# “SMART IRRIGATION SYSTEM USING IOT”

## A PROJECT REPORT
**Submitted by**


| | |
|---|---|
| **M YESHWANTH** | **21781A04B1** |
| **P BALAKRISHNA** | **21781A04D4** |
| **P REDDY RANI** | **21781A04D6** |
| **R ALLIPEERA** | **21781A04F9** |
| **R HARIKA** | **21781A04G2** |


in partial fulfilment of the requirements for the Award of Degree

of

**BACHELOR OF TECHNOLOGY**

**IN**

**ELECTRONICS AND COMMUNICATION ENGINEERING**

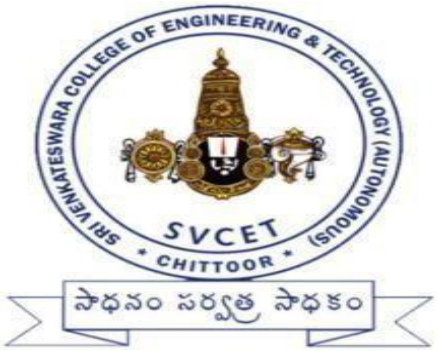
**Under the guidance of**

**Dr.S.JEEVITHA,M.E,Ph.D**
(Assistant Professor)
At


SRI VENKATESWARA COLLEGE OF ENGINEERING& TECHNOLOGY
(AUTONOMOUS)
R.V.S NAGAR, CHITTOOR – 517 127. (A.P).
(Approved by AICTE, New Delhi, Affiliated to JNTUA, Anantapuramu)
(Accredited by NBA, New Delhi AND NAAC A+, Bengaluru)
(An ISO 9001:2000 Certified Institution)


APRIL 2025

SRI VENKATESWARA COLLEGE OF ENGINEERING& TECHNOLOGY
(AUTONOMOUS)
R.V.S NAGAR, CHITTOOR – 517 127. (A.P)
(Approved by AICTE, New Delhi, Affiliated to JNTUA, Anantapuramu)
Accredited by NBA, New Delhi & NAAC A+, Bengaluru)
(An ISO 9001:2000 Certified Institution)




**CERTIFICATE**

This is to certify that this project entitied **"SMART IRRIGATION SYSTEM USING IOT"** is a Bonafide work done by **M YESHWANTH (21781A04B1) , P BALA KRISHNA (21781A04D4) , P REDDY RANI (21781A04D6) , R ALLIPEERA (21781A04F9) ,R HARIKA(21781A04G2)** in partial fulfilment of the requirements for the award of the degree of **BACHELOR OF TECHNOLOGY in ELECTRONICS AND COMMUNICATION ENGINEERING**

**SIGNATURE OF THE GUIDE** **SIGNATURE OF THE HOD**

**Viva-voice conducted on:_____.**

**INTERNAL EXAMINER** **EXTERNAL EXAMINER**

# Acknowledgements

A Grateful thanks **to Dr.R.Venkataswamy**,Chairman,Sri Venkateswara College of Engineering and Technology for providing education in their esteemed institution.

We, wish to record our deep sense of gratitude and profound thanks to our beloved Vice Chairman, **Sri. R.V. Srinivas** for his valuable support throughout the course.

We, express our sincere thanks **to Dr.M.MohanBabu**, our beloved principal for his encouragement and suggestions during the course of study.

We, wish to convey our gratitude and express our sincere thanks to **Dr.D.Srihari,**M.E, Ph.D, Head of the Department, Electronics and Communication Engineering, for giving us his inspiring guidance in undertaking our project report.

We, express our sincere thanks to the Project Guide **Dr.S.Jeevitha,**M.E,Ph.D Assistant Professor, Department of Electronic and Communication Engineering, for her keen interest, stimulating guidance, constant encouragement with our work during all stages, to bring this project into fruition.

We, wish to convey our gratitude and express our sincere thanks to all Project Review Committee members for their support and cooperation rendered for successful submission of our project work.

Finally, we would like to express our sincere thanks to all teaching,non teaching faculty members, our parents, and friends and for all those who have supported us to complete the project work successfully.

M.YESHWANTH 21781A04B1

P.BALAKRISHNA 21781A04D4

P.REDDY RANI 21781A04D6

R.ALLIPEERA 21781A04F9

R.HARIKA 21781A04G2

# ABSTRACT

The majority of nations rely heavily on agriculture to power their economies. A nation’s growth is mostly dependent on agriculture, notably rise of agriculture is the main driver of anation's economy. One type of irrigation system that is frequently utilized in the agricultural industry is the smart irrigation system. In areas of farming where water is scarce, irrigation is used. This intel for people's livelihood and the production of food and other raw resources. The lig The majority of nations rely heavily on agriculture to power their economies. A nation's ent irrigation system is designed with farmers in mind. In this paper, the proposed smart irrigation system uses Node MCU ESP8266. This system reads the values using sensors and waters the plants based on those values. Also, the system will send notification as well as email to the owner for a certain interval of time depending on the owner specification. The owner can also remotely monitor values by using the mobile application or web application. It is very easy to implement, and will save manpower,leading to a cost-effective solution for efficient water management in agriculture. This system harnesses the power of a microcontroller to monitor and control irrigation process,ensuring optimal water usage.



**Keywords: Agriculture, Internet of Things (IoT), Real-time monitoring, Sensor Technology, Smart Irrigation.**

## TABLE OF CONTENTS

INDEX
INDEX

# LIST OF FIGURES

# CHAPTER 1

# INTRODUCTION TO EMBEDDED SYSTEMS

# INTRODUCTION TO EMBEDDED SYSTEMS

## 1.1 INTRODUCTION:

Micro controller are widely used in Embedded Systems products. An Embedded product uses the microprocessor (or microcontroller) to do one task & one task only. A printer is an example of Embedded system since the processor inside it perform one task only namely getting the data and printing it. Although microcontroller is preferred choice for many Embedded systems, there are times that a microcontroller is inadequate for the task.For this reason,in recent years many manufactures of general-purpose microprocessors such as INTEL, Motorola, AMD & Cyrix have targeted their microprocessors for the high end of Embedded market. One of the most critical needs of the embedded system is to decrease power consumptions and space. This can be achieved by integrating more functions into the CPU chips. All the embedded processors have low power consumptions in additions to some forms of I/O, ROM all on a single chip. In higher performance Embedded system, the trend is to integrate more & more function on the CPU chip & let the designer decide which feature he/she wants to use.

## 1.2 EMBEDDED SYSTEM:

Physically, embedded systems range from portable devices such as digital watches and MP3 players, to large stationary installations like traffic lights, factory controllers, or the systems controlling nuclear power plants. Complexity varies from low, with a single microcontroller chip, to very high with multiple units, peripherals and networks mounted inside a large chassis or enclosure

In general, "embedded system" is not an exactly defined term, as many systems have some element of programmability. For example, Handheld computers share some elements with embedded systems such as the operating systems and microprocessors which power them but are not truly embedded systems, because they allow different applications to be loaded and peripherals to be connected. Embedded systems span all aspects of modern life and there are many examples of their use. Telecommunications systems employ numerous embedded systems from telephone switches for the network to mobile phones at the end-user. Computer networking uses dedicated routers and network bridges to route data.

## EXAMPLES OF EMBEDDED SYSTEM:

- Automated teller machines (ATMS).
- Integrated system in aircraft and missile.
- Cellular telephones and telephonic switches.
- Computer network equipment, including outers time servers and firewalls
- Computer printers, Copiers.
- Disk drives (floppy disk drive and hard disk drive)
- Engine controllers and antilock brake controllers for auto mobiles.
- Home automation products like thermostat, air conditioners sprinkles and security monitoring system.
- Household appliances including microwave ovens, washing machines, TV sets DVD layers/recorders.
- Medical equipment.

- Measurement equipment such as digital storage oscilloscopes, logic analyzers and spectrum analyzers.
- Multimedia appliances: internet radio receivers, TV set top boxes.
- Small hand-held computer with P1 M5 and other applications.
- Programmable logic controllers (PLC's) for industrial automation and monitoring.
- Stationary video game controllers.

## 1.3 CHARACTERISTICS:

Embedded systems are designed to do some specific tasks, rather than be a general-purpose computer for multiple tasks. Some also have real-time performance constraints that must be met, for reasons such as safety and usability; others may have low or no performance requirements, allowing the system hardware to be simplified to reduce costs.

Embedded systems are not always standalone devices. Many embedded systems consist of small, computerized parts within a larger device that serves a more general purpose. For example, the Gibson Robot Guitar features an embedded system for tuning the strings, but the overall purpose of the Robot Guitar is, of course, to play music. Similarly, an embedded system in an automobile provides a specific function as a subsystem of the car itself.The software written for embedded systems is often called firm ware, and is usually stored in read-only memory or Flash memory chips rather than a disk drive. It often runs with limited computer hardware resources: small or no keyboard, screen, and little memory.

## 1.4 MICROPROCESSOR (MP):

A microprocessor is a general-purpose digital computer central processing unit (CPU). Although popularly known as a "computer on a chip" is in no sense a complete digital computer. The block diagram of a microprocessor CPU is shown, which contains an arithmetic and logical unit (ALU), a program counter (PC), a stack pointer (SP), some working registers, a clock timing circuit, and interrupt circuits.

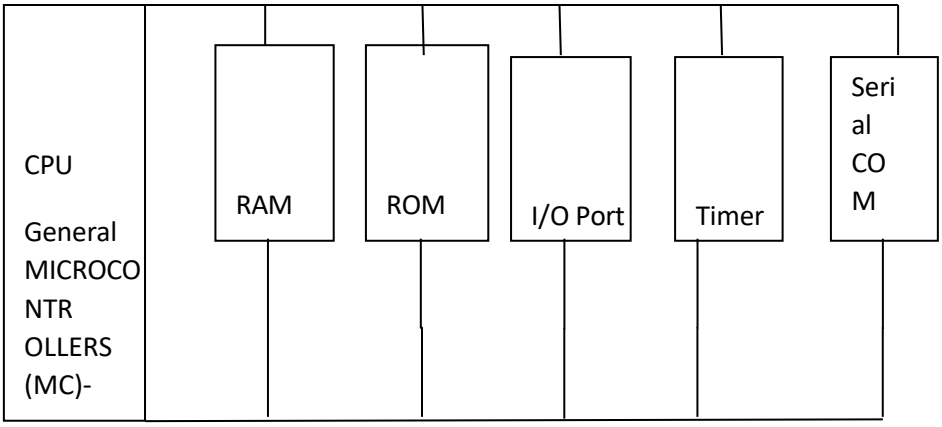



**Fig 1.4:**Block diagram of microprocessor

## 1.5 MICROCONTROLLER(MC):

Figure shows the block diagram of a typical microcontroller. The design in corporates all of the features found in micro-processor CPU: ALU, PC, SP, and registers. It also added the other features needed to make a complete computer: ROM, RAM, parallel I/O, serial I/O, counters, and clock circuit.

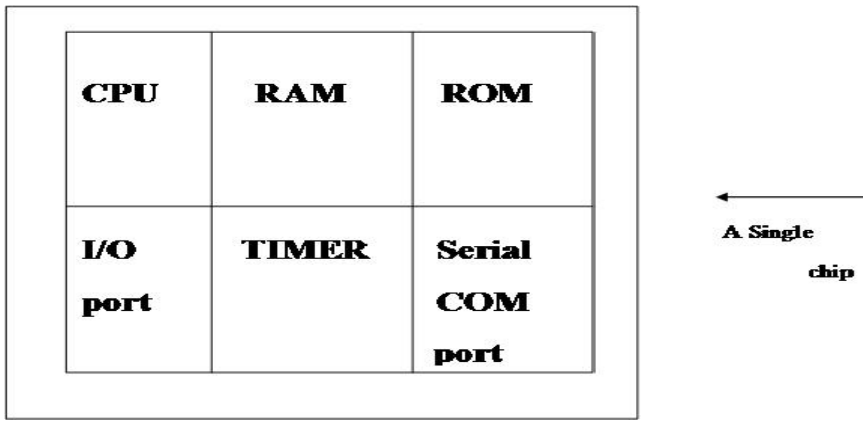



**Fig1.5:** Microcontroller

## 1.6 COMPARISION BETWEEN MICROPROCESSOR AND MICROCONTROLLER

The microprocessor must have many additional parts to be operational as a computer whereas microcontroller requires no additional external digital parts.

1. The prime use of microprocessor is to read data, perform extensive calculations on that data and store them in the mass storage device or display it. The prime functions of microcontroller is to read data, perform limited calculations on it, control its environment based on these data. Thus the microprocessor is said to be general-purpose digital computers whereas the microcontroller are intend to be special purpose digital controller.

