can notice changes with increase or decrease in altitude. The readings from the sensors are displayed during a 16x2 liquid crystal display that is directly connected to the Arduino micro-controller. This is often helpful after we are using the device inside or solely to get the readings on a screen. The liquid crystal display is additionally practical once the device is connected to a portable computer wherever the readings are recorded. There's on-board switch provided to show on/off the liquid crystal display so as to preserve the battery just in case we tend to are powering the device using external batteries. There's a switch provided to show on/off the LCD's back-light display. The back-light display consumes loads of battery power. This is often helpful after we need to preserve the battery and additionally keep the liquid crystal display on. fig-3: architecture diagram Through Water level monitoring system we are able to collect the information regarding humidness and water level and in line with current and former data we are able to manufacture the ends up in graphical manner within the system. The graphical charts may also be uploaded to websites from wherever in it may be accessed from anyplace. The information may also be used for pattern analysis, wherever within the Water level parameters are recorded for an extended amount of your time. The accumulated knowledge is employed for analysis for Water level prediction. thus our main plan was to coin a system that may sense the most parts that formulates the Water level and might be ready to forecast the Water level without human error. However, regardless

however little the typical error becomes with someone system, massive errors inside any explicit piece of guidance are still potential on any given model run.

Hardware used:

- Arduino UNO Microcontroller.
- Node MCU module.
- Power Supply unit
- Water level
- Ultrasonic Sensor
- PIR Sensor
- Flame sensor
- Wi-Fi ModuleRelay.
- SpeakerWater
- motorBuzzer
- GPS tracker
- PH sensor

Software REQUIREMENTS

- Arduino IDE
- Embedded C Programming Language
- Proteus simulation.

CHAPTER 4

HARDWARE DESIGN

4.1 ARDUINO UNO AND ITS PROGRAMMING

Arduino is a tool for making computers that can sense and control more of the physical world than your desktop computer. It's an open-source physical computing platform based on a simple microcontroller board, and a development environment for writing software for the board.

Arduino can be used to develop interactive objects, taking inputs from a variety of switches or sensors, and controlling a variety of lights, motors, and other physical outputs. Arduino projects can be stand-alone, or they can be communicate with software running on your computer. The boards can be assembled by hand or purchased preassembled; the open-source IDE can be downloaded for free.

The Arduino programming language is an implementation of Wiring, a similar physical computing platform, which is based on the Processing multimedia programming environment.

Arduino Uno:

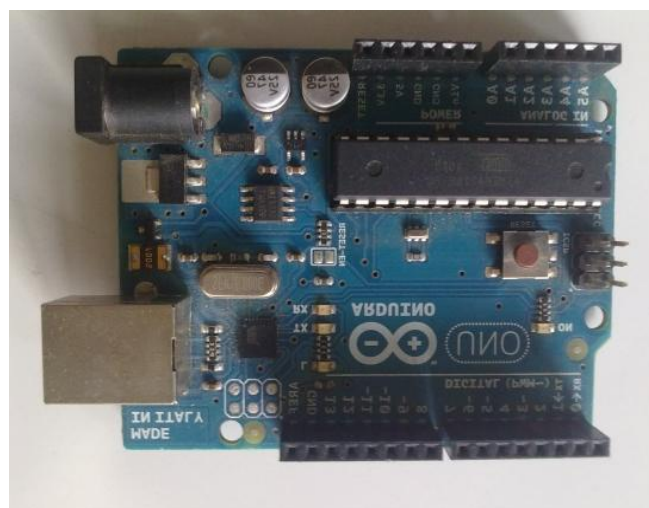


Fig 4.1 ARDUINO UNO 1

4.3 Overview

The Arduino microcontroller is an easy to use yet powerful single board computer that has gained considerable traction in the hobby and professional market. The Arduino is open-source, which means hardware is reasonably priced and development software is free. This guide is for students in ME 2011, or students anywhere who are confronting the Arduino for the first time. For advanced Arduino users, prowl the web; there are lots of resources.

This guide covers the Arduino Uno board (Spark fun DEV-09950, \$29.95), a good choice for students and educators. With the Arduino board, you can write programs and create interface circuits to read switches and other sensors, and to control motors and lights with very little effort. Many of the pictures and drawings in this guide were taken from the documentation on the

This is what the Arduino board looks like.



Fig 4.2 ARDUINO UNO 2

The Duemilanove board features an Atmel ATmega328 microcontroller operating at 5 V with 2 Kb of RAM, 32 Kb of flash memory for storing programs and 1 Kb of EEPROM for

storing parameters. The clock speed is 16 MHz, which translates to about executing about 300,000 lines of C source code per second. The board has 14 digital I/O pins and 6 analog input pins. There is a USB connector for talking to the host computer and a DC power jack for connecting an external 6-20 V power source, for example a 9 V battery, when running a program while not connected to the host computer. Headers are provided for interfacing to the I/O pins using 22 g solid wire or header connectors.

The Arduino programming language is a simplified version of C/C++. If you know C, programming the Arduino will be familiar. If you do not know C, no need to worry as only a few commands are needed to perform useful functions.

An important feature of the Arduino is that you can create a control program on the host PC, download it to the Arduino and it will run automatically. Remove the USB cable connection to the PC, and the program will still run from the top each time you push the reset button. Remove the battery and put the Arduino board in a closet for six months. When you reconnect the battery, the last program you stored will run. This means that you connect the board to the host PC to develop and debug your program, but once that is done, you no longer need the PC to run the program.

The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

4.3 Summary:

Microcontroller ATmega328

Operating Voltage 5V

Input Voltage (recommended) 7-12V

Input Voltage (limits) 6-20V

Digital I/O Pins 14 (of which 6 provide PWM output)

Analog Input Pins 6

DC Current per I/O Pin 40 mA

DC Current for 3.3V Pin 50 mA

Flash Memory 32 KB (ATmega328) of which 0.5 KB used by bootloader

SRAM 2 KB (ATmega328)

EEPROM 1 KB (ATmega328)

Clock Speed 16 MHz

4.4 Pin Configuration

The Arduino Uno can be powered via the USB connection or with an external power supply. The power source is selected automatically.

External (non-USB) power can come either from an AC-to-DC adapter (wall- wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the Gnd and Vin pin headers of the POWER connector.

The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may be unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts.

