INTELLIGENT FARMING MANAGEMENT USING IOT

A MINI PROJECT REPORT

Submitted by

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in partial fulfilment for the award of the degree

of

BACHELOR OF ENGINEERING

IN

ELECTRICAL AND ELECTRONICS ENGINEERING

K. RAMAKRISHNAN COLLEGE OF ENGINEERING
(AUTONOMOUS)
SAMAYAPURAM, TRICHY

ANNA UNIVERSITY

CHENNAI 600 025

MAY 2024

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Under the Guidance of

Mr. T. Vadivelan

Department of Electrical and Electronics Engineering

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BONAFIDE CERTIFICATE

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DECLARATION BY THE CANDIDATE

I declare that to the best of my knowledge the work reported here in has been composed solely by myself and that it has not been in whole or in part in any previous application for a degree.

Submitted for the Mini Project Viva Voce held at K. Ramakrishnan College of Engineering on _________

SIGNATURE OF THE CANDIDATE

INSTITUTE VISION AND MISSION

VISION

To achieve a prominent position among the top technical institutions

MISSION

- To bestow standard technical education par excellence through state of the artinfrastructure, competent faculty and high ethical standards.
- To nurture research and entrepreneurial skills among students in cutting edgetechnologies.
- To provide education for developing high-quality professionals to transform thesociety.

DEPARTMENT VISION AND MISSION

VISION

To emerge as a renowned department for high quality teaching, learning and research in the domain of Electrical and Electronics Engineering, producing professional engineers, to meet the challenges of society

MISSION

M1. To establish the infrastructure resources for imparting quality technical education inElectrical and Electronics Engineering.

M2. To achieve excellence in teaching, learning, research and development.

M3. To impart the latest skills and developments through practical approach along withmoral and ethical values.

PROGRAM SPECIFIC OUTCOME (PSO)

PSO1: Use logical and technical skills to model, simulate and analyze electrical components and systems

PSO2: Integrate the knowledge of fundamental electrical and electronics, power electronics and control systems for the reliability, sustainability and controllability of the electrical systems.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1: Have strong foundation in Electrical and Electronics Engineering to excel inprofessional career, in higher studies or research.

PEO2: Analyze, design and develop various interdisciplinary projects and products, tosolve social issues.

PEO3: Have professional ethics and effective communication skills with life-long learning attitudes.

PROGRAM OUTCOME (PO)

PO1 Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO6 The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7 Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8 Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9 Individual and team work: Function effectively as an individual, and as a memberor leader in diverse teams, and in multidisciplinary settings

PO10 Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11 Project management and finance: Demonstrate knowledge and understanding ofthe engineering and management principles and apply these to one's own work, as amember and leader in a team, to manage projects and in multidisciplinary environments.

PO12 Life-long learning: Recognize the need for, and have the preparation and abilityto engage in independent and life-long learning in the broadest context of technologicalchange

COURSE OUTCOMES:

SNO	BLOOMS LEVEL	DESCRIPTION	PO(1..12) & PSO(1..2) MAPPING
C318.1	K3	To expose the students to apply knowledge to solve problems.	PO1, PSO1, PSO2
C318.2	K3	To expose the students to find solutions to complex problems, issues for public and environmental concerns.	PO3, PO7, PSO1, PSO2
C318.3	K3	To expose the students to give conclusions, analyze methods for various scenarios.	PO4, PSO1, PSO2
C318.4	K2	To expose the students to communicate efficiently their technical knowledge and concepts.	PO9, PO10, PSO2
C318.5	K2	To expose the students to self learning and long term learning processes.	PO12, PSO1

COURSE OUTCOMES VS POS MAPPING (DETAILED; HIGH:3; MEDIUM:2; LOW:1**):**

SNO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
C318.1	3	-	-		-	-	-	-	-	-	-	-	2	3
C318.2	-	-	3	-	-	-	3	-	-	-	-	-	2	3
C318.3	-	-		3	-	-	-	-	-	-	-	-	2	3
C318.4	-	-	-	-	-	-	-	-	3	3	-	-	-	2
C318.5	-	-	-	-	-	-	-	-	-	-	-	3	2	-

* For Entire Course, PO /PSO Mapping; 1 (Low); 2(Medium); 3(High) Contribution to PO/PSO

ABSTRACT

Agriculture is the most important and worshipped occupation in India. Agriculture is livelihood for the most of the Indian who has rural background. Smart Irrigation helps to the development of agricultural country. In India, agriculture contributes about 16% of total GDP and 10% of total exports. Water plays an important role in Agriculture. Water is main resource for Agriculture. Irrigation is one method to supply water. In this irrigation process people are wasting water more by missing the timings. So too save water and time we have a excellent method called Smart irrigation system using IoT. By the smart irrigation system we are using various equipments like temperature sensor, humidity sensor, and soil moisture sensor. IoT defines the system of physical thing rooted with software, sensors as well as additional technologies. These sensors will find the various situations of the soil and based on soil moisture percent, land gets automatically irrigated. It means when field needs water then automatically motor will get ON and it will get OFF.

ACKNOWLEDGEMENT

We thank the Almighty God, for showing abundance of grace, without his blessings it would not have been possible for us to complete our project.

At this pleasing moment of having successfully completed our project, we wish to convey our sincere thanks and gratitude to our beloved kind Chairman, **Dr. K. Ramakrishnan,** who provided all the facilities to us.

Our sincere gratitude to **Dr. S. Kuppusamy,** Executive Director for his constant encouragement. We are also grateful to our Principal **Dr. D. Srinivasan** for constructive suggestions and encouragement during our project.

We wish to express the profound thanks to **Mr. G. Gabriel Santhosh Kumar,** Assistant Professor and Head, Department of Electrical & Electronics Engineering, for providing all necessary facilities for doing this project.

We whole heartedly acknowledge our deep sense of gratitude and indebtedness to beloved guide **Mr. T. VADIVELAN**, Assistant Professor, Department of Electrical & Electronics Engineering, for his expert guidance and encouragement throughout the duration of the project.

We extend our gratitude to all the teaching & non-teaching staff members of Electrical & Electronics Engineering Department, **K. Ramakrishnan College of Engineering**, for their kind help and valuable support to complete the project successfully. We would like to thank our parents and friends for their constant support and encouragement throughout this project.

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LIST OF ABBREVIATIONS

ACRONYMS	EXPANSION
AC	ALTERNATING CURRENT
DC	DIRECT CURRENT
PWM	PULSE WIDTH MODULATION
FM	FREQUENCY MODULATION
UPS	UNINTERRUPTIBLE POWER SUPPLY
NiCd	NICKEL-CADMIUM
NiMH)	NICKEL-METAL HYDRIDE
SLA	SEALED LEAD-ACID
LCD	LIQUID CRYSTAL DISPLAY
AGM	ABSORBED GLASS MAT
GSM	GLOBAL SYSTEM FOR MOBILE COMMUNICATION
IOT	INTERNET OF THINGS
NODE MCU	NODE MICRO CONTROLLER UNIT

CHAPTER 1

INTRODUCTION

1.1 OVERVIEW

Agriculture is the unquestionably the largest livelihood provider in India. With rising population, there is a need for increased agricultural production. In order to support greater production in farms, the requirement of the amount of fresh water used in irrigation also rises. Currently, agriculture accounts 83% of the total water consumption in India. Unplanned use of water inadvertently results in wastage of water. This suggests that there isan urgent need to develop systems that prevent water wastage without imposing pressure on the farmers.

Over the past 15 years, farmers started using computers and software systems to organize their financial data and keep track of their transactions with third parties and also monitor their crops more effectively .In the Internet era, where information plays a key role in people's lives,agriculture is rapidly becoming a very data intensive industry where farmers need to collect and evaluate a huge amount of information from a diverse number of devices (ex, sensors, faming machinery etc.)in order to become more efficient in production and communicating appropriate information With the advent of open source Arduino boards along with cheap moisture sensors, it is viable to create devices that can monitor the soil moisture content and accordingly to the irrigation field landscape when needed.

FIG 1.1: AGRICULTURAL FIELD

1.1.1 INTRODUCTION TO IOT (INTERNETOFTHINGS)

The Internet of things (IoT) is a system of interrelated computing devices, mechanical and digital machines that are provided with unique identifiers (UIDs)and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.

The definition of the Internet of things has evolved due to the convergence of multiple technologies, real-time analytics, machine learning, commodity sensors, and embedded systems. Traditional fields of embedded systems, wireless sensor net- works.

Control systems automation(including home and building automation),and others all contribute to enabling the Internet of things.In the consumer market, IOT technology is most synonymous with products pertaining to the concept of the “smart home”, covering devices and appliances (such a slighting fixtures ,thermostats, home security systems and cameras, and other home appliances) that support one or more common ecosystems ,and can be controlled via devices associated with that ecosystem ,such as smart phones and smart speakers.

There are a number of serious concerns about dangers in the growth of IoT, especially in the areas of privacy and security, and consequently industry and governmental moves to begin to addressthese.

- Basically, IoT is a network in which all physical objects are connected to the internet through network devices or routers and exchange data.

- IoT allows objects to be controlled remotely across existing network infrastructure.

- It refers to the billions of physical devices around the world that are now connected to the internet, all connecting and sharing data the term IoT is mainly used for devices that would an usually begenerally expected to have an internet connection.

- The idea of adding sensors and intelligence to basic objects was discussed in the 1980s and 1990s.

- Processors were cheap and power-frugal enough to be all but disposalwhere needed became before cost effective.

- IoT applications can be used in many ways to help businesses simplify, improve, automate, and control processes while providing relevant information, activity performance, and even environmental conditions that need to be monitored and controlled remotely.

FIG 1.2: IOT

- IoT applications can transform reactive medical-based systems into active wellness-based systems. Resources that are used in current medical research lack important real-world information. It uses controlled environments, leftover data, and volunteers for clinical trials.

