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Moisture Based Automatic Irrigation System

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Abstract: **This project is presented moisture based automatic plant watering system. This technology could improve agriculture efficiency, promoting water conservation and reducing the environmental impacts. The objectives of this project is to avoid wastage of water and increase agriculture efficiency by using control unit base automatic plant watering system with the help of sensors (soil moisture sensor). Soil moisture sensor inserts in the soil to sense whether the soil is wet or dry. The control unit monitors the sensors and when moisture sensor senses dry condition the control circuit will switch on the motor for watering the soil and it will switch off the motor when the moisture sensor senses enough wetness of the soil at which one, two or three of the factors are in abnormal conditions. The controlling unit does the above job when it receives the signal from the sensors. Transistor is used to derive the relay during at all conditions that can monitor by control unit base on the signals fed by sensors from those different factors that affects plant area. Single pole double through relay uses to control the water pump. The aim of this project is to use control engineering principles and concepts to provide Arduino Uno based automatic plant watering system. The system will help in saving money, water and at the same time increasing crops production. Also, our project improves the traditional agriculture watering system in Ethiopia enabling the agriculture system to have high efficiency and low water usage. The controlling unit base sprinkler automatic plant watering system gives the best feature than the traditional one. The moisture sensors measure the moisture level of the different plants. If the moisture level is found to be below the desired level, the moisture sensor sends the signal to the Arduino board which triggers the Relay to turn ON the Water Pump and supply the water to respective plant. When the desired moisture level is reached, the system halts on its own and the Water Pump is turned OFF.**

Keywords: Arduino, Motor, Plant, Relay, Soil moisture, sprinkler, Watering, Water Pump.

1. INTRODUCTION

The continuous increase in food demand requires a rapid improvement in food production technologies. Food insecurity is a major challenge in developing countries. In a country like Ethiopia where the economy is mainly agriculture based, use of technology to improve on yields is paramount [1]. Since scorching summers threatens our planet every year, our farmers are unable to cultivate our traditional crops at their suitable seasons. On other hand farmers are wasting water abundantly without proper management. This leads to the scarcity of water at the time of requirement. Automatic plant watering is the key to a successful agricultural investment [2]. The aforementioned arguments present play a very important role in the pursuit to improve the automatic plant watering system of Ethiopian farm lands. The relevant facts about the agriculture status of the country and the impact of its efficiency to the economy and the environment may have tremendous effect to the country's stability. Thus, the compelling evidence of the challenges posed by this current phenomenon motivated the conduct of the study on simulation of a low-cost electronic-based automatic plant watering system. In agriculture, one of the most important jobs was to watering the farming land. Most of the farmers use the manual control over the land that was to monitor the pumping or watering the land by visiting the site [3]. This will surely need more and more labour and as a result the efficiency of work

degrades. Automatic control system reduces the human labour and increase the efficiency of then corresponding work. In this project, an automatic control system is introduced for watering the land by measuring the humidity. The system measures the humidity of the soil and depending upon the condition it will provide the needed water in the land. There is a sensor included in this system which senses the humidity and sends to the Arduino Uno. The pumps are connected with the system relay circuit. There are two conditions are set in between which the pump will be ON or OFF. When the water supply will be needed, Arduino Uno sends digital pulse to the system to enable the relay circuit and the water will be supplied till the time the pump will be ON. This project used Arduino board. It programs in such a way that it will sense the moisture level of the plants and supply the water if require.

2. MEHODOLOGY

The procedure that follows to complete this study are as follows.

