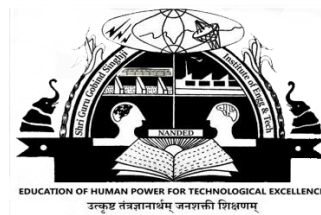# ARDUINO BASED AUTOMATIC PLANT WATERING SYSTEM

Project report submitted

in partial fulfillment of the requirement for the degree of

First Year Bachelor of Technology 2018 - 2019

Engineering Exploration

By

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EDUCATION OF HUMAN POWER FOR TECHNOLOGICAL EXCELLENCE

उत्कृष्ट तंत्रज्ञानार्थम् जनशक्ती शिक्षणम्

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Certificate

This is to Certify that

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ENGINEERING EXPLORATION

satisfied in the year 2018 – 2019

Date : 17 November 2018

Head of Department   *Section Incharge*

INTRODUCTION:

As we all travel a lot to different places then we forget to water our plants, so we need a system such that it can water our plants automatically. Therefore, Arduino based automatic plant watering system is to be designed.

It is a simple system, using Arduino to automate the irrigation and watering of small potted plants or crops.

This system does the control of soil moisture, doing indication via LEDs and in case of dry soil. In this case pump will activate and will start the flow of water to water the plants. And vice versa.

NEED STATEMENT:

As we travel to different places we cannot water our plant, as they need it regularly, so there need to create an AUTOMATIC PLANT WATERING SYSTEM, which can water the plants regularly.

FEATURES:

- Portable
- Low cost
- Durability
- Safety
- Accuracy
- Ease of use
- Design
- Aesthetics
- Environment friendly
- Sensors
- Strong material
- Arduino

CONSTRAINTS:

- Accuracy
- Safety

OBJECTIVE:

- Low Cost
- Ease of use
- Durability
- Portable

MEANS:

- Design
- Aesthetics
- Strong material

FUNCTIONS:

- Environment friendly
- Sensors
- Arduino

PAIR WISE COMPARISON CHART {PCC}:

-	LOW COST	EASE OF USE	DURABILITY	PORTABLE
LOW COST	-	0	0	0
EASE OF USE	1	-	1	1
DURABILITY	1	0	-	1
PORTABLE	1	0	0	-

Result of PCC:

1} Ease of use

2} Durability

3} Portable

4} Low Cost

Problem Statement:

Step 1: Need to create a system to water the plants.

PROBLEM STATEMENT 1:

To construct a system which can water the plants when needed.

Step 2: Considering Constraints

{1} Accuracy and {2} Safety

PROBLEM STATEMENT 2:

To construct a system which can water the plants accurately and with good safety.

Step 3: Establishing Functions

{1} Environment Friendly

{2} Automatic

PROBLEM STATEMENT 3:

"To construct a system which can water the plants automatically considering that it must be safe and environment friendly"

Generating Multiple Solutions:

After researching, our team came up with the following solutions:

1} Simple Arduino Based Automatic Plant Watering System

2} Solar Based Automatic Plant Watering System

3} Wi-Fi Based Automatic Plant Watering System

General Information About The Solution We have Created are as follows:
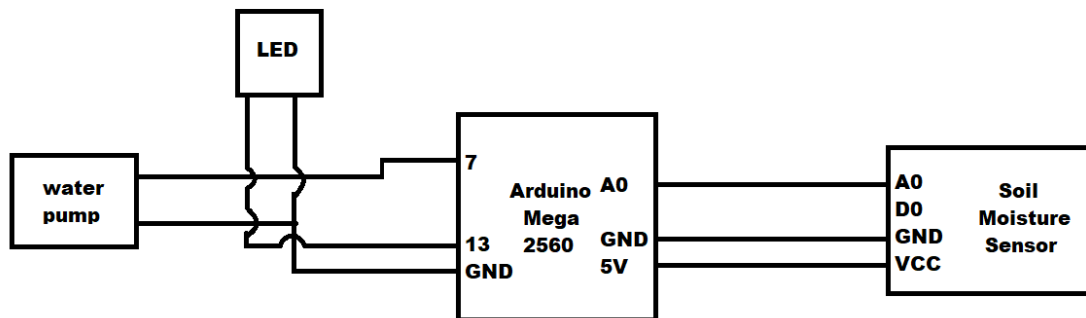
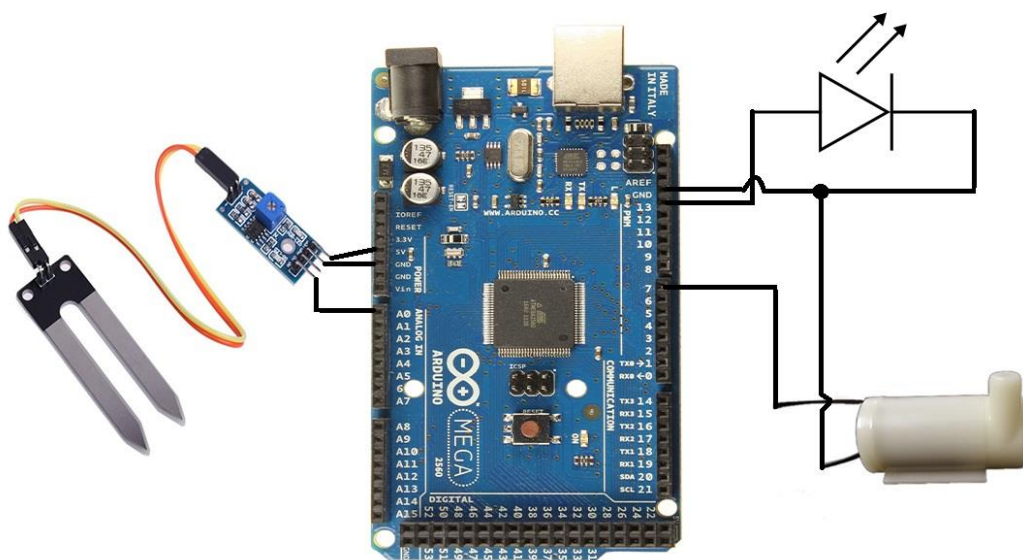# SIMPLE ARDUINO BASED ATOMATIC PLANT WATERING SYSTEM

