ARUN S B
NANDAN K B
P HARSHA VARDHAN
and
RAJATH T M

Arduino based automatic irrigation control system by utilizing moisture content

This work is on development to an efficient and affordable watering system. An automatic plant watering system using Arduino microcontroller UNO R3 is programmed such that it interrupts the signals to the motor. Soil sensor is connected to the pin to the Arduino board which senses the moisture content present in the soil. Whenever the soil moisture content goes down, the sensor senses the humidity change and instructs the microcontroller so that pump can be activated, thus reducing water wastage.

Global warming in nowadays is a serious issue. As the temperatures are rising, there is an observable change in the climatic conditions that is not usually found in the region. With the rising sea levels, many part of the world suffer with either severe famine/drought or floods. Due to this unpredictability of water resources, the farmers are unable to get good yields or may spoil the yield by watering the crops more than required. Hence, we intend to find an economical solution by developing a cost-efficient watering system that has the capability of sensing the moisture content in the soil and water them, if needed.

Keywords: Arduino based automatic irrigation control system, global worming, famine, drought, famine, moisture sensor, GHG.

1.0 Introduction

Water is one of the most important aspects of plant growth. The amount of water determines the growth rate and life span of the plant. Too much or too little water will hinder its growth. Irrigation is an important artificial irrigation method. In arid regions and periods of below-average rainfall, irrigation promotes plant growth, landscape maintenance and re-greening. A common form of irrigation involves manually watering the field using a system: sprinkler, furrow, drip, or manual. One of the main disadvantages of this traditional irrigation is that the amount of water given to the plants cannot be calculated, so the plants cannot obtain the optimal amount of water for growth, thereby reducing their productivity. In this document, we discuss the operation of an automated irrigation system that enables farmers to irrigate and control soil moisture. to optimize the crop yield. This system can be easily modified and fine-tuned for other irrigation applications making it easier to use.

The improper usage of water and its resources has resulted in financial losses due to crop health and quality fails to meet required fulfillments.

To prevent this, it is necessary to maintain the crops and their quality at its best. As the number of people desiring for white collar jobs are increasing, it is getting difficult for farmers to find the required man force. The main factors of crop not growing to the desired level are majorly due to improper irrigation apart from natural disasters. If this issue is eliminated, a big chunk of problem is resolved.

The impact of water shortage earned extreme heat on food production has been a hot button topic in the development circles as the scientific understanding of climate change has grown. One recent study found that climate change could drive an 11% decrease in crop yields and a 20% increase in price by 2050 if countries do not stem their greenhouse gas emissions.

Healthy plants can transpire a lot of water, resulting in an increase in the humidity of the greenhouse air. A high relative humidity (above 80-85 %) should be avoided because it can increase the incidence of the disease and plant transpiration. Sufficient venting or successive heating and venting can prevent condensation on plants surfaces and greenhouse structure. The use of cooling system during the warmer summer months increases the greenhouse air humidity. During periods with warm and humid outdoor conditions, humidity control inside the greenhouse can be a challenge. Greenhouse located in dry environments benefit greatly from evaporative cooling system because large amount of water can be evaporated into the incoming air, resulting in significant temperature drops.

Since the relative humidity alone does not tell us anything about the absolute water holding capacity of air, a different measurement is sometime used to describe the absolute moisture status of the soil. The vapour pressure deficit is a

Messrs. Arun S B, Nandan K B, P Harsha Vardhan, Rajath T M, Department of Mechanical Engineering, Siddaganga Institute of Technology, Tumkur, India. E-mail: arunsb@sit.ac.in / 1si18me065@sit.ac.in / 1si18me074@sit.ac.in / 1si18me085@sit.ac.in

measure of the difference between the amount of moisture the air contains at a given moment and the amount of moisture it can hold at that temperature when the air would be saturated. Pressure deficit measurement can tell us how easy it is for plants to transpire: higher values stimulate transpiration (but too high can cause wilting), and lower values inhibit transpiration and can lead to condensation on leaf and greenhouse surfaces.

This project is taken up as India is an agriculture-oriented country and the rate at which water resources are depleting is a dangerous threat hence there is a need of smart and efficient way of irrigation. In this project we have implemented sensors which detect the humidity in the soil (agricultural field) and supply water to the field which has water requirement.

