AGRISCAPE

AN IOT BASED IRRIGATION SYSTEM

Submitted in partial fulfilment of the requirement

of the degree of

BACHELOR OF ELECTRONICS ENGINEERING

by the students of D16B

MR.AJAY VISHWANATHAN (02)

MR. PRUTHVI DUBEY (20)

MR. MAKRAND FARKADE (21)

MR. SAJJAN JHA (31)

Supervisor:

MR. YOGESH PANDIT

(Assistant Professor, Dept. Of Electronics Engineering)

DEPARTMENT OF ELECTRONICS ENGINEERING

VIVEKANAND EDUCATION SOCIETY'S INSTITUTE OF TECHNOLOGY

2015-16

CERTIFICATE

This is to certify that the project entitled **"Agriscape - An IOT based Irrigation System"** isthe bonafide work ofthe students of D16B"**Mr. Ajay Vishwanathan(02), Mr. Pruthvi Dubey(20), Mr. Makrand Farkade(21), Mr.Sajjan Jha(31)"**submitted to the University of Mumbai in partial fulfilment of the requirement for the award of the degree of **"Bachelor of Engineering"** in **"Electronics"**.

Supervisor/Guide

Mr. Yogesh Pandit

Head of Department

Mrs. Kavita Tewari

Principal

Dr. (Mrs.) J.M. Nair

Project Report Approval for B.E

This project report entitled **"Agriscape - An IOT based Irrigation System"** by **Mr. Ajay Vishwanathan (02), Mr.Pruthvi Dubey (20), Mr. Makrand Farkade (21), Mr.Sajjan Jha (31)** is approved for the degree of **Bachelor of Electronics Engineering**.

Examiners

1._ _ _ _ _ _ _ _ _ _ _ _ _ _

2._ _ _ _ _ _ _ _ _ _ _ _ _ _

Date:

Place:

DECLARATION

We declare that this written submission represents our ideas in our own words and where others ideas or words have been included we have adequately cited and referenced the original sources. We also declare that we have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in our submission. We understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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Mr. Ajay Vishwanathan (D16B/02) Mr. Pruthvi Dubey (D16B/20)

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Mr. Makrand Farkade (D16B/21) Mr. Sajjan Jha(D16B/31)

Date: 16/04/2016

PREFACE

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We take an opportunity to present this project report on “Agriscape - An IOT based Irrigation System” and put before readers some useful information regarding our project.

We have made sincere attempts and taken every care to present this matter in precise and compact form, the language being as simple as possible.

We are sue that the information contained in this volume would certainly prove useful for better insight in the scope and dimension of this project in its true perspective

The task of completion of the project though being difficult was made quite simple, interesting and successful due to deep involvement and complete dedication of our group members.

ACKNOWLEDGEMENT

We are thankful to our college Vivekanand Education Society's Institute of Technology for considering our project and extending help at all stages needed during our work of collecting information regarding the project.

It gives us immense pleasure to express our deep and sincere gratitude to Assistant Professor **Mr. Yogesh Pandit** (Project Guide) for his kind help and valuable advice during the development of project synopsis and for his guidance and suggestions.

We are deeply indebted to Head of the Electronics Department **Mrs. Kavita Tiwari** and our Principal **Dr. (Mrs) J.M. Nair** , for giving us this valuable opportunity to do this project.

We express our hearty thanks to them for their assistance without which it would have been difficult in finishing this project synopsis and project review successfully.

We convey our deep sense of gratitude to all teaching and non-teaching staff for their constant encouragement, support and selfless help throughout the project work. It is great pleasure to acknowledge the help and suggestion, which we received from the Department of Electronics Engineering. We wish to express our profound thanks to all those who helped us in gathering information about the project. Our families too have provided moral support and encouragement at several times.

ABSTRACT

Now days, water shortage is becoming one of the biggest problem in the world. Many different methods are developed for conservation of water. We need water in each and every field. In our day to day life also water is essential. Water is considered to be basic need of human. Water is needed for everyone human beings, animals, plants, etc. Agriculture is one of the fields where water is required in tremendous quantity. Wastage of water major problem in agriculture, every time excess of water is given to the field.

The main aim of this project is to provide automatic irrigation to the plants which helps in saving money and water. The entire system is controlled using 8051 micro controller which is programmed as giving the interrupt signal to the sprinkler. Moisture sensor and water level indicator are connected to internal ports of micro controller, whenever there is a change in moisture and water level of the surroundings, the system gives an interrupt signal to the micro-controller and thus the water pump is activated with the help of relay driver.

The user communicates with the centralized unit through SMS. The centralized unit communicates with the system through SMS which will be received by the GSM with the help of the SIM card. This application makes use of the GPRS [General Packet Radio Service] feature of mobile phone as a solution for irrigation control system. Thus in short whenever the system receives the activation command from the subscriber it checks all the field conditions and gives a detailed feedback to the user and waits for another activation command to start the motor.

The motor is controlled by a relay driver. The starter coil is indirectly activated by means of a transistorized relay circuit. When the motor is started, a constant monitoring on soil moisture and water level is done & once the soil moisture is reached to sufficient level the motor is automatically turned off & a massage is send to subscriber that the motor is turned off. The water level indicator indicates three levels low, medium, high and also empty tank.

The server is used as a medium to transfer commands from the android application to the device on field. The server works on the basis of request and response. A MySQL database is linked to the server to log data.

The android application is used to control the system via phone which could give the facilities of maintaining uniform environmental conditions are proposed.

Chapter 1 deals with the brief introduction about Agriscape, importance of automation of irrigation system.

Chapter 2 deals with the survey of literature

Chapter 3 deals with block diagram of the system, circuit diagram, irrigation server, android application

Chapter 4 deals with Analysis, Experimentation, & results

Chapter 5 deals with the conclusion and references.

CHAPTER 1: INTRODUCTION

INTRODUCTION

Agriculture is the backbone of Indian Economy. In today's world, as we see the rapid growth in global population, agriculture becomes more important to meet the needs of the human race. However, agriculture requires irrigation, and with every year we have more water consumption than rainfall, it becomes critical for growers to find ways to conserve water while still achieving the highest yield .But at the present era, the farmers have been using irrigation technique through the manual control in which they irrigate the land at the regular intervals. This process sometimes consumes more water or sometimes the water reaches late due to which the crops get dried.

Over the past 200 years, farmers have developed simple irrigation systems based on diversion of water from seasonal or permanent streams and rivers. This sort of manual irrigation system provide variable amount of water that is sometimes excess or sometimes insufficient than that required for the suitable growth of crops .Thus, the farmer has to toil himself all day and night to monitor the moisture content in the soil. The advances in the technologies related to wireless communication has led to the emergence of several engineering designs to aid the human requirements. As we all know Agriculture play a significant role in developing country like India and implementing mobile communication for facilitating farmers is the basic idea of our project. IOT BASED IRRIGATION SYSTEM is a simpler, multipurpose, cost-effective design to control the on-off mechanism of an electric motor for irrigation in the field via Short Message Service (SMS) or through an Android App. This tends to utilize the availability of GSM network, mobile phones and electronic circuits to achieve an automated system which is programmed to work as a thinking device to accomplish this purpose. Besides self-monitoring the moisture content

of the soil, this system will also give auxiliary control to the user to enable him/her to irrigate the field from a remote place

In this system, the motor work on its own with the help of inputs received from the sensors which is measuring the moisture content of agricultural land and indicating water level in the water tanks. The farmer can monitor whether everything is going normal or some action is needed to be taken. The entire process is controlled and monitored. Automating farm allows farmers to apply the right amount of water at the right time, regardless of the availability of labor to turn motors 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. Automatic Irrigation is a valuable tool for accurate soil moisture control in highly specialized greenhouse vegetable production and it is a simple, precise method for irrigation. In this project there are soil moisture sensors for monitoring the moisture content of soil which continuously inform about the moisture present in the soil. There is provision of selecting the amount of moisture content required for different crops. Whether we have to irrigate the rice field that requires more water or some other crops that require less amount of moisture content, this system provides suitable moisture for various types of crops. Use of GSM network can work out irrigation system with low cost. This system monitors land owner's soil moisture and the water levet, and send message to the land owner about the status of field and irrigates the field if there is need of irrigation and the motor is switched off automatically after the necessary conditions for irrigation is met.