The concept of a network of smart devices was discussed as early as 1982, with a modified Coke machine at Carnegie Mellon University becoming the first internet-connected appliance, able to report its inventory and whether newly loaded drinks were cold. Kevin Ashton (born on 1968) is a British technology pioneer who is known for inventing the term" The Internet of Things" to describe a system where the Internet is connected to the physical world via ubiquitous sensors.

- IoT is able to interact without human intervention. Some preliminary IoT applications have been already developed in healthcare, transportation, and automotive industries. IoT technologies are at their infant stages; however, many new developments have occurred in the integration of objects with sensors in the Internet.

- The development of IoT involves many issues such as infrastructure, communications, interfaces, protocols, and standards. The objective of this paper is to give general concept of IoT, the architecture and layers in IoT, some basic terms associated with it and the services provided.

1.1.2 Concept of IoT

Kevin Ashton firstly proposed the concept of IoT in 1999, and he referred the IoT as uniquely identifiable connected objects with radio frequency identification (RFID) technology. However, the exact definition of IoT is still in the forming process that is subject to the perspectives taken. IoT was generally defined as dynamic global network infrastructure with self-configuring capabilities based on standards and communication protocols".

- Physical and virtual things in an IoT have their own identities and attributes and are capable of using intelligent interfaces and being integrated as an in- formation network. In easy terms IoT can be treated as a set of connected devices that are uniquely identifiable.

- The word Internet and Things mean an inter-connected world-wide network based on sensors, communication, networking, and information processing technologies, which might be the new version of information.

- The IoT describes the next generation of Internet, where the physical things could be accessed and identified through the Internet. Depending on various technologies for the implementation, the definition of the IoT varies.

- However, the fundamental of IoT implies that objects in an IoT can be identified uniquely in the virtual representations. Within an IoT, all things are able to exchange data andif needed, process data according to predefined schemes.

- To date, a number of technologies are involved in IoT, such as wireless sensor networks (WSNs), barcodes, intelligent sensing, RFID,NFCs, low energy wireless communications, cloud computing and so on.

- The IoT describes the next generation of Internet, where the physical things could be accessed and identified through the Internet. Depending on various technologies for the implementation, the definition of the IoT varies. How- ever, the fundamental of IoT implies that objects in an IoT can be identified uniquely in the virtual representations. Within an IoT, all things are able to exchange data and if needed, process data according to predefined schemes.

1.1.3 ARCHITECTURE OF IoT

A critical requirement of an IoT is that the things in the network must be connected to each other. IoT system architecture must guarantee the operations of IoT, which connects the physical and the virtual worlds. Design of IoT architecture involves many factors such as networking, communication, processes etc. In designing the architecture of IoT, the extensibility, scalability, and operability among devices should be taken into consideration. Due to the fact that things may move and need to interact with others in real-time mode, IoT architecture should be adaptive to make devices interact with other dynamically and support communication amongst them. In addition, IoT should possess the decentralized and heterogeneous nature.Service oriented architecture A critical requirement of an IoT is that the things in the net- work must be inter-connected. IoT system architecture must guarantee theoperations of IoT, which bridges the gap between the physical and the virtual worlds.

Design of IoT architecture involves many factors such as networking, communication, business models and processes, and security. In designing the architecture of IoT, the extensibility, scalability, and interoperability among heterogeneous devices and their models should be taken into consideration.

Due tothe fact that things may move physically and need to interact with each other in real-time mode, IoT architecture should be adaptive to make devices interact withother things dynamically and support unambiguous communication of events.

1.1.3.1 IoT Applications IN Agriculture

There are numerous IoT applications in farming such as collecting data on temperature, rainfall, humidity, wind speed, pest infestation, and soil content. This data can be used to automate farming techniques, take informed decisions to improvequality and quantity, minimize risk and waste, and reduce effort required to manage crops.

For example, farmers can now monitor soil temperature and moisture from afar, and even apply IoT-acquired data to precision fertilization programs.

The proposed system make sure of microcontroller ATMEGA328 Point Arduino Uno platform and IoT which enable farmer store mostly monitor.

The status of moisture content installed on the farm by knowing the sensor values thereby, making the farmers' work much easier as they can concentrate on other farmactivities.

CHAPTER 2

LITERATURE REVIEW

• INTELLIGENT FARMING USING IOT

Srishti Rawal (2017)-In this paper we have studied about the system to monitor moisture levels in the soil was designed and the project provided an opportunity to study the existing systems, along with their features and drawbacks. The proposed system can be used to switch on/off the water sprinkler according tosoil moisture levels thereby automating the process of irrigation. Information from thesensors is regularly updated on a webpage using GSM-GPRS SIM900A modem through which a farmer can check whether the water sprinklers are ON/OFF at any given time. Also, the sensor readings are transmitted to a Thing speak channel to generate graphs for analysis.

• ARDUINO BASED SMART IRRIGATION SYSTEM USING IoT

In this paper we have studied about the main objective of this smart irrigation system is to make it more innovative, user friendly, time savingand more efficient than the existing system. Measuring four parameters such as soil moisture, temperature, humidity and pH values and the system also includes intruder detecting system. Due to server updates farmer can know about crop field nature at anytime, anywhere.

- **INTELLIGENT FARMING USING IoT by -**R Suresh (2014).

In this paper we have studied and mentioned about using automatic microcontroller based rain gun irrigation system in which the irrigation will takeplace only when there will be intense requirement of water that save a large quantity of water. These systems bring a change to management Of field resource where they developed a software stack called Android is used for devices that include an operating system, middleware and key applications. The Android SDK provides the tools and APIs necessary to begin developing applications on the Android platform using the Java programming language. Mobile phones have almost become an integral part of us serving multiple needs of humans. This application makes use of the GPRS feature of mobile phone as a solution for irrigation control system. These system covered lower range of agriculture land and not economically affordable.

- **INTELLIGENT FARMING USING IoT – BY**

(Bobby Singla, Satish Mishra, Abhishek Singh, Shashank Yadav (2019)

In this paper we have studied about te most highlighted feature of this paper is how smartly and automatically control the water supply to the agriculture fields according to the need. For this, sensors used are soilmoisture sensor and DHT-11 temperature sensor. All the information is sent on the farmer mobile application using Wi-Fi Relay Module and Arduino UNOR3.

Study Objectives

- To save water and reduce human intervention in the agriculture field.

- Continuously Monitoring the status of sensors and provide signal for takingnecessary action.

- To get the output of soil moisture sensor and provide required water to crop.

- To observe other parameters for better yield.

- The goal behind the Internet of things is to have devices that self report in real-time, improving efficiency and bringing important information to the surface more quickly than a system depending on human intervention.

- Convenience: Smart tech aims to simplify and automate tasks. This includes features like remote controls, voice commands, and automated processes that save time and effort. Efficiency: Smart tech strives to optimize resource usage, reduce waste, and improve efficiency.

- A IoT's goal is to create more efficient IoT operations, improve human-machine interactions and enhance data management and analytics.

- Among the Internet of Things objectives, there is one IoT purpose that stands out, it is to create a network of connected devices.

CHAPTER 3

IRRIGATION IN INDIA

3.1 Soil moisture constants

"Constants" like field capacity, liquid limit, moisture equivalent, and wilting point are used by most students and workers in soil moisture. These constants may be equilibrium points or other values that describe soil moisture.the soil moisture constant represents definite soil moisture relationship and retention of soil moisture in the field. The three classes of water (gravitational, capillary and hygroscopic) are very broad and do not represent accurately the soil - water relationships that exists under field conditions.

1. Saturation Capacity

This can also be called as maximum moisture holding capacity or total capacity and is the amount of water required of water required to fill all the pore spaces between soil particles by replacing all air held in pore spaces. It is the upper limit of possible moisture content. When the porosity of a soil is known, the saturation capacity can be expressed as equivalent cm of water per meter of soil depth. So, if the porosity is 50% by volume, the moisture in each meter of saturated soil is equivalent to depth of 50 cm the field surface.

1. Field Capacity:

The field capacity is the moisture content of the soil after freedrainage has removed most of the gravity water. The concept of field capacity is extremely useful in arriving at the amount of water available in the soil forplant use. Most of the gravitational water drains through the soil before it canbe used consumptively by plants.

2. Permanent Wilting Point:

Permanent Wilting Point is defined as the minimum amount of water inthe soil that the plant requires not to wilt. If the soil water content decreases to this or any lower point a plant wilt sand can no longer recover its turgidity when placed in saturated atmosphere for 12 hours.

1. Temporary Wilting:

Temporary wilting may sometimes take place during hot windy-day,but the plant will recover in the cooler portion, of the day. No addition of water is required. Thus temporary wilting may take place during the hot summer day, even when soil moisture is higher than the wilting coefficient, because of increased transpiration rates.

2. Ultimate Wilting:

Ultimate wilting is slightly different from permanent wilting. When ultimate wilting occurs, the plant will not regain its turgidity even after the addition of sufficient water to the soil and the plant will die. The soil moisture tension at ultimate wilting point is as high as 60 atm. The ultimate wilting point occurs at the hygroscopic water content. Hence the ultimate wilting point is also known as hygroscopic coefficient. The ultimate wilting point or the hygroscopic coefficient is about 2/3 of the permanent wilting point.

3. Available Moisture:

The difference in water content of the soil between field capacity and permanent wilting point is known as available moisture.

4. Readily Available Moisture:

It is the portion of the available moisture that is most easily extractedby plants, and is approximately 75% of the available moisture.

5. Moisture Equivalent:

This is an artificial moisture property of the soil and is used as an index of the natural properties. It is the percentage of moisture retained in a small sample of wet soil1cm deep when subjected to a centrifugal force 1000 times as great as gravity, usually for a period of 30 minutes. Moisture equivalent is used as single factor to which equivalent roughly equals field capacity for a moisture textured soil.

