FABRICATION OF A MODEL AGRICULTURAL AUTOMATIC WATER SPRINKLER BASED ON MOISTURE SENSING

Dr.RAMACHANDRA C G

Department of mechanical engineering, Anurag group of institutions, Hyderabad, India

Email:- Sohansunny14@gmail.com, 19h61a0385@cvsr.ac.in,vamshiredde24@gmail.com

ABSTRACT

The most significant cultural practise and one of the labour-intensive daily duties in a greenhouse is watering the plants. Watering systems make it easier to supply plants with water when they're in need. Two crucial components of the watering process are timing and quantity of watering. The automatic plant watering system was developed to make gardening easier for the user. There are many automatic watering systems that use sprinklers, tubes, nozzles, and other devices. Because it can water the plants that are in the pots, this system requires a watering sprinkler system. This project makes use of an Arduino board with an ATmega328 microcontroller on it. It is set up such that it will detect the plants' level of moisture and provide water when required.In order to maintain both small and large gardens, this kind of system is frequently employed for general plant maintenance. The plants often require watering twice a day, in the morning and in the evening. In order to water the plants in the garden or farms roughly twice each day, the microcontroller must be programmed. Plants are loved by people for their advantages and the satisfying sense of caring for them. But, for the majority of individuals, maintaining their health and survival becomes difficult. We have created a prototype that helps a plant become more self-sufficient by watering itself from a sizable water tank and supplying itself with artificial sunshine in order to meet this goal.The pro-To type notifies the user when the water tank needs to be refilled and reports status of its current circumstances. The automation of the system is made to help the user. With the help of this prototype, we believe that people will enjoy growing plants without having to deal with absent-mindedness or memory problems.

Keywords: Agricultural need; Moisture sensor; Automatic water sprinkler;Water pump; relay module; Arduino

1. INTRODUCTION

This project's primary goal was to automatically irrigate plants or garden using microcontrollers (Arduino Uno). artificially applying water to the soil or to the land It is used to support the development of agricultural crops, the upkeep of landscapes, and the revegetation of disturbed soils in arid regions and during dry spells. The water travels through the lateral lines once a zone is turned on and eventually arrives at the irrigation electrode (drip) or mechanical device heads. A fitting and a pipe can be linked to a number of sprinklers at their lowest points thanks to pipe thread inlets. Typically, the sprinklers are placed at the top of the head, flush with the ground. Dripping is a common strategy because it lowers significant water losses while enhancing yields and lowering labour costs. When the components are turned on, they all read and send an output signal to the controller, where the user will see the information (farmer). As the sensor values are analogue in nature, the controller's ADC pin will transform them into digital signals. When the motors are turned on or off, the controller will then access the information, which will then be shown on the LCD Panel and serial monitor windows. Many crops can benefit from a variety of water-saving techniques, ranging from simple ones to more complex ones.technologically sophisticated. One system, for instance, scheduled irrigation depending on the temperature of the plant's soil and tracked the status of plant watering. The entire apparatus is mounted on a flat-bed remote-controlled vehicle. The vehicle can be used on a field.

The soil moisture sensor will make touch with the ground when the vehicle is travelling through the field. It gauges the soil's moisture content. It will shower water in the dry area if the water content is low.

2. LITERATURE REVIEW

The availability of water for irrigation is a serious concern for ranchers, especially those who are dependent on rain, and soil moisture content is a more important criterion when compared to other ones for the improvement of automated irrigation systems. As a result, planning an automated irrigation system requires careful consideration of water management, as seen in the majority of the material. Several methods have been used by analysts to precisely quantify moisture material. The most fundamental, intelligent, and power-efficient strategy for everyone is electrical conductivity estimation. However, it is not precise, and its results change over time. Many analysts generally support it despite its drawbacks.

A model was displayed by S. S. Mathurkar and D. S. Chaudhari [9] with regard to moisture, temperature, and humidity sensors. The sensors were all set up for straight reactions. The main goal of a framework is to create a precise framework that can be applied to a real farm and benefit the rancher.

Using Plant waterpressure investigation is a cutting-edge method of handling the construction of automated irrigation systems. It is obtained by using optical and Infrared images of plant overhang. This particular enlistment has some challenges because it is unable to determine the correct coordinating or predictable basic component from the information graphics.

