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Design and Implementation of Automated Plant Watering System Using ARDUINO

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***Abstract*—** People enjoy plants, their benefits and the feeling related to nurturing them. However, in this fast life, for most people, it becomes a challenge to keep them healthy and alive. To accommodate this, we have developed a model, which makes a plant more self-sufficient, watering itself from a water tank. In this paper it will describe the implementation of a sensor which detects the humidity of the soil (of a potted plant) and supplies water, if required. The proposed work is based on Arduino Uno where the ATmega328P microcontroller that controls the water supplies. Once the soil gets dry, the sensor senses the requirement of water in the soil and sends a signal to Arduino. Arduino then instructs the pump to water the soil till the desired humidity and the sensor is deactivated again. This model will enable the people to enjoy having plants without the challenges related to absent or forgetfulness.

***Keywords*—** ARDUINO UNO, Soil moisture sensor, Servo motor, Motor drive board, Mini water pump.

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. In the world of advance electronics, life of human beings should be simpler hence to make life simpler and convenient. This paper is based on a plant watering system which is a model of controlling watering facilities to help millions of people. This working module uses sensor technology with microcontroller to make a smart switching device. The model shows the basic switching mechanism of water pump using sensors from the potted plant by sensing the moisture present in the soil [1][2][3][4][5].

Fig 1: System Overview

II. DESIGN ISSUES AND CONSTRAINTS

A. *Microcontroller*

In this work, the microcontroller board is the main component for WSN design & implementation purpose. The microcontroller board used in this design is ARDUINO UNO Board. ARDUINO is an open-source prototyping platform based on easy-to-use hardware and software. ARDUINO boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output -activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so, the ARDUINO programming language (based on Wiring), and the ARDUINO Software (IDE, Version 1.6.3) is used, based on processing [3][4].

B. *Sensor*

In this work, sensor nodes used is the Soil Moisture Sensor which is easily available and cost effective. The contact type moisture sensor with high sensitivity senses the humidity level of the soil of the potted plant to be watered [3].

C. *Servo Motor*

It provides a rotator platform for the watering system so that by providing suitable angular displacement, the watering pipe waters the entire soil area of the potted plant.

D. H Bridge Motor Driver Board

It is a driver board containing motor driver IC L298N that drives the motor by providing the necessary current and voltage requirements to the motor. The board provides the necessary platform for interfacing the motor leads, external power supply and the enable signals.

E. Mini Water Pump

This lightweight mini submersible water pump is used to draw water from the water source, and direct it to the thirsty soil through a pipe [3].

III. WORKING MODULE

In this proposed work there are two functional components. They are the moisture sensors and the motor/water pump. Thus, the Arduino Board is programmed using the Arduino IDE software. The function of the moisture sensor is to sense the level of moisture in the soil. The motor/water pump supplies water to the plants when the moisture level is low.

This design module comprises of Soil Moisture Sensor, Servo motor, Mini Water pump and one Motor driver. The overall block diagram of our work describe below [5][6].

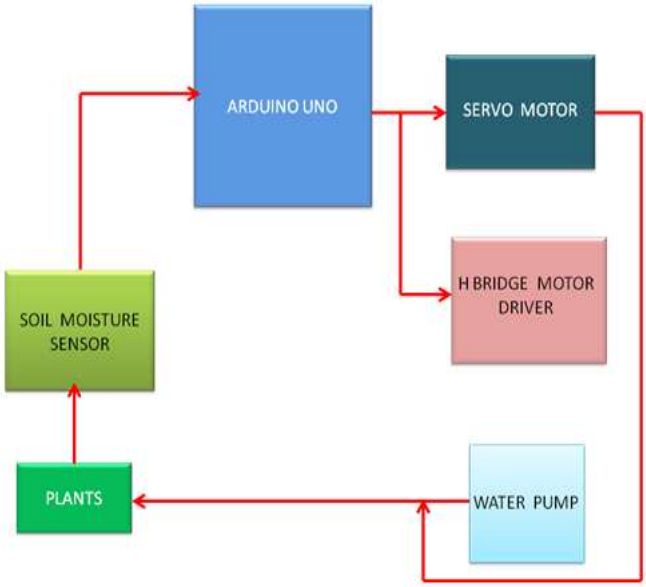


Fig 2: Block Diagram of overall module

A. Testing of soil moisture using soil moisture sensor

In this working module one of the major objectives is to arrive at the threshold value of soil moisture level using soil moisture sensor. The soil moisture sensor has been tested using Arduino board with the below connection which is shown in fig 3.

a) Block Diagram

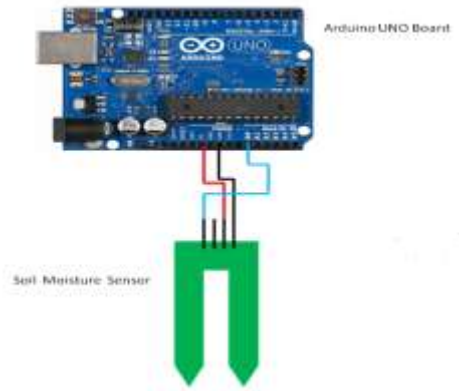


Fig 3: Interfacing of Soil Moisture Sensor

b) Circuit Description

In the given block diagram describe the connections where the sensor has three pins as Vcc, ground and an analog out. The Vcc pin is connected to the 5V pin of Arduino, ground to the ground while the analog out is connected to the A0 pin of the Arduino. This sends the analog value of moisture content of the soil to the Arduino.

Table 1: Circuit Connection of moisture sensor

Soil Moisture Sensor Pins	Arduino UNO Pins
Vcc	5V
GND	GND
A OUT	A0

B. Sweep the shaft of a servo motor back and forth across 180 degrees.

In this proposed module, the design is to test the sweeping action of the servo motor has been described.

a) Block Diagram

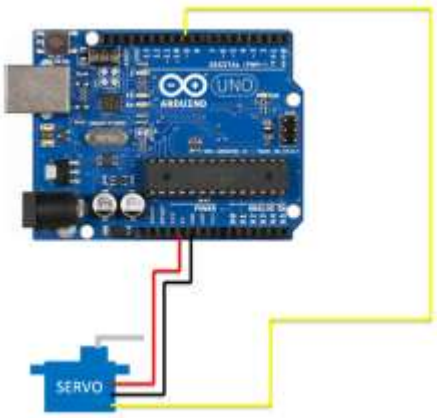


Fig 4: Interfacing of Servo Motor

b) Circuit Description

The servo motor has a female connector with three wired pins whose connections are described in the table above. The orange wire (control signal wire) connects to pin

number 9 on the Arduino and controls the sweeping action of the servo. Below given the circuit connection-

Table 2: Circuit Connection of servo motor

Servo Motor Wires	Arduino Uno Pins
Red	5V
Brown	GND
Orange	9

C. Testing the workability of the water pump using H bridge Motor Driver (IC L298N) and Arduino UNO Board.

The objective of this section is to switch on/off the water pump using H Bridge Motor Driver (IC L298N) and Arduino UNO Board. The basic block has described in this section.

a) Block Diagram

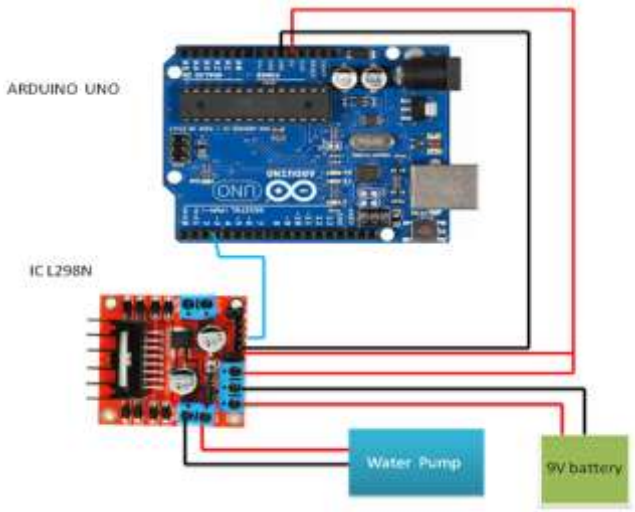


Fig 5: interfacing of water pump

b) Circuit Description

As described below, the out1 and out 2 pins are used to connect the two leads of the pump.

The and the GND pins are for connecting the external power supply (a 9V battery), needed to support the pump while the In2 pin goes straight to the digital pin 3 of the Arduino so as to receive signal to control the on/off function of the pump [6].

Table 2: Circuit Connection of motor driver

Motor Driver Pins	Connections (To)
Out1	-ve pump lead
Out2	+ve pump lead
Positive	+ve of external power supply
GND	-ve of external power supply
5V, Enable	5V of Arduino
In1	GND of Arduino
In2	Arduino digital pin 3

D. Automated plaint watering system

The ultimate goal of this paper is to combine the above stages and with little modification to the above test codes, make our model that is Arduino based plant watering system.

a) Block Diagram

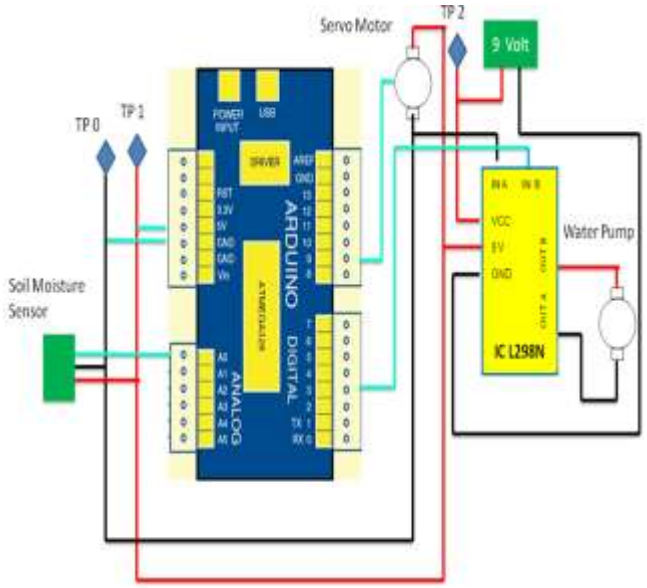


Fig 5: Automated plaint watering system

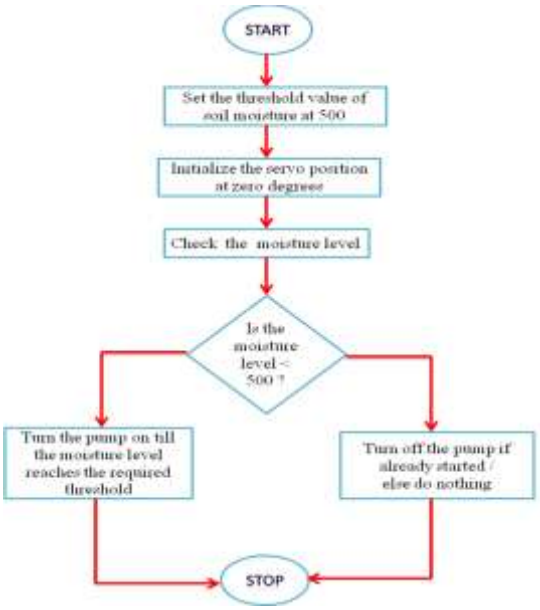
b) Circuit Description

The connections are made as shown above. The analog pin A0 on the Arduino receives the moisture content of the soil from the moisture sensor that is inserted into the soil. A decision is made by the microcontroller whether to active the pump, on the basis of comparison of the received moisture value with a pre-set threshold value [6].

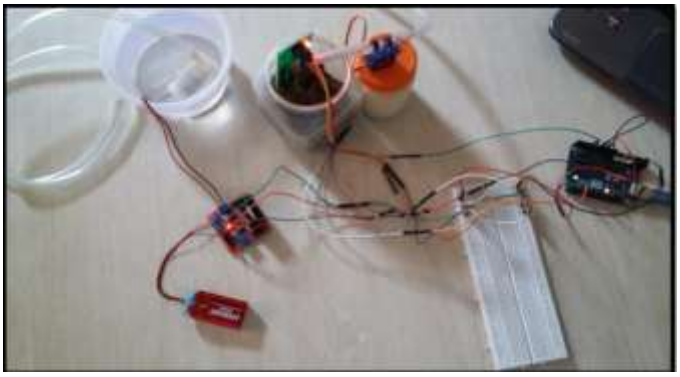
If the detected moisture value is less than the threshold, the motor driver module receives a signal from the controller through pin 3 to switch ON the pump and get ready to water the plant. The servo motor, in the meantime also receives the position of the plant from pin 9 to swipe and direct the pipe attached to its shaft towards the plant. Now the plant is watered. As the moisture level goes up, reaches or exceeds the threshold, the pump is switched OFF by the driver.

If the moisture level is more than the threshold, the microcontroller knows that the soil is moist enough. So, the pump remains off [7][8][9].

c) Flow Chart



d) Hardware Implementation and Output



From the below result shown the overall output of this working module.

Above output shows that when the soil moisture level is below the threshold which is indicating that the soil is dry and watering the plaint.

Now when the soil moisture level is above the threshold after the plant has been watered, the soil moisture level exceeds the threshold level as seen in the above output result the moisture level.

IV. CONCLUSION

Design and implementation of automated plant watering system using Arduino was successfully established and tested. 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 sensor measures the moisture level (water content) of the potted plant. 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 water pump to turn ON and supply the water to plant using the rotating platform of the servo motor. 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.

In our model, we have used a single soil moisture sensor. We can extend it to water five more plants by using more sensors connected to the rest of the analog pins of Arduino Uno. Moreover, if we use Arduino Mega 2560, we can water more plants since it has more number of analog input pins. A Light Emitting Diode and a buzzer can be used to indicate that the water tank is empty and it needs to be refilled. We can add a bluetooth module or a GSM module to wirelessly control the watering of the plants. Finally, we can also add an Ethernet or Wireless-Fidelity shield and use the Twitter

library, which will tweet from your plants side to send messages.

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