This project involves the utilization of Arduino, moisture sensor, relay, and a simple programme. The sensor detects the moisture content present in the soil and feeds the real time data to Arduino which processes the information and decides to water or not depending on the moisture content, reducing the water wastage.

2.0 Working

The automatic plant watering system with Arduino UNO R3 microcontroller is programmed to send an interrupted signals to the motor through the motor control module. The soil sensor is connected to the "A0" pin of the Arduino board to detect the moisture content of the soil. When the soil moisture content drops, the sensor detects the change in moisture by sending a signal to the microcontroller to start the pump (motor). The circuit includes an Arduino UNO board, soil moisture sensor, 5V motor pump, motor driver, and a motor driver IC for driving the water pump. You can use a 5V to 9V wall power supply or connect an adapter or solar panel to power the Arduino board. The pump motor requires a separate 5 to 9 V battery.

3.0 Block diagram

This project consists of two functional components: They are the moisture sensor module and the motor controller for the motor pump. The Arduino board is programmed with the Arduino IDE software. The function of the moisture sensor is to detect the temperature content present in the soil and measure the humidity. When the motor controller breaks the signal, the water pump provides water to the plants. This project uses the Arduino Uno microcontroller board to control the motor and monitor the soil moisture. The motor can run on a 5-volt battery, the power can also provide via an external source or from the Arduino board.

4.0 Components required

4.1 Arduino

An Arduino is an open-source microcontroller development board. Arduino consists of a physical

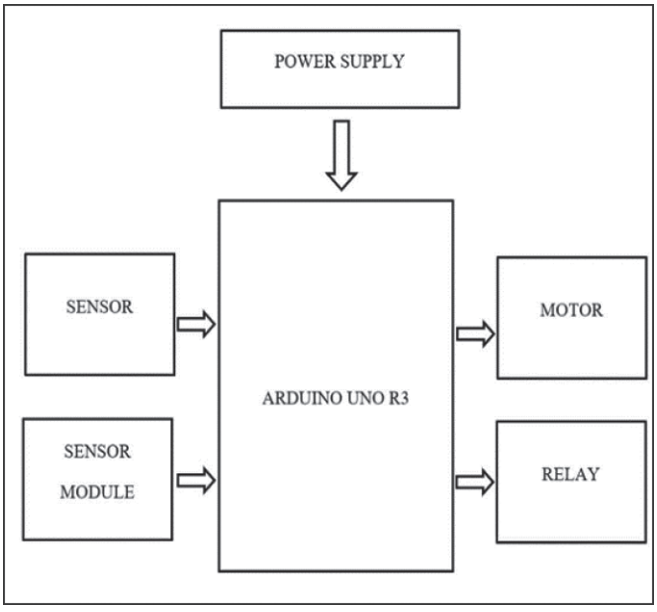

Fig.1: Block diagram

programmable circuit board and software or IDE running on the computer, which is used to write and load computer code onto the physical keyboard. The AT mega 328 microcontroller operates at 5V and has 2 KB RAM, 32 KB flash memory for programme storage and 1 KB EEPROM for parameter storage. The clock speed is 16 MHz, which translates to about executing about 300,000 lines of source code per second. The board has14 digital pins I/O in sand 6 analog pins.The pin diagram is shown in Fig.2.

4.2 Moisture sensor

Soil moisture sensor measure the humidity of water content present in the soil. As the direct hydro metric measuring of free-soil wetness needs removing, drying and co-efficient of a sample, soil wetness sensors leave the meter water level content indirectly by victimization another property of the soil, like electrical phenomenon, non-conduct of constant orinter action with neutrons, as a proxy for the wetness content.

