A Project Report on

THIRST

Submitted in partial fulfillment of award of

BACHELOR OF TECHNOLOGY

Degree in

COMPUTER SCIENCE & ENGINEERING

By

ANTRIKSH SINGH - 1608210030
ANUSHKA KRISHNATREYA - 1608210033
ASTHA SAXENA - 1608210041
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Dr. Neelaksh Sheel
(Associate Professor)

IN PURSUIT OF EXCELLENCE

Dept. of Computer Science & Engineering
Moradabad Institute of Technology
Moradabad (U.P.)

2016-2020

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CERTIFICATE

This is to certify that the project report entitled "THIRST" submitted by **Antriksh Singh (1608210030), Anushka Krishnatreya (1608210033), Astha Saxena (1608210041), Ayushi Mathur (1608210045), Yashika Agarwal (1608231074)** has been carried out under my supervision. It is recommended that the candidate may now be evaluated for the project work by university.

Date: 4/6/2020

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ABSTRACT

THIRST stands for The Hardware based Irrigation through Rainwater using Smart Tank. As the name suggests, our project will quench the thirst of plants as well as ground. It consists of an underground smart tank which will store harvested rain water and the motor pump which will extract the adequate amount of water from our smart tank to water plants with the help of soil moisture sensors that will lead to minimal water consumption. In case, water supply is not required in the plantation system, the excess water will be sent to the ground which will serve in groundwater restoration.

The main aim of the project is to develop techniques in various aspects of plantation which helps to track the moisture of the soil and allow water to the plant based on the detected values.

This will help to develop a lush green environment and will significantly reduce the problem of pollution and ground water level degradation. Along with the environmental benefits, this project will also help to automate the process of watering plants and will reduce the consumption of manpower.

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ACKNOWLEDGEMENT

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I would like to extend my regards to all our faculty members of the Computer Science department for their constructive support and cooperation at each and every step.

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We owe a debt of gratitude to our parents for their consistent support, sacrifice, candid views, and meaningful suggestions given to us at different stages. Last but not the least we are thankful to the almighty who gave us the strength and health for completing our report.

Date: 11/08/2020

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CHAPTER 1

PROJECT OVERVIEW

1.1. INTRODUCTION

Water is, undoubtedly, the top natural resource you need for your home use. It's glamorous to possess a stockpile of guns, gold, and jeweler, but without water, life might prove to be unbearable. Water shortages are sometimes inevitable, and so if you're not prepared for the eventuality, you might find yourself between a rock and a hard place. The best and cheapest alternative to the traditional water supply systems is rainwater harvesting. However, to be able to harvest rainwater, you'll need to install a rainwater harvesting system.[3]

[4] THIRST stands for Hardware based Irrigation through Rainwater using Smart Tank. Rainwater harvesting and management hold tremendous potential for alleviating water runoff and reducing groundwater consumption, particularly in urban areas. Our project THIRST is working for the same cause. Though the costs of installing modern rainwater harvesting systems, storing, and treatment of rainwater

was an area of concern earlier, but now with the advent of new technologies, and with this project this investment has a positive return.

Efficient rain water harvesting technique is the need of the hour. As the name suggests, our project will quench the thirst of underground water as well as plants .Watering is the most cultural practice and most labour intensive task in daily gardening operation. Knowing when and how much to water is the two most important aspects of the watering process. [44]

We have mainly focused the implementation of this project in the open areas like roads and highways as during the rainy season water coagulation on roads is the main concern that leads to traffic jams, degradation of roads and water wastage as water run off leads to the sewage.[8]

Fig. 1.1. Blueprint of THIRST

It consists of an underground smart tank which will store water and the motor pump will extract the water from our Smart reservoir and will work according to the soil condition to water our plantation and transfer water to underground to maintain ground water level.[43] In case water supply is not required in the plantation system, the water will be sent to the ground which will service in groundwater restoration. The main aim of the project is to develop techniques in various aspects of plantation which helps to track the moisture of the soil and temperature in real time and allow water to the plant based on the detected values.

With the help of the elevation of the roads the water will be stored in the tank and later this water can be efficiently used in the gardening of the plants location in the middle of the roads and around the roads and this will help to develop a lush and green environment and will significantly reduce the problem of pollution. Along with the environmental benefits this project will also help to automate the process of road gardening and will reduce the consumption of manpower.[11]

The tank will help to efficiently and smartly distribute the water to the garden lanes of the roads by measuring the accurate amount of the water required with the help of implementation of IOT using sensors that will lead to minimal water consumption and water harvesting.[43] The excess water which is stored in the tank will be sent to the grounds from time to time to avoid the overflow of the tank and for restoring the underground water tables and will lead to Artificial Recharging of water.

Firstly we intend to harvest rain water using our smart tank. This smart tank will be connected to the dripping system as well as to the ground and nearby buildings. We are using ultrasonic sensors in order to determine water level in the

tank. A warning to refill the tank will be sent to the concerned authorities in case the water level goes below a certain threshold. [22]

The Humidity sensor will help us to know whether the plantation needs water or not. When it will sense dryness in plants , the dripping system will start and thus will provide them with an adequate amount of water. If the water supply is not required in the plants, the water will be used by nearby buildings to fulfill daily needs which will undergo a filtration process in our smart tank in order to make it suitable for household use. In case of overflow, water will be sent to the ground. This will help us to enhance ground water level.[21]

1.1.1. ARTIFICIAL RECHARGING

Artificial recharging to augment ground water resources has become a necessity and we should therefore develop and popularize some of the cost effective rainwater harvesting methods in urban and rural areas. The main objectives of rainwater harvesting are:

- To conserve the surface run-off during monsoon.
- To recharge the aquifers and increase the availability of groundwater.
- To overcome the problem of flooding and stagnation of water during monsoon season.

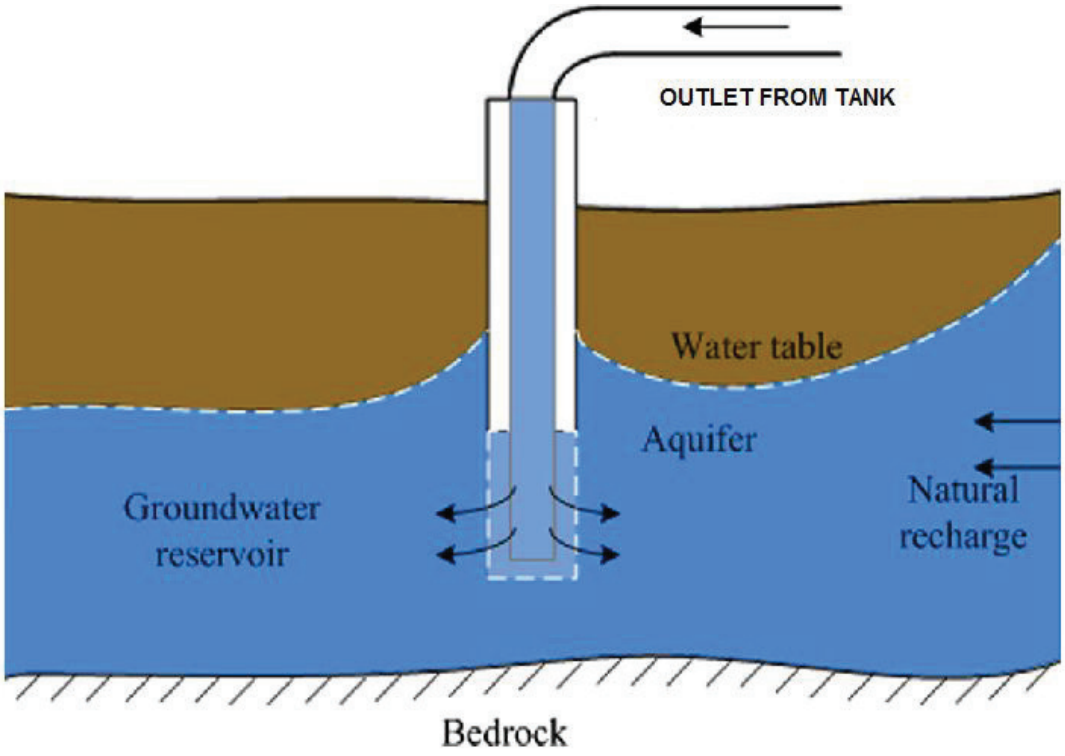

Fig.1.2. Concept of Artificial Recharging

1.1.2. DIGITALIZED ROAD DIVIDER PLANTATION

THIRST will lead to the digital plantation of the road-side and road divider plantation.[24]It is an efficient technique to water the plantation using the dripping system with the minimum and optimum amount of the water required by the plants. The need of the amount of water required by the plants is determined by the help of moisture sensor and humidity sensor.[41] As during the rainy season there is a minimum requirement to water the plants as the thirst of the plants is fulfilled by nature in the form of rain. The dripping system will also help to supply the nutrients required by the soil to have a good yield. There will also be a reduction in the consumption of manpower required for such tasks.[1] Often we see that the workers working on the dividers suffer accidents hence it will also act as a safety initiative for them. Hence, Lush and Green environment will be there.

1.1.3. RAINWATER HARVESTING ON ROADS

In the recent past, rapid growth in the urban areas has led to asphalted roads and stone slabs or pavers or footpaths. This area accounts for a huge percentage of the area of any town. Consequent to this, the rainwater run-off has increased and groundwater recharge has declined.[2]

As the rainwater from the road flows into the tank, water percolates into the ground. During heavy rainfall, excess water spills over to the storm water drains. The tank stores the water during the rainfall temporarily and later this water is sent to the ground slowly for ground water restoration. If for a long period of time there is no rain this water stored in the tank will be sent to the plants for plantation. In this way, there will be optimum usage of water and the water will be harvested properly from an open area like road.[9]

1.1.4. PREVENTS COAGULATION OF WATER ON ROADS

Most of the metropolitan cities like Mumbai suffer from the problem of water coagulation during the rainy season. This affects the day-to-day tasks of the people living in those cities and also affects the infrastructure of the city. [7]In the past years, many deaths have been recorded during the heavy rainfall season because of the coagulation of water as there is lack of proper drainage and water harvesting techniques.

CHAPTER 2

LITERATURE OVERVIEW

2.1. HISTORY OF RAINWATER HARVESTING

Unfortunately, in the modern era, the age-old methodology of rainwater harvesting was greatly neglected. Years of negligence, and short-sighted water management policies that mostly rely on overexploitation of ground and river water, has once again brought rainwater harvesting to the fore because of its life-saving qualities.[15]

Rainwater harvesting is an innovative technique utilized to harvest rainwater from roofs and other above surfaces to be stored for later use. In a normal scenario the rainwater is collected from roof buildings and then stored inside of a special tank. [18] Rainwater harvesting systems are designed after assessing site conditions that include rainfall pattern, incident rainfall, subsurface strata and their storage characteristics.

Rainwater harvesting and management hold tremendous potential for alleviating water runoff and reducing groundwater consumption, particularly in urban areas.[8] Our project THIRST is working for the same cause. Though the costs of installing modern rainwater harvesting systems, storing, and treatment of rainwater was an area of concern earlier, but now with the advent of new technologies, and with this project this investment has a positive return.[2]

Efficient rain water harvesting technique is the need of hour.Rapid growth in the urban areas has led to asphalted roads and stone slabs or pavers or footpaths. This area accounts for a huge percentage of the area of any town. Consequent to this, the rainwater run-off has increased and groundwater recharge has declined. Also during heavy rainfall, excess water spills over to the water drains. [6]

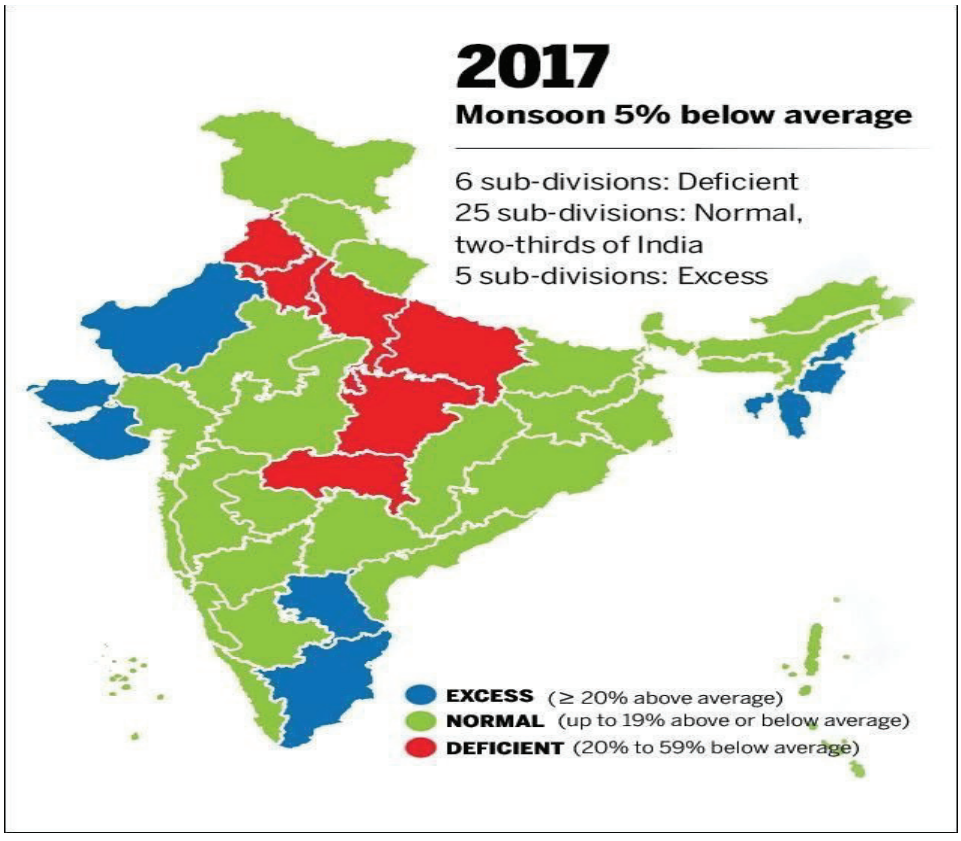

Fig 2.1. Annual distribution of rainfall

2.2. EXISTING PROBLEMS IN RAINWATER HARVESTING

One of the most important underlying values in rainwater harvesting is that it is a benign technology and cannot create undesirable consequences. Water harvesting initiatives are driven by firm beliefs and assumptions, some of which are listed as below:

- There is a huge amount of monsoon flow, which remains un-captured and eventually ends up in the natural sinks, especially seas and oceans.
- Local water needs are too small and as such exogenous water is not needed.
- Local water harvesting systems are always small and, therefore, are cost effective.
- Since the economic, social and environmental values of water are very high in regions hit by water shortages, water harvesting interventions are viable, supported by the assumption that cost- effective alternatives that can bring in the same amount of water, do not exist.
- Incremental structures lead to incremental benefits.
- Being small with low water storage and diversion capacities, they do not pose negative consequences for downstream uses.

