© 2017 IJSRST | Volume 3 | Issue 7 | Print ISSN: 2395-6011 | Online ISSN: 2395-602X
Themed Section: Science and Technology

Modeling and Designing of Automatic Plant Watering System Using Arduino

Parwinder Singh Bains[1], Raman Kumar Jindal[2], Harpreet Kaur Channi[3]
Student of Electrical Engineering Department ([1, 2])
Assistant Professor, Department of Electrical Engineering ([3])
University Institute of Engineering, Chandigarh University, Gharuan, Mohali, Punjab, India

ABSTRACT

Watering the plants is the most important cultural practice and one of the labor intensive tasks in daily greenhouse operation. Watering systems ease the burden of getting water to plants when they need it. Knowing when and how much to water is two important aspects of watering process. To make the gardener works easily, the automatic plant watering system is created. There have a various type using automatic watering system that are by using sprinkler system, tube, nozzles and other. This project uses Arduino board, which consists of ATmega328 Microcontroller. It is programmed in such a way that it will sense the moisture level of the plants and supply the water if required. This type of system is often used for general plant care, as part of caring for small and large gardens. Normally, the plants need to be watered twice daily, morning and evening. So, the microcontroller has to be coded to water the plants about two times per day. People enjoy plants, their benefits and the feeling related to nurturing them. However for most people it becomes challenging to keep them healthy and alive. To accommodate this challenge we have developed a prototype, which makes a plant more self-sufficient, watering itself from a large water tank. We hope that through this prototype people will enjoy having plants without the challenges related to absent or forgetfulness.

Keywords : Automatic Watering System, Arduino-Board Sensor, Soil Moisture Sensor, Micro Controller

I. INTRODUCTION

In the fast paced world human beings require everything to be automated. Our life style demands everything to be remote controlled. Apart from few things man has made his life automated. During summers, most people are too lazy to water the potted plants on their rooftop gardens every day. In the world of advance electronics life of human beings should be simpler hence to make life simpler and convenient, so we have made "Automatic Plant Watering System". Automatic plant watering system is designed to water the plants automatically without any human interference.it contains a soil moisture sensor when senses the moisture level in the soil then it is calculated whether pants need water or not .The system simply senses the moisture level and switches on the irrigation pump when the moisture is below the set limit. The system switches off the pump when the moisture rises above the set point. So by using automatic watering system the plants will get adequate amount of water and grow properly.

II. LITERATURE REVIEW

Joaquín Gutiérrez, Juan Francisco et al.[1] explained that temperature sensors, soil moisture sensor placed in root zone of plant and gateway unit handles the information about sensor and carry data to a web application. One algorithm was developed for measure threshold values of temperature sensor and soil moisture sensor that was programmed into a microcontroller to control water quantity. For power photovoltaic panel was used. Another fact like cellular-Internet interface used that allowed for data inspection and irrigation scheduling to be programmed through a web page. The automatic system was tested for 142 days and save 92% compared with traditional watering system. Three replicas of the automated system have been used successfully in other places for 1 year and 6months. Because of its energy autonomy and low cost, the system has the potential to be useful in water limited geographically isolated area.

Thomas J. Jackson, fellow et al.[2] proposed a model of automatic irrigation system which is based on Controller and solar power was used only for source of power supply. Various sensor are placed in rice field. Sensors sense water level regularly and give the information to farmer through cellular phone. Farmer controls the motor using cellular phone without going in rice or paddy field. If the water level reaches at danger level, automatically motor will be stop without conformation of farmer.

Samysadeky, Ayoub al-Hamadiy et al [3] described that soil moisture content has been detected using a technique that is called acoustic based and it was developed. The main propose of this technique is development for measure level of soil moisture in real time method. The technique based on relationship between speed of sound and the degree of saturation with water in soils. This experiment found that the speed of sound decreases with the moisture content following, depending on the kind of soil.

