AUTOMATIC IRRIGATION SYSTEM

A report submitted in partial fulfilment of the Academic requirements for the award of the degree of

Bachelor of Technology

Submitted by

TEAM 07

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UNDER THE COURSE

INTRODUCTION TO SOCIAL INNOVATION

CENTRE FOR ENGINEERING EDUCATION RESEARCH
CMR COLLEGE OF ENGINEERING & TECHNOLOGY
(Autonomous)
(NAAC Accredited with 'A' Grade & NBA Accredited)
(Approved by AICTE, Permanently Affiliated to JNTU Hyderabad)
KANDLAKOYA, MEDCHAL ROAD, HYDERABAD-501401

2019-20

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CERTIFICATE

This is to certify that the course project report entitled **"AUTOMATIC IRRIGATION SYSTEM"** is a bonafide work done by **P. Pranav Siva Teja (18H51A0525) , K. Bhargavi (18H51A05A2) , G. Pavan (18H51A05C6) , T. Akanksha (18H51A05H7) , V. Ujwala (18H51A05L7) , T. Avyukth Reddy (18H51A05P6),** of IB.Tech, in partial fulfillment of the requirements for the award of the degree of Bachelor of Technology, submitted to Centre for Engineering Education Research, CMR College of Engineering & Technology, Hyderabad during the Academic Year 2018-19

(Names of the project coordinators)
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2. Mr. B. Suresh Ram
3. Mr. P. Mahesh Babu

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Head
CEER

DECLARATION

We, the students of II B. Tech of Centre for Engineering Education Research , CMRCOLLEGE OF ENGINEERING AND TECHNOLOGY, Kandlakoya, Hyderabad, here by declare, that under the supervision of our guide course coordinators, we have independently carried out the project titled "Automatic sprinklers" and submitted the report impartial fulfilment of the requirement for the award of Bachelor of Technology in by the Jawaharlal Nehru Technological University, Hyderabad (JNTUH) during the academic year 2018-2019.

Name, Roll Number and Signature of the students

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Finally we thank all our faculty members and Lab Assistants for their valid support.

We own all our success to our beloved parents, whose vision, love and inspiration has made us reach out for these glories.

ABSTRACT

This project is designed to develop an Automatic Watering System that switches the pump motor ON/OFF on sensing the moisture content of the soil. In the soil, the use of the proper method of watering is important. The advantage of using this method is to reduce human intervention and still ensure proper plantation by not letting the plant getting dried and also not killing by pouring excess of water. This project uses a microcontroller called Arduino which is programmed to receive the input signal of varying moisture conditions of the soil through the sensing arrangement. Once the controller receives this signal, it generates an output that drives a relay for operating the water pump. The sensing arrangement is made by using two stiff metallic rods (known as Soil Moisture Sensors) inserted into the field at a distance. Connections from the metallic rods are interfaced to the control unit.

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INTRODUCTION:

In late decades, there is a quick advancement in Smart Agricultural Systems show that agriculture has great importance worldwide. Indeed, in India for example, about 70 % of the people relay upon the vital sector of agriculture. In the past, irrigation systems used to be dependent on the mills to irrigate the farm by conventional methods without knowing the appropriate quantities of these crops. These old systems are a major cause of the waste of large quantities of water and thus destroy some crops because of the lack of adequate quantities of water. However, with the recent technological developments, there have been innovative systems for irrigation without the farmer interfering in the irrigation process. Indeed, smart systems have proven their capability to regulate the irrigation of crops. It also works to stop the waste of water in irrigation. Furthermore, it will work to minimize number of employees which lead to saving money. Agriculture is developing from mechanized by simple methods in the twentieth century to being automated in the 21st century. It is important that producer considers on the early framework periods of mechanics and actualizes, so can achieve an elevated level of automation. In the fast paced world human beings require everything to be automated. In this project, we try to solve the problems of irrigation such as errors caused by farmers and the consumption of large quantities of water. These errors affect trees as their fungi may also affect the overall stock of water. It is necessary to make effective effort and contribution to achieving the desired objectives of this system. Irrigation process can be used for the cultivation of agricultural crops during the span of inadequate rainfall and for maintaining landscapes. Every irrigation system such as drip, sprinkler and surface gets automated with the help of electronic appliances and detectors such as computer, timers, sensors and other mechanical devices. Therefore, the effort should not be limited to individual effort. In addition farmers must be very important to achieve the high efficiency of modern irrigation systems. With the increase of world population, the need for farming yields is increasing instantaneously. Further, the farmer's potential and abilities in the agriculture filed

are reducing, this is regarding different enterprises that attract workers away from the farming zone (28% of farmers in Japan are over 65 years old). The income in agriculture needs to continue 5 developments regarding the prediction of world population increases from 6.8 billion in 2013 to over 10 billion by 2050.Efficiencies become an essential demand with the declining of farmers' potential. In a country like India, where the economy is mainly based on agriculture and the climatic conditions are isotropic, still we are not able to make full use of agricultural resources. The main reason is the lack of rains & scarcity of land reservoir water. Irrigation has always been an ancient practice which has evolved through so many stages over the years. Our ancestral farmers in a bid to irrigate their farm sought for various methodologies. Manual irrigation using buckets and watering cans, flood irrigation, drip irrigation, sprinkler irrigation were and are still being used today. The existing system has several limitations; leaching off of soil nutrients, erosion due to flooding, loss of water from plant surfaces through evaporation, water wastage which can result to water scarcity in drought areas and production of unhealthy crops. It can prevent irrigation happening on the day at the wrong time, to switch engine ON or OFF by utilizing the irrigation system, the controller will work to switch the engine, so no need for employers, to reduce mistakes of operation due to employees as much as possible and to preserve water from waste. Hence to make life simpler and convenient, we have made "AUTOMATIC IRRIGATION SYSTEM". A model of controlling irrigation facilities to help millions of people. This model uses sensing arrangement technology with microcontroller to make a smart switching device. The continuous increasing demand of food requires the rapid improvement in food production technology. This problem can be rectified if we use microcontroller based automated irrigation System in which the irrigation will take place only when there will be acute requirement of water.