Introduction:

In everyday life, there must be some physical elements that need to be controlled in order for them to perform their expected behaviours. A control system therefore can be defined as a device, or set of devices, that manages commands, directs or regulates the behaviour of other device or system. Consequently, automatic controlling involves designing a control system to function with minimal or no human interference. Intelligent systems are being used in a wide range of fields including from medical sciences to financial sciences, education, law, and so on.

Automatic water controller is a series of functions to control the Automatic Water Pump Controller Circuit in a reservoir or water storage. The Soil moisture sensor is placed in the soil, it detects the moisture level in the soil. If there is dry condition then automatically the water pump will start to pump the water towards the plants.

Block Diagram:

Circuit Diagram:

Components:

1. Soil Moisture Sensor
2. Arduino Mega 2560
3. Jumper wires
4. Water Pump
5. LED
6. PCB

SOLAR BASED AUTOMATIC PLANT

WATERING SYSTEM

Introduction:

The solar automatic plant watering system works on the principle of conductivity in the soil. Solar energy is the environment friendly type of energy. By using solar panels we and soil moisture sensor we can develop automate plant watering system.

System Design:

This system consists of solar panel, which is the main source of energy and is given to the charge controller for extracting regulated power for solar panel and also to maintain correct charging voltage and current in order to charge the battery and increase its life. Water conservation of plants is controlled using microcontroller with soil moisture sensor.

Principle of operation:

It works on the principle of the conductivity in the soil due to moisture content or water content present in the soil depending upon the soil moisture conductivity is control of buzzer or the pump. When there is conductivity in the soil then there will be conductivity between the strands of the sensors in the soil which acts as short circuit ,i.e., which allows the current to pass through the strands where the buzzer goes OFF. For the pumps will be OFF stage. When the conductivity in the soil decreases it acts as open circuit which allows the current to pass through the buzzer or pumps which turns to ON position in which the water is let it the soil gets moisture content that the current supply will shift to the sensor part.

Components:

1} Transistors: Q1- 2N3904 NPN and Q2- 2N2222 NPN

2} LED 1, LED 2, LED 3

3} R_1- 10KΩ

4} R_2- 100KΩ

5} VR_1- 50K Potentiometer

6} Buzzer (BZ_1)- 6V

7} Battery (B_1)- 6V

8} Solar Panel wire- 6V

9} LCD display

10} Immersive water pump and water tube

Block Diagram:
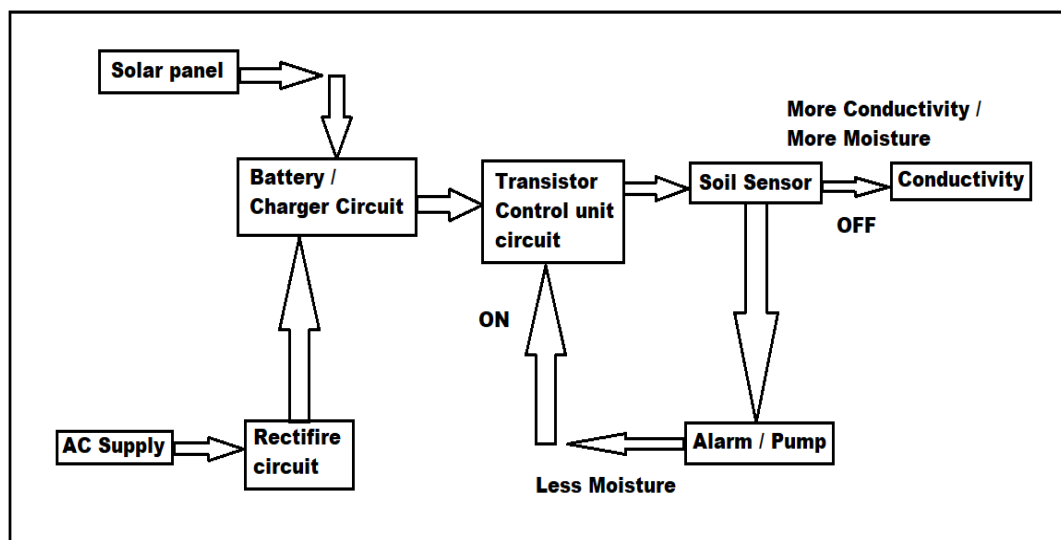
Circuit Diagram:
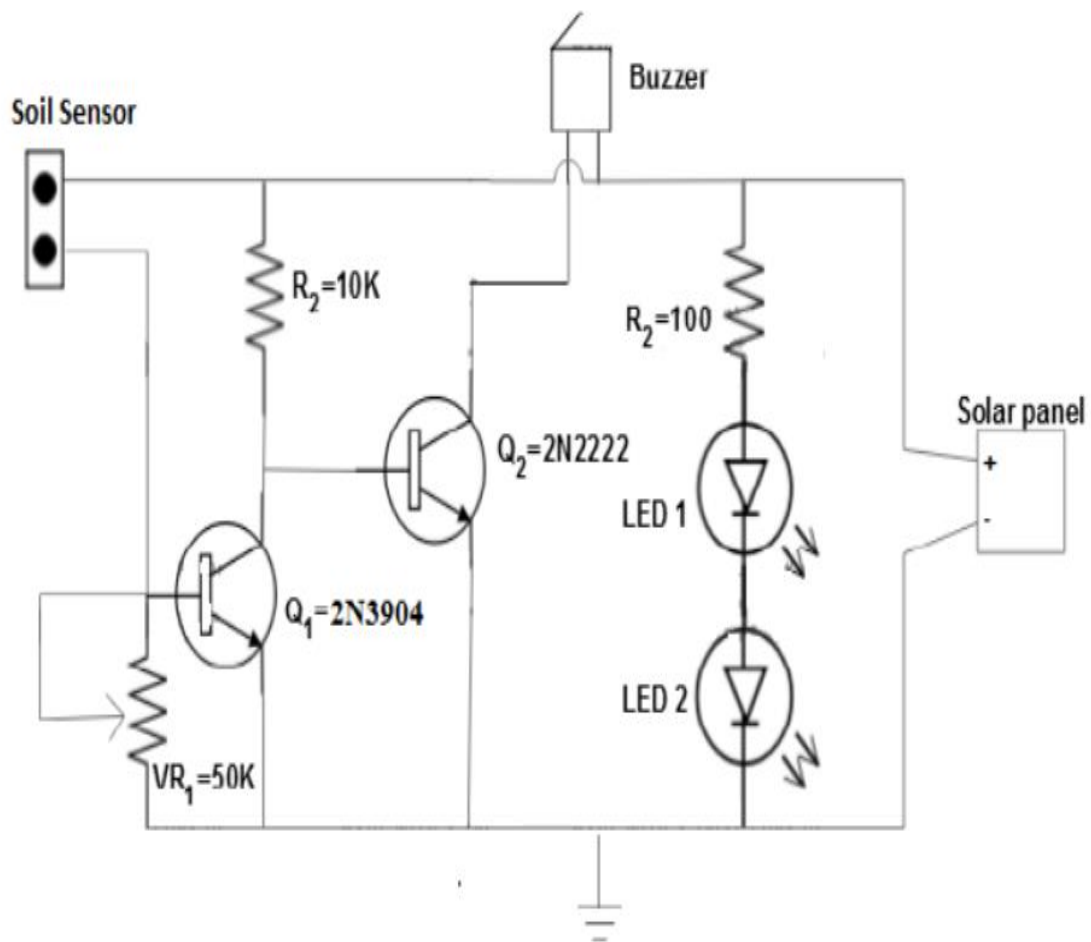
It works according to soil condition. As coming to the cost wise it is cheaper. It reduces labor work, when the soil need water is indicated by the sensor by this automatic plant watering system is implemented.

Wi-Fi BASED AUTOMATIC PLANT WATERING SYSTEM

Application Introduction:

The plant is at normal state if the soil humidity sensor value is 0-800 and soil humidity detected is 300 to 800; the plant is at water lack state if such value is less tan 300. So, by this application we have to just switch on the Bluetooth to water the plant.

How System Works:

Firstly, switch on BLUNO in mobile phone, click scan at top right corner and select "connect BLUNO V1.8". It indicates that the mobile phone Bluetooth is connected with BLUNO if "connected" is displayed at the top right corner.

Second, click the Relay button in BLUNO, and the we can water the plant.

Principle of operation:

It works on the principle of the conductivity in the soil due to moisture content or water content present in the soil depending upon the soil moisture conductivity is control of buzzer or the pump. When there is conductivity in the soil then there will be conductivity between the strands of the sensors in the soil which acts as short circuit ,i.e., which allows the current to pass through the strands where the buzzer goes OFF. For the pumps will be OFF stage. When the conductivity in the soil decreases it acts as open circuit which allows the current to pass through the buzzer or pumps which turns to ON position in which the water is let it the soil gets moisture content that the current supply will shift to the sensor part.

