

Smart Irrigation System Based on Fertility and Soil Moisture

A Project Report Phase – II

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

By

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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 **KOTHARU ADITYA PAVAN KUMAR (39130244), KANDULA LEELA SURYA SAI (39130256)** who carried out the project entitled “**Smart Irrigation System Based on Fertility and Soil Moisture**” under our supervision from November 2022 to April 2023.

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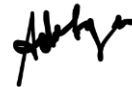
We **KOTHARU ADITYA PAVAN KUMAR (39130244)**, **KANDULA LEELA SURYA SAI (39130256)** here by declare that the training and Project Report entitled Project “**Smart Irrigation System Based on Fertility and Soil Moisture**” done by us under the guidance of **Ms. SHAMINI G I, M.Tech., (Ph.D.)**, Dept of Electronics and Communication Engineering is submitted in Partial fulfillment of the requirements for the award of Bachelor of Engineering Degree in ELECTRONICS AND COMMUNICATION ENGINEERING.

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SIGNATURE OF THE CANDIDATE

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ABSTRACT

A center pivot is a mechanized irrigation system type that irrigates crops in a circular pattern around a central pivot. Using Innovative IoT applications alongside center pivot irrigation systems allows for increasing agricultural labor automation, better water management, and cost rationalization this could aid farmers in making more informed decisions by giving accurate real-time data that is collected and analyzed for making better decisions in the future. Our system is making the irrigation process very easy since we are now in the age of IoT systems and with our system can make the irrigation process depending on the parameters that we take and take a specific action that we can irrigate or not when we can start and end the irrigation process and also the required amount of it. It also assists us in making wise decisions and makes recommendations based on the soil type. It assists us in making wise decisions, which in turn assists us in producing more yield by providing us with the appropriate amount of light, temperature, humidity, soil moisture, and acoustic sensing.

Nowadays, for irrigation, different techniques are available which are used to reduce the dependency on rain. And mostly this technique is driven by electrical power and on/off schedule. In this technique, a water level indicator is placed in the water reservoir and soil moisture sensors are placed root zone of the plant and near the module, unit handles the sensor information and transmits data to the controller which in turn control the flow of water through the valves.

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CHAPTER 1

1.1 INTRODUCTION

In India, most people depend on agriculture as their livelihood, in ancient times groundwater level was high so crop yield was high. With the regular irrigation system, the field has to be monitored by the farmer continuously, which is a huge challenge. In modern times, technology has improved a lot, and internet connectivity is even available at cheaper rates. So, farmers can use WSN-based irrigation systems to control the crops through their smartphones. Farmers can know the temperature, humidity, and Water level of their crops on their smartphone through which they can efficiently secure their crop yield. It is also a major reason for the reduction in crop yield and cattle. If we have Irrigation and atmospheric condition systems, we can solve these problems and improve crop yield India is a

country of villages and agriculture plays an important role in the development of the country.

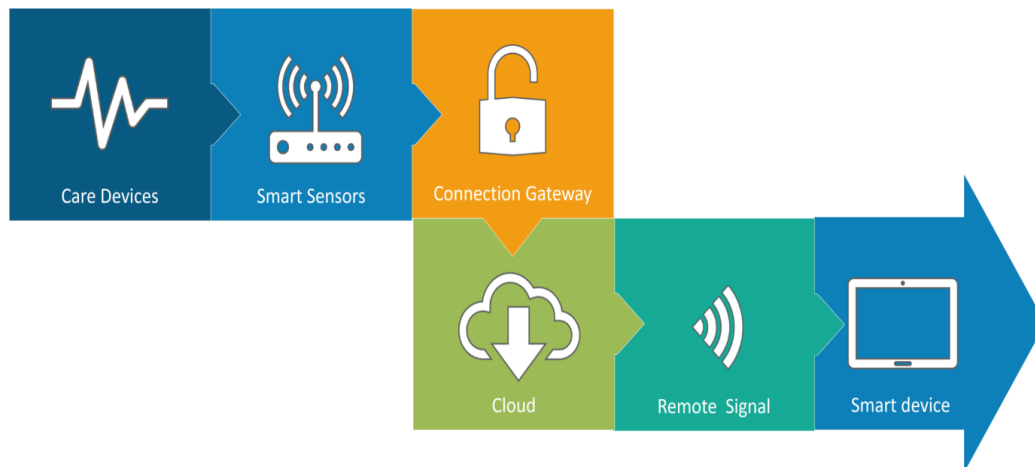


Figure 1.1 – Working of IoT Enabled Service Unit

In our country, agriculture depends on the monsoons which have an insufficient source of water. So, irrigation is used in the agricultural field. In the Irrigation system, depending upon the soil type, water is provided to plants. In agriculture, two things are very important, first to get information of about the fertility of the soil and second to measure moisture content in the soil. Nowadays, for irrigation, different techniques are

available which are used to reduce the dependency on rain. And mostly this technique is driven by electrical power and on/off schedule. In this technique, a water level indicator is placed in the water reservoir and soil moisture sensors are placed root zone of the plant and near the module, unit handles the sensor information and transmits data to the controller which in turn control the flow of water through the valves. Every living organism needs fresh water as a result, saving water is our primary obligation. The majority of irrigation water is wasted due to free-flow irrigation.

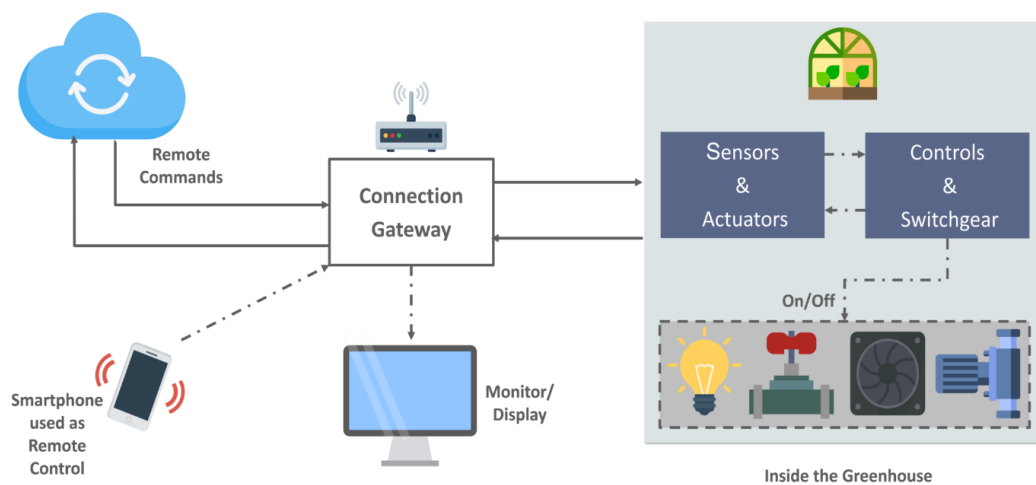


Figure 1.2 – IoT Controlled Green House Environment

Water should be utilized efficiently in irrigation by employing contemporary technology. It is important to be aware of new advances in order to combat the free flow of water in irrigation and regulate it via the use of smart irrigation techniques. As a result, a review of the existing literature was conducted in order to investigate current advancements in making irrigation automated and obtaining the needed nutritional content of the crop in production. Every living thing needs clean water As a result, conserving water is our major responsibility. Because of free-flow irrigation, the bulk of irrigation water is squandered. Water should be used efficiently in irrigation by utilizing modern technologies. It is critical to stay up to date on new developments in order to

prevent the free flow of water in irrigation and manage it via the use of smart irrigation techniques.

As a consequence, a survey of the available literature was carried out in order to explore current developments in automating irrigation and achieving the required nutritional content of the crop in production. The zig bee protocol, Global System for Mobile Communication (GSM), and other telemetry techniques are useful for communicating between the transmitter unit (i.e., farm unit) and reception unit (i.e. farmer sitting room) to make irrigation automated. Irrigation optimization in terms of time and space needs sophisticated irrigation scheduling methods. Scientific irrigation scheduling is a method that provides an expected future water need over a reasonably short period of time in order to satisfy all crop requirements while avoiding water under or over application. There are numerous variations, but these scheduling techniques usually employ real historical short-term climatic data to estimate future short-term water usage in order to forecast the timing of the next irrigation event.