2. LITERATURE REVIEW:

Our project and those literatures that we have contemplated. Automation of irrigation system refers to the operation of the system with no or minimum manual interventions. Irrigation automation is justified where a large irrigated area is divided into Small segments called irrigation blocks and segments are irrigated in sequence to match the discharge available from the water source. In this regard, the works that we have surveyed, describe the different types of automatic irrigation techniques, how they actually have served the purpose and the primary difference.

GSM BASED IRRIGATION SYSTEM

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. The GSM sends this data to ARM7 which is also continuously receives the data from sensors in some form of codes. After processing, this data is displayed on the LCD. 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 simple manipulation in the internal structure of the starter. 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. In 2007 a GSM-SMS remote measurement and control system for greenhouse based on PC-based database system connected with base station was introduced. Base station is developed by using a microcontroller, GSM module, sensors and actuators. In practical operation, the central station

receives and sends messages through GSM module. Criterion value of parameters to be measured in every base station is set by central station, and then in base stations parameters including the air temperature, the air humidity etc. mainly focuses on reviews in the field of remote monitoring and control, the Technology used and their potential advantages. The paper proposes an innovative GSM/Bluetooth based remote controlled embedded system for irrigation. The system sets the irrigation time depending on the temperature and humidity reading from sensors and type of crop and can automatically irrigate the field when unattended. Information is exchanged between far end and designed system via SMS on GSM network. A Bluetooth module is also interfaced with the main microcontroller chip which eliminates the SMS charges when the user is within the limited range of few meters to the designated system. The system informs users about many conditions like status of electricity, dry running motor, increased temperature, water content in soil and smoke via SMS on GSM network or by Bluetooth. The GSM based irrigation system may offer users the flexibility to regulate and control the operations of their irrigation systems with little intervention to reduce runoff from over watering for improvement in crop yield. This enables users to take advantage of the globally deployed GSM networks with its low SMS service cost to use mobile phones and simple SMS commands to manage their irrigation system. It will be possible for users to use SMS to monitor directly the conditions of their farmland, schedule the water GSM based Automatic Irrigation Control System for Efficient Use of Resources and Crop Planning needs of crops, automatically control watering, and set control operational conditions in accordance with the water needs and minimize overwatering of crops. This will decrease production cost.

Average Cost: Rs 15,000/-

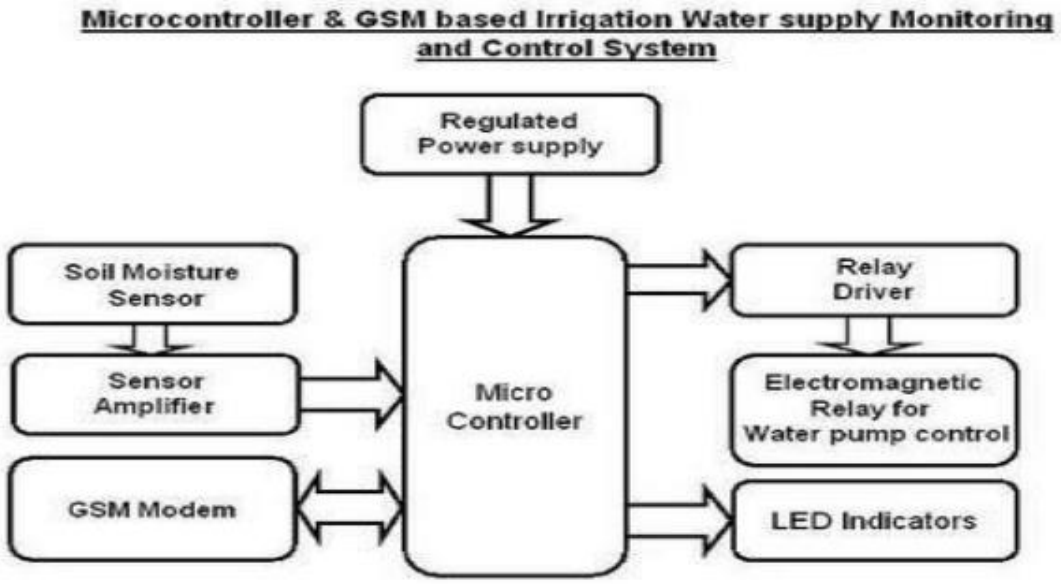


Fig.No.1: GSM based irrigation system

DISADVANTAGES OF GSM BASED IRRIGATION:

Many of the GSM technologies are patented by Qualcomm and hence licenses need to be obtained from them. In order to increase the coverage repeaters are required to be installed. GSM provides limited data rate capability, for higher data rate GSM advanced version devices are used. GSM uses FTDMA access scheme. Here multiple users share same bandwidth and hence will lead to interference when more number of users are using the GSM service. In order to avoid this situation, robust frequency correction algorithms are used in mobile phones and base stations. GSM uses pulse based burst transmission technology and hence it interferes with certain electronics. Due to this fact airplanes, petrol bunks and hospitals prevent use of GSM based mobile or other gadgets.

SOLAR IRRIGATION SYSTEM

In recent days, agriculture field farmers are facing many problems in watering their plants to keep their crops green in summer season. It's because they don't have correct idea about the availability of the power. Even if the power is available, they have to wait until the pitch is properly watered. Thus this process restricts them to stop doing other deeds. But, there is a solution, i.e., automatic solar submersible pump control panel for irrigation. In the trial of solar based plant irrigation using submersible pumps, PV cells are used to generate electricity, which is stored in rechargeable batteries. These batteries produce power for the system operation. A submersible pump controller is used to pump water from a bore well to a storage water tank. Then, the water is drawn by a submersible pump at the slope's toe, where the installed sprinklers water the crops or plants.