2. Microprocessor need many opcodes for moving data from the external memory to the CPU, microcontroller may require just one or two, also microprocessor may have one or two types of bit handling instructions whereas microcontrollers have many.

## PERIPHERALS:

Embedded Systems talk with the outside world via peripherals, such as

- Serial Communication Interfaces (SCI): RS-232, RS-422, RS-485etc
- Synchronous Serial Communication Interface: I2C, SPI,JTAG, SSC and ESSI
- Universal Serial Bus (USB)
- Networks: Ethernet, Controller Area Network, LAN networks, etc
- Timers: PLL(s), Capture/Compare and Time Processing Units
- Discrete IO: aka General Purpose Input/output (GPIO)
- Analog to Digital/Digital to Analog (ADC/DAC)

## TOOLS:

As for other software, embedded system designers use compilers, assemblers, and debuggers to develop embedded system software. However, they may also use some more specific tools:

- Utilities to add a check sumor CRC to a program, so the embedded system can check if the program is valid.
- For systems using digital signal processing, developers may use a math workbench such as MATLAB, Simulink, Mathcad, or Mathematica to simulate the mathematics. They might also use libraries for both the host and target which eliminates developing DSP routines as done in DSP nano RTOS and Unison Operating System.
- Custom compilers and linkers may be used to improve optimization for the particular hardware.
- An embedded system may have its own special language or design tool, or add enhancements to an existing language such as Forth or Basic.

- Another alternative is to add a Real-time operating system or Embedded operating system, which may have DSP capabilities like DSP Nano RTOS.

# CHAPTER 2

## OVERVIEW OF THE PROJECT

# OVERVIEW OF THE PROJECT

## 2.1 INTRODUCTION

India is one of the countries which have largest population in the world. Agriculture is the most important source of income in India to maintain good economy. In India agriculture provides employment to almost 70% of the population and it is the cause of 25% GDP.As increasing the agriculture in country, government is providing some online facilities and some service providers to the farmers to maintain good agricultural profits. Most of the farmers are facing a major problem with water. Irrigation plays an important role in agriculture. To overcome this water deficiency in country we have to save it as we can. Unnecessary irrigation should be avoided. Farmers have been using irrigation through manual control. They irrigate the land at particular time. The previous survey farming uses almost 80% of fresh water world. If it is continued world has to face many water deficiency problems according to the demand of food for increasing population. We have to manage the water by irrigating properly. For this smart irrigation helps a lot. By arranging some useful sensors like temperature, humidity, soil moisture sensors will find the percent of moisture in soil. Then if the moisture percent is low, then motor will gets ON atomically and OFF when it maintains a sufficient percent.

## 2.2 EXISTING SYSTEM

Primary investigation is administered under the subsequent stages, like Understanding the existing approaches, Understanding the wants, developing an abstract for the system. Soil moisture sensor, temperature and humidity sensors placed at roots of a plant and the data is given to android app. Temperature, humidity and soil moisture values are displayed on the app in user's device. Smart Irrigation System on Sensing Soil Moisture, intension is to create an automated irrigation process which turns the water motor ON and

OFF on detecting moisture percent of the earth. Smart irrigation system developed for the irrigational use of agriculture, which is placed at the remote location and required water provides for plantation when the moisture of the soil gets low than the set-point value. This smart irrigation system made use of GSM to control the system which may cost more. Butnthis IOT smart system displays temperature and humidity values.

## 2.3 PROPOSED SYSTEM

All the sensors i.e. moisture sensor, humidity sensor, temperature sensor, is connected to the microcontroller.5volts of power is supplied to the micro controller. From that microcontroller a relay gets the information about the percent of the moisture in the soil. If the moisture percent is low then the motor gets automatically ON and the notification is sent to the user device. Block diagram of arduino based smart irrigation system which consist of three sensors which are connected to controller and sensed values from these sensors are send to the mobile application.

### 2.3.1 BLOCK DIAGRAM OF PROPOSED SYSTEM

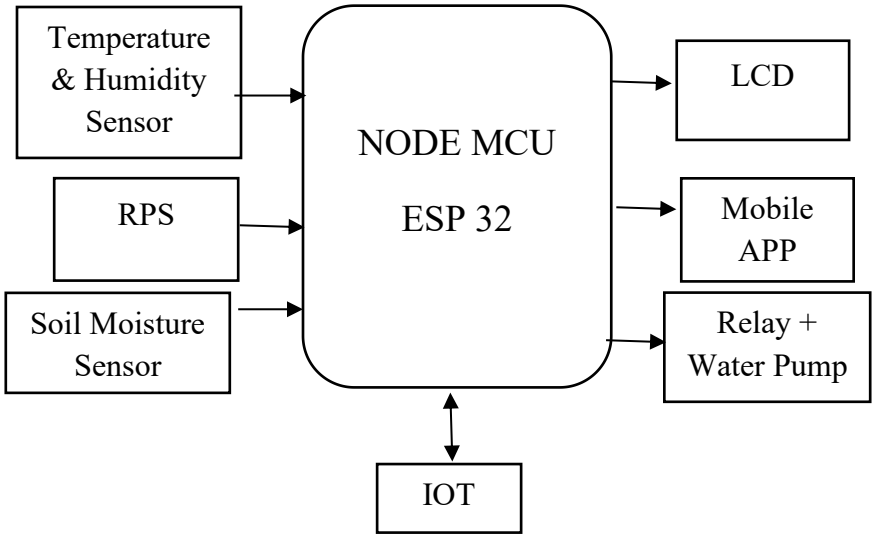



**Fig 2.3:** Block Diagram

### 2.3.2 HARDWARE COMPONENTS

- Power Supply
- Node MCU ESP32
- Soil Moisture Sensor
- Temperature & Humidity Sensor
- Realy
- Water Pump
- LCD

### 2.3.3 SOFTWARE COMPONENTS

- Arduino IDE
- Proteus

# CHAPTER 3

## TECHNOLOGY USED

# TECHNOLOGY USED

## 3.1 INTRODUCTION OF IOT TECHNOLOGY

1. The term "Internet of Things" has come to describe a number of technologies and research disciplines that enable the Internet to reach out into the real world of physical objects.
2. The Internet of Things, also called The Internet of Objects, refers to a wireless network between objects.
3. From any time, any place connectivity for any one, we will now have connectivity for anything!

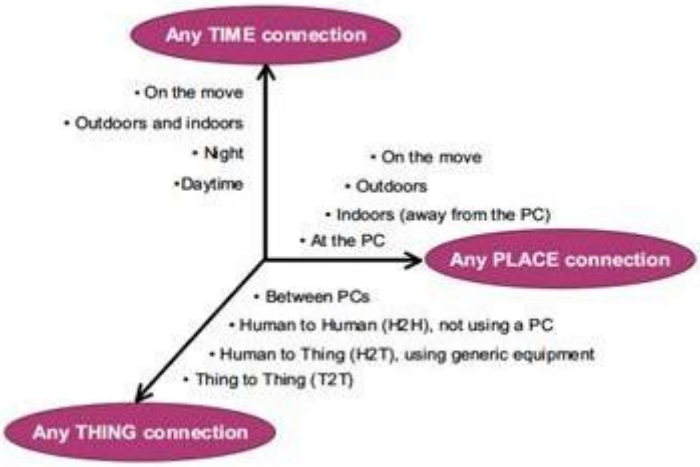



**Fig3.1:**IOT Technology

### 3.1.1 THE VISION

To improve human health and well-being is the ultimate goal of any economic, technological and social development. The rapid rising and aging of population are one of the macro powers that will transform the world dramatically, it has caused great pressure to food supply and healthcare systems all over the world, and the emerging technology breakthrough of the

Internet-of-Things (IOT)is expected to offer promising solutions (National Information Council 2008). Therefore, the application of IOT technologies for the food supply chain (FSC) (so-called Food-IOT) and in-home healthcare (IHH) (so-called Health-IOT 1) have been naturally highlighted in the strategic research road maps (European Commission Information Society 2009). To develop practically usable technologies and architectures of IOT for these two applications is the final target of this work. The phrase "Internet of Things" (IOT) was coined at the beginning of the 21st century by the MIT Auto-ID Center with special mention to Kevin Ashton (Ashton 2009) and David L. Brock (Brock 2001). As a complex cyber- physical system, the IOT

Integrates all kinds of sensing, identification, communication, networking, and informatics devices and systems, and seamlessly connects all the people and things upon interests, so that anybody, at any time and any place, through any device and media, can more efficiently access the information of any object and any service (ITU 2005, European Commission Information Society 2008 and 2009). “Ubiquitous” is the distinct feature of IOT technologies, so the IOT is often related to ubiquitous identification (Sheng et al. 2010), ubiquitous sensing (ITU-T, 2008), ubiquitous computing (Fried Ewald and Raabe 2011), ubiquitous intelligence (Zheng et al. 2008), etc. As shown in Figure 1-1, a vivid description of this vision has been illustrated in a report by The Economist in 2007 (The Economist 2007).

A vivid description of the vision of Internet-of-Things (Authorized by Jon Berkeley) The impact caused by the IOT to human life will be as huge as the internet has caused in the past decades, so the IOT is recognized as “the next of internet”. A part of the enabling technologies are sensors and actuators, Wireless Sensor Network (WSN), Intelligent and Interactive Packaging (I2Pack), real-time embedded system, Micro electro mechanical Systems (MEMS), mobile internet access, cloud computing, Radio Frequency Identification (RFID), Machine-to-Machine (M2M) communication, human

machine interaction (HMI), middleware,With various descriptions from various viewpoints, the IoT has become the new paradigm of the evolution of information and communication technology (ICT).

## CHARACTERISTICS FOR INTERNET OF THINGS:

- Event driven
- Ambient intelligence
- Flexible structure
- Semantic sharing
- Complex access technology

Anyone who says that the Internet has fundamentally changed society may be right, but at the same time, the greatest transformation actually still lies ahead of us. Several new technologies are now converging in a way that means the Internet is on the brink of a substantial expansion as objects large and small get connected and assume their own web identity.

Following on from the Internet of computers, when our servers and personal computers were connected to a global network, and the Internet of mobile telephones, when it was the turn of telephones and other mobile units, the next phase of development is the Internet of things, when more or less anything will be connected and managed in the virtual world. This revolution will be the Net's largest enlargement ever and will have sweeping effects on every industry — and all of our everyday lives.

Smart connectivity with existing networks and context-aware computation using network resources is an indispensable part of IoT. With the growing presence of Wi-Fi and 4G-LTE wireless Internet access, the evolution towards ubiquitous information and communication networks is

already evident. However, for the Internet of Things vision to successfully emerge, the computing paradigm will need to go beyond traditional mobile computing scenarios that use smart phones and portables, and evolve into connecting everyday existing objects and embedding intelligence into our environment. For technology to disappear from the consciousness of the user, the Internet of Things demands a shared understanding of the situation of its users and their appliances, software architectures and pervasive communication networks to process and convey the contextual information to where it is relevant, and the analytics tools in the Internet of Things that aim for autonomous and smart behavior. With these three fundamental grounds in place, smart connectivity and context-aware computation can be accomplished.

A radical evolution of the current Internet into a Network of interconnected objects that not only harvests information from the environment (sensing) and interacts with the physical world (actuation/ command/control), but also uses existing Internet standards to provide services for information transfer, analytics, applications, and communications. Fueled by the prevalence of devices enabled by open wireless technology such as Bluetooth, radio frequency identification (RFID), Wi-Fi, and telephonic data services as well as embedded sensor and actuator nodes, IOT has stepped out to fits in fancy and is on the verge of transforming the current static Internet into a fully integrated Future Internet.

The Internet revolution led to the interconnection between people at an unprecedented scale and pace. The next revolution will be the interconnection between objects to create a smart environment. Onlyin2011didthenumber of inter connected devices on the planet overtake the actual number of people. Currently there are 9 billion interconnected devices and it is expected to reach 24 billion devices by 2020. According to the GSMA, this amounts to $1.3 trillion revenue opportunities for mobile

network operators alone spanning vertical segments such as health, automotive, utilities and consumer electronics.

