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IoT based Irrigation Powered by Solar Voltaic System

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***Abstract*-About 45% of the world population is dependent on agriculture and in India this figure goes to 58%. The time has come to bring technological revolution in agriculture. Irrigation plays a major role in agriculture but at the same time proper optimal usage of water is very important. Everyone is well informed about the scarcity of water therefore optimal usage of water in agriculture is necessary. Usually a farmer is not scientifically well informed about the metabolism of plants during various stages of its growth and therefore sometimes this becomes a major disadvantage specially due to imprecise amount of moisture. So there is need to build a smart irrigation system which perform according to the correct scientific information fed to it. The system will become more independent if we supply power to it through solar panels. The solar panels can be provided a double axis solar tracking system. A battery can be used as an alternative power source in the absence of sunlight. Microcontroller is required to interconnect all the sensors and devices. We will use Arduino , a 9v solar panel , a sprinkler , moisture level sensor , a 9v battery**.

Keywords – Solar Panels , Ardiono , Moisture Senor , Sprinkler

1. INTRODUCTION

A sprinkler is a mechanical device which delivers the required amount of water to the soil uniformly, fully and easily. It is a very tedious job for a human to water large agricultural fields on a daily basis. Shortage of water is a serious issue in agriculture and sprinklers need a lot of water to function properly. The idea in this paper is optimization of water resource by using moisture or humidity level sensor and distribution as per only requirement.

The idea of Internet of Things (IoT) is connecting regular things around us though internet. After connection they start smart processes between them for the convenience of end user. So, if we connect a sprinkler through it then it can be controlled remotely by user for watering the fields. The need of automated system is necessary in today's world because of its simplicity in using. An electronic moisture level sensor can sense more accurately and precisely than human therefore overwatering or any other human error is prevented. Automatic irrigation system based on microcontroller in which the irrigation will be done only when there will be heavy requirement of water. The system is just limited to low level of automation of irrigation system. This Microcontroller based system can easily be improved by using other modern microcontrollers like Arduino, RaspberryPi etc. which are affordable but far more functional and eliminates the need of having an ADC. The irrigation method removes the need for human labor. The major power source for the sprinkler will solar energy. However, solar energy is not reliable because in a cloudy weather the system will not get enough power from the Sun. We will be using Blynk module in this system for controlling the sensor by a remote. The idea of IoT is that the information should be available to everyone all the time. Therefore, that kind of information should be stored to a certain place through internet. Cloud serveres act as virtual storage space which can be interpreted as a front end to access for internet enabled devices. Internet cost is decreasing as speed and consumption rate is increasing, so it is only a wise move to use such resource. A Smartphone application can also be used and more features like monitoring, security can be added in future.

2. LITERATURE REVIEW

T.Sangavi, S. Darshna ,Sheena Mohan put forward a Smart Irrigation System. In the present framework, farmers are using manually operated irrigation methods. This cause wastage of water. An automated system is required which can precisely supply water. The device uses Esp8266 WiFi module and microcontroller.

Borade Samar Sarjerao and Ravi Kishore Kodali had presented a cheap Smart Irrigation System. MQTT Protocol was uswed in the design. The design is economical because low-priced Esp8266 NodeMCU-12E.Esp8266 NodeMCU-12E is used and a small microcontroller consumes less power.

G.parameswaran And K.Sivaprasa designed a Smart Drip Irrigation System based on Arduino using Internet Of Things. Restricted water consumption and better production are major specification of this design.

Sonal Mahajan, Priyanka Padalalu, and SushmitaMitkar had proposed Smart Water Dripping System for irrigation. The introduced model control and record the precise water requirement in the field automatically. A microcontroller is used which increases system and cut down the power consumption.

Sanghamitra Saikia and Pushkar Singh had introduced the depiction and application of an Arduino-Based Smart Irrigation System. The Arduino-based data transmission was made to facilitate the function, implimentation, maintenance and the cost. The machine is completely automated. Sensors send data through the website communication system from in nanoseconds.

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3. HARDWARE COMPONENTS

The Hardaware components involved in the project are:

3.1 Arduino Uno

A board which has microchip ATmega328P microcontroller. is given sets of digital and analog input/output pins.

3.2 Relay Module

switch which regulate a circuit by an independent low-power signal, or where several circuits must be controlled by one signal.

3.3 I2C 16*2 LCD Display

Liquid crystal display uses light-modulation of liquid crystals.

3.4 Soil Moisture Sensor

It measures the volumetric water content indirectly by using property of the soil, like electric resistance, dielectric constant, or interaction with neutrons, as a proxy for the moisture content. Portable probe instruments are often employed by farmers or gardeners.