The power pins are as follows:

- **VIN.** The input voltage to the Arduino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.
- **5V.** this pin outputs a regulated 5V from the regulator on the board. The board can be supplied with power either from the DC power jack (7 - 12V), the USB connector (5V), or the VIN pin of the board (7-12V). Supplying voltage via the 5V or 3.3V pins bypasses the regulator, and can damage your board.
- **3V3.** A 3.3 volt supply generated by the on-board regulator. Maximum current draw is 50 mA.
- **GND.** Ground pins.
- **IOREF.** This pin on the Arduino board provides the voltage reference with which the microcontroller operates. A properly configured shield can read the IOREF pin voltage and select the appropriate power source or enable voltage translators on the outputs for working with the 5V or 3.3V.

library

There are a couple of other pins on the board:

- **AREF.** Reference voltage for the analog inputs. Used with analog Reference ().

Reset. Bring this line LOW to reset the microcontroller. Typically used to add a reset button which blocks the one on the board.

Hardware setup:

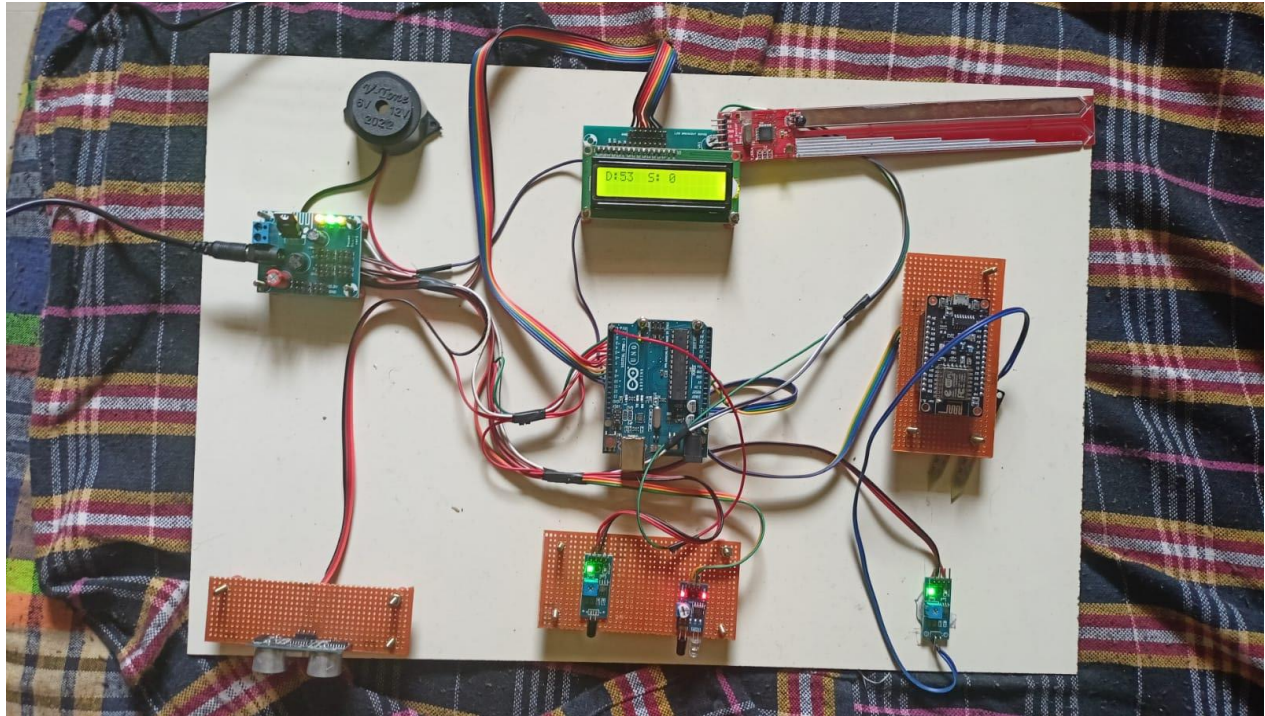


Fig 4.3 Hardware set up

Communication

Microcontrollers depend on a host computer for developing and compiling programs. The software used on the host computer is known as an integrated development environment, or IDE. For the Arduino, the development environment is based on the open source Processing platform (www.processing.org) which is described by its creators as a “programming language and environment for people who want to program images, animation, and interactions.” The Arduino programming language leverages an open source project known as Wiring (wiring.org.co). The Arduino language is based on good old- fashioned C. If you are unfamiliar with this language, don’t worry; it’s not hard to learn, and the Arduino IDE provides some feedback when you make mistakes in your programs.

The Arduino Uno has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers. The ATmega328 provides UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX). An ATmega16U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer. The '16U2 firmware uses the standard USB COM drivers,

and no external driver is needed. However, on Windows, a .inf file is required. The Arduino software includes a serial monitor which allows simple textual data to be sent to and from the Arduino board. The RX and TX LEDs on the board will flash when data is being transmitted via the USB-to-serial chip and USB connection to the computer (but not for serial communication on pins 0 and 1).

A Software Serial library allows for serial communication on any of the Uno's digital pins. The ATmega328 also supports I2C (TWI) and SPI communication. The Arduino software includes a Wire library to simplify use of the I2C bus; see the documentation for details. For SPI communication, use the SPI library.

As you go through the list of programming statements available in the Arduino IDE (choose Help->Reference), you might think there isn't much power for doing things like running servos, operating stepper motors, reading potentiometers, or displaying text on an LCD. Like most any language based on C, the Arduino supports the notion of "libraries" code.

Repositories that extend core programming functionality. Libraries let you re-use code without having to physically copy and paste it into all your programs. The standard Arduino software installation comes with several libraries you may use, and you can download others from the Arduino support pages and from third-party websites that publish Arduino library code.

NODE MCU

NodeMCU is an open-source Lua based firmware and **development board** specially targeted for IoT based Applications. It includes firmware that runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module

Programming NodeMCU ESP8266 with Arduino IDE

The NodeMCU Development Board can be easily programmed with Arduino IDE since it is easy to use.

Programming NodeMCU with the Arduino IDE will hardly take 5-10 minutes. All you need is the Arduino IDE, a USB cable and the NodeMCU board itself. You can check this Getting Started Tutorial for NodeMCU to prepare your Arduino IDE for NodeMCU.

