CHAPTER-1

INTRODUCTION

Agriculture is the backbone of all developed countries. It uses 85% of available fresh water resources worldwide and this percentage continues to be dominant in water consumption because of population growth and increased food demand. Due to this, efficient water management is the major concern in many cropping system in arid and semi-arid areas. An automated irrigation system is needed to optimize water use for agricultural crops. The need of automated irrigation system is to overcome over irrigation and under irrigation. Over irrigation occurs because of poor distribution or management of waste water, chemical which leads to water pollution. Under irrigation leads to increased soil salinity with consequent build-up of toxic salts on the soil surface in areas with high evaporation. To overcome these problems and to reduce the man power smart irrigation system has been used.

As the world is trending into new technologies and implementations it is a necessary goal to trend up in agriculture also. Many researches are done in the field of agriculture. Most projects signify the use of wireless sensor network collect data from different sensors deployed a various nodes and send it through the wireless protocol. The collected data provide the information about the various environmental factors. Monitoring the environmental factors is not the complete solution to increase the yield of crops. There are number of other factors that decrease the productivity to a greater extent. Hence automation must be implemented in agriculture to overcome these problems. So, in order to provide solution to all such problems, it is necessary to develop an integrated system which will take care of all factors affecting the productivity in every stage. But complete automation in agriculture is not achieved due to various issues. Though it is implemented in the research level it is not given to the farmers as a product to get benefitted from the resources. Hence this paper deals about developing smart agriculture using IoT and given to the farmers.

Generally most of the irrigation systems are manually operated one. These traditional techniques are being is replaced with semi-automated and automated techniques suggested an automated concept of irrigation to use the water efficiently and effectively Automated Drip Irrigation system is implemented either based on the soil humidity or based on the user input via

SMS commanding systems. Former method is an isolated irrigation system where the farmer doesn’t updated with the irrigation status and later lags in smart utilization of water due to user command without considering the condition of soil. From that ever growing requirement of the population, modern techniques are introduced to control the system.

To give proper attention to the land located far away from the human settlement, supervisory automatic control systems like multi-terminal control systems are used since in many processes, factors like soil, salinity, irrigation, temperature, light intensity, etc. needs repeated tasks and have to work in abnormal environmental conditions of the soil and to overcome the flaws in the existing system here we are irrigating the land based on the soil humidity and at the same time the status of the irrigation is updated wirelessly to Server via serial communication.With this farmers are intimated about fertilizers required for the crops for better yield at various conditions by measuring soil nature and the better crop cultivation based on the climatic conditions. That leads to flexibility in monitoring the irrigation system at anywhere provided with internet. The server side data can be retrieve via the internet to access it for easy to handle the devices and now a day’s internet is also necessity for all human beings then only it will become a booming to continuous monitoring and controlling of irrigation system.

Internet of Things (IoT) is a broad term that describes the interconnection of different daily life objects through the internet. In the concept of IoT every object is connected with each other through a unique identifier so that it can transfer data over the network without a human to the human interaction. IoT has referred as a network of everyday objects having ubiquitous computing. The ubiquity of the objects has increased by integrating every object with embedded system for interaction. It connects human and devices through a highly distributed network. IoT is basically the world wide interconnection of devices. The aim of IoT is to connect every person and every object through the internet. In IoT every object is assigned a unique identifier, so that every object is accessible through the internet.

CHAPTER-2

LITERATURE SURVEY

The contribution of various researches throughout the globe in the field of Internet of Things (IoT) and applications of smart irrigation is reviewed in this section. To know the available system and to discriminate its advantages and its disadvantages, there is need to study the existing system so literature survey is a study of existing methodology.

1. Rajalakshmi.P, Mrs.S.Devi Mahalakshmi proposed "IOT Based Crop-Field Monitoring And Irrigation Automation",2016

In this work, a system is developed to monitor crop-field using sensors (soil moisture, temperature, humidity, Light) and automate the irrigation system. The data from sensors are sent to web server database using wireless transmission. In server database the data are encoded in JSON format. The irrigation is automated if the moisture and temperature of the field falls below the brink. In greenhouses light intensity control can also be automated in addition to irrigation. The notifications are sent to farmers' mobile periodically. The farmers' can able to monitor the field conditions from anywhere. This system will be more useful in areas where water is in scarce. This system is 92% more efficient than the conventional approach. The author suggest us extension work is the prediction of crop water requirement using data mining algorithms in which they are progressing. The prediction helps to supply the right amount of water to the crops.

2.Viswanath Naik.S, S.PushpaBai, Rajesh.P, MallikarjunaNaik.B proposed "IoT Based GreenHouse Monitoring System",International Journal of Electronics Communication Engineering & Technology (IJECET),Volume 6, Issue 6, June (2015), pp. 45-47.

A low cost and flexible greenhouse monitoring system using an embedded MCU with WI-FI connectivity to the internet. The proposed system does not require a dedicated server pc with respect to similar systems and offers a light weight communication protocol to monitor and control the environment. To demonstrate the feasibility and effectiveness of this system, devices such as soil moisture sensor and temperature sensor have been integrated with the proposed greenhouse control system. The basic idea of the project was achieved despite being an area yet to explore completely. Moreover there are lot of areas to be improved.

3. Ami J. Shukla Mr. Viraj Panchal Mr. Sahil Patel proposed" Intelligent Greenhouse Design based on Internet of Things(IoT)" International Journal of Emerging Trends in Electrical and Electronics (IJETEE – ISSN: 2320-9569) Vol. 11, Issue. 2, June 2015.

A design of an intelligent greenhouse with the use of Internet of Things. This design monitors and controls the climate intelligently without the intervention of man. In this paper, we focus on red bell pepper cultivation using intelligently controlled environment. In India, generally green peppers are commonly used. Many types and colors are available for peppers. But the long time duration to get red color and sweet taste in pepper than any other pepper, it becomes a costly affair for the farmers. It also requires specific attention for cultivation. In this paper we will discuss the design of controlled environment. For this we make use of different sensors to measure environmental parameters and according to plant requirement. By connecting this system to IoT (Internet of Things), we create a cloud server to access it remotely. This removes constant manual monitoring. The cloud server also allows to process data and apply control action inside greenhouse. This design will help to provide optimal and cost effective solutions to our farmers with least manual intervention. The proposed design helps in increasing the yield with the precise design and at very low cost and low labor.

4. S. Darshna, T.Sangavi, Sheena Mohan, A.Soundharya, Sukanya Desikan," Smart Irrigation System", IOSR Journal of Electronics and Communication Engineering (IOSRJECE) e-ISSN: 2278-2834,p- ISSN: 2278-8735.Volume 10, Issue 3, Ver. II (May - Jun.2015), PP 32-36. Issue 3, Ver. II (May - Jun.2015), PP 32-36.

This project aims at saving time and avoiding problems like constant vigilance. It also helps in water conservation by automatically providing water to the plants/gardens depending on their water requirements. It can also prove to be efficient in Agricultural fields, Lawns & Parks. As technology is advancing, there is always a chance of reducing risks and making work simpler. Embedded and micro controller systems provide solutions for many problems. This application precisely controls water system for gardens by using a sensor micro controller system. It is achieved by installing sensors in the field to monitor the soil temperature and soil moisture which transmits the data to the microcontroller for estimation of water demands of plants. In this project can be improvised by adding a Web scaper which can predict the weather and water the plants/crops accordingly. If rain is forecasted, less water is let out for the plants. Also, a GSM module can be included so that the user can control the system via smart phone. A water meter can be installed to estimate the amount of water used for irrigation and thus giving a cost estimation. A solenoid valve can be used for varying the volume of water flow. Furthermore, Wireless sensors can also be used.

5. Chetan Dwarkani M, Ganesh Ram R, Jagannathan S, R. Priyatharshini proposed "Smart Farming System Using Sensors for Agricultural Task Automation", IEEE International Conference on Technological Innovations in ICT for Agriculture and Rural Development (TIAR 2015).

The existing method and one of the oldest ways in agriculture is the manual method of checking the parameters. In this method the farmers they themselves verify all the parameters and calculate the readings. It focuses on developing devices and tools to manage, display and alert the users using the advantages of a wireless sensor network system. It aims at making agriculture smart using automation and IoT technologies. The highlighting features are smart GPS based remote controlled robot to perform tasks like weeding, spraying, moisture sensing,
human detection and keeping vigilance. The cloud computing devices that can create a whole computing system from sensors to tools that observe data from agricultural field images and from human actors on the ground and accurately feed the data into the repositories.

6. R.Suresh, S.Gopinath, K.Govindaraju, T.Devika,N.SuthanthiraVanitha, proposed "GSM based Automated Irrigation Control using Raingun Irrigation System", International Journal of Advanced Research in Computer and Communication Engineering Vol. 3, Issue 2, February 2014.

In GSM Based Automated Irrigation Control using Rain gun Irrigation System using automatic microcontroller based rain gun irrigation system in which the irrigation will take place only when there will be intense requirement of water that save a large quantity of water. These system brings a change to management of field resources where they developed a software stack called Android is used for mobile 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. The System Supports excess Amount of water in the land and uses GSM to send message and an android app is been used they have used a methodology to overcome under irrigation, over irrigation that causes leaching and loss of nutrient content of soil they have also promised that Microcontroller used can increase System Life and lower the power Consumption. There system is just limited to the automation of irrigation system and lacks in extra ordinary features.

7. Laxmi Shabadi, Nandini Patil, Nikita. M, Shruti. J, Smitha. P & Swati.C, proposed "Irrigation Control System Using Android and GSM for Efficient Use of Water and Power",International Journal of Advanced Research in Computer Science and Software Engineering, Volume 4, Issue 7, July 2014.

In Irrigation Control System Using Android and GSM for Efficient Use of Water and Power, Automated irrigation system uses valves to turn motor ON and OFF. These valves may be easily automated by using controllers. Automating farm or nursery irrigation allows farmers to apply the right amount of water at the right time, regardless of the availability of labor to turn valves on and off. In addition, farmers using automation equipment are able to reduce runoff from over watering saturated soils, avoid irrigating at the wrong time of day, which will improve crop performance by ensuring adequate water and nutrients when needed. Those valves may be easily automated by using controllers. Automating farm or nursery irrigation allows farmers to apply the right amount of water at the right time, regardless of the availability of labour to turn valves on and off. They lack in a featured mobile application developed for users with appropriate user interface. It only allows the user to monitor and maintain the moisture level remotely irrespective of time.