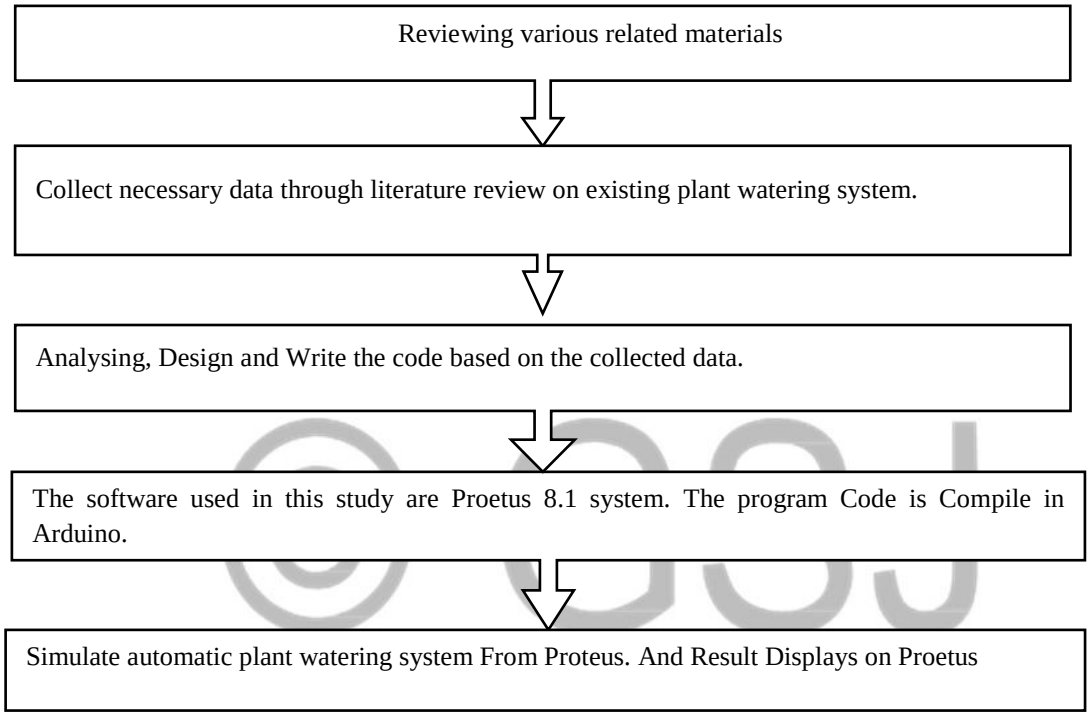

Figure 2.0-1: Methodology of the Project

3.1. Block diagram of automatic plant watering system

The systems of sensors use to sense moisture of soil and sends signal to the Arduino Uno software. The controller unit interprets those signals and according to the program load it sends an output signal to dc motor. The dc motor turns water pump to pump water. The Liquid Crystal Display (LCD) displays moisture of soil or RH values in the soil and the motor pump state or condition. Relay's control one electrical circuit by opening and closing contacts in another circuit. These systems use to switch on/off the dc motor to pump water according to set soil moisture levels based on Arduino Uno When the moisture level of soil find to below the desired level, the sensor sends the signal to the Arduino board from the surrounding of plants which triggers the Relay to turn on /off the Water Pump and supply the water to respective plant software command.

3.2. Power Supply

Power supply is the circuit from which we get a desired dc voltage to run the other circuits. The voltage we get from the main line is 230V AC but the other components of our circuit require 5V DC. Hence a step-down transformer is used to get 12V AC which is later converted to 12V DC using a rectifier. The output of rectifier still contains some ripples even though it is a DC signal due to which it is called as Pulsating DC. To remove the ripples and obtain smoothed DC power filter circuits are used. Power supplies are designed to convert high voltage AC mains to a suitable low voltage supply for electronic circuits and other devices.

3.3. Soil Moisture Sensor

A soil moisture sensor is a device that measures the volumetric water content (VWC) of soil. Mathematically VWC, θ, is given as follows; Θ=Vw/VT. Soil moisture sensor is connected to the Arduino board which senses the moisture content present in the soil. The moisture sensor measures the level of moisture in the soil and sends the signal to the Arduino if Watering is requiredYL-69 Moisture Sensor this is an Electrical resistance Sensor. This soil moisture sensor reads the moisture content around it. A current is passed across the electrodes through the soil and the resistance to the current in the soil determines the soil moisture. This sensor has both digital and analogue outputs. Digital output is simple to use but is not as accurate as the analogue output. Potentiometer is basically a variable resistor that measures the moisture level depending on the amount of water in soil. Variable resistor is a device that is used to change the resistance according to our needs in an electronic circuit. Like analog potentiometers, digital potentiometers are used to scale or adjust resistance of a circuit [12]. When the amount of water in the soil high the conductivity is high and resistivity low. A compactor is an electronic device that compares two voltages or currents and gives a digital signal as the output. It indicates which of the two compared quantities is large. A comparator has a least two input pins and one output pin. Operational amplifier operating in open loop configuration and without negative feedback can be used as a simple comparator.