Iia Uddin, S.M. Taslim Reza, Qadernewaz, Jamal Uddin et al [4] explained the automatic system based on ARM (Advanced RISC Machine) and for communication GSM (Global System for Mobile communication) technology was used. Irrigation system provides foe adequate irrigation in particular area which is real time. Soil moisture sensor placed in root zone in paddy field and sense water level. The system was set up using ARM7TDMI core and GSM. GSM is an important part of these this system. System communicates using GSM. GSM operate through SMS and is a link between ARM processor and centralized unit. This system detects climate condition and field condition in real time. This information send to user in the form of SMS and GSM modem is controlled with the help of standard set of AT (Attention) commands. These commands are used to control majority of the functions of GSM model.

Ms. Sweta S. Patil, Prof. Mrs. A.V. Malvijay [5] explained automatic irrigation technique irrigated using wireless sensor network i.e. Zig-bee and internet technology. The idea was developed by improve irrigation system and reduced cost of irrigation water level. Sensors are placed in farm and sense continuously and collect the information. This information stored at center monitor and also passes to more data collection interface and then broadcast to the wireless sensor node. Using this information system was control automatically using internet.

III. PROBLEM FORMULATION

Can we automatically water the plants when going on vacation or do we have to bother our neighbours? Sometimes the neighbours do too much of watering and the plants end up dying anyway. There are timer based devices available in India which water the soil on set interval. They do not sense the soil moisture and the ambient temperature to know if the soil actually needs watering or not.

Can we know if the soil actually needs to be watered? Irregular watering leads to mineral loss in the soil and might end up rotting the plants.

Can we manually water the soil from remote location?

MOTIVATION

In our increasingly busy lifestyle we often forget or forget to water our plants as a result due to lack of proper care the plants do not grow properly and ultimately die. Another problem that occurs is improper watering of plants, often we put more water than required and if drainage is not proper they will be damaged and not grow properly. We know that people do not pour the water on to the plants in their gardens when they go to vacation or often forget to water plants. As a result, there is a chance to get the plants damaged. Here is a simple project more useful in watering plants automatically without any human interference. We may call it as "Automatic Plant Watering System". This project is an excellent solution for such kind of problems.

OBJECTIVES

The objective of our project is to minimize the human intervention and make the process of plant watering automatic, for this purpose we have used Arduino along with soil moisture sensor. The Arduino based "Automatic Plant Watering System" will serve the following purposes.

1. Continuously monitor the amount of soil water available to plants (this is usually achieved using a sensing system).
2. Determine if watering is required for the plants based on the information obtained from monitoring the soil water content.
3. Supply exact (or approximate) amount of water required for the plants. This will be enhanced by how well it achieves objective 1.
4. Discontinue the water supply when the required amount has been delivered to the plants. This feature is important as theamount of water available for the irrigation system is not infinite, therefore water management is paramount.

IV. METHODOLOGY

The automatic watering system was designed to continuously sense the moisture level of the soil in the pots. The system responds appropriately by wateringthe soil with the exact required amount of waterand then shuts down the water supply when therequired level of soil moisture is achieved. Thereference level of soil moisture content was made to be adjustable according to the needs of the user.

***Step 1*: Connect the Soil Sensor to the Arduino**

The soil moisture sensor is connected to the Arduino, it will sense the moisture level in the soil and the depending upon the moisture level further action would be taken.We have colour coded the wires for easy understanding of how to connect the soil sensor with the Arduino.

a. Red wire - Connect the Vcc pin on soil sensor to the +5V pin on Arduino.
b. Green wire - Connect the Gnd pin on soil sensor to the Gnd pin on Arduino.
c. Orange wire - Connect the A0 (Analog) pin on soil sensor to the A0 (Analog) pin on Arduino (figure 1).