SUMMARY OF LITERATURE SURVEY

From the above literature survey, we can say that farmers themselves verify all the parameters and calculate the readings, so it takes more time. To overcome this type of problems we are focusing on developing devices and tools to manage, display and alert the users, using the advantages of a wireless sensor network system. It aims at making agriculture smart using automation and IoT technologies

OBJECTIVES

1. To build greenhouse which is equipped with automatic monitoring and controlling system
2. Constantly monitor and control environmental conditions in greenhouse to ensure it remains at present temperature, moisture, and humidity levels.
3. It focuses on saving water, increasing efficiency and reducing the environmental impacts on plants production.
4. The user can see the atmospheric conditions of the greenhouse plants on website and control the greenhouse from faraway places by using IoT.

PROPOSED TITLE

Internet of things(IoT) based greenhouse irrigation monitoring/controlling system.

METHODOLOGY

1. Measuring the physical parameters of the soil conditions (i.e Soil moisture, humidity, temperature.

2. Collected information (data) are moved to the cloud by using IoT technique for further process.

3. The collected data are processed for decision making either pump may be on/off.

PROBLEM STATEMENT

One of the most challenging problems is due to unequal distribution of rain water, it is very difficult to farmer to manage the water equally to all the crops in whole farm it requires some irrigation method that suitable for any weather condition, soil types and variety of crops. Greenhouse is the best solution for all this, but for this farmer need continuous tracing of a green house to maintain all environmental conditions that needed for different crops. If there is any change in the system should change or maintain that changes according to farmer instruction.

Nowadays, most greenhouse system still uses the manual system in monitoring the temperature and humidity in the greenhouse. By using the manual system, a lot of problem can occurred not for worker but also affected production system. This all has changed in the modern greenhouses because size of the greenhouse itself is become bigger than before in order to support the need in market and the greenhouse facilities provide several options to make local adjustments to the lights, ventilation, heating and other greenhouse support systems. However, more measurement data is also needed to make this kind of automation system work properly. Increased number of measurement points should not dramatically increase the automation system cost. The first problem is if the greenhouse is far away from the maintenance office, worker or engineer must go on the site to check manually every hour to check if there are any problem occurs. Then, the reading of the temperature and humidity must be checking manually to make sure the greenhouse is in a normal condition

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This project therefore mainly designs to minimize the risk for workers to avoid from hazard in the greenhouse. Monitoring the temperature and humidity in greenhouse on the LCD screen can reduce time and problem easier. The second problem is many greenhouse system still use the cable to send data from sensor level to monitoring. It is difficult to install the system if the greenhouse is far away from maintenance office. The data cable are easy to damage if lay in high temperature and danger condition. These projects were upgrade from wired to wireless sensor network to send data from greenhouse to monitoring on the LCD screen in the maintenance office.

CHAPTER-3

IoT AND GREENHOUSE

3.1. INTERNET OF THINGS (IoT)

The Internet of things (IoT) is the inter-networking of physical devices, vehicles, buildings, and other items embedded with electronics, software, sensors, actuators, and network connectivity which enable these objects to collect and exchange data. IOT is defined as an environment in which objects (devices) are given unique identifiers and the ability to transfer data over a network without having human-to-human or human-to-computer interaction.

The IoT is being formed from two words internet and things which combine means any object or person which can be distinguishable by the real world can be connected to global system of interconnected computer networks and governs by standard protocol. They defined IoT as “An open and comprehensive network of intelligent objects that have the capacity to auto organize, share information, data and resources, reacting and acting in face of situations and changes in the environment” The internet of things is a new era of intelligence computing and it is providing a privilege to communicate around the world.

3.1.1. HISTORY

As of 2016, the vision of the Internet of things has evolved due to a convergence of multiple technologies, including ubiquitous wireless communication, real-time analytics, machine learning, commodity sensors, and embedded systems. This means that the traditional fields of embedded systems, wireless sensor networks, control systems, automation (including home and building automation), and others all contribute to enabling the Internet of things(IoT).

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. Mark Weiser's seminal 1991 paper on ubiquitous computing, "The Computer of the 21st Century", as well as academic venues such as UbiComp and PerCom produced the contemporary vision of IoT. In 1994 Reza Raji described the concept in IEEE Spectrum as "[moving] small packets of data to a large set of nodes, so as to integrate and automate everything from home appliances to entire factories". Between 1993 and 1996 several companies proposed solutions like Microsoft's at Work or Novell's NEST. However, only in 1999 did the field start gathering momentum. Bill Joy envisioned Device to Device (D2D) communication as part of his "Six Webs" framework, presented at the World Economic Forum at Davos in 1999.

The concept of the Internet of things became popular in 1999, through the Auto-ID Center at MIT and related market-analysis publications. Radio-frequency identification (RFID) was seen by Kevin Ashton (one of the founders of the original Auto-ID Center) as a prerequisite for the Internet of things at that point. Ashton prefers the phrase "Internet for Things." If all objects and people in daily life were equipped with identifiers, computers could manage and inventory them. Besides using RFID, the tagging of things may be achieved through such technologies as near field communication, barcodes, QR codes and digital watermarking.

In its original interpretation, one of the first consequences of implementing the Internet of things by equipping all objects in the world with minuscule identifying devices or machine-readable identifiers would be to transform daily life. For instance, instant and ceaseless inventory control would become ubiquitous. A person's ability to interact with objects could be altered remotely based on immediate or present needs, in accordance with existing end-user agreements. For example, such technology could grant motion-picture publishers much more control over end-user private devices by remotely enforcing copyright restrictions and digital rights management, so the ability of a customer who bought a Blu-ray disc to watch the movie could become dependent on the copyright holder's decision, similar to Circuit City's failed DIVX.

In 2013 the Global Standards Initiative on Internet of Things (IoT-GSI) defined the IoT as "a global infrastructure for the information society, enabling advanced services by interconnecting (physical and virtual) things based on existing and evolving interoperable information and communication technologies" and for these purposes a "thing" is "an object of the physical world (physical things) or the information world (virtual things), which is capable of being identified and integrated into communication networks". The IoT allows objects to be sensed or controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit in addition to reduced human intervention.

When IoT is augmented with sensors and actuators, the technology becomes an instance of the more general class of cyber-physical systems, which also encompasses technologies such as smart grids, virtual power plants, smart homes, intelligent transportation and smart cities. Each thing is uniquely identifiable through its embedded computing system but is able to interoperate within the existing Internet infrastructure. Experts estimate that the IoT will consist of about 30 billion objects by 2020.

3.1.2. CONCEPT OF IOT

Typically, IoT is expected to offer advanced connectivity of devices, systems, and services that goes beyond machine-to-machine (M2M) communications and covers a variety of protocols, domains, and applications. IoT allows people and things to be connected Any-time, anyplace, with anyone, ideally using any network and any service. Automation is another important application of IoT technologies. It is the monitoring of the energy consumption and the Controlling the environment in buildings, schools, offices and museums by using different types of sensors and actuators that control lights, temperature, and humidity.

"Things," in the IoT sense, can refer to a wide variety of devices such as heart monitoring implants, biochip transponders on farm animals, electric clams in coastal waters, automobiles with built-in sensors, DNA analysis devices for environmental/food/pathogen monitoring or field operation devices that assist firefighters in search and rescue operations. Legal scholars suggest looking at "Things" as an "inextricable mixture of hardware, software, data and service". These devices collect useful data with the help of various existing technologies and then autonomously flow the data between other devices.

Current market examples include home automation (also known as smart home devices) such as the control and automation of lighting, heating (like smart thermostat), ventilation, air conditioning (HVAC) systems, and Appliances such as washer/drier robotic vaccums,air purifiers ,ovens or refrigerators freezers that use Wi-Fi remote monitoring.

3.2. GREENHOUSE

A greenhouse is a building where plants are grown. Greenhouses are often used for growing flowers, vegetables, fruits, and tobacco plant. Most greenhouse system still uses the manual system in monitoring the temperature and humidity in the greenhouse, a lot of problem can occurred not for worker but also affected production rate because the temperature and humidity of greenhouse must be constantly monitored to ensure optimal conditions. The wireless sensor network can be used to gather the data from point to point to trace down the local climate parameters in different parts of the big greenhouse to make the greenhouse automation system work properly.

3.2.1. HISTORY

The idea of growing plants in environmentally controlled areas has existed since Roman times. The Roman emperor Tiberiusate a cucumber-like vegetable daily. The Roman gardeners used artificial methods (similar to the greenhouse system) of growing to have it available for his table every day of the year. Cucumbers were planted in wheeled carts which were put in the sun daily, then taken inside to keep them warm at night. The cucumbers were stored under frames or in cucumber houses glazed with either oiled cloth known as specularia or with sheets of selenite , according to the description by Pliny the Elder.

Greenhouses in which the temperature could be manually manipulated first appeared in 15th century Korea. The 15th century treatise, the Sanga Yorok, contains descriptions of greenhouses designed to regulate the temperature and humidity requirements of plants and crops. One of the earliest records of the Annals of the Joseon Dynasty in 1438 confirms growing mandarin orange trees in a traditional Korean greenhouse during the winter and installing an ondol system to provide heat.

The concept of greenhouses also appeared in the Netherlands and then England in the 17th century, along with the plants. Some of these early attempts required enormous amounts of work to close up at night or to winterize. There were serious problems with providing adequate and balanced heat in these early greenhouses. Today, the Netherlands has many of the largest greenhouses in the world, some of them so vast that they are able to produce millions of vegetables every year.

The French botanist Charles Lucien Bonaparte is often credited with building the first practical modern greenhouse in Leiden, Holland, during the 1800s to grow medicinal tropical plants. Originally only on the estates of the rich, the growth of the science of botany caused greenhouses to spread to the universities. The French called their first greenhouses orangeries, since they were used to protect orange trees from freezing. As pineapples became popular, pineries, or pineapple pits, were built.

3.3 GREENHOUSE IRRIGATION USING INTERNET OF THINGS

The greenhouse industry is the fastest growing sector worldwide. The greenhouse separates the crop from the environment, thus providing some way of shelter from the direct influence of the external weather conditions. This enables the production of crops which otherwise could not be produced at that specific location. The greenhouse enclosure enables the manipulation of the crop environment. This asset allows the farmer to improve the cultivation in a way the plants need. It leads to higher crop yield, prolonged production period, better quality, and less use of protective chemicals. The added value per unit area in greenhouse crops is much higher than that in open-field cultivation. In moderate climate zones, energy is needed, whereas in arid zones, the cooling and availability of water is of major concern. The use of materials and energy as well as crop yield and quality can be influenced by operating the adjustable components of greenhouse, such as heating and cooling inputs, window opening, drip irrigation, screening and CO_2 dosage.

Internet of Things (IoT) is the network of physical things embedded with electronic circuits, sensors, software and network connection which enables these things to exchange data from one another. IoT is the fusion of the digital and physical world. In a world of IoT, millions of things or devices will be interconnected and uniquely identified on the Internet. The Internet of Things allows objects to be sensed and controlled remotely across existing network infrastructure, creating opportunities for more direct integration between the physical world and computer-based systems, and resulting in improved efficiency, accuracy and economic benefit.