In order to get a satisfactory enrolment outcome, X. Wang et al. [10] developed an Automated Cross-Correlation arrangementcalculation that makes use of data from intelligent image structure while eliminating the influence of pictureshading and power in the relationship operation. Also, they implemented a skilled calculating approach that can considerably reduce the ACC computation's calculation unpredictability while maintaining desired precision. Receiving N-maxima approach in the control point computation also improved arrangementpower. Trials have shown that the suggested framework outperformed all othersTerritory-based strategies are an innovative approach to dealing with automated irrigation framework configuration.

Very competent automated framework with remote sensor organisation was carried out by J. Gutierrez et al. Remote access was made available via the GPRS module (MTSMC-G2-SP). The framework comprises two informational parameters: a soil temperature sensor and a moisture sensor (VH400), which are both used in electromagnetic estimation (DS1822). The recorded data was stored locally on a memory chip and also sent over the internet. The framework completely destroys solar-powered vitality and is controllable. The encouraging results of about 90% water sparing were observed.

3. METHODOLOGY

The ATMEGA328P microcontroller used in the autonomous plant watering system is programmed to send interrupt signals to the motor through the relay. The Arduino board has a soil sensor connected, which detects the amount of moisture in the soil. The sensor detects any changes in the soil's moisture level and sends a signal to the microcontroller so that the pump (motor) can be turned on. Automated watering systems are practical, particularly for travellers. Automatic irrigation systems can even help you save money and promote water conservation if designed andconfigured correctly. The replacement of dead lawn grass and plants can be costly [4]. but autonomous watering systems can offer much greater cost savings. irrigation using a Water is wasted when using an oscillator or hose to water. Neither technique yields any appreciable results when it targets plant roots. As a result, the "Automated Irrigation system based on soil moisture using Arduino" has been successfully developed and tested.

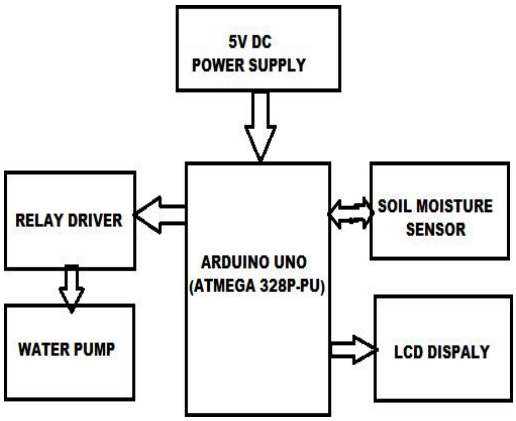

Fig 1. Block Diagram

4. HARDWARE SPECIFICATONS

A. *Arduino Uno :*

An open-source microcontroller board called Arduino Uno is built around the ATmega328P processor. Inputs include 6 analogue inputs, 14 digital I/O pins, a USB port, a power jack, an ICSP header, and a reset button. All the modules required to support the microcontroller are present in it. Simply use a USB cable to connect it to a computer or an adapter to supply power to get it going. With an Arduino, you may experiment without too much concern. If the worst happened, you could always get a new one because the Uno is so inexpensive in comparison to other boards like the Raspberry Pi, STM, etc.

I. *How to use software to upload code to an Arduino board (IDE)*

- Use a USB cord to connect your Arduino to the PC.
- The USB type A 2.0 end of the USB cable connects to a USB port on your computer, and the USB type B 2.0 end connects to your Arduino.
- To locate your Arduino board in the menu, select ToolsBoardArduino Uno.
- All Arduino boards, including the Arduino MEGA 2560 and Arduino Leonardo, can be found under this menu.
- Decide which serial port on your USB cord is appropriate.
- By selecting ToolsSerial Port from the com port menu, you can quickly locate the serial port. X is a chosen number at random. If you've just connected your Arduino to a Windows PC, the COM port will often beyour next com port for that device will be greater if you are connecting many of gadgets to your computer.
- Choose "Upload" from the menu.
- The upper left corner is where you'll find this button. The keyboard shortcuts Ctrl+U for Windows and cmd+U for Mac OS X are also available.