## 3.2 DEFITNITION OF INTERNET OF THINGS (IoT)

"Today computers—and, therefore, the Internet—are almost wholly dependent on human beings for information. Nearly all of the roughly 50 petabytes(a petabyte is 1,024 terabytes) of data available on the Internet were first captured and created by human beings— by typing, pressing a record button, taking a digital picture, or scanning a bar code. Conventional diagrams of the Internet … leave out the most numerous and important routers of all - people. The problem is, people have limited time, attention and accuracy—all of which means they are not very good at capturing data about things in the real world. And that's a big deal. We're physical, and so is our environment …You can't eat bits, burn them to stay warm or put them in your gas tank. Ideas and information are important, but things matter much more. Yet today's information technology is so dependent on data originated by people that our computers know more about ideas than things. If we had computers that knew everything there was to know about things—using data they gathered without any help from us—we would be able to track and count everything, and greatly reduce waste, loss and cost. We would know when things needed replacing, repairing or recalling, and whether they were fresh or past their best. The Internet of Things has the potential to change the world, just as the Internet did. Maybe even more so".

"Things are active participants in business, information and social processes where they are enabled to interact and communicate among themselves and with the environment by exchanging data and information sensed about the environment, while reacting autonomously to the real/physical world events and influencing it by running processes that trigger actions and create services with or without direct human intervention."

"The Internet of Things represents an evolution in which objects are capable of interacting with other objects. Hospitals can monitor and regulate pacemakers' long distance, factories can automatically address production line issues and hotels can adjust temperature and lighting according to a guest's preferences, to name just a few examples."

## 3.324 HOURS IN FUTURE WITH INTERNE TO FTHINGS

How many devices do you currently own? Three, four or more? A laptop, a tablet, a smart phone or even a smart watch and a smart band or the new Nike smart shoes maybe? It goes without saying that technology has become an in dispensable part of our lives.

Here is how 24 hours would like in the future with IOT.I wouldn't need to set an alarm for the next day. My smart phone will pick up the time of my meeting from my digital calendar will connect to estimate the real time traffic and predict my travelling time to the meeting venue will analyze how much time I usually take to get ready AND finally it will calculate how early I need to wake up!

My smart heater would know that I am up and it will adjust the water temperature according to my preference.When I'll be ready to leave the house, the smart refrigerator will tell me that there is milk and fruits for my breakfast and I shouldn't eat cheese today because I didn't exercise yesterday. It is so smart that if any food item has finished or expired- it will connect to the supermarket on the internet, order my groceries and I would be able to pay sitting from anywhere anytime through my mobile wallet.

When I am finished eating breakfast, my smart car will turn the AC on so that as soon as I start driving there is a favorable temperature in the car and smart radio will be automatically turned to my favorite radio station. When let's say I get back from a yoga class, my smart clothing will know that I am

sweating and this data will be sent to my smart home temperature system which will adjust the room temperature as soon as I enter the house to make me feel comfortable.

## 3.4 ARCHITECTURE OF INTERNET OF THINGS

Architecture of internet Of Things contains basically 4 layers:

Application Layer

1. Gateway and the network layer
2. Management Service layer
3. Sensor layer

## APPLICATION LAYER:

- Lowest Abstraction Layer
- With sensors we are creating digital nervous system.
- In corporate to measure physical quantities
- Inter connects the physical and digital world
- Collects and process the real time information

## GATEWAY AND THE NETWORK LAYER:

- Robust and High-performance network infrastructure
- Supports the communication requirements for latency, band width or security
- Allows multiple organizations to share and use the same network independently

## MANAGEMENT LAYER:

- Capturing of periodic sensory data
- Data Analytics (Extracts relevant information from massive amount of raw data)
- Streaming Analytics (Process real time data)
- Ensures security and privacy of data.

## SENSOR LAYER:

- Provides a user interface for using IOT.
- Different applications for various sectors like Transportation, Health care, Agriculture, Supply chains, Government, Retail etc.

## 3.5 INTERNET OF THINGS ELEMENTS

There are three IoT components which enables seamless:

a) Hardware made up of sensors, actuators and embedded communication hardware
b) Middleware on demand storage and computing tools for data analytics and
c) Presentation—novel easy to understand visualization and interpretation tools which can be widely accessed on different platforms and which can be designed for different applications

## 3.6 RADIO FREQUENCY IDENTIFICATION (RFID)

RFID technology is a major breakthrough in the embedded communication paradigm which enables design of microchips for wireless data communication. They help in the automatic identification of anything they are attached to acting as an electronic barcode. The passive RFID tags are not battery powered and they use the power of the reader's interrogation

signal to communicate the ID to the RFID reader. This has resulted in many applications particularly in retail and supply chain management. The applications can be found in transportation (replacement of tickets, registration stickers) and access control applications as well. The passive tags are currently being used in many bank cards and road toll tags which are among the first global deployments. Active RFID readers have their own battery supply and can instantiate the communication. Of the several applications, the main application of active RFID tags is in port containers for monitoring cargo.

## 3.7 WIRELESS SENSOR NETWORKS (WSN)

Recent technological advances in low power integrated circuits and wireless communication shave made available efficient, low cost, low power miniature devices for use in remote sensing applications. The combination of these factors has improved the viability of utilizing a sensor network consisting of a large number of intelligent sensors, enabling the collection, processing, analysis and dissemination of valuable information, gathered in a variety of environments. Active RFID is nearly the same as the lower end WSN nodes with limited processing capability and storage. The scientific challenges that must be overcome in order to realize the enormous potential of WSNs are substantial and multi disciplinary in nature. Sensor data are shared among sensor nodes and sent to a distributed or centralized system for analytics. The components that make up the WSN monitoring network include:

a) WSN hardware—Typically a node (WSN core hardware) contains sensor interfaces, processing units, transceiver units and power supply. Almost always, they comprise of multiple A/D converters for sensor interfacing and more modern sensor nodes have the ability

to communicate using one frequency band making them more versatile.

b) WSN communication stack—The nodes are expected to be deployed in an ad-hoc manner for most applications. Designing an appropriate topology, routing and MAC layer is critical for the scalability and longevity of the deployed network. Nodes in a WSN need to communicate among themselves to transmit data in single or multi-hop to a base station. Node drop outs, and consequent degraded network lifetimes, are frequent.

c) WSN Middle ware—A mechanism to combine cyber infrastructure with a Service Oriented Architecture (SOA) and sensor networks to provide access to heterogeneous sensor resources in a deployment independent manner. This is based on the idea of isolating resources that can be used by several applications. A platform-independent middleware for developing sensor applications is required, such as an Open Sensor Web Architecture.

d) Secure Data aggregation—An efficient and secure data aggregation method is required for extending the lifetime of the network as well as ensuring reliable data collected from sensors. Node failures are a common characteristic of WSNs, the network topology should have the capability to heal itself. Ensuring security is critical as the system is automatically linked to actuators and protecting the systems from intruders becomes very important.

## 3.8 APPLICATIONS:

There are several application domains which will be impacted by the emerging Internet of Things. The applications can be classified based on the type of network availability, coverage, scale, heterogeneity, repeatability, user involvement and impact.

We categorize the applications into four application domains:

1) Personal and Home
2) Enter prize
3) Utilities
4) Mobile.

There is a huge crossover in applications and the use of data between domains. For instance, the Personal and Home IOT produces electricity usage data in the house and makes it available to the electricity (utility) company which can in turn optimize the supply and demand in the Utility IOT. The internet enables sharing of data between different service providers in a seamless manner creating multiple business opportunities.

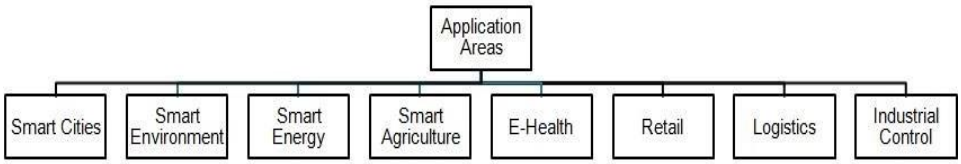



**Fig3.8:**Flow chart

## PERSONAL AND HOME

The sensor information collected is used only by the individuals who directly own the network. Usually, Wi-Fi is used as the backbone enabling higher band width data (video) transfer as well as higher sampling rates (Sound).Ubiquitous healthcare has been envisioned for the past two decades. IOT gives a perfect platform to realize this vision using body area sensors and IOT back end to upload the data to servers. For instance, a Smart phone can be used for communication along with several interfaces like Bluetooth for interfacing sensors measuring physiological parameters. So far, there are several applications available for Apple iOS, Google Android and Windows Phone operating systems that measure various parameters. However, it is yet to be centralized in the cloud for general physicians to access the same.

An extension of the personal body area network is creating a home monitoring system for elderly care, which allows the doctor to monitor patients and the elderly in their homes thereby reducing hospitalization costs through early intervention and treatment.Control of home equipment such as air conditioners, refrigerators, washing machines etc., will allow better home and energy management. This will see consumers become involved in the IOT revolution in the same manner as the Internet revolution itself.Social networking is set to undergo another transformation with billions of inter connected objects. An interesting development will be using a Twitter like concept where individual 'Things' in the house can periodically tweet the readings which can be easily followed from anywhere creating a Tweetot. Although this provides a common framework using cloud for information access, a new security paradigm will be required for this to be fully realized.

## ENTERPRISE

We refer to the 'Network of Things' within a work environment as an enter prize- based application. Information collected from such networks are used only by the owners and the data may be released selectively. Environmental monitoring is the first common application which is implemented to keep track of the number of occupants and manage the utilities within the building (e.g., HVAC, lighting).

Sensors have always been an integral part of the factory setup for security, automation, climate control, etc. This will eventually be replaced bya wireless system giving the flexibility to make changes to the setup whenever required. This is nothing but an IoT subnet dedicated to factory maintenance.One of the major IOT application areas that is already drawing attention is Smart Environment IOT. There are several test beds being implemented and many more planned in the coming years. Smart environment includes subsystems and the characteristics from a technological

perspective.

These applications are grouped according to their impact areas. This includes the effect on citizens considering health and well-being issues; transport in light of its impact on mobility, productivity, pollution; and services in terms of critical community services managed and provided by local government to city inhabitants.


**Fig3.8:**IOT Sub net

## Utilities

The information from the networks in this application domain is usually for service optimization rather than consumer consumption. It is already being used by utility companies (smart meter by electricity supply companies) for resource management in order to optimize cost vs. profit. These are made up of very extensive networks for monitoring critical utilities and efficient resource management. The backbone network used can vary between cellular, Wi-Fi and satellite communication.

Smart grid and smart metering are another potential IOT application which is being implemented around the world. Efficient energy consumption

can be achieved by continuously monitoring every electricity to modify the way electricity is consumed. This information at the city scale is used for maintaining the load balance within the grid ensuring high quality of service.

Video based IOT, which integrates image processing, computer vision and networking frame works, will help develop a new challenging scientific research area at the intersection of video, infrared, microphone and network technologies. Surveillance, the most widely used camera network applications, helps track targets, identify suspicious activities, detect left luggage and monitor unauthorized access.Water network monitoring and quality assurance of drinking water is another critical application that is being addressed using IOT. Sensors measuring critical water parameters are installed at important locations in order to ensure high supply quality. This avoids accidental contamination among storm water drains, drinking water and sewage disposal. The same network can be extended to monitor irrigation in agricultural land. The network is also extended for monitoring soil parameters which allows informed decision-making concerning agriculture.

## MOBILE:

Smart transportation and smart logistics are placed in a separate domain due to the nature of data sharing and backbone implementation required. Urban traffic is the main contributor to traffic noise pollution and a major contributor to urban air quality degradation and greenhouse gas emissions. Traffic congestion directly imposes significant costs on economic and social activities in most cities. Supply chain efficiencies and productivity, including just-in-time operations, are severely impacted by this congestion causing freight delays and delivery schedule failures. Dynamic traffic information will affect freight movement, allow better planning and improved scheduling. The transport IOT will enable the use of large scale WSNs for online monitoring of travel times, origin– destination (O–D) route choice behavior, queue lengths and air pollutant and noise emissions. The IOT is

likely to replace the traffic information provided by the existing sensor networks of inductive loop vehicle detectors employed at the intersections of existing traffic control systems. They will also underpin the development of scenario-based models for the planning and design of mitigation and alleviation plans, Combined with information gathered from the urban traffic control system, valid and relevant information on traffic conditions can be presented to travelers. The prevalence of Bluetooth technology (BT) devices reflects the current IOT penetration in a number of digital products such as mobile phones, car hands-free sets, navigation systems, etc. BT devices emit signals with a unique Media Access Identification (MAC-ID) number that can be read by BT sensors within the coverage area.

