iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 8 **Issue:** II **Month of publication:** February 2020

DOI: http://doi.org/10.22214/ijraset.2020.2089

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.177
Volume 8 Issue II Feb 2020- Available at www.ijraset.com

Automatic Plant Irrigation System using Arduino

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Abstract: ***Water plays an important role not only for human beings but also for plants and animals. The world today faces a common problem of water inadequacy. The agricultural sector faces more water loss due to denuding of water through excess irrigation. Hence we are in need to develop an automatic irrigation system that would sense the moisture content of the soil and would automatically irrigates the plants accordingly. This could be made possible by using a soil moisture sensor, arduino, LCD display, and a motor pump. If the moisture of the soil is less, the percentage of moisture content will be displayed on the LCD screen and according to the predefined level, water will be irrigated to the soil. The major application of using this methodology is, it can be effectively used to reduce water loss and save your time in all major scopes of agriculture.***
Keywords: Arduino, Soil moisture sensor, LCD display, Motor pump, Automatic irrigation system.

I. INTRODUCTION

The ultimate aim of proposing this methodology is to irrigate water to the plants automatically according to the dryness of the soil. Considering the scenario of being out of home for several days, our plants would become dry without water. Unless, the scope for rain in this situation, there would be no other way to supply water without human hands. But if an automatic irrigation system is installed in our agricultural field, the system will spontaneously supply water according to the moisture content of the crops. Nowadays a lot of new emerging technologies reduced this risk in agricultural field. The wireless sensor can be used to supply water based on specific irrigation techniques [1]. A low cost microcontroller might be used to monitor the temperature of our field crops [2]. Engrossment of water to the land can assist in the growth of plants [3]. Real-time online soil water monitoring is also made possible through advancement in Research and technology [4]. Greenhouse management could be accomplished using wireless network infrastructure [5]. Theoretical and practical aspects of military wireless sensor networks could effectively be used in horticulture and in any fields of agricultural surveillance [7]. Sensors always gives output in analog nature. But the results what we expect is needed to be in digital form. The analog to digital converter pin which is embedded in the controller will transform this analog signal into a digital output [8]. Considering a variety of irrigation techniques, sprinkler irrigation methods have a sprinkler at the top of the setup [9] but this method of irrigation tends to quite large loss of water in consideration with drip irrigation. The controller present in the system of automatic irrigation decides when the motor should be turned OFF or ON according to the moisture content displayed by the LCD screen [10]. The automatic irrigating methodology is more reliable when compared to other systems and also has a lot of advantages. For instance, this system saves time, saves labor costs, saves water, covers whole area of the field, and it is easy to control.

II. BLOCK DIAGRAM

The block for automatic irrigation system consists of power supply, arduino UNO, a motor pump (DC), a soil moisture sensor, and a power supply.

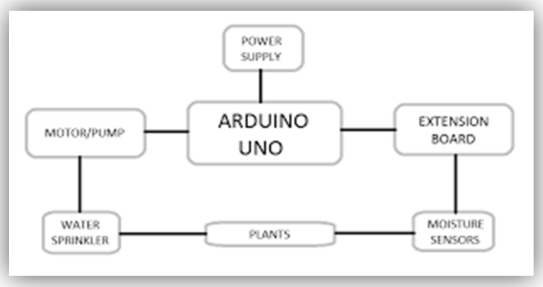

Figure 1 – Block diagram

The arduino board is uploaded with the necessary programs to be executed. It controls the pump and the sensor. The soil moisture sensor is a transducer which detects the changes in the moisture content of soil and displays the corresponding outcome at the LCD display. The LCD display is not mandatory to execute this methodology; but here it is used as an additional component. It displays the percentage value of moisture present in the soil and also the state of the motor whether it is ON or OFF. In accordance with the moisture detected by the sensor, the motor pumps water to the plants. A water sprinkler may be used to sprinkle the water over the plants. The entire set up is driven by a 5 volt supply.

III. THE ARDUINO

Massimo Banzi invented the arduino. It is inbuilt with several ports to be used for input and output. It is a microcontroller and it can also be bonded with external extension boards. 9 volt supply can make an arduino to be active with a help of an USB cable. It can accept the voltage range of 7 to 20 volts. There are several types which include Arduino UNO (UNO in arduino denotes 'ONE' .This is used to indicate the initial release of this set of boards) it has 14 digital input output interface, Arduino Due; it has 54 digital input output interface, Arduino mega; it has 54 digital input output interface, and Arduino Leonardo; it has 20 digital input output interface. The memory in arduino is static in nature. The arduino has the facility to communicate with computers, other arduino or with other microcontrollers. In this methodology the programs necessary for the function of automatic irrigation system is uploaded and the board can be connected via an USB cable from the computer.