CHAPTER-4

EXISTING SYSTEM

The existing method and one of the oldest ways in agriculture is the manual method of checking the parameters. In this method the farmers they themselves verify all the parameters and calculate the readings.

This idea proposes a novel methodology for smart farming by linking a smart sensing system and smart irrigator system through wireless communication technology . In this paper, greenhouse is a building in which plants are grown in closed environment. It is used to maintain the optimal conditions of the environment, greenhouse management and data acquisition.

GSM MODULE

Figure 4.1 GSM Module

GSM Modem can accept any GSM network operator SIM and it can act just like a mobile phone with its own unique phone number. The necessity to use this is it can use RS-232 protocol which can be easily connected to the controller. It can be used like a phone where it can send and receive SMS and make a call.

The GSM modem is connected to the controller through RS-232. The SMS is sent through the terminal to the number using AT Commands. “AT-Attention” commands which is used by the controller to control the GSM to perform the desired function. It also has reverse voltage protection and the LED notifications. It is operated in 900/1800 MHz.

CHAPTER-5

PROPOSED SYSTEM

5.1. INTRODUCTION

Generally most of the irrigation systems are manually operated one. These traditional techniques are being is replaced with semi-automated and automated techniques suggested an automated concept of irrigation to use the water efficiently and effectively Automated Drip Irrigation system is implemented either based on the soil humidity or based on the user input via SMS commanding systems. Former method is an isolated irrigation system where the farmer doesn’t updated with the irrigation status and later lags in smart utilization of water due to user command without considering the condition of soil. From that ever growing requirement of the population, modern techniques are introduced to control the system.

To give proper attention to the land located far away from the human settlement, supervisory automatic control systems like multi-terminal control systems are used since in many processes, factors like soil, salinity, irrigation, temperature, light intensity, etc. needs repeated tasks and have to work in abnormal environmental conditions of the soil and to overcome the flaws in the existing system here we are irrigating the land based on the soil humidity and at the same time the status of the irrigation is updated wirelessly to Server via serial Communication.

With this farmers are intimated about fertilizers required for the crops for better yield at various conditions by measuring soil nature and the better crop cultivation based on the climatic conditions. That leads to flexibility in monitoring the irrigation system at anywhere provided with internet. The server side data can be retrieve via the internet to access it for easy to handle the devices and now a day’s internet is also necessity for all human beings then only it will become a booming to continuous monitoring and controlling of irrigation system.

5.2. Block Diagram of IoT based greenhouse monitoring

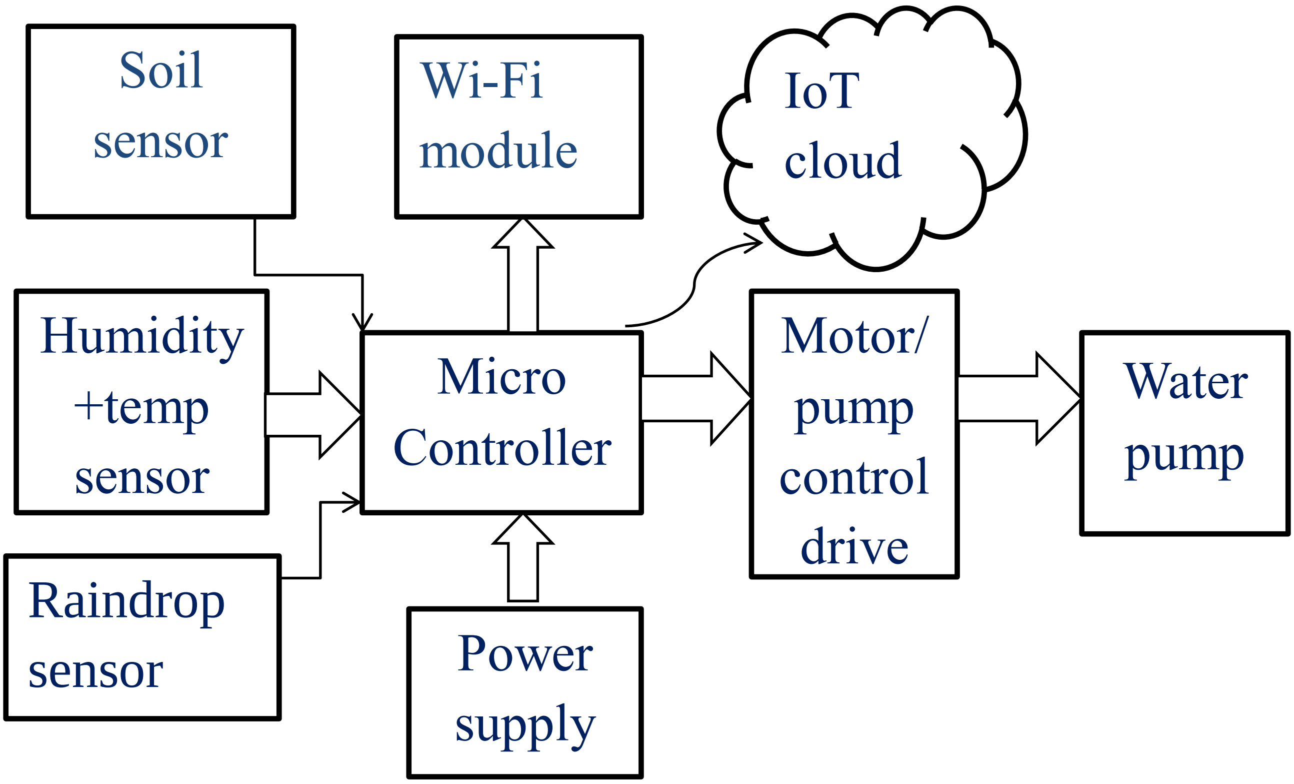


Figure 5.1 Block diagram of Iot based Greenhouse monitoring

Appropriate environmental conditions are necessary for optimum plant growth, improved crop yields, and efficient use of water and other resources. Automating the data acquisition process of the soil conditions and various climatic parameters that govern plant growth allows information to be collected with this system with less labour requirements.

This is a microcontroller-based circuit which monitors and records the values of temperature, humidity, soil moisture and pH values of the natural environment that are continuously updated as a log in order to optimize them to achieve maximum plant growth and yield.

An integrated Liquid crystal display (LCD) is also used for real time display of data acquired from the various sensors and the status of the various devices. The system constantly monitors the digitized parameters of the various sensors.

Monitoring and controlling of a greenhouse environment involves sensing the changes occurring inside it which can influence the rate of growth in plants. The important parameters are the temperature inside the greenhouse which affects the photosynthetic and transpiration process, humidity, moisture content and pH value in the soil. The sensors used in this system are :

1. Soil moisture sensor
2. Humidity sensor
3. Temperature sensor

1. Soil moisture sensor (FC-28)

The use of soil moisture sensor is measuring the moisture level of the soil, according to this we will be deciding weather the motor should get on/off.

2. Humidity sensor and Temperature sensor (DHT11)

Humidity sensor is used for sensing the vapours in the air. The Change in RH (Relative Humidity) of the surroundings would result in display of values.

If the temperature is very low and humidity is very high and we check the soil moisture level also, if it has a moderate soil moisture it is not required to switch on the motor. If the temperature is very high and humidity is very low and if the soil moisture is very low we will switch on the motor.

All this parameters are displayed on LCD. Since we are using IoT based this parameters are sent to cloud by using WI-FI MODULE.

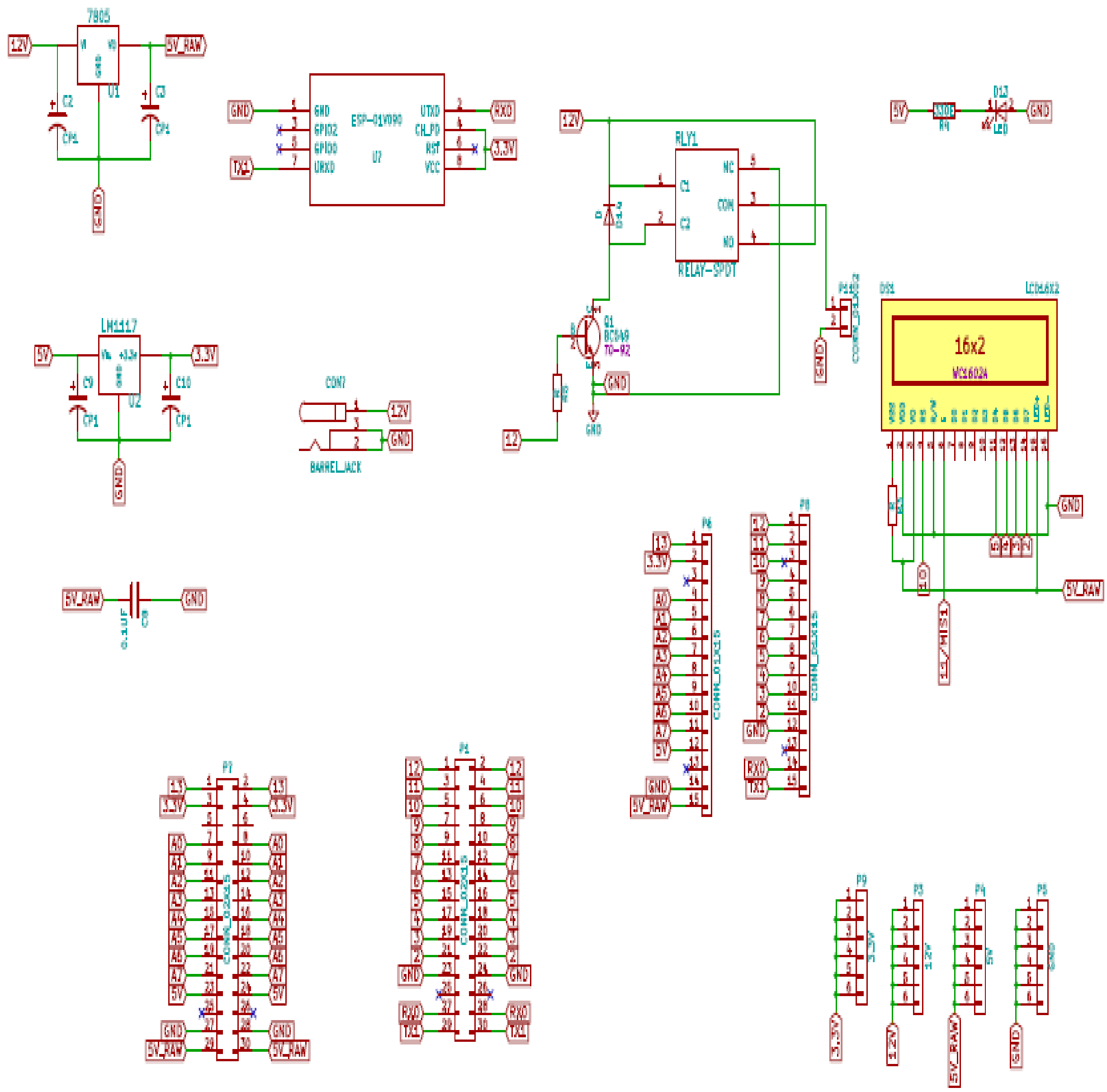
The hardware unit of the prototype of the system is represented by the block diagram. It contains a Atmega328P micro-controller as the main processing unit and it gets inputs from the temperature sensor, Humidity sensor, Ph sensor and Soil moisture sensor. From the data obtained from the sensors, displays the values on a LCD. The whole system gets power from DC supply. The system operates according to the block diagram. The readings from the sensors are analog values. The analog input value is converted to a digital value using ADC and given to the micro-controller for further processing. In this system the temperature sensor detects the current temperature value inputs it to pin of the microcontroller. There is an analog input and it is converted to a digital input and calibrated then it is displayed. Similarly for humidity, moisture, and Ph sensor.