2.2.1. PREVIOUS HARVESTING TECHNIQUES

The total amount of water that is received in the form of rainfall over an area is called the rainwater endowment of that area. Out of this, the amount that can be effectively harvested is called the water harvesting potential.[5]

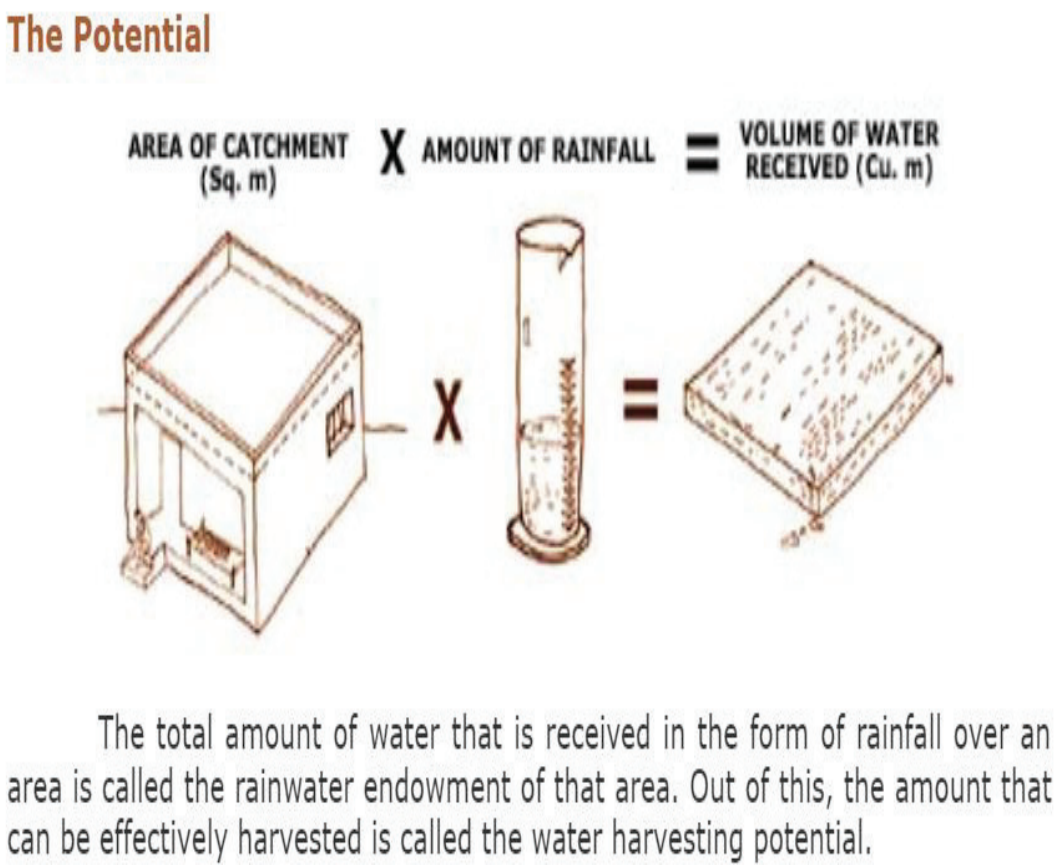

Fig. 2.2. Calculation for determining amount of rainfall

2.2.2. INFLUENCING FACTORS

Among the several factors that influence the rainwater harvesting potential of a site, eco-climatic conditions and the catchment characteristics are considered to be the most important.[47]

❑ RAINFALL

- **Quantity:**

Rainfall is the most unpredictable variable in the calculation and hence, to determine the potential rainwater supply for a given catchment, reliable rainfall data are required, preferably for a period of at least10 years. Also, it would be far better to use rainfall data from the nearest station with comparable conditions.[37]

- **Pattern:**

The number of annual rainy days also influences the need and design for rainwater harvesting. The fewer the annual rainy days or longer the dry period, the more the need for rainwater collection in a region. However, if the dry period is too long, big storage tanks would be needed to store rainwater. Hence in such regions, it is more feasible to use rainwater to recharge groundwater aquifers rather than for storage.[28]

❑ CATCHMENT AREA CHARACTERISTICS

[49] Runoff depends upon the area and type of the catchment over which it falls as well as surface features. All calculations relating to the performance of rainwater catchment systems involve the use of runoff coefficient to account for losses due to spillage, leakage, infiltration, catchment surface wetting and evaporation, which will all contribute to reducing the amount of runoff. (Runoff coefficient for any catchment is the ratio of the volume of water that runs off a surface to the volume of rainfall that falls on the surface).

Runoff coefficients for various catchment surfaces are listed below:

Type of Catchment	Coefficients
Roof Catchments	
- Tiles	0.8- 0.9
- Corrugated metal sheets	0.7- 0.9
Ground surface coverings	
- Concrete	0.6- 0.8
- Brick pavement	0.5- 0.6
Untreated ground catchments	
- Soil on slopes less than 10 per cent	0.0 - 0.3
- Rocky natural catchments	0.2 - 0.5
Untreated ground catchments	
- Soil on slopes less than 10 per cent	1.0 - 0.3
- Rocky natural catchments	0.2 - 0.5

Fig.2.3. Runoff coefficients for various catchment surfaces

Potential Water Harvesting From Urban Roads Or Streets: Water tunnel tanks were not able to pump the accumulated rainwater in the tanks despite the small and limited catchment area,[21] due to the lack of electricity and services during the aggression war period and it formed water pool.Water tunnel tanks may act as harvesting structure temporarily or storage tanks may be constructed near the tunnels,

CHAPTER 3

TECHNOLOGICAL REVIEW

3.1.SENSORS

A sensor is a device, module, machine, or subsystem whose purpose is to detect events or changes in its environment and send the information to other electronics, frequently a computer processor .[18]

Sensors are sophisticated devices that are frequently used to detect and respond to electrical or optical signals. A Sensor converts the physical parameter (for example: temperature, blood pressure, humidity, speed, etc.) into a signal which can be measured electrically.[22]

A sensor is always used with other electronics. Sensors can improve the world through diagnostics in medical applications, improved performance of energy

sources like fuel cells and batteries and solar power, improved health and safety and security for people, sensors for exploring space and the known university and improved environmental monitoring.[29]

Sensory Technologies assists companies in the integration of audio and visual communication technology.[30] Our service offerings include videoconferencing system design, web streaming and distribution, sound and acoustic design, video and audio integration, and management of support services. Sensors are proliferating across countless applications as we move to an increasingly connected world. Many of those applications require multiple sensors in a small footprint with no degradation of performance – and often with very low power requirements.

[40]Sensors react to changing physical conditions by altering their electrical properties. Thus, most artificial sensors rely on electronic systems to capture, analyse and relay information about the environment. These electronic systems rely on the same principles as electrical circuits to work, so the ability to control the flow of electrical energy is very important.

3.1.1.CLASSIFICATION OF SENSORS

There are several classifications of sensors made by different authors and experts. Some are very simple and some are very complex. The following classification of sensors may already be used by an expert in the subject but this is a very simple classification of sensors.[9]

In the first classification of the sensors, they are divided in to Active and Passive.[10] Active Sensors are those which require an external excitation signal or a power signal. Passive Sensors, on the other hand, do not require any external power signal and directly generate output response.

The other type of classification is based on the means of detection used in the sensor. Some of the means of detection are Electric, Biological, Chemical, Radioactive etc. The next classification is based on conversion phenomenon i.e. the input and the output. Some of the common conversion[26] phenomena are Photoelectric, Thermoelectric, Electrochemical, Electromagnetic, Thermooptic, etc.

The final classification of the sensors are Analog and Digital Sensors. Analog Sensors produce an analog output i.e. a continuous output signal with respect to the quantity being measured. Digital Sensors, in contrast to Analog Sensors, work with discrete or digital data. The data in digital sensors, which is used for conversion and transmission, is digital in nature.[13]

3.1.2.DIFFERENT TYPES OF SENSORS

The following is a list of different types of sensors that are commonly used in various applications. All these sensors are used for measuring one of the physical properties like Temperature, Resistance, Capacitance, Conduction, Heat Transfer etc.

- **TEMPERATURE SENSOR**

One of the most common and most popular sensors is the Temperature Sensor. A Temperature Sensor, as the name suggests, senses the temperature i.e. it

measures the changes in the temperature. Given below are some pictures of temperature sensor:[14]

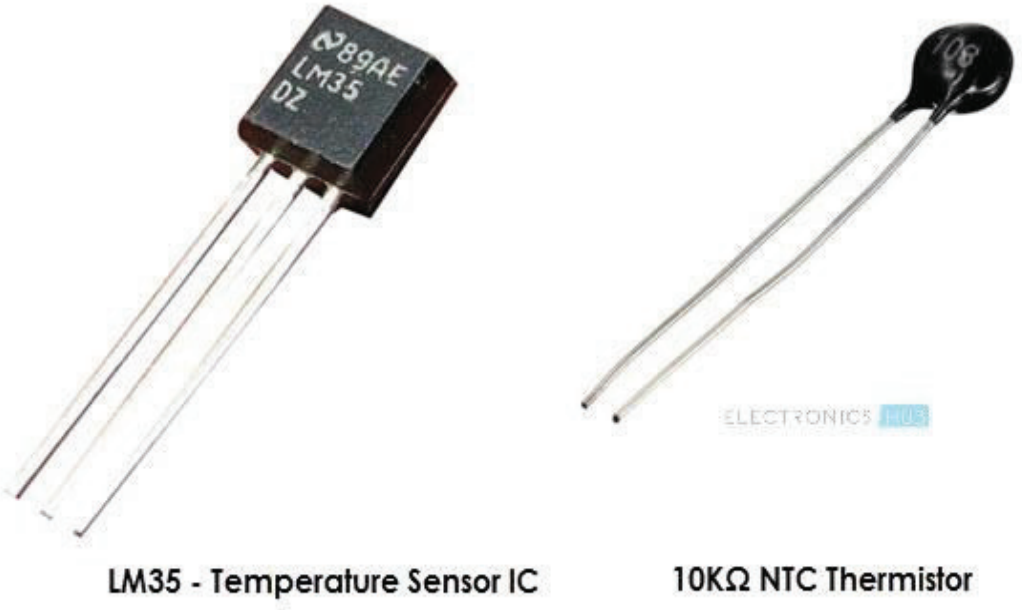

Fig.3.1.Temperature Sensor

In a Temperature Sensor, the changes in the Temperature correspond to change in its physical property like resistance or voltage. There are different types of Temperature Sensors like Temperature Sensor ICs (like LM35), Thermistors, Thermocouples, RTD (Resistive Temperature Devices), etc.Temperature Sensors are used everywhere like computers, mobile phones, automobiles, air conditioning systems, industries etc. [17]

- **PROXIMITY SENSORS**

A Proximity Sensor is a non-contact type sensor that detects the presence of an object. Proximity Sensors can be implemented using different techniques like

Optical (like Infrared or Laser), Ultrasonic, Hall Effect, Capacitive, etc.Some of the applications of Proximity Sensors are Mobile Phones, Cars (Parking Sensors), industries (object alignment), Ground Proximity in Aircrafts, etc. Inductive Proximity Sensors detect magnetic loss due to eddy currents that are generated on a conductive surface by an external magnetic field. [22]

An AC magnetic field generates on the detection coil, and changes in the impedance due to eddy currents generated on a metallic object are detected.Other methods include Aluminum-detecting Sensors, which detect the phase component of the frequency, and All-metal Sensors, which use a working coil to detect only the changed component of the impedance.[16] There are also Pulse-response Sensors, which generate an eddy current in pulses and detect the time change in the eddy current with the voltage induced in the coil.

Fig. 3.2 Proximity Sensor

- **INFRARED SENSOR (IR SENSOR)**

IR Sensors or Infrared Sensors are light based sensors that are used in various applications like Proximity and Object Detection. IR Sensors are used as proximity sensors in almost all mobile phones.

There are two types of Infrared or IR Sensors: Transmissive Type and Reflective Type. In Transmissive Type IR Sensor, the IR Transmitter (usually an IR LED) and the IR Detector (usually a Photodiode) are positioned facing each other so that when an object passes between them, the sensor detects the object.[25]

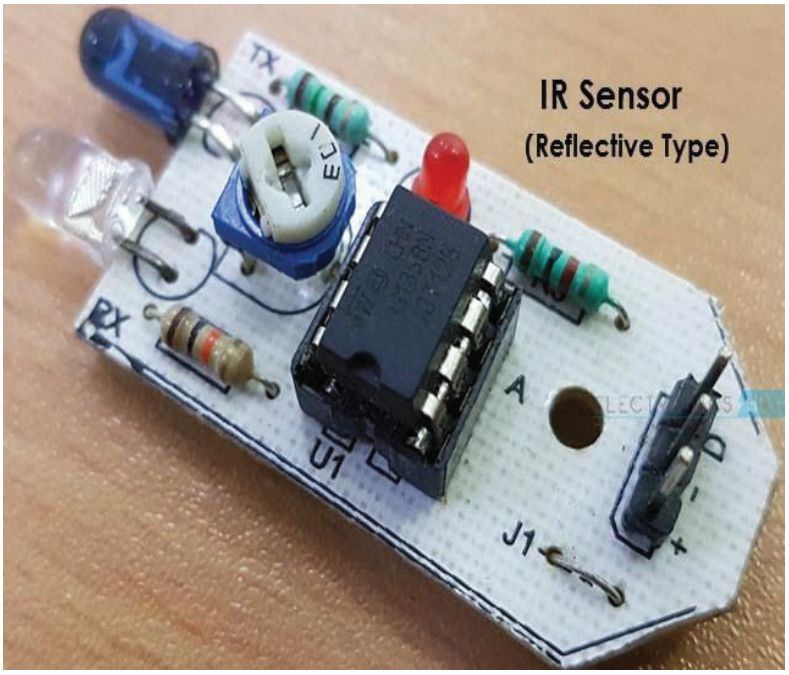

Fig.3.3. Infrared Sensor

The other type of IR Sensor is a Reflective Type IR Sensor. In this, the transmitter and the detector are positioned adjacent to each other facing the object. When an object comes in front of the sensor, the sensor detects the object.Different applications where IR Sensor is implemented are Mobile Phones, Robots, Industrial assembly, automobiles etc.[23]

- **ULTRASONIC SENSOR**

Ultrasonic sensor is a sensor which measures distance by using ultrasonic waves. The sensor head emits an ultrasonic wave and receives the wave reflected back from the target. Ultrasonic Sensors measure the distance to the target by measuring the time between the emission and reception. An optical sensor has a transmitter and receiver, whereas an ultrasonic sensor uses a single ultrasonic element for both emission and reception. In a reflective model ultrasonic sensor, a single oscillator emits and receives ultrasonic waves alternately. This enables miniaturization of the sensor head.[27]

Distance Calculation:

The distance can be calculated with the following formula:

Distance, **L = 1/2 × T × C** ,

Where, L is the distance, T is the time between the emission and reception, and C is the sonic speed. (The value is multiplied by 1/2 because T is the time for go-and-return distance).

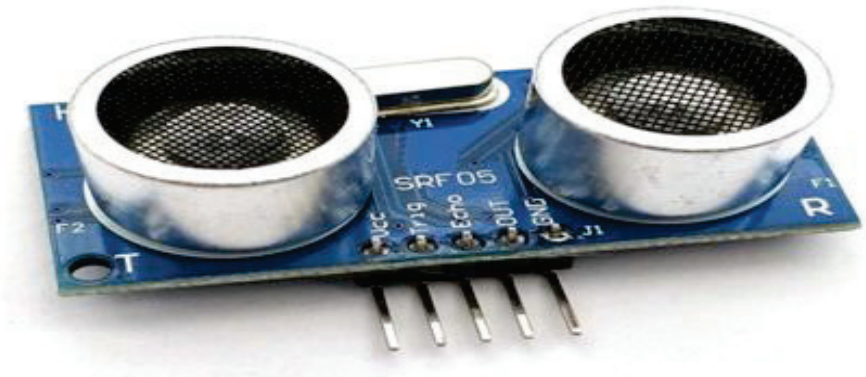

Fig 3.4. Ultrasonic Sensor

- **SOIL MOISTURE SENSOR**

Soil moisture sensors measure the volumetric water content in soil. Since the direct gravimetric measurement of free soil moisture requires removing, drying, and weighing of a sample, soil moisture sensors measure the volumetric water content indirectly by using some other property of the soil, such as electrical resistance, dielectric constant, or interaction with neutrons, as a proxy for the moisture content.[35]

The relation between the measured property and soil moisture must be calibrated and may vary depending on environmental factors such as soil type, temperature, or electric conductivity.[32] Reflected microwave radiation is affected by the soil moisture and is used for remote sensing in hydrology and agriculture.

Portable probe instruments can be used by farmers or gardeners. Soil moisture sensors typically refer to sensors that estimate volumetric water content.

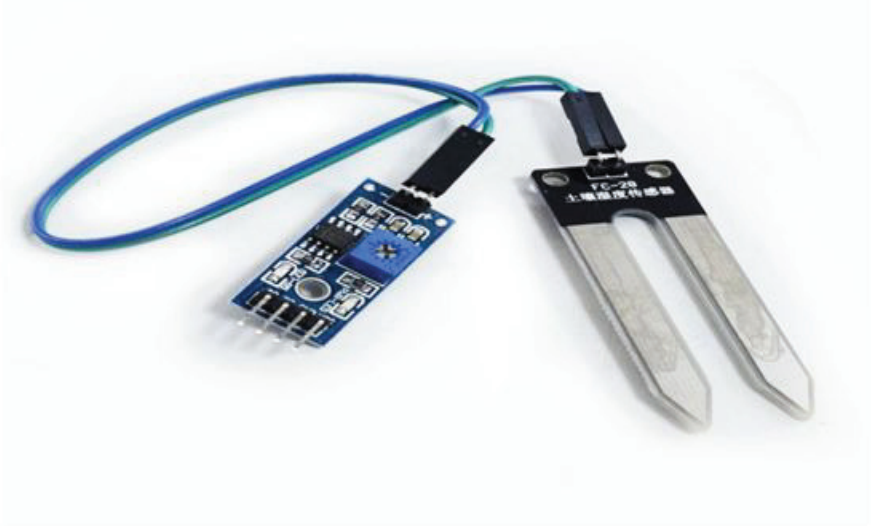

Fig. 3.5. Soil moisture sensor

Application of soil moisture sensor are:

1. Agriculture

Measuring soil moisture is important for agricultural applications to help farmers manage their irrigation systems more efficiently. Knowing the exact soil moisture conditions on their fields, not only are farmers able to generally use less water to grow a crop, they are also able to increase yields and the quality of the crop by improved management of soil moisture during critical plant growth stages.[37]

2. Landscape Irrigation

In urban and suburban areas, landscapes and residential lawns are using soil moisture sensors to interface with an irrigation controller. Connecting a soil moisture sensor to a simple irrigation clock will convert it into a "smart" irrigation controller that prevents irrigation cycles when the soil is already wet, e.g. following a recent rainfall event.