Figure 2 – Arduino UNO

IV. THE SOIL MOISTURE SENSOR

Generally a sensor is more common like a transducer which senses the given condition or environment and gives the user the results with predicted values. The soil moisture sensor as the name indicates, it senses the moisture content in the soil. Normal analysis of soil moisture needs removal, dehydrating, and sample weighing, this method is not commonly used to predict the moisture content. Rather than this, the content of water in soil is predicted by other parameters such as resistance (opposition to electric field), by the constant of dielectrics, and by companionship with neutrons (neutral particles). The major application for these kind of sensors lies in the sector of agriculture. Measurement of temperature, humidity, moisture are miscellaneous requirements of effective irrigation. These have been successfully used in agricultural science, horticulture, climate research etc. In market today, simple sensors are available for gardeners which are very cheap and more reliable too. It indicates the farmer about the moisture content after when it is inserted into the soil for approximately 60 seconds.

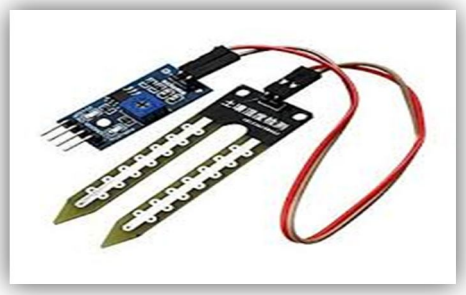

Figure 3 – soil moisture sensor

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V. L293D MOTOR DRIVER

The L293D is a motor driver or a motor driver integrated chip(IC), which is used to run DC motor in both directions. It has 16 pins and it is capable of simultaneous control of two DC motors in any direction. That is, one L293D motor driver is sufficient of controlling two motors. It receives the signal from processor and processes the signal in order to drive the motor. Two voltage pins are present in this motor driver. One of them can be used to draw current for the function of L293D and the other pin is used to proceed the motor with a voltage supply. The purpose of using a motor driver in this methodology is, the input current signal to the motor has a low value. This is not sufficient enough to run the motor. Hence if a driver is used, this low value of current can be converted into high value of current. This high current signal is then applied to the motor.

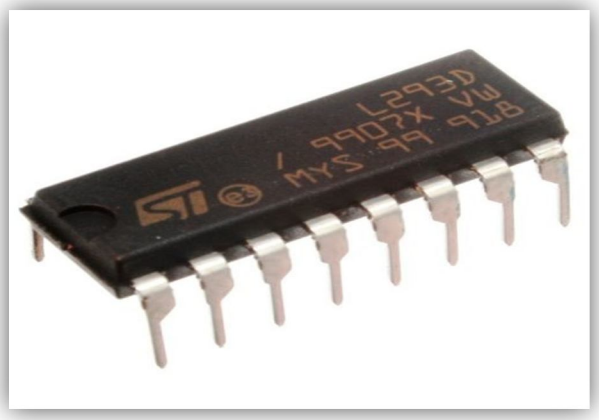

Figure 4 – L293D motor driver

VI. CIRCUIT DIAGRAM

The circuit consists of Arduino, a DC motor, an L293D motor driver, LCD display, a power supply and a soil moisture sensor. The necessary pin configurations are made by reference with the following diagram. A 9 volt power supply is been connected with power supply pins of the arduino. The pins of motor are connected to the motor driver. Resistors may be included in the circuit to provide opposition to the flow of current to the LCD display. With the help of motor driver, a constant high level of current may be supplied to the motor.

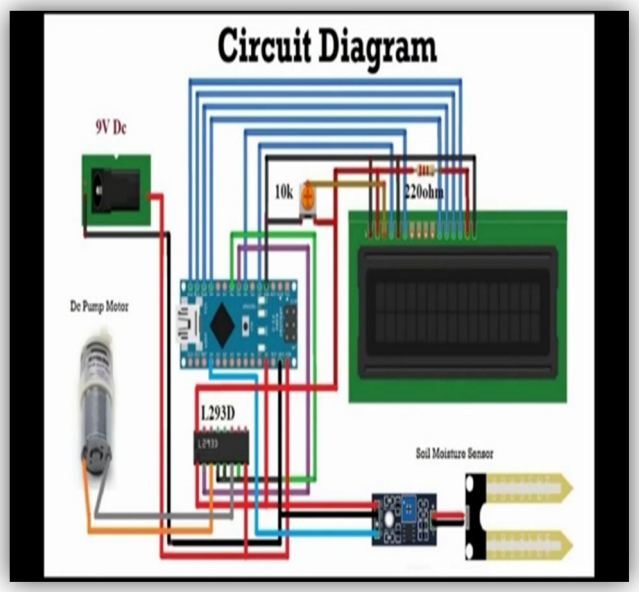

Figure 5- Circuit diagram

VII. WORKING METHODOLOGY

The working of automatic irrigation system is very simple. The soil moisture sensor is placed on plants. All other connections are made as per the circuit block. The programs uploaded in the arduino will carry on the entire process. The 9 volt supply will power the entire experimental set up. Let us consider a case of plants without optimum level of water. In this case, the soil moisture sensor identifies that the plants moisture content is low and turns the motor ON to supply water. On the other side, if the plants have sufficient water moisture content, the sensor senses it and maintains the motor to be in OFF condition.