3.5 Servomotor

It is a positioner or linear actuator that permits precise control of angular or linear position, acceleration and velocity. It has an appropriate motor coupled to a sensor for position feedback.

3.6 Water Pump

A device that moves fluid or slurry with the help of mechanical action.it operated though reciprocating or rotary in moving the fluid.

3.7 Water Level Sensor

Water Level sensors are used to detect fluid ,granular substance, powder , slurry that have an upper free surface. Continuous level type sensor which measure level within a range and determine the exact amount of substance. Point sensors just indicate whether the substance is above or below the sensing point.

We made a water level sensor using Transistors, LED's and Resistances. Each could be defined as follows:

3.7.1 Transistor (BC547):

It is semiconductor device used to switch and intensify electrical power , it has 3 terminals for connections**.**

3.7.2 LED (light emitting diode):

A LED is a semiconductor source in which electrons interacts with holes releasing photons that emits light when current flows through it. The color emitted ,corresponding to the energy of the photons.

3.7.3 Resistance (1k ohm):

A resister is an electrical component which provides electrical resistance as a circuit element. Resistors are used to regulate and modify current and split voltage. High valued resistor disperse power in the form of heat.

3.8 Jumper Wires

A jump wire or jumper is an electric component which has pin at one end and slot on the other that is used to connect components on board without soldering.

3.9 Power Supply

In this project we are using 220V a.c. supply to operate the pump and a 9V battery along with arduino to operate the sensors like moisture sensor, LCD display, water level sensor, etc.

3.10 Solar panel

Solar panels require sunlight to generate electricity. solar panel is a combination of photovoltaic cells connected in series.

4. PHOTO VOLTAIC OPERATION

Semiconductors like silicon are used in photovoltic cells. When sunlight strikes the surface of photovoltic cell some energy is stored . This energy looses the electrons making them free to flow. The electric field in pv cell forces the electrons to move in a certain direction. This generates electric current, by making contact to the top and bottom of the PV cell, the current can be drawn for external uses. A PV cells consists of p and n type of semiconductor. By placing the p and n type together a junction is formed so that the charge can pass through it . The electrons and positive holes from the p and n type are attracted to each other and start to flow to opposite types in semiconductor. This attraction between electrons and holes is counterbalanced by the electric field . That is created as the charge of the material is changed when there is loss of some of its charged particles. The region that is surrounding the junction is known as depletion region. This provides p-n junction the ability to convert sunlight into electricity. Till the sun shines, the current will be provided.

The conventional solar panel consists of six layers:

4.1 The glass cover that protects delicate PV cells.

4.2 Anti reflecting coat that helps to absorb maximum incident sunlight.

4.3 Contact grid used to grip the components together.

4.4 Negative and

4.5 Silicon

4.6 Finally the back contact which is simply the back support of the entire cell.

5. SOFTWARE COMPONENT

Arduino IDE is a cross platform where we can write our Arduino codes and upload it to Arduino board. It consists of editor and a compiler. We use editor to write our code and compiler to run it error free.

The source code for the project "*Automated Smart Irrigation System*" is as follows:

```
#include<Servo.h>
#include <Wire.h>
#include<SoftwareSerial.h>
#include <LiquidCrystal_I2C.h>
#define servoPin 8
Servo s1;
SoftwareSerial SwSerial(10, 11);
// RX, TX
WidgetLCD LCD(V1);
LiquidCrystal_I2C lcd(0x27,16,2);
#define moisturepin A3
int levelthreshold=150;
#define pumppin 7
void waterlevel()
{lcd.setCursor(0,0);

if(analogRead(A0)>levelthreshold)
```