Readers placed at different locations can be used to identify the movement of the devices. Complemented by other data sources such as traffic signals, or bus GPS, research problems that can be addressed include vehicle travel time on motorways and arterial streets, There are many privacy concerns by such usages and digital forgetting is an emerging domain of research in IOT where privacy is a concern. Another important application in mobile IOT domain is efficient logistics management. This includes monitoring the items being transported as well as efficient transportation planning. The monitoring of items is carried out more locally, say, within a truck replicating enter prize domain but transport planning is carried out using a large scale IOT network.

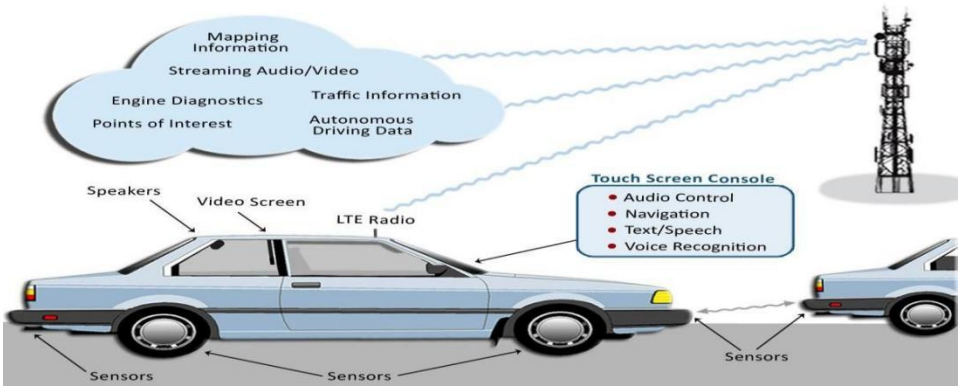



**Fig3.8:**Mapping information

## CLOUD CENTRIC INTERNET OF THINGS

The vision of IOT can be seen from two perspectives— 'Internet' centric and 'Thing' centric. The Internet centric architecture will involve internet services being the main focus while data is contributed by the objects. In the object centric architecture, the smart objects take the center stage.

In order to realize the full potential of cloud computing as well as ubiquitous sensing, a combined frame work with a cloud at the center seems to be most viable. This not only gives the flexibility of dividing associated costs in the most logical manner but is also highly scalable. Sensing service providers can join the network and offer their data using a storage cloud; analytic tool developers can provide their software tools; artificial intelligence experts can provide their data mining and machine learning tools useful in converting information to knowledge and finally computer graphics designers can offer a variety of visualization tools. Cloud computing can offer these services as Infrastructures, Platforms or Software where the full potential of human creativity can be tapped using them as services.

The new IOT application specific frame work should be able to provide support for:

a) Reading data streams either from sensors directly or fetch the data from databases.
b) Easy expression of data analysis logic as functions/operators that process data streams in a transparent and scalable manner on Cloud infrastructures
c) If any events of interest are detected, out comes should be passed to output streams, which are connected to a visualization program. Using such a frame work, the developer of IOT applications will able to harness the power of Cloud computing without knowing low-

level details of creating reliable and scale applications.

## BENEFITS OF INTERNET OF THINGS

- Improved citizen's quality of life

  Health care from anywhere

  Better safety, security and productivity

- New business opportunities

  IOT can be used in every vertical for improving the efficiency

  Creates new businesses, and new and better jobs

- Economic growth

  Billions of dollars in savings and new services

- Better environment

  Saves natural resources and trees

  Helps in creating a smart, greener and sustain able planet

## 3.9INTERNET OF THINGS IN 2016

## SMART WATCHES

Smart watches broke new ground last year, with the popularity of the devices like the pebble and the Galaxy Gear. More mart watches making their way in the market with better and at the feasible prices. With apple's long-anticipated but expected announcement of the IWatch, as the company has been ramping up its sapphire glass production and flexible, wearable watch like patents.Industry Innovators: Pebble, Meta watch, Samsung Galaxy Gear

## THE AUTOMATED HOME

Popular devices like Google's Nest Smart Thermostat and WeMo's electrical outlet controller gained in popularity last year. Since then, numerous home automation IoT technologies have flourished- everything from smart locks to Wi-Fi enabled light bulbs.

Industry Innovators: Nest, Lockitron, Lifx

## FITNESS AND HEALTH TRACKING

Last year, health and fitness devices like Nike Fuel band and Jawbone Up were among the most popular IOT gadgets, making large appearance at CES.

Industry Innovators: Fit bit, Nike, Jawbone

## CONNECTED RETAIL

Traditional retailer store is struggling to keep up with the growing e-commerce. Thanks to the Internet of Things, innovators have started to breathe new life into the retail experience- offering connected point of sale systems, NFC payments solutions and supply chain software's.Industry Innovators: Shop keep, Cisco, Place meter

## VIRTUAL AUGMENTED REALITY

Last year Oculus Rift and Google glass made headline in both the virtual and augmented Reality worlds. Oculus was acquired by Face book for $2.3 Billion earlier this year and Google glass recently rolled out a one-day sale of its "Explorer Edition".

Industry Innovators: Oculus, Google Glass, Sony

## 3.10 CLOUD COMPUTING

Integrated IOT and Cloud computing applications enabling the creation of smart environments such as Smart Cities need to be able to:

a) Combine services offered by multiple stake holders
b) Scale to support a large number of users in a reliable and decentralized manner.

They need to be able operate in both wired and wireless network

The Cloud application platforms need to be enhanced to support:

a) The rapid creation of applications by providing domain specific programming tools and environments.
b) Seamless execution of applications harnessing capabilities of multiple dynamic and heterogeneous resources to meet quality of service requirements of diverse users

# CHAPTER 4

## HARDWARE IMPLEMENTATION

# HARDWARE IMPLEMENTATION

## HARDWARE COMPONENTS ARE

- Power Supply
- Node MCU ESP32
- ESP32 Cam
- Telegram Bot
- Servo Motor
- LCD
- Buzzer

## 4.1 POWER SUPPLY

In this project we have power supplies with +5V & -5V option normally +5V is enough for total circuit. Another (-5V) supply is used in case of OP amp circuit.

Transformer primary side has 230/50HZ AC voltage whereas at the secondary winding the voltage is step downed to 12/50 Hz and this voltage is rectified using two full wave rectifiers the rectified output is given to a filter circuit to fitter the unwanted ac in the signal. After that the output is again applied to a regulator LM7805 (toprovide+5v) regulator. WhereasLM7905 is for providing –5Vregulation. Z (+12V circuit is used for stepper motors, Fan and Relay by using LM7812 regulator same process like above supplies).

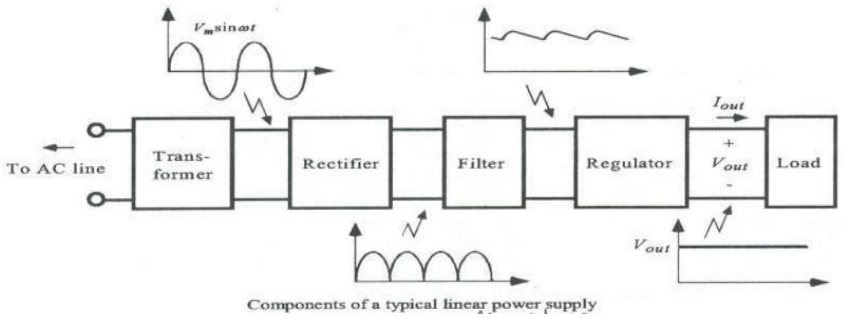



**Fig 4.1 RPS**

## TRANSFORMER

Transformers are used to convert electricity from one voltage to another with minimal loss of power. They only work with AC (alternating current) because they require a changing magnetic field to be created in their core. Transformers can increase voltage (step-up) as well as reduce voltage (step-down).

Alternating current flowing in the primary (input) coil creates a continually changing magnetic field in them on core. This field also passes through the secondary (output) coil and the changing strength of the magnetic field induces an alternating voltage in the secondary coil. The correct term for the induced voltage is ‘induced electromotive force’ which is usually abbreviated to induced e.m.f.

## RECTIFIERS

The purpose of a rectifier is to convert an AC wave form into a DC wave form(OR) Rectifier converts AC current or voltages into DC current or voltage. There are two different rectification circuits, known as 'half-wave' and 'full-wave' rectifiers. Both use components called diodes to convert into DC.

## FILTERS

A filter circuit is a device which removes the ac component of rectifier output but allows the dc component to the load. The most commonly used filter circuits are capacitor filter, choke input filter and capacitor input filter or pi-filter. We used capacitor filter here.

The capacitor filter circuit is extremely popular because of its low cost, small size, little weight and good characteristics. For small load currents this type of filter is preferred. It is commonly used in transistor radio battery eliminators.

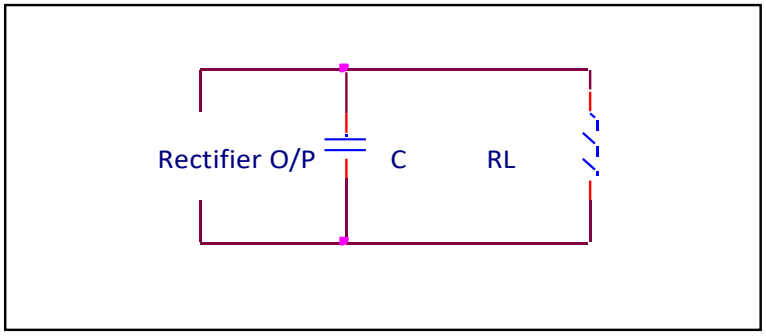



**Fig 4.1:** Capacitor

## 4.2 NODE MCU ESP32

The NodeMCU ESP32 board (in some cases also known as ESP32-DevkitC) is fully supported by ESP Home. Simply select ESP32 when the ESP Home wizard asks you for your platform and **Nodemcu-32s** as the board type.

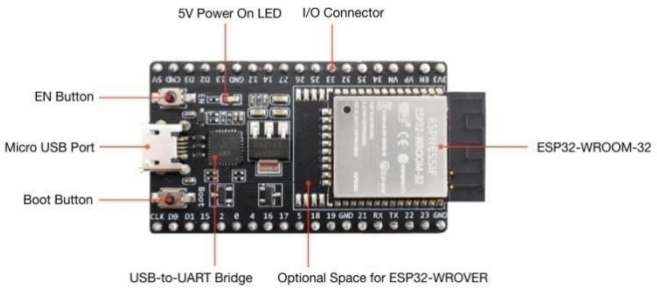



**Fig4.2:** NodeMCU ESP32

**PINOUT**

The ESP32 chip comes with 48 pins with multiple functions. Not all pins are exposed in all ESP32 development boards, and some pins cannot be used.

There are many questions on how to use the ESP32 GPIOs. What pins should you use? What pins should you avoid using in your projects? This post aims to be a simple and easy-to-follow reference guide for the ESP32 GPIOs.

The figure below illustrates the ESP-WROOM-32 pinout. You can use it as a reference if you're using an **ESP32 bare chip** to build a custom board:

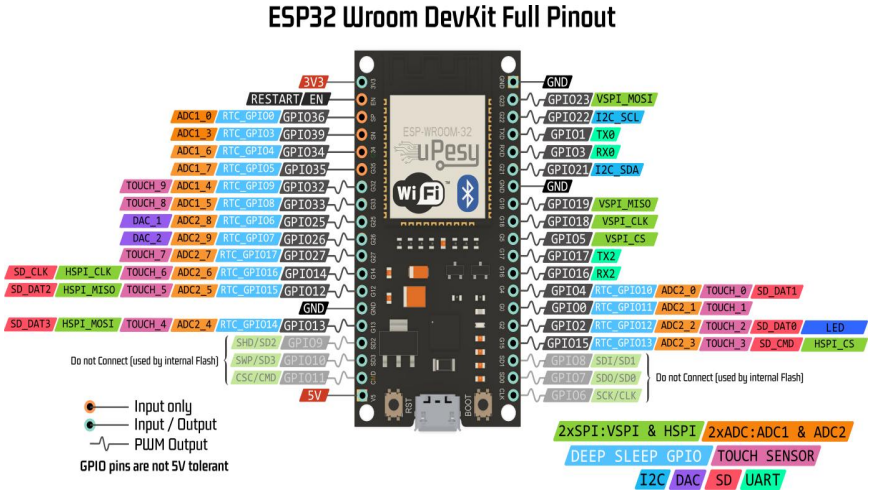


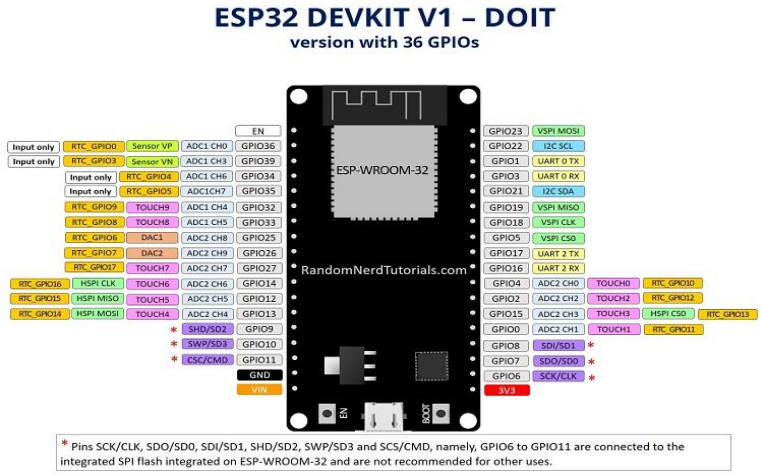

**Fig4.2:** NodeMCU ESP32 Pinout

**The ESP32 peripherals include:**

- 18 Analog-to-Digital Converter (ADC) channels
- 3 SPI interfaces
- 3 UART interfaces
- 2 I2C interfaces
- 16 PWM output channels
- 2 Digital-to-Analog Converters (DAC)
- 2 I2S interfaces
- 10 Capacitive sensing GPIOs

The ADC (analog to digital converter) and DAC (digital to analog converter) features are assigned to specific static pins. However, you can decide which pins are UART, I2C, SPI, PWM, etc – you just need to assign them in the code. This is possible due to the ESP32 chip's multiplexing feature.