Average Cost: Rs.1, 16,000/-

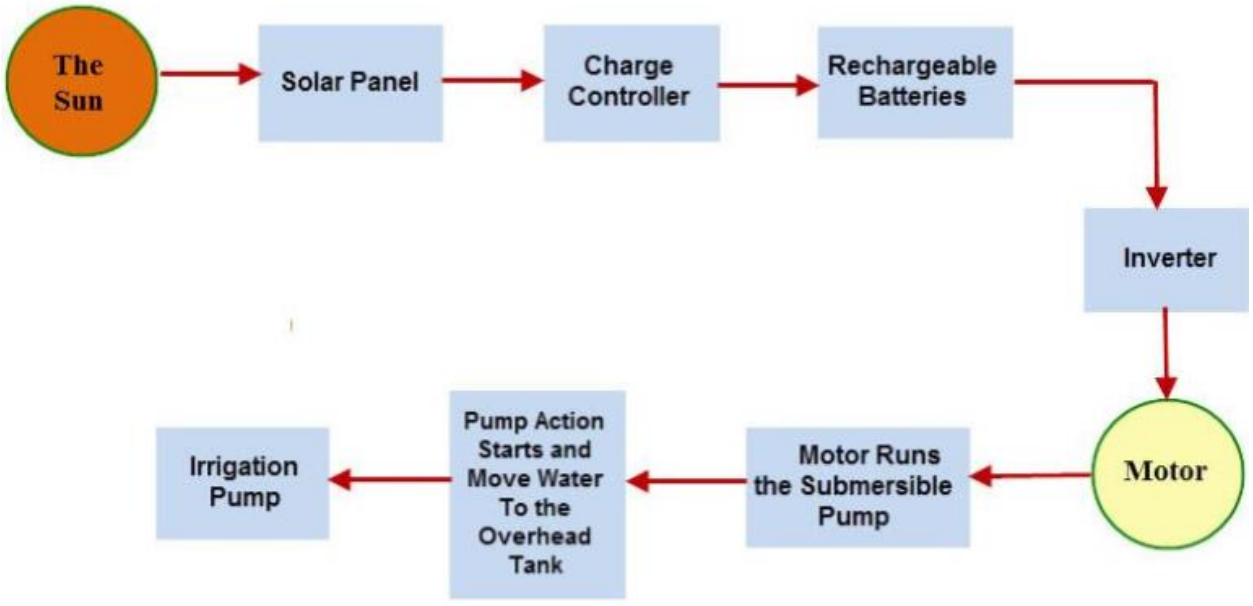


Fig.No.2: Solar Irrigation system

DISADVANTAGES OF SOLAR IRRIGATION:

1. Cost

The initial cost of purchasing a solar system is fairly high. This includes paying for solar panels, inverter, batteries, wiring, and for the installation. Nevertheless, solar technologies are constantly developing, so it is safe to assume that prices will go down in the future.

2. Weather Dependent

Although solar energy can still be collected during cloudy and rainy days, the efficiency of the solar system drops. Solar panels are dependent on sunlight to effectively gather solar energy. Therefore, a few cloudy, rainy days can have a noticeable effect on the energy system. You should also take into account that solar energy cannot be collected during the night.

3. Solar Energy Storage Is Expensive

Solar energy has to be used right away, or it can be stored in large batteries. These batteries, used in off-the-grid solar systems, can be charged during the day so that the energy is used at night. This is a good solution for using solar energy all day long but it is also quite expensive. In most cases, it is smarter to just use solar energy during the day and take energy from the grid during the night.

4. Uses a Lot of Space

The more electricity you want to produce, the more solar panels you will need, as you want to collect as much sunlight as possible. Solar PV panels require a lot of space and some roofs are not big enough to fit the number of solar panels that you would like to have. An alternative is to install some of the panels in your yard but they need to have access to sunlight.

5. Associated with Pollution

Although pollution related to solar energy systems is far less compared to other sources of energy, solar energy can be associated with pollution. Transportation and installation of solar systems have been associated with the emission of greenhouse gases. There are also some toxic materials and hazardous products used during the manufacturing process of solar photovoltaic systems, which can indirectly affect the environment. Nevertheless, solar energy pollutes far less than other alternative energy sources.

SMART SPRINKLERS

Weather-based smart irrigation controllers

Weather-based controllers, also referred to as evapotranspiration (ET) controllers, use local weather data to adjust irrigation schedules. Evapotranspiration is the combination of evaporation from the soil surface and transpiration by plant materials. These controllers gather local weather information and make irrigation run-time adjustments so the landscape receives the appropriate amount of water.

There are three basic forms of these weather-based ET controllers:

Signal-based controllers use meteorological data from a publicly available source and the ET value is calculated for a grass surface at the site. The ET data is then sent to the controller by a wireless connection.

Historic ET controllers use a pre-programmed water use curve, based on historic water use in different regions. The curve can be adjusted for temperature and solar radiation.

On-site weather measurement controllers use weather data collected on-site to calculate continuous ET measurements and water accordingly.

Soil moisture sensors used with smart irrigation controllers Soil moisture sensor-based smart irrigation controllers use one of several well-established technologies to measure soil moisture content. When buried in the root zone of turf, trees or Shrubs, the sensors accurately determine the moisture level in the soil and transmit this reading to the controller. There are two different soil moisture sensor-based systems available.

Suspended cycle irrigation systems, which are set like traditional timer controllers, with watering schedules, start times and duration. The difference is that the system will stop the next scheduled irrigation when there is enough moisture in the soil.