5.3. Cloud Storage

Cloud storage is a model of data storage in which the digital data is stored in logical pool, the physical storage spans multiple servers and often locations and the physical environment is typically owned and managed by a hosting company. These cloud storage providers are responsible for keeping the data available and accessible, and the physical environment protected and running. People and organizations buy or lease storage capacity from the providers to store user organization data. Cloud storage services may be accessed through a co-located cloud computer service. Cloud storage less expensive, only that it incurs operating expenses rather than capital expenses. Cloud storage provides users with immediate access to broad range of resources and applications hosted in the infrastructure of another organization via a web service interface.

Cloud storage is a cloud computing model in which data is stored on remote servers accessed from the internet or cloud.it is maintained ,operated and managed by a cloud storage service provider on a storage server that are built on virtualization techniques. Cloud storage is also known as utility storage –a term subject to differentiation based on actual implementation and service delivery.

5.4 Connection diagram of greenhouse irrigation system



5.5. THINGSPEAK

Thingspeak is an open source Internet of Things (IoT) application and API to store and retrieve data from things using the HTTP protocol over the Internet or via a Local Area Network. Thing Speak enables the creation of sensor logging applications, location tracking applications and a social network of things with status updates.

ThingSpeak has a close relationship with Math works, In fact all the ThingSpeak documentation is incorporated into the Math works Matlab documentation site and even enabling registered Math works user accounts as valid login credentials on the Thingpeak website. The terms of service and privacy policy of Thingspeak.com are between the agreeing user and Math works .

5.6. ARDUINO UNO (ATMEGA 328)

Arduino is a open source electronics prototyping platform based on flexible, easy-to-use hardware and software. It’s intended for artists, designers, hobbyists, and anyone interested in creating interactive objects or environments. It’s an open-source physical computing platform based on a microcontroller board, and a development environment for writing software for the board.

In simple words, Arduino is a small microcontroller board with a USB plug to connect to your computer and a number of connection sockets that can be wired up to external electronics, such as motors ,relays, light series, loudspeakers,microphones,etc.,They can either be powered through the USB connection from the computer or from a 9V battery. They can be controlled from the computer or programmed by the computer and then disconnected and allowed to work independently.

The name “Arduino” is reserved by the original makers. However, clone Arduino designs often have the letters “duino” on the end of their name, for example, Freeduino or DFRduino. The software for programming our Arduino is easy to use and also freely available for Windows, Mac, and LINUX computers at no cost.

5.7. Wi-Fi MODULE (ESP8266):

Wi-Fi stands for wireless Fidelity. we are using Wi-Fi which acts as heart for IoT. Through Wi-Fi the consumer can set changes in threshold value, he can ON and OFF the energy meter. Time to Time the readings of units and cost are displayed on webpage. Consumer Can accesses the Arduino board and meter with help of Wi-Fi.

5.8. TEMPERATURE AND HUMIDITY SENSOR (DHT11)

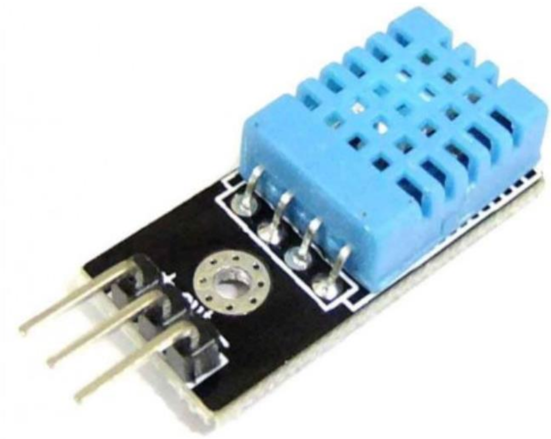


Figure 5.3.Temperature and Humidity sensor

DHT11 is a Humidity and Temperature Sensor, which generates calibrated digital output. DHT11 can be interface with any microcontroller like Arduino, Raspberry Pi, etc. and get instantaneous results. DHT11 is a low cost humidity and temperature sensor which provides high reliability and long term stability.

In this project, we will build a small circuit to interface Arduino with DHT11 Temperature and Humidity Sensor. One of the main applications of connecting DTH11 sensor with Arduino is weather monitoring.

5.9. SOIL MOISTURE SENSOR (FC-28)

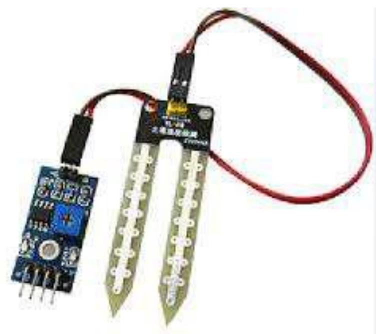


Figure 5.4.Soil moisture sensor

Soil moisture sensor is a sensor which senses the moisture content of the soil. The sensor has both the analog and the digital output. The digital output is fixed and the analog output threshold can be varied. It works on the principle of open and short circuit. The output is high or low indicated by the LED. When the soil is dry, the current will not pass through it and so it will act as open circuit. Hence the output is said to be maximum. When the soil is wet, the current will pass from one terminal to the other and the circuit is said to be short and the output will be zero. The sensor is platinum coated to make the efficiency high. The range of sensing is also high.

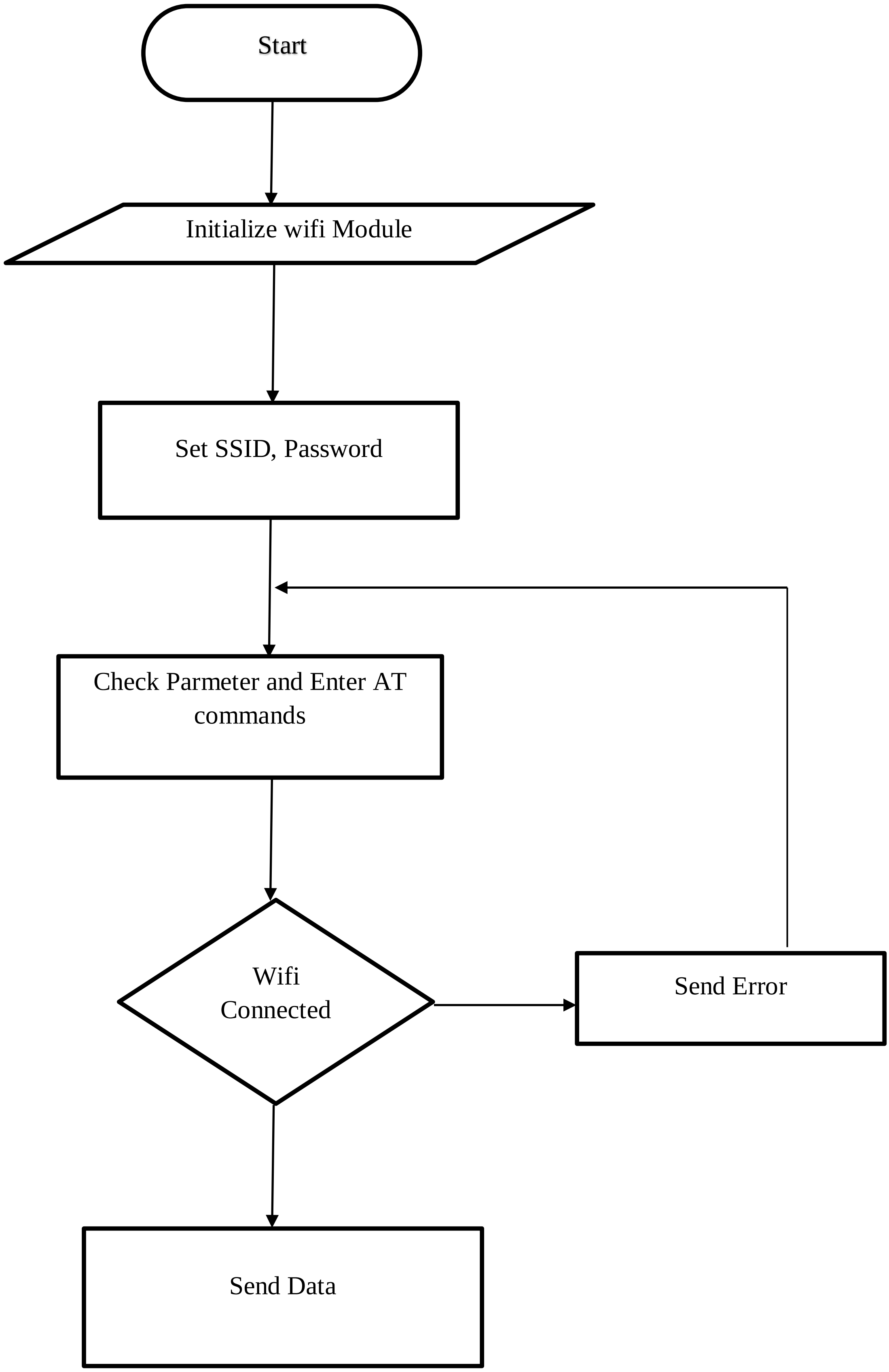
5.10. RAIN DROP SENSOR(KG004)