The relation between these area follows: Moisture equivalent = Field capacity 1.5to 2 Permanent wilting point

9.Soil Moisture Deficiency:

Soil moisture deficiency or field moisture deficiency is the water required to bring the soil moisture content of the soil to its field capacity.

3.2 Crop Seasons in India

10. Kharif Crops:

The word Kharif is Arabic for autumn since the season coincides with the beginning of autumn or winter. Kharif crops also are known as monsoon crops. These are the crops that are cultivated in the monsoon season. The Kharif season differs in every state of the country but is generally from June to September. These crops are usually sown at the beginning of the monsoonseason around June and harvested by September or October. Rice, maize, bajra, ragi, soybean, groundnut, cotton are all Kharif types crops.

11. Rabi Crops:

The Arabic translation of the word Rabi is spring. These crops harvesting happens in the springtime hence the name came. The Rabi seasonusually starts in November and lasts up to March or April. Rabi crops are mainly cultivated using irrigation since monsoons are already over by November. In fact, unseasonal showers in November or December can ruin the crops. The seeds are sown at the beginning of autumn, which results in a spring harvest. Wheat, barley, mustard and green peas are some of the majorrabi types of crops that grow in India.

12. Zaid Crop:

There is a short season between Kharif and Rabi season in the months of March to July. The crops that grow in this season are Zaid crops. These crops are grown on irrigated lands and do not have to wait for monsoons. Some

3.3 Major Types of Crops in India

13. Rice:

Rice is tropical crop that can be grown almost throughout the year. India is the second largest producer of rice in the world. It is a kharif, rabi type of crop. Rainfall required is 150 cm. Temperature required forth is crop is 24?

Major producers are West Bengal, Uttar Pradesh, Andhra Pradesh, Punjab, Bihar,Orissa, Assam, Tamil Nadu, Haryana.

14. Wheat:

It is the 2nd most important food crop in India. Type of crop is Rabi.

Temperature required is 17-20? Rainfall required for this crop is 20 - 100 cm. Soil typeis Clay loam, Sandy loam.
Major producers are Gujarat, Maharashtra, Haryana, Madhya Pradesh, Punjab,Rajasthan, Bihar, West Bengal, Uttarakhand. The crop requires 4 - 6 irrigations depending on the soil type and rainfall. Wheat crop requires minimum of 5 irrigations at the following critical stages. Crown root initiation and flowering are the most critical stages. Water stagnation should be avoided at the time of germination

15. Cotton:

Cotton is a tropical and subtropical kharif crop. India ranks 3rd in the production of cotton world wide.It is a dry crop but roots need timely supply of water at maturity. Temperature required for this crop is 21-30
Rainfall required for this crop is 50-100cm. Soil type is Black soil (Highly waterretentive soil).

Major producer are Gujarat, Maharashtra, Andhra Pradesh, Haryana, MadhyaPradesh, Punjab, Rajasthan, Karnataka, Tamil Nadu, Orissa.

16. Jute:

Jute is a tropical plant that requires hot and humid climate. Almost 85% of the world's jute is cultivated in the Ganges Delta.

- Type of soil is Zaid.

Temperature required for this crop is 24 - 35. Rainfall required for this crop is 125 - 200 cm. Soil type is Sandy and Clay loam.

Major Producers In India , the following states

- Meghalaya
- Nagaland
- Tripura
- Bihar

17. Tea:

Tea is an evergreen plant that mainly grows in tropical and subtropical climates. India is the 2nd largest procedure and the largest consumer of tea in the world.

Tea plants require high rainfall but its roots cannot tolerate water logging. Temperature required for this crop is 20 - 30? Rainfall required for this crop is 150 -300 cm. Soil type is Loamy soil which is acidic In nature and rich in organic matter.

Major Producers are Assam, Darjeeling (West Bengal), Meghalaya, Kerala, Himachal Pradesh, Tamil Nadu, Karnataka.

18. Sugarcane:

Sugarcane is a tropical and subtropical crop that plays a vital role in the agricultural economy of India. India ranks 2nd in the production of sugarcane globally. The soil type suitable for sugarcane is deep, rich loamy soil with good drainage, although it can also be grown in alluvial and black soils.

Major sugarcane-producing states in India include Uttar Pradesh, Maharashtra, Karnataka, Tamil Nadu, Andhra Pradesh, Gujarat, Bihar, Punjab, and Haryana.

All cane sugars are refined to some extent, even the so-called "raw" and "unrefined" which are only slightly less refined and, in terms of nutritional value

CHAPTER 4

COMPONENTS FOR INTELLIGENT FARMING

The proposed system consists of different components, the brief introduction about components was given below.

- Soil moisture sensor.
- Arduino UNO.
- Jumpers.
- Pump.
- Relays.

4.1 POWER SUPPLY

The ac voltage, typically 220V rms, is connected to a transformer, which steps that acvoltage down to the level of the desired dc output. A diode rectifier then provides a full-wave rectified voltage that is initially filtered by a simple capacitor filter to produce a dc voltage. This resulting dc voltage usually has some ripple or ac voltage variation.

A regulator circuit removes the ripples and also remains the same dc value even if theinput dc voltage varies, or the load connected to the output dc voltage changes. This voltageregulation is usually obtained using one of the popular voltage regulator IC units

Working principle

Transformer

The potential transformer will step down the power supply voltage (0-230V) to (0-6V)level. Then the secondary of the potential transformer will be connected to the precision rectifier, which is constructed with the help of op–amp. The advantages of using precision rectifier are it will give peak voltage output as DC, rest of the circuits will give only RMS output.

Bridge rectifier

When four diodes are connected as shown in figure, the circuit is called as bridge rectifier. The input to the circuit is applied to the diagonally opposite corners of the network,and the output is taken from the remaining two corners. Let us assume that the transformer is working properly and there is a positive potential, at point A and a negative potential at point B. the positive potential at point A will forward biasD3 and reverse bias D4.

The negative potential at point B will forward bias D1 and reverse D2. At this time D3and D1 are forward biased and will allow current flow to pass through them; D4 and D2 arereverse biased and will block current flow.

The path for current flow is from point B through D1, up through RL, through D3, through the secondary of the transformer back to point B. this path is indicated by the solid arrows. Waveforms (1) and (2) can be observed across D1 and D3.

One-half cycle later the polarity across the secondary of the transformer reverse, forward biasing D2 and D4 and reverse biasing D1 and D3. Current flow will now be from point A through D4, up through RL, through D2, through the secondary of T1, and back to point A.

This path is indicated by the broken arrows. Waveforms (3) and (4) can be observedacross D2 and D4. The current flow through RL is always in the same direction. In flowing through RL this current develops a voltage corresponding to that shown waveform (5).

Sincecurrent flows through the load (RL) during both half cycles of the applied voltage, this bridge rectifier is a full-wave rectifier.

One advantage of a bridge rectifier over a conventional full-wave rectifier is that witha given transformer the bridge rectifier produces a voltage output that is nearly twice that ofthe conventional full-wave circuit.

This may be shown by assigning values to some of the components shown in views Aand B. assume that the same transformer is used in both circuits.

The peak voltage developed between points X and y is 1000 volts in both circuits. In the conventional full-wave circuit shown in view A, the peak voltage from the center tap to either X or Y is 500 volts.

IC voltage regulators

Voltage regulators comprise a class of widely used ICs. Regulator IC units contain thecircuitry for reference source, comparator amplifier, control device, and overload protectionall in a single IC. IC units provide regulation of either a fixed positive voltage, a fixed negative voltage, or an adjustably set voltage.

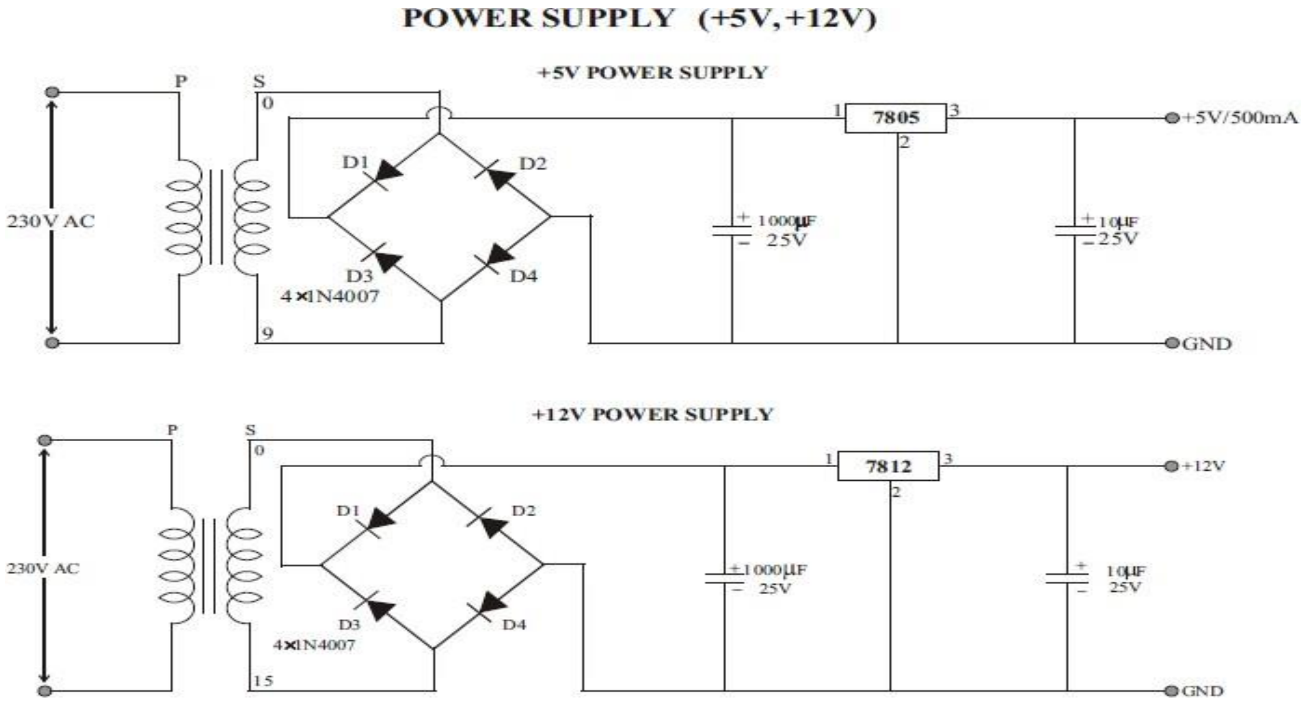


FIG:4.1 Circuit diagram (Power supply)

A fixed three-terminal voltage regulator has an unregulated dc input voltage, Vi, applied to one input terminal, a regulated dc output voltage, Vo, from a second terminal, with the third terminal connected to ground.