Golf courses are using soil moisture sensors to increase the efficiency of their irrigation systems to prevent over-watering and leaching of fertilizers and other chemicals into the ground.[39]

3. Research

Soil moisture sensors are used in numerous research applications, e.g. in

agricultural science and horticulture including irrigation planning, climate research, or environmental science including solute transport studies.

4. Simple sensors for gardeners

Relatively cheap and simple devices that do not require a power source are available for checking whether plants have sufficient moisture to thrive. After inserting a probe into the soil for approximately 60 seconds, a meter indicates if the soil is too dry, moist or wet for plants. [43]

- **RAIN DROP SENSOR**

The rain sensor module is an easy tool for rain detection. It can be used as a switch when a 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. Raindrop sensor is basically a board on which nickel is coated in the form of lines. It works on the principle of resistance. When there is no rain drop on board. Resistance is high so we get high voltage according to V=IR. When a raindrop is present it reduces the resistance because water is conductor of electricity and presence of water connects nickel lines in parallel so reduced resistance and reduced voltage drop across it.[44]

The rain sensor works on the principle of total internal reflection. An infrared light beams at a 45-degree angle on a clear area of the windshield from the sensor inside the car. When it rains, the wet glass causes the light to scatter and a lesser amount of light gets reflected back to the sensor. [45]

Fig. 3.6.Rain Drop Sensor

Pin Configuration of Raindrop Sensor

It consists of two parts one is a black board with nickel layers on it and other is an integrated chip provided with some output pins.Board has 2 output pins(+,-) and chip has 6 pin(+, –, Vcc, GND, A0, D0).

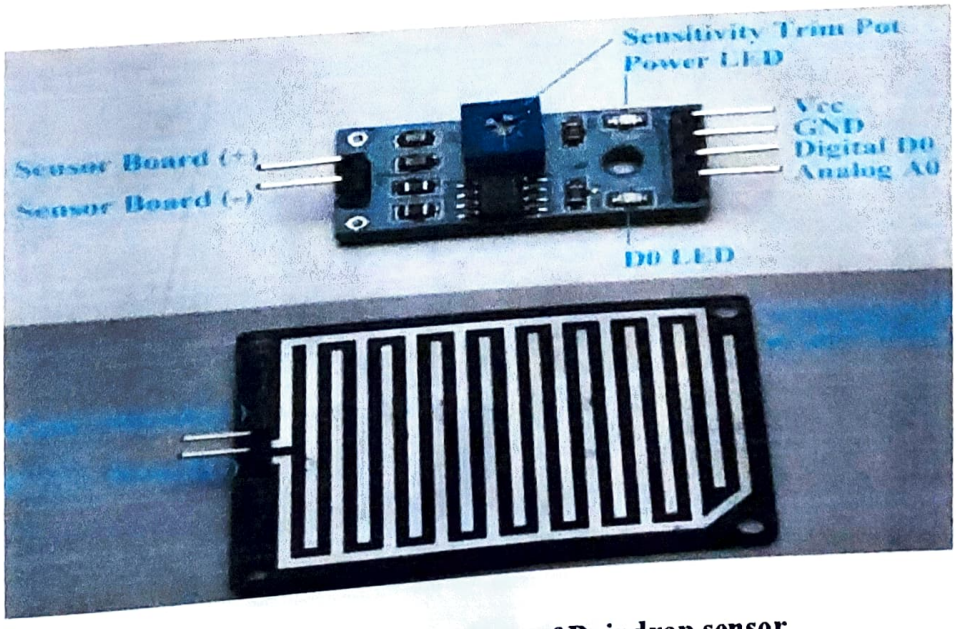

Fig. 3.7.Pin Configuration of Raindrop sensor

3.2.MICROCONTROLLERS

A **microcontroller** (MCU for *microcontroller unit*) is a small computer on a single metal-oxide semiconductor (MOS) integrated circuit chip. In modern terminology, it is similar to, but less sophisticated than, a system on a chip (SoC); a SoC may include a microcontroller as one of its components. A microcontroller contains one or more CPUs (processor cores) along with memory and programmable input/output peripherals.

Program memory in the form of ferroelectric RAM, NOR flash or OTP ROM is also often included on chip, as well as a small amount of RAM. Microcontrollers are designed for embedded applications, in contrast to the microprocessors used in personal computers or other general purpose applications consisting of various discrete chips.[1]

Microcontrollers are used in automatically controlled products and devices, such as automobile engine control systems, implantable medical devices, remote controls, office machines, appliances, power tools, toys and other embedded systems. By reducing the size and cost compared to a design that uses a separate microprocessor, memory, and input/output devices, microcontrollers make it economical to digitally control even more devices and processes. Mixed signal microcontrollers are common, integrating analog components needed to control non-digital electronic systems. In the context of the internet of things, microcontrollers are an economical and popular means of data collection, sensing and actuating the physical world as edge devices.[5]

Some microcontrollers may use four-bit words and operate at frequencies as low as 4 kHz, for low power consumption (single-digit milliwatts or microwatts). They generally have the ability to retain functionality while waiting for an event such as a button press or other interrupt; power consumption while sleeping (CPU clock and most peripherals off) may be just nanowatts, making many of them well suited for long lasting battery applications.[9] Other microcontrollers may serve

performance-critical roles, where they may need to act more like a digital signal processor (DSP), with higher clock speeds and power consumption

3.2.1.ARDUINO

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing.[2]

It is an open source electronic prototyping platform that allows to create robots and interactive electronic objects. The **Arduino UNO** is the best board to get started with electronics and coding. If this is your first experience tinkering with the platform, the UNO is the most robust board you can start playing with. The UNO is the most used and documented board of the whole Arduino family.

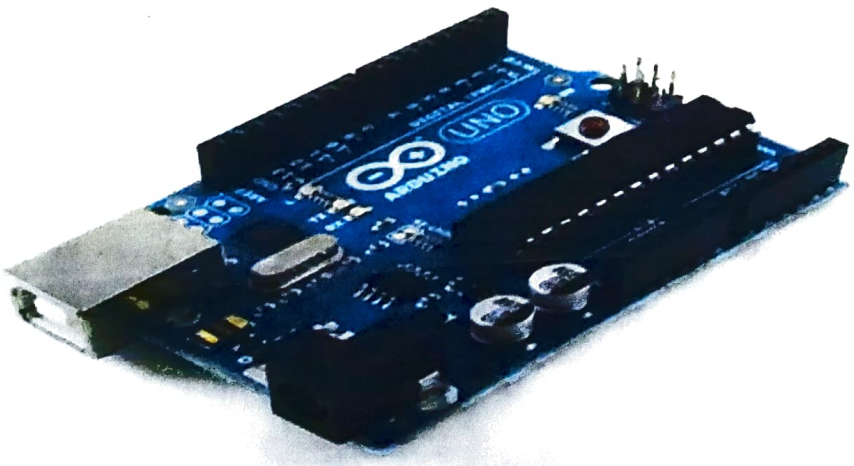

Fig. 3.8.Arduino Board

Over the years Arduino has been the brain of thousands of projects, from everyday objects to complex scientific instruments.[4] A worldwide community of makers - students, hobbyists, artists, programmers, and professionals - has gathered around this open-source platform, their contributions have added up to an incredible amount of accessible knowledge that can be of great help to novices and experts alike.

Arduino was born at the Ivrea Interaction Design Institute as an easy tool for fast prototyping, aimed at students without a background in electronics and programming. As soon as it reached a wider community, the Arduino board started changing to adapt to new needs and challenges, differentiating its offer from simple 8-bit boards to products for IoT applications, wearable, 3D printing, and embedded environments. All Arduino boards are completely open-source, empowering users to build them independently and eventually adapt them to their particular needs. The software, too, is open-source, and it is growing through the contributions of users worldwide.[6]

3.2.2.SOME ADVANTAGES OF USING ARDUINO

1. Inexpensive

Arduino boards are relatively inexpensive compared to other microcontroller platforms. The least expensive version of the Arduino module can be assembled by hand, and even the pre-assembled Arduino modules cost less than $50.

2. Cross-platform

The Arduino Software (IDE) runs on Windows, Macintosh OSX, and Linux operating systems. Most microcontroller systems are limited to Windows.[8]

3. Simple, clear programming environment

The Arduino Software (IDE) is easy-to-use for beginners, yet flexible enough for advanced users to take advantage of as well. For teachers, it's conveniently based on the Processing programming environment, so students learning to program in that environment will be familiar with how the Arduino IDE works.[3]

4. Open source and extensible software

The Arduino software is published as open source tools, available for extension by experienced programmers. The language can be expanded through C++ libraries, and people wanting to understand the technical details can make the leap from Arduino to the AVR C programming language on which it's based. Similarly, you can add AVR-C code directly into your Arduino programs if you want to.

5. Open source and extensible hardware

The plans of the Arduino boards are published under a Creative Commons license, so experienced circuit designers can make their own version of the module, extending it and improving it. Even relatively inexperienced users can build the breadboard version of the module in order to understand how it works and save money.[11]

3.3.EMBEDDED C LANGUAGE

3.3.1.INTRODUCTION

Embedded C is a set of language extensions for the C programming language by the C Standards Committee to address commonality issues that exist between C extensions for different embedded systems.

Embedded C programming typically requires nonstandard extensions to the C language in order to support enhanced microprocessor features such as fixed-point arithmetic, multiple distinct memory banks, and basic I/O operations.

In 2008, the C Standards Committee extended the C language to address such capabilities by providing a common standard for all implementations to adhere to. [18]

It includes a number of features not available in normal C, such as fixed-point arithmetic, named address spaces and basic I/O hardware addressing. Embedded C uses most of the syntax and semantics of standard C, e.g., main() function, variable definition, data type declaration, conditional statements (if, switch case), loops (while, for), functions, arrays and strings, structures and union, bit operations, macros, etc.

Embedded C is perhaps the most popular language among Embedded Programmers for programming Embedded Systems. There are many popular programming languages like Assembly, BASIC, C++ etc. that are often used for

developing Embedded Systems but Embedded C remains popular due to its efficiency, less development time and portability.[25]

An embedded C program will begin with at least one #include statements. These statements are used to introduce the contents of a separate file into your source file. This is a handy way to keep your code organized, and it also allows you to use library functionality, hardware-configuration routines, and register definitions provided by the manufacturer.

In embedded system programming C code is preferred over other languages. Due to the following reasons:

- Easy to understand
- High Reliability
- Portability
- Scalability

The block diagram of Embedded C Programming development:

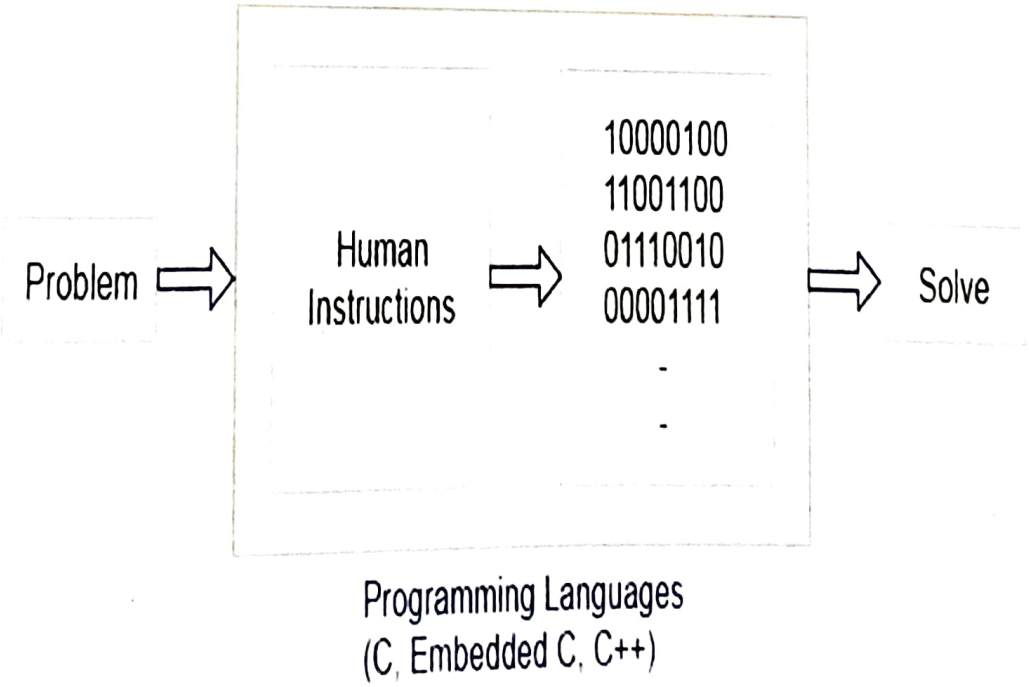

Fig. 3.9. Block diagram of Embedded C

Function is a collection of statements that is used for performing a specific task and a collection of one or more functions is called a programming language. Every language is consisting of basic elements and grammatical rules. The C language programming is designed for function with variables, character set, data types, keywords, expression and so on are used for writing a C program.

The extension in C language is known as embedded C programming language. As compared to above the embedded programming in C is also have some additional features like data types, keywords and header file etc [48]

Basic Embedded C Programming Steps:

The block diagram representation of Embedded C Programming Steps:

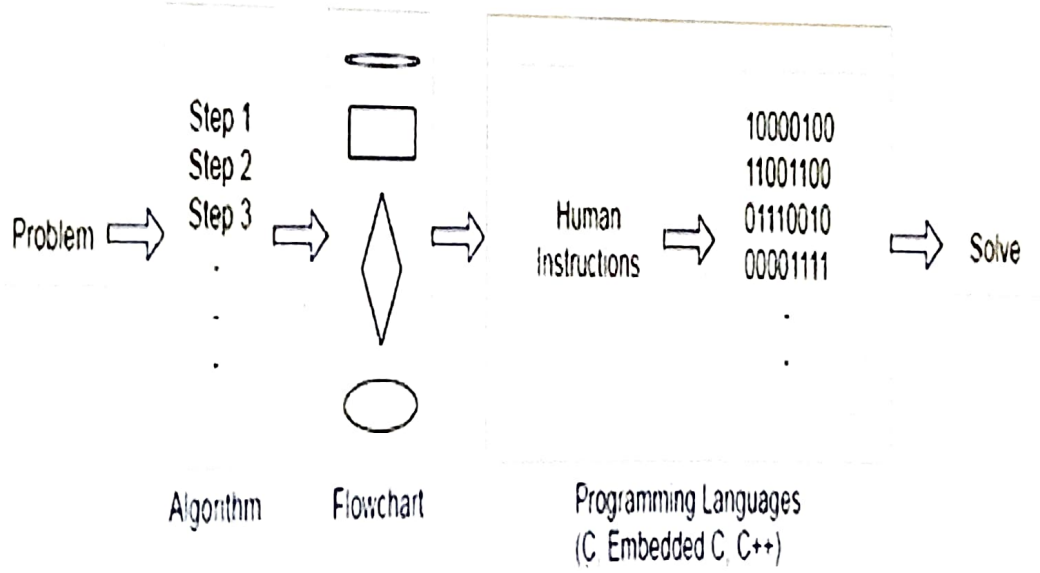

Fig. 3.10.Steps of Embedded C programming

The microcontroller programming is different for each type of operating system. Even though many operating systems exist such as Windows, Linux, RTOS, etc but RTOS has several advantages for embedded system development.[40]

3.3.2 STRUCTURE OF EMBEDDED C PROGRAM

- comments
- preprocessor directives
- global variables
- main() function

{

- local variables
- statements

……..

……..

}

- fun(1)

{

- local variables
- statements

……..

……..

}

- **Comments:**

In embedded C programming language, we can place comments in our code which helps the reader to understand the code easily.

C=a+b; (add two variables whose value is stored in another variable C)

- **Preprocessor directives:**

All the functions of the embedded C software are included in the preprocessor library like "#includes<reg51.h>, #defines". These functions are executed at the time of running the program.

- **Global variable:**

A global variable is a variable that is declared before the main function, and can be accessed on any function in the program.

- **Local variable:**

A local variable is a variable declared within a function, and it is valid only to be used within that function.

- **Main () function:**

The execution of a program starts with the main function. Every program uses only one main () function.