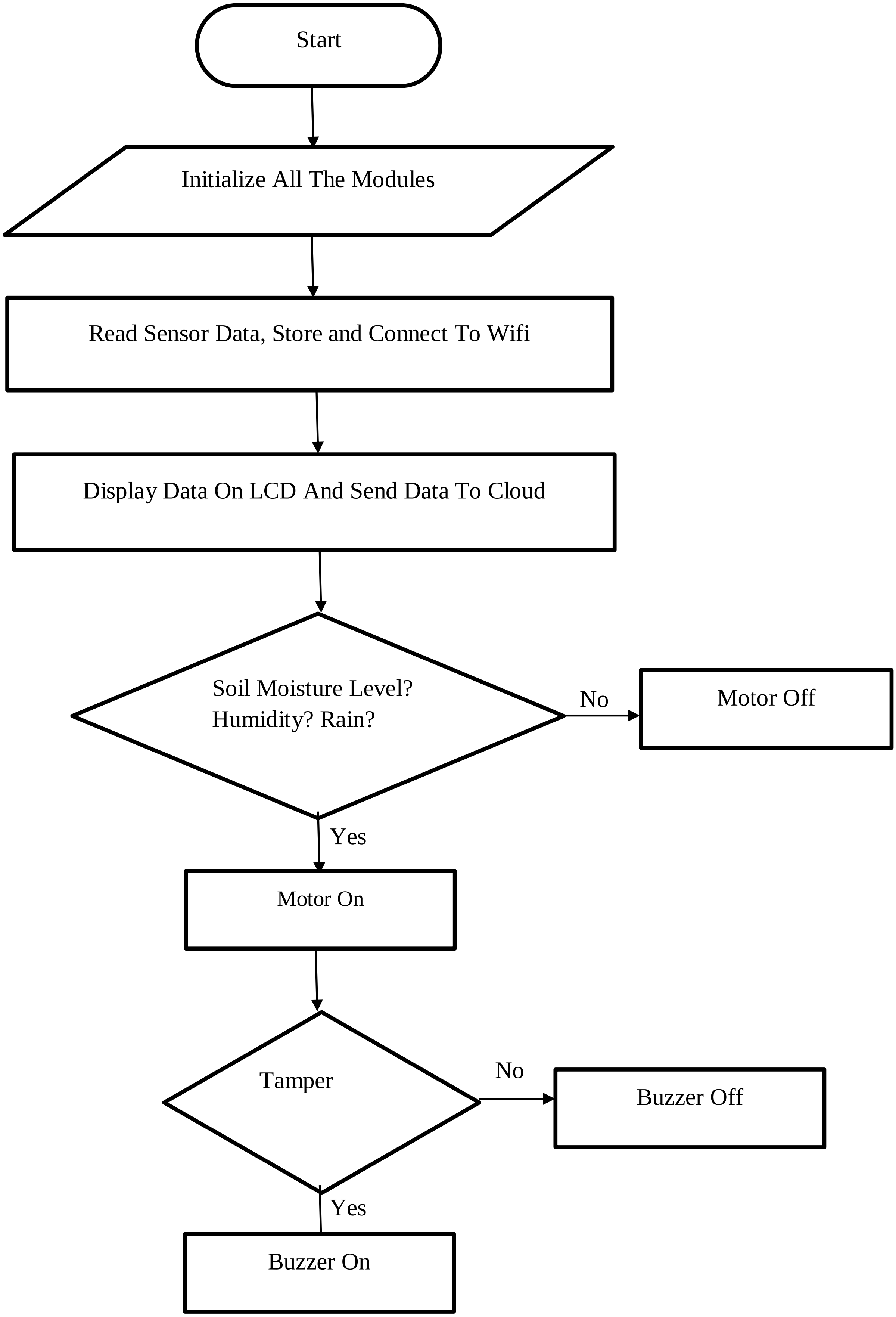
Figure 5.5: Rain drop sensor

The rain sensor module is an easy tool for rain detection. It can be used as a switch when raindrop falls through the raining board and also for measuring rainfall intensity. The module features, a rain board and the control board that is separate for more convenience, power indicator LED and an adjustable sensitivity though a potentiometer.

The analog output is used in detection of drops in the amount of rainfall. Connected to 5V power supply, the LED will turn on when induction board has no rain drop, and DO output is high. When dropping a little amount water, DO output is low, the switch indicator will turn on. Brush off the water droplets, and when restored to the initial state, outputs high level.

5.11.FLOW CHART FOR WI-FI MODULE CONTROL





5.12 : FLOWCHART FOR SYSTEM CONTROL

CHAPTER-6

HARDWARE SPECIFICATIONS AND DETAILS

6.1.Introduction to the Arduino Board

ARDUINO board designs use a verity of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output(I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The boards feature serial communications interfaces, including Universal serial Bus (USB) on some models, which are also used for loading programs from personal computers.T he microcontrollers are typically Programmed using a dialect of features from the programming languages C and C++. In addition to using traditional compiler tool chains, the ARDUINO project provides an integrated development environment (IDE) based on the processing language project.

Looking at the board from the top down, this is an outline of ARDUINO board

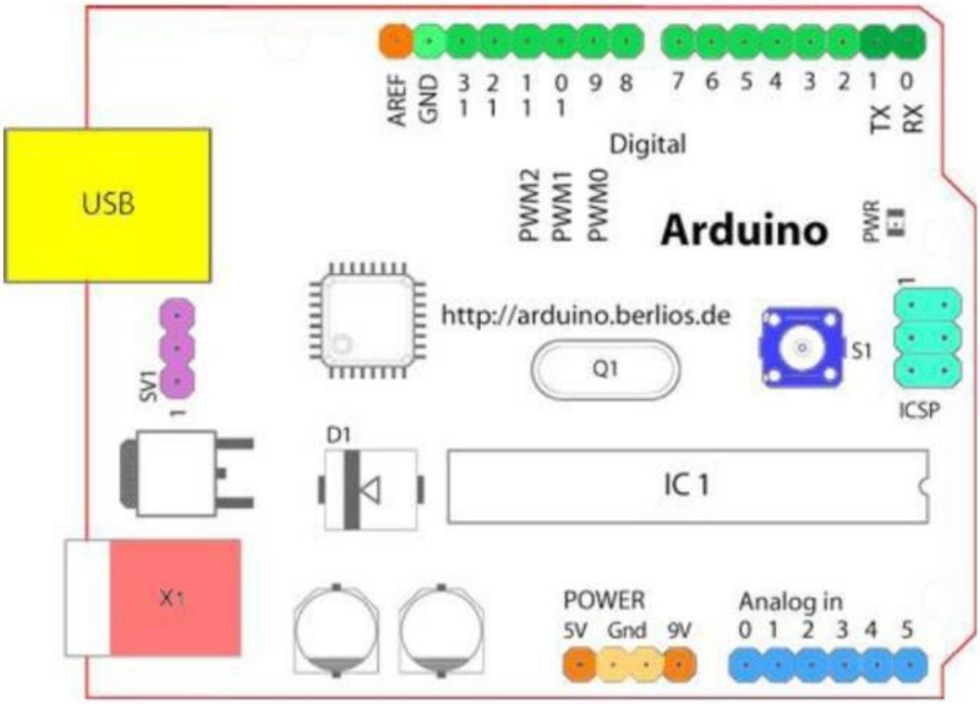


Figure 6.1: Arduino board

Starting clockwise from the top center in

1. Analog Reference pin (orange)
2. Digital Ground (light green)
3. Digital Pins 2-13 (green)

4. Digital Pins 0-1/Serial In/Out - TX/RX (dark green) - These pins cannot be used for digital i/o (digitalRead and digitalWrite) if you are also using serial communication (e.g. Serial.begin).

5. Reset Button - S1 (dark blue)

6. In-circuit Serial Programmer (blue-green)

7. Analog In Pins 0-5 (light blue)

8. Power and Ground Pins (power: orange, grounds: light orange)

9. External Power Supply In (9-12VDC) - X1 (pink)

10. Toggles External Power and USB Power (place jumper on two pins closest to desired supply) - SV1 (purple)

11. USB (used for uploading sketches to the board and for serial communication between the board and the computer; can be used to power the board) (yellow)

6.2. Digital Pins

In addition to the specific functions listed below, the digital pins on an ARDUINO board can be used for general purpose input and output via the pinMode(), digitalRead(), and digitalWrite() commands. Each pin has an internal pull-up resistor which can be turned on and off using digitalWrite() (value of HIGH or LOW, respectively) when the pin is configured as an input. The maximum current per pin is 40 mA.

- **Serial:** 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data. On the ARDUINO Diecimila, these pins are connected to the corresponding pins of the FTDI USB-to-TTL Serial chip. On the ARDUINO BT, they are connected to the corresponding pins of the WT11 Bluetooth module. On the ARDUINO Mini and LilyPad Arduino, they are intended for use with an external TTL serial module (e.g. the Mini-USB Adapter).
- **External Interrupts:** 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:** 3,5,6,9,10, and 11. Provide 8-bit PWM output with the analogWrite() function. On boards with an ATmega8, PWM output is available only on pins 9, 10, and 11.
- **BT Reset:** 7. (Arduino BT-only) Connected to the reset line of the bluetooth module.

- **SPI:** 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). These pins support SPI communication, which, although provided by the underlying hardware, is not currently included in the Arduino language.
- **LED:** 13. On the Diecimila and LilyPad, there is a built-in LED connected to digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.

6.3. Analog Pins

The analog input pins support 10-bit analog-to-digital conversion (ADC) using the analogRead() function. Most of the analog inputs can also be used as digital pins: analog input 0 as digital pin 14 through analog input 5 as digital pin 19. Analog inputs 6 and 7 (present on the Mini and BT) cannot be used as digital pins.

6.4. Power Pins

- VIN (sometimes labelled "9V"). The input voltage to the Arduino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin **SPI**.
- 5V. The regulated power supply used to power the microcontroller and other components on the board. This can come either from VIN via an on-board regulator, or be supplied by USB or another regulated 5V supply.
- 3V3. (Diecimila-only) A 3.3 volt supply generated by the on-board FTDI chip.
- GND. Ground pins.

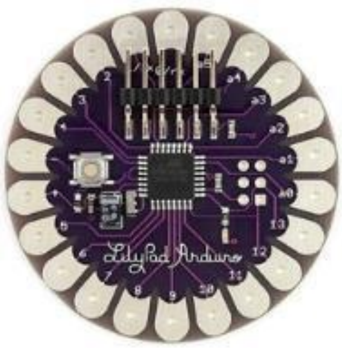
6.5. Other Pins

- AREF. Reference voltage for the analog inputs. Used with analog Reference.
- Reset. (Diecimila-only) Bring this line LOW to reset the microcontroller. Typically used to add a reset button to shields with block the one on the board.