Fig 2. Arduino Uno

B. L298N H-BRIDGE MOTOR DRIVER

The widely used L298 Dual H-Bridge Motor Driver Integrated Circuit serves as the foundation for this dual bidirectional motor driver. You can simply control two motors with up to 2A each in both directions using this circuit. It works great for robotic applications and connects easily to microcontrollers with only a few control lines needed for each motor. Relays, TTL logic gates, basic manual switches, and other devices can all be interfaced with it. This board has built-in protective diodes, a +5V regulator, and power LED indications.

The ST L298N dual full-bridge driver, an integrated monolithic circuit in a 15-lead Multi watt and PowerSO20 packages, is used by the Double H driver module. It is a high voltage, high current twin full-bridge driver intended to drive inductive loads such relays, solenoids, DC motors, and stepping motors. It also accepts conventional TTL logic levels. To enable or disable the device independently of the input signals, there are two enable inputs available. Each bridge has a connection between the emitters of its lower transistors, and the corresponding external terminal can be used to connect an external sensing resistor. The logic operates at a lower voltage thanks to an additional supply input.

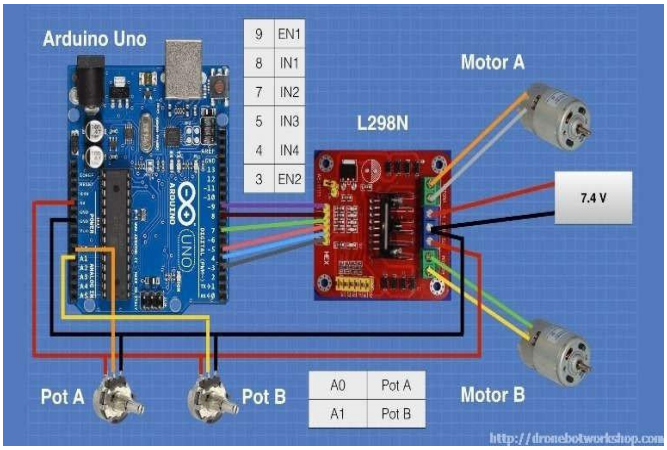

Fig 3. Motor Driver circuit connection

The other method is to use an automatic plant watering system that is set to send interrupt signals to the motor through a relay and uses the microcontroller ATMEGA328P-PU. The Arduino board has a soil sensor connected, which detects the amount of moisture in the soil. The sensor detects any changes in the soil's moisture level and sends a signal to the microcontroller so that the pump (motor) can be turned on. For an automatic watering system, apply this notion.

C. RELAY MODULE

One type of electro-mechanical component that serves as a switch is the relay. In order to open or close contact switches, DC is used to energise the relay coil. A coil and two contacts, such as ordinarily open (NO) and usually closed (NC), are often found in a single channel 5V relay module (NC). This article gives a general overview of the 5V relay module and how it operates, but first we need to understand what a relay is and how its pins are configured.

An automatic switch called a 5volt relay is frequently used in automatic control circuits to regulate high currents with low current signals. The relay signal's input voltage spans the 0 to 5V range.

Fig 4. Relay module

D. HC-05 BLUETOOTH MODULE

It is used in several consumer applications, including wireless headsets, game controllers, wireless mice, wireless keyboards, and many more.

Depending on the transmitter and receiver, atmosphere, geography, and urban settings, the range can go up to about 100m.

The established protocol used to create wireless Personal Area Networks is IEEE 802.15.1. (PAN). Data is transmitted over the air using frequency-hopping spread spectrum (FHSS) radio technology.It converses with devices using serial communication. It uses a serial port to connect with the microcontroller (USART).