3.3.3.ADVANTAGES OF EMBEDDED C

- It takes less time to develop an application program.
- It reduces complexity of the program.
- It is easy to verify and understand.
- It is portable in nature from one controller to another.

3.4.ARDUINO IDE

IDE (Integrated Development Environment) is basically a software that enables better and assisted code editing, compiling and debugging. The Arduino IDE runs on the Java Platform. So the language java has different IDEs that ease the usage of the language for a particular purpose.

However, Eclipse doesn't support the functions and commands that work on an arduino board. So, this Arduino IDE basically has inbuilt functions and commands that though work on Java platform, are customised to run on the arduino dev. board. Thus Arduino IDE serves for code editing, its compilation, debugging and then burning the code into the arduino dev. board.[45]

The Arduino Integrated Development Environment (IDE) is a cross-platform application (for Windows, macOS, Linux) that is written in functions from C and C++. It is used to write and upload programs to Arduino compatible boards, but also, with the help of 3rd party cores, other vendor development boards.[45]

The source code for the IDE is released under the GNU General Public License, version 2. The Arduino IDE supports the languages C and C++ using special

rules of code structuring. It supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub *main()* into an executable cyclic executive program with the GNU toolchain, also included with the IDE distribution. [46]

The Arduino IDE *does* manage a few details of the language for you to make it somewhat more beginner-friendly. The difference between the full-spec C++ language and C++ with a few shortcuts you can take with it in the Arduino IDE are what have given rise to the myth of an Arduino language.[35]

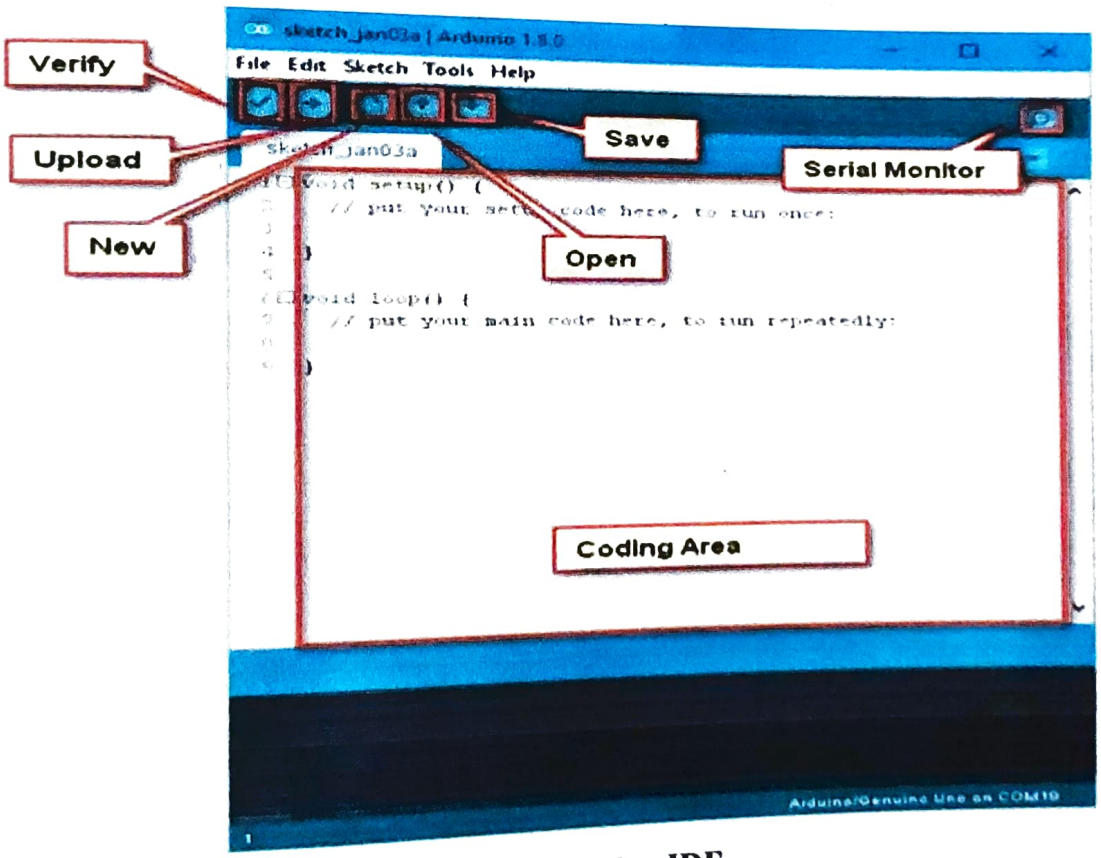

Fig. 3.11. Arduino IDE

The Arduino IDE employs the program avrdude to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware. By default, avrdude is used as the uploading tool to flash the user code onto official Arduino boards.

It is fully developed into functionality full of libraries,as long as programming the Arduino UNO in Embedded C language is possible because Arduino IDE can Compile both arduino code as well as AVR standard code. It is a tool used to write and upload code to the Arduino. Embedded C (or C++) is a language or a subset of the language. The Arduino IDE is provided with, and runs the GNU g++ - a C++ compiler - so that is the language you would need to write in. If you're asking for a comparison between C++ and the mythical "Arduino language", there is no Arduino language - it is C++.[32]

CHAPTER 4

REQUIREMENT ANALYSIS

4.1.HARDWARE REQUIREMENTS

As the project is working on the Sensor Technology, it requires a broad range of sensors and an interfacing board to implement the working modules.

4.1.1.ARDUINO BOARD

Arduino is an open-source electronics platform based on easy-to-use hardware and software.Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do

so you use the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing.[27]

4.1.2. WHY ARDUINO?

Thanks to its simple and accessible user experience, Arduino has been used in thousands of different projects and applications. The Arduino software is easy-to-use for beginners, yet flexible enough for advanced users. It runs on Mac, Windows, and Linux. Teachers and students use it to build low cost scientific instruments, to prove chemistry and physics principles, or to get started with programming and robotics. Designers and architects build interactive prototypes, musicians and artists use it for installations and to experiment with new musical instruments. Makers, of course, use it to build many of the projects exhibited at the Maker Faire, for example. Arduino is a key tool to learn new things. Anyone - children, hobbyists, artists, programmers - can start tinkering just following the step by step instructions of a kit, or sharing ideas online with other members of the Arduino community.[22]

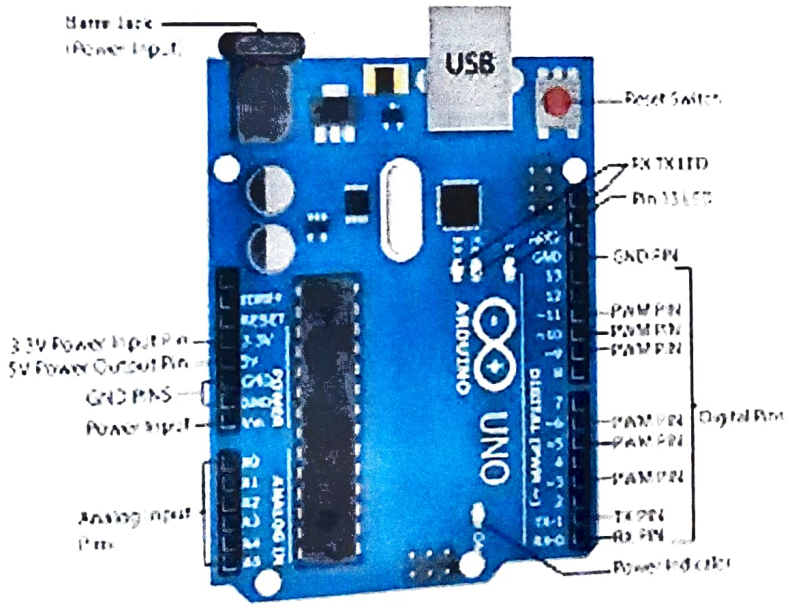

Fig.4.1. Arduino Board

4.1.3.RAINDROP SENSOR:

Raindrop sensor is basically a board on which nickel is coated in the form of lines. It works on the principle of resistance. The Rain Sensor module allows to measure moisture via analog output pins and it provides a digital output when a threshold of moisture exceeds.[19]

The module is based on the LM393 op amp. It includes the electronics module and a printed circuit board that "collects" the rain drops. As raindrops are collected on the circuit board, they create paths of parallel resistance that are measured via the op amp. The sensor is a resistive dipole that shows less resistance when wet and more resistance when dry.

When there is no rain drop on board it increases the Resistance so we gets high voltage according to

V=IR.

When a raindrop present it reduces the resistance because water is a conductor of electricity and the presence of water connects nickel lines in parallel so reduces resistance and reduces voltage drop across it.[20]

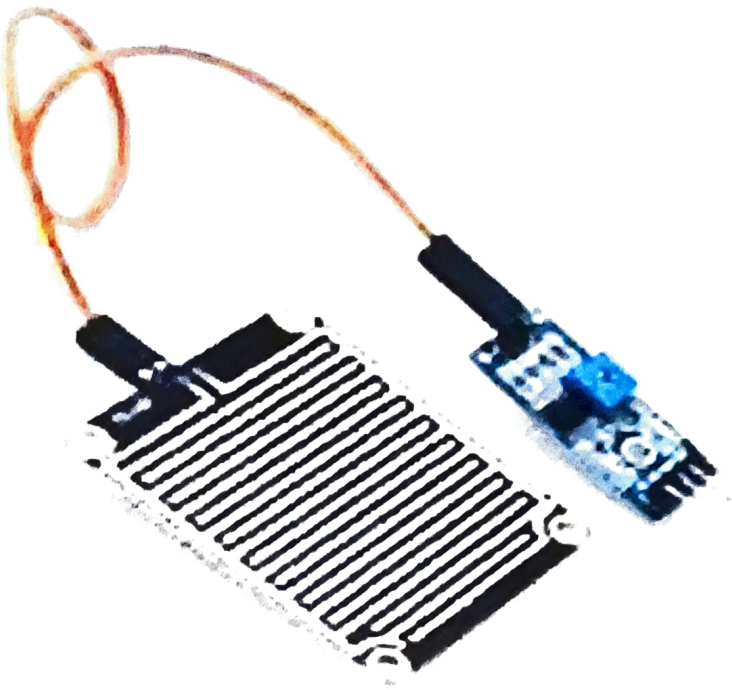

Fig.4.2. Rain drop sensor

Pins of rain drop sensor and their description is given below:

Vcc : +5 Volts Power Source

GND : Ground or negative power source

D0 : Digital Output.Goes low when moisture exceeds the set threshold.

A0 : Analog Output – Zero to five volts. The lower the voltage the greater the moisture

POWER LED : Indicates that power is applied

OUTPUT LED : Illuminates when moisture has exceeded threshold set by

Sensitivity Adjustment. Sensitivity Adjustment Clockwise is more sensitive. Counterclockwise is less sensitive.

4.1.4.SOIL MOISTURE SENSOR

The soil moisture sensor consists of two probes that measure the volume of water in the soil. The two probes allow the electric current to pass through the soil and, according to its resistance, measures the moisture level of the soil.[17]

When there is more water, the soil conducts more electricity, which means that the resistance will be less. So the moisture level will be higher. Dry soil reduces conductivity. So, when there is less water, the soil conducts less electricity, which means it has more resistance. So the moisture level will be lower.[31]

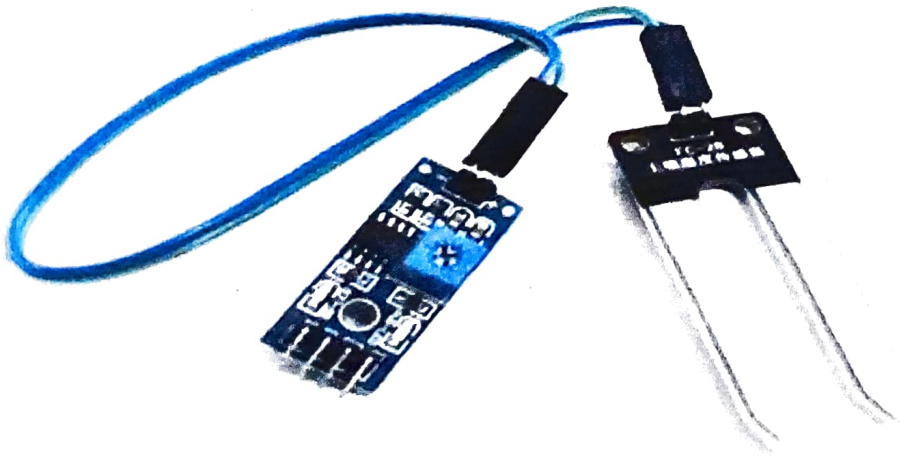

Fig.4.3. Soil Moisture sensor

- **Soil Moisture Sensor – Pin Out**

There are different types of soil moisture sensors on the market, but their working principles are all similar.All of these sensors have at least three pins: VCC, GND, and AO. The AO pin changes according to the amount of moisture in the soil and increases as there is more water in the soil. Some models have an additional base called DO. If the moisture amount is less than the permissible amount (which can be changed by the potentiometer on the sensor) the DO pin will be "1", otherwise it will remain"0".[33]

4.1.5.ULTRASONIC SENSOR

Ultrasonic Sensor HC-SR04 is a sensor that can measure distance. It emits an ultrasound at 40000 Hz (40kHz) which travels through the air and if there is an object or obstacle on its path It will bounce back to the module. Considering the travel time and the speed of the sound you can calculate the distance.[39]

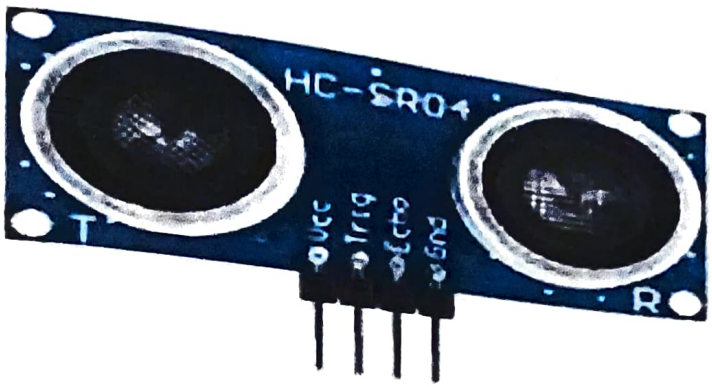

Fig.4.4.Ultrasonic Sensor

The configuration pin of HC-SR04 is VCC (1), TRIG (2), ECHO (3), and GND (4). The supply voltage of VCC is +5V and you can attach TRIG and ECHO pin to any Digital I/O in your Arduino Board.

In order to generate the ultrasound we need to set the Trigger Pin on a High State for 10 µs. That will send out an 8 cycle sonic burst which will travel at the speed sound and it will be received in the Echo Pin. The Echo Pin will output the time in microseconds the sound wave travelled.

For example,[29] if the object is 20 cm away from the sensor, and the speed of the sound is 340 m/s or 0.034 cm/µs the sound wave will need to travel about 588 microseconds. But what you will get from the Echo pin will be double that number because the sound wave needs to travel forward and bounce backward. So in order to get the distance in cm we need to multiply the received travel time value from the echo pin by 0.034 and divide it by 2.

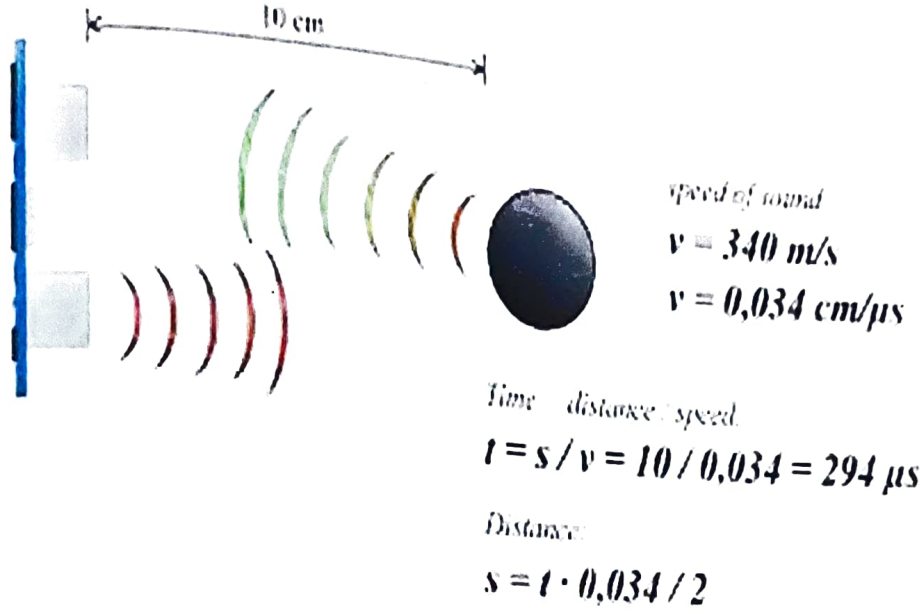

Fig.4.5.Working of Ultrasonic Sensor

4.1.6. L298N : MOTOR DRIVER

The L298N is an integrated monolithic circuit in a 15- lead Multiwatt and PowerSO20 packages.It is a high voltage , high current dual full-bridge driver designed to accept standard TTL logic levels and drive inductive loads such as relays, solenoids, DC and stepping motors. Two enable inputs are provided to enable or disable the device independently of the in-put signals .