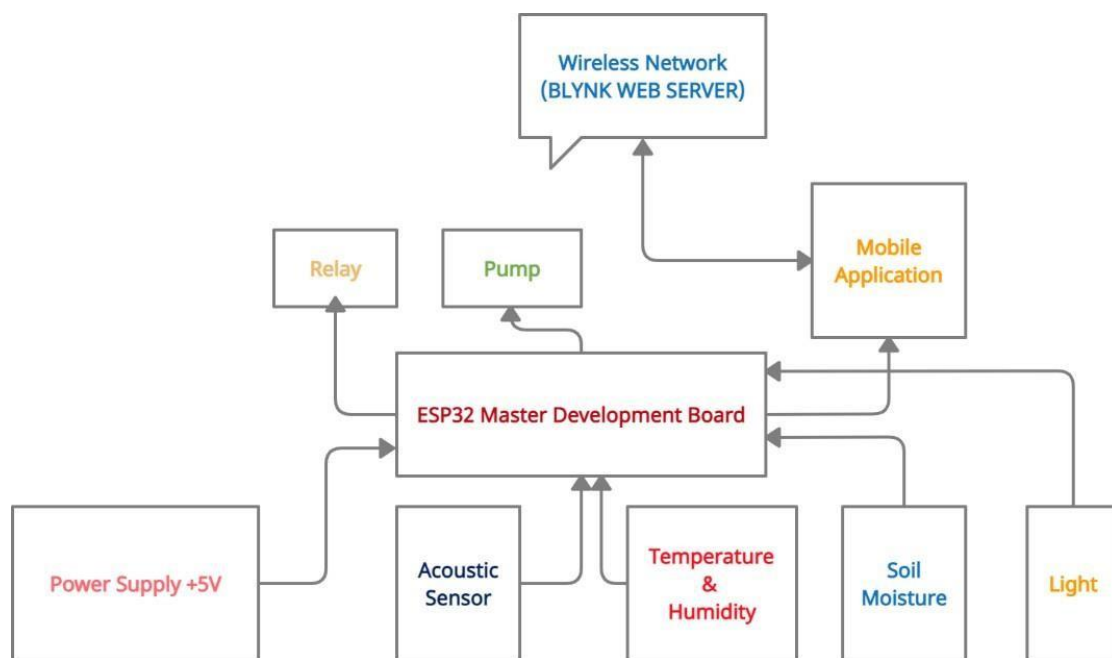


Figure 1.3 –Smart Irrigation Block Diagram

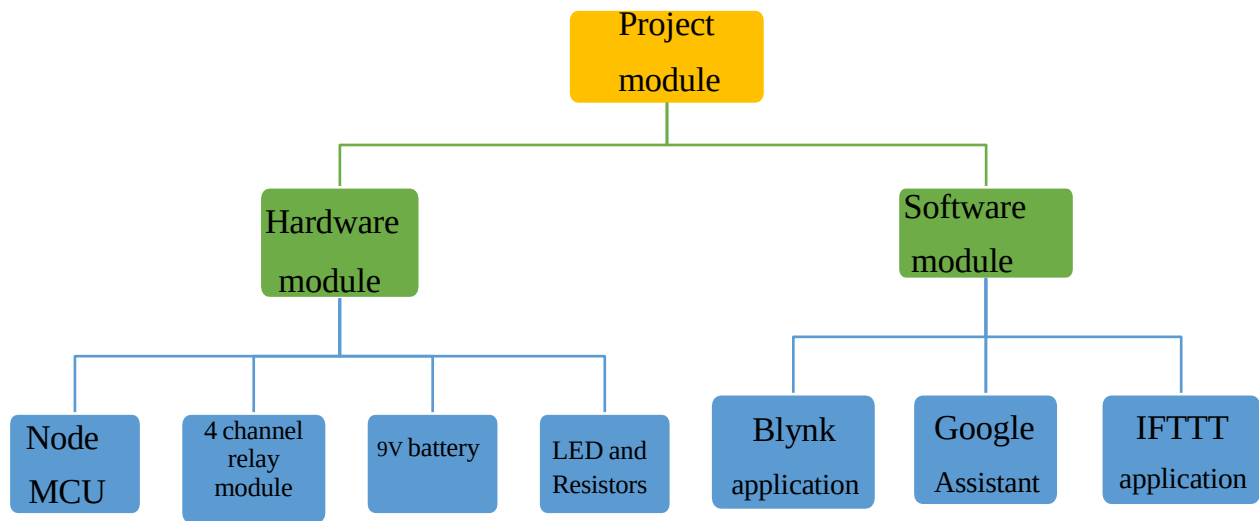


Figure 1.4 – Layout Diagram of the System

Irrigation scheduling is often planned to meet full irrigation conditions, although the techniques are equally applicable to a shortage of irrigation. Plant responses to stress, such as stem water potentials, plant temperature, and growth rates, or fluctuations in stem diameters, measured soil water levels, internode lengths, or monitored by energy balances, can also be scheduled, as can various combinations of these processes with climate-based approaches. Irrigation scheduling enhances the yield-to-consumptive-use ratio, owing to better timing of water applications. However, it is usually not possible to separate the impacts of schedule from other improved farming techniques that a firm normally employs in an on-farm irrigation scheduling system. Improving irrigation systems, such as switching from gravity surface irrigation to pressurized drip or sprinkler irrigation, can help with irrigation scheduling, especially when the system is automated and composed of soil water sensors, but the specific benefits of scheduling systems are difficult to allow or quantify.

This article describes a cloud-based and IoT-based irrigation system. This system uses sensors to gather real-time irrigation data, saves it in the cloud, the data owner issues a command, and necessary action is done depending on the results. Annals of

R.S.C.B., a concept that is used to send emergency information in case of fire in farmland or sparking in the motor pump. The author recommended utilizing a drip irrigation system to irrigate the land in [20]. The drip irrigation approach also employs the use of a fertility meter and a potential of hydrogen (pH) meter to calculate the crop's fertility requirements. This is an excellent approach since the necessary amount of fertilizer is applied to the plants, assisting in the resolution of problems such as soil salinity and other associated difficulties. Sumalatha and Kumar's system uses solar energy to automate irrigation, while a GSM system is utilized to maintain contact between agriculture and the farmer. Temperature sensors and soil moisture sensors are used to provide the precise value of moisture, based on which the valve in the system is turned on/off.



Figure 1.5 - IoT Cloud Output

Anusha and Goutham utilize a distributed wireless network of temperature and moisture sensors implanted in the root zone of the plants, as well as a water level sensor inserted in the tank to verify the water level in the tank. Wireless sensors are an excellent

watering concept. The microcontroller is preprogrammed with the soil moisture sensor's threshold value and the tank's water level to limit water waste the irrigation is controlled by the ARMLPC2148 Microcontroller. The system employs dispersed nodes for signal transmission, and all nodes are linked to a centralized node, which employs an Advanced RISC Machine (ARM). The system also contains a widespread wireless network of moisture sensors positioned near the root zone of the plants that sense the state and communicate it to the nodes, and the microcontroller controls the entire process by receiving the signal The study describes an automated irrigation system powered by solar energy, with the microcontroller serving simply as a power source. Various sensors are placed in a paddy field to precisely monitor the moisture content of the soil.

These sensors provide the farmer with the value of the water level on a regular basis via a cellular phone. If the moisture level exceeds a certain level, the motor pump will shut off automatically. Today, farmers usually work on large portions of land that are partitioned to grow different types of crops. During the dry season, they practice irrigation farming. There is a shortage of water for irrigation, and it is not possible for a person to monitor the amount of water content in the soil, in order to keep the root of the plant moist or to detect it in real-time. This study aims to address the water shortage problem, that is often faced by farmers using irrigation systems, by providing an autonomous sensor interface for the remote monitoring and control of the supply of water to the soil, thereby removing much of the effort required by farmers. Recently, the use of intelligent sensory techniques has gained a significant amount of attention from farmers who practice irrigation agriculture.

These techniques have been applied in agriculture to plan numerous activities and tasks appropriately, by utilizing limited resources with less human intervention. Aeroponics is a modern agricultural method that is commonly practiced around the world. In this system, plants are cultivated under complete control conditions in a growth chamber, by way of a light misting of a nutrient solution, replacing the soil medium. These nutrient mists are ejected through atomization nozzles on a periodic basis. During the plant cultivation period, many parameters are optimized, including temperature, humidity, light intensity, water nutrient solution level, pH and EC levels, CO₂ concentration,

atomization time, and atomization interval time, in order to enhance plant growth with the present technological advancements, there is a greater demand for specialized information regarding agricultural practices.

This is because much of agricultural studies are based on exploratory investigations, on a local scale, using ground data by employing a single remote sensor. In addition, the methods employed mostly depend on local knowledge of management practices, the environment, and biological materials. These limitations call for a new direction toward smart irrigating. A scheme for the optimal watering of agricultural crops, using a wireless sensor network, has been previously presented by the authors. In that study, the main goal was to design and develop a control system using a sensor node in the crop field, with data management and application control, through a smartphone and web application interface. The proposed scheme provides three components: (1) The hardware control box, (2) a web-based application, and (3) a mobile application. In addition, the system allows either, automatic, or manual control, by the user. The results showed the usefulness of this system in agriculture, by reducing cost and increasing agricultural productivity.

The use of internet of things (IoT) technology for agricultural practices has been demonstrated in monitoring citrus soil moisture and nutrients, integrating of fertilization, and an irrigation decision support system. Significant achievements have been made. These include a single-point, multi-layer citrus soil temperature and humidity detection, wireless sensor node and citrus precision fertilization, and the construction of an irrigation management decision support system. This approach can help farmers improve the use of fertilizers in the irrigation system. In addition, it increases the precision of citrus production, and reduces labor costs and pollution, caused by the application of chemical fertilizers to the soil. In a smart irrigation system, the design and fabrication of a self-powered and autonomous fringing-field capacitive sensor, is used to measure soil water content, is possible. This kind of sensor is manufactured using a conventional printed circuit board (PCB) and incorporates a porous ceramic material.

The design allows the energy-harvesting module to operate, based on the condition that the micro-sprinkler spinner irrigates the soil, and the supercapacitor is fully

charged to 5 V in approximately three hours during the first irrigation. Subsequently, with the supercapacitor fully charged, the system can supply power from the supercapacitor for approximately 23 d, without any energy being harvested. Agricultural practices have been the most important means of living over the course of human evolution. Hence, humans depend on a wide range of agricultural products in nearly every facet of life. The process involved in the artificial application of water to farmlands, in assisting the growth of plants, is referred to as irrigation agriculture. This process has become a great advantage in complementing agricultural activities, especially in the dry season. Irrigation plays a vital role in advancing the agricultural, educational, and economic growth of the nation as a whole.

The traditional method of farming is undertaken manually, by engaging individual farmers in almost all stages of crop development and monitoring and control of the processes involved at all stages of irrigation farming. From time to time, these processes are replaced with semi-automated and automated processes, to provide assistance to farmers and improve agricultural productivity. The four traditional irrigation practices are ditch irrigation, drip irrigation, terraced irrigation, and the use of a sprinkler system. Owing to the increased demand for agricultural raw materials for industrial use and human consumption, irrigation tends to attract a significant amount of attention, particularly in the developed and underdeveloped world. In the traditional system, the farmers apply water to plants mechanically at different stages of plant development, to assist in the growth and development lifecycle.

However, an inadequate supply of water to plants affects plant growth, and the scarcity of water has become a global issue, particularly in the irrigation system, which is specifically caused by global warming. Various human activities, including the burning of fuel, industrial activities, and deforestation have been the major causes of the depletion of the ozone layer and inadequate rainfall, particularly affecting plant growth and development. The traditional approach to irrigation involves the use of watering cans and water channels, which must be manually monitored and controlled. This causes a significant amount of water to be wasted and misused.

The high demand and consumption of water, owing to rapid human population growth and agricultural practices are the dominant factors of water consumption. Accordingly, urgent attention is required to create techniques and strategies, based on science and technology, in order to maintain and sustain the use of water for agricultural development. The idea of an autonomous sensor interface for an IoT-based irrigation monitoring and control system results from plant watering management requirements. Therefore, the use of WSNs can provide the means of communication, computation, and sensing information from near and remote places.

1.2 PROBLEM STATEMENT

1. Water acts as a great essential life source. It is a well-known fact that life began with water and water cleanliness is a very important aspect of life to survive on earth.
2. But, the by-products of science laid their monstrous footsteps as pollutants.
3. Most of these pollutants are toxic and are affecting adversely the water resources (wells, lakes, rivers, and sea), living organisms in the water, and all dependent organisms.
4. Also, due to the carelessness in the use & maintenance of water bodies, millions of tons of plastics and other floating wastes are dumped into the water daily.
5. Most of the time, the water bodies are cleaned manually with human labor which requires a lot of time and cost.