Fig 5. HC-05 Bluetooth Module

- The red LED on the HC-05 shows if Bluetooth is connected or not as well as the connection status. This red LED continually and irregularly blinks before being connected to the HC-05 module. It blinks for two seconds when it is in Bluetooth range of any other device.
- This module operates at 3.3 volts. Since the module contains a built-in 5 to 3.3 V regulator, we may also connect a 5V supply voltage.
- There is no need to change the transmit level of the HC-05 Bluetooth module because it has a 3.3V level for RX/TX and the microcontroller can detect that level. Nevertheless, we must change the microcontroller's transmit voltage level to the HC-05 module's RX.
- The HC-05 module's data transfer rate can change from 0 to 1 Mbps in

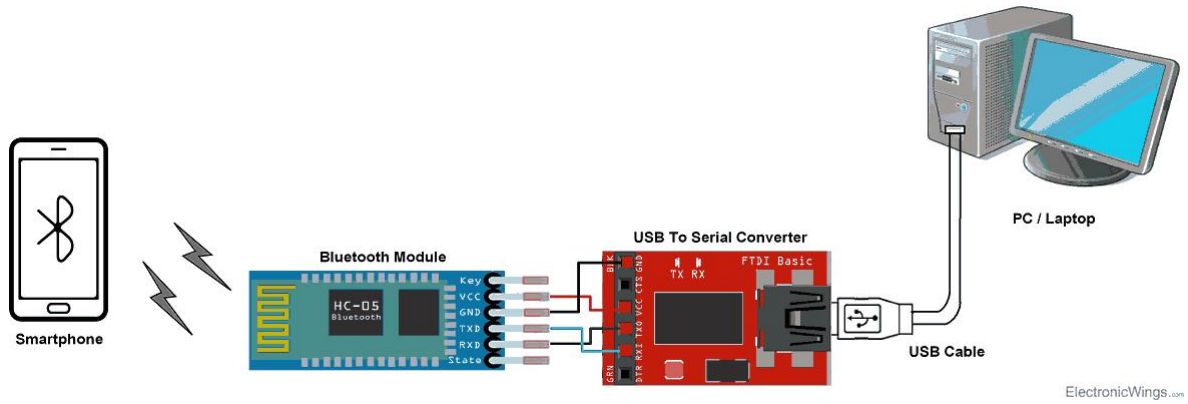

Fig 6. bluetooth Module Serial Interface

E. LITHIUMION BATTERIES

An intriguing emerging technology is lithium-ion batteries. Several portable electronic devices use small lithium-ion batteries, and some huge lithium-ion batteries have been developed to power EVs. These were just prototypes, and more work is still being done on them. These prototypes were expensive, and there are still some technical issues to be fixed. Japan has been engaged in the so-called LIBES initiative since the 1990s to perform research and development on large-scale lithium secondary batteries for EVs and home-use loadlevelingsystems. For stationary medium- and high-voltage applications, Saft offers solutions utilising high-capacity Li-ion batteries.

Lithium-ion batteries are a fascinating new technology. Small lithium-ion batteries are used in many portable electronic gadgets, while large lithium-ion batteries have been developed to power electric vehicles (EVs). These were only rough draughts; further development is currently being done. These prototypes were pricey,

and some technological problems still need to be resolved. Since the 1990s, Japan has been conducting research and development of large-scale lithium secondary batteries for EVs and home-use loadleveling systems under the so-called LIBES effort. For a static medium:

Lithium-ion batteries are becoming more and more well-liked these days. Mobile phones, PDAs, and PCs all contain them. Compared to other sizes of rechargeable batteries, they are typically much lighter. A lithium-ion battery's electrodes are constructed of lightweight lithium and carbon. Due of lithium's strong reactivity, a significant amount of energy can be stored in its atomic bonds. With lithium-ion batteries, this translates into an extremely high energy density. Here is a technique to put the energy density into perspective. A typical lithium-ion battery has a storage capacity of 150 watt-hours per kilogramme of battery. Although 60 to 70 watt-hours may be more common, a NiMH (nickel-metal hydride) battery pack has a potential storage capacity of 100 watt-hours per kilogramme. An acid battery

Fig 7. Lithium ion battery

F. SOIL MOISTURE SENSOR

The amount of water in the soil is measured or estimated by soil moisture sensors. These sensors can either be fixed or mobile, like handheld probes. Portable soil moisture probes may monitor soil moisture at many sites, in contrast to stationary sensors, which are installed in the field at specified depths and locations.

The soil moisture sensor module is utilised to gauge soil moisture. It calculates the volumetric amount of water present in the soil and outputs the moisture content. The module contains a potentiometer to change the threshold level as well as digital and analogue outputs.