The emitters of the lower transistors of each bridge are connected together and the corresponding external terminal can be used for the connection of an external sensing resistor. An additional Supply input is provided so that the logic works at a lower voltage.

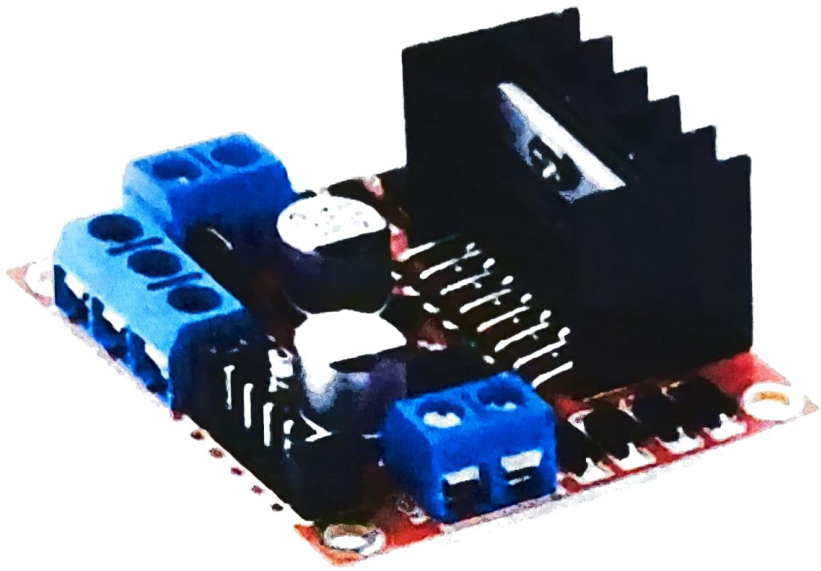

Fig.4.6. L298N Stepper motor driver board

- **Features:**

1) High operating voltage, which can be up to 40 volts;

2) Large output current, the instantaneous peak current can be up to 3A;

3) With 25W rated power;

4) Two built in H-bridge, high voltage, large current, full bridge driver, which can be used to drive DC motors, stepper motors, relay coils and other inductive loads.

5) Using standard logic level signal to control.

6) Able to drive a two-phase stepper motor or four-phase stepper motor, and two-phase DC motors.

7) Adopt a high-capacity filter capacitor and a freewheeling diode that protects devices in the circuit from being damaged by the reverse current of an inductive load, enhancing reliability

8) The module can utilize the built-in stabilivolt tube 78M05 to obtain 5v from the power supply. But to protect the chip of the 78M05 from damage, when the drive voltage is greater than 12v, an external 5v logic supply should be used.

9) Drive voltage: 5-35V; logic voltage: 5V

10) PCB size: 4.2 x 4.2 cm

4.1.7. WATER PUMP

A **pump** is a device that moves fluids (liquids or gases), or sometimes slurries, by mechanical action. Pumps can be classified into three major groups according to the method they use to move the fluid: direct lift, displacement, and gravity pumps.[10]

Fig.4.7.Water Pump

4.2. SOFTWARE REQUIREMENTS

4.2.1.ARDUINO IDE:

The **Arduino** Integrated Development Environment (**IDE**) is a cross-platform application (for Windows, macOS, Linux) that is written in functions from C and C++. It is used to write and upload programs to Arduino compatible boards, but also, with the help of 3rd party cores, other vendor development boards.[42]

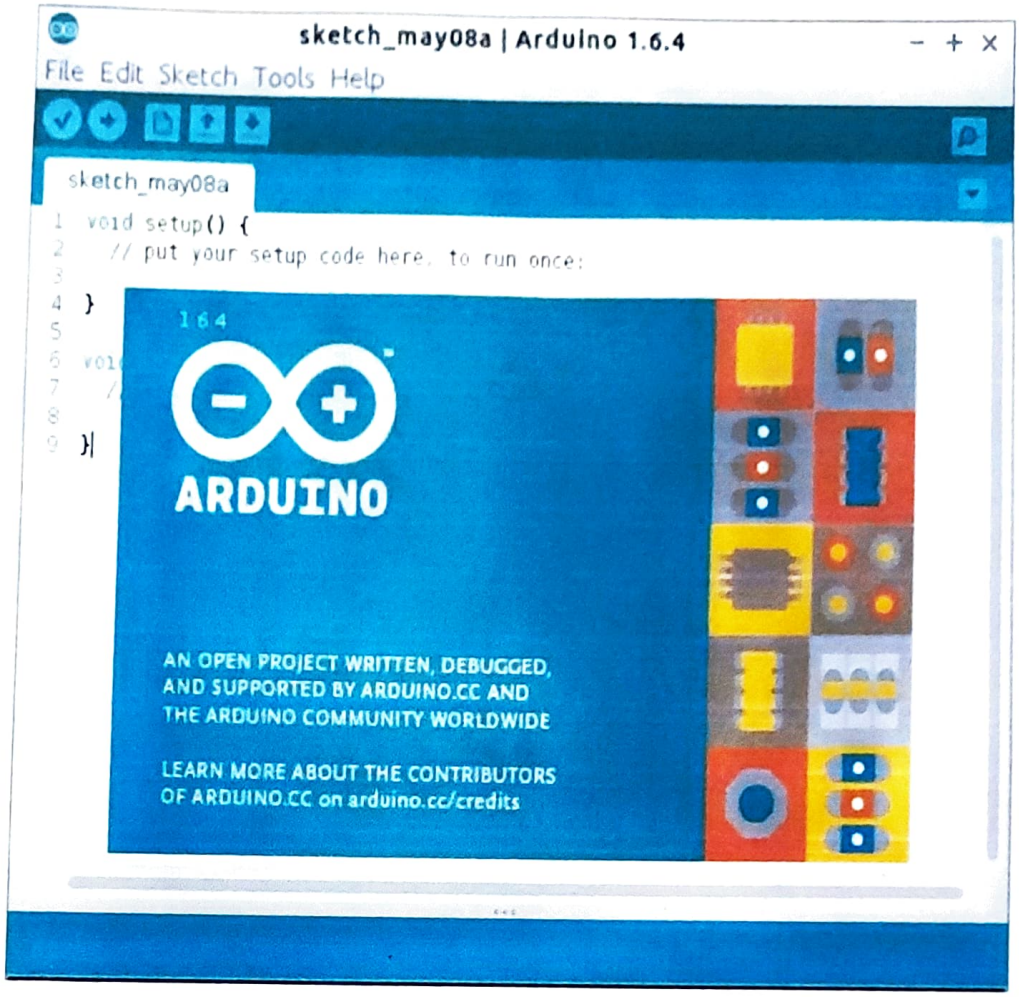

Fig.4.8.Arduino IDE

4.2.2.FRITZING

Fritzing is an open-source initiative to develop amateur or hobby CAD software for the design of electronics hardware, to support designers and artists ready to move from experimenting with a prototype to building a more permanent circuit. It was developed at the University of Applied Sciences Potsdam.[30]

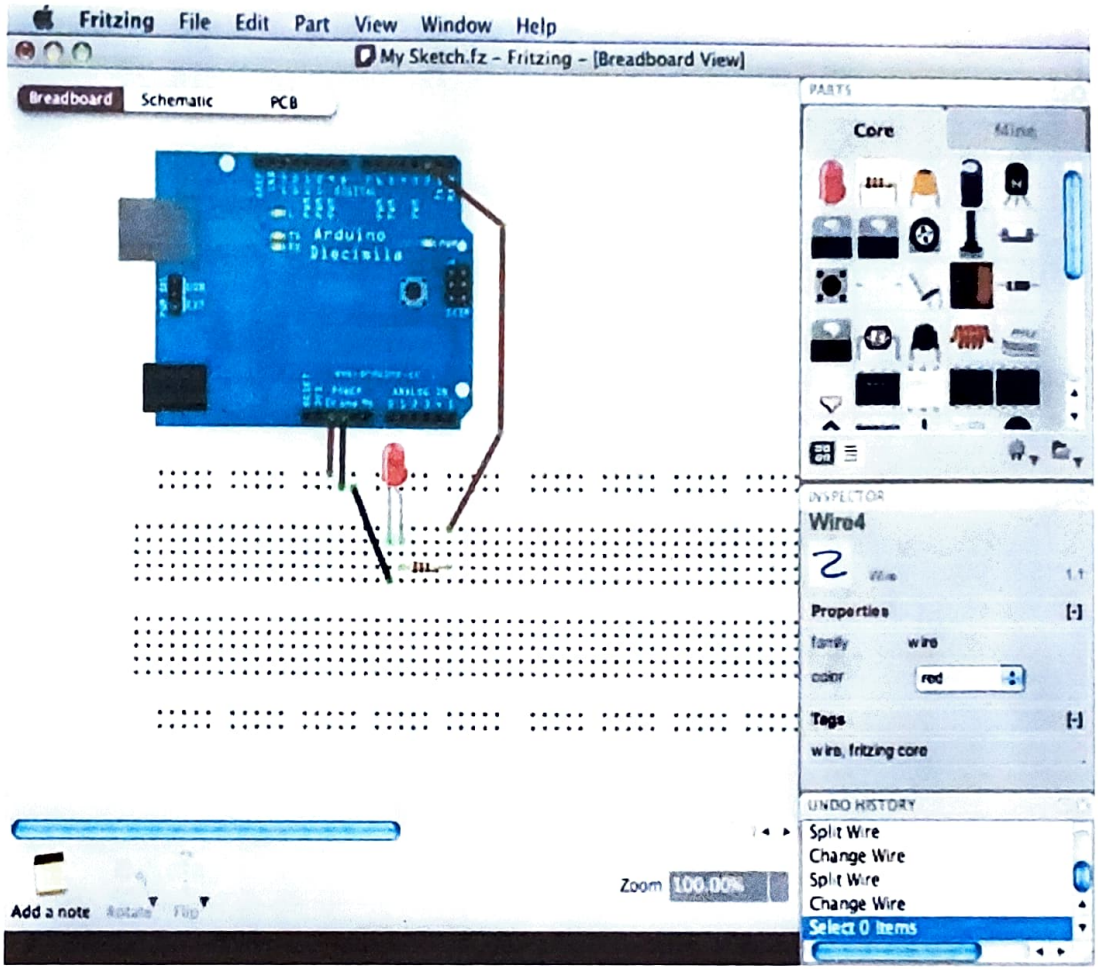

Fig.4.9.Fritzing Simulation Environment

4.3.MODULES

The project consists of different modules which are integrated together on one board to function.

- Rain water harvesting

- Dripping System
- Smart Tank
- Filtration module

4.3.1.RAINWATER HARVESTING

The whole project focuses on saving water from the roads and from the household roofs in the further module advancements.

The rainwater is collected and the ground water level is increased due to this.

4.3.2.DRIPPING SYSTEM

The module contains an automatic watering system which provides water to the plants whenever they go dry.

This is done with the help of a soil moisture sensor. The sensor senses the dryness level of the plants continuously. When the dryness of the plants go below a certain threshold level, it sends an alarming signal to the microcontroller and the water pump is turned on. [39]

4.3.3.SMART TANK

This module contains a tank dug deep into the earth's surface. The tank has an ultrasonic sensor attached to it at the top. The sensor tells the height of water in the tank. The tank is able to collect water from the rain and the water from the roads, thus helping in rain water harvesting and increase in the ground water level.

If the water in the tank is overflowed, the outlet of outgoing water to the water saving tank is switched to ON. When it is not raining, the water from this tank will be provided to the plants through a dripping system.[38]

4.3.4. FILTRATION MODULE

The water required for the reservoir from the smart tank is taken out from a certain height of the tank so as to avoid the sand particles and other impurities present in the water. [45]

The impurities of the water will settle down at the ground level of the tank and hence, the rest of the water at the top will be free from impurities.

CHAPTER 5

PROJECT DESIGN

5.1.DESIGN APPROACH

Shown below is the design implementation of our project.

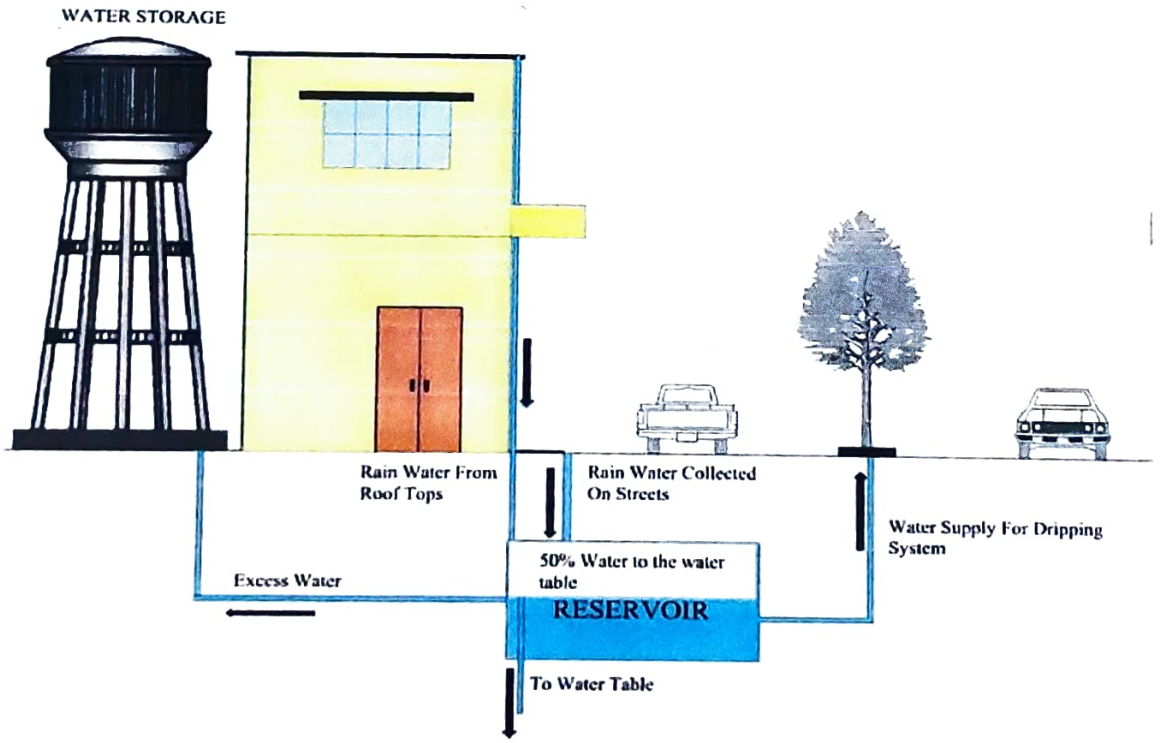

Fig.5.1.Project design

Explanation:

1. The blueprint shows the concept of the project implementation. The dripping system is applied to the plantation on the road diversions.
2. At a certain depth, our smart tank is installed which is collecting water from the rooftops and road depressions.
3. When it is raining in that certain area, the excess water from the rooftops is getting collected inside our smart tank, hence implementation of rainwater harvesting.
4. The water from road depressions is also collected in our smart tanks, hence, removing water clogging problems on the roads.
5. The smart tank is always kept 50% empty so as to extract out the impurity free water from the tank to the reservoir.
6. The impurities in the water get settled at the ground of the tank.
7. The impurity free water is then extracted from the outlet which is fit onto the 50% height of the smart tank.
8. The water from the reservoir can be further used in the household supply and other usages.[43]
9. Whenever it is not raining, and the soil moisture sensor gives us the reading that the plantation requires water, the water pump of the smart tank will be on and the water will be supplied to the dripping system .
10. Once the soil moisture sensor tells that the moisture content in the plants is enough and the water is no longer needed, the water supply from the tank will be automatically turned off.
11. The water is continuously going to the groundwater as well, hence, increasing the ground water level. [42]