NodeMCU is an open source firmware for which open source prototyping board designs are available. The name "NodeMCU" combines "node" and "MCU" (microcontroller unit).^[8] The term "NodeMCU" strictly speaking refers to the firmware rather than the associated development kits.^[citation needed]

Both the firmware and prototyping board designs are open source.^[8]

The firmware uses the Lua scripting language. The firmware is based on the eLua project, and built on the Espressif Non-OS SDK for ESP8266. It uses many open source projects, such as lua-cjson^[9] and SPIFFS.^[10] Due to resource constraints, users need to select the modules relevant for their project and build a firmware tailored to their needs. Support for the 32-bit ESP32 has also been implemented.

The prototyping hardware typically used is a circuit board functioning as a dual in-line package (DIP) which integrates a USB controller with a smaller surface-mounted board containing the MCU and antenna. The choice of the DIP format allows for easy prototyping on breadboards. The design was initially based on the ESP-12 module of the ESP8266, which is a Wi-Fi SoC integrated with a Tensilica Xtensa LX106 core, widely used in IoT applications (see related projects).

NodeMCU was created shortly after the ESP8266 came out. On December 30, 2013, Espressif Systems began production of the ESP8266. NodeMCU started on 13 Oct 2015, when Hong committed the first file of nodemcu-firmware to GitHub. Two months later, the project expanded to include an open-hardware platform when developer Huang R committed the gerber file of an ESP8266 board, named devkit v0.9. Later that month, Tuan PM ported MQTT client library from Contiki to the ESP8266 SoC platform, and committed to NodeMCU project, then NodeMCU was able to support the MQTT IoT protocol, using Lua to access the MQTT broker. Another important update was made on

30 Jan 2015, when Devsaurus ported the u8glib to the NodeMCU project, enabling NodeMCU to easily drive LCD, Screen, OLED, even VGA displays.

In the summer of 2015 the original creators abandoned the firmware project and a group of independent contributors took over. By the summer of 2016 the NodeMCU included more than 40 different modules.

ESP8266 Arduino Core

As Arduino.cc began developing new MCU boards based on non-AVR processors like the ARM/SAM MCU and used in the Arduino Due, they needed to modify the Arduino IDE so that it would be relatively easy to change the IDE to support alternate toolchains to allow Arduino C/C++ to be compiled for these new processors. They did this with the introduction of the Board Manager and the SAM Core. A "core" is the collection of software components required by the Board Manager and the Arduino IDE to compile an Arduino C/C++ source file for the target MCU's machine language. Some ESP8266 enthusiasts developed an Arduino core for the ESP8266 WiFi SoC, popularly called the "ESP8266 Core for the Arduino IDE". This has become a leading software development platform for the various ESP8266-based modules and development boards, including NodeMCUs.

NodeMCU is an open-source LUA based firmware developed for the ESP8266 wifi chip. By exploring functionality with the ESP8266 chip, NodeMCU firmware comes with the ESP8266 Development board/kit i.e. NodeMCU Development board.

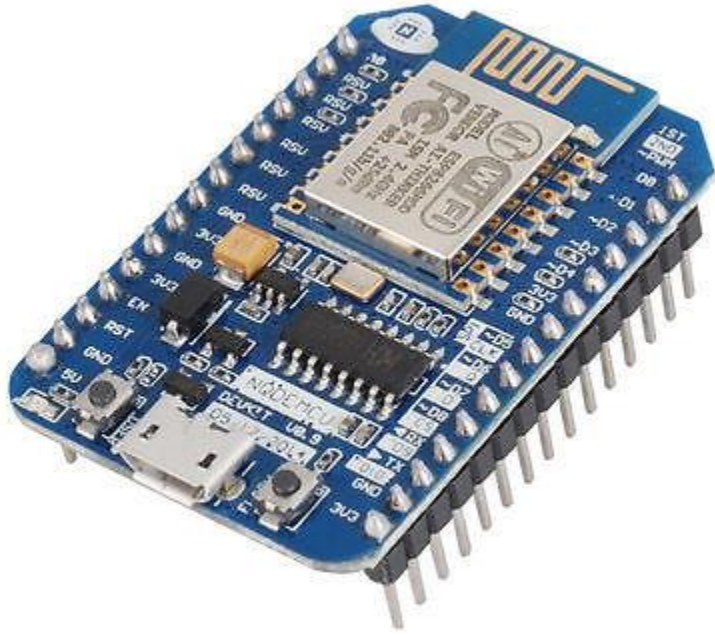


Fig 4.4 NodeMCU Development Board/kit v0.9 (Version1)

Since NodeMCU is an open-source platform, its hardware design is open for edit/modify/build.

NodeMCU Dev Kit/board consist of ESP8266 wifi enabled chip. The **ESP8266** is a low-cost Wi-Fi chip developed by Espressif Systems with TCP/IP protocol. For more information about ESP8266, you can refer to the ESP8266 WiFi Module.

There is Version2 (V2) available for NodeMCU Dev Kit i.e. **NodeMCU Development Board v1.0 (Version2)**, which usually comes in black colored PCB.

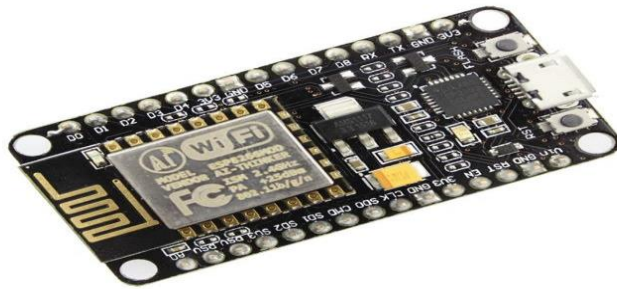


Fig 4.5 NodeMCU Development Board/kit v1.0 (Version2)

For more information about NodeMCU Boards available in the market refer to NodeMCU Development Boards

NodeMCU Dev Kit has **Arduino like** Analog (i.e. A0) and Digital (D0-D8) pins on its board. It supports serial communication protocols i.e. UART, SPI, I2C, etc.

Using such serial protocols we can connect it with serial devices like I2C enabled LCD display, Magnetometer HMC5883, MPU-6050 Gyro meter + Accelerometer, RTC chips, GPS modules, touch screen displays, SD cards, etc.

How to start with NodeMCU?

NodeMCU Development board is featured with wifi capability, analog pin, digital pins, and serial communication protocols.