Figure -6

In figure 6, consider the moisture content of the soil is less which is indicated as 39% in the LCD display. As the moisture content is low, the motor is set to ON position and sufficient water is pumped into the plants.

Figure -7

In figure 7, after the water supply, an optimum level of moisture content is present in the soil. Hence, the LCD display reads a value of 93% moisture level. Due to high moisture content, the motor is turned OFF.

VIII. CONCLUSION

The major crisis faced by India today is, water scarcity due to lack of adequate rainfall. As a scope to resolve these problems, this methodology of automatic irrigation has been developed. This procedure is more reliable and it could help to conserve a huge quantity of water which is been wasted through improper and excess irrigation. It has major scope in agricultural field where farmers might be more profited by saving labor costs, time and water. This methodology has a major scope in agricultural science, climate research and in horticulture. As a next stage of development, wireless techniques can be employed using IoT that can be used to irrigate water automatically and to monitor the level of moisture and fertility content in the soil.

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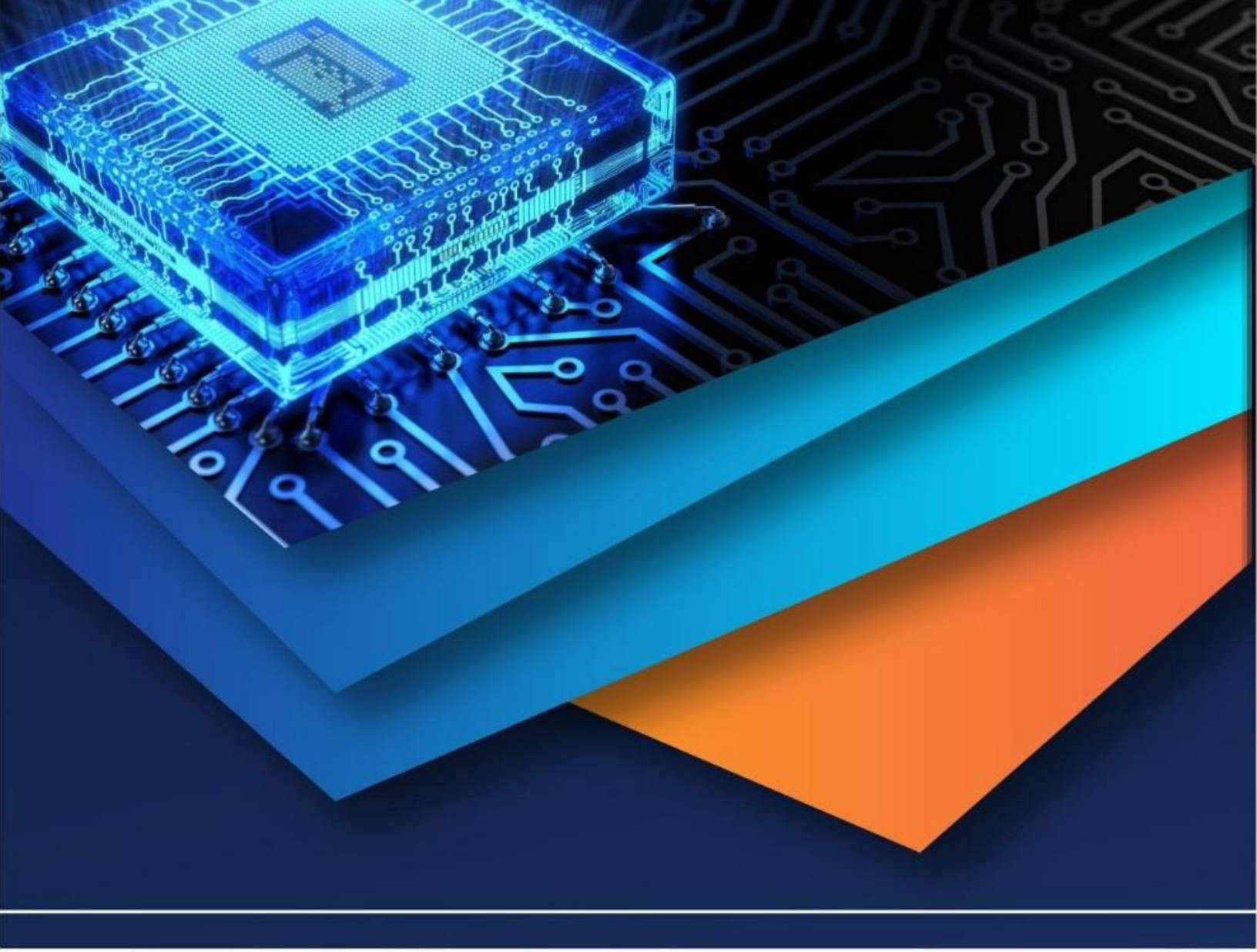

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