Although you can define the pins properties on the software, there are pins assigned by default as shown in the following figure (this is an example for the ESP32 DEVKIT V1 DOIT board with 36 pins – the pin location can change depending on the manufacturer).



Additionally, there are pins with specific features that make them suitable or not for a particular project. The following table shows what pins are best to use as inputs, outputs and which ones you need to be cautious.

The pins highlighted in green are OK to use. The ones highlighted in yellow are OK to use, but you need to pay attention because they may have an unexpected behaviour mainly at boot. The pins highlighted in red are not recommended to use as inputs or outputs.

### INPUT ONLY PINS

GPIOs 34 to 39 are GPIs – input only pins. These pins don't have internal pull-up or pull-down resistors. They can't be used as outputs, so use these pins only as inputs:

- GPIO 34
- GPIO 35
- GPIO 36
- GPIO 39

### SPI FLASH INTEGRATED ON THE ESP-WROOM-32

GPIO 6 to GPIO 11 are exposed in some ESP32 development boards. However, these pins are connected to the integrated SPI flash on the ESP-WROOM-32 chip and are not recommended for other uses. So, don't use these pins in your projects:

- GPIO 6 (SCK/CLK)
- GPIO 7 (SDO/SD0)
- GPIO 8 (SDI/SD1)
- GPIO 9 (SHD/SD2)

- GPIO 10 (SWP/SD3)
- GPIO 11 (CSC/CMD)

**CAPACITIVE TOUCH GPIOS**

The ESP32 has 10 internal capacitive touch sensors. These can sense variations in anything that holds an electrical charge, like the human skin. So they can detect variations induced when touching the GPIOs with a finger. These pins can be easily integrated into capacitive pads and replace mechanical buttons. The capacitive touch pins can also be used to wake up the ESP32 from deep sleep.

Those internal touch sensors are connected to these GPIOs:

- T0 (GPIO 4)
- T1 (GPIO 0)
- T2 (GPIO 2)
- T3 (GPIO 15)
- T4 (GPIO 13)
- T5 (GPIO 12)
- T6 (GPIO 14)
- T7 (GPIO 27)
- T8 (GPIO 33)
- T9 (GPIO 32)

## 4.3 SOIL MOISTURE SENSOR

The soil moisture sensor or the hygrometer is usually used to detect the humidity of the soil. So, it is perfect to build an automatic watering system or to monitor the soil moisture of your plants. The sensor is set up by two pieces:

the electronic board and the sensor probe with two pads, that detects the water content.

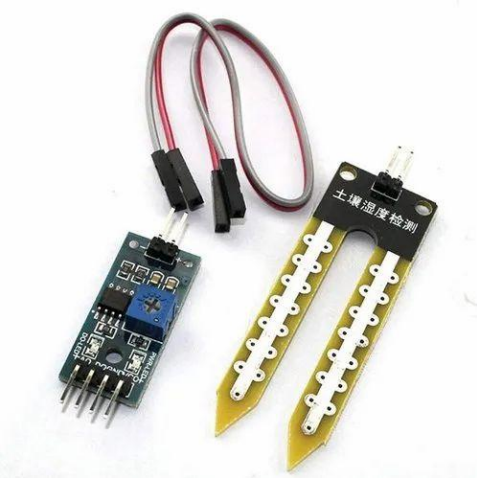



**Fig4.3:**Soil Moisture Sensor

## Description

- Interface: 4-Wire.
- Operating Voltage: 3.3V~5Vdc.
- Output: Digital and Analogue.
- Cable Length: ~21cm.
- Panel PCB Dimension: 3cm x 1.5cm.
- Soil Probe Dimension: 6cm x 3cm

### FEATURES

- High accuray sensor
- Fast response sensor
- Simple soil insertion (vertical and Horizontal orientation)
- Progammable start time and data
- Miniature Size

- Weather proof enclosure
- User caibration through MadgeTech Software
- Probe is powered from data recored's battery. No external power required.

## 4.4 TEMPERATURE AND HUMIDITY SENSOR

DHT11 Temperature & Humidity Sensor features a temperature & humidity sensor with calibrated digital output. By using the exclusive digital-signal-acquisition technique and temperature & humidity sensing technology, it ensures high reliability and excellent longterm stability. This sensor includes a resistive-type humidity measurement component and an NTC temperature measurement component with 8-bit microcontroller, offering excellent quality, fast response, anti-interference ability and cost-effectiveness.

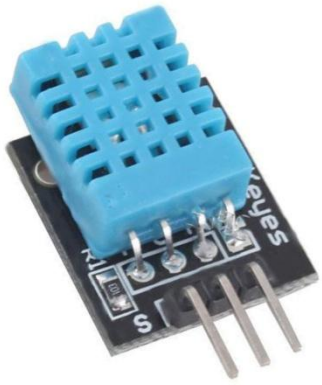


**Fig4.4:** DTH11 Sensor

**BRIEF DATA**

- Operating voltage: 3.5~5.5V.
- Humidity Range: 20~90% ± 5%.
- Humidity Resolution: 1%.
- Temperature Range: 0~50℃ ± 1℃.
- Temperature Resolution: 1℃.

- Operating Current: 3mA (Max).
- Standby: 0.15mA.
- Sampling Period: 1s.
- Mounting Hole: M3.
- 2.54mm breadboard friendly header pin connector.

**OPERATING SPECIFICATIONS**

1. **Power and Pins**

   Power's voltage should be 3-5.5V DC. When power is supplied to sensor, don't send any Instruction to the sensor within one second to pass unstable status. One capacitor valued 100nF Can be added between VDD and GND for power filtering.

2. **Communication and signal**

   Single-bus data is used for communication between MCU and DHT11.

## 4.5 RELAY

The relay is the device that opens or closes the contacts to cause the operation of the other electric control. It detects the intolerable or undesirable condition with an assigned area and gives the commands to the circuit breaker to disconnect the affected area. Thus protects the system from damage.


**Fig 4.5:**Relay

## ADVANTAGES OF RELAY

- Static Relay burden is less than Electromagnetic type of relays. Hence error is less.
- Low Weight
- Required Less Space which results in panel space saving.
- Arc less switching.
- No acoustical noise.
- Multi-function integration.
- Fast response.
- Long life (High Reliability): more than 109 operations
- High Range of Setting compared to electromechanical Relay
- More Accurate compared to electromechanical Relay
- Low Electromagnetic Interference.
- Less power consumption.
- Shock and vibration resistant
- No contact bounces.

## 4.6 WATER PUMP

Micro dc 3-6v micro submersible pump mini water pump for fountain garden mini water circulation system diy project dc 3v to 6v submersible pump micro mini submersible water pump 3v to 6vdc water pump for diy dc pump for hobby kit mini submersible pump motor this is a low cost, small size submersible pump motor which can be operated from a 2.5 ~ 6V power supply. It can take up to 120 litres per hour with very low current consumption of 220ma. Just connect tube pipe to the motor outlet, submerge it in water and power it. Make sure that the water level is always higher than

the motor. The dry run may damage the motor due to heating and it will also produce noise.

**Fig 4.6:** DC Water Pump

## FEATURES:

- Voltage: 2.5-6V
- Maximum lift: 40-110cm / 15.75"-43.4"
- Flow rate: 80-120L/H
- Outside diameter: 7.5mm / 0.3"
- Inside diameter: 5mm / 0.2"
- Diameter: Approx. 24mm / 0.95"
- Length: Approx. 45mm / 1.8"
- Height: Approx. 30mm / 1.2"
- Material: Engineering plastic
- Driving mode: DC design, magnetic driving

## APPLICATIONS:

- Controlled fountain water flow.

- Controlled Garden watering systems.
- Hydroponic Systems.
- Fresh water intake or exhaust systems for fish aquarium

## 4.7 LCD (LIQUID CRYSTAL DISPLAY):

LCD (liquid crystal display) is the technology used for displays in notebook and other smaller computers. Like light-emitting diode (LED) and gas-plasma technologies, LCDs allow displays to be much thinner than cathode ray tube (CRT) technology. LCDs consume much less power than LED and gas-display displays because they work on the principle of blocking light rather than emitting it.


**Fig 4.7:** LCD

**FEATURES**

- E-blocks compatible
- Low cost
- Compatible with most I/O ports in the E-Block range (requires 5 I/O lines via 9-way D-type connector)
- Ease to develop programming code using Flow code icons

## Fundamentals of Liquid Crystal Displays

The term liquid crystal is used to describe a substance in a state between liquid and solid but which exhibits the properties of both. Molecules in liquid crystals tend to arrange themselves until they all point in the same specific direction. This arrangement of molecules enables the medium to flow as a liquid. Depending on the temperature and particular nature of a substance, liquid crystals can exist in one of several distinct phases. Liquid crystals in a nematic phase, in which there is no spatial ordering of the molecules, for example, are used in LCD technology.

One important feature of liquid crystals is the fact that an electrical current affects them. A particular sort of nematic liquid crystal, called twisted nematics (TN), is naturally twisted. Applying an electric current to these liquid crystals will untwist them to varying degrees, depending on the current's voltage. LCDs use these liquid crystals because they react predictably to electric current in such a way as to control the passage of light.

The working of a simple LCD is shown in Figure 1. It has a mirror (A) in back, which makes it reflective. There is a piece of glass (B) with a polarizing film on the bottom side, and a common electrode plane (C) made of indium-tin oxide on top. A common electrode plane covers the entire area of the LCD. Above that is the layer of liquid crystal substance (D). Next comes another piece of glass (E) with an electrode in the shape of the rectangle on the bottom and, on top, another polarizing film (F), at a right angle to the first one.

# CHAPTER 5

## SOFTWARE IMPLEMENTATION

# SOFTWARE IMPLEMENTATION

## 5.1 ARDUINO SOFTWARE

### PROGRAMMING

Step1: Installing the Firmware


**Fig5.1**:Desktop window

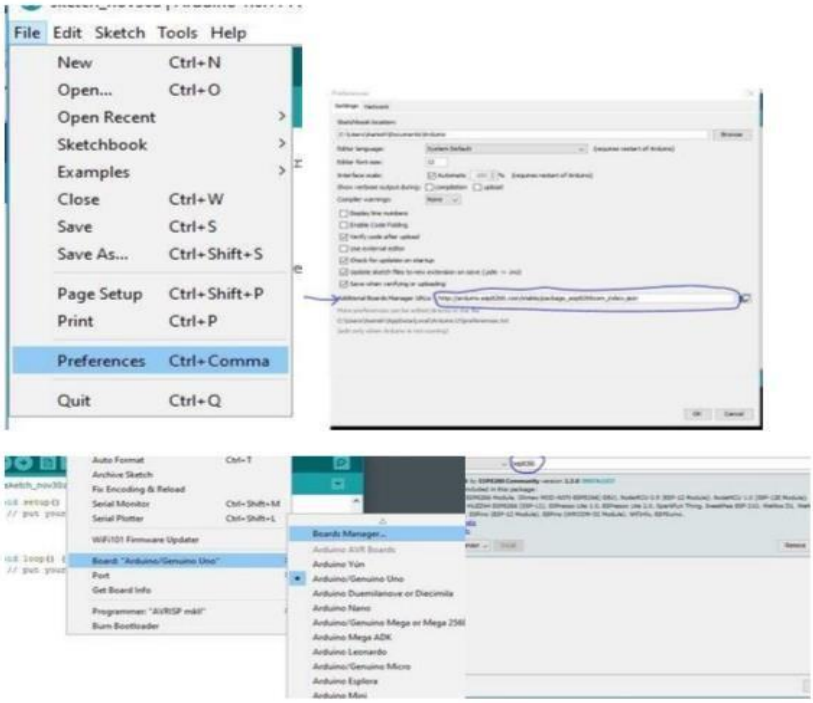
In Node MCU Boards the first thing you need is to install the Firmware to the board the following method works for all Node MCU Boards

1. Open the Node MCU flasher master folder than open the win32/win64 folder as your computer. Now open the folder Release than double click ESP8266Flasher.