To get started with using NodeMCU for IoT applications first we need to know about how to write/download NodeMCU firmware in NodeMCU Development Boards. And before that where this NodeMCU firmware will get as per our requirement.

There are online NodeMCU custom builds available using which we can easily get our custom NodeMCU firmware as per our requirement.

To know more about how to build custom NodeMCU firmware online and download it refer to Getting started with NodeMCU

How to write codes for NodeMCU?

After setting up ESP8266 with Node-MCU firmware, let's see the IDE (Integrated Development Environment) required for the development of NodeMCU.

NodeMCU with ESPlorer IDE

Lua scripts are generally used to code the NodeMCU. Lua is an open-source, lightweight, embeddable scripting language built on top of C programming language.

For more information about how to write Lua script for NodeMCU refer to Getting started with NodeMCU using ESPlorerIDE

NodeMCU with Arduino IDE

Here is another way of developing NodeMCU with a well-known IDE i.e. Arduino IDE. We can also develop applications on NodeMCU using the Arduino development environment. This makes it easy for Arduino developers than learning a new language and IDE for NodeMCU.

For more information about how to write Arduino sketch for NodeMCU refer to Getting started with NodeMCU using Arduino IDE

The difference in using ESPlorer and Arduino IDE

Well, there is a programming language difference we can say while developing an application for NodeMCU using ESPlorer IDE and Arduino IDE.

We need to code in C\C++ programming language if we are using Arduino IDE for developing NodeMCU applications and Lua language if we are using ESPlorer IDE.

Basically, NodeMCU is Lua Interpreter, so it can understand Lua script easily. When we write Lua scripts for NodeMCU and send/upload it to NodeMCU, then they will get executes sequentially. It will not build a binary firmware file of code for NodeMCU to write. It will send Lua script as it is to NodeMCU to get executed.

In Arduino IDE when we write and compile code, the ESP8266 toolchain in the background creates a binary firmware file of code we wrote. And when we upload it to

NodeMCU then it will flash all NodeMCU firmware with newly generated binary firmware code. In fact, it writes the complete firmware.

That's the reason why NodeMCU not accept further Lua scripts/code after it is getting flashed by Arduino IDE. After getting flashed by Arduino sketch/code it will be no more Lua interpreter and we got an error if we try to upload Lua scripts. To again start with Lua script, we need to flash it with NodeMCU firmware.

Since Arduino IDE compiles and upload/writes complete firmware, it takes more time than ESPlorer IDE.

NodeMCU ESP8266 Specifications & Features

- Microcontroller: Tensilica 32-bit RISC CPU Xtensa LX106
- Operating Voltage: 3.3V
- Input Voltage: 7-12V
- Digital I/O Pins (DIO): 16
- Analog Input Pins (ADC): 1
- UARTs: 1
- SPIs: 1
- I2Cs: 1
- Flash Memory: 4 MB
- SRAM: 64 KB
- Clock Speed: 80 MHz
- USB-TTL based on CP2102 is included onboard, Enabling Plug n Play
- PCB Antenna
- Small Sized module to fit smartly inside your IoT projects

Pressure Sensor

A pressure sensor measures pressure, typically of gases or liquids. Pressure is an expression of the force required to stop a fluid from expanding, and is usually stated in terms of force per unit area. A pressure sensor usually acts as a transducer; it generates

a signal as a function of the pressure imposed. For the purposes of this article, such a signal is electrical.

Pressure sensors are used for control and monitoring in thousands of everyday applications. Pressure sensors can also be used to indirectly measure other variables such as fluid/gas flow, speed, water level, and altitude. Pressure sensors can alternatively be called pressure transducers, pressure transmitters, pressure senders, pressure indicators, piezometers and manometers, among other names.

Pressure sensors can vary drastically in technology, design, performance, application suitability and cost. A conservative estimate would be that there may be over 50 technologies and at least 300 companies making pressure sensors worldwide.

There is also a category of pressure sensors that are designed to measure in a dynamic mode for capturing very high speed changes in pressure. Example applications for this type of sensor would be in the measuring of combustion pressure in an engine cylinder or in a gas turbine. These sensors are commonly manufactured out of piezoelectric materials such as quartz.

Some pressure sensors, such as those found in some traffic enforcement cameras, function in a binary (off/on) manner, i.e., when pressure is applied to a pressure sensor, the sensor acts to complete or break an electrical circuit. These types of sensors are also known as a pressure switch.

The BMP180 series is designed to sense absolute air pressure in an altimeter or barometer applications

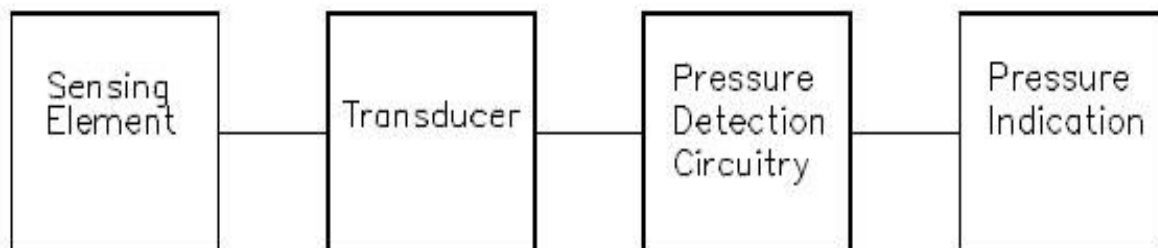


Fig 4.6 Block Diagram of Pressure

BMP180 General Description

The BMP180 is the function compatible successor of the BMP085, a new generation of high precision digital pressure sensors for consumer applications.

The ultra-low power, low voltage electronics of the BMP180 is optimized for use in mobile phones, GPS navigation devices and outdoor equipment. With a low altitude noise of merely 0.25m at fast conversion time, the BMP180 offers superior performance. The I2C (Inter-Integrated Circuit) interface allows for easy system integration with a microcontroller.

The BMP180 is based on piezo-resistive technology for EMC robustness, high accuracy and linearity as well as long term stability.