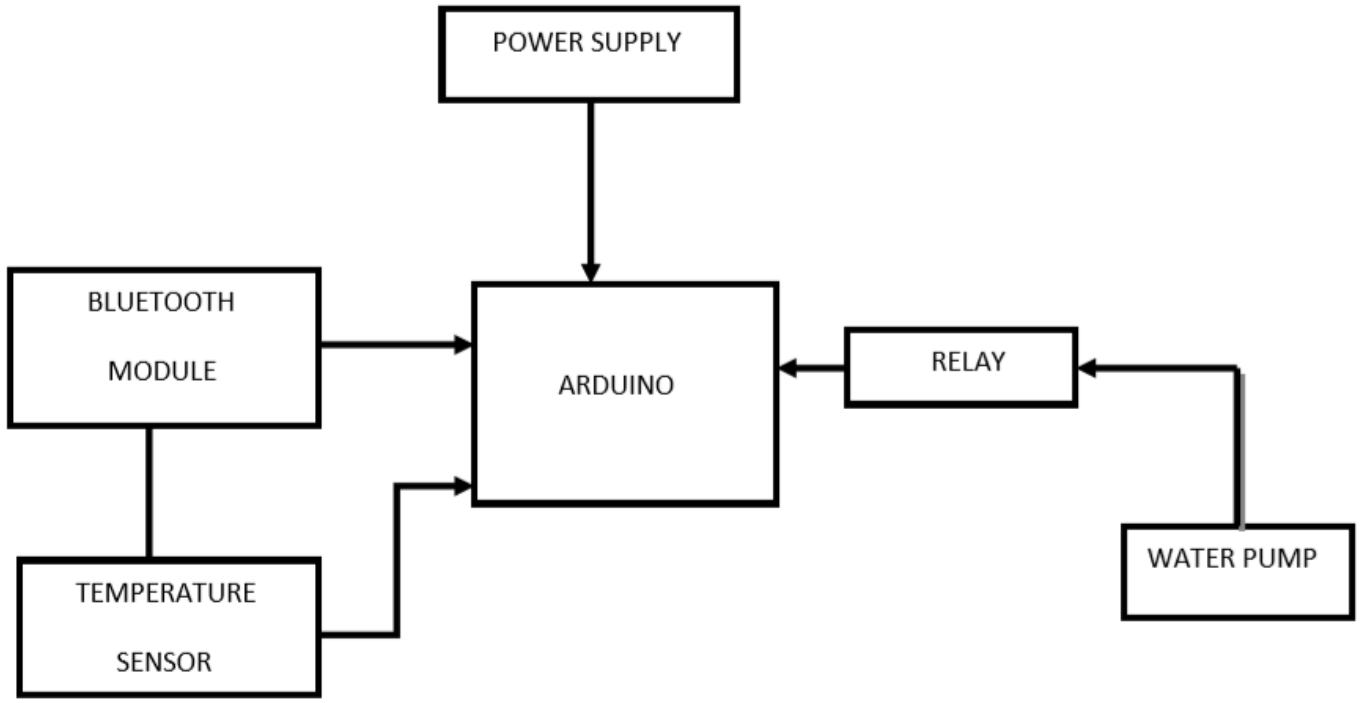
Water on demand irrigation requires no programming of irrigation duration (only start times and days of the week to water). It has a user-set lower and upper threshold, which initiates irrigation when the soil moisture level fails to meet those levels.

Average Cost: 50,000/-

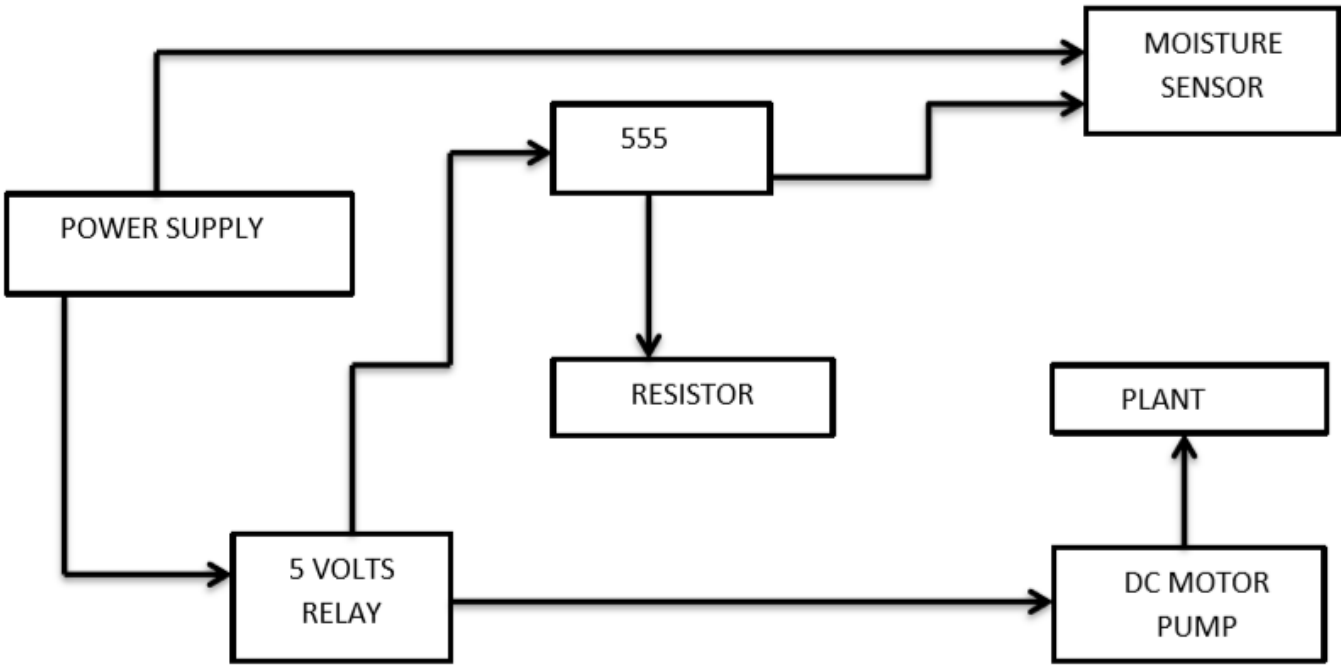
DISADVANTAGES

- The primary disadvantage associated with a sprinkler system is the expense. These systems can be quite costly depending on the size of the property. Furthermore, portions of the lawn will have to be dug up to install pipe work and attach it to the plumbing system of the home. This can equate to days or weeks without use of the yard. Afterward, the landscaping will have to be repaired.
- It is best to install an irrigation system before installing sod or extensive landscaping because some of it will have to be torn up. Homeowners who already have pristine yards may be turned off by this reality.
- Even the most efficient sprinkler systems can have their pitfalls. Wind can wreak havoc on sprinklers, directing water in the wrong direction. Underground pests may damage water delivery systems, resulting in water pooling or broken parts. The repairs to fix an irrigation system can be much more costly than replacing a damaged garden hose.