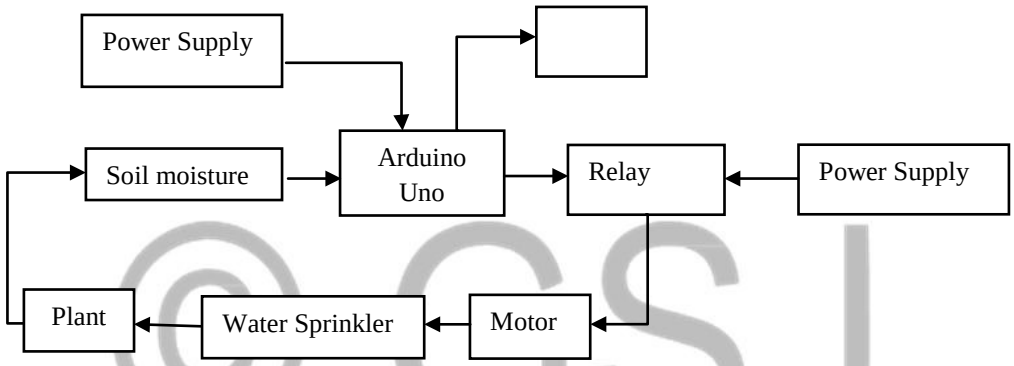

Fig. 3.1: Block diagram of automatic plant watering system

3.4. DC Motor

A DC motor is an electric motor that runs on direct current (DC) electricity. DC motors were used to run machinery, often eliminating the need for a local steam engine or internal combustion engine. DC motors can operate directly from rechargeable batteries, providing the motive power for the first electric vehicles. DC motor take information from the Arduino through transistor and energize the coil of relay. Speed is regulated by connecting variable resistance either in series with the armature for less speed or in series with the field for higher speeds. Its operation is based on the principle that when a current carrying conductor is placed in a magnetic field, the conductor experiences a mechanical force. A force is exerted on the coil as a result of the interaction of magnetic field and electric current. The force on the two sides of the coil is such that the coil starts to move in the direction of force. Such coils are wound on the rotor, all of which experience force, resulting in rotation. The greater the current in the wire, or the greater the magnetic field, the faster the wire moves because of the greater force created. At the same time this torque is being produced, the conductors are moving in a magnetic field. At different positions, the flux linked with it changes, which causes an emf to be induced. This voltage is in opposition to the voltage that causes current flow through the conductor and is referred to as a counter-voltage or back emf. The value of current flowing through the armature is dependent upon the difference between the applied voltage and this counter-voltage.

3.5. Arduino

Arduino is an open-source electronics design platform. The Arduino board is specially designed for programming and prototyping with Arduino software [8]. An Arduino interacts with physical world via sensors. Using Arduino; electric

equipment's can be designed to respond to change in physical elements like temperature, humidity, heat or even light. The open-source Arduino environment allows one to write code and load it onto the Arduino board's memory. The Arduino Uno can be programmed with the Arduino software. In this project use Arduino Uno to write code on it that runs the simulation of automatic plant watering system. Based on Arduino Uno software to develop electronics software code interfacing with proteus 8 professional to simulate automatic plant watering system and display soil moisture level in LCD.

4. RESULTS AND DISCUSSION

Arduino Uno is the brain of the project which initiates the Relay and LED signal at a junction. The LEDs are automatically on and off by making the corresponding port pin of the Arduino Uno high. So, the sequence of the lights determines the moisture level in the soil. An automatic plant watering system using Arduino Uno is programmed such that it gives the interrupt signals to the motor via the relay. Soil sensor is connected to the Arduino board which senses the

moisture content present in the soil. Whenever there is a change in the moisture content of the soil, the sensor senses the change, giving signal to the Arduino Uno so that the pump can be activated. The POT meter or variable resistance measures the moisture level depending on the amount of water in soil. When the amount of water in the soil high the conductivity is high and resistivity low vice versa. Depending on this way the moisture sensor measures the amount of Relative Humidity (RH) in the soil. The output of POT connects to Analog input pin of Arduino Uno. If the soil or plant needs the water, POT sends the signals to Arduino Uno R3 then the relay become energized. When the relay energized the motor, pump start to pump water to plant until the required moisture level is reached. The three LED indicates that RH ranges, RED LED indicates high range of RH, GREEN LED indicates that suitable RH range and YELLOW LED shows that low ranges of RH values. The LCD display RH values in the soil and the motor pump condition. There are three results:

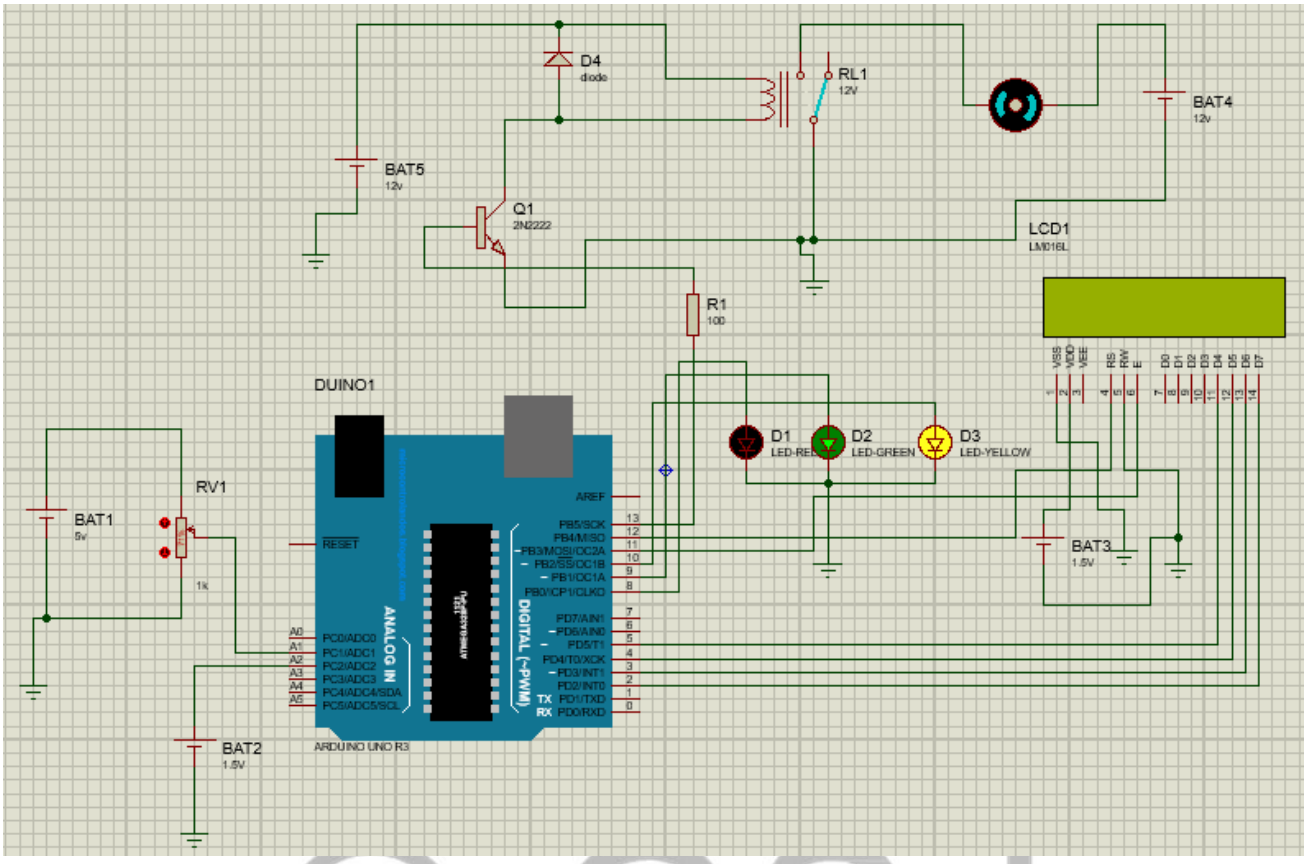

Fig. 4.1: Circuit diagram of automatic plant watering system

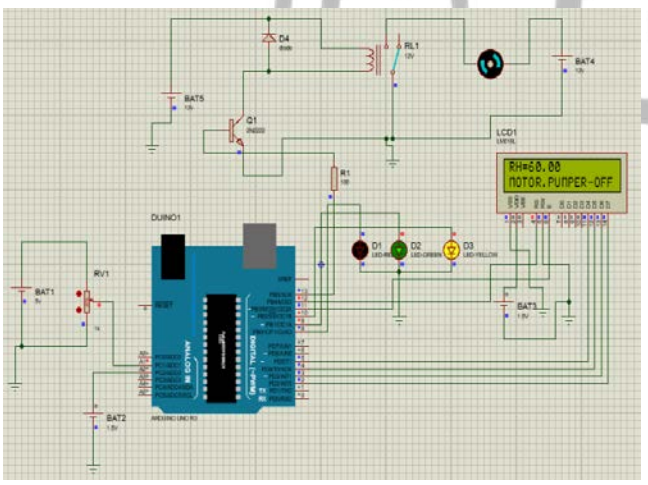

Fig.4.2: Circuit diagram of automatic plant watering system

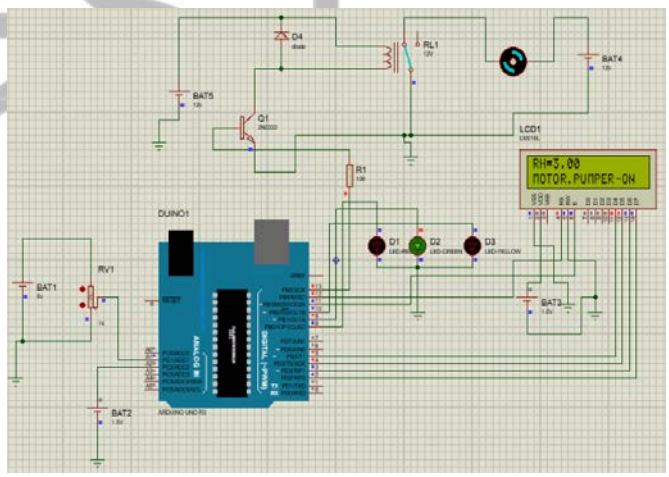

Fig. 4.3: Circuit diagram of automatic plant watering system

We will show the following analysis based on the different values of the Sensor inputs. Fig. 4.2 is the normal condition, meaning the soil moisture is at suitable to the plant. In this condition the motor pumper off because there is wet condition. Yellow and Green LED indicates this condition. The RH range for this condition is greater than 60.

Fig.4.3. shows that, the condition to which motor pumping activity takes places, meaning the soil moisture level is low so the plant needs water. In this condition the motor pumps on the water pump until the desired point reached. Green LED indicates this condition. The RH range for this condition is less than 60.

5. CONCLUSION AND RECOMENDATION

5.1. Conclusion

We conclude that in this project we have studied and simulated an automatic plant watering system using Arduino Uno. 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. System was used to switch on/off the watering system/pump according to set soil moisture levels. The moisture content of the soil is continuously measured by the sensor. It's value and the status of motor i.e., ON or OFF condition of motor is displayed continuously on the LCD. If there is an enough moisture in the soil i.e., there is no need to water the field then the motor is not switched on but if the moisture content is very less, there is a need of water then the motor is switched on automatically and after the field attains the required moisture content, then the motor is switched off automatically. The objective is to use sensors such as soil moisture sensor as signal receivers in surrounding of plants for automatic plant watering system. Based on our project, control unit is reliable to use as a voltage comparator because the cost and operation is better compared to PLC and Microcontroller. The results show that the sensors are able to receive the required signals from the surrounding of plants and it can operate its operation as it is required. This project can have many usages in practical fields, saving time, saving money and increasing of crop production.

5.2. Recommendation

The automatic plant watering system still can be improved for future development. Some modification and renovation on the system have to be made in order to acquire powerful system of automatic plant watering. Therefore, a list of recommendations is given as below in future this system can be used to inform people about different places. This can be done through Data transfer between the Arduino Uno and computer can also be done through telephone network, data call activated SIM this technique allows the operator to gather the recorded data from a far end to his home computer or phone without going site and also used to GSM technology for fault indication. The system should be tested to be practical in agricultural sectors to assist the economic activities of the country and therefore stakeholders such as our university and ministry of agriculture must cooperate to see the fruit of this project. The system can be used to spray the fertilizers on the surrounding of plants in scientific way for proper growth of the plants to increase agricultural production as a whole and the system can be improved by PLC systems and Microcontrollers.

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