Components:

1} Phone with Bluetooth

2} BLUNO- An Arduino Bluetooth 4.0 (BLE) Board

3} ID Expansion Shield For Arduino V7.1

4} 2.7" OLED 128*64 Display Module

5} Immersive Pump And Water tube

6} Digital 5A Relay Module

7} Analog soil Moisture Sensor for Arduino

8} Buzzer (BZ_1)- 6V

9} Battery (B_1)- 6V

Model Example:

PUGH CHART:

It is the chart which is prepared to compare different products or ideas.

In this we will be comparing our different ideas with the listed objectives or functions ,i.e., All Features.

We will compare Simple Arduino Based vs Wi-Fi Based vs Solar Based automatic plant watering system.

	Weight	Arduino based	Solar based	Wi-Fi based
Portable	1	+++	+	++
Low cost	2	+++	--	+
Durability	1	0	0	0
Safety	3	0	0	0
Accuracy	3	+++	+	++
Ease of use	2	0	0	0
Design	1	+++	-	-
Aesthetics	1	+	+	+
Environment friendly	1	0	0	0
Strong Material	2	0	0	0
∑ + ∑ - ∑ 0 TOTAL		22 0 9 22	5 5 9 0	11 1 9 10

From above PUGH chart the most convenient product is *SIMPLE ARDUINO BASED AUTOMATIC PLANT WATERING SYSTEM*.

Introduction to components:

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 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. 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. 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. Another class of sensors measure another property of moisture in soils called water potential; these sensors are usually referred to as soil water potential sensors and include tensiometers and gypsum blocks.
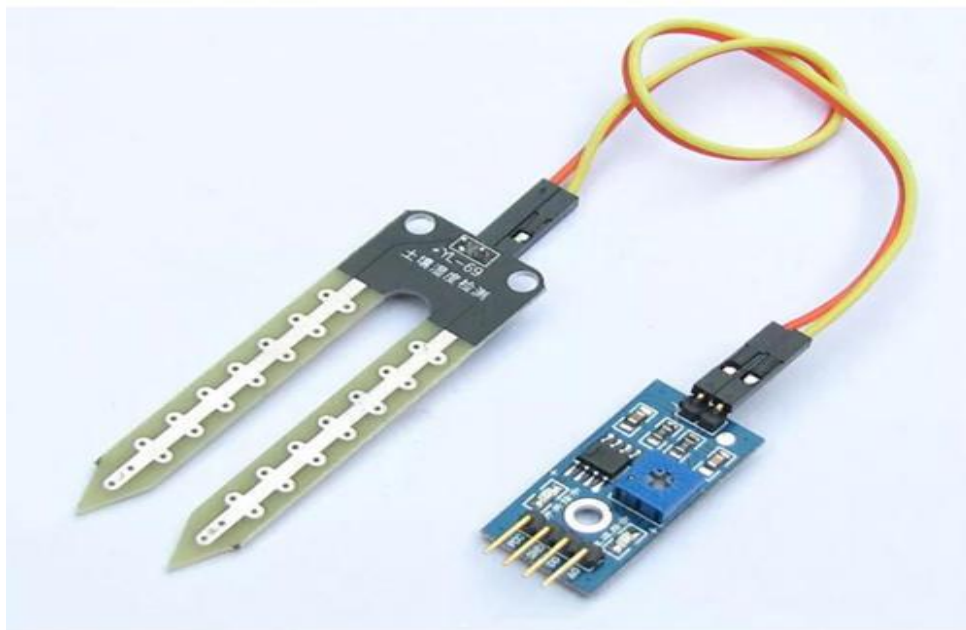
Arduino:

Arduino is an open-source prototyping 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.
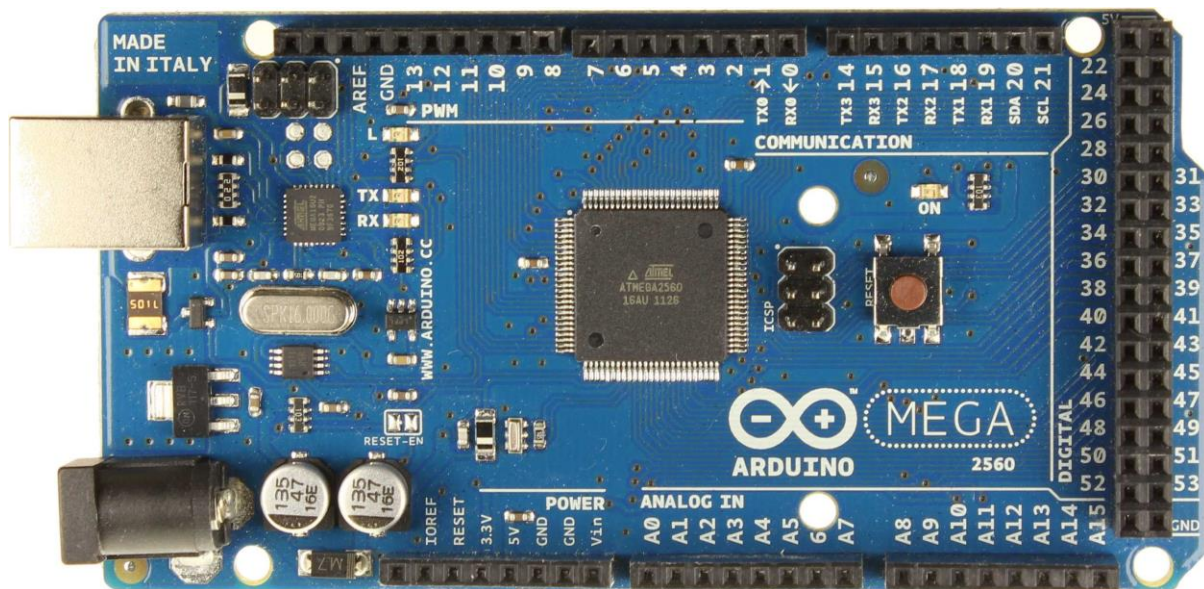
Jump Wires:

A **jump wire** (also known as jumper, jumper wire, jumper cable, DuPont wire, or DuPont cable – named for one manufacturer of them) is an electrical wire, or group of them in a cable, with a connector or pin at each end (or sometimes without them – simply "tinned"), which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other equipment or components, without soldering.

Individual jump wires are fitted by inserting their "end connectors" into the slots provided in a breadboard, the header connector of a circuit board, or a piece of test equipment.
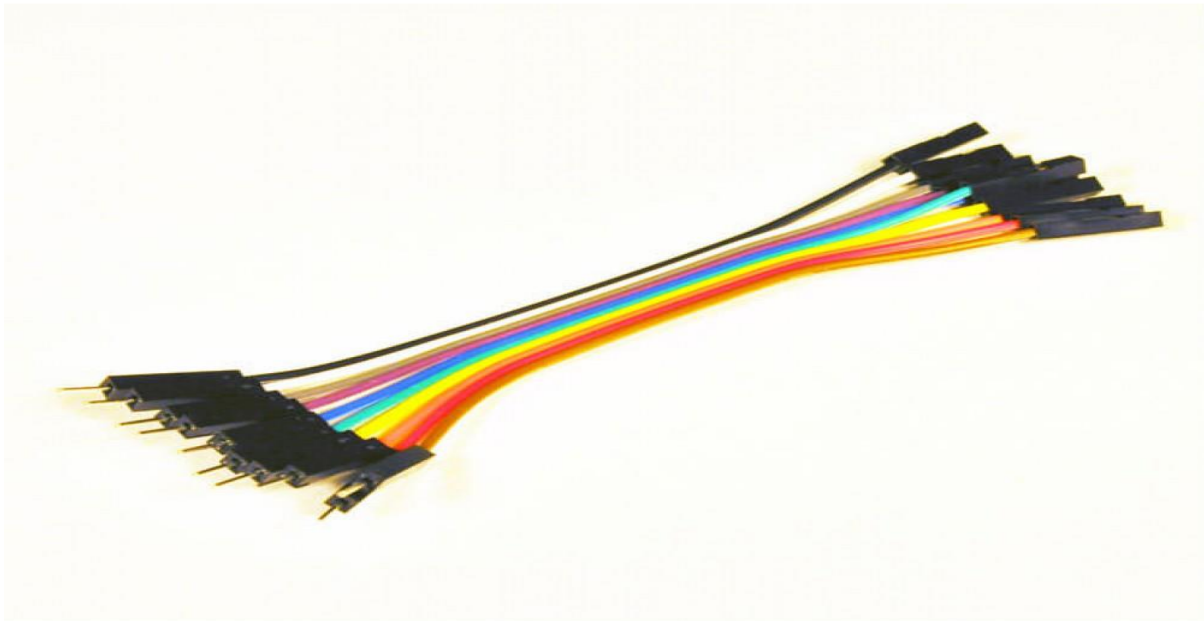
Water Pump:

A pump is a device that moves fluids (liquids or gases), or sometimes slurries, by mechanical action. Pumps operate by some mechanism (typically reciprocating or rotary), and consume energy to perform mechanical work for moving the fluid.
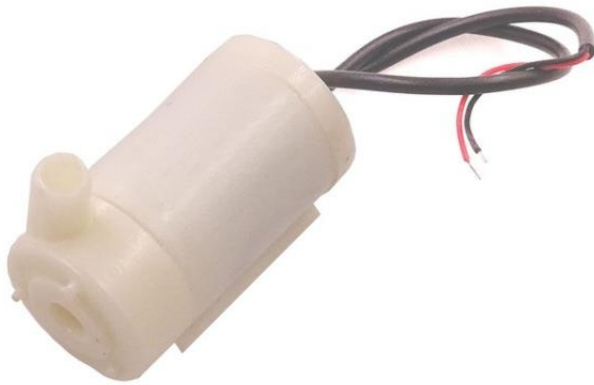
REPORT

ARDUINO BASED AUTOMATIC PLANT WATERING SYSTEM

Introduction:

Arduino based automatic plant watering system is a system in which we can water our plants automatically.

In this we have used Arduino which can control the water pump to water the plant when there is need.