The series 78 regulators provide fixed positive regulated voltages from 5 to 24 volts. Similarly, the series 79 regulators provide fixed negative regulated voltages from 5 to 24 volts.

4.2 Soil moisture sensor

In this proposed system the soil moisture sensor is one part of the wireless sensorunit.

Use: To measure the moisture content of the soil.

Copper electrodes are used to sense the moisture content of soil.

Soil Moisture Sensor. The Soil Moisture Sensor is used to measure the volumetric water content of soil.

This makes it ideal for performing experiments in courses such as soil science, agricultural science, environmental science, horticulture, botany, and biology.

However, soil tension measurements are soil specific and can be inaccurate. Depending on your crop and soil observations, soil tension limits should be refined.

For example, note the soil tension at the earliest indication of water stress and always make sure that you irrigate before it reaches that point.

You can also track your water movement by taking measurement right after an irrigation event.

If your bottom sensor after irrigation indicates zero reading that means you might have irrigated more than required, but if it shows no movement that means you irrigated less.

Working Principle of Moisture Sensor

The Soil Moisture Sensor uses capacitance to measure dielectric permittivityof the surrounding medium In soil, dielectric permittivity is a function of the water content. The sensor averages the water content over the entire length of the sensor.

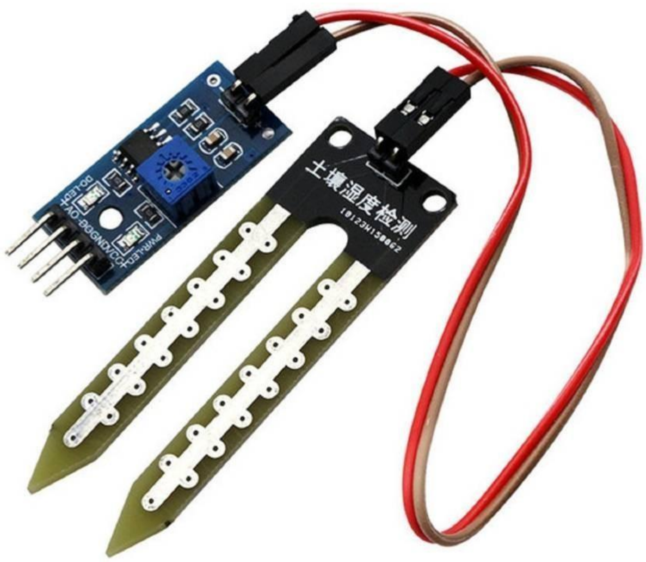
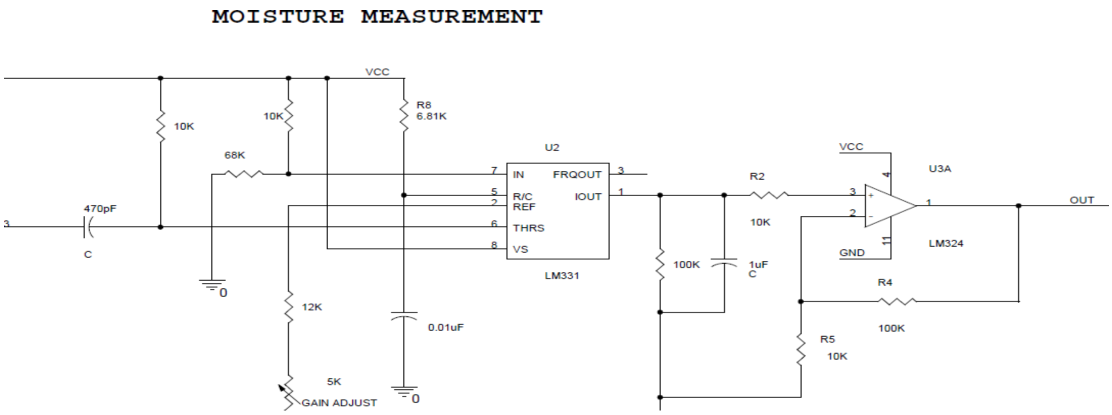


FIG:4.2 Soil Moisture Sensor

Efficient irrigation management can improve yields, grain quality, conserve water and energy, and reduce nutrient leaching. One of the easiest and most effective ways to improve irrigation efficiency is to implement soil sensor technology in irrigation scheduling. This article provides basic knowledge and practical recommendations for using soil moisture sensors for irrigation scheduling.

MOISTURE MEASUREMENT



MOISTURE

The amount of water vapor in an air sample. There are three different ways to measure MOISTURE: absolute Moisture, relative Moisture, and specific Moisture. Relative Moisture isthe most frequently encountered measurement of Moisture because it is regularly used in weather forecasts. It’s an important part of weather reports because it indicates the likelihood of precipitation, due, or fog. Higher relative Moisture also makes it feel hotter outside in the summer because it reduces the effectiveness of sweating to cool the body by preventing the evaporation of perspiration from the skin. This effect is calculated in a heat index table. Warmer air has more thermal energy than cooler air; thus more water molecules can evaporate and stayin the air in a vapour state rather than a liquid state.

This may be why people say that warmer Air "holds" more Moisture in warmer air, there is more energy for more water molecules to hold themselves in the air (and overcome hydrogen bonds which seek to pull water molecules together).

Circuit description:

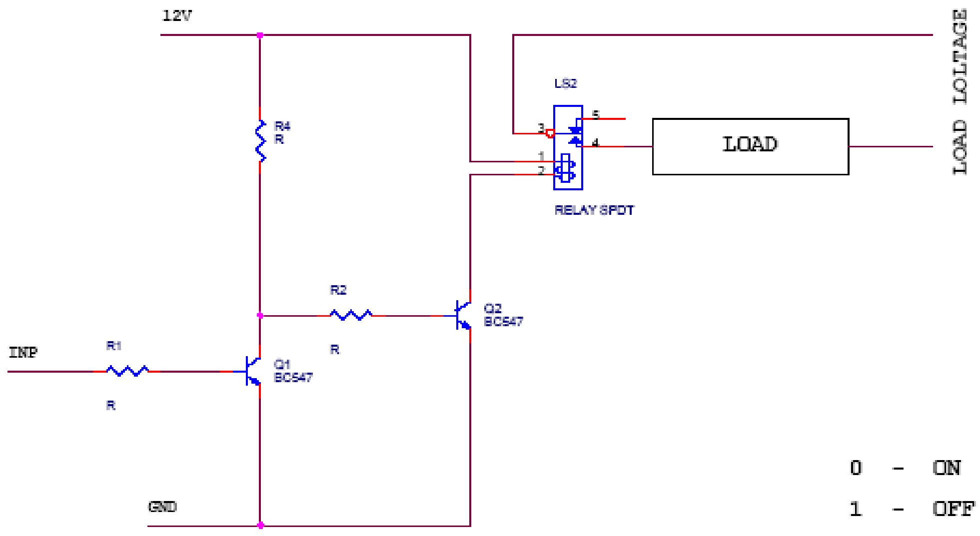
This circuit is designed to measure the Moisture level in the atmosphere air. The Moisture sensor is used for the measurement device. The Moisture sensor is consist of a stablemulti vibrator in which the capacitance is varied depends on the Moisture level. So, the multi vibrator produces the varying pulse signal which is converted into correspondingvoltage signal.

The voltage signal is given to inverting input terminal of the comparator. The reference voltage is given to non inverting input terminal. The comparator is designed by the LM324 operational amplifier.

The comparator is compared with reference Moisture level and delivered the corresponding error voltage at its output which is given to next stage of gain amplifier in whichthe variable resistor is connected in the feedback path by adjusting the resistor we can get the desired gain. Then the final voltage is given to microcontroller or other circuit in order to find the Moisture level in the atmosphere.

Soil moisture sensors measure or estimate the amount of water in the soil. These sensors can be stationary or portables such as handheld probes. Stationary sensors are placed at the predetermined locations and depths in the field, whereas portable soil moisture probes can measure soil moisture at several locations. Field capacity can be measured very easily in the field using soil moisture sensors. The VWC measurements provided by the soil moisture sensor after 12-24 hours of heavy irrigation or rain is the field capacity of the soil.

RELAY CIRCUIT - SPST



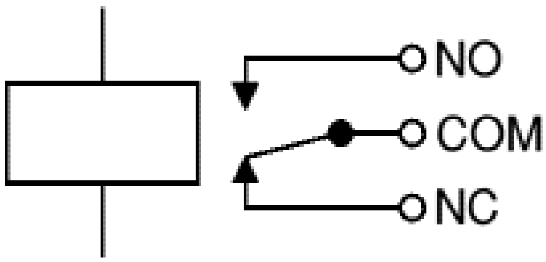
4.3 Relay:

A relay is an electrically operated switch. Current flowing through the coil of the relay creates a magnetic field which attracts a lever and changes the switch contacts. The coil current can be on or off so relays have two switch positions and they are double throw (change over) switches. Relays allow one circuit to switch a second circuit which can be completely separate from the first. For example a low voltage battery circuit can use a relay to switch a 230V AC mains circuit. There is no electrical connection inside the relay between the two circuits; the link is magnetic and mechanical.