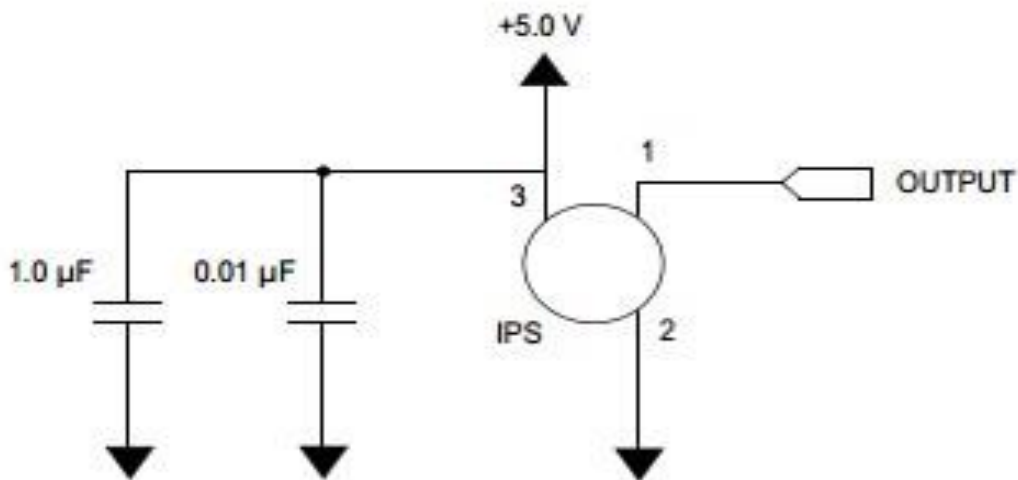


Fig 4.7 Block Diagram of circuitry

INTERNAL CIRCUITRY

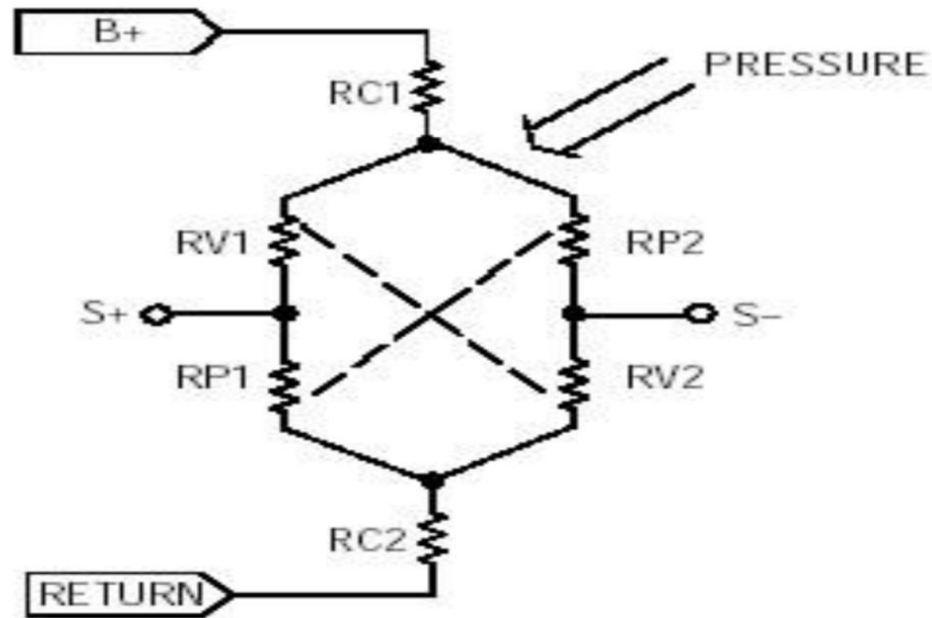


Fig 4.8 internal circuit diagram

Bridge resistors RP1, RP2, RV1 and RV2 are arranged on a thin silicon diaphragm such that when pressure is applied RP1 and RP2 increase in value while RV1 and RV2 decrease a similar amount. Pressure on the diaphragm, therefore, unbalances the bridge and produces a differential output signal. One of the fundamental properties of this structure is that the differential output voltage is directly proportional to bias voltage B+. This characteristic implies that the accuracy of the pressure measurement depends directly on the tolerance of the bias supply. It also provides a convenient means for water level compensation. The bridge resistors are silicon resistors that have positive water level coefficients.

Therefore, when they are placed in series with zero TC water level compensation resistors RC1 and RC2 the amount of voltage applied to the bridge increases with water level. This

increase in voltage produces an increase in electrical sensitivity which offsets and compensates for the negative water level coefficient associated with piezoresistance.

TYPES OF PRESSURE SENSORS

1. ABSOLUTE SENSOR-An absolute pressure sensor measures static, dynamic or total pressure with reference to a vacuum

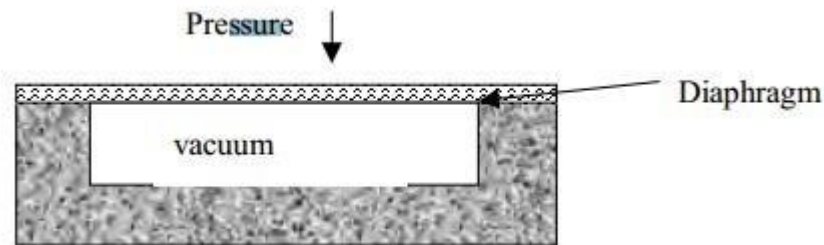


Fig 4.9 Diagram of vacuum

1. RELATIVE SENSOR- relative pressure sensor measures static, dynamic or total pressure with reference to ambient atmospheric pressure

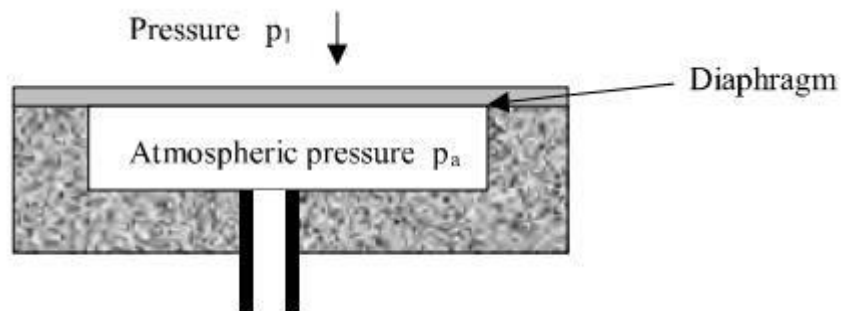


Fig 4.10 Diagram of Atmospheric Pressure

3. DIFFERENTIAL SENSOR-A differential pressure sensor measures a static, dynamic or total pressure with reference to an unspecified variable pressure p_2