CHAPTER 2: LITERATURE SURVEY

LITERATURE SURVEY

2.1 importance of Irrigation System

Automation of *irrigation* systems refers to the operation of the system with no or minimum manual interventions. The system is automated using sensors, timers and computer devices. It makes the *irrigation* process more efficient and the farmer can concentrate on other important farming tasks. An irrigation system can have two main benefits – it helps to conserve water and, through automation, an automated sprinkler system can prevent over-watering or under-watering. On the other hand, such a system can be expensive and very complex in its design and may needs experts to plan and implement it. Although an automated irrigation system can be more expensive in the short run, installing an automated irrigation system could pay dividends in terms of cost and sheer efficiency down the road.

1. **Automatic Lawn and Garden Feeding Apparatus (US 5366159 A) - Lance L. Childers[4]**

   An automatic fertilizing is a apparatus which injects fertilizer directly into the water stream of a sprinkler system. Each time the sprinkler system is activated, a predetermined amount of fertilizer is dispensed into the water-stream. The apparatus can be controlled to dispense fertilizer only thru sprinkler lines determined by the user.

2. Automatic Plant Irrigation System [6]

We know that people do not pour the water on to the plants in their gardens when they go on vacation or often forget to water plants. As a result, there is a chance to get the plants damaged. This project is an excellent solution for such kind of problems.

3. GSM based Technology:

In GSM Based Automated Irrigation Control using Rain gun Irrigation System. R.Suresh, S.Gopinath, K.Govindaraju, T.Devika, N.SuthanthiraVanitha [1] mentioned about 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.

CHAPTER 3: ADOPTED METHODOLOGY

ADOPTED METHODOLOGY

3.1 Block Diagram of Irrigation System

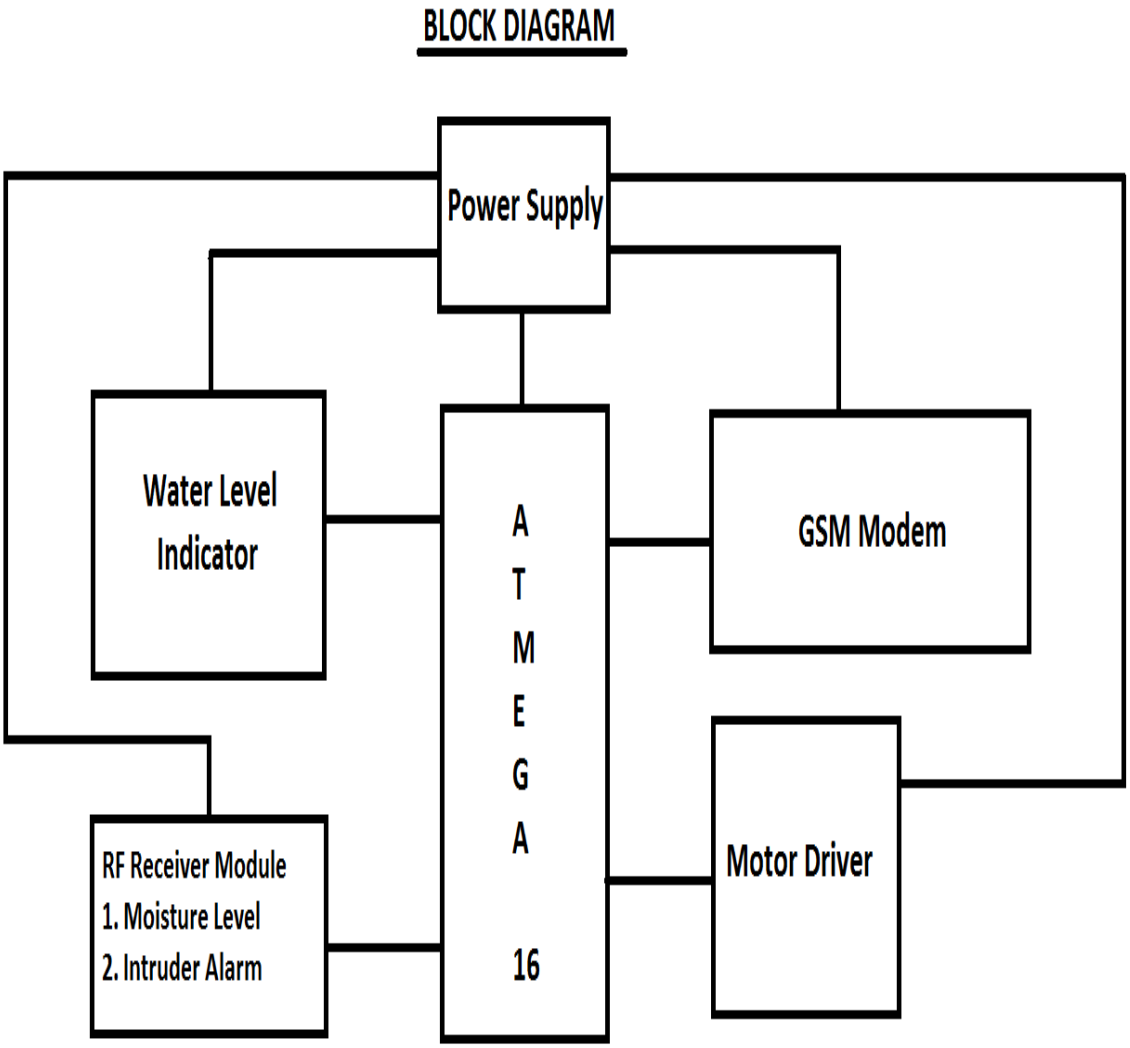

Fig 3.1

3.1.1 HARDWARE DESCRIPTION:

- **Microcontroller:** ATmega16 is an 8-bit high performance microcontroller of Atmel's Mega AVR family with low power consumption. Atmega16 is based on enhanced RISC (Reduced Instruction Set Computing), architecture with 131 powerful instructions. Most of the instructions execute in one machine cycle. Atmega16 can work on a maximum frequency of 16MHz.ATmega16 has 16 KB programmable flash memory, static RAM of 1 KB and EEPROM of 512 Bytes.ATmega16 is a 40 pin microcontroller. There are 32 I/O (input/output) lines which are divided into four 8-bit ports designated as PORTA, PORTB, PORTC and PORTD.ATmega16 has various in-built peripherals like USART, ADC, Analog Comparator, SPI, JTAG etc. Each I/O pin has an alternative task related to in-built peripherals.

- **Power Supply:** The power supply is used to power up the microcontroller and other modules including RF. As microcontroller and other modules require minimum of 5 volts to power up, a 9 volts Adapter is used which with the help of a voltage regulator LM7805 yields a 5 volts supply.

- **Water Pump:** A submersible pump (or sub pump, electric submersible pump (ESP)) is a device which has a hermetically sealed motor close-coupled to the pump body.Thesubmersible pumps used in ESP installations are multistage centrifugal pumps operating in a vertical position. Although their constructional and operational features underwent a continuous evolution over the years, their basic operational principle remained the same. Produced liquids, after being subjected to great centrifugal forces caused by the high rotational speed of 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. When fluids enter the pump through an intake screen and are lifted by the pump stages.Other parts include the radial bearings (bushings) distributed along the length of the shaft providing radial support to the pump shaft turning at high rotational speeds. An optional thrust bearing takes up part of the axial forces arising in the pump but most of those forces are absorbed by the protector's thrust bearing.

- **Relay Driver:** An electromagnetic relay is a switch which is used to switch High Voltage or Current using Low power circuits. It magnetically isolates low power circuits from high power circuits. It is activated by energizing an electromagnet, coil wounded on a soft iron core. A relay should not be directly connected to a microcontroller. it needs a driving circuit due to the following reasons.