5.2 FLOW CHART DIAGRAM

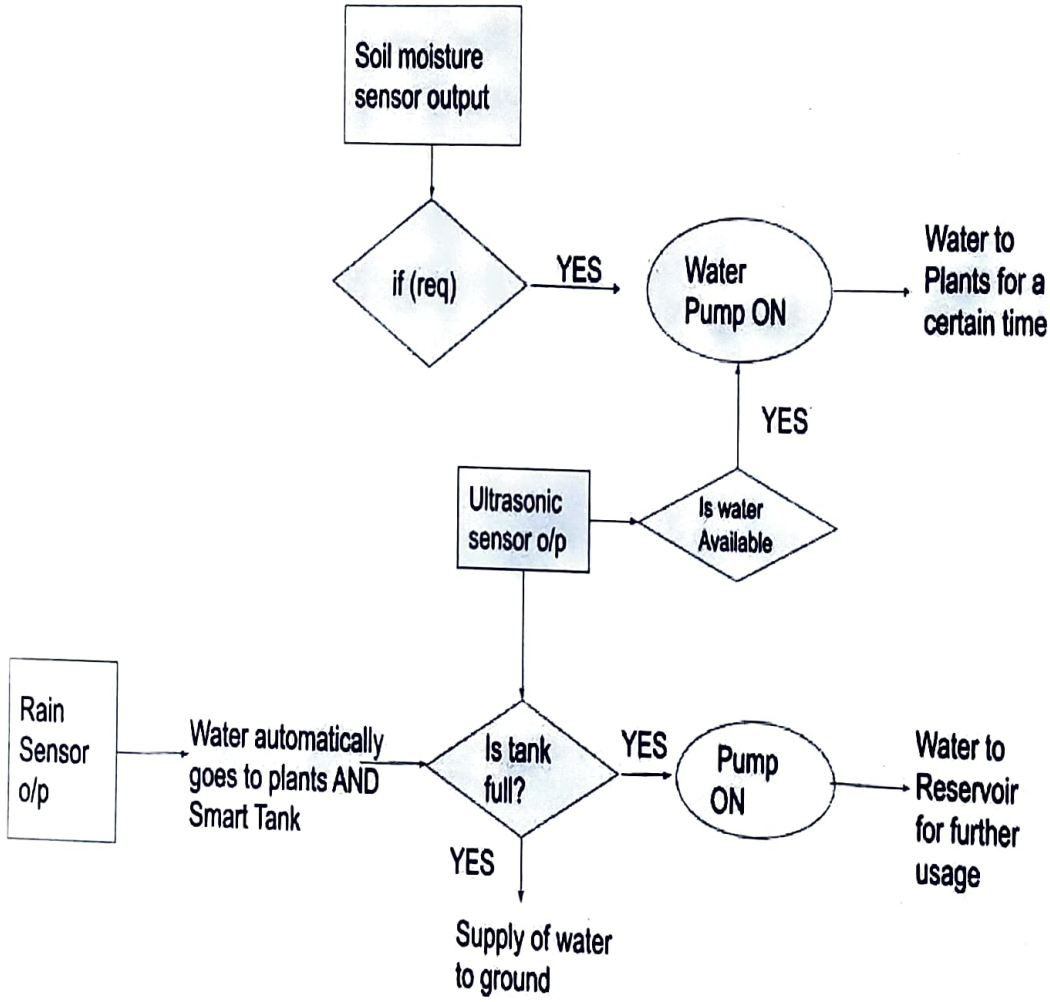

Fig.5.2. Flow Chart

CHAPTER 6

PROJECT SNAPSHOTS

6.1. CASE STUDY

In our case study , we found that water is not given to the plants from time to time whereas, sometimes excess water is given which leads to dead plants and water wastage. Also manual watering consumes a lot of time and manpower.

In the case study the amount of rainfall in the area will be estimated. For example if it is found that a particular area is having about 500 gallons of water collected after a rainfall ,then a 1000 gallon water tank will be installed.

Here are some pictures of our case study:

Fig.6.1. Excess water in plants

Fig.6.2. Manual watering

6.2. MICROCONTROLLER AND SENSORS USED

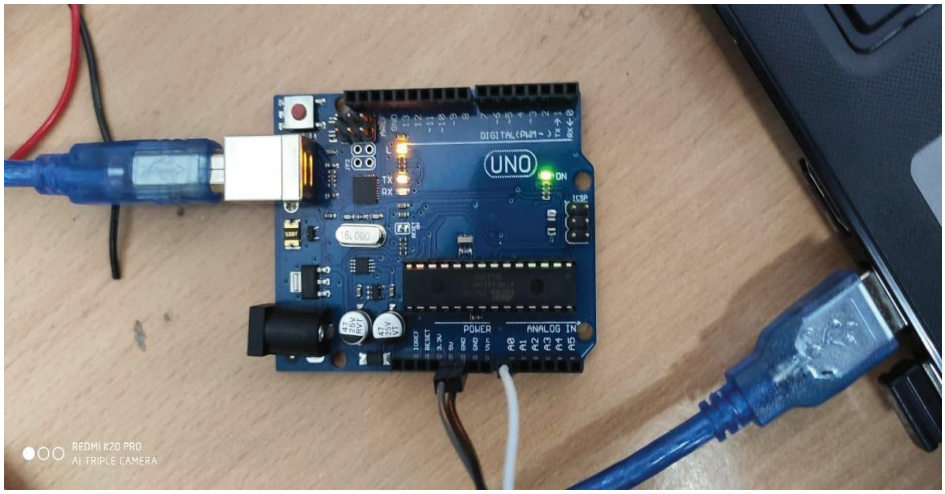

Fig.6.3. Arduino Microcontroller

Fig.6.4 .Soil Moisture Sensor installed in divider

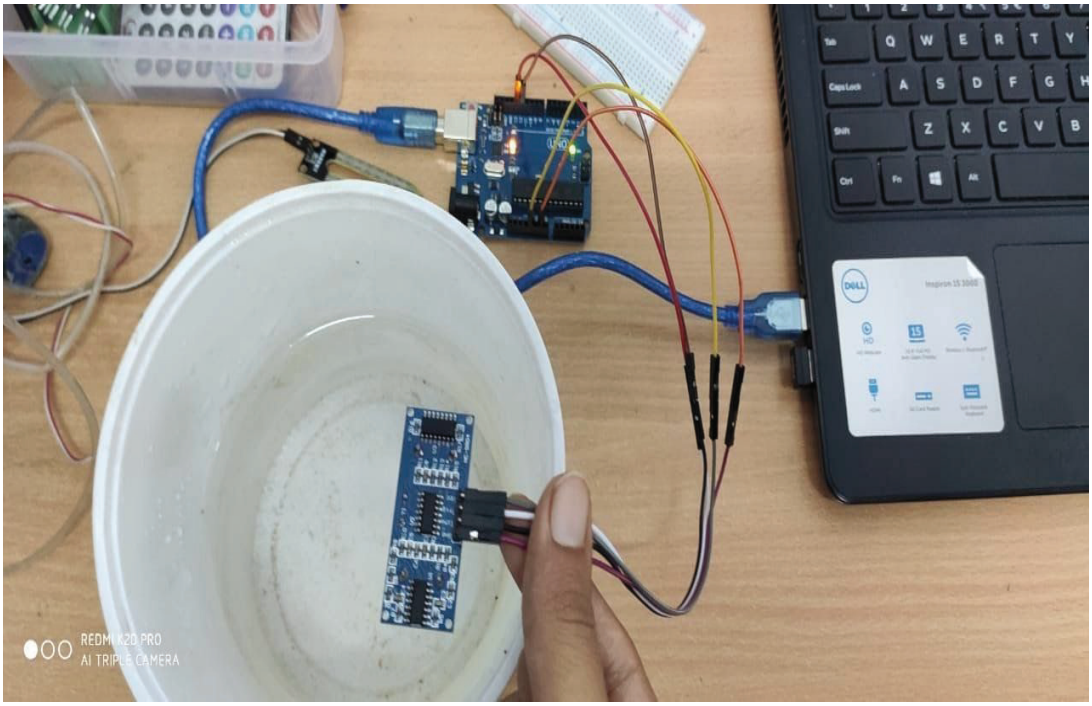

Fig.6.5. UltraSonic Sensor

6.3 SENSOR READINGS

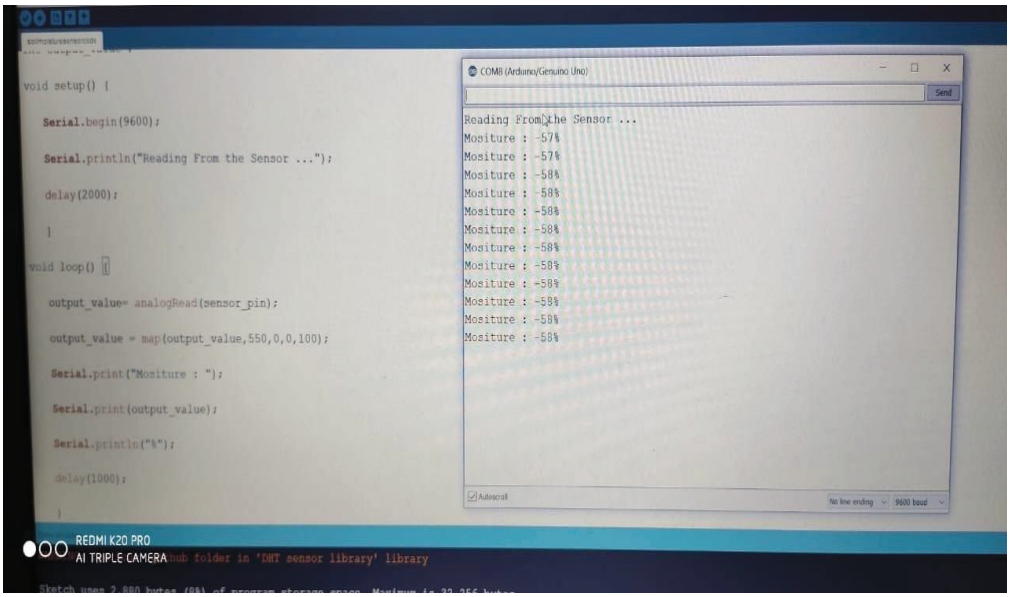

Fig. 6.6 Reading of Soil Moisture Sensor

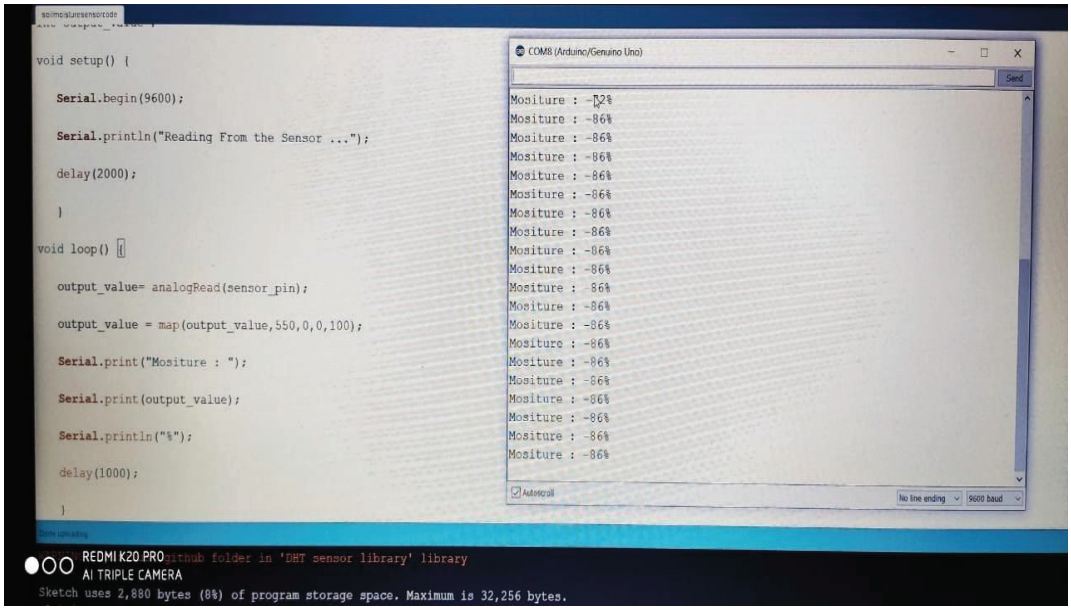

Fig. 6.7 Readings of Moisture Sensor

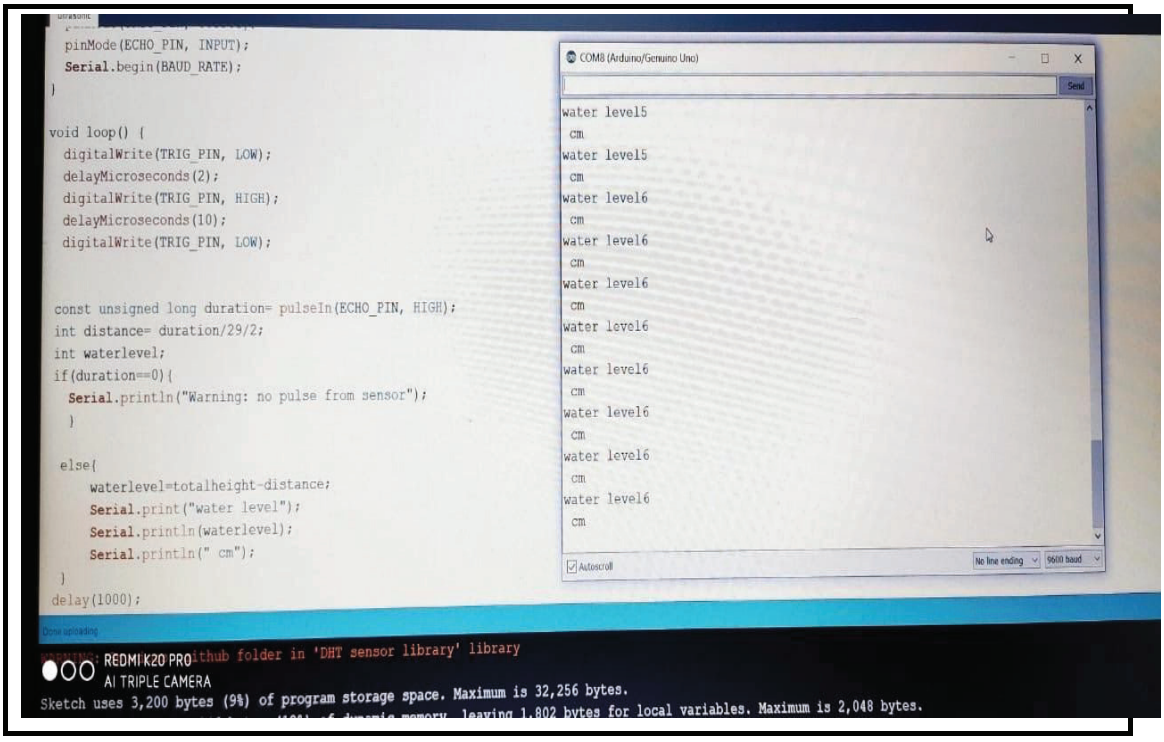

Fig. 6.8 Readings of Ultrasonic Sensor

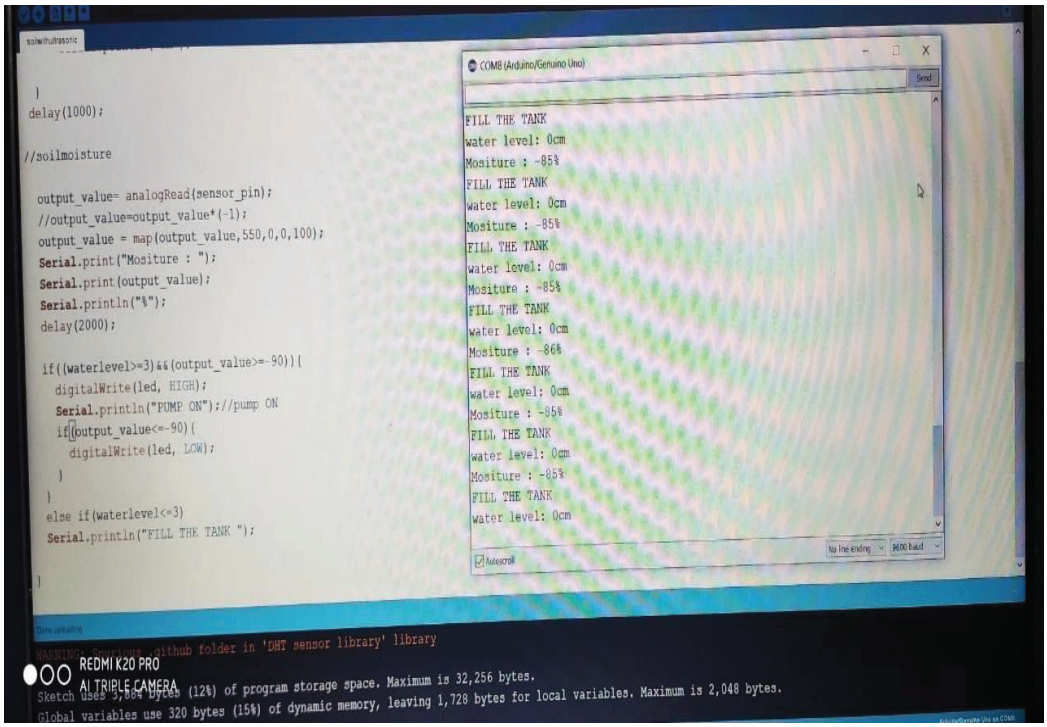

Fig. 6.9 Alert for filling tank based on sensor readings

6.4 FILTRATION OVER SMART TANK

Given below is the proposed implementation of the filtration over our smart tank. This smart tank will be used to harvest rain water as well all the sensors required for an automated watering system.

