DESIGN AND IMPLEMENTATION OF ARDUINO BASED SMART WATERING SYSTEM FOR AGRICULTURAL SECTOR

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Abstract

Despite India's tremendous growth and urbanization, only 18-20% of water is used for industrial and domestic purposes, the rest is used ONLY by Agricultural sector. Even though economy of our country is based on agriculture, farmers in drought prone region face water depletion problem on a higher level. So there is a need to create such an efficient system which will save water as well as human effort by providing required amount of water to plants when needed. This system uses a Soil Moisture Sensor and Arduino Uno. The Arduino Uno uses ATmega 328P microcontroller. The working voltage of the Arduino system is 7V to 20V. The Soil Moisture Sensor, depending on the moisture content, sends signal to the Arduino board, which in turn triggers the motor using a relay.

Keywords: Agriculture, Arduino, Soil Moisture, Efficient use of water, Irrigation.

1. Introduction

The 21st century being the era of advance electronics and technology, the main objective is to make human life more comfortable and convenient. Agriculture sector being backbone of our country, automation in this sector is must. This system is one of the many effort towards automation in agricultural sector which is named as "SMART WATERING SYSTEM FOR AGRICULTURAL SECTOR". It is a model which controls watering of fields, aimed to help farmers across the country. By sensing the moisture using soil moisture sensor, the pump is triggered through Arduino system and thus watering the field.

Humidity being another important factor, it needs consideration. High relative humidity should be avoided as it increases the chances of disease and reduce important qualities of plants like transpiration. Humidity can't be controlled and it doesn't tell anything about absolute water holding capacity of soil. To overcome this problem, we use an actual soil moisture sensor.

Another main aspect of this system is to save water. Traditionally, we used to water plants based on time of the day, like during morning and evening only. When the soil is visibly wet, people avoid watering. As irregular watering of plants reduces the mineral content of soil, this can have an adverse effects on crops. Rotting of crops is a huge loss for both farmers as well as government.

Sometimes even though the problem seems to be eminent, there is always easy solution to that problem. In this case, there is a simple and economical solution for this problem. The solution exists on the form of an interdisciplinary action of electronics, electrical and partly mechanical (pump) system.

The system to be designed is based on Arduino system using ATmega328P microcontroller. Arduino board is the backbone of the system as it interfaces with the sensors and pump.

Objectives:-

1. To Design and Develop a controlled system for watering of plants using Arduino Uno (ATmega328P)
2. Using a soil moisture sensor to measure the moisture content and to act as a trigger for pump.
3. To develop the prototype so that it can be used in agricultural sector.

2. Block Diagram

Main components of this system include:-

1. Soil Moisture Sensor
2. Comparator
3. Arduino Uno
4. ATmega328P microcontroller

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5. Relay
6. Water Pump
7. Power Input(Adapter or Laptop)

The Arduino Uno uses the input signal from sensor to trigger the pump to water the plants. Pump or motor is driven by a 9V battery or directly plugged. The Arduino board is programmed using Arduino IDE, which is based on C++. As per our program, when the desired moisture level is achieved the Arduino sends STOP signal to pump.

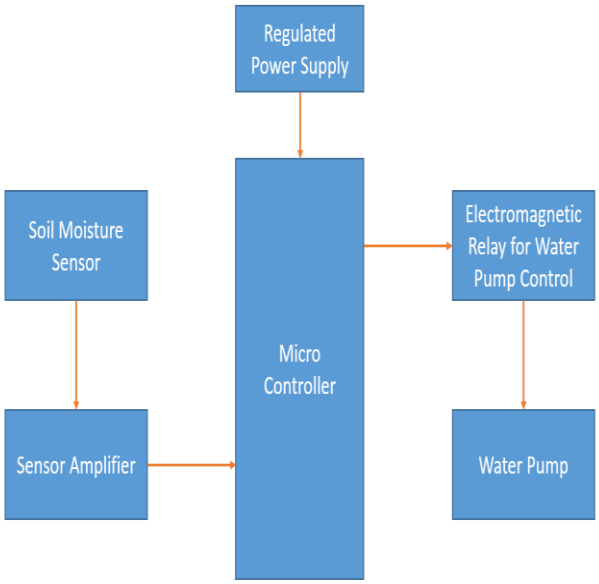

Fig.1 Basic Block Diagram Of Smart Watering System

Soil Moisture Sensor:-

The soil moisture sensor is one of the most important components as it provides the input signal to the system. The sensor works by calculating the Di-electric Constant of the soil. In this case, as we are using digital pins for input, the input value from sensor ranges from 0-1023. 0 being low and 1023 being high. In simple words, as the moisture content increases the conductivity of soil increases and the sensor gives the "high" value.

Arduino Uno:-

Arduino Uno is a microcontroller board which uses ATmega328P. Total 14 digital input/output pins are available out of which 6 can be used as PWM outputs. 6 analog pins are also available on the board. It uses a 16MHz resonator and is powered through a USB cable or through an Adapter as an external power source. External source can be 6-20 volts. But if the supplied voltage is less than 7, the board may supply less than 5V and if supplied above 12V, the board overheats and may get damaged. Hence the recommended voltage is 7-12 volts.

Table 1 Arduino Specifications

S. No	Feature	Specifications
1	Microcontroller	ATmega328P
2	Operating Voltage	5V
3	Input Voltage	7-12 Volts
4	Digital I/O Pins	14
5	Analog Input Pins	6
6	DC Current per I/O Pin	40mA
7	DC Current for 3.3 V Pin	50mA
8	Flash Memory	32KB
9	SRAM	2KB
10	EEPROM	1KB
11	Clock Speed	16MHz

Arduino IDE:-

The Arduino IDE is based on C and C++. The IDE is provided with software library which holds many input and output procedures.
A program written by user is called a *SKETCH*. Sketch is stored as a text file with extension '.ino'. The program consists of two main part :-

1. *setup( )* :- It generally used to set pinMode or to initialize variables.
2. *loop( )* :- After setup() is initialized the loop function is repeated. It continues till we cut-off the power or is reset.

Program used for proposed system -

```
int val;
void setup()
{
pinMode(13,OUTPUT);
pinMode(8,INPUT);
}
void loop() {
val = digitalRead(8);
if(val == LOW)
{
digitalWrite(13,LOW);
}
else
{
digitalWrite(13,HIGH);
}
delay(400);
}
```

Conclusions

"SMART WATERING SYSTEM FOR AGRICULTURAL SECTOR" is the need of 21st century. Modernization of conventional system usually has many advantages. In this case, the automated watering system saves human effort, saves water. This system will work even if the

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farmer is not available for e.g. at times like night when the moisture content drops and the farmer is asleep. Water can be stored in a tank as water is not available 24x7 in our country.

The pump output can given to Sprinkler or Drip Irrigation System as per our convenience. A mini system which can carry out this task has already been checked and tested. The system can be modified to some extent as to meet our needs.

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