2. Select the Comport.

3. Go to configure tab.
4. Click on the small gear and open up the firmware which you have downloaded.
5. Go to the advanced tab and select the desired Baud rate.
6. Go to the Operation tab and click on Flash Button. Add Tip Ask Question Comment Download

Step2: Preparing the Arduino IDE




After installing the firmware, you are ready to do the programming with the ESP8266

1. Install the Arduino IDE
2. Open the Arduino IDE from the desktop icon
3. Click on File tab and then open preferences
4. In the additional Boards Manager URLs add the following link (http://arduino.esp8266.com/stable/package_esp8266com_index.json) and

click OK

1. GotoTools>Borads>BoardsManager

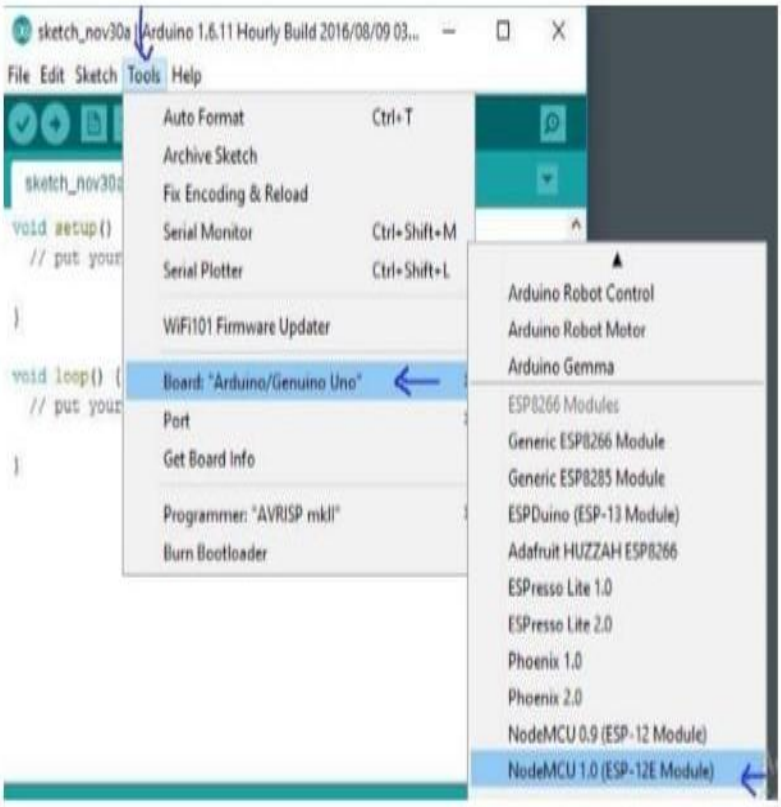
2. Inthe search field type esp8266 click the esp8266 byESP8266 Community option and click Install

Step3: Code...

Now we can do whatever you want with your Node MCU board Following is an example for led blinking with Node MCU board via web server

- In arduino IDE go to tools>Boards>select NODE MCU 1.0 (ESP-12E Module)
- Again, go to tools and select port.
- Change the Wi-Fi name and password from the following code.
- Now click on Upload button to upload the following code.
- Connect the led's positive leg on D9 pin of board and negative to the ground of the code.
- Power up the board and open the serial monitor from arduino IDE
- After connecting to the Wi-Fi, it will show you the IP address.
- Type that IP address on the web browser (Edge, Chrome, Firefox etc.,)

- A webpage will open you can change the status of LED by turning it ON or OFF.

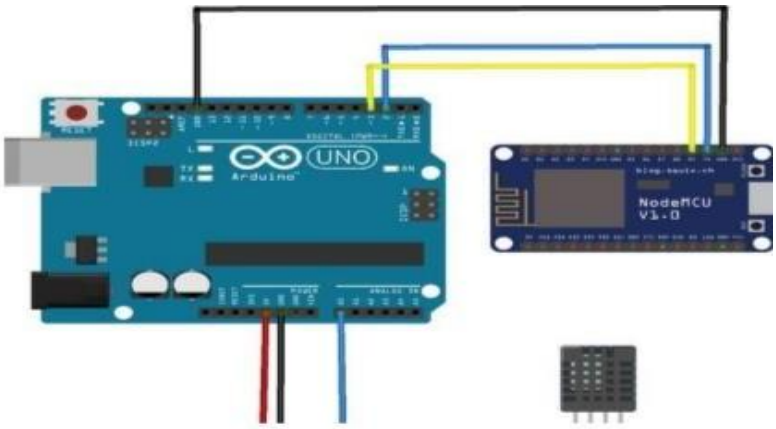



**COPY, PASTE AND UPLOAD THE TUTORIAL SKETCH**

The sketch is one that comes as an example from ESP8266.COM.

```
#include "ESP8266WiFi.h"

void setup() {
  Serial.begin(115200);
  // Set WiFi to station mode and disconnect from an AP if it was
previously connected
  WiFi.mode(WIFI_STA);
  WiFi.disconnect();
  delay(2000);
  Serial.println("Setup done");
}

void loop() {
  Serial.println("scan start");


  int n = WiFi.scanNetworks();// WiFi.scanNetworks will return the
number of networks found
  Serial.println("scan done");
  if (n == 0)
    Serial.println("no networks found");
  else
  {
    Serial.print(n);
    Serial.println(" networks found");
    for (int i = 0; i < n; ++i)
    {
      // Print SSID and RSSI for each network found
```

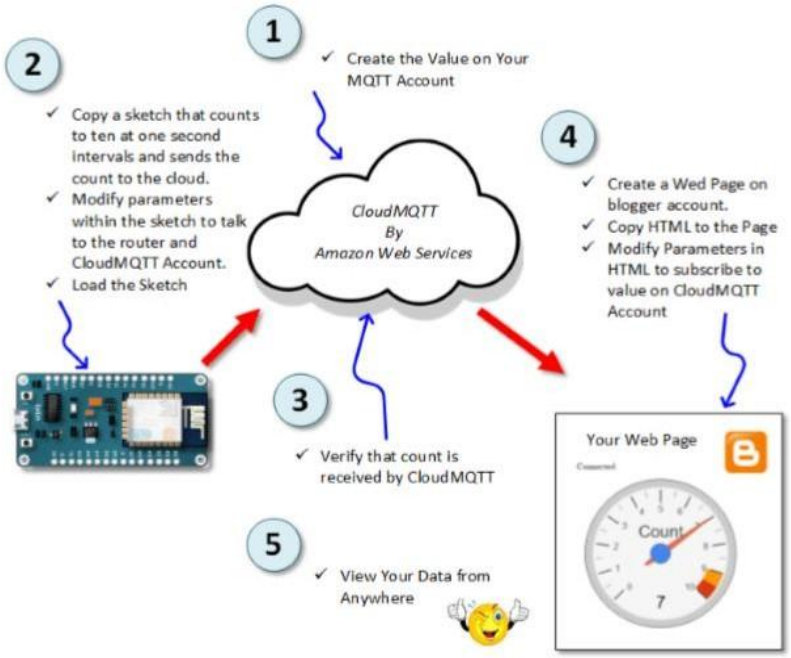
```
      Serial.print(i + 1);
      Serial.print(": ");
      Serial.print(WiFi.SSID(i));
      Serial.print(" (");
      Serial.print(WiFi.RSSI(i));
      Serial.print(")");
      Serial.println((WiFi.encryptionType(i) == ENC_TYPE_NONE)?" ":
"*");
      delay(10);
    }
  }
  Serial.println("");

  // Wait a bit before scanning again
  delay(5000);
}
```




**Serial Communication between Node MCU and Arduino**

## PROJECTS AND APPLICATIONS

Node MCU V3 is mainly used in the Wi-Fi Applications which mostof the other embedded modules fail to process unless incorporated with some externalWi-Fiprotocol. Followingaresome major applications used for Node MCU V3.




- Internet Smoked Alarm

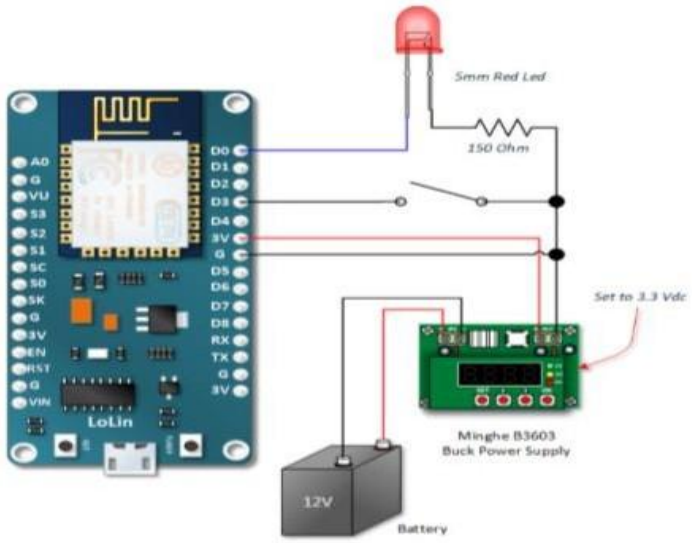
- VR Tracker
- Octopod
- Serial Port Monitor
- ESP Lamp
- Incubator Controller
- IoT home automation
- Security Alarms

## Application Example:

Node MCU ESP-12E Arduino IDE Digital Input Tutorial

## CONNECT THE CIRCUIT

You may wish to power your Node MCU another way. You can read about it HERE.



## COPY, PASTE AND UPLOAD THE CODE

The code is real simple works as follows:

The input is read from switch pin. If switch is closed, it will read a low.

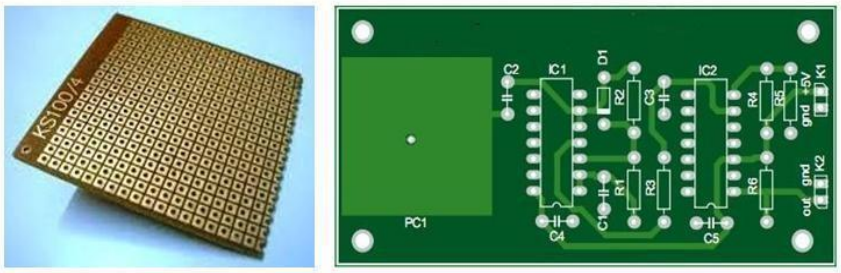
The LED output pin is set to the opposite of the switch pin. If the switch is closed, the output pin will be set to a high. A high will turn on the LED.

```
int switchPin = 0;
int LedPin = 16;
int switchValue;

void setup() {
  pinMode(LedPin, OUTPUT);
  pinMode(switchPin, INPUT_PULLUP);
}

void loop() {
  // Read the switch value
  switchValue = digitalRead(switchPin);
  /* Set the LED output pin the opposit of what is read on the sw
itch
   * input pin
   */
  digitalWrite(LedPin, !switchValue);

}
```

## 5.2 PROTEUS

## INTRODUCTION:

Generally, we are listening the words PCB's, PCB layout, PCB designing, etc. But What is PCB? Why we are using this PCB? We want to know about all these things as an electronic engineer. PCB means Printed Circuit Board. This is a circuit board with printed copper layout connections. These PCBs are two types. One is dotted PCB and another one is layout PCB. The two examples are shown in below.