The coil of a relay passes a relatively large current, typically 30mA for a 12V relay, butit can be as much as 100mA for relays designed to operate from lower voltages. Most ICs (chips) cannot provide this current and a transistor is usually used to amplify the small IC current to thelarger value required for the relay coil.

FIG:4.3

Relay are usually SPDT or DPDT but they can have many more sets of switch contacts,for example relays with 4 sets of changeover contacts are readily available. Most relays are designed for PCB mounting but you can solder wires directly to the pins providing you take care to avoid melting the plastic case of the relay. The animated picture shows a working relaywith its coil and switch contacts. You can see a lever on the left being attracted by magnetism when the coil is switched on. This lever moves the switch contacts. There is one set of contacts(SPDT) in the foreground and another behind them, making the relay DPDT.



The relay's switch connections are usually labeled COM, NC and NO:

COM = Common, always connect to this, it is the moving part of the switch.

NC = Normally Closed, COM is connected to this when the relay coil is **off**.

NO = Normally Open, COM is connected to this when the relay coil is **on**.

Circuit description:

This circuit is designed to control the load. The load may be motor or any other load. Theload is turned ON and OFF through relay. The relay ON and OFF is controlled by the pair of switching transistors (BC 547). The relay is connected in the Q2 transistor collector terminal. A Relay is nothing but electromagnetic switching device which consists of three pins. They are common, normally close (NC) and Normally open (NO).

The relay common pin is connected to supply voltage. The normally open (NO) pin connected to load. When high pulse signal is given to base of the Q1 transistors, the transistor is conducting and shorts the collector and emitter terminal and zero signals is given to base of the Q2 transistor. So, the relay is turned OFF state.

When low pulse is given to base of transistor Q1 transistor, the transistor is turned OFF. Now 12v is given to base of Q2 transistor so the transistor is conducting and relay is turned ON.Hence the common terminal and NO terminal of relay are shorted. Now load gets the supply voltage through relay.

SSRs consist of an input circuit, a control circuit, and an output circuit. The input circuit is the portion of a relays frame to which the control component is connected. The input circuit performs the same function as the coil of electromechanical relays.

4.4 Arduino UNO:

4.4.1 The Arduino Uno board is a microcontroller based on the ATmega328.

4.4.2 It has 14 digital input and output pins (of which 6 can provide PWM output),6 analog inputs, a USB connector, a power jack and reset button.

4.4.3 The operating voltage is 5 volts.

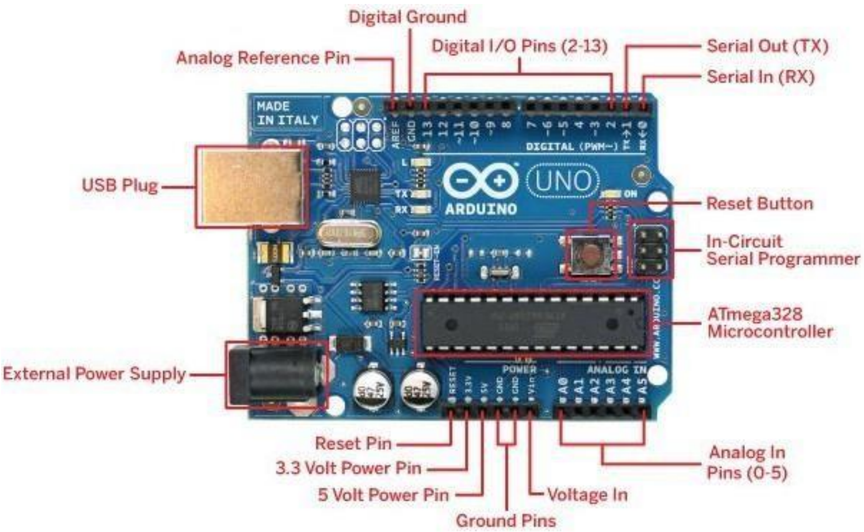


FIG:4.5 Arduino UNO

Overview

Arduino Uno is a microcontroller board based on 8-bit ATmega328P microcontroller. Along with ATmega328P, it consists other components such as crystal oscillator, serialcommunication, voltage regulator, etc. to support the microcontroller. Arduino Uno has 14 digital input/output pins (out of which 6 can be used as PWM outputs).

How to use Arduino Board

The 14 digital input/output pins can be used as input or output pins by using pin Mode (), digital Read () and digital Write () functions in arduino programming. Each pin operates at 5V and can provide or receive a maximum of 40mA current, and has an internal pull-up resistor of 20-50 Kilo Ohms which are disconnected by default. Out of these 14 pins, some pins have specific functions as listed below:

Serial Pins 0 (Rx) and 1 (Tx): Rx and Tx pins are used to receive and transmit TTL serial data. They are connected with the corresponding ATmega328P USB to TTL serial chip.

External Interrupt Pins 2 and 3: These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value.

PWM Pins 3, 5, 6, 9 and 11: These pins provide an 8-bit PWM output by using analog Write () function.

SPI Pins 10 (SS), 11 (MOSI), 12 (MISO) and 13 (SCK): These pins are used for SPI communication.

In-built LED Pin 13: This pin is connected with an built-in LED, when pin 13 is HIGH – LED is on and when pin 13 is LOW, its off.

Along with 14 Digital pins, there are 6 analog input pins, each of which provide 10 bits of resolution, i.e. 1024 different values..

Analog pin 4 (SDA) and pin 5 (SCA) also used for TWI communication using Wire library. Arduino Uno has a couple of other pins as explained below:

AREF: Used to provide reference voltage for analog inputs with analog Reference () function.

Reset Pin: Making this pin LOW, resets the microcontroller

Communication:

Arduino can be used to communicate with a computer, another Arduino board or other microcontrollers. The ATmega328P microcontroller provides UART TTL (5V) serial communication which can be done using digital pin 0 (Rx) and digital pin 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 ATmega16U2 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. There are two RX and TX LEDs on the arduino board which will flash when data is being transmitted via the USB-to-serial chip and USB connection to the computer (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 ATmega328P also supports I2C(TWI) and SPI communication. The Arduino software includes a Wire library to simplify use of the I2C bus.

Arduino Uno to ATmega328 Pin Mapping

When ATmega328 chip is used in place of Arduino Uno, or vice versa, the image below showsthe pin mapping between the two.

Arduino Uno to ATmega328 Pin Mapping

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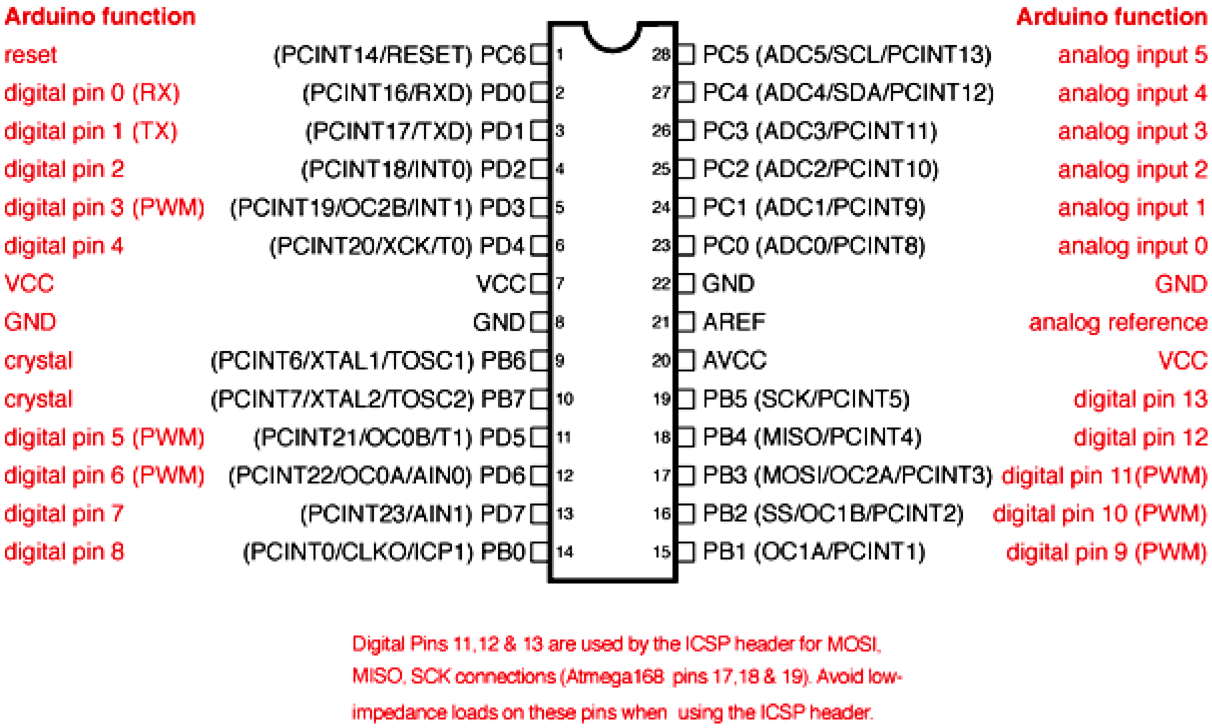


Software

Arduino IDE (Integrated Development Environment) is required to program the ArduinoUno board.