1.3 OBJECTIVE

1. To develop an effective farm yield to meet the rapidly growing demand for food for the population.
2. By considering and predicting ecological circumstances, farm productivity can be increased.
3. Maintain the crop quality by collecting data from the farm field such as Soil Moisture, Ambient Temperature, and Humidity.

4. In our project proposal we present an irrigation monitoring and controlling System, that uses the wireless sensor network to monitor the environmental conditions.
5. Our primary objective is to develop a system that has both automatic and manual mode.

1.4 SCOPE OF THE PROJECT

The aim is to design a prototype that establishes wireless remote control over a network of home appliances. The application is designed to run on an android device providing features like switch-mode control, voice command control, and a provision to view the status of the devices on the application itself. Considering its wide range of applications, the following is the scope of this prototype. The system can be implemented in homes, small offices, and malls as well, being in charge of control of the electrical appliances. For remote access to appliances on the internet or intranet. The appliances in the above-mentioned environment can be controlled intra-network or can be accessed via the internet. The development of a technology-friendly environment. The system incorporates the use of technology and making SAS. By the use of day-to-day gadgets, we can utilize them from a different perspective. It also assists us in making wise decisions and makes recommendations based on the soil type. It assists us in making wise decisions, which in turn assists us in producing more yield by providing us with the appropriate amount of light, temperature, humidity, soil moisture, and acoustic sensing.

1.5 COMPONENTS

1.5.1 ESP8266 Express If Systems Wi-Fi Development Board.

The ESP8266 ESP-01 is a Wi-Fi module that allows microcontrollers access to a Wi-Fi network. This module is a self-contained SOC (System On a Chip) that doesn't necessarily need a microcontroller to manipulate inputs and outputs as you would normally do with an Arduino, for example, because the ESP-01 acts as a small computer. The chip was popularized in the English-speaking maker community in August 2014 via the **ESP-01** module, made by a third-party manufacturer Ai-Thinker. This small module

allows microcontrollers to connect to a Wi-Fi network and make simple TCP/IP connections using Hayes style commands. However, at first, there was almost no English-language documentation on the chip and the commands it accepted.



Figure 1.6 - ESP8266 Wi-Fi Development Board

APPLICATIONS

The **applications of the ESP8266 Wi-Fi module** are given below.

- Access points portals
- IoT projects
- Wireless data logging
- Used in learning the networking fundamentals.
- Sockets and smart bulbs
- Smart home automation systems

1.5.2 DHT11 (Temperature and humidity sensor).

DHT11 is a low-cost digital sensor for sensing temperature and humidity. This sensor can be easily interfaced with any micro-controller such as Arduino, Raspberry Pi etc... to measure humidity and temperature instantaneously.

DHT11 humidity and temperature sensor is available as a sensor and as a module. The difference between this sensor and module is the pull-up resistor and a power-on LED. DHT11 is a relative humidity sensor. To measure the surrounding air this sensor uses a thermistor and a capacitive humidity sensor.

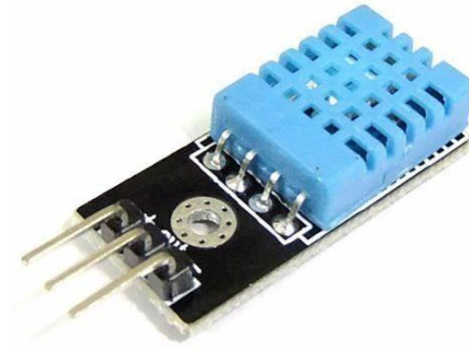


Figure 1.7 DHT11 (Temperature and humidity sensor)

APPLICATIONS

This sensor is used in various applications such as measuring humidity and temperature values in heating, ventilation and air conditioning systems. Weather stations also use these sensors to predict weather conditions. The humidity sensor is used as a preventive measure in homes where people are affected by humidity. Offices, cars, museums, greenhouses and industries use this sensor for measuring humidity values and as a safety measure.

It's compact size and sampling rate made this sensor popular among hobbyists. Some of the sensors which can be used as an alternative to DHT11 sensor are DHT22, AM2302, SHT71.

1.5.3 Hi-Link AC – DC Converter

As a result, power supplies are sometimes referred to as electric power converters. The Hi-Link Power Supply Module is a plastic enclosed PCB mounted isolated switching power supply module. It is widely used in a smart home, automation and control, communication equipment, instrumentation, and other industries.



Figure 1.8 Hi-Link AC – DC Converter

1.5.4 Soil Moisture Sensor

The soil moisture sensor is one kind of sensor used to gauge the volumetric content of water within the soil. As the straight gravimetric dimension of soil moisture needs eliminating, drying, as well as sample weighting. These sensors measure the volumetric water content not directly with the help of some other rules of soil like dielectric constant, electrical resistance, otherwise interaction with neutrons, and replacement of the moisture content.

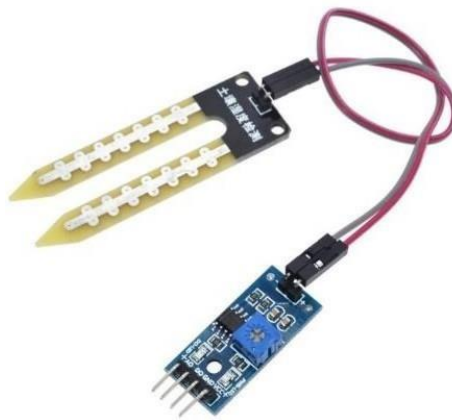


Figure 1.9 Soil Moisture Sensor

APPLICATIONS

The applications of moisture sensor include the following.

- Agriculture
- Landscape irrigation
- Research
- Simple sensors for gardeners

1.5.5 Voltage Regulator 7805

A **voltage regulator** is a system designed to automatically maintain a constant voltage. A voltage regulator may use a simple feed-forward design or may include negative feedback. It may use an electromechanical mechanism, or electronic components. Depending on the design, it may be used to regulate one or more AC or DC voltages.

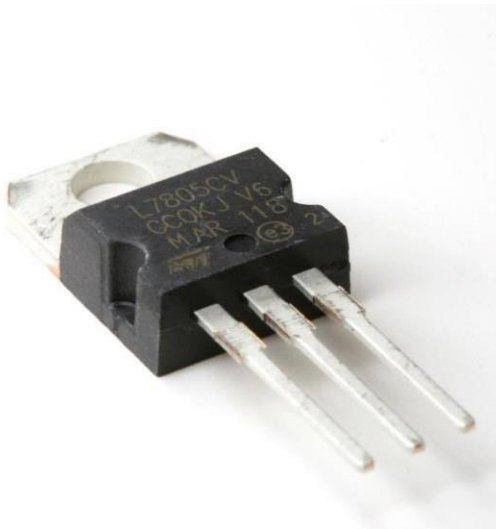


Figure 1.10 Voltage Regulator 7805

APPLICATIONS

The **applications of the 7805 voltage regulator IC** include the following.

- Regulated dual supply.
- Current regulator.
- These regulators are used to design different circuits like UPS, Phone chargers, portable CD players, etc

- This regulator is used in different circuits like Fixed & adjustable output regulators, Phone chargers, bench power supplies, current regulators,
- Inductance meters & reversal protection circuits.

1.5.6 Toggle Power SPDT Switches

SPDT Toggle Switch is a three-terminal switch, only one is used as input other two are as output. Therefore, we get two outputs, one from COM and A and second is from COM and B, but only one at a time. Mainly it is used in three-way circuit to turn ON/OFF an electrical appliance from two location.



Figure 1.11 Toggle Power SPDT Switch

1.5.7 ARDUINO UNO BOARD

The Arduino Uno R3 is a microcontroller board based on a removable, dual-inline-package (DIP) ATmega328 AVR microcontroller. It has 20 digital input/output pins (of which 6 can be used as PWM outputs and 6 can be used as analog inputs). Programs can be loaded on to it from the easy-to-use Arduino computer program. The Arduino has an extensive support community, which makes it a very easy way to get started working with embedded electronics. The R3 is the third, and latest, revision of the Arduino Uno.

APPLICATIONS

- It is an easy USB interface. This allows interface with USB as this is like a serial device.
- The chip on the board plugs straight into your USB port and supports on your computer as a virtual serial port. The benefit of this setup is that serial communication is an extremely easy protocol which is time-tested and USB makes connection with modern computers and makes it comfortable.
- It is easy-to-find the microcontroller brain which is the ATmega328 chip. It has more number of hardware features like timers, external and internal interrupts, PWM pins and multiple sleep modes.
- It is an open source design and there is an advantage of being open source is that it has a large community of people using and troubleshooting it. This makes it easy to help in debugging projects.
- It is a 16 MHz clock which is fast enough for most applications and does not speeds up the microcontroller.
- It is very convenient to manage power inside it and it had a feature of built-in voltage regulation. This can also be powered directly off a USB port without any external power. You can connect an external power source of upto 12v and this regulates it to both 5v and 3.3v.
- 13 digital pins and 6 analog pins. This sort of pins allows you to connect hardware to your Arduino Uno board externally. These pins are used as a key for extending the computing capability of the Arduino Uno into the real world. Simply plug your electronic devices and sensors into the sockets that correspond to each of these pins and you are good to go.
- This has an ICSP connector for bypassing the USB port and interfacing the Arduino directly as a serial device. This port is necessary to re-bootload your chip if it corrupts and can no longer used to your computer.
- It has a 32 KB of flash memory for storing your code.
- An on-board LED is attached to digital pin 13 to make fast the debugging of code and to make the debug process easy.

- Finally, it has a button to reset the program on the chip.