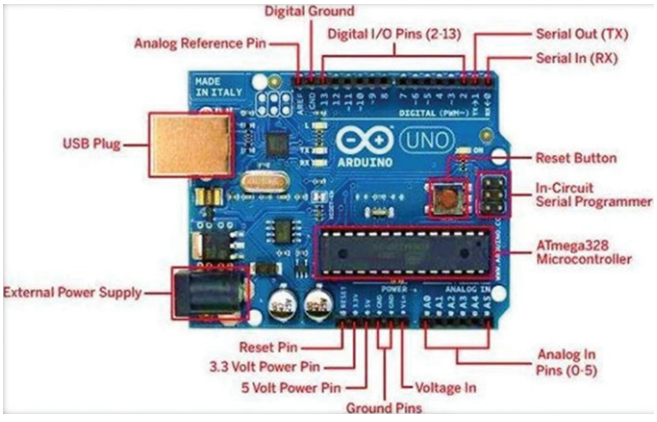

Fig.2: Arduino UNOR3

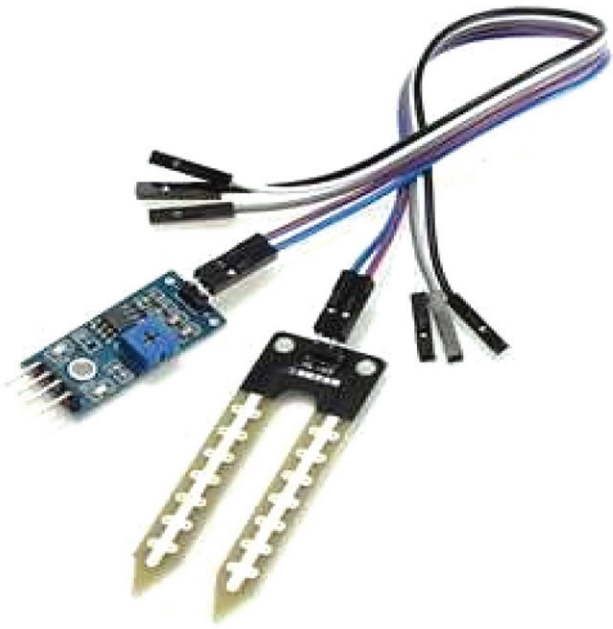

Fig.3: Moisture sensor

4.3 Relay

Fig.4 shows a relay that is an electrically operated switch. Multiple relays use a magneto-automatically operate a switch, but alternative principles of operation are used, such as solid-state relays. Relays are used when necessary to control a switch with a separate low power signal, or where many circuits need to be controlled by one signal. Essential relays were operated a samplifier sinlong-distance communication circuits; they did not interrupt the signal coming back from one circuit and transmitted it to another circuit.

4.4 Motor

The AC motor is an electric motor that is powered by alternating current (AC) power by Associate. In Fig.5, the AC motor normally consists of two basic components, an outer stationary stator coil with AC coils that provide a rotating flux and an inner rotor that is connected to the output shaft and generates a second rotating flux. The rotor flux could also be generated by permanent magnets, reluctance bumps or electrical direct current (DC) or alternating current (AC) windings.

Fig.5: Motor

4.5 Power source

The power supply of the Arduino can be done with the help of an exterior power supply or an USB connection. The exterior power supply (5V to 20V) mainly includes a battery or an AC to DC adapter.

4.0 Circuit diagram

In the Fig.6, soil moisture sensors are connected to the Arduino A0 pin for the analog input so we can get the temperature content present in the soil. The VCC pin is connected across the Arduino 5V pin. The GND pin represents the ground to connect all components. D7 is known as a digital pin, so it connects to transistors. The