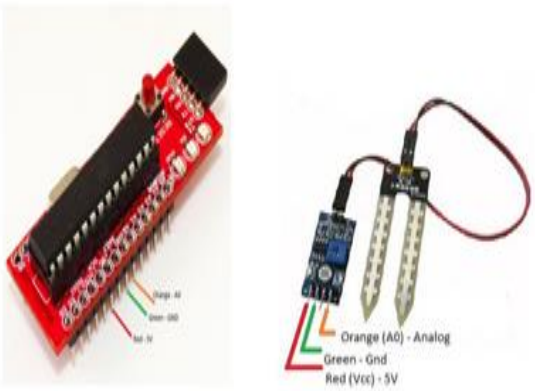

Figure 1. Arduino and Soil Moisture Sensor

***Step 2:* Connect the Pump Controller Board to the Arduino (figure 2)**

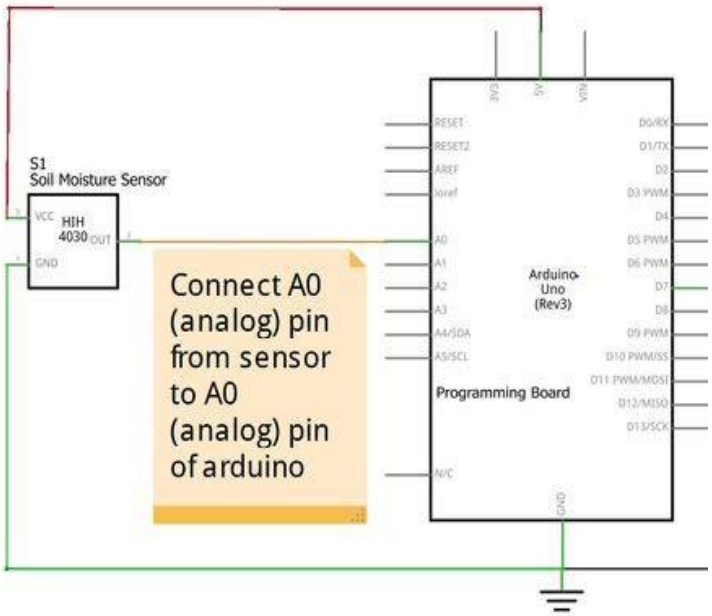

Figure 2. Circuit Diagram

The Pump Controller Board comprises of -

1. 1k ohm resistor

2. 2N2222A transistor

3. 5V Pump Motor

***Step 3:* The Code to Be Uploaded to Arduino**

The code required is uploaded to Arduino using IDE

***Step 4:* Setup the Drip Irrigation Kit**

The point to note here is that there are 6 analog pins on Arduino that can be used to sense soil moisture. At the

very minimum, one can use the same setup to sense 6 plants. But if designed in a better way, one can use the same setup to sense as many plants in multiple of 6 (figure 3).

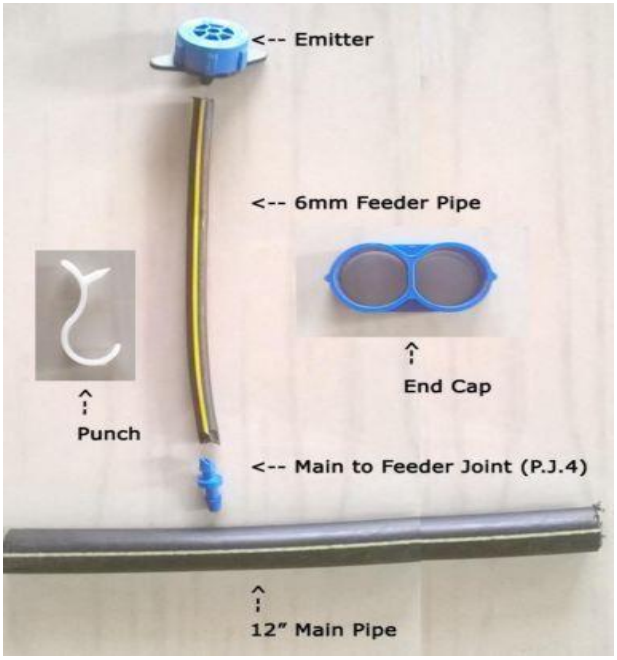

Figure 3. Drip Irrigation Kit Components

Step 5: **Connect the Pump to the Drip Main Line (figure 4)**

Figure 4. Main drip line connected to water source

The pump is connected to drip main line which will pump water to the line which will supply the water to the plants for watering.

Software

Integrated Development Environment

The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino and Genuino hardware to upload programs and communicate with them.

A program written with the IDE for Arduino is called a *sketch*. Sketches are saved on the development computer as text files with the file extension.