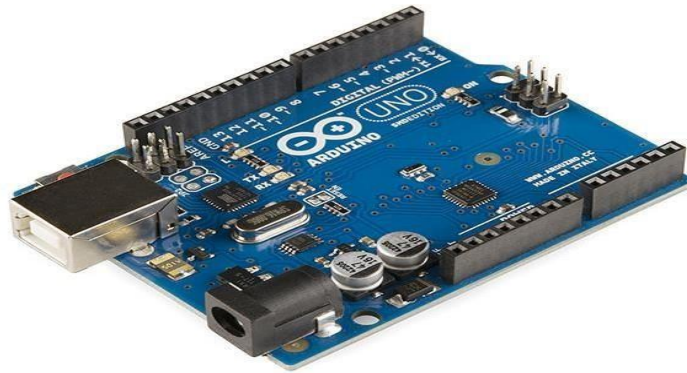


Figure 1.12 Arduino UNO

CHAPTER 2

2.1 LITERATURE SURVEY

The following shows a survey done for dual home automation for with and without internet on Realtime which includes an instant feedback mechanism that drives the appliances. This system is reliable to integrate on multiple platforms with the help of ESP32 master which serves as standard firmware. Further, the study was extended to multiple operation platforms like Linux, Windows, and IOS are discussed as follows. In this detailed survey, we have learned a lot in stabilizing our concepts from the existing feedback mechanisms that were designed in the previous study,

Mohamed A. Ragab, Abdelrhman Sedhom “IoT BASED SMART IRRIGATION SYSTEM”, International Journal of Industry and Sustainable Development (IJISD) 2021.

This paper presents a step-by-step procedure of a smart home automation controller. It uses IoT to convert home appliances to smart and intelligent devices, with the help of design control. An energy-efficient system is designed that accesses the smart home remotely using IoT connectivity. The proposed system mainly requires, Node MCU as the microcontroller unit, IFTTT to interpret voice commands, Adafruit a library that supports MQTT acts as an MQTT broker, and Arduino IDE to code the microcontroller. The smart home is implemented with the main control unit that is connected to the 24-hour available Wi-Fi network. To ensure, that the Wi-Fi connection doesnot turn off, the main controller is programmed to establish an automatic connection with the available network and connected to the auto power backup.

Pros: The target scaling factor is efficient throughout the multiple platforms switching

Cons: Slower transit cycles when compared to CoAP, low scalability, and lack of security encryption

Shweta B Saraf, Shaunak Oke, Parth “IoT Based Smart Irrigation Monitoring and Controlling System”, International Conference on recent Trends in Electronics Information and Communication Technology (IRTEICT) 2020.

This paper focuses on a system that provides features of Home Automation relying on IoT to operate easily, in addition to that it includes a camera module and provides home

security. The android application basically converts smartphones into a remote for all home appliances. Security is achieved with motion sensors if movement is sensed at the entrance of the house; a notification is sent that contains a photo of the house entrance in real-time. This notification will be received by the owner of the house via the internet such that the app can trigger a notification. So, the owner can raise an alarm in case of any intrusion or he/she can toggle the appliances like opening the door if the person is a guest. The system uses Raspberry Pi, a small-sized computer that acts as a server for the system. The smart home consists of two modules. Home automation consists; of a fanlight and door controller, and a security module that consists; of a smoke sensor motion sensor, and camera module.

Pros: Implementation of IR Interface was an excellent Idea for creating universal remote

Cons: The system Uses Infrared Radiation for data transfer which is much faster than CoAP but could be easily mapped with 38 kHz of regular frequency

Kiranmai Pernapati “IoT based low Cost Smart Irrigation System”, International Conference on Inventive Communication and Computational Technologies (ICICCT), 2021.

This paper proposes an optimization of home power consumption based on PLC (Power Line Communication) for an easy-to-access home energy consumption. This also proposes a Zigbee and PLC-based renewable energy gateway to monitor the energy generation of renewable energies. ACS and DDEM algorithms are proposed for the design of intelligent distribution of power management systems to make sure ongoing power supply of home networks. To provide efficient power management the power supply models of home sensor networks are classified into groups viz. main supply only, main supply and backup battery, rechargeable battery power, and non-rechargeable battery power. Devices with particular features are assigned to these groups. It targets establishing a real-time processing scheme to address variable sensor network topologies.

Pros: Fast and secured since the data encryption is 64bit ratio and it follows MQTT protocol

Cons: Does not support large database size, and it has no support for ROLE, COMMIT, and Stored Procedures

Amogh Jayaraj Rau “IoT Based Smart Irrigation System and Nutrient Detection with Disease Analysis”, International Journal of Innovative Research In Physics, 2021.

This paper proposes a system that develops a model to reduce the computation overhead in existing smart home solutions that use various encryption technologies like AES, ECHD, hybrid, etc. these solutions use an intermediate gateway for connecting various sensor devices. The proposed model provides a method for automation with sensor-based learning. These smart home devices with sensors can configure themselves autonomously and can operate without human intervention. This work minimizes encryption decryption and focuses on authentication and automation of smart home devices with learning. The system bypasses the local gateway mentioned in the existing system to provide better security for smart home devices and sensor data and save computation overhead. The real-time broker cloud is directly connected with the smart home and manages all incoming and outgoing requests between users and devices.

Pros: Bringing AR with Deep Neural schema is an Excellency and this system can be integrated with the 7 senses of the future world.

Cons: It has a range of support between 3.5Hz to 75Hz which in turn directly matches the neural frequency that potentially messes up sensory organs.

Dongxing “SMART IRRIGATION SYSTEM BASED ON THINGSPEAK AND ARDUINO”, International Journal Of Research and Science, 2020.

The paper presents a vision-based machine intelligence system to sense the on/off state of common home appliances. The proposed method of sensing the state of appliances results in a novel home automation system. The accessibility of the suite of devices in the home over a remote network is facilitated by the IP Addressing methods in the IoT. This project uses two boards viz. Raspberry Pi and Intel Galileo Gen 2. The communication between the User devices, Raspberry Pi, and the Intel Galileo boards happens over a wireless network. The UDP protocol is deployed to facilitate the wireless

communication of the nodes present in the home automation network. A Pi Cam and a USB Logitech camera are attached to the rotating shaft of two different servo motor capture snapshots that are passed as inputs to the Machine Learning based models trained using dlib-C++ to detect the state of the operation of the appliances. The proposed method uses visual modality to automate the appliances, as privacy concerns may emerge while using the images from some specific places, as a counter to this issue, an SPDT switch is added to the Raspberry Pi which when turned off ensures that even if the images are taken from the webcams, they are just passed as inputs to the machine learning models and are not displayed on the website when the users access the website on the server address obtained from Raspberry Pi.

Pros: High Visual and Artificial Database was integrated which can be a link between and virtual and physical world. A creative contextual database has created a huge responsive factor

Cons: Superimposing virtual environmental capacity has no range of lower frequency AR camera support

K.N. Bhanu ; H. S. Mahadevaswamy ; H. J. Jasmine, “IoT based Smart System for Enhanced Irrigation in Agriculture”, Procedia Computer Science Transactions on Mobile Device, 2022.

Internet of Things (IoT) is an interconnection of devices that can transfer information over the internet and to control operations without human interference. Agriculture provides a rich source of parameters for data analysis which helps in better yielding of crops. The usage of IoT devices in agriculture helps in the modernizing of information and communication in smart farming. The key parameters that can be considered for better growth of crops are soil types, soil moisture, mineral nutrients, temperature, light, oxygen and so on. Various sensors have been used to sense these parameters and communicate the same to the cloud. This paper considers a few of these parameters for data analysis that helps in proposing the users to take better agricultural decisions using IoT. The proposed system performed better and is implemented at Thing Speak IoT cloud platform.

Pros: Implementing a local server reduces cognitive allocation in the server.

Cons: Error Factors are high since it is purely based on local server data.

Mrs. Paul Jasmin Rani, Jason Bakthakumar, Praveen Kumar B, Praveen Kumar U. Santhosh Kumar. “Voice Controlled Home Automation System using Natural Language Processing and Internet of Things”, INCC Transactions on National Security Science and Computation, 2018

The paper focuses on the construction of a fully functional voice-based home automation system that uses the Internet of Things, Artificial Intelligence, and Natural Language Processing (NLP) to provide a cost-effective, efficient way to work together with home appliances using various technologies such as GSM, NFC, etc. it implements a seamless integration of all the appliances to a central console, i.e., the mobile device. The prototype uses Arduino MK1000, known as Genuine MK1000. The NLP in this project gives the user the freedom to interact with the home appliances with his/her own voice and normal language rather than complicated computer commands. The appliances are connected to the mobile device through an Arduino Board that establishes the concept of the Internet of Things. The Arduino Boards are interfaced with the appliances and programmed in such a way that they respond to mobile inputs.

Pros: Only a few notable parameters throughout the project

Cons: The rate of prediction is proportionally less when compared to real-world predictions

Jonathan J. Hull, Berna Erol, Jamey Graham, Qifa Ke, Hidenobu Kishi, Jorge Moraleda, Daniel G. Van Olst, Research Gate “Paper-Based Augmented Reality”, Research Gate Transaction on Camera and Paper documentation, 2007

A new method for augmenting paper documents with electronic information is described that does not modify the format of the paper document in any way. Applicable to both commercially printed documents as well as documents that are output from PCs, the technique we call Paper-Based Augmented Reality substantially improves the utility of paper. We describe the recognition technology that makes this possible as well as

several applications. An implementation on a camera phone is discussed that lets users retrieve data and access links from paper documents to electronic data. Recognition is performed at 4 frames per second on a Treo 700w and support is provided for several user applications, including “clickable paper” – printed web pages whose appearance is unchanged but that can be navigated with a camera phone.

Pros: Augmented reality with virtual automation was brought to the physical world with the paper content

Cons: Linking patches of text will increase a lot of security reasons

Mikko Kytö^{1,2}, Barrett Ens², Thammathip Piumsomboon², Gun A. Lee², and Mark Billingham², Research Gate “Pinpointing: Precise Head- and Eye-Based Target Selection for Augmented Reality”, Research Gate Transactions on Augmented Reality in Computer Science Engineering, 2018

Head and eye movement can be leveraged to improve the user’s interaction repertoire for wearable displays. Head movements are deliberate and accurate and provide the current state-of-the-art pointing technique. Eye gaze can potentially be faster and more ergonomic but suffers from low accuracy due to calibration errors and the drift of wearable eye-tracking sensors. This work investigates precise, multimodal selection techniques using head motion and eye gaze. A comparison of speed and pointing accuracy reveals the relative merits of each method, including the achievable target size for robust selection. We demonstrate and discuss example applications for augmented reality, including compact menus with deep structure, and a proof-of-concept method for online correction of calibration drift.