Programming Arduino

Once arduino IDE is installed on the computer, connect the board with computer using USB cable. Now open the arduino IDE and choose the correct board by selecting Tools>Boards>Arduino/Genuine Uno, and choose the correct Port by selecting Tools>Port. Arduino Uno is programmed using Arduino programming language based on Wiring. To get itstarted with Arduino Uno board and blink the built-in LED, load the example code by selecting Files>Examples>Basics>Blink. Once the example code (also shown below) is loaded into yourIDE, click on the 'upload' button given on the top bar. Once the upload is finished, you shouldsee the Arduino's built-in LED blinking. Below is the example code for blinking:

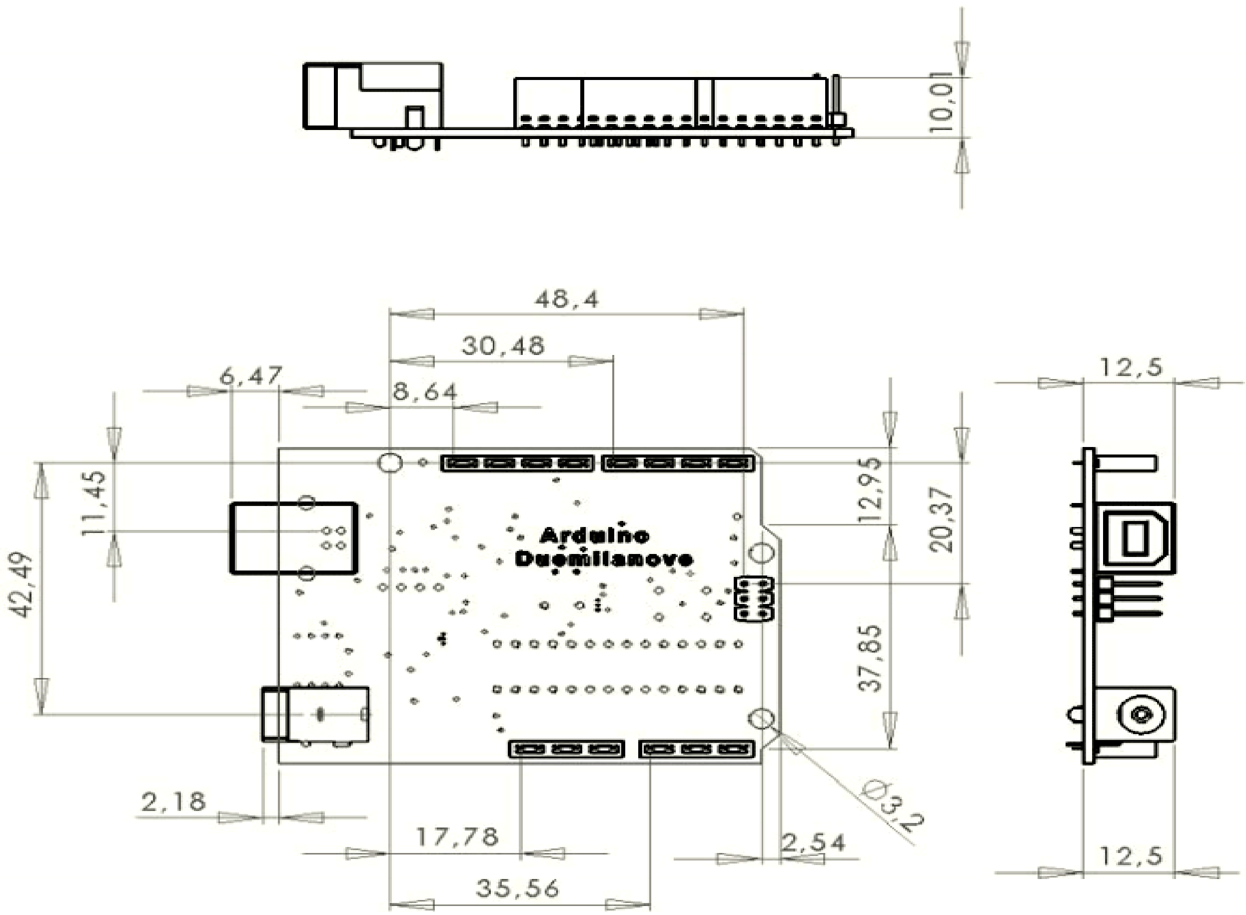
Applications

- Prototyping of Electronics Products and Systems
- Multiple DIY Projects.
- Easy to use for beginner level DIYers and makers.

Projects requiring Multiple I/O interfaces and communication.

Arduino Uno 2D Model

Let see actual connections of Node MCU with ESP8266 i.e. ESP-12



Node MCU pinout is having labels D0 to D8 and RX-TX but when programming it using Arduino IDE we observe that its labels are not matching with IO connections.

Node MCU is an open source IoT platform. It includes firmware which runs on the **ESP8266**Wi-Fi SoC from Express if Systems, and hardware which is based on the ESP-12 module. We get two on board LEDs one is connected to GPIO2 and another is to GPIO16

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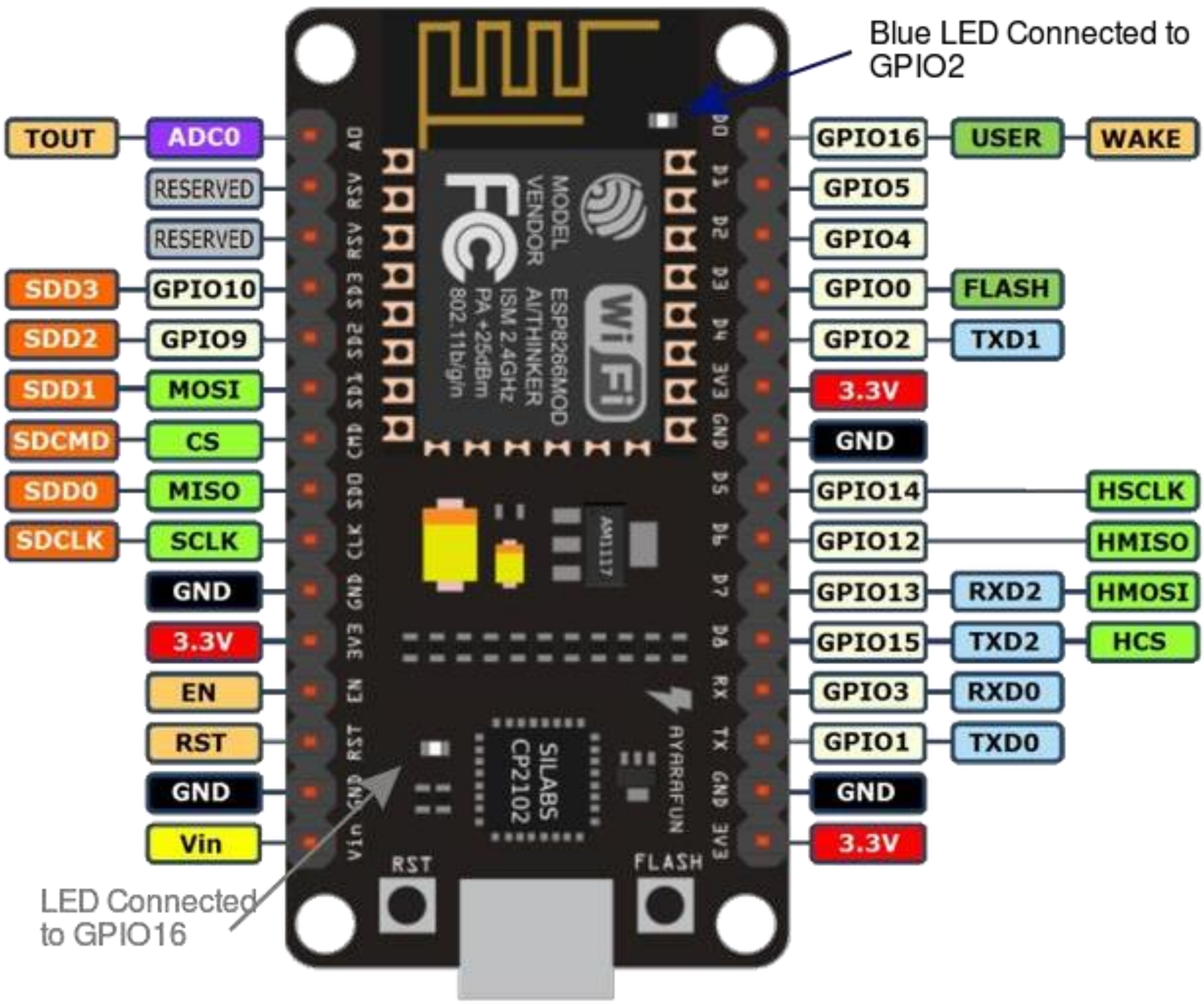
module.We get two on board LEDs one is connected to GPIO2 and another is

to GPIO16

Node MCU Pinout



Node MCU Pinout

The module is mainly based on ESP8266 that is a low-cost Wi-Fi microchip incorporating both a full TCP/IP stack and microcontroller capability. It is introduced by manufacturer Express if Systems A manufacturer based in Shanghai, China.

Arduino Modules and Microcontrollers have always been a great choice to incorporate automation into the relevant project. But these modules come with a little drawback as they don’t feature a built-in Wi-Fi capability, subsequently, we need to add external Wi-Fi protocol into these devices to make them compatible with the internet channel.

This is where Node MCU V3 comes handy that incorporates a built-in Wi-Fi support, giving an easy pathway to design IoT applications as per your technical requirements.

Introduction to Node MCU V3

Node MCU V3 is an open-source firmware and development kit that plays a vital role indesigning your own IoT product using a few Lua script lines.

Multiple GPIO pins on the board allow you to connect the board with other peripherals and arecapable of generating PWM, I2C, SPI, and UART serial communications.

- The interface of the module is mainly divided into two parts including both Firmware and Hardware
- where former runs on the ESP8266 Wi-Fi SoC and later is based on the ESP-12 module.

The firmware is based on Lua – A scripting language that is easy to learn, giving a simple programming environment layered with a fast scripting language that connects you with a well-known community.
And open source firmware gives you the flexibility to edit, modify and rebuilt the existing module and keep changing the entire interface until you succeed in optimizing the module as per your requirements.

USB to UART converter is added on the module that helps in converting USB data to UART data which mainly understands the language of serial communication.

Instead of the regular USB port, Micro USB port is included in the module that connects it withthe computer for dual purposes: programming and powering up the board.