Fig. 6.10 Filtration over Smart Tank

6.5. 3D PROJECT MODEL

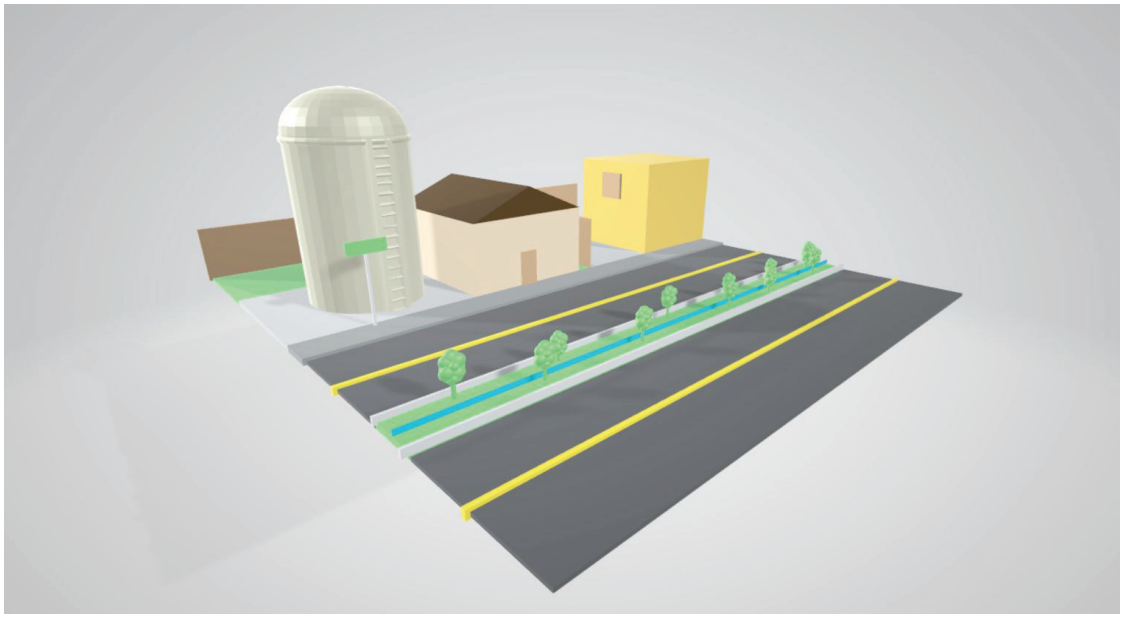

Fig. 6.11 Top Left view

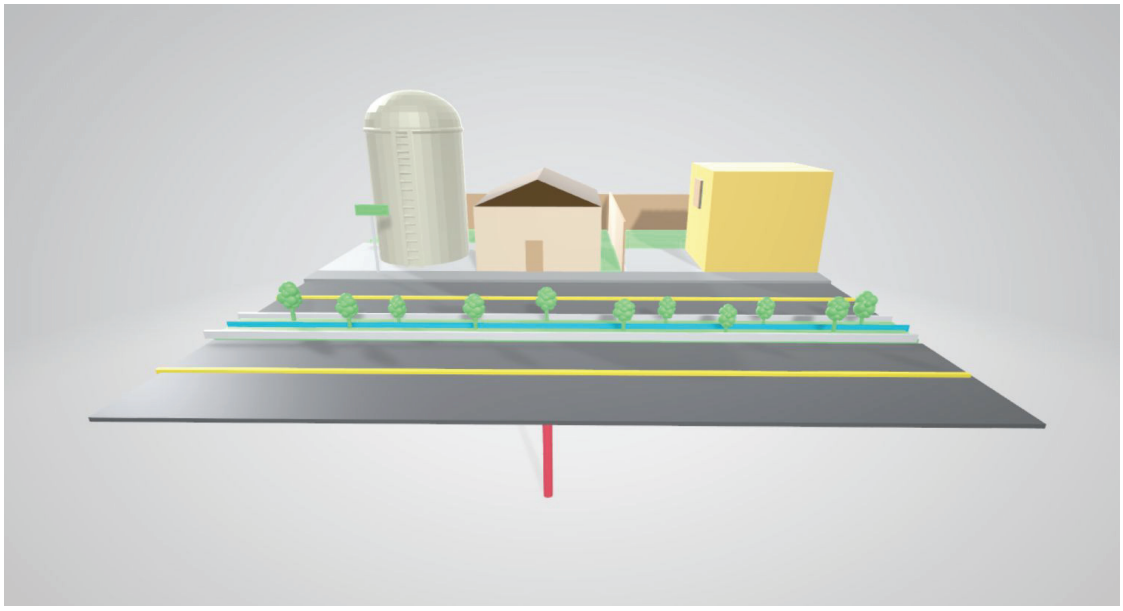

Fig. 6.12 Top Front view

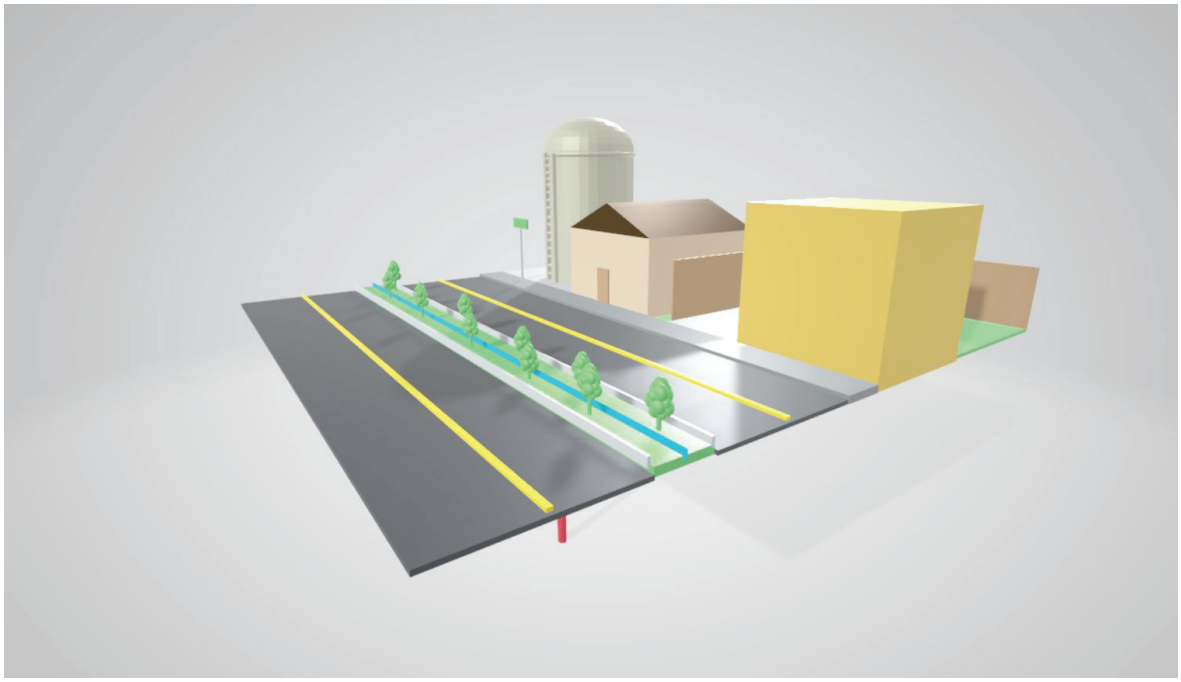

Fig. 6.13 Top Right view

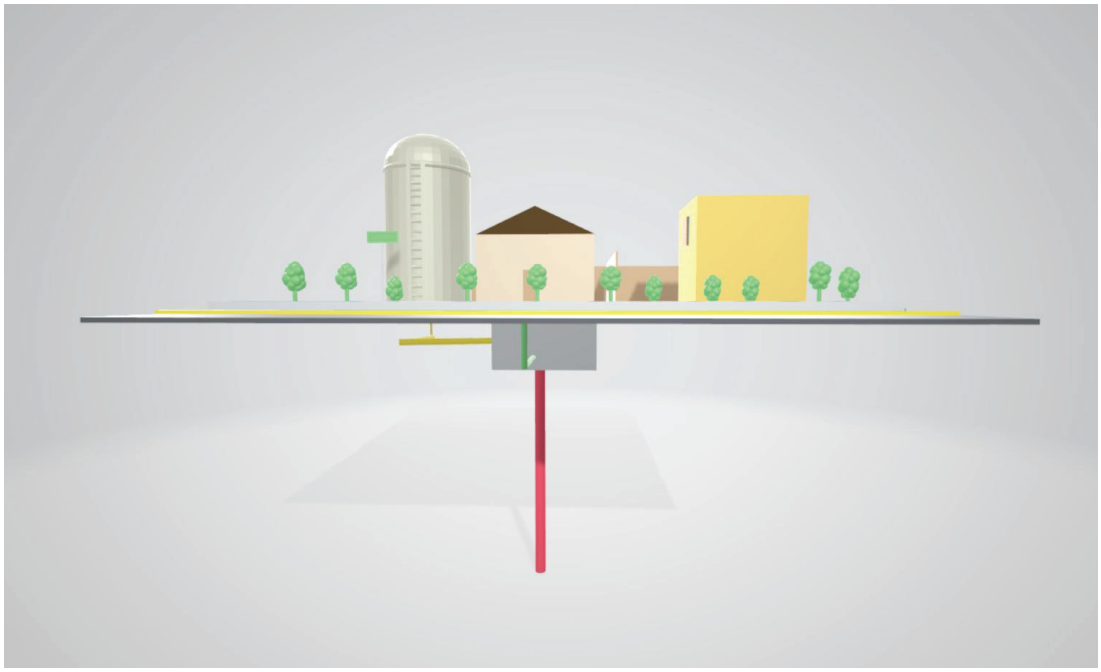

Fig. 6.14 Bottom Front view

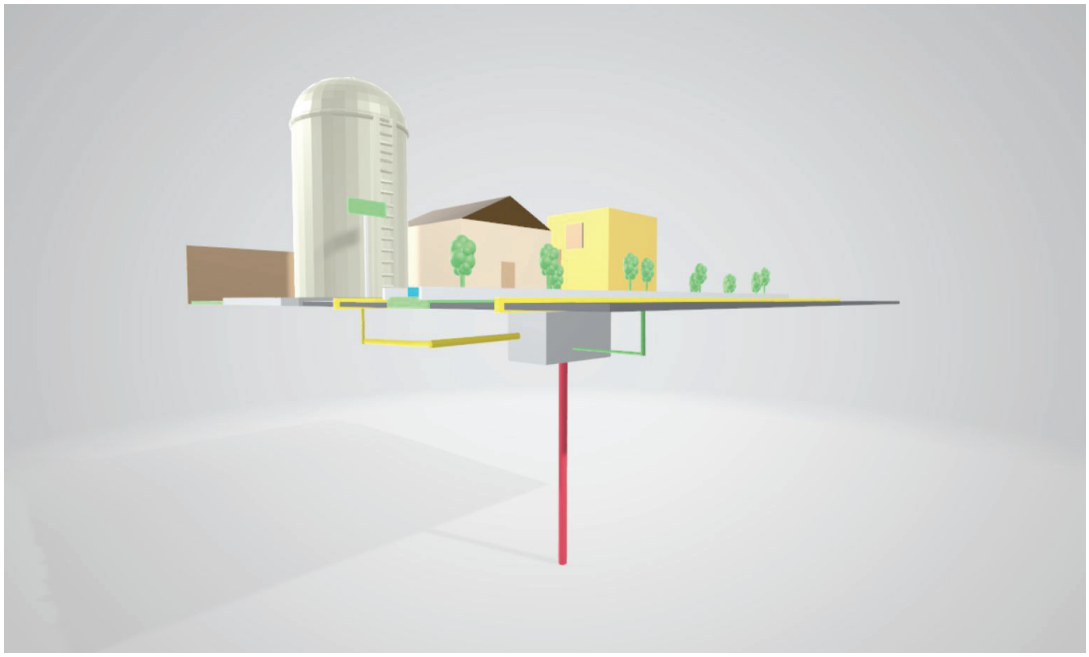

Fig. 6.15 Bottom Left view

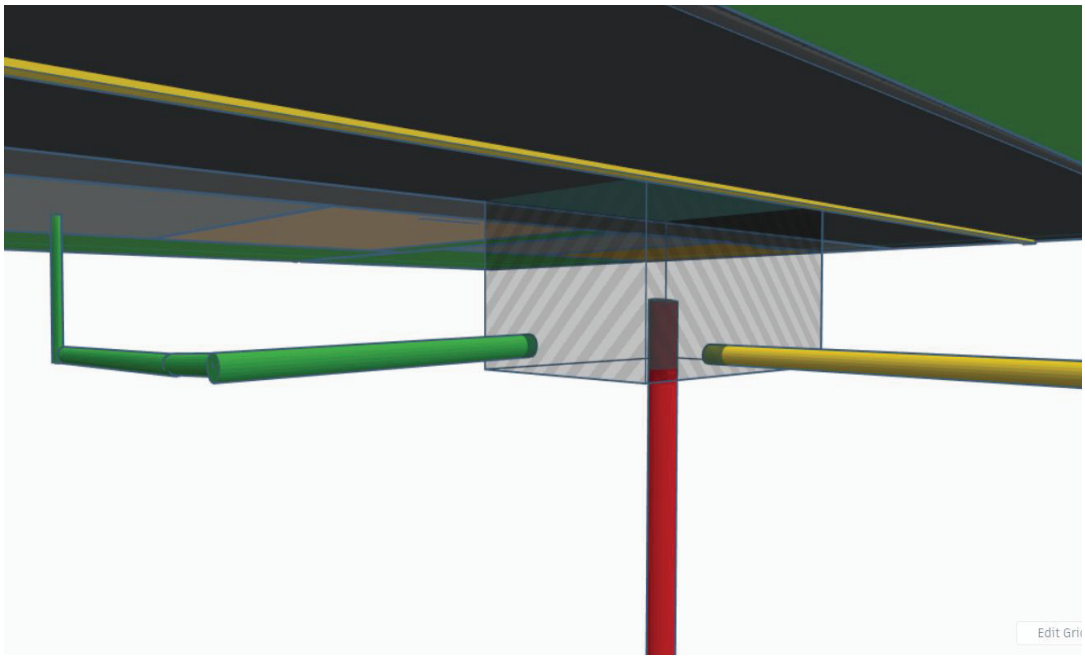

Fig. 6.16 Bottom view of the underground tank

6.6 PROJECT MODEL

Given below are the pictures of our project model.