Pros: Accuracy has reached 97% with a simple algorithm

Cons: 97% precise and accurate but depends purely on real-time saturation and hue point of target images

**Subramani Roy Choudri, A. Divija, G. V V N Vijayalakshmi, P. Vamsi, JARTMS
“TOUCHLESS HOME AUTOMATION USING AUGMENTED REALITY”, JARTMS
Transactions on Augmented Reality and Web Interface, 2021**

As human life is heading towards a busy schedule it becomes necessary to automate our home appliances. Human error is something that cannot be completely erased. With the busy schedule in hand, there is defiantly a possibility of missing something that may be trivial to us but can result in a catastrophe. For these reasons, Our Project home automation can increase efficiency, security, and reliability. AR has recently evolved for the automation of various electrical appliances by popping virtual objects into the real world.

Pros: Target Image can be linked to the Virtual world

Cons: Target Image can be linked-to automation with an augmented environment but in the case of wet hands, this linking process will not produce tokens to respective servers.

CHAPTER - 3

SYSTEM ANALYSIS

3.1 IoT (Internet of Things)

IoT as a term has evolved a long way as a result of the convergence of multiple technologies, machine learning, embedded systems, and commodity sensors. IoT is a system of interconnected devices assigned a UID, enabling data transfer and control of devices over a network. It reduced the necessity of actual interaction in order to control a device. IoT is an advanced automation and analytics system that exploits networking, sensing, big data, and artificial intelligence technology to deliver complete systems for a product or service. These systems allow greater transparency, control, and performance when applied to any industry or system.

3.1.1 Feature of IoT

- A. Intelligence
- B. Connectivity
- C. Dynamic Nature
- D. Enormous Scale
- E. Sensing
- F. Heterogeneity
- G. Security

3.1.1.1 Intelligence

IoT comes with the combination of algorithms and computation, software & hardware that makes it smart. Ambient intelligence in IoT enhances its capabilities which facilitate the things to respond in an intelligent way to a particular situation and supports them in carrying out specific tasks. In spite of all the popularity of smart technologies, intelligence in IoT is only concerned with a means of interaction between devices, while user and device interaction are achieved by standard input methods and graphical user interface.

3.1.1.2 Connectivity

Connectivity empowers the Internet of Things by bringing together everyday objects. The connectivity of these objects is pivotal because simple object-level interactions contribute to collective intelligence in the IoT network. It enables network accessibility and compatibility in the things. With this connectivity, new market opportunities for the Internet of things can be created by the networking of smart things and applications.

3.1.1.3 Dynamic Nature

The primary activity of the Internet of Things is to collect data from its environment, this is achieved with the dynamic changes that take place around the devices. The state of these devices changes dynamically, for example sleeping and waking up, connected and/or disconnected as well as the context of devices including temperature, location, and speed. In addition to the state of the device, the number of devices also changes dynamically with a person, place, and time

3.1.1.4 Enormous Scale

The number of devices that need to be managed and that communicate with each other will be much larger than the devices connected to the current Internet. The management of data generated from these devices and their interpretation for application purposes becomes more critical. Gartner (2015) confirms the enormous scale of IoT in the estimated report where it stated that 5.5 million new things will get connected every day and 6.4 billion connected things will be in use worldwide in 2016, which is up by 30 percent from 2015. The report also forecasts that the number of connected devices will reach 20.8 billion by 2020

3.1.1.5 Sensing

It wouldn't be possible without sensors that will detect or measure any changes in the environment to generate data that can report on their status or even interact with the environment. Sensing technologies provide the means to create capabilities that reflect a true awareness of the physical world and the people in it. The sensing information is simply the analog input from the physical world, but it can provide a rich understanding of

our complex world

3.1.1.6 Heterogeneity

Heterogeneity in the Internet of Things is one of the key characteristics. Devices in IoT are based on different hardware platforms and networks and can interact with other devices or service platforms through different networks. IoT architecture should support direct network connectivity between heterogeneous networks. The key design requirements for heterogeneous things and their environments in IoT are scalabilities, modularity, extensibility, and interoperability.

3.1.1.7 Security

IoT devices are naturally vulnerable to security threats. As we gain efficiencies, novel experiences, and other benefits from the IoT, it would be a mistake to forget about the security concerns associated with it. There is a high level of transparency and privacy issues with IoT. It is important to secure the endpoints, the networks, and the data that is transferred across all of it means creating a security paradigm.

3.1.2 Advantages of IoT

- A. Communication
- B. Automation and Control
- C. Information
- D. Monitor
- E. Time
- F. Money
- G. Automation of daily tasks leads to better monitoring of devices
- H. Efficient and saves time
- I. Saves money
- J. Better Quality of Life

3.1.2.1 Communication

IoT encourages communication between devices, also famously known as

Machine-to-Machine (M2M) communication. Because of this, the physical devices are able to stay connected, and hence the total transparency is available with lesser inefficiencies and greater quality.

3.1.2.2 Automation and Control

Due to physical objects getting connected and controlled digitally and centrally with wireless infrastructure, there is a large amount of automation and control in the workings. Without human intervention, the machines are able to communicate with each other leading to faster and timely output.

3.1.2.3 Information

It is obvious that having more information helps make better decisions. Whether it is mundanedeisions such as needing to know what to buy at the grocery store or if your company has enough widgets and supplies, knowledge is power and more knowledge is better.

3.1.2.4 Monitor

The second most obvious advantage of IoT is monitoring. Knowing the exact quantity of supplies orthe air quality in your home can further provide more information that could not have previously been collected easily. For instance, knowing that you are low on milk or printer ink could save you another trip to the store in the near future. Furthermore, monitoring the expiration of products canand will improve safety.

3.1.2.5 Time

As hinted in the previous examples, the amount of time saved because of IOT could be quite large.And in today's modern life, we all could use more time.

3.1.2.6 Money

The biggest advantage of IoT is saving money. If the price of the tagging and monitoring equipmentis less than the amount of money saved, then the Internet of Things

will be very widely adopted. IoT fundamentally proves to be very helpful to people in their daily routines by making the appliances communicate with each other in an effective manner thereby saving and conserving energy and cost. Allowing the data to be communicated and shared between devices and then translating it in our required way, makes our systems efficient.

3.1.2.7 Automation of daily tasks leads to better monitoring of devices

The IoT allows you to automate and control the tasks that are done on a daily basis, avoiding human intervention. Machine-to-machine communication helps to maintain transparency in the processes. It also leads to uniformity in the tasks. It can also maintain the quality of service. We can also take necessary action in case of emergencies.

3.1.2.8 Efficient and saves time

The machine-to-machine interaction provides better efficiency, hence accurate results can be obtained fast. This results in saving valuable time. Instead of repeating the same tasks every day, it enables people to do other creative jobs.

3.1.2.9 Saves Money

Optimum utilization of energy and resources can be achieved by adopting this technology and keeping the devices under surveillance. We can be alerted in case of possible bottlenecks, breakdowns, and damage to the system. Hence, we can save money by using this technology.

3.1.2.10 Better Quality of Life

All the applications of this technology culminate in increased comfort, convenience, and better management, thereby improving the quality of life.

3.1.3 Disadvantages of IoT:

- A. Compatibility
- B. Complexity
- C. Privacy / Security

- D. Safety
- E. Lesser Employment of Menial Staff
- F. Technology Takes Control of Life

3.1.3.1 Compatibility

Currently, there is no international standard of compatibility for the tagging and monitoring equipment. I believe this disadvantage is the easiest to overcome. The manufacturing companies of this equipment just need to agree to a standard, such as Bluetooth, USB, etc. This is nothing new or innovative needed.

3.1.3.2 Complexity

As with all complex systems, there are more opportunities for failure. With the Internet of Things, failures could skyrocket. For instance, let's say that both you and your spouse each get a message saying that your milk has expired, and both of you stop at a store on your way home, and you both purchase milk. As a result, you and your spouse have purchased twice the amount that you both need. Or maybe a bug in the software ends up automatically ordering a new ink cartridge for your printer each and every hour for a few days, or at least after each power failure when you only need a single replacement.

3.1.3.3 Privacy / Security

With all of this IoT data being transmitted, the risk of losing privacy increases. For instance, how well encrypted will the data be kept and transmitted? Do you want your neighbors or employers to know what medications you are taking or your financial situation.

3.1.3.4 Safety

Imagine if a notorious hacker changes your prescription. Or if a store automatically ships you an equivalent product that you are allergic to, a flavor that you do not like, or a product that is already expired. As a result, safety is ultimately in the hands of the consumer to verify any and all automation. As all the household appliances, industrial

machinery, public sector services like water supply and transport, and many other devices are connected to the Internet, a lot of information is available on it. This information is prone to attack by hackers. It would be very disastrous if private and confidential information is accessed by unauthorized intruders.

3.1.3.5 Lesser Employment of Menial Staff

The unskilled workers and helpers may end up losing their jobs in the effect of automation of daily activities. This can lead to unemployment issues in society. This is a problem with the advent of any technology and can be overcome with education. With daily activities getting automated, naturally, there will be fewer requirements for human resources, primarily, workers and less educated staff. This may create an Unemployment issue in society.

3.1.3.6 Technology Takes Control of Life

Our lives will be increasingly controlled by technology and will be dependent on it. The younger generation is already addicted to technology for every little thing. We have to decide how much of our daily lives are we willing to mechanize and be controlled by technology.

CHAPTER 4

4.1 EXISTING SYSTEM

1. There is no proper tracking of water source utility.
2. Automatic Pump and Station AMC is not monitored.
3. Physical emergency overflow cutoff is still in practice.
4. Unwanted distribution of water flow is not monitored.
5. Terrain distribution of water sources is not precise.

4.2 PROPOSED METHODOLOGY

The Soil Moisture Sensor, Humidity, and Temperature Sensor are connected to the ESP8266 Node MCU Microcontroller. The sensors send the data from their respective positions to ESP8266 Node MCU. The received analog data can be processed by the controller and then send to end users like web servers, or mobile via MQTT server. The Soil Moisture Sensor, Humidity, and Temperature Sensor are connected as inputs to Microcontroller. The water pump is connected via Relay. The measured temperature and humidity values send to the end user. The moisture sensor senses the water quantity in the soil and the water pump will supply it whenever the quantity of water in the soil is reduced. For a better understanding of end users, notifications can be sent like “Water deficiency in the soil ON water pump”.