The Soil Moisture Sensor Module in brief .A moisture sensor, resistor, capacitor, potentiometer, comparator LM393 IC, power source, and status LED are all included in this moisture sensor module

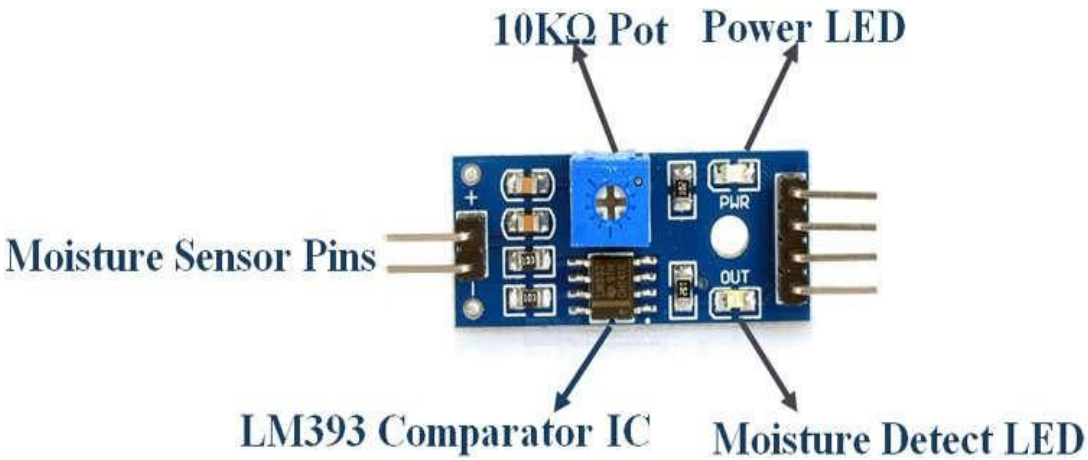

Fig 8. Soil moisture sensor

The four pins on the moisture sensor module are VCC, GND, DO, and AO. The analogue pin is connected to the moisture sensor, while the digital out pin is connected to the LM393 comparator IC's output pin. The Moisture Sensor Module's internal circuit schematic is provided below

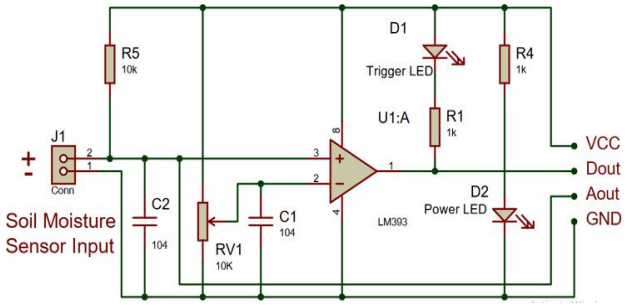

Fig 9. Soil moisture sensor circuit

It is relatively simple to use a moisture sensor module with a microcontroller. Attach the module's Analog/Digital Output pin to the microcontroller's Analog/Digital pin. Attach the microcontroller's VCC and GND pins to its 5V and GND pins. The probe should then be inserted into the ground. The soil will conduct more electricity when there is more water present, resulting in low resistance and high moisture levels.

Ground texture	FC (%)	PWP (%)	TAW (%)
Sand	12	5	7
Loamy sand	18	8	10

TABLE I. Moisture level for different soils

The calculation formula is soil moisture content=W/M*100%, M is the weight of soil before drying, and W is the weight of soil moisture, that is, the difference between M and the weight of soil after drying M'.

Volumetric water content (VWC) can be used to calculate %soil water depletion using the following formula:

$$\%\ Soil\ Water\ Depletion = \left[1 - \left(\frac{Sensor\ VWC(\%) - PWP(\%)}{FC(\%) - PWP(\%)}\right)\right] * 100$$

Where PWP is permanent wilting point and FC is field capacity.