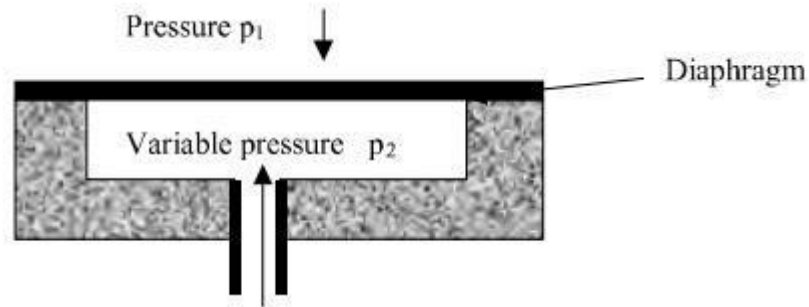


Fig 4.11 Diagram of variable Pressure

ADVANTAGES

- ✓ High output signal level
- ✓ Adaptable to many applications
- ✓ Technology robustness

APPLICATIONS

- 1) Security purposes- pressure sensors are nowadays used as alarms to detect any change in pressure in vaults and sensitive areas.
- 2) Aerodynamics of automobiles: The wind tunnelling tests of automobiles or defence equipments are dependent on their pressure characteristics which are sensed by pressure sensors

LEVEL MEASUREMENT

In industry, liquids such as water, chemicals, and solvents are used in various processes. The amount of such liquid stored can be found by measuring level of the liquid in a container or vessel. The level affects not only the quantity delivered but also pressure and rate of flow in and out of the container. Level sensors detect the level of substances like liquids, slurries, granular materials, and powders. The substance to be measured can be inside a container or can be in its natural form (e.g. a river or a lake). The level measurement can be either continuous or point values.

Wide spectrum of sensors is available in the market and commonly, they are classified based on the specific application of the sensor. Sensor used for measuring Pressure sensor is termed as Pressure sensor sensor, the one used for measurement of pressure is called pressure sensor, sensor used for measurement of displacement is called position sensor and so on though all of them may be using the similar sensing principle. In a similar fashion, the sensor used for measurement of fluid levels is called a level sensor.

Quite obvious from its name, level sensors are used to measure the level of the free-flowing substances. Such substances include liquids like water, oil, slurries, etc as well as solids in granular/powder form (solids which can flow). These substances tend to get settled in the container tanks due to gravity and maintain their level in rest state. Level sensors measure their level against a pre-set reference.

They are important not only in nuclear plants but in lot many applications. Every car, truck and motorcycle is equipped with a fuel level sensor to measure the amount of gasoline left in the fuel tank. In addition, there are sensors for level measurement of engine oil, brake / power steering fluid, cooling water, windshield cleaning liquid, etc. Industrial applications include liquid level sensing in water treatment tanks, transport and storage tanks, in the petrochemical industry for liquids such as petrol, etc. Liquid level measurement is important in household applications for devices such as automated coffee machines, water dispensers, juice squeezers, water evaporators, steamers, fridges and freezers, boilers, heating systems, dishwashers, washing machines, steam irons, etc

In short, level sensors are one of the very important sensors and play very important role in variety of consumer/ industrial applications. As with other type of sensors, level sensors are available or can be designed using variety of sensing principles. Selection of an appropriate type of sensor suiting to the application requirement is very important.

Continuous level sensors measure the level to determine the exact amount of substance in a continuous manner.

Point-level sensors indicate whether the substance is above or below the sensing point. This is essential to avoid overflow or emptying of tanks and to protect pumps from dry run.

From the application point of view the considerations are:

- Price
- Accuracy
- Response rate
- Ease of calibration
- Physical size and mounting of the instrument
- Monitoring or control of continuous or discrete levels

Level measurements are broadly classified in two groups:

- Direct methods
- Indirect methods

In direct methods, the level is indicated directly by means of simple mechanical devices. The measurement is not affected by changes in material density. Few examples are:

- Dip Stick
- Resistance Tapes
- Sight Glass
- Floats
- Ultrasonic
- Radar

In Indirect methods, the level is converted in a measurable signal using a suitable transducer. Change in the material affects the measurement. A corrective factor must be used in recalibrating the instrument. Few examples are:

- Hydrostatic head methods
- Load cell
- Capacitance
- Conductivity

Applications:

Level Probes are used for measuring level of

1. Liquids
2. Powdered and granular solids
3. Liquid metals at very high water level
4. Liquefied gases at very low water level

Disadvantages:

Light density materials under 20 lb/ft³ and materials with particle sizes exceeding 1/2 in. in diameter can be a problem due to their very low dielectric constants (caused by the large amount of air space between particles)

CHAPTER 5

SOFTWARE DESIGN

5.1 Arduino IDE:

Arduino IDE is an integrated development environment.

Can be used over different operating systems or platforms i.e. Windows, macOS, Linux.

IDE is used for writing and uploading the code of the hardware for programming the microcontroller accordingly.

The IDE consists of the different software libraries from the previous wiring project.

Features:

1. Both Analog and digital signal can be read by the IDE.
2. Directly connected to the microcontroller over a USB.
3. Arduino IDE supports different languages for writing the code

-C, C++, JAVA

Working:

Step 1. Connecting the Arduino device with the computer using a USB.