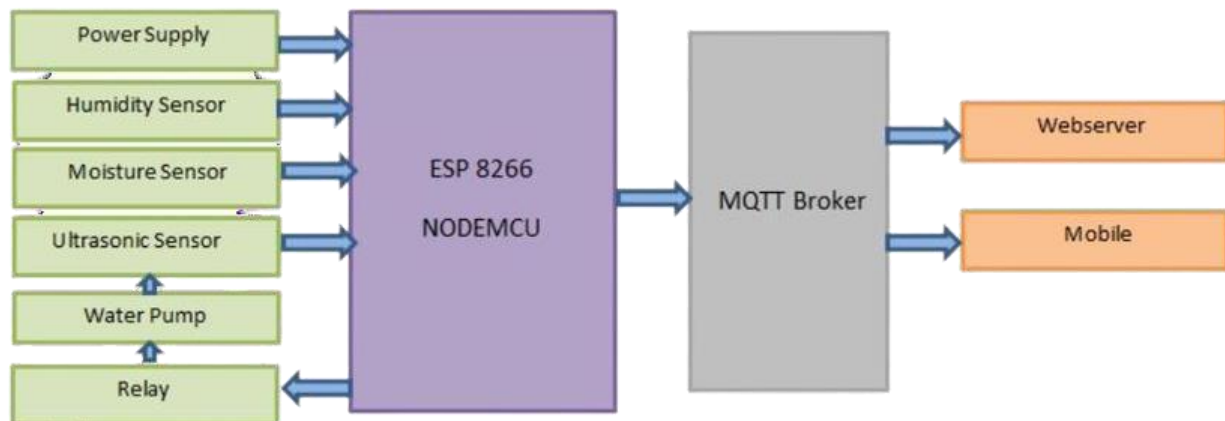


Figure 4.1 - Proposed Methodology Flow Chart

4.3 ADVANTAGES OF PROPOSED METHODOLOGY

1. Low cost, the Node MCU is less costly compared to any other IoT-based device.
2. Node MCU has Arduino Like hardware I/O. It is becoming very popular these days that Arduino IDE has extended its software to work in the field of ESP 8266 Field module version.
3. Node MCU has an easily configurable network API.
4. Integrated support for the Wi-Fi network: ESP 8266 is incorporated in Node MCU, which is an easily accessible Wi-Fi module.
5. Reduced size of the board.
6. Low power consumption.

CHAPTER 5

IMPLEMENTATION DETAILS

5.1 SOFTWARE AND HARDWARE SPECIFICATION DOCUMENT

Microcontroller - **Arduino Uno** and Arduino Ide Software the Arduino Interfaced Development Environment, or more also known as the Arduino Ide software (IDE), is indeed available. It includes a scripting language for a scripting language, a user interface, a text terminal, a toolbox with buttons for frequently performed functions, and a variety of menus. It interfaces with the Arduino hardware to upload applications and communicate with them.

The board has a total of 20 pins that can be used for input and output operations. The power pins on the Arduino Uno R3 are used for supplying power to the board. There are two power pins, namely the 5V pin and the 3.3V pin. The analog pins on the Arduino Uno R3 are used to read analog signals. The board has six analog pins, labeled A0 to A5. These pins can read voltage values between 0 and 5 volts and convert them into digital signals that can be read by the board. These pins are particularly useful for sensors that produce analog outputs, such as temperature sensors, light sensors, and potentiometers. The digital pins on the Arduino Uno R3 are used for both input and output operations. The board has a total of 14 digital pins, labeled 0 to 13. These pins can be configured as either input or output pins, depending on the requirement of the project. These pins can be used to control various electronic components, such as LEDs, motors, and relays. They can also be used to read digital signals from sensors or other input devices.

The Arduino Uno has a number of facilities for communicating with a computer, another Arduino board, 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 board channels this serial communication over USB and appears as a virtual com port to software on the computer. The 16U2 firmware uses standard USB COM drivers, and no external driver is needed. However, on Windows, a .inf file is required. Arduino Software (IDE) includes a serial monitor which allows simple textual data to be sent to and from the 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 serial communication on any of the Uno's digital pins.

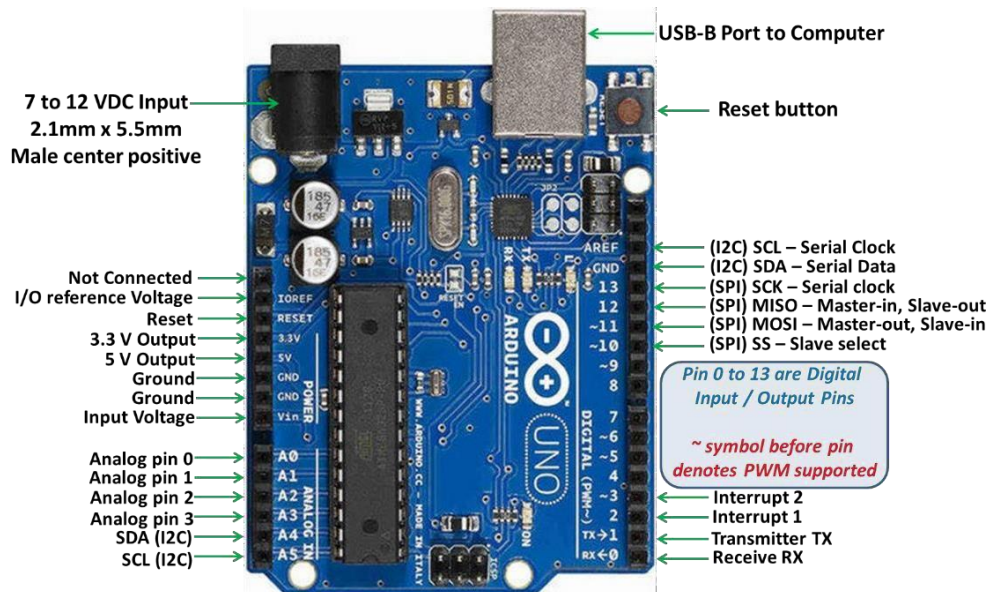


Figure 5.1 Arduino UNO

5.1.1 Arduino UNO Architecture

The Arduino Uno is built around the ATmega328P microcontroller, which is an 8-bit AVR microcontroller. It has a 16 MHz crystal oscillator that provides the clock signal for the microcontroller. The ATmega328P has 32KB of flash memory for storing the program code, 2KB of SRAM for data storage, and 1KB of EEPROM for non-volatile data storage.

The Arduino Uno has a simple and easy-to-use architecture that makes it popular among hobbyists, students, and professionals alike. It has 14 digital input/output pins, six of which can be used as PWM (pulse-width modulation) outputs, and six analog input pins. These pins can be used to interface with a wide range of sensors, actuators, and other electronic devices.

The digital input/output pins can be used to read digital signals from sensors or control digital outputs such as LEDs or motors. They can also be used to communicate with other

devices using protocols such as I2C, SPI, or UART. The PWM pins can be used to generate analog voltage signals for controlling devices such as DC motors or servos.

The analog input pins on the Arduino Uno can be used to read analog signals from sensors or other analog devices. The ATmega328P has a built-in 10-bit ADC (analog-to-digital converter) that converts analog signals into digital values that can be read by the microcontroller. The analog input pins can also be used as digital input/output pins if needed.

The Arduino Uno has a USB interface that allows it to communicate with a computer. This interface is used to upload the program code to the microcontroller and to communicate with the serial monitor, which can be used to debug the program code or to display data sent from the microcontroller.

The Arduino Uno has a power supply circuit that allows it to be powered from either the USB port or an external power supply. The board has a voltage regulator that converts the input voltage to a regulated 5V voltage that is used to power the microcontroller and other components on the board. The board also has a reset button that can be used to restart the program code running on the microcontroller.

Overall, the architecture of the Arduino Uno is simple and easy to understand, which makes it a great platform for learning about microcontrollers and electronics. Its open-source nature also makes it easy to find resources and support online. The popularity of the Arduino platform has also led to the development of a wide range of shields and modules that can be used to extend the capabilities of the Arduino Uno and other Arduino boards.

5.2 BLYNK SOFTWARE

Blynk software is designed to make it easy for developers to create mobile applications for controlling and monitoring hardware projects. The Blynk app is available for both iOS and Android devices and can be downloaded from the respective app stores. Once downloaded, users can create an account and start building their custom interfaces.

Blynk supports a variety of hardware platforms, including the popular microcontroller boards such as Arduino, Raspberry Pi, ESP8266, ESP32, Particle, and others. The platform is also compatible with many popular communication protocols such as Bluetooth, Ethernet, WiFi, and GSM.

Developers can use Blynk's extensive library of pre-built widgets to create their custom interfaces quickly. These widgets can be easily customized by changing their size, colour, and other properties to suit the specific needs of the project. Blynk also provides a library of code examples and documentation to help developers get started with the platform quickly

One of the key features of Blynk is its support for the virtual pins. These virtual pins allow developers to create custom functions that can be controlled from the mobile app. For example, a virtual pin can be used to set the temperature of a thermostat or turn on/off a device remotely. Blynk also provides support for data logging and analysis, allowing developers to analyze the data collected from their sensors over time.

Blynk's cloud-based platform allows developers to store their projects and data on the cloud, which can be accessed from anywhere with an internet connection. The cloud platform also allows developers to collaborate on projects with others, sharing their code and interfaces with other members of the Blynk community.

Blynk offers both a free and a paid subscription plan. The free plan provides access to all the core features of the platform but with some limitations. The paid subscription plan provides access to additional features such as increased data storage, custom domains, and priority support.

Overall, Blynk software provides a simple and easy-to-use platform for creating mobile applications for controlling and monitoring hardware projects. Its support for a wide range of hardware platforms and communication protocols, as well as its extensive library of pre-built widgets, makes it an excellent choice for both beginners and experienced developers alike.