G. WATER PUMP

This is Micro Submersible Water Pump DC 3V-5V, can be easily integrate to your water system project. The water pump works using water suction method which drain the water through its inlet and released it through the outlet. You can use the water pump as exhaust system for your aqurium and controlled water flow fountain. Little water pump for fountains and gardens using a tiny dc 3-6v motor a small water circulating system DIY task dc Submersible pump 3 to 6 volts a tiny, portable submersible water pump For a hobby kit, a 3v to 6vdc water pump uses direct current. motor for a tiny submersible pump This compact, inexpensive submersible pump motor can be powered by a 2.5 to 6V power source. It has a maximum flow rate of 120 litres per hour and uses relatively little current (220ma). You only need to attach a tube pipe to the motor output, submerge it in water, and then power it. Make sure the motor is never submerged beneath the water. Due to heating, the dry run may cause damage to the motor and make noise.

A little submersible water pump's main benefit, besides being compact and lightweight, is that the water absorbs the sound it makes as it runs, making it very quiet. Because you won't hear a submersible water

Fig 10. Water pump

pump working, even in a small location, this is ideal for domestic use. Because they don't take much power to hoover the water they are submerged in, mini submersible water pumps are also quite effective. The tiny submersible water pump's known drawback is that over time, seals erode, potentially allowing water to flow into the motor. When this occurs, the motor might become ineffective, and accessing and repairing it become quite challenging.

In general, submersible pumps are made to be completely submerged in water. Submersible pumps are typically used for drainage in floods, sewerage pumping, emptying ponds, or even as pond filters because they are situated inside the reservoir of water that needs to be pumped out.The mini submersible pump, a type of submersible water pump that is smaller, will be explicitly discussed in this article with regard to its mechanism.

A micro submersible pump is a more compact, lightweight, energy-efficient, and quiet variant of the submersible water pump. A tiny submersible water pump is frequently used in homes for tasks including watering plants, cooking, cleaning, and bathing.

A tiny submersible water pump uses a motor to drive an impeller that rotates and forces water outwards, making it a centrifugal water pump. The water pump's body and the motor are both in close proximity and are enclosed in a waterproof seal.

Aquarium fish tanks' internal filtration pumps use a particular kind of little water pump. To move water where it is needed, a small submersible water pump is put inside the fish tank itself.

H. DC MOTOR

Any of a group of rotating electric motors that use direct current (DC) electricity to create mechanical energy is referred to as a DC motor. The most prevalent kinds depend on the forces created by induced magnetic fields brought on by current flowing through the coil. For a portion of the motor's current to occasionally shift direction, almost all types of DC motors contain an internal mechanism that is either electromechanical or electronic.

Due to their ability to be supplied by existing direct-current lighting power distribution networks, DC motors were the first type of motors that were widely employed. A DC motor's speed can be varied across a large range by varying the supply voltage or the amount of current flowing through its field windings, toys, and tools all employ small DC motors. Both direct current and alternating current can be used to power the universal motor, a small, light brush motor used in portable power equipment and appliances. Bigger DC motors are being employed for steel rolling mill drives, elevator and hoist propulsion, and electric vehicle propulsion. AC motors can now be used in many applications in place of DC motors thanks to the development of power electronics

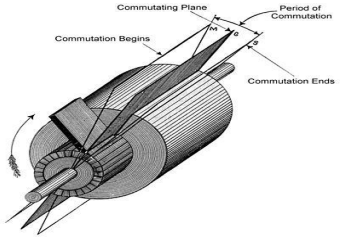

Fig 11. DC motor

5. CONCLUSION

The "ARDUINO BASED AUTOMATIC PLANT WATERING SYSTEM" has therefore been successfully constructed and tested. It was created by integrating functionality from every piece of hardware used. Every module's presence has been thoughtfully considered and arranged, which helps the unit function as best it can. The Arduino-based automatic plant watering system has thus been successfully constructed and tested. The system's ability to run autonomously has been evaluated. The moisture sensors gauge the various plants' moisture content (or moisture level). The moisture sensor transmits a signal to the Arduino board, which causes the Water Pump to turn ON and feed the appropriate plant with water, if the moisture level is discovered to be below the specified level. when the desired level of moisture isAfter it is attained, the system shuts down automatically, turning the water pump off. As a result, the system's functioning has been rigorously tested and is said to work as intended.

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