Soil Moisture sensor in placed in the soil. When soil is dry Arduino activates the water pump to water the plant and when it is wet water pump is off.

DC water pump is used to water the plant.

Objective:
There are some objectives need to be achieved in order to accomplish this project. These objectives will act as a guide and will restrict the system to be implemented for certain situations:
1) To develop water control system, to control the water pump to water the plants.
2) To check the moisture level in the soil, depending on the moisture level switches the motor on when the moisture level goes below a predetermined level or switches the motor off.
3) Use Arduino c language software to write the code.

Block Diagram:
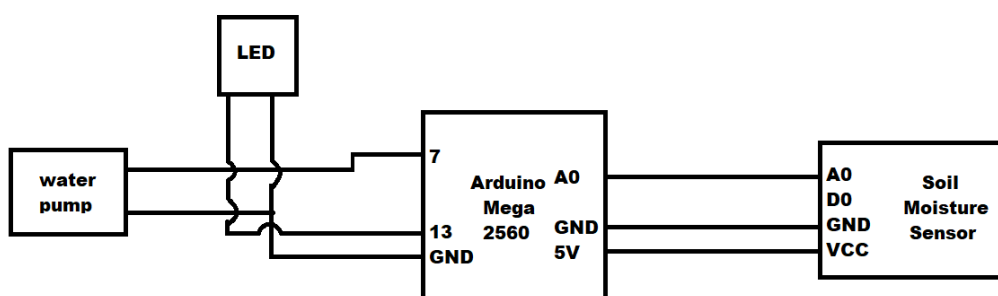
Circuit Diagram:
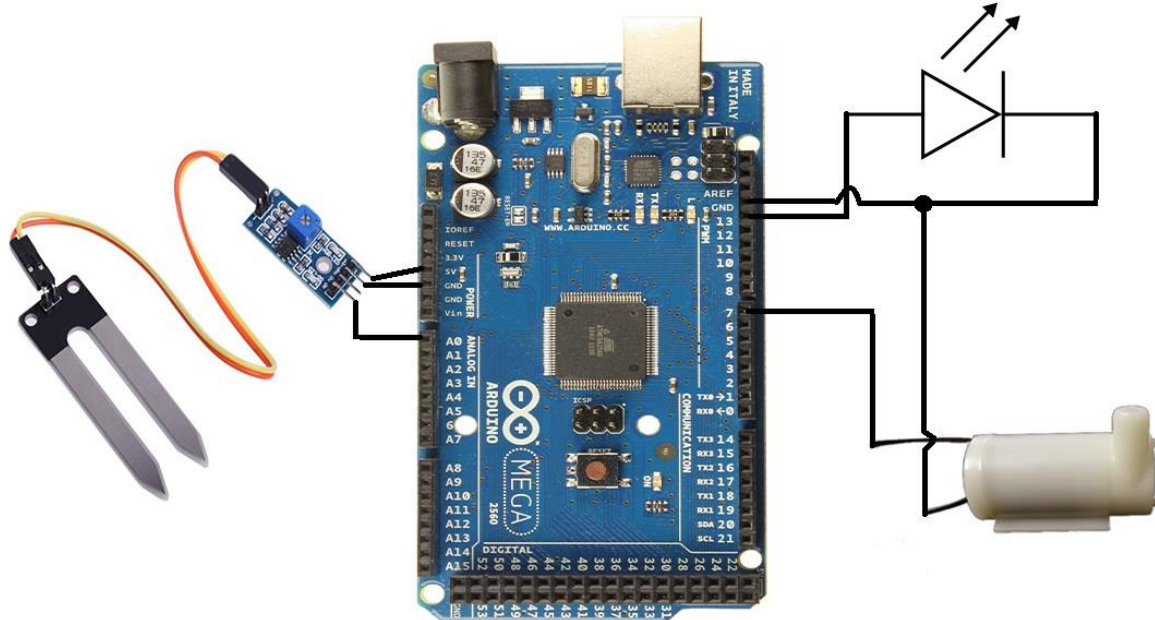
Components required:

1. Soil Moisture Sensor
2. Arduino Mega 2560
3. Jumper wires
4. Water Pump
5. LED
6. PCB

Construction and Principle of working:

The aim of our project is to develop prototype of Automatic Plant Watering System or Water Control System.

The circuit diagram of Automatic Plant Watering System using Arduino is shown above. Soil moisture sensor is placed in Soil to detect the moisture level in the soil. Water pump is placed in the water tank. LED is implemented to shown whether the water pump is ON or OFF, if LED is ON then water pump is OFF. All connections are taken to Arduino Mega 2560, which controls the water pump, whether it should be ON or OFF.

When Soil Moisture Sensor detects that soil is dry (moisture level above 1000) then Arduino will give command to the water pump that it should be ON, in this case LED is OFF.

When Soil Moisture Sensor detects that soil is wet (moisture level nearer to 450) then Arduino will give command to water pump that it should be OFF, in this case LED is ON.