Dotted PCB Layout PCB

**Fig 5.2:**Dotted PCB and Layout PCB

**What is the main difference between the dotted PCB and layout PCB?**

In dotted PCB board only, dots are available. According to our requirement we can place or insert the components in those holes and attach the components with wires and soldering lid. In this dotted PCB we can make the circuit as out wish but it is very hard to design. There are so many difficulties are there. Those are connecting the proper pins, avoiding shot connections and etc. Coming to the layout PCB this is simple to design. First, we select the our circuit and by using different PCB designing software's, design the layout of the circuit and by itching process preparing the copper layout of our circuit and solder the components in the correct places. It is simple to design, take less time to design, no shortages, looking nice and perfect.

Up to now we have discussed about types of PCB's and difference between the types. Now we can discuss about PCB designing software. There are so many PCB designing software's available. Some are Express PCB, eagle PCB, PCB Elegance, free PCB, open circuit design, zenith PCB and Proteus etc. Apart from remaining Proteus is different. Proteus is design suit and PCB layout designing software. In Proteus we can design any circuit and simulate the circuit and make PCB layout for that circuit.

## Introduction to Proteus:

Proteus professional is a software combination of ISIS schematic capture program and ARES PCB layout program. This is a powerful and integrated development environment. Tools in this suit are very easy to use and these tools are very useful in education and professional PCBd esigning.

As professional PCB designing software with integrated space-based auto router, it the curser at the component pin end then draw the connections with that pen symbol. Connect all the components according to circuit then that designed circuit is show in below image.

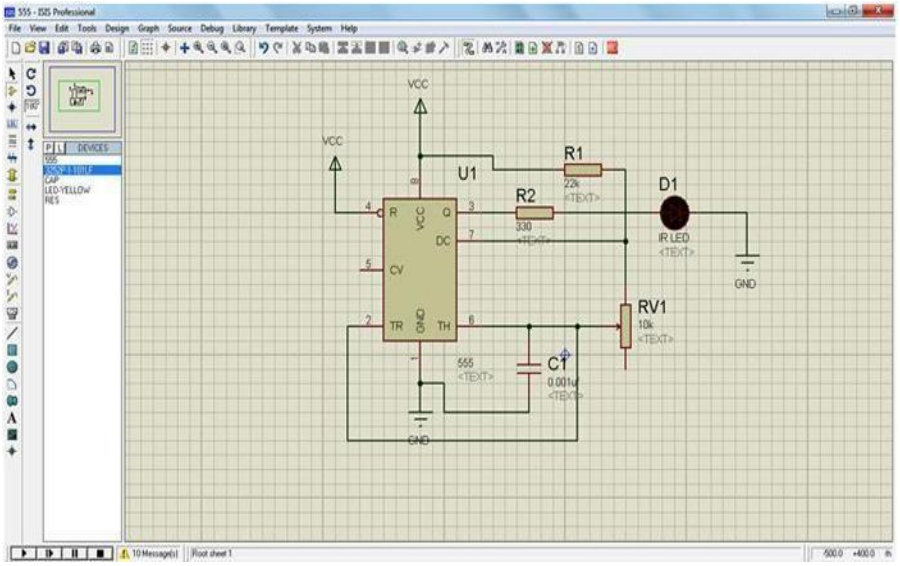
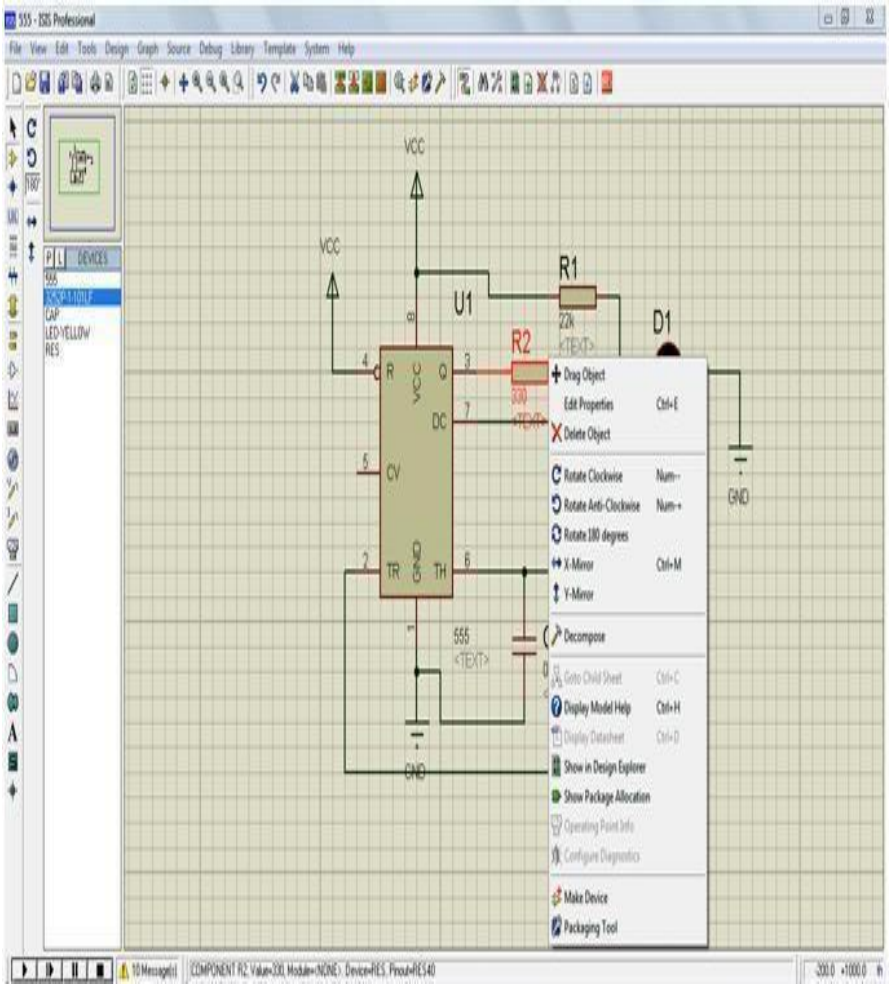



Fig5.2:Design of PCB layout

If any modifications want to do to the component place the mouse point and click on right button then option window will open. That is shown in below figure.

After completion of designing save with some mane and debug it. This is virtual simulation means without making circuit we can see the result in virtually through this software and we can **design the PCB layout** to our required circuit with this software.


555 - ISIS Professional
File View Edit Tools Design Graph Source Debug Library Template System Help
VCC
VCC
R1
22k
<TEXT>
U1
R2
D1
GND
555
<TEXT>
GND
Drag Object
Edit Properties Ctrl+E
Delete Object
Rotate Clockwise Num--
Rotate Anti-Clockwise Num-+
Rotate 180 degrees
X-Mirror Ctrl+M
Y-Mirror
Decompose
Goto Child Sheet Ctrl+C
Display Model Help Ctrl+H
Display Datasheet Ctrl+D
Show in Design Explorer
Show Package Allocation
Operating Point Info
Configure Diagnostics
Make Device
Packaging Tool

# CHAPTER 6
## RESULT AND DISCUSSION

# RESULT AND DISCUSSION

## 6.1 RESULT

We have successfully created and installed a smart irrigation system using Internet of Things.This automates the irrigation based on the soil moisture values, using an intelligent system. This saves a lot of time, requires less manpower and easy installation. The sensor values can be remotely monitored. All the components to make this research are low cost so a poor farmer can also set up this in their fields or gardens. Once the system is installed successfully no maintenance is required.

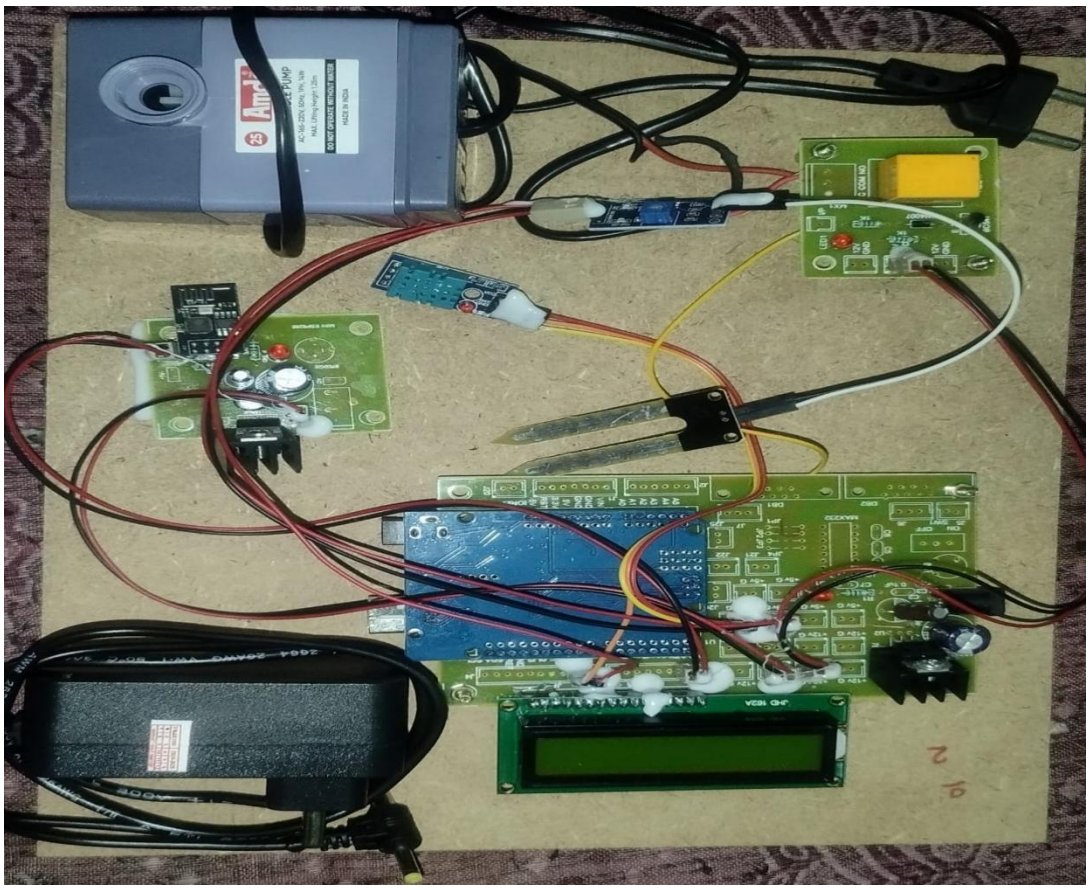


**Fig6.1:**Smart irrigation kit

## 6.2 OPERATION OF THE KIT

### 1. Sensors Collect Data:

- Soil Moisture Sensor (visible in the center): Measures the moisture content of the soil.
- DHT11 Sensor (small blue sensor): Measures temperature and humidity of the surrounding environment.

### 2. Microcontroller Processes Data:

- An Arduino Uno (or compatible board under the shield) is used to read data from the sensors.
- The sensor data is processed and compared with threshold values for soil moisture.

### 3. Decision Making:

- If the soil is dry (below the threshold moisture level), the system turns ON the water pump.
- If the soil moisture is sufficient, the pump remains OFF.

### 4. Relay Module:

- The relay module acts as a switch to control the AC-powered water pump based on the microcontroller's decision.

### 5. Water Pump Activation:

- Once activated via the relay, the water pump starts irrigating the soil.

### 6. Display Module:

- The 16x2 LCD display shows real-time data like temperature, humidity, and soil moisture status.

### 7. Power Supply:

- The system uses an adapter for the microcontroller and sensors, and a separate power supply for the water pump.

### 8. IoT Functionality (Optional in setup):

- If Wi-Fi module like ESP8266 is integrated (not clearly visible in the image), sensor data can be uploaded to a cloud platform like Blynk or ThingSpeak for remote monitoring and control.

## Optional Enhancements:

- Mobile app integration for manual pump control or notifications.
- Scheduling based on weather forecasts.