The board incorporates status LED that blinks and turns off immediately, The ability of module to establish a flawless Wi-Fi connection between two channels makes it an ideal choice for incorporating it with other embedded devices like Raspberry Pi.

Node MCU V3 pinout

Node MCU V3 comes with a number of GPIO Pins. Following figure shows the Pinout of the board. There is a candid difference between Vin and VU where former is the regulated voltage that may stand somewhere between 7 to 12 V while later is the power voltage for USBthat must be kept around 5 V.

Node MCU V3 features

- Open-source
- Arduino-like hardware
- Status LED Micro USB port
- Reset/Flash buttons
- Interactive and Programmable
- Low cost
- ESP8266 with inbuilt wi-fi
- USB to UART converter
- GPIO pins

As mentioned above, a cable supporting micro SB port is used to connect the board.

As you connect the board with a computer, LED will flash.

You may need some drivers to be installed on your computer if it fails to detect the Node MCU board. You can download the driver from this page.

Note: We use Arduino IDE software for programming this module. It is important to note thatthe pin configuration appearing on the board is different from the configuration.

We use to program the board on the software i.e. when we write code for targeting pin 16 on the ArduinoIDE, it will actually help is laying out the communication with the D0 pin on the module.

Following figure the shows the pin configuration to use in Arduino IDE.

You can see from the pinout image above, there are five ground pins and three 3V3 pins on the board. The board can be powered up using the following three ways.

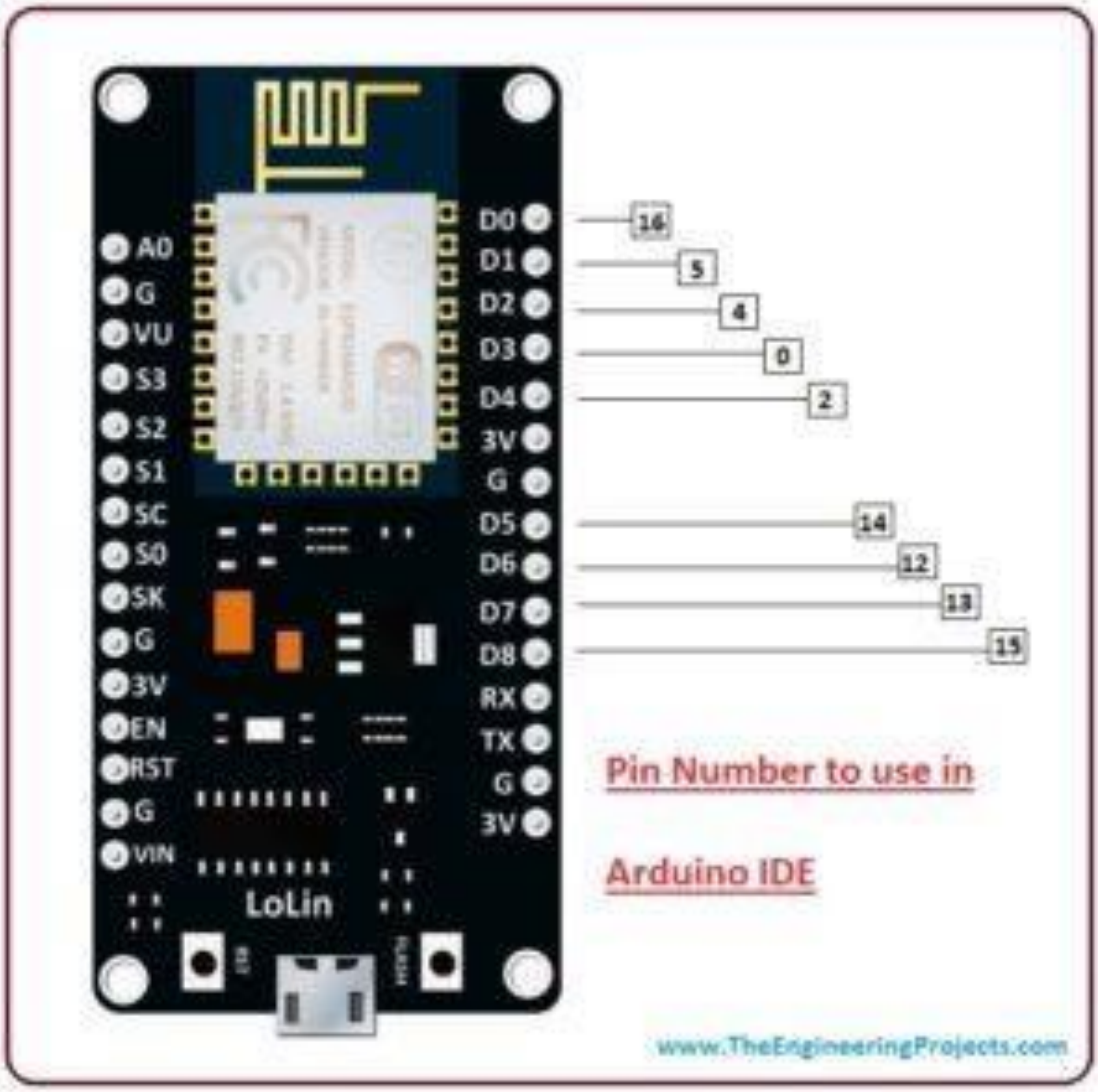

A0
G
VU
S3
S2
S1
SC
S0
SK
G
3V
EN
RST
G
VIN
LoLin
D0
D1
D2
D3
D4
3V
G
D5
D6
D7
D8
RX
TX
G
3V
16
5
4
0
2
14
12
13
15
Pin Number to use in
Arduino IDE
www.TheEngineeringProjects.com

FIG:4.6

USB Power. It proves to an ideal choice for loading programs unless the project you aim to design requires separate interface i.e. disconnected from the computer.

Provide 3.3V. This is another great option to power up the module. If you have your own off-board regulator, you can generate an instant power source for your development kit.

Power Vin. This is a voltage regulator that comes with the ability to support up to 800 mA. It can handle somewhere between 7 to 12 V. You cannot power the devices operating at 3.3 V, asthis regulator unable to generate as low as 3.3V.

Project and applications

Node MCU V3 is mainly used in the Wi-Fi Applications which most of the other

embedded modules fail to process unless incorporated with some external Wi-Fi protocol.Following are some major applications used for Node MCU V3.

- Internet Smoked Alarm
- VR Tracker
- Octopod
- Serial Port Monitor
- ESP Lamp
- Incubator Controller
- IoT home automation
- Security Alarms

4.5 Jumpers:

Jumper wires typically come in three versions male-to-male, male-to-female and female-to- female. The difference between each is in the end point of the wire. Jumper wires are simply wires that have connector pins at each end, allowing them tobe used to connect two points to each other without soldering. Jumper wires are typically used with bread boards and other prototyping tools in order to make it easy tochange a circuit as needed.

FIG:4.5 Jumpers

CHAPTER 5

METHODOLGY

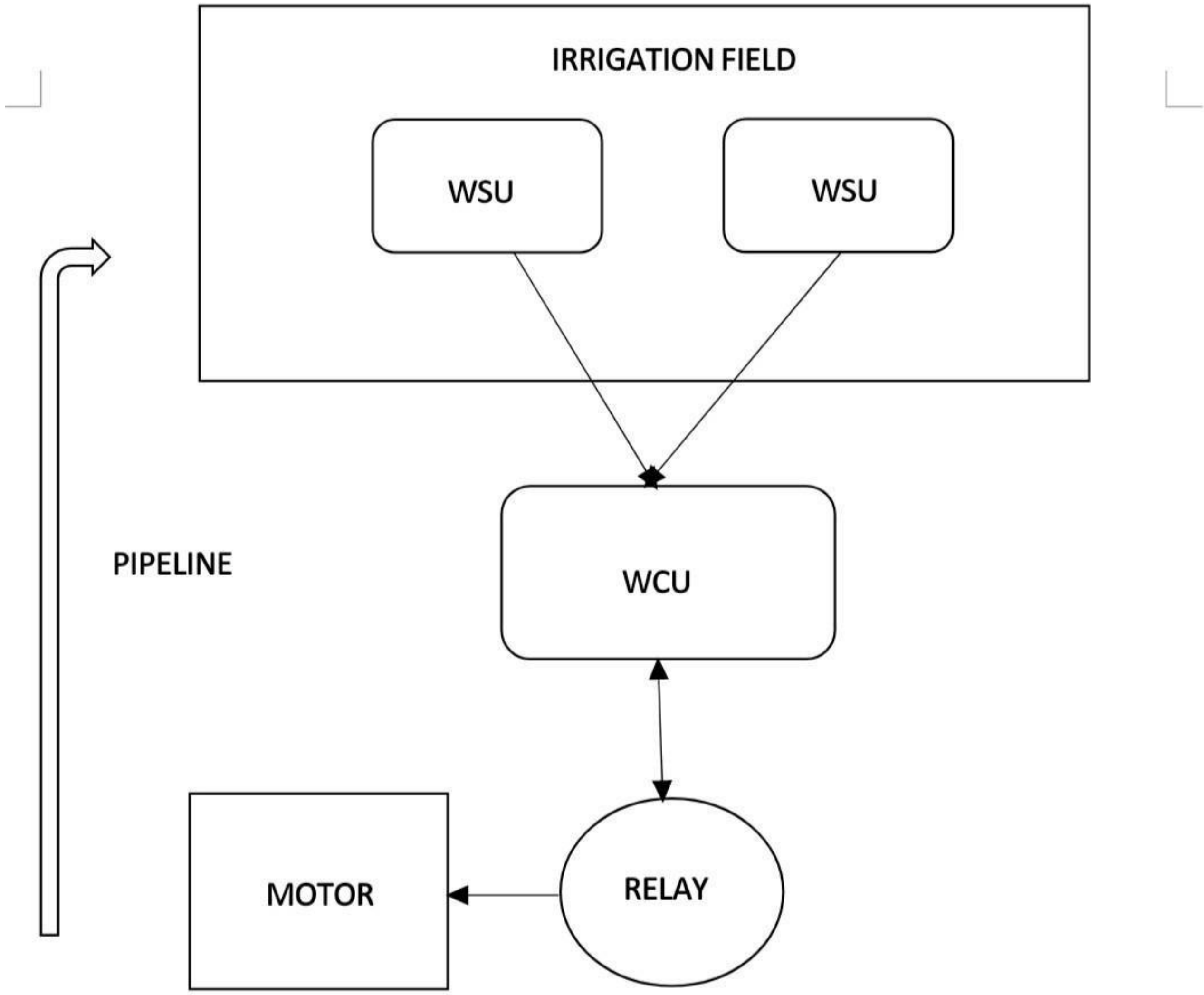
System Overview

In order to solve the water management to the irrigation system we proposed this" IoT-Based Smart Plant Watering System".