Hardware

Arduino-Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or ide (integrated development environment) that is used to write and upload computer code to the physical board. This project uses Arduino board, which consists of atmega328 microcontroller. It is programmed in such a way that it will sense the moisture level of the plants and supply the water if required.

Sensor module- 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.

Servo motor module- A servo motor controller is a circuit that is used to control the position of a servo motor. It is also called as a servo motor driver. a servo motor controller consists of a controller, the servo motor and the power supply unit.

Water pump-The water pump is used to artificially supply water for a particular task. It can be electronically controlled by interfacing it to a microcontroller. It can be triggered on/off by sending signals as required. The process of artificially supplying water is known as pumping. There are many varieties of water pumps used. This project employs the use of a small water pump.

V. Results

Irrigation becomes easy, accurate and practical with the idea above shared and can be implemented in agricultural fields in future to promote agriculture to next level. The output from moisture sensor and level system plays major role in producing the output. The primary applications for this project are for farmers and gardeners who do not have enough time to water their crops/plants. It also covers those farmers who are wasteful of water during irrigation. The project can be extended to greenhouses where manual supervision is far and few in between. The principle can be extended to create fully automated gardens and farmlands. Combined with the principle of rain water harvesting; it could lead to huge water savings if applied in the right manner.

VI. Conclusion

Thus the "Automatic Plant Watering System" has been designed and tested successfully. It has been developed by integrated features of all the hardware components used. Presence of every module has been reasoned out and placed carefully, thus contributing to the best working of the unit. The system has been tested to function automatically. The moisture sensors measure the moisture level (water content) of the different plants. If the moisture level is found to be below the desired level, the moisture sensor sends the signal to the microcontroller which triggers the water pump to turn on 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. Thus, the functionality of the entire system has been tested thoroughly and it is said to function successfully.

VII. ACKNOWLEDGMENT

We take this opportunity to express gratitude towards our guide Harpreet Kaur Channi,Assistant Professor Department Of Electrical Engineering, University Institute of Engineering, Chandigarh University, Gharuan, Mohali for her constant support and guidance throughout the course of our work. Her sincerity, thoroughness and perseverance have been a constant source of information for us. It is only her cognizant efforts that our endeavors have seen light of the day. Also, we would like to take the opportunity to thanks Dr. Inderpreet Kaur (HOD) for permitting us to pursue this work.

VIII. REFERENCES

[1]. Joaquin Gutierrez, Juan Francisco Villa-Medina, Alejandra Nieto-Garibay, and Miguel Angel Porta-Gándara "Automated Irrigation System Using a Wireless Sensor Network and GPRS module" Ieee 2013.

[2]. Thomas J. Jackson, fellow, Ieee, Michael H. Cosh, Rajatbindlish, senior member, Ieee, Patric J. Starks, David D. Bosch, mark Seyfried, David C. Goodrich, Mary Susan Moran, senior member, Ieee, and Jinyang Du ,"Validation of Advanced Microwave Scanning Radiometer Soil Moisture Products", Ieee 2010 .

[3]. Samysadeky, Ayoub al-Hamadiy, Bernd Michaelisy, Usama Sayedz, "An Acoustic Method for Soil Moisture Measurement", ieee 2004.

[4]. Iia Uddin, S.M. Taslim Reza, Qadernewaz, Jamal Uddin, Touhidul Islam, and Jong-Myonkim,"Automated Irrigation System Using Solar Power" ©2012 Ieee.

[5]. Ms. Sweta S. Patil, Prof. Mrs. A.V. Malvijay, "Review for Arm Based Agriculture Field Monitoring System", International journal of scientific and research publications, volume 4, issue 2, February 2014.

[6]. Zhang Feng Yulin university Yulin University tfnew21@sina.com, "Research on Water-Saving Irrigation Automatic Control System Based on Internet of Things Institute ofInformation Technology", 2011 Ieee.

[7]. AbhinavRajpal, Sumit Jain, NisthaKhare and Anil Kumar Shukla"Microcontroller-based Automatic Irrigation System with Moisture Sensor"Proceedings of the International Conference on Science and Engineering (ICSE 2011).