MERITS AND DEMERITS:

It works according to the soil condition. As coming to the cost wise it is cheaper and having the reliable circuit. It reduces labor work. As the agriculturist is not required to constantly monitor the progress of irrigation as it is automatic system, the agriculturist is available to perform other tasks without any interruption. Agriculturist with automation is more inclined to irrigate when the plants need water, not when it suits the agriculturist. Automation can help to keep the fertilizer on farm by effectively reducing run off from the property. Retaining fertilizer on farm has both economic and environmental benefits. Automatic system can be switched into manual mode whenever required.

ARDUINO CODE:

```
const int VAL_PROBE = 0; //Analog pin 0
const int MOISTURE_LEVEL = 450; // the value after the LED goes on
void setup()
{
 Serial.begin(9600);
 pinMode(13, OUTPUT);
 pinMode(7, OUTPUT);
}
void LedState(int state)
{
 digitalWrite(7,state);
}
void loop()
{
 int moisture = analogRead(VAL_PROBE);
 Serial.print("Moisture = ");
 Serial.println(moisture);
 if(moisture > MOISTURE_LEVEL)
 {
 LedState(HIGH);
 digitalWrite(13,LOW);
 }
 else
 {
 LedState(LOW);
 digitalWrite(13,HIGH);
 }
 delay(500);
}
```
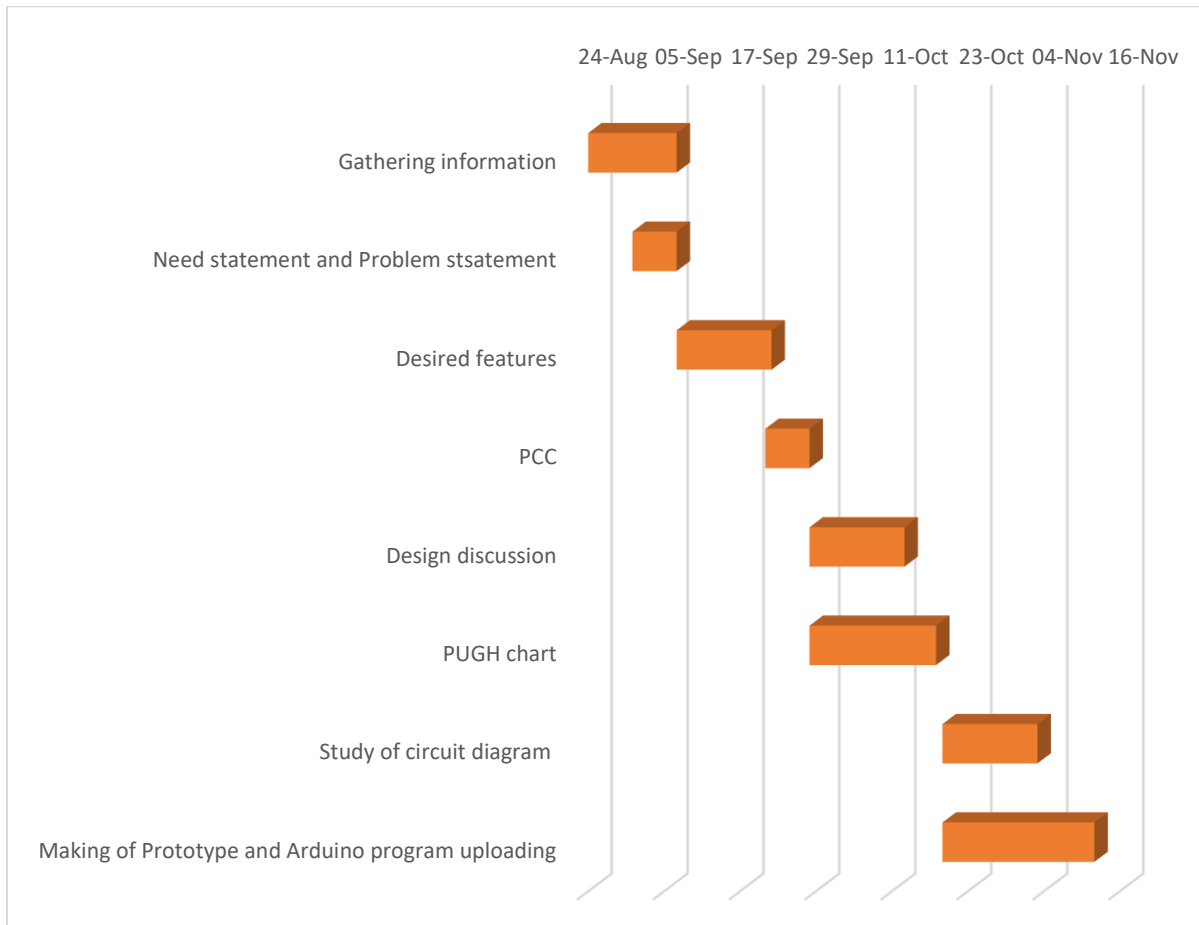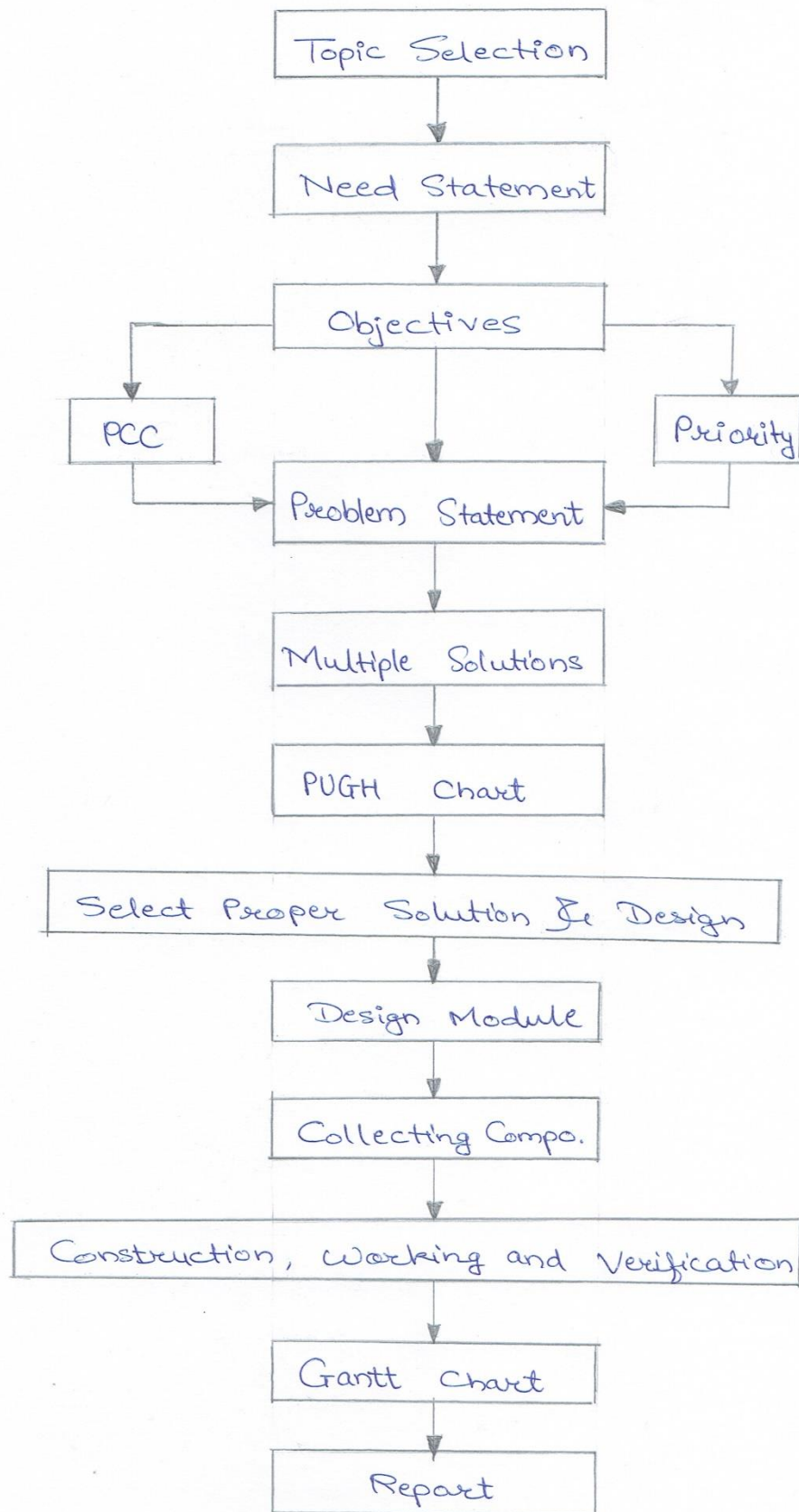
Gantt Chart:

TASK	Starting Date	Days to complete
Gathering information	24-Aug	14
Need statement and Problem statement	31-Aug	7
Desired features	07-Sep	15
PCC	21-Sep	7
Design discussion	28-Sep	15
PUGH chart	28-Sep	20
Study of circuit diagram	19-Oct	15
Making of Prototype and Arduino program uploading	19-Oct	24

Plan Chart:

Topic Selection → Need Statement → Objectives → (PCC, Priority) → Problem Statement → Multiple Solutions → PUGH Chart → Select Proper Solution & Design → Design Module → Collecting Compo. → Construction, Working and Verification → Gantt Chart → Report

Conclusion:

When the soil needs water is indicated by the sensor by this Automatic Plant Watering system is implemented. As to increase the production of yield and to improve the agricultural sector by the implementation of modern equipment's and modern methods of technique is more essential. Implementation of the Automatic Plant Watering system is one of the present modern technique in which implementation in their land will increase the effectiveness in their farming and it also reduces the labor cost. Which improves the agricultural sector and it makes a change in national economy.

References:

1} en.wikipedia.org/wiki/automation-in-irrigation

2} www.google.com

3} www.youtube.com

Cost Of Components:

Component	Quantity	Cost
Arduino MEGA 2560	1	990/-
DC water pump	1	225/-
PCB	1	60/-
LED Light	2	5/-
Jumper Wires	10	25/-
Soil Moisture Sensor	1	130/-
Total		1435/-

Snaps of our Project: