AN APPROACH TOWARDS ARDUINO BASED AUTOMATED PLANT IRRIGATION SYSTEM USING SOIL MOISTURE SENSOR

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Abstract - Irrigation is the most important cultural exercise and most labor exhaustive job in daily greenhouse procedure. Irrigation systems ease the load of getting water to plants when they need it. Knowing when and how much to water is two significant features of watering procedure. To make the planter works effortlessly, the automatic plant watering system is generated. In our home also, we have potted plants on the rooftop gardens. During summers, most people are too lazy to water these plants every day. Or sometimes it may happen that, whenever we go out of town for few days, we used to worry about our plants as they need water on regular basis. So here we are making Automatic Plant Irrigation System using Arduino, which automatically provides water to our plants and keep us updated by sending message to our cell phone.

In This Plant Irrigation System, Soil Moisture Sensor checks the moisture level in the soil and if moisture level is low then Arduino switches on a water pump to provide water to the plant. Water pump gets automatically off when system finds enough moisture in the soil. Whenever system switches on or off the pump, a message is sent to the user via GSM module, updating the status of water pump and soil moisture. This system is very useful in farms, gardens, home etc. This system is completely automated and there is no need for any human involvement.

Index Terms – Arduino, Soil Moisture Sensor, GSM Module, Irrigation, LCD, Relay, Water Pump

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I. INTRODUCTION

Irrigation is the artificial application of water to the land or soil. It is used to support in the budding of agricultural harvests, upkeep of landscapes, and re-vegetation of upset soils in waterless areas and during times of insufficient rainfall. When a region comes on, the water flows through the lateral lines and finally finishes up at the irrigation emitter (drip) or sprinkler heads. Many sprinklers have pipe thread inlets at the bottom of them which permits a fitting and the pipe to be attached to them. The sprinklers are typically connected with the top of the head flush with the ground surface. When the water is forced, the head will arise out of the ground and water the desired area until the valve closes and shuts off that region. Once there is no more water pressure in the lateral line, the sprinkler head will retract back into the ground. Emitters are usually placed on the soil surface or buried a few inches to decrease evaporation losses.

Healthy plants can transpire a lot of water, causing in a rise in the moisture of the greenhouse air. A high comparative humidity (above 80-85%) should be avoided since it can increase the occurrence of diseases and decrease plant transpiration. Adequate venting or consecutive heating and venting can thwart concentration on plants surfaces and the greenhouse structure. The usage of cooling schemes during the warmer summer months rises up the greenhouse air moisture. During times with warm and humid outdoor environments, moisture-control inside the greenhouse can be a challenge. Greenhouses found in dry, dessert atmospheres profit significantly from evaporative cooling schemes because huge amounts of water can be evaporated into the arriving air, resulting in substantial temperature drops.

Subsequently the comparative moisture alone does not convey us anything about the absolute water holding ability of air, a different measurement is occasionally used to define the outright moisture position of the soil. The vapour pressure shortage is a measure of the variance amongst the amount of moisture the air has at a given moment and the amount of moisture it can clench at that temperature when the air would be saturated. Pressure shortage measurement can state us how easy it is for plants to transpire: higher values stimulate transpiration (but too high can cause wilting), and lower values hinder transpiration and can lead to concentration on leaf and greenhouse surfaces.

In the mid-20th period, the arrival of diesel and electric motors led to mechanisms that could pump groundwater out of chief aquifers faster than drainage basins could restock them. This can lead to permanent loss of aquifer ability, reduced water quality, ground subsidence, and other difficulties.

Apart from all these glitches and failures, there has been a substantial development in the approaches to accomplish irrigation with the support of technology. The application of technology in the areas of irrigation has upheld to be of prodigious assistance as they bring efficacy and correctness.

II. COMPONENTS REQUIRED

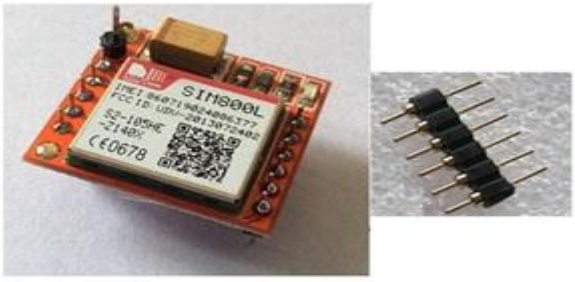
Arduino Uno
GSM Module
Transistor BC547
Connecting wires
16x2 LCD (optional)
Power supply 12v 1A
Relay 12v Water cooler pump
Soil Moisture Sensor Module
Resistors

Variable Resistors
Terminal connectors
Voltage Regulator IC LM317

Here the GSM Module is used to send the user a message regarding the status of the water pump i.e. whether the water pump is switched on or off and soil moisture.

GSM Module

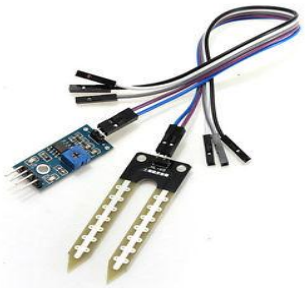
Here we have used TTL SIM800 GSM module. The SIM800 is a complete Quad-band GSM/GPRS Module which can be embedded easily by customer. SIM900 GSM Module provides an industry-standard interface; the SIM800 delivers GSM/GPRS 850/900/1800/1900MHz performance for voice, SMS, Data with low power consumption. The design of this SIM800 GSM Module is slim and compact. It is easily available in the market or online from eBay. The SIM800 GSM Module is small in size and also GPRS enabled which gives us TTL Output.



SIM800L GSM Module Core Board

Circuit Description

In this Plant Irrigation System, we have used a Soil Moisture Sensor to sense the soil moisture level. It consists of two probes, which must be inserted into the soil. One side of the sensor module is directly connected to Vcc and other terminal goes to the base of BC547 transistor. A potentiometer is connected to the base of the transistor to adjust the sensitivity of the sensor.



Soil Moisture Sensor Module

If the soil moisture sensor is not available, the following circuit can be used as an alternative. The circuit shown below has a fixed sensitivity.

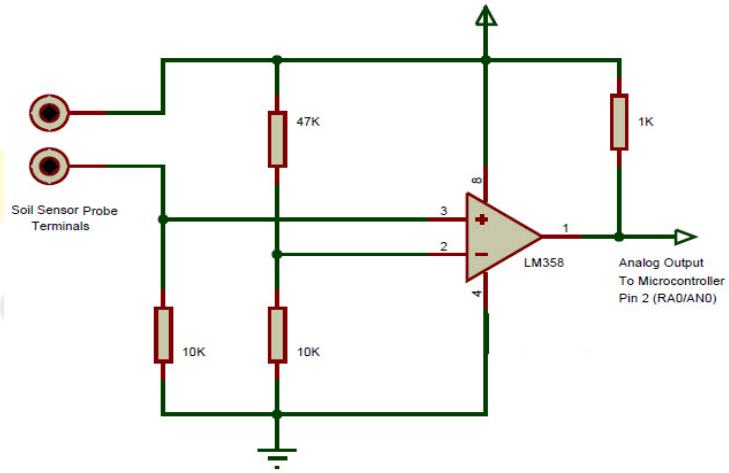


Fig. 1 Soil Moisture Sensing Circuit

Arduino is used for controlling the whole process of this Automatic Plant Irrigation System. The output of soil sensor circuit is directly connected to digital pin D7 of Arduino. An LED is used in the sensor circuit, this LED's ON state specifies the presence of moisture in the soil and OFF state shows the absence of moisture in the soil.

The **GSM module** gives and takes TTL logic directly. An LM317 Voltage Regulator is used to power the SIM800 GSM module. The operating voltage rating of LM317 is 3.8v to 4.2v.