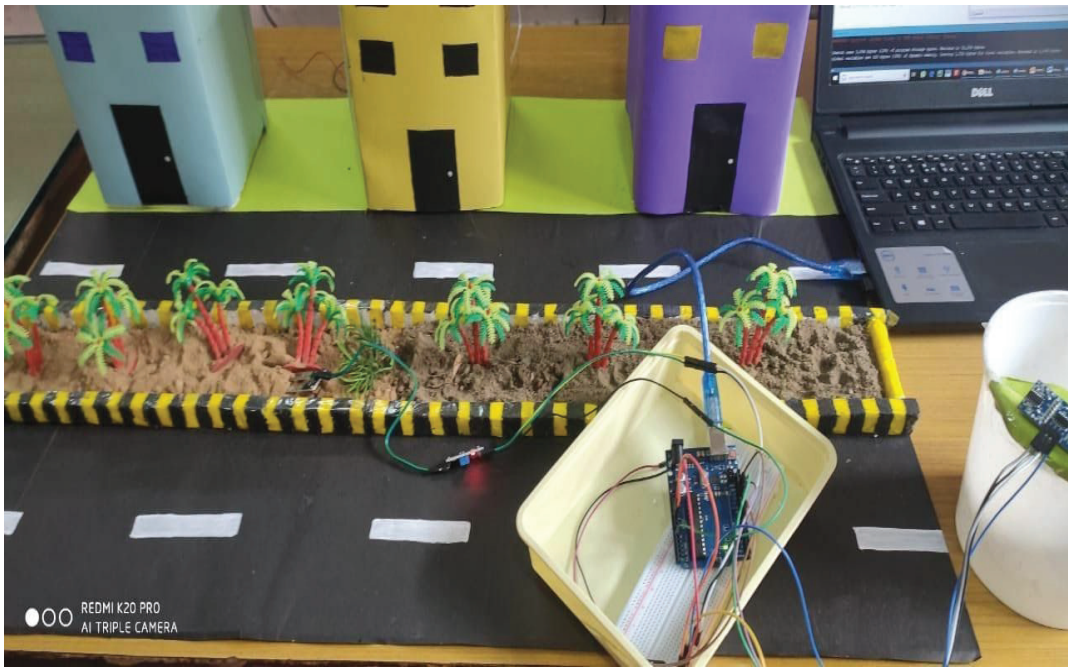

Fig. 6.17.(a) Project Model

Fig. 6.17.(b) Project Model

CONCLUSION

The Rainfall distribution in India mainly lies between the moderate to high rainfall. Capturing the rainwater can help recharge local aquifers, reduce urban flooding and most importantly ensure water availability in water-scarce zones. There is a huge amount of monsoon flow, which remains un-captured and eventually ends up in the natural sinks, especially seas and oceans.[20]

[43]India is the largest user of groundwater in the world. It uses an estimated 230 cubic kilometers of groundwater per year - over a quarter of the global total. More than 60% of irrigated agriculture and 85% of drinking water supplies are dependent on groundwater. Urban residents increasingly rely on groundwater due to unreliable and inadequate municipal water supplies. Some 90% of rural India's drinking water comes from groundwater and 75% of agriculture is groundwater-based. In urban India, 50% of the water supply is groundwater-based.

In case of **Moradabad**, it experiences the average annual rainfall of 976mm which is considered to be more than enough for the natural plantation and crops. A huge amount of water gets evaporated or gets collected over streets. The water is being wasted in both ways.

If the current trend continues, India is set to become a water scarce country in the near future. [33]While drought addled farmers pray for a renewed

monsoon season and a kinder summer, the problem goes beyond drought and immediate weather conditions. On the other hand, there are places that experience heavy rainfall which ends up in flooding. Years of pollution, inefficient farming, decentralized governance, groundwater exploitation and poor infrastructure have depleted the water supply. A rapidly increasing population has driven up the demand to balance both the conditions in which we efficiently collect rainfall to restore groundwater level and for other purposes.

Our project **"The Hardware based Irrigation through Rainwater using Smart Tank (THIRST)"** aims to quench the need for water wherever it is required in the most efficient way.

*It is a step towards making sure that no one is left thirsty, not even the **EARTH***.

This project aims to maximize the rain water harvesting by collecting the rainwater from the streets as well as rooftops of nearby buildings, and to make use of it in the most efficient way by watering plants and supplying it to ground in order to restore ground water level.[29]

This is a concept for smart cities, to provide them with their own water management systems where all the requirements can be fulfilled while maintaining the ground water level.

OUTCOME OF THIS PROJECT

- **Rain Water Harvesting:**

The smart tank in our system will help to collect the rainwater that generally evaporates or gets run off in the drains. The collected water can be used for different purposes such as watering plants, maintaining ground water level , etc.

- **Automated Watering:**

The Dripping system will use the sensors in order to check the temperature and humidity of the soil and will provide the adequate amount of water to the plant bedding in the divider of roads.[12] Hence, plantation on the dividers which is generally left unattended will receive water whenever required and will help us to build a greener environment.

- **Restores Ground Water Level:**

When the water in our smart tank will exceed a certain threshold , the flap to the ground will be opened and extra water will be supplied to the ground. The ultrasonic sensor will be used to check the water level in the tank. Hence, the supply of excess water to the ground will help in maintaining the ground water level.

- **Efficient maintenance of reservoir's water level:**

Our system ensures that the water level in the tank is maintained. If the water level in the tank goes below a certain level the concerned authorities are notified to fill the tank as soon as possible. This will help in supplying water to the plant bedding without any hindrance.

- **Other benefits:**

Our system solves many other water related problems that we face in our day to day life. This system will help in clearing the roads that suffer from water clogging and hence the traffic will be able to flow easily. It will reduce the inconvenience faced by the pedestrians. One of the major problems faced after water clogging is the growth of mosquitos which will also be decreased. Thus, it will help us in keeping our atmosphere clean and green.[17]

FUTURE AMENDMENTS

- **Solar Panel**

In this system, we are planning on using solar energy to operate microcontrollers, sensors and pumps. Saving energy is one of the concerned issues in present. So we look forward to replacing the source of power supply with solar panels in the future. Installing solar panels will help us in conserving electricity and making our system more environment-friendly. Solar panels will also decrease the cost of power supply in the long run.

- **Filtration**

The size of our reservoir can vary with the location and the amount of rainfall a location experiences. In the cases, where we experience heavy rainfall, the reservoir will have an excess amount of water that can be used for daily use. Since the rain water is dirty and needs a cleaning system, we are looking forward to installing a filtration system that will help us to supply water to the nearby buildings.

- **Rain Prediction**

In order to maintain the amount of water in the reservoir efficiently, we are looking forward to including a prediction system that will help us in forecasting next rainfall. We will be using Machine Learning algorithms to implement this prediction system. This system will help us in notifying the authorities to fill the reservoir only when there is no upcoming rainfall. Hence, we will be able to use the rainwater more efficiently.

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INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

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THIRST

The Hardware based Irrigation through Rainwater using Smart Tank

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***Abstract*-.The main aim of the project is to step towards making sure that no one is left thirsty, not even the EARTH.**
As the name suggests our project will quench the thirst of underground water as well as plants. Watering is the most cultural practice and most labor intensive task in daily gardening operation. Knowing when and how much water is needed, is the two most important aspects of the watering process.
This is a concept for smart cities. In this project we are installing a smart tank under the roads which will store rainwater which will be used to water the plantation over dividers .The motor pump will extract the water from our Smart reservoir and will work according to the soil condition to water our plantation, and also half of that water will be transferred underground to maintain ground water level.The main work of the project is to cope with the water clogging problem faced over the roads which then affects the traffic and causes different problems also the project aims to develop techniques in various aspects of plantation which helps to track the moisture of the soil and temperature in real time and allow water to the plant based on the detecting values.
Firstly we intend to harvest rain water using our smart tank. This smart tank will be connected to the dripping system as well as to the ground and an external reservoir. We are using ultrasonic sensors in order to determine water level in the reservoir .The Humidity sensor will help us to know whether a plantation needs water or not. When it will sense dryness in the soil, the water pump will start and thus will provide them with an adequate amount of water through a dripping system. In case of overflow, water will be sent to the nearby reservoir which may go through some filtration process and can be made suitable for human use. Half of the water will be automatically sent to the underground water table through a borehole which will help us to enhance ground water level.

***Keywords*— Smart tank, Sensors, Dripping System**

I. INTRODUCTION

THIRST stands for The Hardware based Irrigation through Rainwater using Smart Tank. Efficient rain water harvesting technique is the need of the hour.[3] As the name suggests our project will quench the thirst of underground water as well as the plants. Watering is the most cultural practice and most labour intensive task in daily gardening operation. Knowing when and how much water is to be sent are the two most important aspects of the watering process. We are developing a smart reservoir which will store water and the motor pump will extract the water from our Smart reservoir and will work according to the soil conditions to water our plantation and transfer water underground to maintain ground water level. In case water supply is not required in the plantation system, the water will be sent to the ground which will service in groundwater restoration.[9] The main aim of the project is to develop techniques in various aspects of plantation which helps to track the moisture of the soil and temperature in real time and allow water to the plant based on the detecting values.[6]

II. HISTORY

India has a long tradition of water harvesting. Many of the traditional water harvesting systems have either fallen to misuse due to a variety of physical, social, economic, cultural and political factors that have caused their deterioration, and due to the decline of institutions that have nurtured them , or have lost their relevance in the modern day context due to their inability to meet the desires of communities.[1]

The lack of willingness to appreciate the fact that different periods in history are marked by the genesis, rise and fall of new water harvesting traditions, is also very clear.[4]

III. EXISTING PROBLEMS IN RAIN WATER HARVESTING

One of the most important underlying values in rainwater harvesting is that it is a benign technology and cannot create desirable consequences.

Water harvesting initiatives are driven by firm beliefs and assumptions, some of which are:

1.There is a huge amount of monsoon flow, which remains un-captured and eventually ends up in the natural sinks, especially seas and oceans[2]

2. Local water needs are too small and as such exogenous water is not needed

3. Local water harvesting systems are always small and, therefore, are cost effective

4. Since the economic, social and environmental values of water are very high in regions hit by water shortages, water harvesting interventions are viable, supported by the assumption that cost- effective alternatives that can bring in the same amount of water, do not exist[3]

5. Incremental structures lead to incremental benefits

6. Being small with low water storage and diversion capacities, they do not pose negative consequences for downstream uses.

IV. PREVIOUS HARVESTING CALCULATIONS

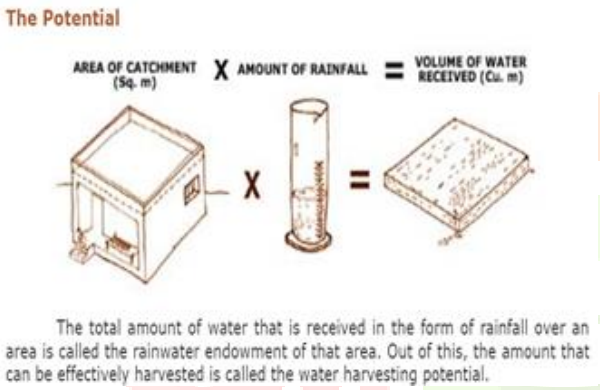


Fig 1 :Previous methods

V. RAINWATER HARVESTING AS SOLUTION

Since the Rainfall distribution in India mainly lies between the moderate to high rainfall .Capturing the rainwater can help recharge local aquifers, reduce urban flooding and most importantly ensure water availability in water-scarce zones. Some ancient rainwater harvesting methods followed in India include madakas, ahar pynes, surangas, taankas and many more.[1]

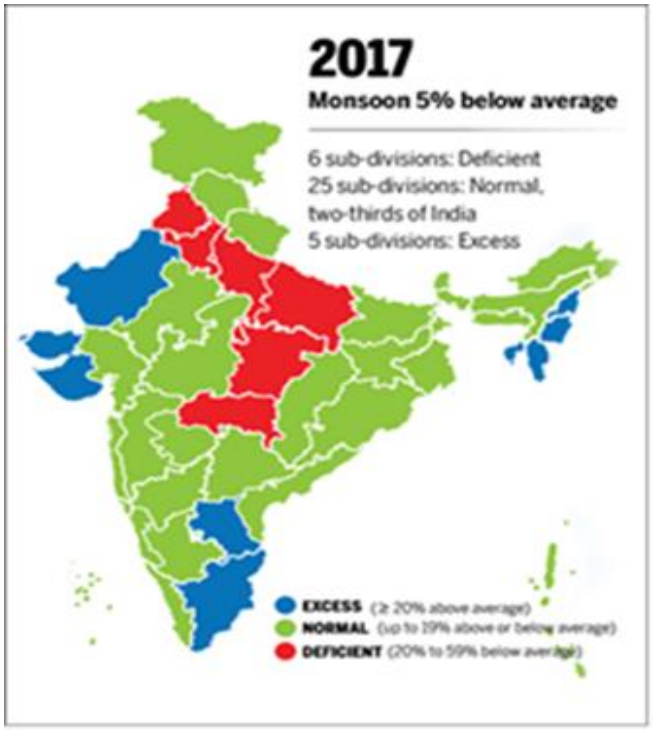


Fig 2: Rainfall chart

VI. PROCEDURE

As we all know water is being wasted on an alarming level for different purposes of daily life. Also the greenery is going out of hand due to lack of proper care. So to solve these problems we are building a smart system named **THIRST** i.e. The Hardware based Irrigation through Reservoir using Sensor Technology[6].

Firstly we intend to harvest rain water using our smart reservoir. This smart reservoir will be connected to the dripping system as well as to the ground and nearby buildings. We are using ultrasonic sensors in order to determine the water level in the reservoir. A warning to refill the reservoir will be sent to the concerned authorities in case the water level goes below a certain threshold[7].

The Humidity sensor will help us to know whether a plantation needs water or not. When it will sense dryness in plants , the dripping system will start and thus will provide them with an adequate amount of water. If the water supply is not required in the plants, the water will be used by nearby buildings to fulfill daily needs which will undergo a filtration process in our smart reservoir in order to make it suitable for household use . In case of overflow, water will be sent to the ground. This will help us to enhance ground water level. We are using the raindrop sensor to detect whether it's raining or not.

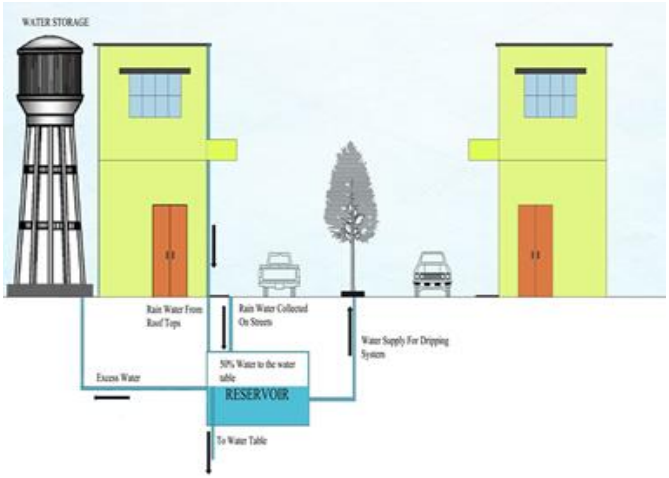
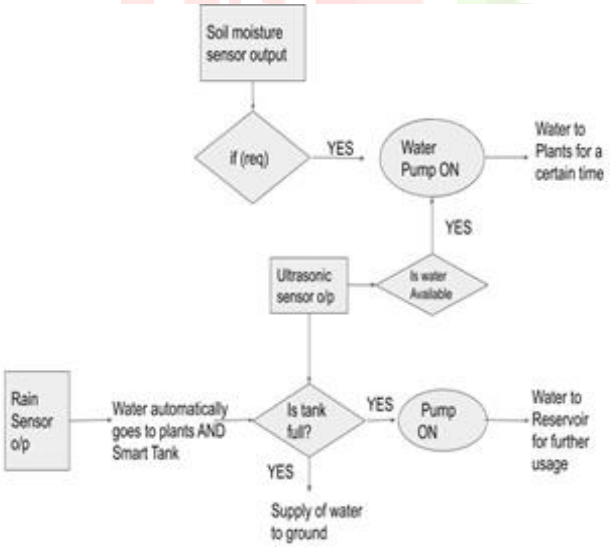


Fig 3: Basic Idea (Blue print)

VII. TECHNOLOGY

- Sensors - Ultrasonic sensor, Raindrop sensor, Soil moisture sensor.
- Actuators - Water pumps
- Microcontroller - Arduino UNO
- Embedded C language.
- Fritzing - For Circuit simulation.
- Tinker cad - For making 3D image of the project.
- Arduino IDE - For programming the microcontroller.

VIII. FLOW CHART DIAGRAM



IX. CONCLUSION

India is the largest user of groundwater in the world. It uses an estimated **230 cubic kilometers** of groundwater per year - over a quarter of the global total.[1]

More than 60% of irrigated agriculture and 85% of drinking water supplies are dependent on groundwater. Urban residents increasingly rely on groundwater due to unreliable and inadequate municipal water supplies.

Some 90% of rural **India's** drinking **water** comes from **groundwater** and75% of agriculture is **groundwater** based. In urban **India**, 50% of the **water** supply is **groundwater** based.

So in short there is a serious need to manage the water usage.

The project aims to maximize the rain water harvesting by collecting the rainwater from the streets as well as rooftops, and to make use of it in the most efficient way.

In case of **Moradabad** ,it experiences the average annual rainfall of **976mm** which is considered to be more than enough for the natural plantation and crops. A huge amount of water gets evaporated or gets collected over streets . The water is being wasted in both ways.[5]

X. OUTCOME OF THE PROJECT

1. The roads that suffer from water clogging will be clear and the traffic will be able to flow easily.
2. The water that generally evaporates or gets run off will be collected and can be used for different purposes.
3. One of the major problems faced after water clogging is the growth of mosquitos which will be avoided.
4. Plantation on the dividers which is generally left unattended will receive water whenever required, through the dripping system.
5. for ground water recharge, all the excess water will be sent to the ground which will help in maintaining the ground water level.[7]

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