This prototype monitors the amount of soil moisture. A predefined range of soil moisture is set, and can be varied with soil type or crop type. In case the moisture of the soil deviates from the specified range, the watering system is turned on/off.

The proposed system used to control the water irrigation system using Wireless Sensor Unit (WSU)and Wireless Control Unit (WCU) based on microcontroller.

The block diagram of smart plant watering system is represented below. It consists of a microcontroller which is the brain of the system. Both soil moisture sensors are connected to the input pins of the controller. The relay is connected to output pins. Relay and two motors are coupled with each other. If the sensors depart from the predefined range, the controller turns on the pump. The relay is used to control the motor.



Block Diagram

Project Description

Hardware Design:

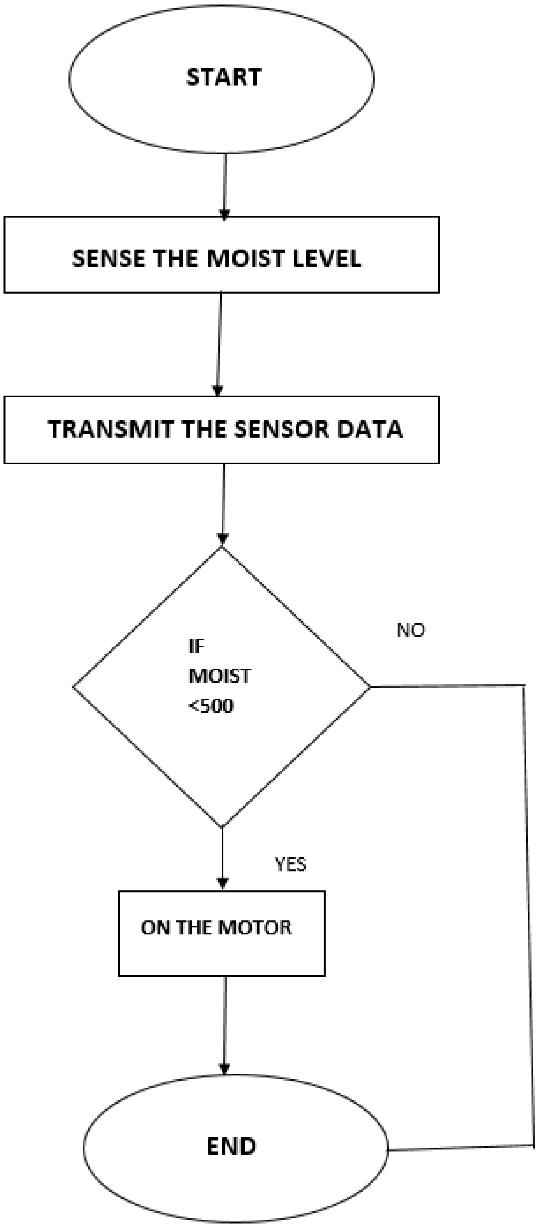
In our model, we are demonstrating watering of two fields, so two soil moisture sensors are used. Depending on the number of fields the number of moisture sensors will vary. When the soil moisture sensor is interfaced with the board the inbuilt ADC in Arduino is used to convert the data into digital form (0 to 1023), which represents resistance. Dry soil will have maximum resistance and wet soil will have leastresistance.

The relay is connected with the output pins of the Arduino, the motor will turned on using relay when the value is less than the threshold value. The vice-versa isapplicable when value is greater than the threshold value

Software Design

The software used in this project is Arduino. It provides a number of libraries to make programming simple. In our prototype, the controller AtMega328 is programmed in Arduino. The program is Arduino design at preset range of resistance value in digital format (ranging from 0 to 1023) for both the moisture sensor. Any aberration from the set range switches ON/Off the pump, to water theplants.

FLOW CHART


START
SENSE THE MOIST LEVEL
TRANSMIT THE SENSOR DATA
IF
MOIST
<500
NO
YES
ON THE MOTOR
END

Program for Arduino UNO

```
moisture2

 int trigl= 7;

 int trig2= 8;

 void setup() {

 // put your setup code here, to run once:

 pinMode (trigl, OUTPUT);

 pinMode (trig2, OUTPUT);

 Serial.begin(9600);

 void loop() (

// put your main code here, to run repeatedly:

 int moist1= analogRead (A0);

 int moist2 analogRead (Al);

if (moistl < 450) {

digitalWrite(trigl, HIGH);
```

```
Serial.println(moistl);

}

else if (moist2 < 500)

{

 digitalWrite(trig2, HIGH);

Serial.printin (moist2);

}

else
{
digitalWrite(trig2,10);

 digitalWrite(trig2,);

}
```

CHAPTER 6

RESULTS

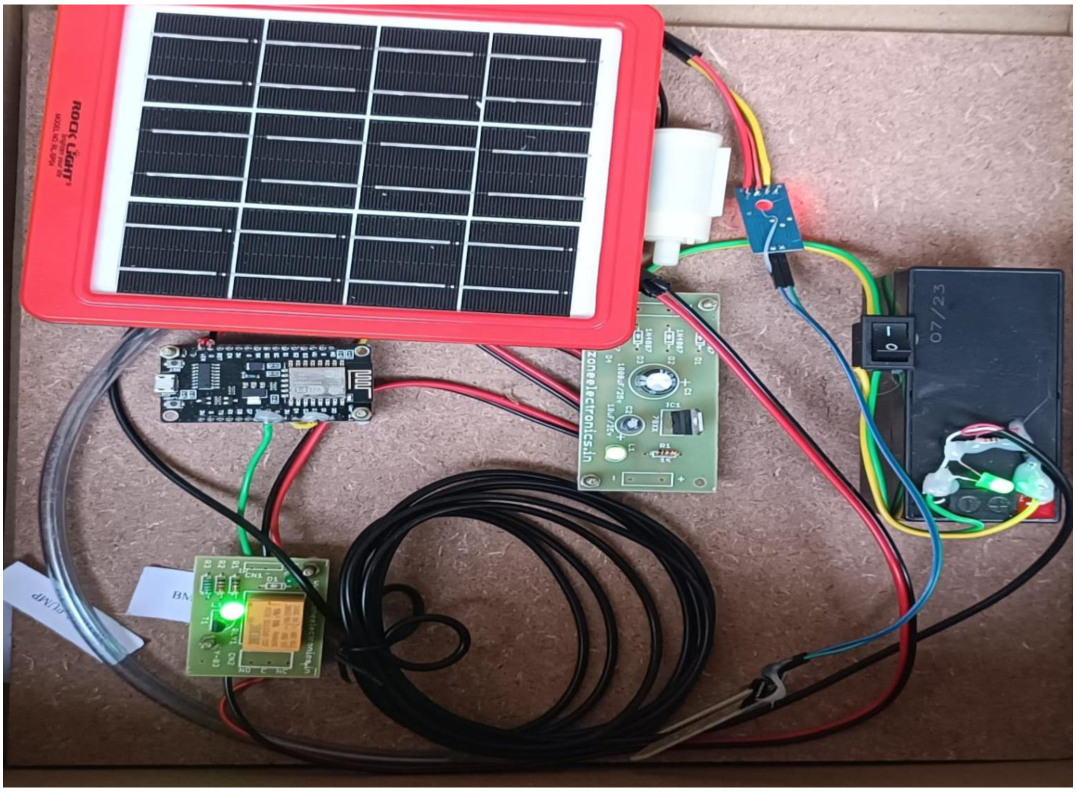
6.1 Advantages

- Water Conservation.
- Lowered Operation Costs.
- Efficient and Saves Time.
- Increase in productivity.
- Reduces soil erosion and nutrient leaching.
- Very accurate
- Ability to read soil volumetric water content directly.
- Continuous measurements at same location.

6.2 Disadvantages

- Difficult in maintenance
- Difficult in setup/repairs
- The process will cost huge amount.

HARDWARE KIT



CHAPTER 7

CONCLUSION

A system to monitor moisture levels in the soil was designed. The proposed system can be used to switch on/off the water supply (or) motor according to soil moisture levels thereby automating the process of irrigation which is one of the most time consuming activities in farming. The system uses information from soil moisturesensors to irrigate soil which helps to prevent over irrigation or under irrigation of soilthere by avoiding crop damage. Through this project it can be concluded that there canbe considerable development in farming with the use of IoT and automation. Thus, thesystem is a potential solution to the problems faced in the existing manual process of irrigation by enabling efficient utilization of water resources.

Further Work

To improve the efficiency and effectiveness of the system, the following recommendations can be put into consideration. Option of controlling the water pump can be given to the farmer he can switch on/off the pump in order to start/stop the process of irrigation without being present at the farm.

The farmer may chooseto stop the growth of crops or the crops may get damaged due to adverse weather conditions. In such cases farmer may need to stop the system remotely. The idea of using IoT for irrigation can be extended further to other activities in farming such as cattle management, fire detection and climate control. This would mini malize human intervention in farming activities.

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