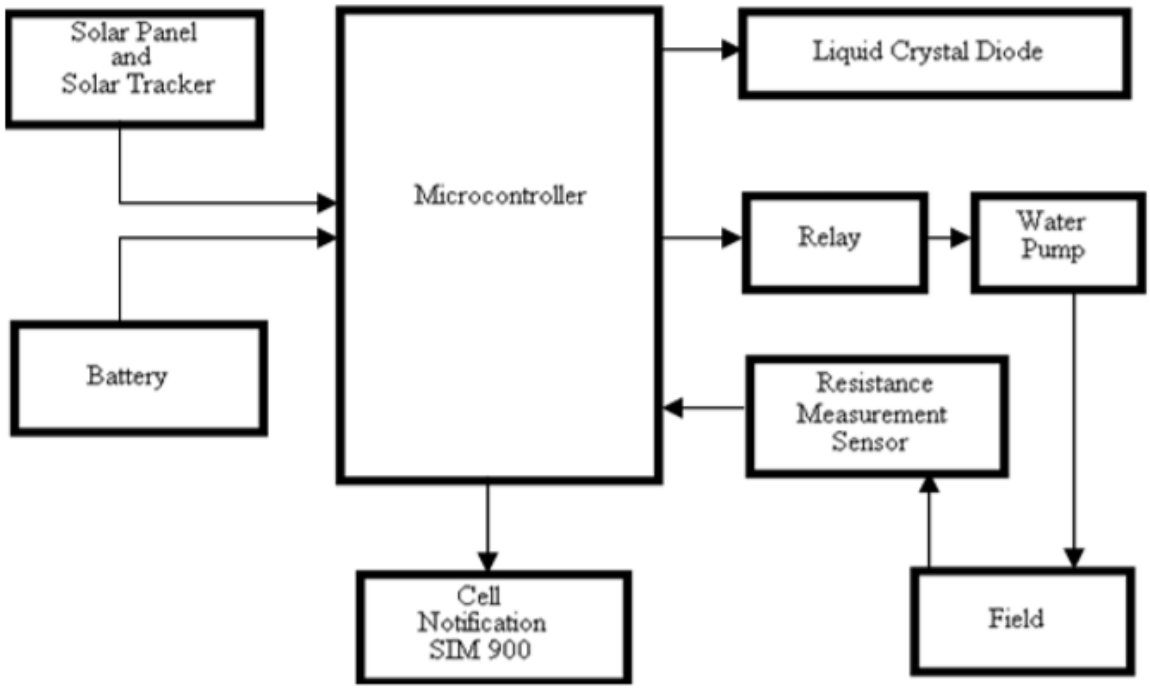
1. Automatic irrigation using Arduino



2. Automatic irrigation using moisture sensor



3. Automatic irrigation using solar panels



3. PROBLEM DEFINITION:

The use of manual irrigation which will involve the use of more water since there is no control and therefore this project proposes the use of an automatic irrigation control system. At present farmers have been using irrigation techniques in India through the manual control in which the farmers 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. Water deficiency can be detrimental to plants before visible wilting occurs. Slowed growth rate, lighter weight fruit follows slight water deficiency. This problem can be perfectly rectified if we use an automatic microcontroller based drip irrigation system in which the irrigation will take place only when there will be an intense requirement of water.

3.1. Community interaction with the concerned project team:

The irrigation system uses soil moisture sensors to turn irrigation ON and OFF. These valves may be easily automated by using controllers and soil moisture sensors. Automating farm or nursery irrigation allows farmers to apply the right amount of water at the right time, regardless of the availability of labour to turn valves on and off. Also, farmers using automation equipment can 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. It also helps in time-saving, removal of human error in adjusting available soil moisture levels and to maximize their net profits.

3.2. OBJECTIVE:

The main objective of this project was to design, construct and test an automatic irrigation control system.

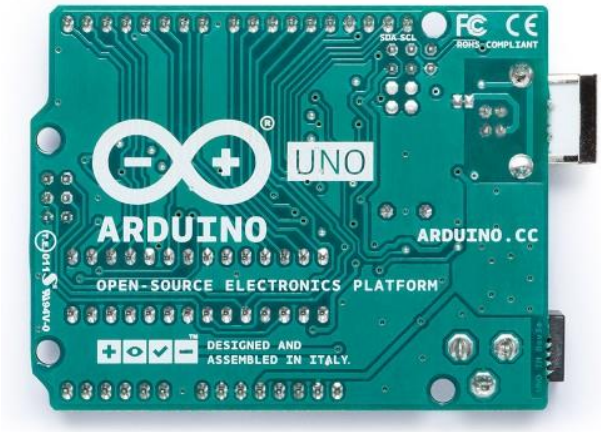
General objectives:

1. Recognize the need for water saving in irrigation systems
2. Provide sufficient water to plants when required.
3. Reduce the number of workforce in the farm.
4. Storing the excess of water and can be reused.

3.3. REQUIREMENT ANALYSIS:

Arduino Uno:

It is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started.



Soil moisture Sensor:

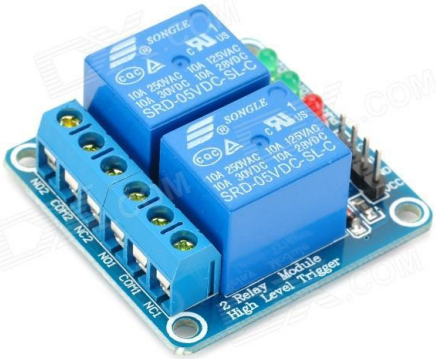
Soil moisture sensor measures the volumetric water content in the soil. Since the direct gravimetric measurement of free soil moisture requires removing, drying, and weighting of a sample, soil moisture sensors measure the volumetric water content indirectly by using some other property of the soil,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

Water pump:

Pumps operate by some mechanism (typically reciprocating or rotary) and consume energy to perform mechanical work moving the fluid. Pumps operate via many energy sources, including manual operation, electricity, engines, water, or wind power, come in many sizes,.

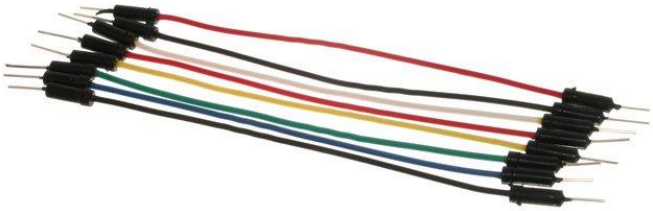
5V Two Channel Relay:

This is a LOW-Level 5V 2-channel relay interface board, and each channel needs a 15-20mA driver current. It can be used to control various appliances and equipment with large current. It is equipped with high-current relays that work under AC250V 10A or DC30V 10A. It has a standard interface that can be controlled directly by a microcontroller.



Jumper wires:

Jumper wires are simply wires that have connector pins at each end, allowing them to be used to connect two points without soldering. Jumper wires are typically used with breadboards and other prototyping tools to make it easy to change a circuit as needed.



3.4. METHODOLOGY:

There are two functional components in this project. They are the moisture sensors module and the relay for motor pump.

The function of the moisture sensor is to sense the temperature content present in the soil, and also it measure moisture level in the soil.

The motor driver interrupts the signal to, water pump supplies water to the plants. This project uses microcontroller Arduino Uno board to control the motor and monitor soil moisture.

Follow the schematic to connect the Arduino to the relay, and the relay to the water pump

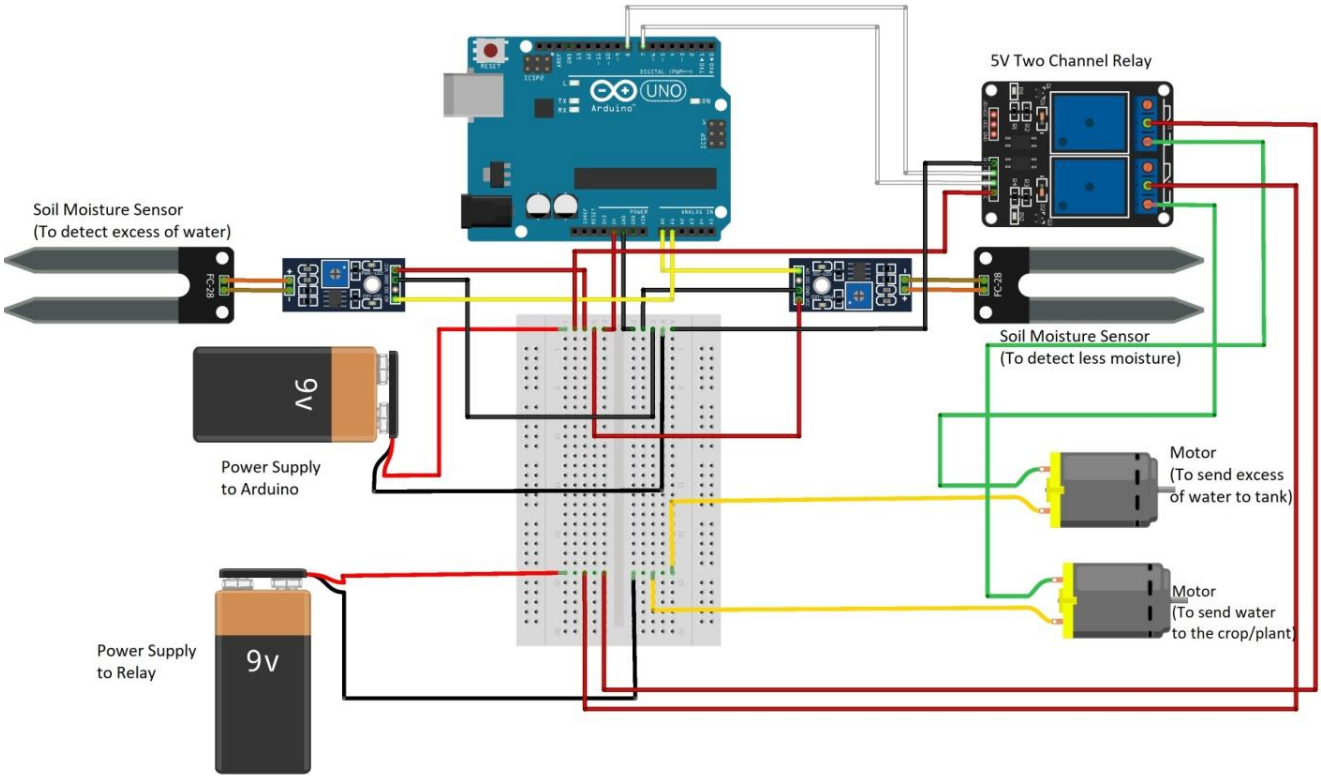
The motor can be driven by a 9 volt battery, we can also supply power from external source or from Arduino board. The Arduino Board is programmed using the Arduino IDE software.

The soil moisture sensors which are nothing but copper strands are inserted in the soil. The soil sensing arrangement measures the conductivity of the soil. Wet soil will be more conductive than dry soil. The soil sensing arrangement module has a comparator in it. The voltage from the prongs and the predefined voltage are compared and the output of the comparator is high only when the soil condition is dry, low only when the soil condition is wet.