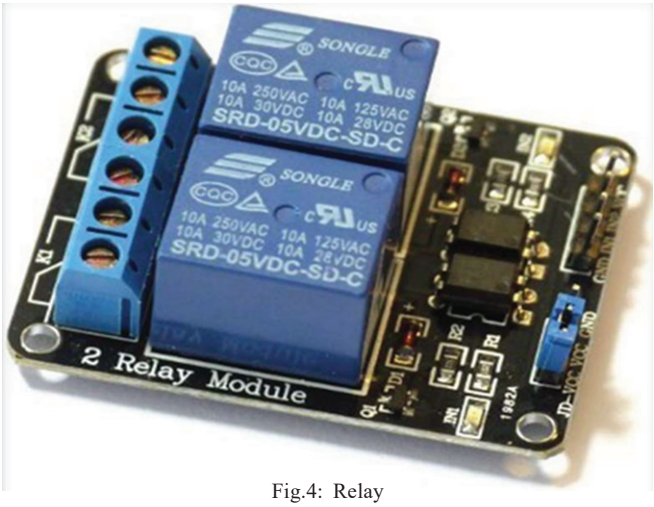

Fig.4: Relay

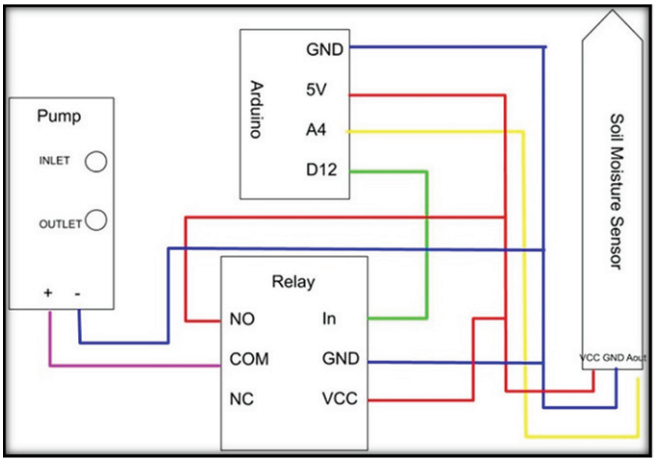

Fig.6: Circuit diagram

2N2222 can be an ordinary NPN bipolar semiconductor device; Bipolar Transistors (BJT) used for general low power amplification or switching applications. It is designed for low to medium current, low boost current, low power, medium voltage and can be operated at moderately high speeds. TO18 metal for low power amplification. VCC pin of the motor driver module connected via the D13 pin of the Arduino board, conducts the current to the motor pump according to the temperature monitor, the D7 pin is used for ground, we can write a connected output D7 via 1k resistors and the same connection goes via transistors for low gain. In the transistor it has three pins that we call the emitter, base and collector.

5.0 Conclusions

Thus, we were able to successfully design and test the irrigation system, which was developed through integrated properties of all hardware components used. The presence of each component was carefully thought out and placed, thus contributing to the better operation of the device. Therefore, the automatic plant irrigation system was developed and successfully tested. The system has been tested to work automatically. The humidity sensors measure the humidity and when the humidity is below the desired value, the humidity sensors ends the signal to the Arduino board, which in turn turns on the water pump and delivers water when the desired humidity is reached, the system stops by itself, and the water pump turns off and found that it works.

References

[1] Pavithra D.S, M.S. Srinath, (2014): "GSM based Automatic Irrigation Control System for Efficient Use of Resources and Crop Planning by Using an Android Mobile", *IOSR Journal of Mechanical and Civil Engineering* (IOSR-JMCE) Vol 11, Issue I, Jul-Aug, pp 49-55.

[2] N.V.Gowtham Deekshithulu, G. Ravi Babu, R. Ganesh Babu and M. Siva Ramakrishna (2018): "Development of Software for the Microcontroller Based Automated Drip Irrigation System Using Soil Moisture Sensor" *International Journal of Current Microbiology and Applied Sciences* ISSN: 2319-7706 Volume 7 Number 01.

[3] Mahesh M. Galgalikar and Gayatri S. Deshmukh (2010): "Real Time Automization of Irrigation system for Social Modernization of Indian Agricultural System", Proceedings of the *International Journal of Computer Applications*, Volume 1.

[4] How Drought and Extreme Heat Are Killing the World's Crops - Justin Worlan. Drought and Extreme Heat Are Killing the World's Crops | Time

[5] S.V. Devika, SK. Khamuruddeen et al., (2014): "Arduino based automated plant watering system" in *International Journal of Advanced Research in Computer Science and Software Engineering,* Volume 4, Issue 10, October.

[6] Jonathan Gana Kolo, (2007): "Design and Construction of an Automatic Power Changeover Switch" in *AU Journal of Technology*, 11(2): (Oct.).

[7] S. Darshna et al., (2015) "Smart Irrigation System" in *IOSR Journal of Electronics and Communication Engineering* (IOSR JECE), Volume 10, Issue 3, Ver.II (May-Jun).

[8] Jesper Sandberg and Thomas Kockholm: ''iPlant: Intelligent Plant System", in SPCL-2012 - Report.

[9] Vinay Bakale and SiddheshTolakar, "Wireless Automatic Plant Irrigation System", *International Journal on Recent Technologies in Mechanical and Electrical Engineering.*

[10] Sanju kumar, and R.V. Krishnaiah, (2013): "Advance Technique for Soil Moisture Content Based Automatic Motor Pumping for Agriculture Land Purpose". *International Journal of VLSI and Embedded Systems*- IJVES, Vol 04, Article 09149; September, pp 599-603.