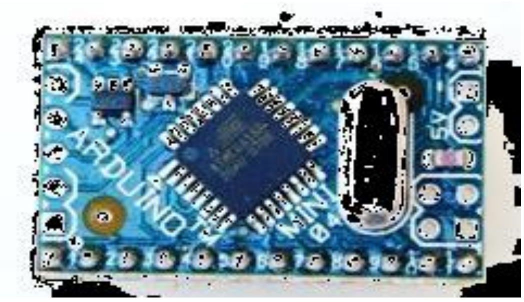
6.6.TYPES OF ARDUINO BOARDS

ARDUINO UNO (ATmega328p)

ARDUINO MEGA (ATmega2560)

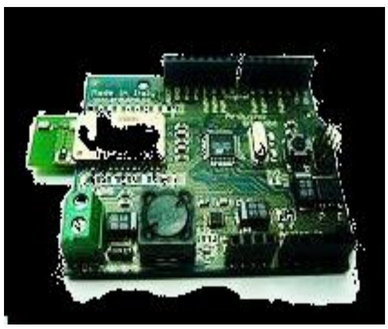


ARDUINO LILYPAD (ATmega 328p)



AURDUINO MINI(ATmega168p)

ARDUINO MINI PRO (ATmega560p)



ARDUINO BT(ATmega 480p)

Figure 6.2: Types of Arduino boards

6.7.ESP8266 WIFI MODULE

The ESP8266 Wi-Fi Module is a self contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your Wi-Fi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. Each ESP8266 module comes pre-programmed with an AT command set firmware. The ESP8266 module is an extremely cost effective board with a huge, and ever growing, community.

This module has a powerful enough on-board processing and storage capability that allows it to be integrated with the sensors and other application specific devices through its GPIOs with minimal development up-front and minimal loading during runtime. Its high degree of on-chip integration allows for minimal external circuitry, including the front-end module, is designed to occupy minimal PCB area. The ESP8266 supports APSD for VoIP applications and Bluetooth co-existence interfaces; it contains a self-calibrated RF allowing it to work under all operating conditions, and requires no external RF parts.

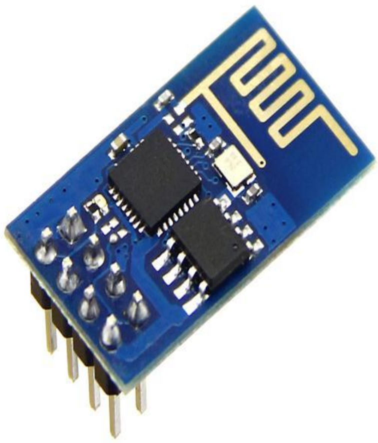


Figure 6.3: ESP8266 Wi-Fi module

Note: The ESP8266 Module is not capable of 5-3V logic shifting and will require an external Logic Level Converter. Please do not power it directly from your 5V dev board.

6.8.Features:

- 802.11 b/g/n
- Wi-Fi Direct (P2P), soft-AP
- Integrated TCP/IP protocol stack
- Integrated TR switch, balun, LNA, power amplifier and matching network
- Integrated PLLs, regulators, DCXO and power management units

- +19.5dBm output power in 802.11b mode
- Power down leakage current of <10uA
- 1MB Flash Memory
- Integrated low power 32-bit CPU could be used as application processor
- SDIO 1.1 / 2.0, SPI, UART
- STBC, 1×1 MIMO, 2×1 MIMO
- A-MPDU & A-MSDU aggregation & 0.4ms guard interval
- Wake up and transmit packets in < 2ms
- Standby power consumption of < 1.0mW (DTIM3)

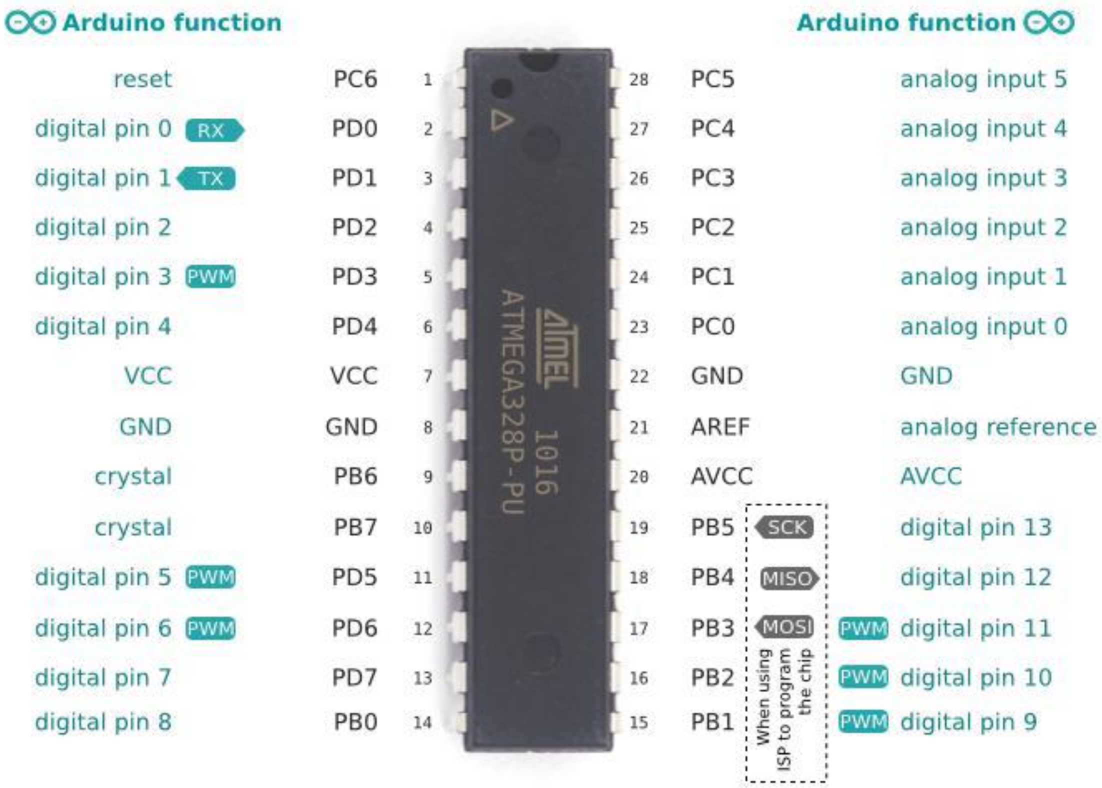


Figure 6.4: ATmega328p pin mapping

6.9 SUBMERSIBLE PUMP:

A Pump is a mechanical device which moves liquid from a lower level to a higher level. The pump draws the liquid inside pressurizes it and discharges it through the outlet. A pump is driven by a prime mover which is, generally, an electric motor. IC engines and turbines can also be used as prime movers to drive the pump. So pumps are generally classified into centrifugal pump and positive displacement pump. Centrifugal pumps are non positive displacement pumps. They work on the principle of centrifugal action.

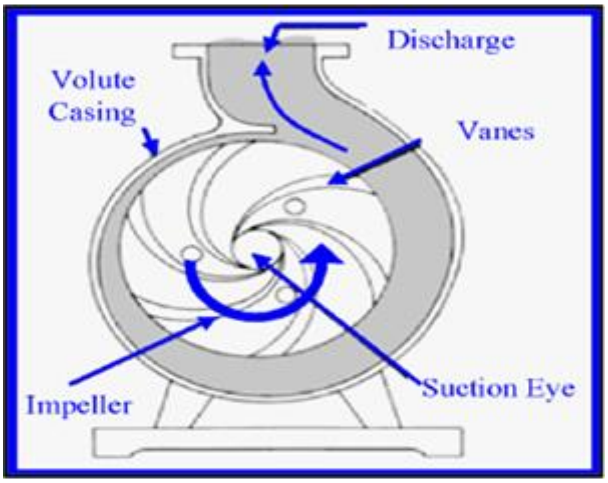


Figure 6.5: construction and working of centrifugal pump

Centrifugal pump works on the principle that a fluid of mass is given a force it is thrown outward radially. The main parts of the centrifugal pump include

- Suction eye
- Vanes
- Impeller
- Casing
- Suction pipe
- Discharge pipe

The suction pipe is connected to the sump or a ground level tank from where the fluid has to be pumped. The suction pipe at the sump is connected with strainer thus restricting any foreign particles entering into the pump. Generally as the length of the suction pipe is less the friction loss also will be less.

A submersible pump (or electric submersible pump) is a device which has a hermetically sealed motor close-coupled to the pump body as shown in Figure: (6.5) The whole assembly is submerged in the fluid to be pumped. The main advantage of this type of pump is that it prevents pump cavitation, a problem associated with a high elevation difference between pump and the fluid surface. Submersible pumps push fluid to the surface as opposed to jet pumps having to pull fluids. Submersibles are more efficient than jet pumps.

Figure 6.6: submersible pump

WORKING PRINCIPLE OF SUBMERSIBLE PUMP:

Electric submersible pumps are multistage centrifugal pumps operating in a vertical position. Liquids, accelerated by the impeller, lose their kinetic energy in the diffuser where a conversion of kinetic to pressure energy takes place. This is the main operational mechanism of radial and mixed flow pumps.

The pump shaft is connected to the gas separator or the protector by a mechanical coupling at the bottom of the pump.Other parts includes the radial bearings (bushings) distributed along the length of the shat providing radial support to the pump shaft. An optional thrust bearing takes up part of the axial forces arising in the pump but most of those forces are absorbed by the protectors's thrust bearing.

APPLICATION OF SUBMERSIBLE PUMP:

Submersible pumps are found in many applications. Single stage pumps are used for drainage, sewage pumping, general industrial pumping and slurry pumping. They are also popular with pond filters. Multiple stage submersible pumps are typically lowered down a borehole and most typically used for residential, commercial, municipal and industrial water extraction, water wells and in oil wells.

Other uses for submersible pumps includes sewage treatment plants, seawater handling, fire fighting (since it is flame retardant cable), water well and deep well drilling, offshore drilling rigs, artificial lifts, mine dewatering, and irrigation systems.

6.10 RELAY

Relays are simple switches which are operated both electrically and mechanically. Relays consist of a n electromagnet and also a set of contacts. The switching mechanism is carried out with the help of the electromagnet. There are also other operating principles for its working. But they differ according to their applications. Most of the devices have the application of relays. The working of a relay can be better understood by explaining the following diagram given below.

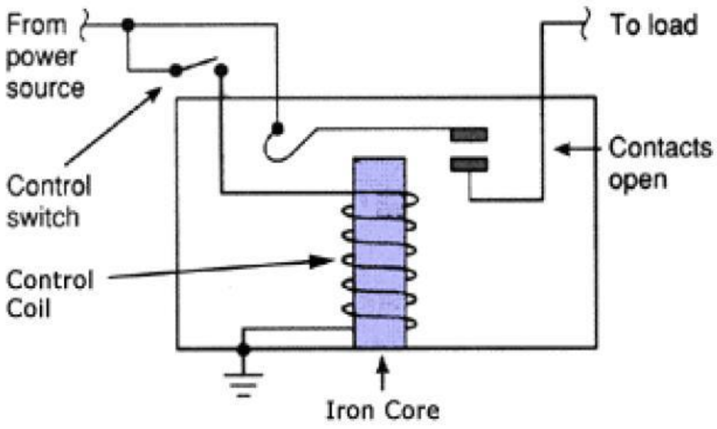


Figure 6.7: working of relay

The Figure 6.7 shows an inner section diagram of a relay. An iron core is surrounded by a control coil. As shown, the power source is given to the electromagnet through a control switch and through contacts to the load. When current starts flowing through the control coil, the electromagnet starts energizing and thus intensifies the magnetic field. Thus the upper contact arm starts to be attracted to the lower fixed arm and thus closes the contacts causing a short circuit for the power to the load. On the other hand, if the relay was already de-energized when the contacts were closed, then the contact move oppositely and make an open circuit.

As soon as the coil current is off, the movable armature will be returned by a force back to its initial position. This force will be almost equal to half the strength of the magnetic force. This force is mainly provided by two factors. They are the spring and also gravity.

Relays are mainly made for two basic operations. One is low voltage application and the other is high voltage. For low voltage applications, more preference will be given to reduce the noise of the whole circuit. For high voltage applications, they are mainly designed to reduce a phenomenon called arcing.

RELAY DRIVER CIRCUIT:

Relays are components that permit a low-power circuit to control signals or to switch high current ON and OFF which should be electrically isolated from controlling circuit.

The Required Components

- Zener Diode
- 6-9V Relay
- 9V Battery or DC Power Supply
- 2N2222 Transistor
- 1K Ohm Resistor
- Second input voltage source

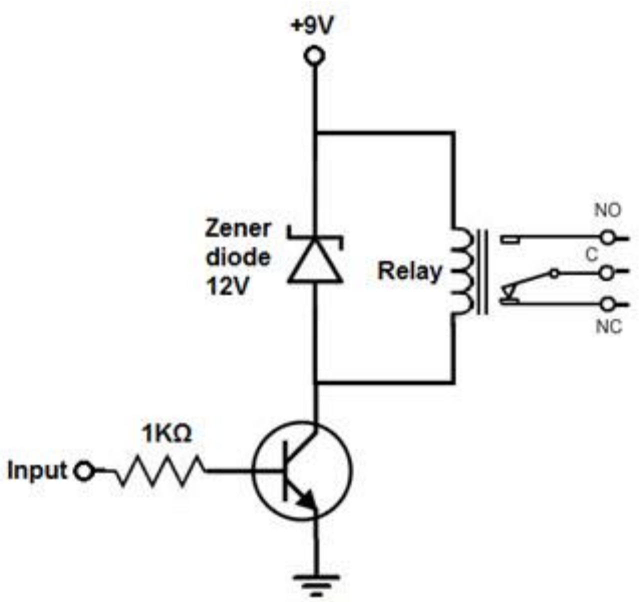


Figure 6.8: Relay driver IC circuit

In order to drive the relay, we use transistor and only less power can be possibly used to get the relay driven. Since, transistor is an amplifier so the base lead receives sufficient current to make more current flow from Emitter of Transistor to Collector. If the base once gets power that is sufficient, then the transistor conduct from Emitter to Collector and power the relay.

The Transistor’s emitter-to-collector channel will be opened even though no input current or voltage is applied to Base lead of Transistor. Therefore, blocking current flows through relay coil.

The emitter-to-collector channel will be opened and allows current to flow through relay's coil if enough current or voltage is applied as input to the base lead. AC or DC Current can be used to power the relay and circuit. Relays are electromagnetic devices which allow low power circuit to switch a high current ON and OFF switching devices with the help of an armature that is moved by an electromagnet.

Driver Circuit is used to boost or amplify signals from micro-controllers to control power switches in semi-conductor devices. Driver circuits take functions that include isolating the control circuit and the power circuit, detecting malfunctions, storing and reporting failures to the control system, serving as a precaution against failure, analyzing sensor signals and creating auxiliary voltages.

6.11.Cloud Computing

Cloud computing is a type of Internet-based computing that provides shared computer processing resources and data to computers and other devices on demand. It is a model for enabling ubiquitous, on-demand access to a shared pool of configurable computing resources (e.g., computer networks, servers, storage, applications and services) which can be rapidly provisioned and released with minimal management effort. Cloud computing and storage solutions provide users and enterprises with various capabilities to store and process their data in either privately owned, or third-party data centers that may be located far from the user–ranging in distance from across a city to across the world. Cloud computing relies on sharing of resources to achieve coherence and economy of scale, similar to a utility (like the electricity grid) over an electricity network.

Figure.6.9 Cloud computing

6.12 Role of cloud computing in the Internet of things

Cloud computing and the IoT both serve to increase efficiency in our everyday tasks, and the two have a complimentary relationship. The IoT generates massive amounts of data, and cloud computing provides a pathway for that data to travel to its destination.

1. Amazon Web Services, one of several IoT cloud platforms at work today, points out six advantages and benefits of cloud computing:

1. Variable expense allows you to only pay for the computing resources you use, and not more.
2. Providers such as AWS can achieve greater economies of scale, which reduce costs for customers.
3. You no longer need to guess your infrastructure capacity needs.

Some of the more popular IoT cloud platforms on the market include Amazon Web Services, GE Predix, Google Cloud IoT, Microsoft Azure IoT Suite, IBM Watson, and Sales force IoT Cloud.

6.13 Arduino software

Arduino is an open source, computer hardware and software company, project, and user community that designs and manufactures single-board microcontrollers and microcontrollers kits for building digital devices and interactive objects that can sense and control objects in the physical world.

Arduino board is the heart of our system .Entire functioning of system depends on this board. Arduino reacts to the 5v supply given by opto-coupler and keeps on counting the supply and then calculates the power consumed and also the cost. This data, it continuous stores on webpage, so that users can visit any time and check their consumption. It even reacts accordingly as per programed, to the situations like message sending during threshold value .

```
/*
  Library inclusion
*/
#include "DHT.h"
#include <Wire.h>
#include <LiquidCrystal_I2C.h>
#include <SoftwareSerial.h>

/*
```

```
  Pin defination
  LCD SDA A4
  LCD SCL A5
**/
#define DHTPIN A0
#define SoilSensor A2
#define RainSensor A1
#define TheftSwitch A3
#define WaterPump 13
#define Buzzer 5
#define DEBUG FALSE //comment out to remove debug msgs
#define _baudrate 115200//*-- Hardware Serial
#define DHTTYPE DHT11   // DHT 11
//#define DHTTYPE DHT22   // DHT 22  (AM2302), AM2321
//#define DHTTYPE DHT21   // DHT 21 (AM2301)
//*-- IoT Information
#define SSID "smartagri"
#define PASS "smartagri"
#define IP "184.106.153.149" // ThingSpeak IP Address
String GET = "GET /update?key=QI44ZGS0AT02PLAU";// GET /update?key=[THINGSPEAK_KEY]&field1=[data 1]&field2=[data 2]...;

DHT dht(DHTPIN, DHTTYPE);
LiquidCrystal_I2C lcd(0x27, 16, 2);
SoftwareSerial mySerial(3, 2);
// Variable Defination
int TamperState = 0;
int RainState = 0;
int Soilmoisture_value = 0;
int dry = 1020;
int Wet_comp = 263;
float h =  0;
int t =  0;
float f =  0;
```

```
float hif =  0;
float hic =  0;
int Soilsensor_value = 0;
void setup() {
  pinMode(TheftSwitch, INPUT_PULLUP);
  pinMode(WaterPump, OUTPUT);
  pinMode(Buzzer, OUTPUT);
  Serial.begin( _baudrate );
  debug.begin( _baudrate );
  sendDebug("AT");
  delay(5000);
  if (Serial.find("OK"))
  {
    debug.println("RECEIVED: OK\nData ready to sent!");
    Serial.println("OK");
   connectWiFi();
  }
if (RainState == HIGH && Soilmoisture_value <= 50 )
  {
    digitalWrite(WaterPump, HIGH);
    lcd.setCursor(9, 1);
    lcd.print("NO RAIN");
    updateTS(TAMPER, HUMIDITY, TEMP, RAIN, SOIL);
    Debug();
  }
  else
  {
    digitalWrite(WaterPump, LOW);
    lcd.setCursor(9, 1);
    lcd.print("RAIN");
    updateTS(TAMPER, HUMIDITY, TEMP, RAIN, SOIL);
    Debug();
  }
Serial.println("AT+CWMODE=1");//WiFi STA mode - if '3' it is both client and AP
```

```
delay(2000);
//Connect to Router with AT+CWJAP="SSID","Password";
// Check if connected with AT+CWJAP?
String cmd = "AT+CWJAP=\""; // Join accespoint
cmd += SSID;
cmd += "\",\"";
cmd += PASS;
cmd += "\"";
sendDebug(cmd);
delay(5000);
if (Serial.find("OK"))
{
  debug.println("RECEIVED: OK");
  return true;
}
else
{
  debug.println("RECEIVED: Error");
  return false;}
```

CHAPTER 7

RESULTS OF DESIGN SYSTEM

In this chapter we are presenting the pictures of results we got from the developed module.

7.1 Snapshots of obtained results of the project

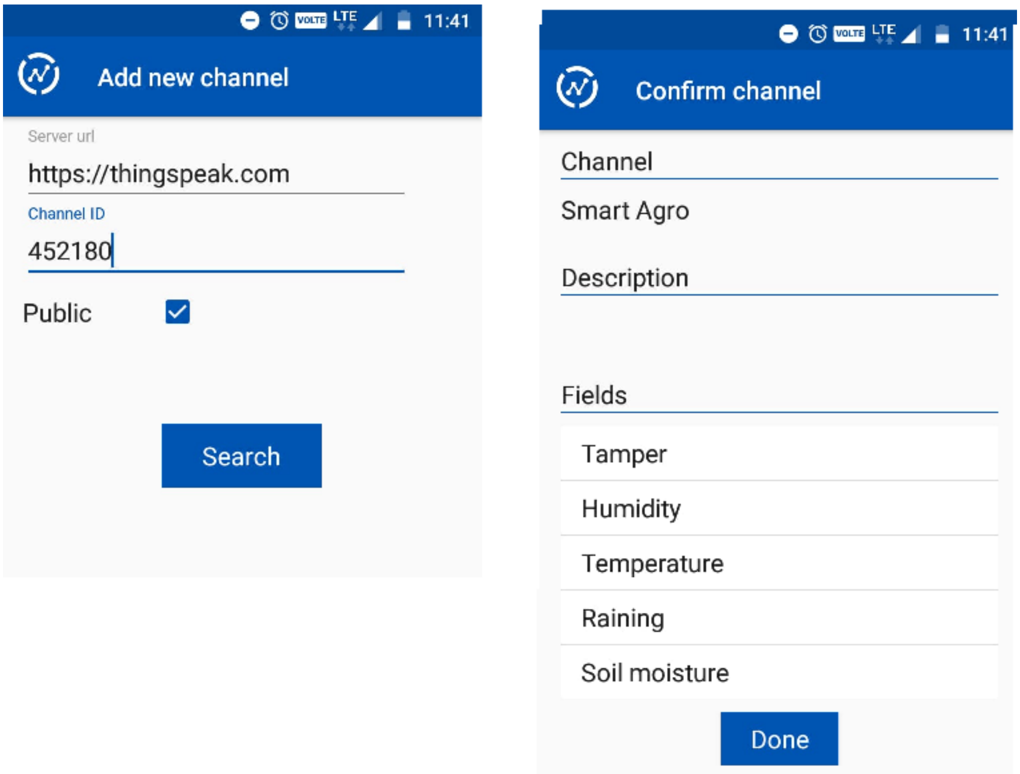


Figure 7.1 Web application channel

Web application channel is a computer program that utilizes web browsers and web technology to perform tasks over the internet.

As shown in the figure(7.1) we are entering sever url, and channel ID inorder to get main channel i.e. Smart Agro.

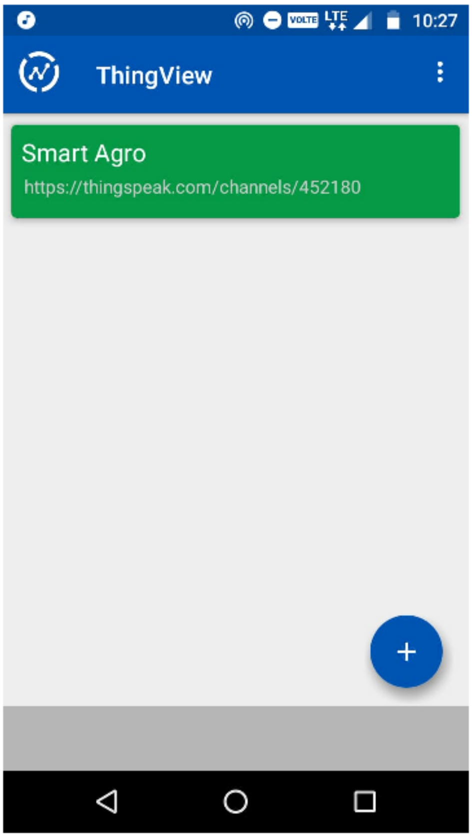


Figure 7.2 Mobile application page

Figure 7.3 Soil moisture level

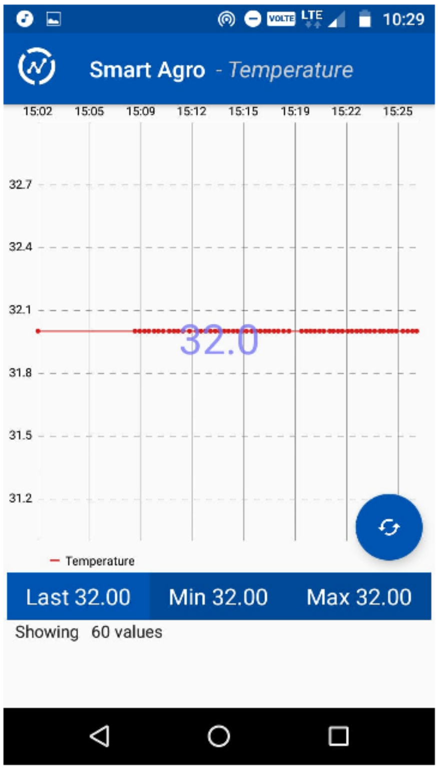


Figure 7.4 Temperature level

Figure 7.5 Humidity level

Figure 7.6 Raining level

Figure 7.7 Tamper level

After measuring the soil moisture level, the readings are sent to the cloud by Wi-Fi module and then it will be displayed like above graph at a given time as shown in figure(7.3)

Like the soil moisture, Temperature level, Humidity level, Raining level are also shown in the above graph at a specific time, the values are different for a different time n season as we know that temperature and humidity varies morely during rainy season, so by the above data farmer will get clear idea about the varying parameters and the motor action can be controlled.

Tamper switch is mainly used for theft detection, if anyone tries to hack the system or to remove any components from the system, the buzzer gives the notification that the system is hacked by someone.

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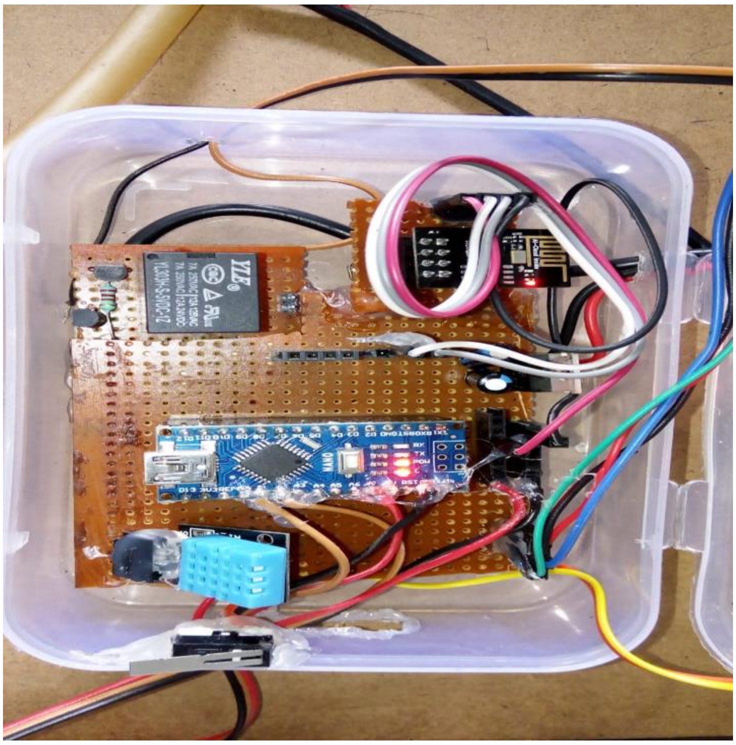

Figure 7.8 Hardware setup made to realize the project

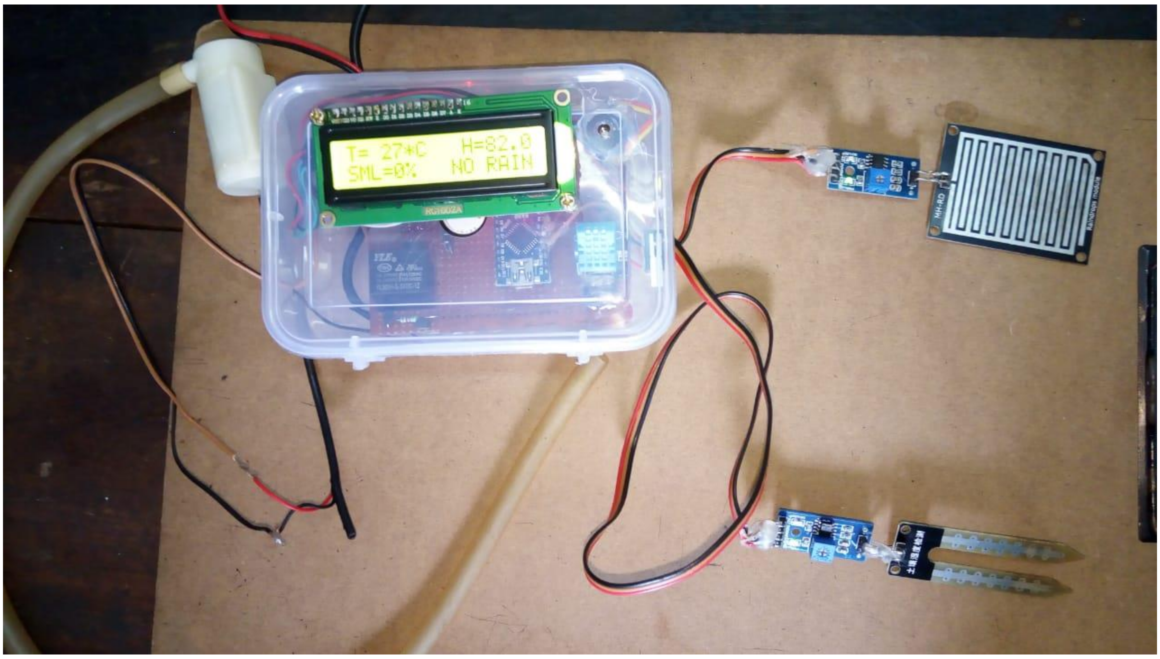

Figure 7.9 Real time output of the project

7.2 ADVANTAGES, LIMITATIONS AND APPLICATIONS

Advantages

1. Relatively simple to design and install.
2. It is safest system and no manpower is required.
3. The system helps the farmer to work when irrigation is taking place, as only the area between the plants are wet.
4. Reduce soil erosion and nutrient leaching.
5. The system need smaller water sources, as it consumes less than half of the water.
6. PH content of the soil is maintained through the suggestions which help for healthy plant growth.

Limitations

1. Illiterate people will not be able to read the message in English.
2. Network problem-because of network coverage in rural areas.
3. Cannot be able to monitor if the registered mobile number is switched off.

Applications

1. Utilized for irrigation purpose.
2. Can be operated from any place in the world.
3. No need of manual check for moisture level in soil.
4. User friendly.

CHAPTER 8

CONCLUSION

As water supplies become scarce and polluted, there is a need to irrigate more efficiently in order to minimize water use. Recent advances in soil water sensoring make the commercial use of this technology possible to automate irrigation management for agriculture production. However, report indicates that different sensors types may not perform alike under all conditions. Reductions in water use range as high as 70% compared to farmer practices with no negative impact on crop yields. Due to the soil's natural variability, location and number of soil water sensors may be crucial and future work should include optimization of sensor placement. Additional research should also include techniques to overcome the limitation of requiring a soil specific calibration.

The Microcontroller based irrigation system proves to be a real time feedback control system which monitors and controls all the activities of irrigation system efficiently. The present proposal is a model to modernize the agriculture industries at a mass scale with optimum expenditure. Using this system, one can save manpower, water to improve production and ultimately profit.

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