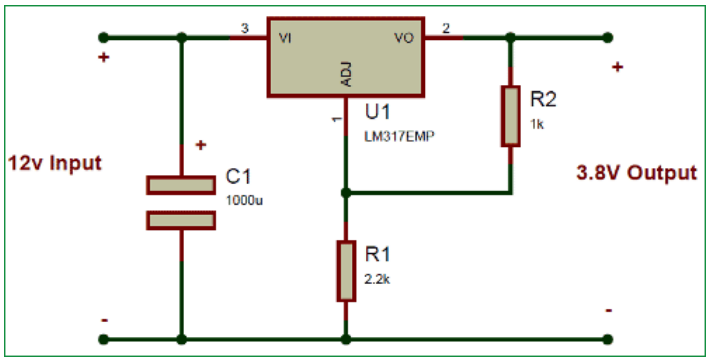
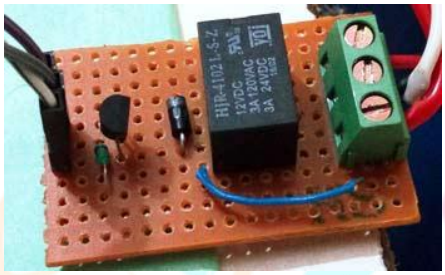


Fig. 2 Circuit Diagram of power supply given to GSM Module

A **12V Relay** is used to control the 220VAC small water pump. The relay is driven by a BC547 Transistor which is further connected to digital pin 11 of Arduino.



Relay Module

An optional **LCD** is also used for displaying the status and the messages. Control pins of LCD, RS and EN are connected to pin 14 and 15 of Arduino and data pins of LCD D4-D7 are directly connected at pin 16, 17, 18 and 19 of Arduino. LCD is used in a 4-bit mode and driven by Arduino's inbuilt LCD library.