Fig 5.1 USB Cable

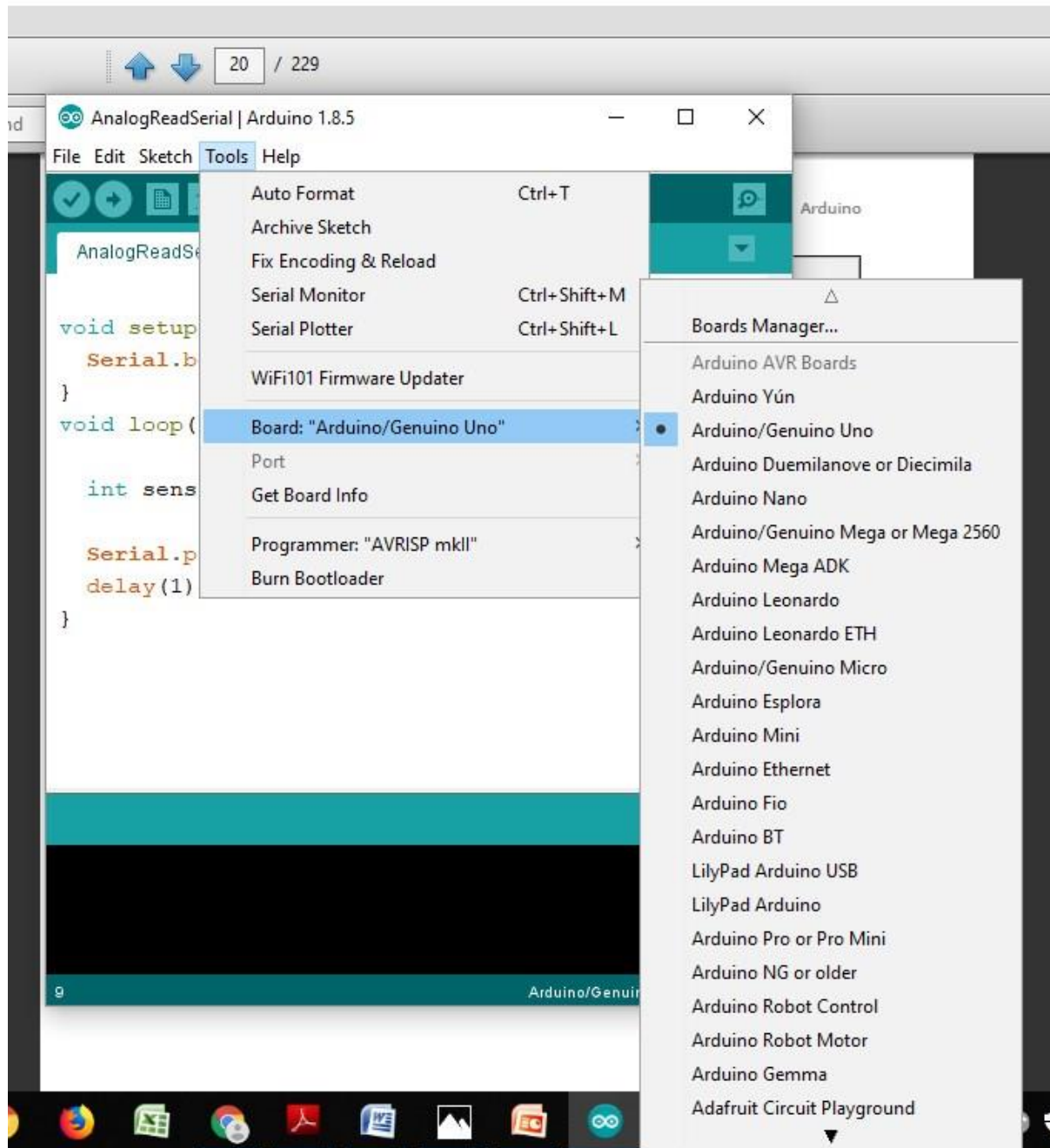
Step 2. Writing the code in the preferred language.

A screenshot of the Arduino IDE interface. The title bar reads 'AnalogReadSerial | Arduino 1.8.5'. The menu bar includes 'File', 'Edit', 'Sketch', 'Tools', and 'Help'. The toolbar contains icons for checking, running, serial monitor, upload, and download. The sketch editor shows the following code:

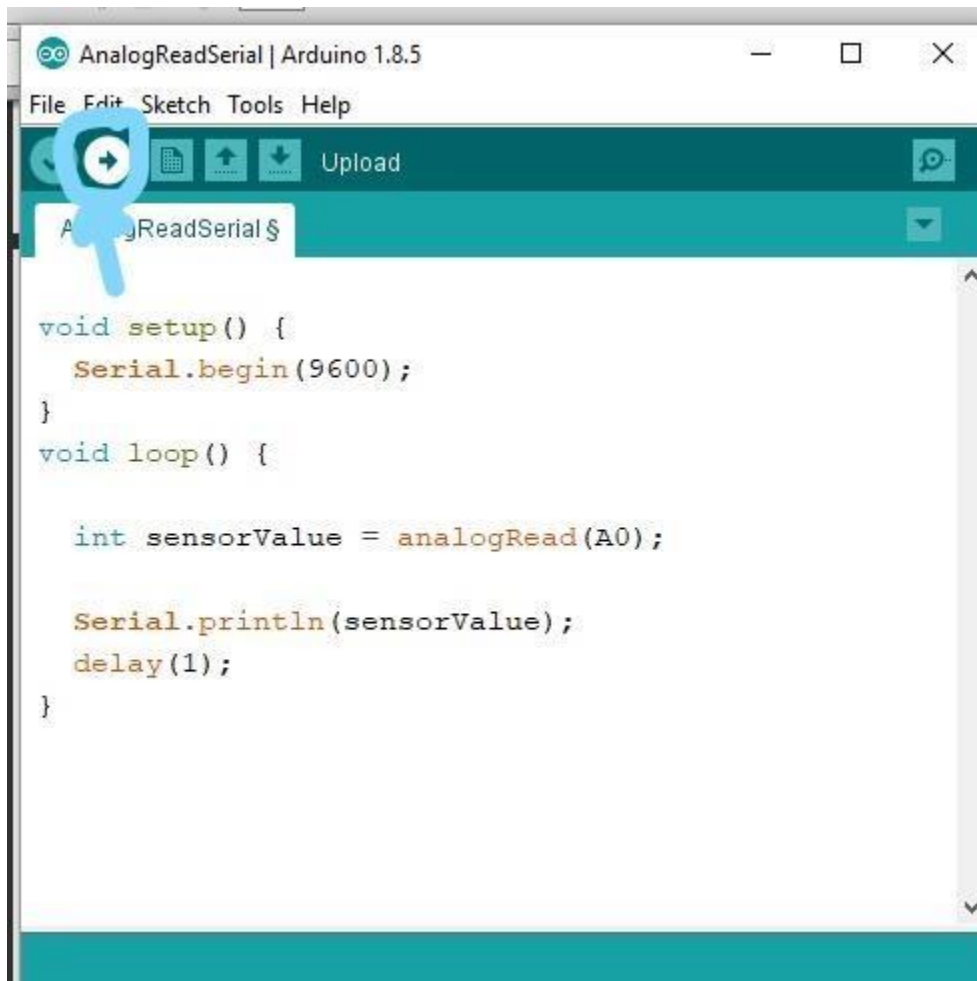
```
void setup() {  
  Serial.begin(9600);  
}  
void loop() {  
  int sensorValue = analogRead(A0);  
  Serial.println(sensorValue);  
  delay(1);  
}
```

The status bar at the bottom indicates 'Arduino/Genuino Uno on COM3'.

Step 3. Selecting the port from the list of ports.



Step 4. Uploading the code over to the Arduino UNO microcontroller.



5.2 IOT

The structure of this chapter is the following: Section 1.1 defines the motivation for this work. Section 1.2 shows the research objectives and questions. Section 1.3 presents the steps required to achieve our objectives. Section 1.4 shows the structure of the report.

5.3 Background

The Future Internet goal is to provide an infrastructure to have an immediate access to information about the physical world and its objects. Physical objects can be applicable to different application domains, such as e-health, warehouse management, etc. Each application domain may have different types of physical devices. Each physical device can have its own specifications, which is required to use in order to interact with it. To achieve the future Internet goal, a layered vision is required that can facilitate data access. Internet of Things (IoT) is a vision that aims to integrate the virtual world of information to the real world of devices through a layered architecture.

The term „Internet of Things“ consists of two words, namely *Internet* and *Things*. *Internet* refers to the global network infrastructure with scalable, configurable capabilities based on interoperable and standard communication protocols. *Things* are physical objects or devices, or virtual objects, devices or information, which have identities, physical attributes and virtual personalities, and use intelligent interfaces [1]. For instance, a virtual object can represent an abstract unit of sensor nodes that contains metadata to identify and discover its corresponding sensor nodes. Therefore, IoT refers to the *things* that can provide information from the physical environment through the Internet.

Middleware is as an interface between the hardware layer and the application layer, which is responsible for interacting with devices and information management [2]. The role of a middleware is to present a unified programming model to interact with devices. A middleware is in charge of masking the heterogeneity and distribution problems that we face when interacting with devices [3].

5.4 Motivation

IoT-based system is in charge of providing knowledge from an environment to a non-expert user. IoT-based system can be used in different environments, so it needs to be able to address many heterogeneous devices. Thus, a major concern within developing an IoT-based system is how to handle the interaction with the heterogeneous devices for non-expert users. This concern can be addressed by a middleware layer between devices and non-expert users. This layer is responsible to hide the diversity of devices from the user perspective, and provides access transparency to the devices for the end users.

The idea of creating abstractions of devices been addressed in the literature. The middleware we found in the literature can provide satisfaction by facilitating the interaction with devices, but they do not support low-level device configuration .

5.5 IoT Definition

In this section, we explain some of the IoT definitions. Also, we explain the layered architecture for IoT. Internet of Things (IoT) has increasingly gained attention in industry to interact with different types of devices. IoT can have influence on industry and society by integrating physical devices into information networks . IoT impacts can be on different perspectives, namely for private and business users. From the perspective of a private user, IoT has effect on both working and personal fields, such as smart homes and offices, e-health and assisted living. From the aspect of a business user the impacts would be in fields such as automation and industrial manufacturing, logistics, business process management, intelligent transportation of people and goods

IoT integrates physical things into information networks. IoT covers the overall infrastructure, including software, hardware and services, which is used to support these information networks. The integrated physical things can exchange data about the physical properties and information that they sense in their environment. To identify devices, we can use identification technologies like for example RFID, which allow each device be uniquely identified.

International Telecommunication Union (ITU)¹ defines IoT as “A global infrastructure for the Information Society, enabling advanced services by interconnecting (physical and virtual) things based on, existing and evolving, interoperable information and communication technologies”

IoT has a layered architecture designed to answer the demands of various industries, enterprises and society. shows a generic layered architecture for IoT that consist of five layers, which are discussed, in the following:

Edge Technology layer

This is a hardware layer that consists of embedded systems, RFID tags, sensor networks and all of the other sensors in different forms. This hardware layer can perform several functions, such as collecting information from a system or an environment, processing

information and supporting communication.

Access Gateway layer

This layer is concerned with data handling, and is responsible for publishing and subscribing the services that are provided by the *Things*, message routing, and hovelling the communication between platforms.

Middleware layer

This layer has some critical functionalities, such as aggregating and filtering the received data from the hardware devices, performing information discovery and providing access control to the devices for applications.

Application layer

This layer is responsible for delivering various application services. These services are provided through the middleware layer to different applications and users in IoT-based systems. The application services can be used in different industries such as, logistics, retail, healthcare, etc.

CHAPTER 6

RESULT AND DISCUSSIONS

CONCLUSION

This terminate that present project work is a huge success and will provide a considerable way for saving Water level parameters of real time and will help farmers, industries, normal people as well as others whose daily life is related with Water level and its parameters. It can be used to get required information about for each or particular area for many years. The collected information will used to determine the best conditions required for plants to grow if we talk about agriculture and the farmer can modify the environment conditions which is more suitable for the plan growth. This, will have a large effect on agriculture and also on farmers everywhere.

FUTURE SCOPE

Present model can be updated to monitor the cities and industries for pollution related data gathering. To shield the public health from pollution, model will provide an efficient and very cheaper solution for constant monitoring of environment and its conditions. We can do lots of additions in this system such as adding pressure sensor, gas sensor like CO, soil and moisture retrieving sensor which will able to tell us water content present in soil etc. This concludes that the current work was successful and it'll give a competent methodology for recording real time Water level readings and facilitate farmers whose resource depends on the Water level in a very country like Asian country to supply higher quality crops. It may be accustomed gather data concerning the necessities for every space over the years. The gathered data is employed to work out the best conditions for plants to grow and also the farmer will modify the atmosphere appropriate for the expansion of the plant. As the conclusion this project have cleared the objective that to build a system that can monitored Water level parameter by wireless system and IoT. The Sensor station and Water level station will be communicated by hotspot Wi-Fi and it is limited in areas covered but still better in communication via wireless. The value that been recorded from google sheet and Table 1, 2 and 3 it seen that the Water level at particular

place has different condition from the exact condition with the accuracy of Water level reporting system and forecast system data has been compared. It says that Water level reporting system is more accurate than forecast system.

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