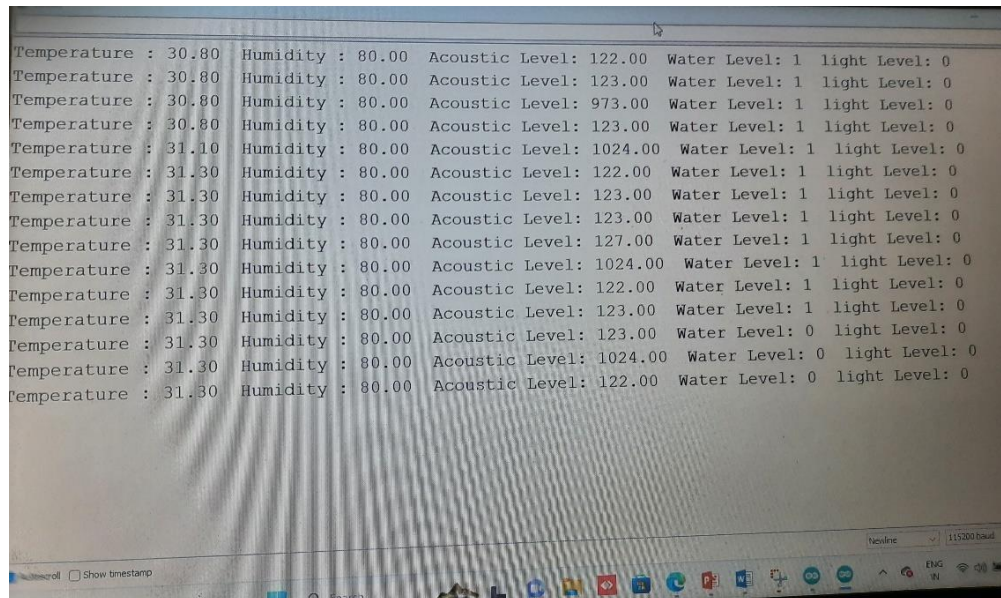
CHAPTER 6

RESULTS AND DISCUSSIONS

6.1 CODE AND SIMULATION

6.1.1 RESULTS

The above figure depicts the values or results obtained from various sensors such as DHT 11(Temperature and Humidity), Acoustic sensor (Sound in Decibels(dB)), Soil moisture sensor and Light sensor which indicates the photosynthesis level of the plant.



Temperature : 30.80	Humidity : 80.00	Acoustic Level: 122.00	Water Level: 1	light Level: 0
Temperature : 30.80	Humidity : 80.00	Acoustic Level: 123.00	Water Level: 1	light Level: 0
Temperature : 30.80	Humidity : 80.00	Acoustic Level: 973.00	Water Level: 1	light Level: 0
Temperature : 30.80	Humidity : 80.00	Acoustic Level: 123.00	Water Level: 1	light Level: 0
Temperature : 31.10	Humidity : 80.00	Acoustic Level: 1024.00	Water Level: 1	light Level: 0
Temperature : 31.30	Humidity : 80.00	Acoustic Level: 122.00	Water Level: 1	light Level: 0
Temperature : 31.30	Humidity : 80.00	Acoustic Level: 123.00	Water Level: 1	light Level: 0
Temperature : 31.30	Humidity : 80.00	Acoustic Level: 123.00	Water Level: 1	light Level: 0
Temperature : 31.30	Humidity : 80.00	Acoustic Level: 127.00	Water Level: 1	light Level: 0
Temperature : 31.30	Humidity : 80.00	Acoustic Level: 1024.00	Water Level: 1	light Level: 0
Temperature : 31.30	Humidity : 80.00	Acoustic Level: 122.00	Water Level: 1	light Level: 0
Temperature : 31.30	Humidity : 80.00	Acoustic Level: 123.00	Water Level: 1	light Level: 0
Temperature : 31.30	Humidity : 80.00	Acoustic Level: 123.00	Water Level: 0	light Level: 0
Temperature : 31.30	Humidity : 80.00	Acoustic Level: 1024.00	Water Level: 0	light Level: 0
Temperature : 31.30	Humidity : 80.00	Acoustic Level: 122.00	Water Level: 0	light Level: 0

Figure 6.1 Output for Adaptive Farming with acoustic sensor



A) Figure 6.2 BLYNK notification for bug alert

B) Figure 6.3 BLYNK notification for Soil dryness level

C) Figure 6.4 BLYNK notification for photosynthesis detection

6.1.2 RESULTS

- The below figure depicts the results obtained from executing the code mentioned above and the result obtained is by entering or giving the input as 5 it is the representing number used to represent the **Sandy soil type crops**.

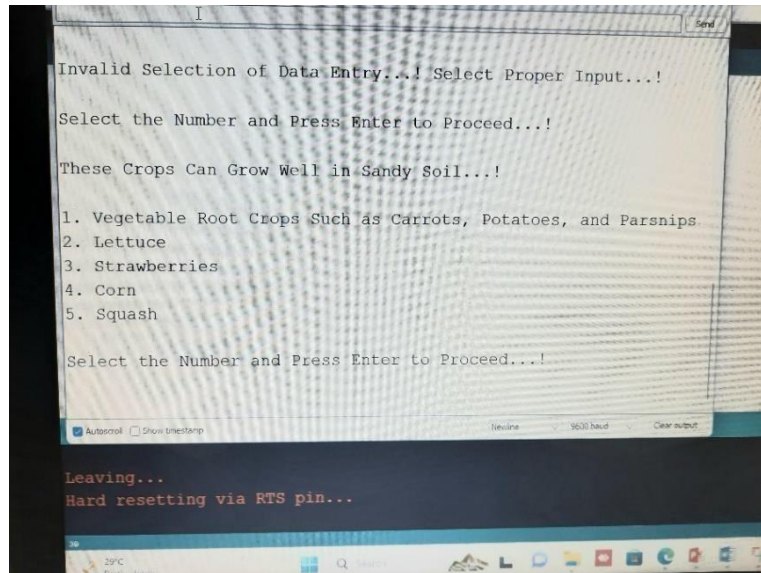


Figure 6.5 Output obtained by giving the input as 5.

- The below figure depicts the results obtained from executing the code mentioned above and the result obtained is by entering or giving the input as 6 it is the representing number used to represent the **Clay soil type crops**.

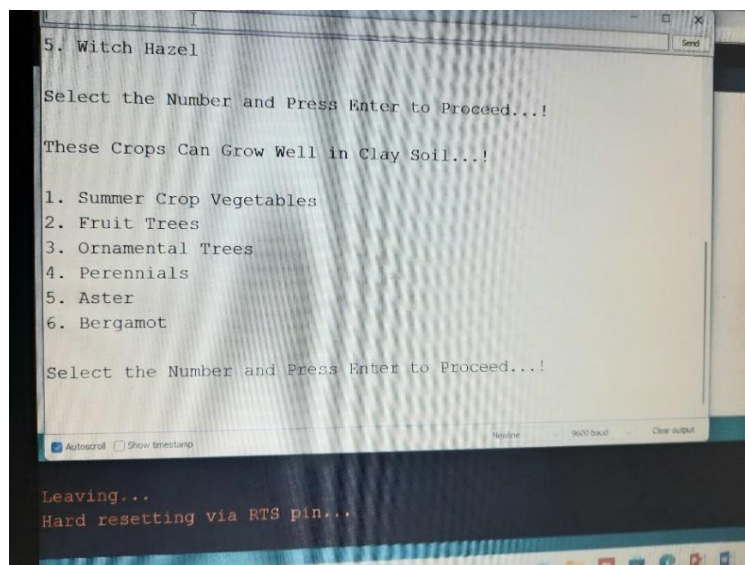
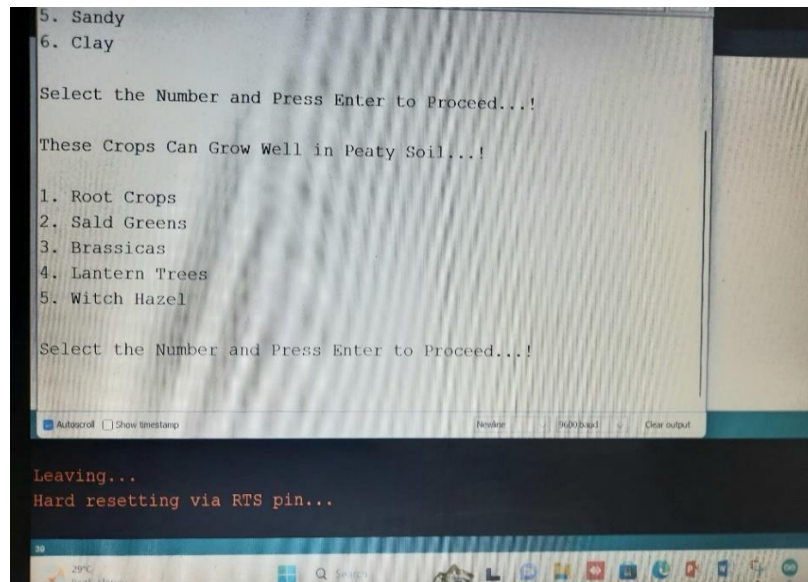


Figure 6.6 Output obtained by giving the input as 6.

- The above figure depicts the results obtained from executing the code mentioned above and the result obtained is by entering or giving the input as 3 it is the representing number used to represent the **Peaty soil type crops**.



```

5. Sandy
6. Clay

Select the Number and Press Enter to Proceed...!

These Crops Can Grow Well in Peaty Soil...!

1. Root Crops
2. Sald Greens
3. Brassicas
4. Lantern Trees
5. Witch Hazel

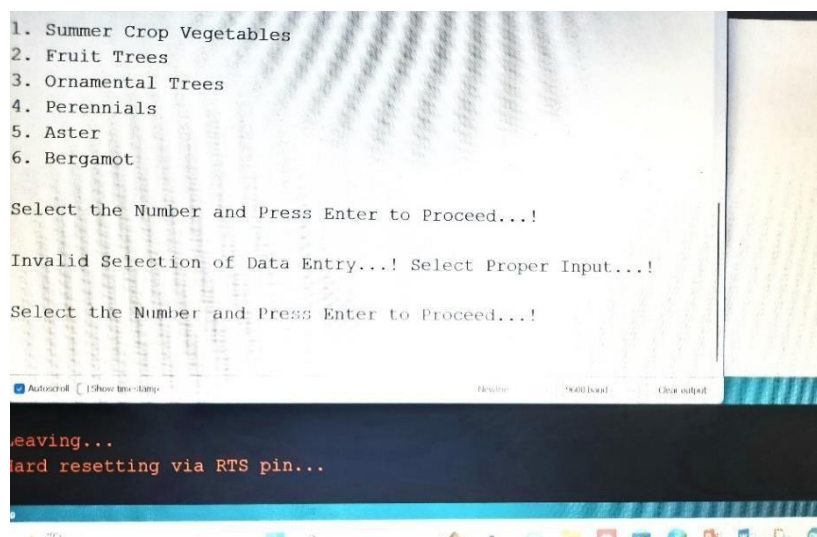
Select the Number and Press Enter to Proceed...!

Leaving...
Hard resetting via RTS pin...

```

Figure 6.7 Output obtained by giving the input as 3.