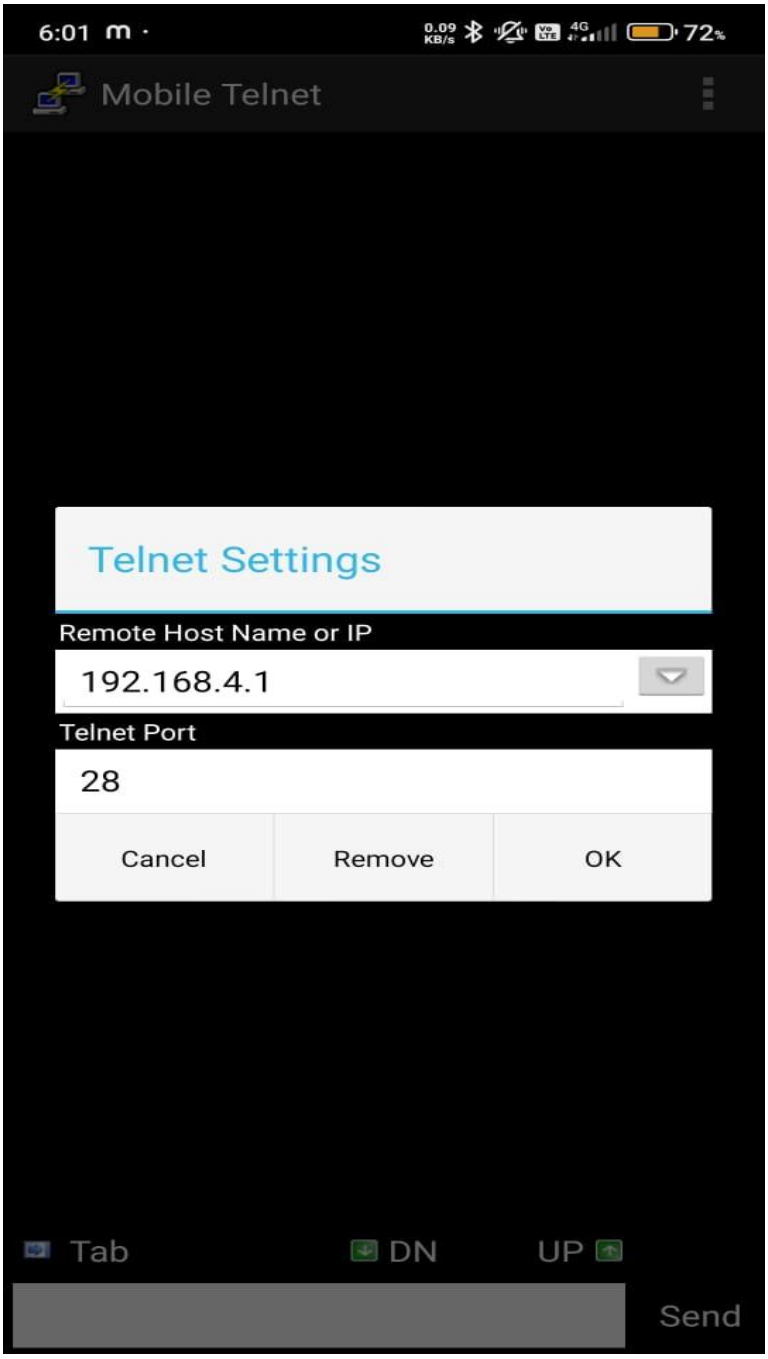



**Fig 6.2:**Mobile telnet app

.

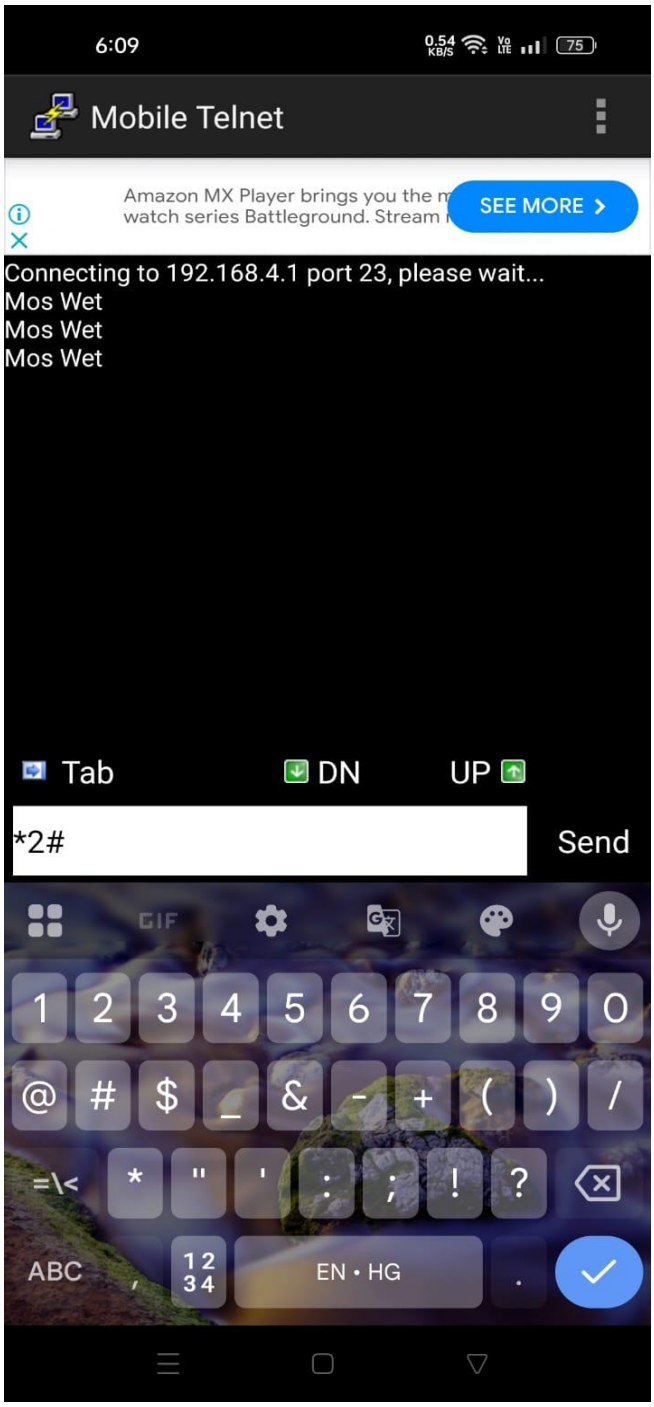



**Fig 6.2:** Mobile dashboard.

## 6.3 MOBILE TELNET

Telnet (TELecommunication NETwork) is a network protocol used to provide a command-

line interface for communication with a remote device or server over TCP/IP.

## In Your Smart Irrigation Project:

### Client Side (Mobile App):

- Sends simple string commands like:
- ON → start water pump
- OFF → stop water pump
- STATUS → return soil moisture data

### Server Side (IoT Device):

- Listens on port 23
- Accepts incoming TCP connections
- Parses incoming ASCII commands
- Responds via same socket

# CHAPTER 7

## ADVANTAGES AND APPLICATIONS

# ADVANTAGES AND APPLICATIONS

## 7.1 ADVANTAGES

**Precision Irrigation:**

- Sensors embedded in the soil collect real-time data on moisture levels, allowing for targeted irrigation delivery only where and when needed, minimizing water waste.

**Optimized Crop Yield:**

- By precisely managing water supply according to specific crop requirements at different growth stages, farmers can maximize crop yields.

**Water Conservation:**

- Automated systems can significantly reduce water usage by preventing over watering and adapting to changing weather conditions.

**Real-time Monitoring:**

- IoT sensors provide continuous updates on soil moisture, temperature, and other crucial parameters, enabling proactive management.

**Early Problem Detection:**

- Machine learning algorithms can analyze sensor data to identify potential issues like nutrient deficiencies, pests, or diseases early on, allowing for timely intervention.

**Automated Decision Making:**

- Based on real-time data and predictive analytics, the system automatically adjusts irrigation schedules to meet the evolving needs of the crops.

## 7.2 APPLICATIONS

### 1. Agriculture

- Precision Farming: Delivers the right amount of water based on real-time soil and weather data, improving crop yield.
- Water Conservation: Minimizes over watering and under-watering.
- Crop Health Monitoring: Maintains optimal soil moisture, reducing the risk of disease due to water stress.

### 2. Horticulture & Greenhouses

- Controlled Environment Agriculture (CEA): Automates watering schedules based on plant needs.
- Microclimate Monitoring: Uses IoT sensors to adjust irrigation according to humidity and temperature inside greenhouses.

### 3. Urban & Smart Cities

- Smart Lawns and Parks: Automates irrigation in public green spaces using weather and soil data.
- Rooftop Gardens & Vertical Farming: Maintains consistent moisture levels in space-constrained urban environments.

### 4. Remote and Rural Farming

- Remote Monitoring: Allows farmers to check and control irrigation systems from their smartphones or computers.
- Labor Reduction: Minimizes the need for manual irrigation, ideal for farms with limited workforce.

## 5. Commercial Landscapes

- Golf Courses, Hotels, and Resorts: Ensures lush, green landscapes while saving on water bills.
- Corporate Campuses: Integrates with building management systems for sustainability goals.

## 6. Government and Environmental Projects

- Watershed Management: Helps monitor and manage water distribution in drought-prone areas.
- Agricultural Subsidy Programs: Governments can use data to support smart farming initiatives.

# CHAPTER 8
# CONCLUSION

# CONCLUSION AND FUTURE SCOPE

The application of agriculture networking technology is need of the fashionable agricultural development, but also an important symbol of the future level of agricultural development; it will be the future direction of agricultural development. After building the agricultural water irrigation system hardware and analyzing and researching the network hierarchy features, functionality and therefore the corresponding software architecture of precision agriculture water irrigation systems, actually applying the web of things to the highly effective and safe agricultural production has a significant impact on ensuring the efficient use of water resources also as ensuring the efficiency and stability of the agricultural production.

# CHAPTER 9
# REFERENCE

# REFERENCE


1. M. Priyanka et al. IOT Based Smart Irrigation system,Jurnal of Engineering Sciences, Vol 14 Issue 04,2023.
2. S. Shobana et al. IOT Based Smart Irrigation System Using Soil Moisture Sensor and NodeMCU, Internatioanl Journal of Computer Science and Information Technology Research Vol 9,Issue 2, April - June 2021.
3. C.K. Gomathy et.al. The Smart Irrigation System Using IOT,International Research Journal of Engineering and Technology,Volume 08 Issue: 10 Oct 2021.
4. Tigist Hilemariam Senbetu, Kishore kumar k, G.M. Karpura Dheepan, "IOT BASED IRRIGATION REMOTE REAL-TIME Engineering (IJITEE), May 2019.
5. Chiyurl Y.; Miyoung H.; Changkyu L. SWAMP: "Implement Smart Farm with IoT Technology". In Proceedings of the International Conference on Advanced Communications Technology (ICACT), Chuncheon-si,Gangwon-do, Korea, 11–14 February 2018.
6. Dr.C K Gomathy, Article: A Web Based Platform Comparison by an Exploratory Experiment Searching For Emergent Platform Properties, IAETSD Journal For Advanced Research In Applied Sciences, Volume 5, Issue 3, P.No-213-220, ISSN NO: 2394-8442,Mar/2018.
7. Dr.C K Gomathy, Article: A Scheme of ADHOC Communication using Mobile Device Networks, International Journal of Emerging technologies and Innovative Research ( JETIR ) Volume 5 | Issue 11 | ISSN : 2349-5162, P.No:320-326, Nov-2018.
8. Gutiérrez, J., & Villa-Medina, J. F. IoT for Agriculture: A Comprehensive Review. Computers and Electronics in Agriculture, 153, 8-2 2018.

9. Gondchawar, N., & Kawitkar, R. S. IoT Based Smart Agriculture. International Journal of Advanced Research in Computer and Communication Engineering, 5(6), 101- 105 2016.
10. Gayatri, M. K., Jayasakthi, J., & Anandhamala, G. S. Providing Smart Agriculture Solutions to Farmers for Better Yielding Using IoT. IEEE International Conference on Technological Innovations in ICT for Agriculture and Rural Development (TIAR) 2015.
11. Dwarkani, C. M., Ram, G. R., Jagannathan, S., & Priyatharshini, R. Smart Farming System Using Sensors for Agricultural Task Automation. IEEE International Conference on Technological Innovations in ICT for Agriculture and Rural Development (TIAR) 2015.
12. Nandurkar, S. R., Thool, V. R., & Thool, R. C. Design and Development of Precision Agriculture System Using Wireless Sensor Network. IEEE International Conference on Automation, Control, Energy and Systems (ACES) 2014.
13. Gutiérrez, J., & Villa-Medina, J. F. IoT for Agriculture: A Comprehensive Review. Computers and Electronics in Agriculture, 153, 8-2 2012.
14. C. Arun, K. Lakshmi Sudha "Agricultural Management using Wireless Sensor Networks – ASurvey"2nd International Conference on Environment Science and Biotechnology vol.48 2012.
15. Lakshmisudha, K., Hegde, S., Kale, N., & Iyer, S. Smart Precision Based Agriculture Using Sensors. International Journal of Computer Applications, 146(11), 25-29 2011.
16. Jeonghwan Hwang, Changsun Shin, and Hyun Yoe "Study on an Agricultural Environment Monitoring Server System using Wireless Sensor Networks", 2010.