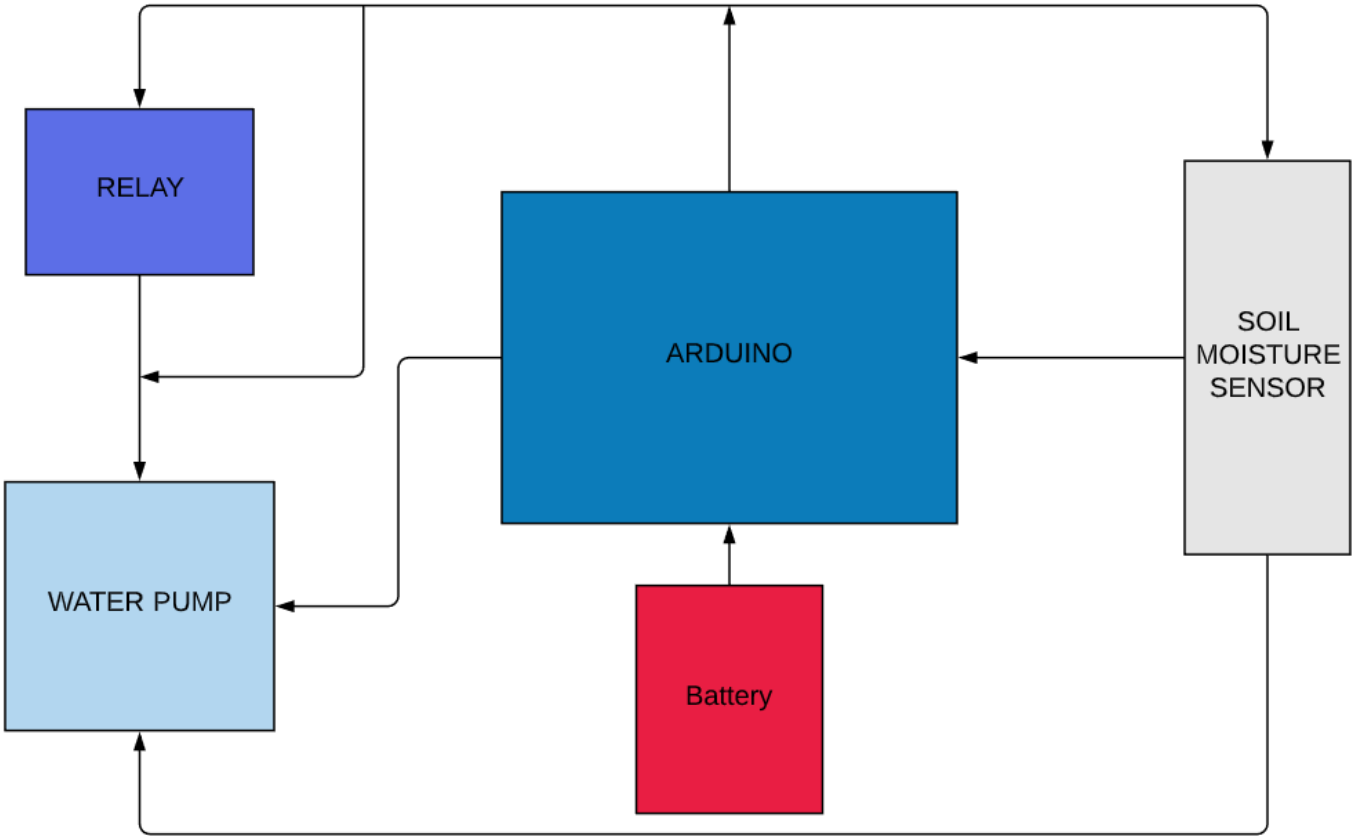
This output from the soil sensing arrangement is given to the analog input pin of the microcontroller. The microcontroller continuously monitors the analogue input pin.

When the moisture in the soil is above the threshold, the motor is OFF. When the moisture above the soil is more than the threshold, the motor is ON. When the output from the soil sensing arrangement is high if the moisture of the soil is less & low if the moisture of the soil is less.

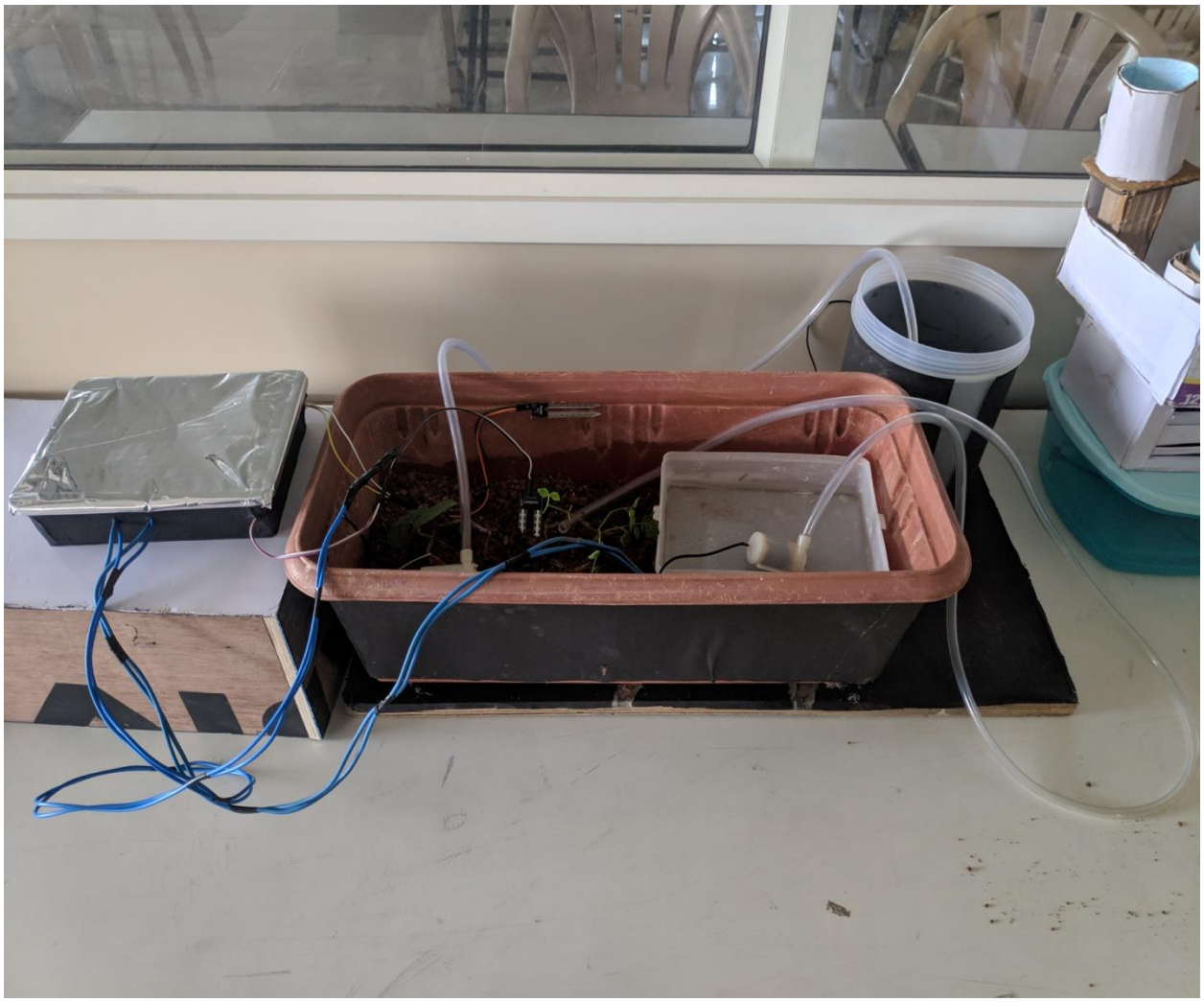
4.1 CONCEPTUAL DESIGN:



4.2 BLOCK DIAGRAM:



4.3 BUSINESS MODEL:



4.4 DESIGN DESCRIPTION:

The design consists of soil moisture sensors, 2 Submersible DC water pumps, a Two Channel 5V Relay Module, an Arduino UNO which acts as a microcontroller and 2 9V Battery where one is for the power supply to Arduino UNO and the second one is for the power supply to Relay which gives power to the motors depending on the condition of soil that is detected by two Soil Moisture Sensors.

5. IMPLEMENTATION :

An automatic plant watering system using Arduino microcontroller is programmed such that it gives the input signals to the motor via the Soil moisture sensors. Soil sensor is connected to the pin to the Arduino board which senses the moisture content present in the soil. Whenever the soil moisture content values goes down, the sensor senses the humidity change, giving signal to the microcontroller so that the pump (motor to water the plant/crop) can be activated and also whenever the moisture content values goes up, the sensor senses the humidity change, giving signal to the microcontroller so that the pump (motor to remove the excess of water from the plant/crop) can be activated. This concept can be used for automatic plant watering system. The circuit comprises an Arduino UNO board, 2 soil moisture sensor's, 2 motor pump's, a relay, 2 batteries to run the system. You can power the Arduino board using a 5V to 9V adaptor.

5.1 RESULTS AND DISCUSSIONS:

- The system provides with several benefits below the reference. Due to the direct transfer of water to the roots water conservation takes place and also helps to maintain the moisture to soil ratio at the root to one constant to some extent. Thus, the system is efficient and compatible to the changing environment.
- Present days especially farmers are facing major problems in watering their agriculture fields. It is because they have no proper idea about when the power is available so that they can pump water. When after then they need to wait until the field is properly watered, this makes them to stop doing other activities.
- There is an idea which helps not only farmers but also for watering the gardens, which senses the moisture and switches the pump automatically when the power is 0.
- It can be used in wide landscapes, properly installed; maintained and managed system can be implemented in large fields.

5.2. CONCLUSIONS:

The application of agriculture networking technology is need of the modern agricultural development, but also an important symbol of the future level of agricultural development; it will be the future direction of agricultural development. After building the agricultural water irrigation system hardware and analysing and researching the network hierarchy features, functionality and the corresponding software architecture of precision agriculture water irrigation systems. The Microcontroller based irrigation system proves to be a real time feedback control system which monitors and controls all the activities of irrigation system efficiently. The present proposal is a model to modernize the agriculture industries at a mass scale with optimum expenditure. Using this system, one can save manpower, water to improve production, saving and reusing the water and ultimately profit. Thus, this system ensures the following:

- Efficient management of water
- Healthy growth of plant
- Very less frequency of human effort
- Remote access and monitoring

6. APPENDIX:

6.1 Code:

```
int m=0;
int n=0;
void setup()
{
        pinMode(A0, INPUT_PULLUP);
        pinMode(8,OUTPUT);
        pinMode(A1, INPUT_PULLUP);
        pinMode(7,OUTPUT);
        Serial.begin(9600);
}
void loop()
{
        int m= analogRead(A0);
        Serial.println(m);
        delay(1000);
        int n= analogRead(A1);
        Serial.println(n);
        delay(1000);
        Serial.print('\n');
        if(m>850)
        {       if (n>850)
                {       digitalWrite(7, HIGH);
```

```
                digitalWrite(8, LOW);  }
        else if (n<=650)
        {       digitalWrite(8, HIGH);
                digitalWrite(7, LOW);           }
        else if(n>650 && n<850)
        {       digitalWrite(8, HIGH);
                digitalWrite(7, HIGH);          }
    }
    else if(m<=650)
    {       if (n<=650)
            {       digitalWrite(8, HIGH);
                    digitalWrite(7, LOW);  }
            else if (n>850)
            {       digitalWrite(8, HIGH);
                    digitalWrite(7, HIGH); }
            else if(n>650 && n<850)
            {       digitalWrite(8, HIGH);
                    digitalWrite(7, HIGH); }
    }
    else if(m>650 && m<850)
    {       digitalWrite(8, HIGH);
            digitalWrite(7, HIGH);          }
}
```

6.1 References:

References are taken from the internet.

- Pictures from http://images.google.co.in/

Websites:

- http://web.science.mq.edu.au/
- http://en.wikipedia.org/wiki/
- http://www.journals.elsevier.com/
- http://pages.cs.wisc.edu/
- http://cs.stanford.edu/projects/
- http://www.Drip-Irrigation-Images.com/