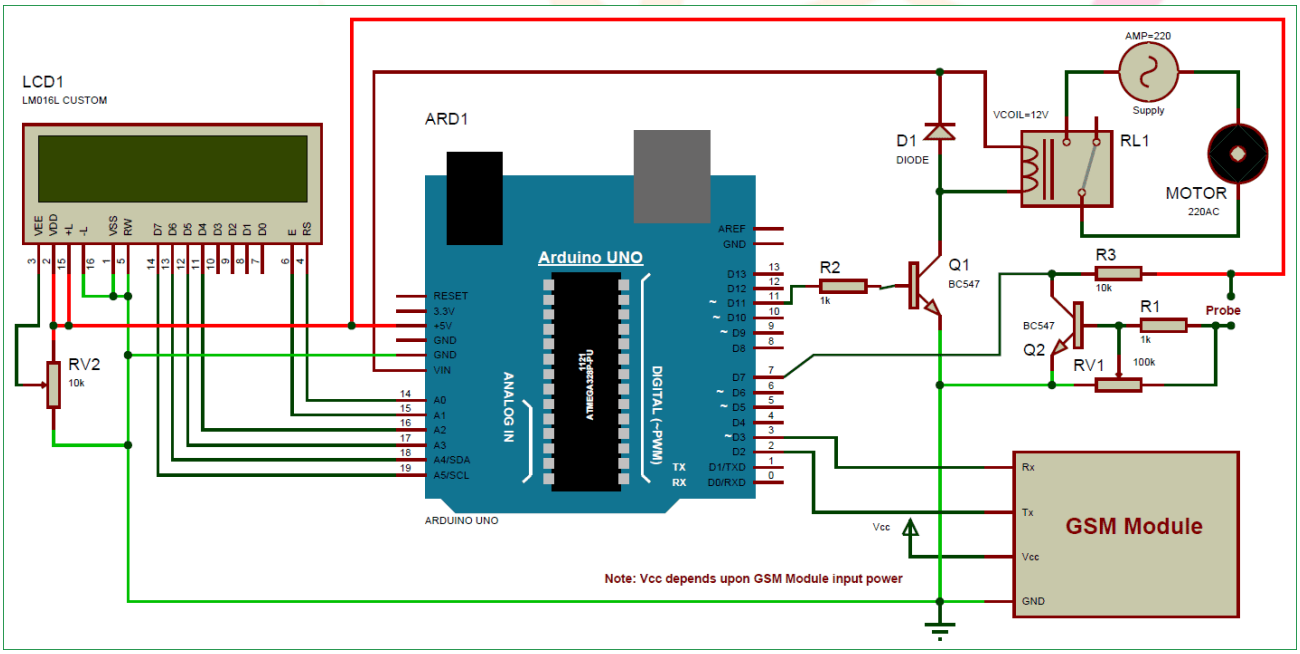


Fig. 3 Circuit Diagram of the Automatic Plant Irrigation System

III. WORKING PRINCIPLE

The idea is to implement an Automatic Irrigation System by sensing the moisture of the soil. Working of this system is quite simple. First of all, it is a Completely Automated System and there is no need of manpower to control the system. Arduino is used for controlling the whole process and GSM module is used for sending alert messages to user on his Cellphone

The soil moisture sensor is at first inserted into the soil. Depending on the quality of the sensor, it must be inserted near the roots of the plant. The soil moisture sensor measures the conductivity of the soil. Wet soil will be more conductive than dry soil.

If moisture is present in soil then there is conduction between the two probes of Soil Moisture sensor and due to this conduction, transistor Q2 remains in triggered/on state and Arduino Pin D7 remains Low. When Arduino reads LOW signal at D7 i.e. when the moisture in the soil is above the threshold, then it sends SMS to user about "Soil Moisture is Normal. Motor turned OFF" and water pump remains in Off state.

When the output from the soil moisture sensor is high i.e. the moisture of the soil is less, then the Transistor Q2 becomes Off and Pin D7 becomes High. Then Arduino reads the Pin D7 and turns on the water motor and also sends message to the user about "Low Soil Moisture detected. Motor turned ON".

When the moisture of the soil reaches the threshold value, the output of the soil moisture sensor is low and the motor will be automatically turned off.

The system is also designed to warn when the moisture is very high than the threshold and the soil is too wet, which is dangerous for the plant.

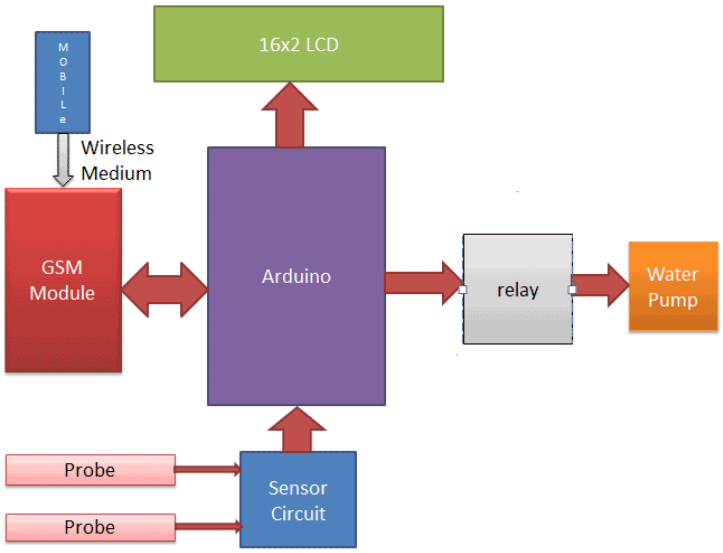


Fig. 4 Block Diagram of the Automatic Plant Irrigation System

IV. CONCLUSION

The system provides with several benefits and can be operated with less manpower. The system supplies water only when the humidity in the soil goes below the reference. Due to the direct transfer of water to the roots, water conservation takes place. Thus it makes the appropriate use of water resource which will help us to fight with the water scarcity problem and it also improve the health and life of plants. Hence the system is efficient and compatible to changing environment. This circuit can also be used to measure the loss of moisture in the soil over time due to evaporation and intake. The circuit is designed to work automatically and so, there is no need for any human intervention. This system will reduce the human efforts in gardening and also make the gardening automated and tech friendly. This system can also be used for the betterment of farmers by including the some more sensors which work over quality of soil and nutrients present in soil.

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