  - A microcontroller will not able to supply current required for the proper working of a relay. The maximum current that A89C51 microcontroller can sink is 15mA while a relay needs about 50 – 100mA current.
  - A relay is activated by energizing its coil. Microcontroller may stop working by the negative voltages produced in the relay due to its back emf.

- **Moisture Detection System:** The Moisture Sensor Grove is a 2.0cmX6.0cm module. It can be used to detect the moisture of soil or judge if there is water around the sensor, it helps to detect the moisture content in the soil and then

read it with the help of a hygrometer which is attached to the Grove. This sensor output helps to control the system depending on the moisture content of the soil. It works on the principle of soil resistivity measurement.

- **Water level indicator:** This is a **simple transistor based water level indicator circuit which** is very useful to indicate the water levels in a tank. Whenever tank gets filled, we get alerts on particular levels. Here we have created 3 levels (low, medium and full), we can create alarms for more levels. We have added 3 LEDs to indicate initial three levels. When tanks gets filled completely we get beep sound from Buzzer which indicates full level.

- **Intruder Detection System:** It is a simple transistor based Intruder Alarm System is built to try and prevent the possible intrusion of wild animals, people or any other creatures which may destroy crops. The intrusion system produces a loud and unpleasant sound to scare away the animal
- **RF Module:** The RF module operates at Radio Frequency. In the RF system, the digital data is represented as variations in the amplitude of carrier wave. This kind of modulation is known as Amplitude Shift Keying (ASK). This **RF module** comprises of an **RF Transmitter** and an **RF Receiver**. The transmitter/receiver (Tx/Rx) pair operates at a frequency of **434 MHz**. An RF transmitter receives serial data and transmits it wirelessly through RF through its antenna connected at pin4. The transmission occurs at the rate of 1Kbps - 10Kbps.The transmitted data is received by an RF receiver operating at the same frequency as that of the transmitter.The RF module is often used alongwith a pair of encoder/decoder. The encoder is used for encoding parallel data for transmission feed while reception is decoded by a

decoder. HT12E-HT12D, HT640-HT648, etc. are some commonly used encoder/decoder pair ICs.

- **GSM Module:** The GSM Modem can accept any GSM network operator SIM card and act just like a mobile phone with its own unique phone number. Advantage of using this modem will be that you can use its RS232 port to communicate and develop embedded applications. Applications like SMS Control, data transfer, remote control and logging can be developed easily. The modem can either be connected to PC serial port directly or to any microcontroller through MAX232. It can be used to send and receive SMS or make/receive voice calls. It can also be used in GPRS mode to connect to internet and do many applications for data logging and control. In GPRS mode you can also connect to any remote FTP server and upload files for data logging. This GSM modem is a highly flexible plug and play quad band **SIM900A** GSM modem for direct and easy integration to RS232 applications. Supports features like Voice, SMS, Data/Fax, GPRS and integrated TCP/IP stack.

Applications

- SMS based Remote Control & Alerts
- Security Applications & Sensor Monitoring
- GPRS Mode Remote Data Logging

3.2 Circuit Diagram

3.2.1 Main Module Circuit Diagram with Motor Interfacing

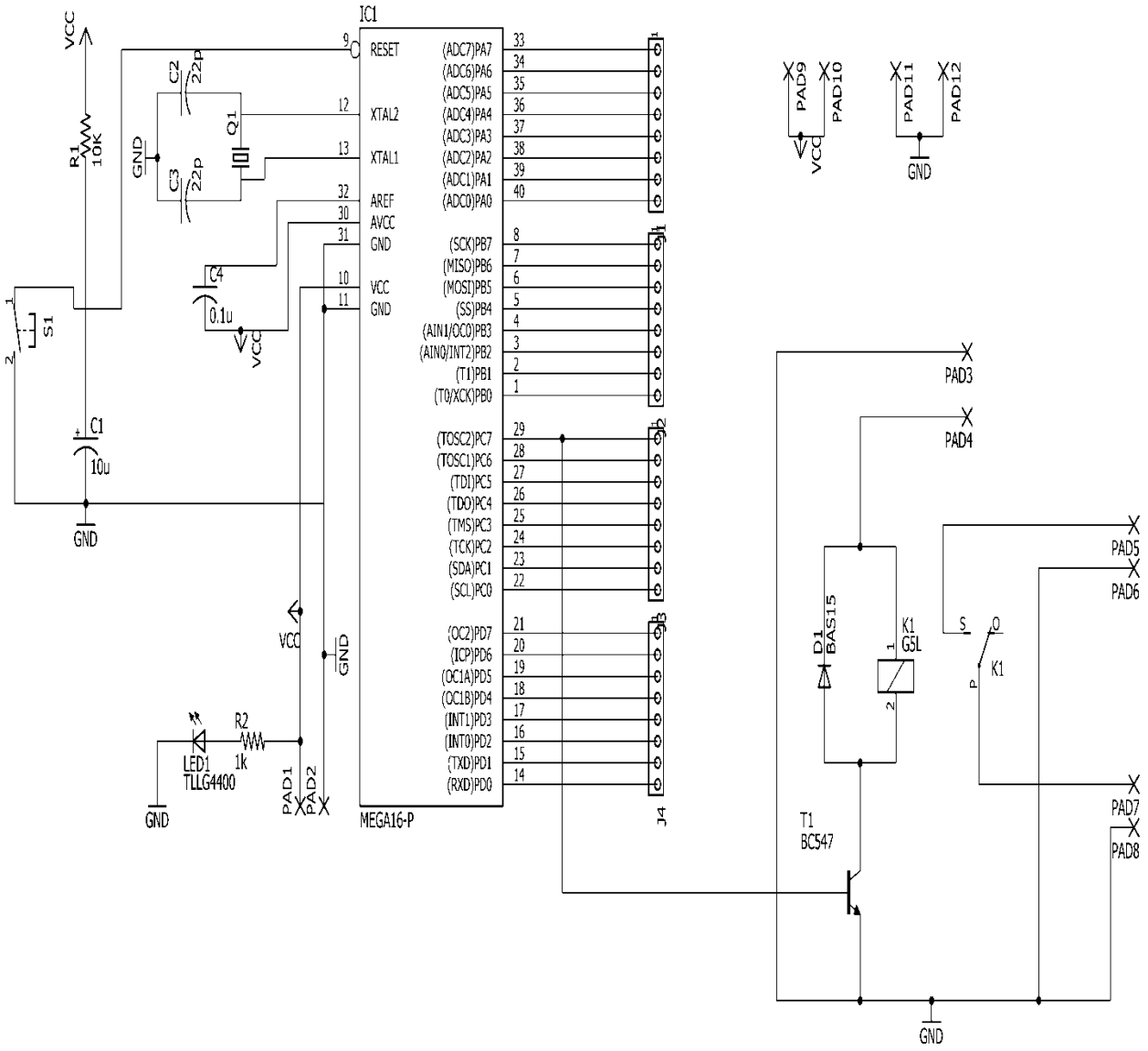

Fig 3.2

3.2.2 Power Supply Circuit Diagram

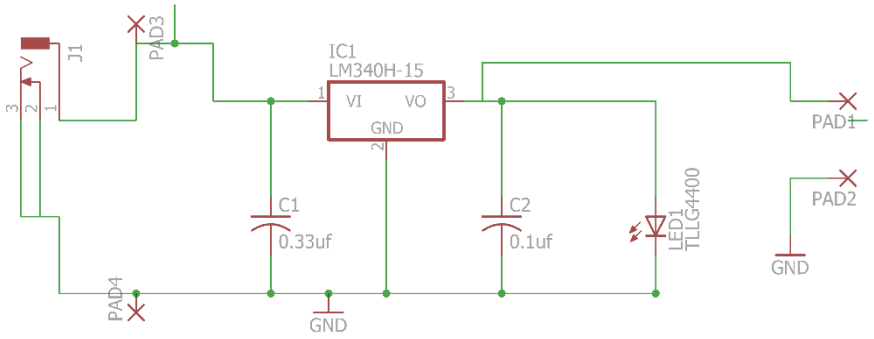

Fig 3.3

3.2.3 RF based Intruder alarm Circuit Diagram

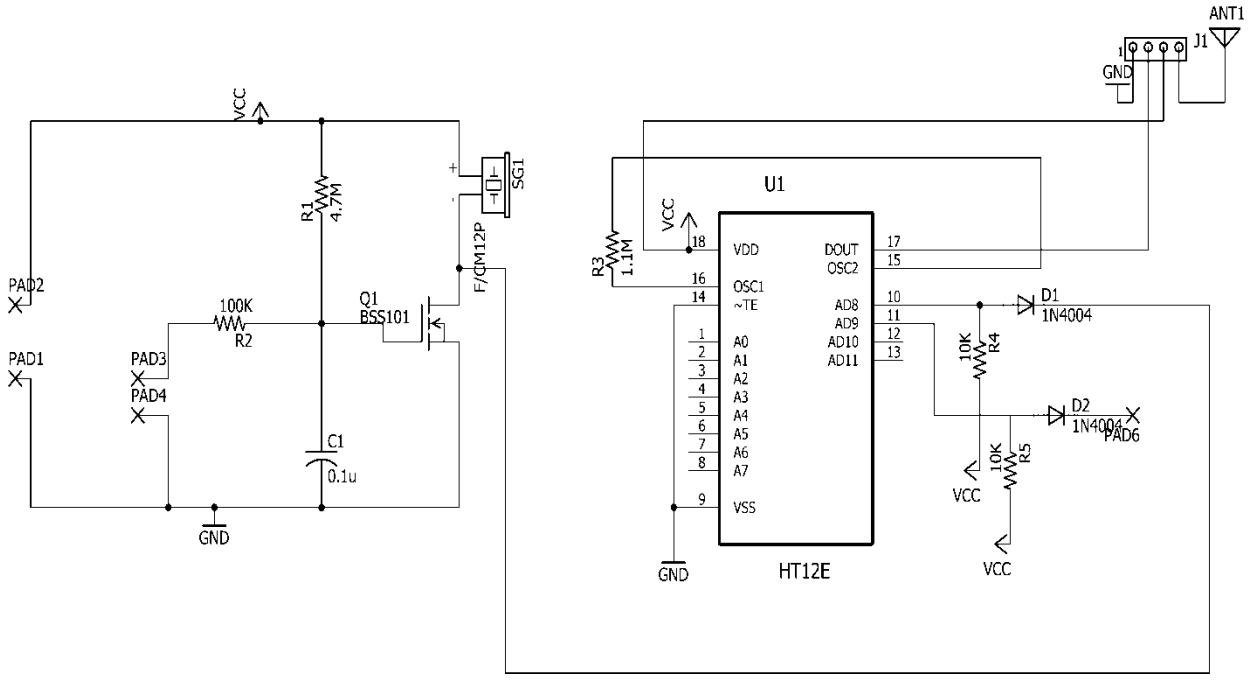

Fig 3.4

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3.2.4 Receiver Module Circuit Diagram

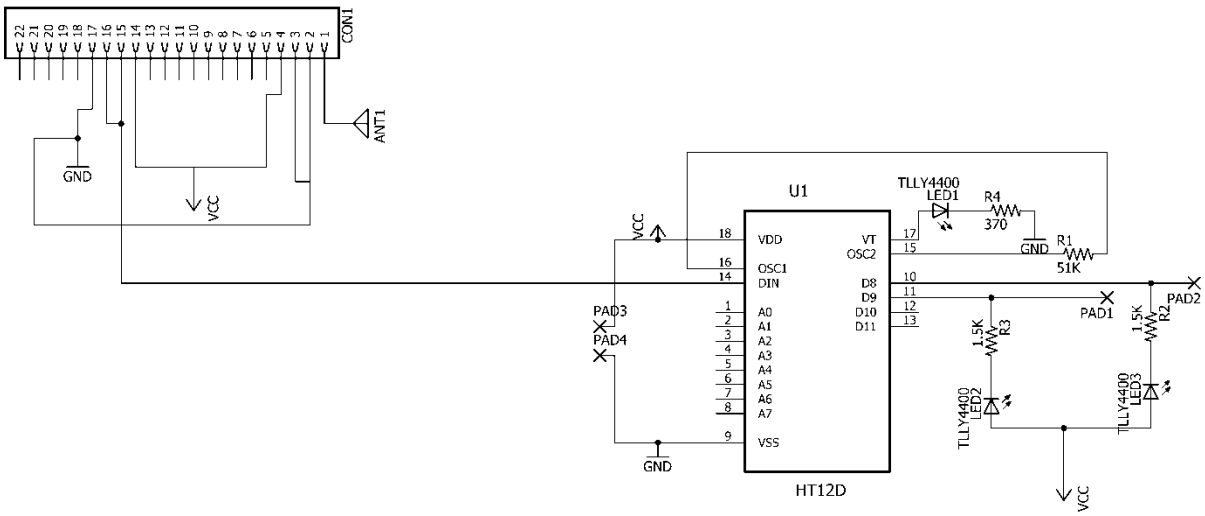

Fig 3.5

3.2.5 Water Level Circuit Diagram

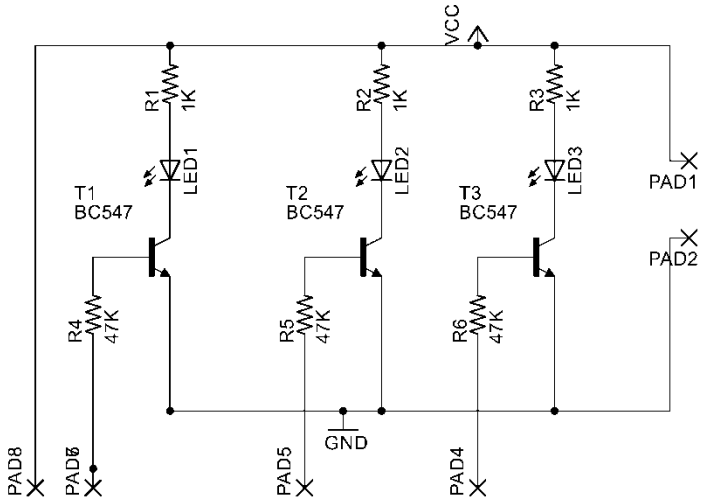

Fig 3.6

3.3 Weather Monitoring System

Weather monitoring holds great importance and is used in keeping track of agricultural field weather conditions. Weather monitoring would help in keeping track of different climatic behaviors including temperature, humidity and light intensity. It provides farmer with real-time conditions of the field and helps in taking the decisions accordingly.

Weather Monitoring System can be either wired or wireless one. In case of wireless communication, the connectivity will be more convenient and user friendly and weather monitoring would not require physical presence of the person at the location.

Wireless communication is the transfer of information over a distance without the use of wires. The distances involved may be short (a few meters as in television remote control) or long (thousands or millions of kilometers for radio communications).GSM technology is the cheapest and the most convenient technology now being used for wireless communication. The wireless weather monitoring system basically requires few basic modules such as GSM module, Display, module and microcontroller module.

3.4 Irrigation System Server

In computing, a **server** is a computer program or a device that provides functionality for other programs or devices, called "clients". This architecture is called the client–server model, and a single overall computation is distributed across multiple processes or devices. Servers can provide various functionalities, often called "services", such as sharing data or resources among multiple clients, or performing computation for a client. A single server can serve multiple clients, and a single client can use multiple servers. A client process may run on the same device or may connect over a network to a server on a different device.

The server is part of the client–server model; in this model, a server serves data for clients. The nature of communication between a client and server is request and response. This is in contrast with peer-to-peer model in which the relationship is on-demand reciprocation. In principle, any computerized process that can be used or called by another process (particularly remotely, particularly to share a resource) is a server, and the calling process or processes is a client. Thus any general purpose computer connected to a network can host servers. For example, if files on a device are shared by some process, that process is a file server. Similarly, web server software can run on any capable computer, and so a laptop or a personal computer can host a web server.

For this project, we build a server in PHP, which will be linked to the Android Application and the Device in the field. This server is linked to a MySql database which will be logging data as and when received from the Device and the android application. The server database will have 4 parameter viz. Motor Control, Water Level Indicator, Moisture Level and Intruder alarm. As mentioned above this server also works on request and response.

As the server requests are made and data values are changed, the new values of the parameter are stored in the database with the timestamp.

3.5 Android Application

Android Applications ("apps"), which extend the functionality of devices, are written using the Android software development kit (SDK) and, often, the Java programming language that has complete access to the Android APIs. Java may be combined with C/C++, together with a choice of non-default runtimes that allow better C++ support; the Go programming language is also supported since its version 1.4, which can also be used exclusively although with a restricted set of Android APIs. The SDK includes a comprehensive set of development tools including a debugger, software libraries, a handset emulator based on QEMU, documentation, sample code, and tutorials.

The android application for this project is built to send commands to the device present on the field. The application was built using Java. It has the following viewable parameters:

1. Motor Control
2. Water Level and Moisture Level
3. Intruder alarm
4. Weather Reports

The Motor Control is used to switch on or off the Motor and to also view the current status of motor. The Water Level and Moisture Level is used to check the current level of water in the wells and the moisture level in the field. The intruder alarm will be used to notify the user if the alarm has been tripped or not and the current status of it. The weather report is used to give localized report of the weather conditions.

CHAPTER4: EXPERIMENTATION AND RESULT

EXPERIMENTATION AND RESULT

4.1 Android Application Windows

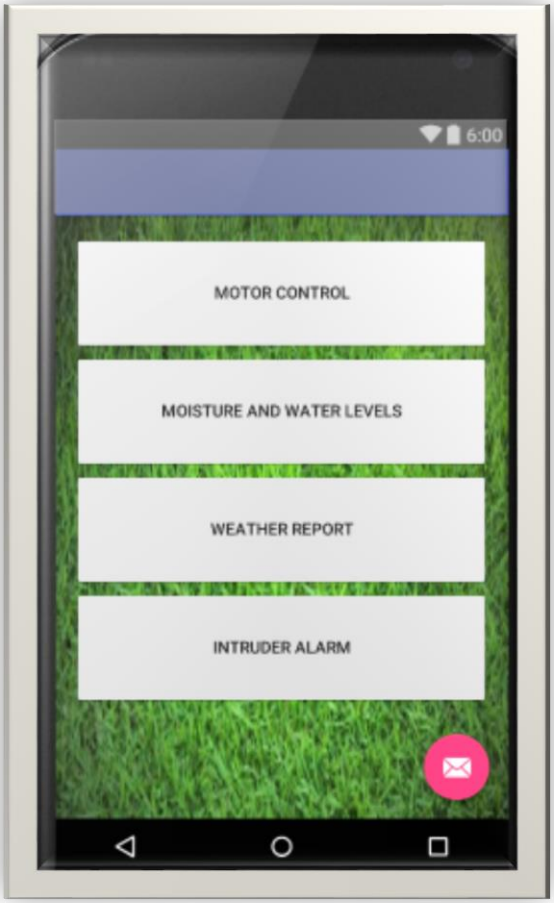

Fig 4.1 Home

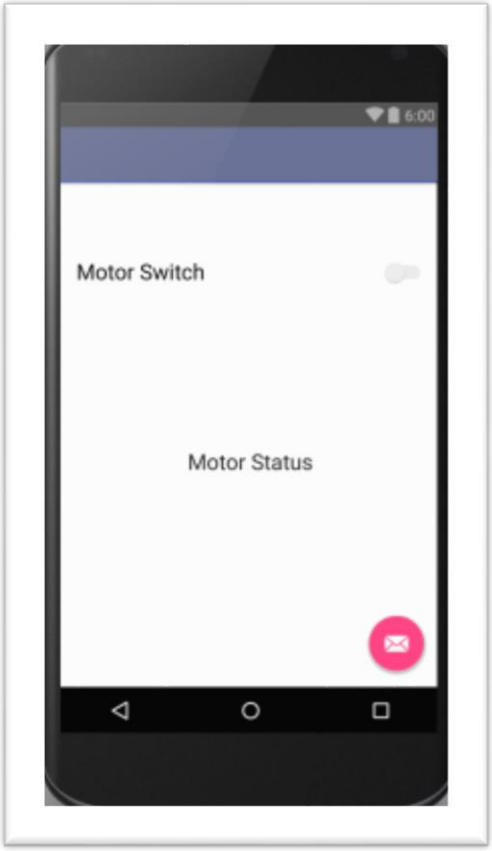

Fig 4.2

4.2 Irrigation System Server Windows

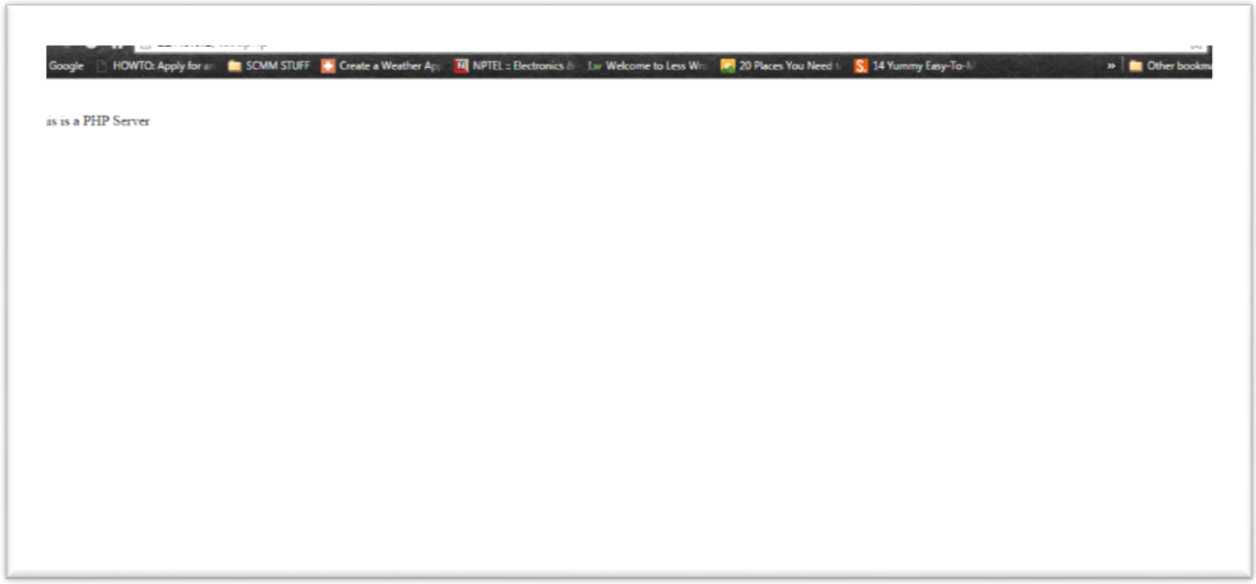

Fig 4.3 Homepage

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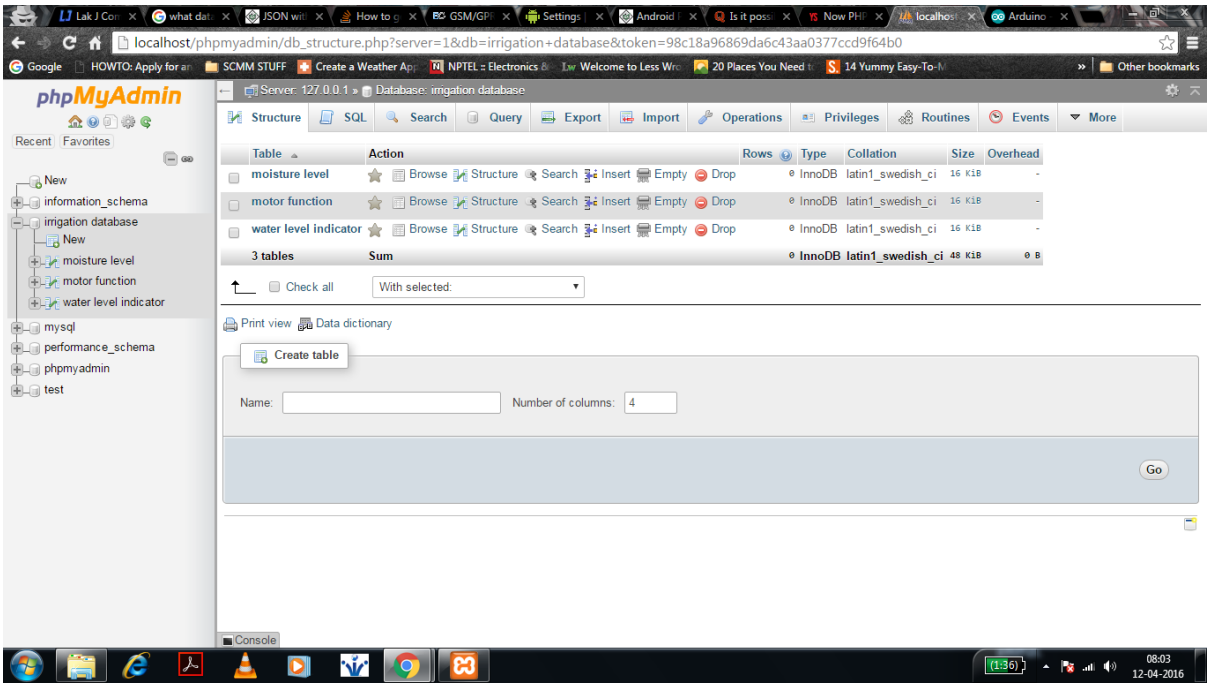

Fig 4.4 Database page

4.3 PCB LAYOUT

4.3.1 Main Module Layout with Motor Interface

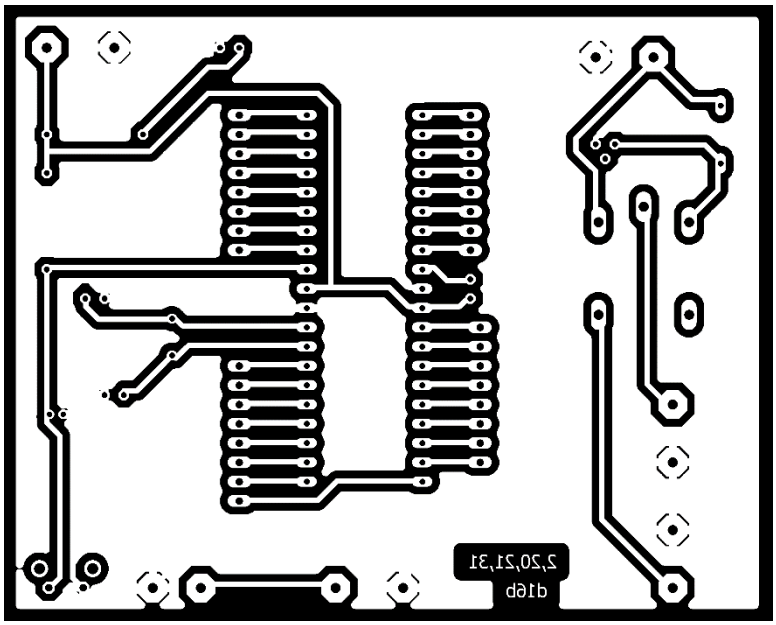

Fig 4.5

4.3.2 Power Supply Layout

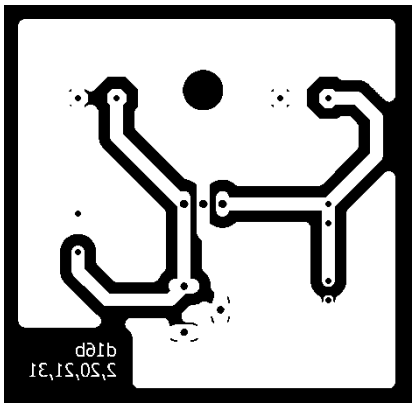

Fig 4.6

4.3.3 RF based Intruder Alarm System

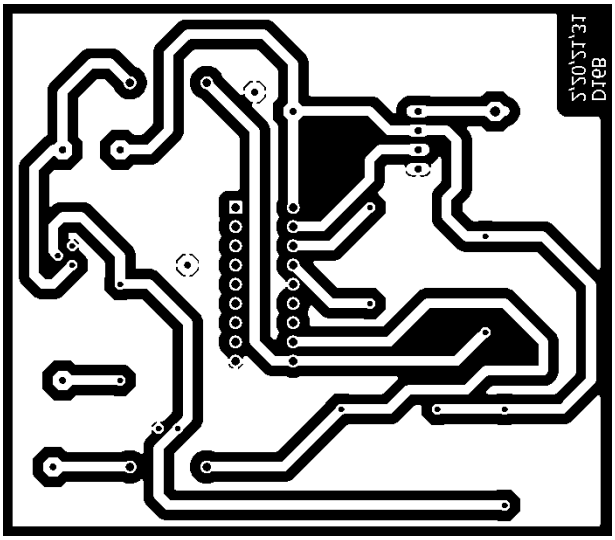

Fig 4.7

4.3.4 Receiver Module Layout

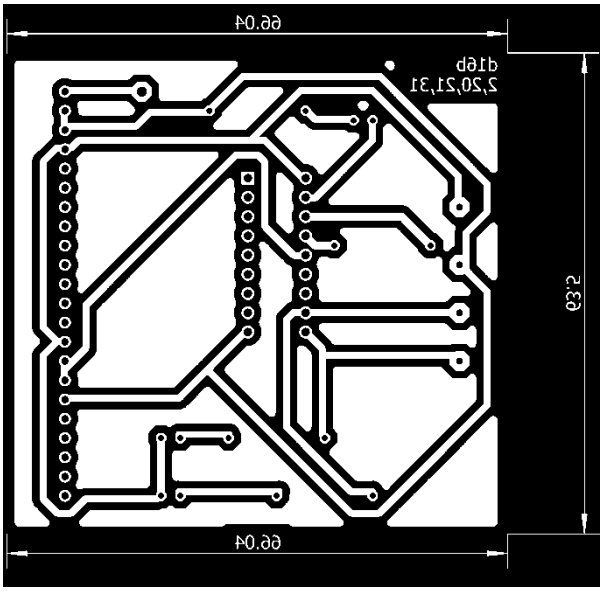

Fig 4.8

4.3.5 Water Level Indicator

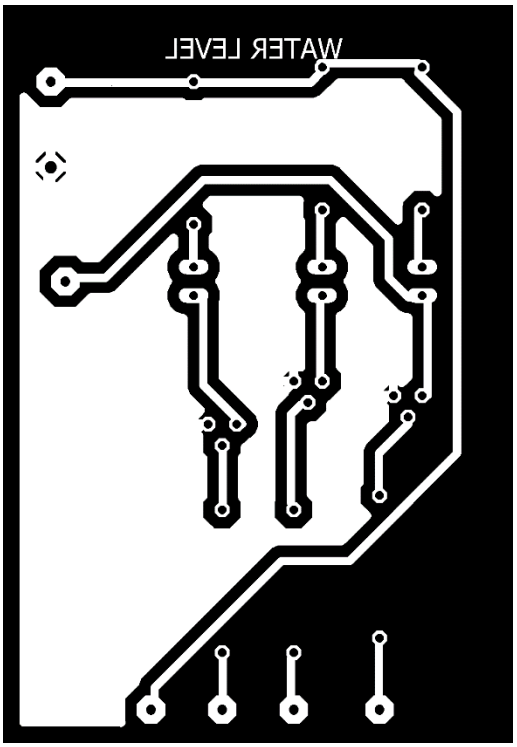

Fig 4.9

4.4. Hardware Implementation

4.4.1 P.C.B. Fabrication & Designing of layout:

- Open source software CadSoft Eagle v7.5 is used to convert the circuit diagram in PCB layout.
- The board used is made of fiber glass for longer durability.
- Printout of the layout was taken using laser printer on A4 sized photo paper.
- Make sure that the printout is made on the glossy side of the paper
- Cut board according to the size of layout.
- Rub the copper side of PCB using steel wool or abrasive spongy scrubs. This removes the top oxide layer of copper as well as the photo resists layer.
- Transfer the printed image from the photo paper to the board. Make sure to flip top layer horizontally. Put the copper surface of the board on the printed layout. Ensure that the board is aligned correctly along the borders of the printed layout.
- Iron on the paper to provide heat which will transfer the layout on to the PCB.
- Place the PCB in water for cooling and gently remove the photo paper.
- Dip the PCB in Ferric Chloride solution for etching.
- Rub PCB with metal scrubber to remove the remaining impurities.

4.4.2 Drilling and Soldering:

- After PCB is fabricated, holes are drilled with 1 mm or 0.8 mm drill.
- For soldering of any joints first the terminal to be soldered are cleaned to remove oxide film or dirt on it. If required flux is applied on the points to be soldered.
- Now the joint to be soldered is heated with the help of soldering iron. Heat applied should be such that when solder wire is touched to joint, it must melt quickly.
- The joint and the soldering iron is held such that molten solder should flow smoothly over the joint.
- When joint is completely covered with molten solder, the soldering iron is removed.
- The joint is allowed to cool, without any movement.
- The bright shining solder indicates good soldering.
- In case of dry solder joint, an air gap remains in between the solder material and the joint. It means that soldering is improper. This is removed and again soldering is done.

CHAPTER 5: CONCLUSIONS AND REFERENCES

CONCLUSIONS AND REFERENCES

Conclusion:

Since agriculture has become the backbone of human civilization, irrigation has become the backbone of agriculture. Earlier irrigation practices lead to huge wastage of water, but in present scenario conservation of water is of utmost importance. By continuously monitoring the moisture of soil, the flow of water can be controlled and thereby reduce the wastage.

By continuously knowing the status of moisture in soil through GSM using the sensors, water flow is controlled by the click of a button. This system offers a potential solution to support site specific irrigation management that allows farmers to maximize the productivity while saving water.

The system incorporates RF Module and GSM Modem to ensure wireless connectivity from the specific area of concern. Through use of modules for wireless communication along with android application, the system makes utilization of IoT to its required potential. Safety measures are taken care of by implementation of Intruder Detection module. The design is low power, low cost, small size and highly versatile.

Thus, the system avoids over irrigation and under irrigation, detects intrusion and reduces the wastage of water. Thereby achieving the objective of the project using minimalistic approach to resources and setting up new openings for further growth in irrigation.

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CHAPTER 6: APPENDIX

6.1 Features and Specifications

1. Microcontroller(ATmega16)

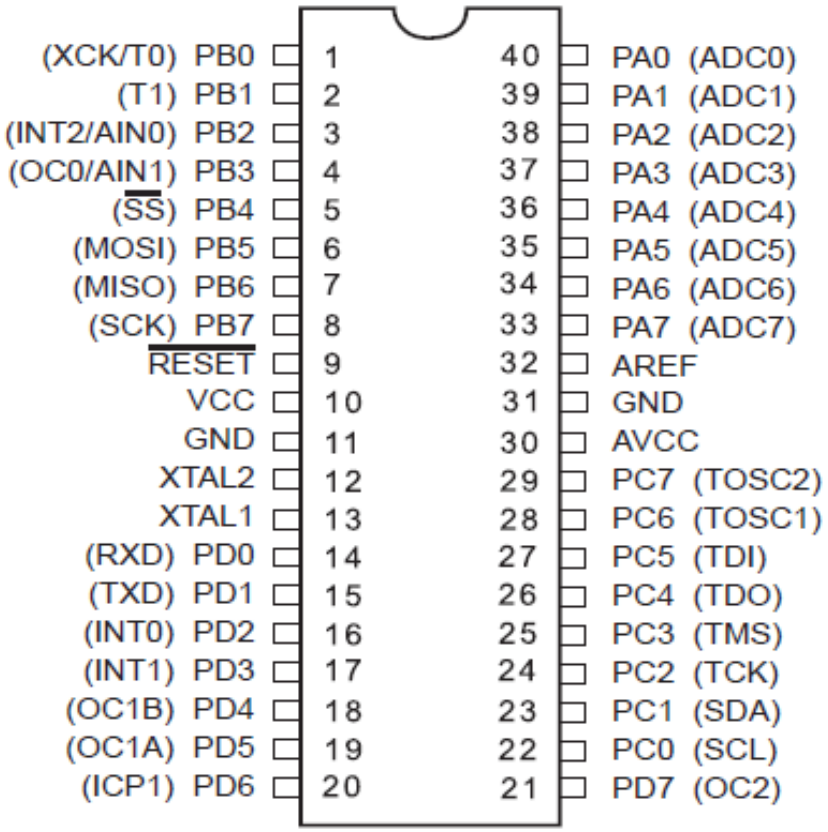

Fig 6.1 Pin Configuration

Features:

- **High-performance**, Low-power Atmel®AVR® \8-bit Microcontroller
- **Advanced RISC Architecture**

  – 131 Powerful Instructions – Most

  Single-clock Cycle Execution

  – 32 × 8 General Purpose Working Registers

  – Fully Static Operation

  – Up to 16 MIPS Throughput at 16 MHz

  – On-chip 2-cycle Multiplier

- **High Endurance Non-volatile Memory segments**

  – 16 Kbytes of In-System Self-programmable Flash program memory

  – 512 Bytes EEPROM

  – 1 Kbyte Internal SRAM

  – Write/Erase Cycles: 10,000 Flash/100,000 EEPROM

  – Data retention: 20 years at 85°C/100 years at 25°C(1)

  – Optional Boot Code Section with Independent Lock Bits

  In-System Programming by On-chip Boot Program

  True Read-While-Write Operation

  – Programming Lock for Software Security
- **JTAG (IEEE std. 1149.1 Compliant) Interface**

  – Boundary-scan Capabilities According to the JTAG Standard

  – Extensive On-chip Debug Support

  – Programming of Flash, EEPROM, Fuses, and Lock Bits through the JTAG Interface
- **Peripheral Features**

  – Two 8-bit Timer/Counters with Separate Prescalers and Compare Modes

  – One 16-bit Timer/Counter with Separate Prescaler, Compare Mode, and Capture Mode

  – Real Time Counter with Separate Oscillator

  – Four PWM Channels

  – 8-channel, 10-bit ADC 8 Single-ended Channels

  7 Differential Channels in TQFP Package Only

  2 Differential Channels with Programmable Gain at 1x, 10x, or 200x

  – Byte-oriented Two-wire Serial Interface

  – Programmable Serial USART

  – Master/Slave SPI Serial Interface

  – Programmable Watchdog Timer with Separate On-chip Oscillator

  – On-chip Analog Comparator

- **Special Microcontroller Features**

  – Power-on Reset and Programmable Brown-out Detection

  – Internal Calibrated RC Oscillator

  – External and Internal Interrupt Sources

  – Six Sleep Modes: Idle, ADC Noise Reduction, Power-save, Power-down, Standby and Extended Standby
- **I/O and Packages**

  – 32 Programmable I/O Lines

  – 40-pin PDIP, 44-lead TQFP, and 44-pad QFN/MLF
- **Operating Voltages**

  – 2.7V - 5.5V for ATmega16L

  – 4.5V - 5.5V for ATmega16
- **Speed Grades**

  – 0 - 8 MHz for ATmega16L

  – 0 - 16 MHz for ATmega16
- **Power Consumption @ 1 MHz, 3V, and 25°C for ATmega16L**

  – Active: 1.1 mA

  – Idle Mode: 0.35 mA

  – Power-down Mode: < 1 μA

2. GSM Modem(SIM900)

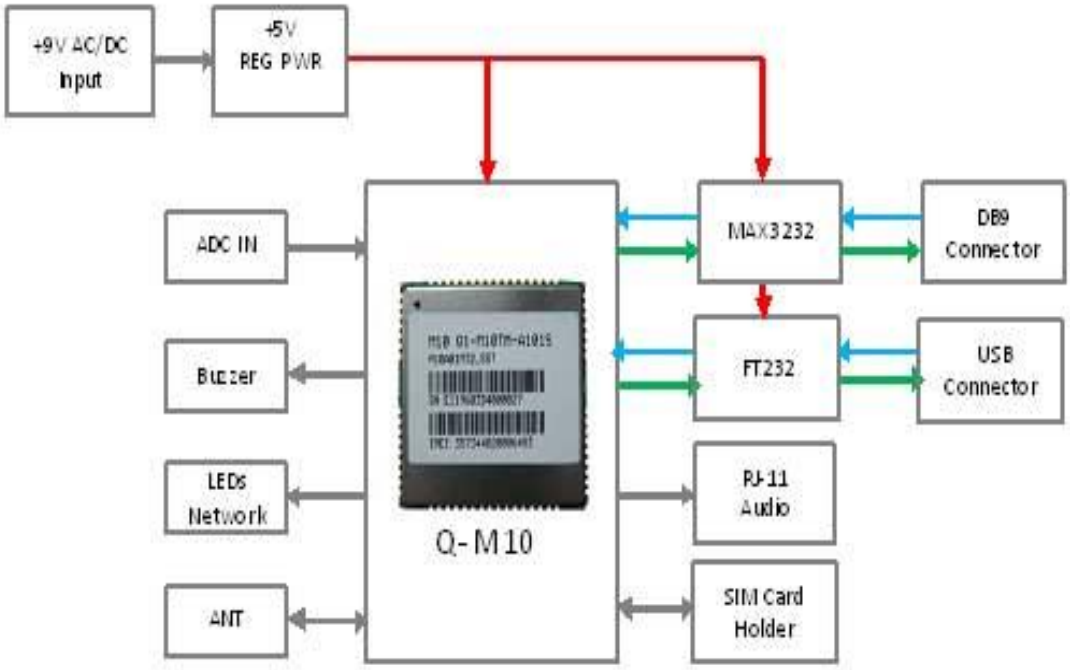

Fig 6.2 GSM Block Diagram

Features & Specifications:

- Quad-Band 850/ 900/ 1800/ 1900 MHz
- GPRS multi-slot class 10/8
- Dimensions: 24* 24 * 3 mm
- Control via AT commands (GSM 07.07, 07.05)
- SIM application toolkit
- Supply voltage range: 3.1-4.8V
- Low power consumption: 1.5mA(sleep mode)
- Operation temperature: -40° C to +85°C

3. Moisture Detection Grove

Fig 6.3 Moisture detection Grove

Features & Specifications:

- Soil moisture sensor based on soil resistivity measurement
- Easy to use
- 2.0cmX6.0cm grove module
- Voltage Range: 3.3V - 5V
- Current Range: 0mA – 35mA

4. Voltage Regulator (LM7805)

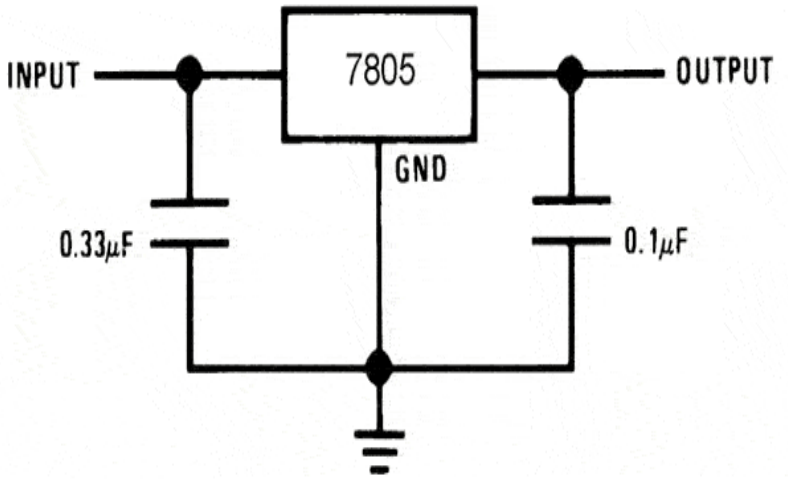

Fig 6.4 LM7805 Circuit Diagram

7805 is a voltage regulator integrated circuit. It is a member of 78xx series of fixed linear voltage regulator ICs. The voltage source in a circuit may have fluctuations and would not give the fixed voltage output. The voltage regulator **IC** maintains the output voltage at a constant value. The 05 in 7805 indicates the fixed output voltage it is designed to provide +5V regulated power supply. Capacitors of suitable values can be connected at input and output pins depending upon the respective voltage levels.

Features & Specifications:

- Output Current up to 1A
- Output Voltages of 5,
- Thermal Overload Protection
- Short Circuit Protection
- Output Transistor Safe Operating Area Protection

5. RF Module

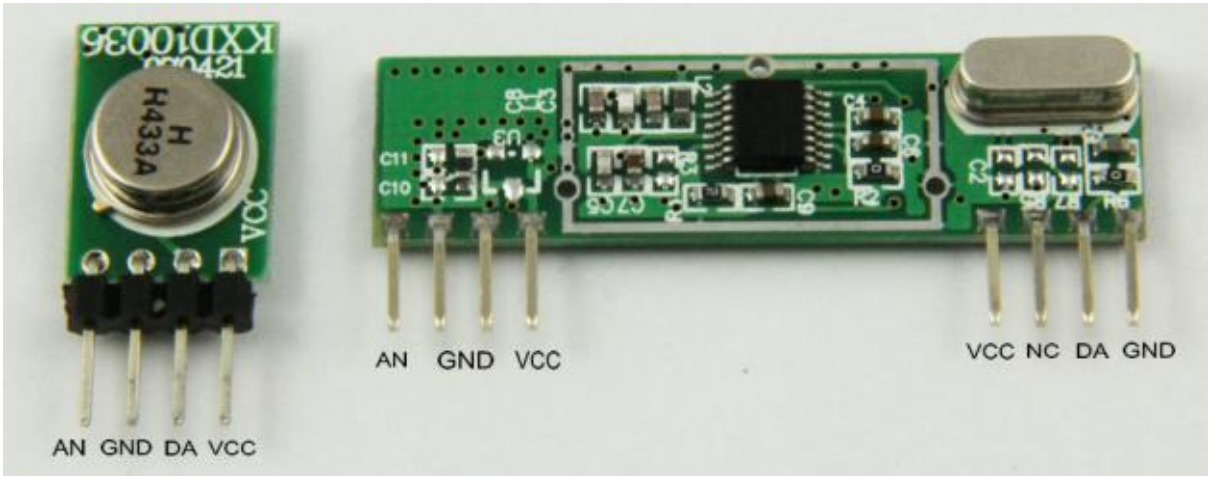

Fig 6.5 RF Module

This RF module comprises of an RF Transmitter and an RF Receiver. The transmitter/receiver (Tx/Rx) pair operates at a frequency of 434 MHz. An RF transmitter receives serial data and transmits it wirelessly through RF through its antenna connected at pin4. The transmission occurs at the rate of 1Kbps - 10Kbps.The transmitted data is received by an RF receiver operating at the same frequency as that of the transmitter.

Features & Specifications:

- Range in open space(Standard Conditions) : 100 Meters
- RX Receiver Frequency : 433 MHz
- RX Typical Sensitivity : 105 Dbm
- RX Supply Current : 3.5 mA
- RX IF Frequency : 1MHz
- Low Power Consumption
- Easy For Application
- RX Operating Voltage : 5V
- TX Frequency Range : 433.92 MHz
- TX Supply Voltage : 3V ~ 6V
- TX Out Put Power : 4 ~ 12 D bm