- The above figure depicts the results obtained from executing the code mentioned above but in this case, we can see there was an In-valid number entry that is due we have only considered limited number of soils (i.e., 1 to 6) any number outside of this frame is considered as an In-valid number.



```

1. Summer Crop Vegetables
2. Fruit Trees
3. Ornamental Trees
4. Perennials
5. Aster
6. Bergamot

Select the Number and Press Enter to Proceed...!

Invalid Selection of Data Entry...! Select Proper Input...!

Select the Number and Press Enter to Proceed...!

Leaving...
Hard resetting via RTS pin...

```

Figure 6.8 Output obtained by selecting invalid number.

CHAPTER 7

7.1 CONCLUSION

In normal irrigation systems, the farmers control the irrigating land manually. These techniques take a longer duration and waste the available water at higher rates so it leads to the usage of more water than that is required. For a plant to survive healthily it needs water continuously, the automatic system helps to get absolute results for this. Implementing this kind of irrigation system in agriculture gives more comfort to farmers in terms of time-saving and accurate usage of water without wasting it. Moreover, the required power for operating the ESP8266 Node MCU Microcontroller chip and wireless sensors is very less, as well as all these features, are available at a very low cost.

7.2 FUTURE WORK

Smart irrigation is the use of advanced technologies to optimize the irrigation process, including the monitoring of environmental factors such as soil moisture, weather conditions, and plant water needs. Smart irrigation systems can improve water use efficiency, reduce water waste, and lower irrigation costs.

In the future, smart irrigation will continue to play a vital role in sustainable agriculture and water management. Here are some potential developments that may shape the future of smart irrigation:

1. **Integration of IoT:** The Internet of Things (IoT) can be used to collect and analyze data from various sources in real-time. By integrating IoT devices into irrigation systems, farmers can collect information on soil moisture, temperature, humidity, and other environmental factors, and adjust their irrigation schedules accordingly. IoT sensors can also be used to detect leaks and other issues in irrigation systems, reducing water waste.
2. **Artificial Intelligence:** AI can be used to analyze large amounts of data collected from sensors, satellites, and other sources to identify patterns and trends in crop growth, soil moisture, and weather conditions. This data can be used to create predictive models that help farmers make better decisions about irrigation, crop management, and resource allocation.

3. Precision Agriculture: Precision agriculture is a data-driven approach to farming that uses advanced technologies to optimize crop production. Smart irrigation is an essential component of precision agriculture, as it enables farmers to precisely control the amount of water applied to crops based on their needs. Precision agriculture techniques can help farmers reduce water usage, increase crop yields, and improve overall sustainability.

4. Autonomous Irrigation Systems: Autonomous irrigation systems can use AI and machine learning algorithms to make decisions about when and how much to irrigate crops. These systems can be connected to weather sensors and other data sources, allowing them to make adjustments based on real-time conditions. Autonomous irrigation systems can save farmers time and money, as they eliminate the need for manual irrigation scheduling.

5. Water Management: As water resources become increasingly scarce, smart irrigation will play an important role in water management. Smart irrigation systems can be used to optimize water usage, reduce waste, and improve water quality. In the future, we may see more widespread adoption of smart irrigation technologies, as governments and water management agencies seek to conserve water resources and promote sustainable agriculture.

In conclusion, smart irrigation is a rapidly evolving field that will continue to shape the future of agriculture and water management. As technology advances and new applications are developed, we can expect to see more efficient, sustainable, and precise irrigation systems that help farmers produce more with less water. Smart irrigation has the potential to revolutionize the way we grow crops and manage water resources, and it will be exciting to see what the future holds.

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SOURCE CODE

ADAPTIVE FARMING WITH ACOUSTIC SENSOR CODE

```
//#define BLYNK_TEMPLATE_ID "TMPLlloaQEdS"
//#define BLYNK_TEMPLATE_NAME "Adaptive Farming"
//#define BLYNK_AUTH_TOKEN "J9Ax47UtlxWQtC2fCrRC0okTKtbmyNsP"
//#define BLYNK_TEMPLATE_ID "TMPLqVmsJT76"
//#define BLYNK_TEMPLATE_NAME "Adaptive Farming"
//#define BLYNK_AUTH_TOKEN "PKfLBqdlNqwyTJ4dAJY9zRXACEXRiRCW"
//#define BLYNK_TEMPLATE_ID "TMPL2usAtCB0"
//#define BLYNK_TEMPLATE_NAME "Adaptive Farming"
//#define BLYNK_AUTH_TOKEN "qyo4HB-D2jEKVgCGp9FKv-pWmBnrA8mZ"
#define BLYNK_TEMPLATE_ID "TMPL319Z77yLk"
#define BLYNK_TEMPLATE_NAME "Adaptive Farming"
#define BLYNK_AUTH_TOKEN "ncYpE0RzG9u7nCpOCgTjTShUQuMJgaRB"
#define BLYNK_PRINT Serial
#include <ESP8266WiFi.h>
#include <BlynkSimpleEsp8266.h>
#include <DHT.h>
char auth[] = BLYNK_AUTH_TOKEN;
char ssid[] = "MSJ Broadband";
char pass[] = "MSI19911993";

#define DHTPIN D4
#define Soil D0
#define LDR D5
#define Sprayer D7
#define Relay D8
#define DHTTYPE DHT11
DHT dht(DHTPIN, DHTTYPE);
BlynkTimer timer;
void sendSensor()
{
```

```

float s = analogRead(A0);
int water_level = digitalRead(Soil);
int light_level = digitalRead(LDR);

float h = dht.readHumidity();
float t = dht.readTemperature();
if (isnan(h) || isnan(t))
{
    Serial.println("Failed to read from DHT sensor!");
    return;
}
Blynk.virtualWrite(V5, t);
Blynk.virtualWrite(V6, h);
Blynk.virtualWrite(V7, s);
Blynk.virtualWrite(V8, water_level);
Blynk.virtualWrite(V9, light_level);
Serial.print("Temperature : ");
Serial.print(t);
Serial.print(" Humidity : ");
Serial.print(h);
Serial.print(" Acoustic Level: ");
Serial.print(s);
Serial.print(" Water Level: ");
Serial.print(water_level);
Serial.print(" light Level: ");
Serial.println(light_level);
if(s > 750)
{
    Blynk.logEvent("bug_alert","Alert...! The activity of bug found, Activating Pest Sprayer");
    digitalWrite(Sprayer, HIGH);
}

```

```

else if(light_level == HIGH)
{
    digitalWrite(Relay, HIGH);
}

else
{
    digitalWrite(Sprayer, LOW);
    digitalWrite(Relay, LOW);
}
}

void setup()
{
    pinMode(Soil, INPUT);
    pinMode(LDR, INPUT);
    pinMode(Sprayer, OUTPUT);
    pinMode(Relay, OUTPUT);
    digitalWrite(Sprayer, LOW);
    digitalWrite(Relay, LOW);
    Serial.begin(115200);
    Blynk.begin(auth, ssid, pass);
    dht.begin();
    timer.setInterval(2500L, sendSensor);
}

void loop()
{
    Blynk.run();
    timer.run();
}

```

PLANT GROWTH AND SOIL TYPES CODE

```
long i;
void setup()
{
  Serial.begin(9600);
  Serial.println("There are six main types of soil:");
  Serial.println();
  Serial.println("1. Loamy");
  Serial.println("2. Chalky");
  Serial.println("3. Peaty");
  Serial.println("4. Silty");
  Serial.println("5. Sandy");
  Serial.println("6. Clay");
  Serial.println();
  Serial.println("Select the Number and Press Enter to Proceed...!");
  Serial.println();
}

void loop()
{
  while(Serial.available() == 0)
  {
  }

  i = Serial.parseInt();
  if(i == 1)
  {
    Serial.println("These Crops Can Grow Well in Loamy Soil...!");
    Serial.println();
    Serial.println("1. Climbers");
    Serial.println("2. Vegetables");
    Serial.println("3. Berries");
```

```

Serial.println("4. Root Crops");
Serial.println();
Serial.println("Select the Number and Press Enter to Proceed...!");
Serial.println();
}
else if(i == 2)
{
Serial.println("These Crops Can Grow Well in Chalky Soil...!");
Serial.println();
Serial.println("1. Spinach");
Serial.println("2. Beets");
Serial.println("3. Sweet Corn");
Serial.println("4. Cabbage");
Serial.println("5. Lilacs");
Serial.println();
Serial.println("Select the Number and Press Enter to Proceed...!");
Serial.println();
}

else if(i == 3)
{
Serial.println("These Crops Can Grow Well in Peaty Soil...!");
Serial.println();
Serial.println("1. Root Crops");
Serial.println("2. Sald Greens");
Serial.println("3. Brassicas");
Serial.println("4. Lantern Trees");
Serial.println("5. Witch Hazel");
Serial.println();
Serial.println("Select the Number and Press Enter to Proceed...!");
Serial.println();
}

```

```

else if(i == 4)
{
    Serial.println("These Crops Can Grow Well in Silty Soil...!");
    Serial.println();
    Serial.println("1. Most Veggie Crops");
    Serial.println("2. Climbers");
    Serial.println("3. Perenial Plants");
    Serial.println("4. Willow Trees");
    Serial.println("5. Dogwood Trees");
    Serial.println();
    Serial.println("Select the Number and Press Enter to Proceed...!");
    Serial.println();
}
else if(i == 5)
{
    Serial.println("These Crops Can Grow Well in Sandy Soil...!");
    Serial.println();
    Serial.println("1. Vegetable Root Crops Such as Carrots, Potatoes, and Parsnips");
    Serial.println("2. Lettuce");
    Serial.println("3. Strawberries");
    Serial.println("4. Corn");
    Serial.println("5. Squash");
    Serial.println();
    Serial.println("Select the Number and Press Enter to Proceed...!");
    Serial.println();
}

else if(i == 6)
{
    Serial.println("These Crops Can Grow Well in Clay Soil...!");
    Serial.println();
    Serial.println("1. Summer Crop Vegetables");

```

```
Serial.println("2. Fruit Trees");
Serial.println("3. Ornamental Trees");
Serial.println("4. Perennials");
Serial.println("5. Aster");
Serial.println("6. Bergamot");
Serial.println();
Serial.println("Select the Number and Press Enter to Proceed...!");
Serial.println();
}
else if(i > 6)
{
    Serial.println("Invalid Selection of Data Entry...! Select Proper Input...!");
    Serial.println();
    Serial.println("Select the Number and Press Enter to Proceed...!");
    Serial.println();
}
}
```