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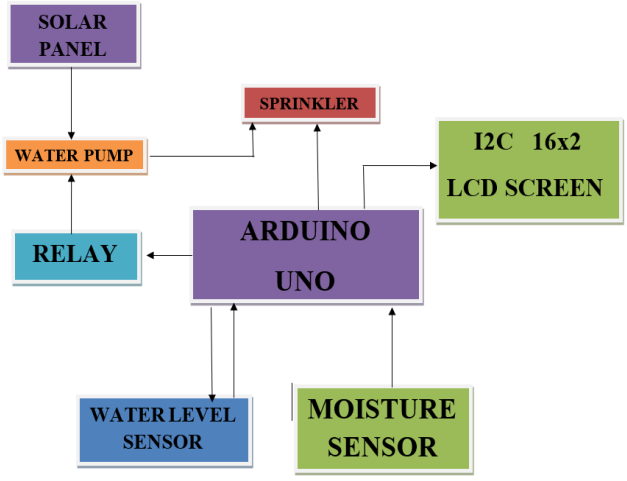
```
{
   Serial.println("Water level
100");
   LCD.print(0,0,"Water level
100%");
   lcd.print("Water level 100%");


}else
if(analogRead(A1)>levelthreshold)
{
   Serial.println("Water below
50");
   lcd.print("Water below 50%");
   LCD.clear();
   LCD.print(0,0,"Water level
50%");
   delay(50);

}else
if(analogRead(A2)>levelthreshold)
{
   Serial.println("Water level
below 20");
   lcd.print("Water below 20%");
   LCD.clear();
   LCD.print(0,0,"Water level
20%");
   delay(50);

}else
{   Serial.println("No water
left");
    lcd.print("no water left");
    LCD.clear();
    LCD.print(0,0,"No Water
left");
    delay(50);
}}
void moisturesensor()
{   float
moistureval=analogRead(A3);
   lcd.setCursor(0,1);

if(moistureval<800)
{   digitalWrite(pumppin,HIGH);
    lcd.print("Moistval ");
    lcd.print(moistureval/4);
    LCD.print(0,1,"AMS Value ");
    LCD.print(10,1,moistureval/4);
    Serial.println(moistureval/4);
}
else
{   digitalWrite(pumppin,LOW);
    lcd.println("MoistVal ");
    lcd.print(moistureval/4);
    LCD.print(0,1,"AMS Value ");
    LCD.print(10,1,moistureval/4);
    s1.write(0);
    delay(500);
    s1.write(150);
    delay(500);
}
}
void setup() {
  Serial.begin(9600);
    s1.attach(servoPin);
    SwSerial.begin(9600);

    lcd.begin();
    LCD.clear();
    lcd.backlight();
    pinMode(A0,INPUT);
    pinMode(A1,INPUT);
    pinMode(A2,INPUT);
    pinMode(A3,INPUT);
    pinMode(pumppin,OUTPUT);
    pinMode(13,OUTPUT);
```

6. FLOW DIAGRAM AND ITS WORKING

First, the system consists of following parts i.e. a microcontroller, relay, soil moisture sensor (LM393), I2C LCD display(16x2), Water pump and Water Level Sensor. A pipe is connected to the water pump in the water tank, which has a water level sensor attached to it, to check the amount of water left in the tank at every moment. The Water pump is connected to the Relay, operated on A.C supply, which turns ON/OFF as per the data sent by microcontroller by reading the moisture on the soil.



The moisture sensor is dipped under the ground near the plants. The sensor is always ON and senses the moisture content and sends the data to the controller which in exploits it to the LCD for displaying the data. Whenever the moisture content goes down, as per the crop farmer grows, the

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specified value; the Sprinkler starts to sprinkle the water to the field. We are using a servo motor to make a Sprinkler to perform back and forth motion.

The controller used here is Arduino. Arduino is chosen as it is widely used for research purposes and different sensors and hardware are easy to interface. The soil moisture/humidity sensor uses 0.4 mA of current so chance of loading effect is very less. All the sensors are be operated by a +9V D.C supply. The LCD is connected to the controller via usual connections with 15th and 16th pins are given +9V and ground connection for backlighting which is useful for viewing in low light. The display shows moisture content is percentage as programmed. The code is written so that it can collect data from a certain server address and send data to it.

7. RESULT AND FUTURE SCOPE

First, the moisture/humidity sensor doesn't tell the moisture content of soil but it takes the di-electric constant of soil and measure the change in resistance as the water quantity increases its resistivity. So, proper calibration is required for the controller to detect the content. For this, a simple experiment is done. Bowls filled dry soil and water is taken and the sensor is dipped in both and input voltage is observed. For dry soil and total water content are set as 0 and 100 percent. The rest of values are mapped by the controller itself although it is still advised to check them properly. Next part, relay module is connected to the controller with internal power supply. The relay opens only the controller sends high signal to it. The controller follows a simple algorithm written in the code. For the software part, Arduino IDE is used for writing the code and uploading the code to the microcontroller which is done in C language. The interfacing with wireless module is done using pins. The module must be connected to the internet all the time. For small scale demonstration, free cloud services are chosen(Blynk) but for complex systems these services aren't recommended. Currently this service only sends ON/OFF signal to the sprinkler. The server can be opened from simple web browser from any device having an active internet connection.

The conventional method of farming is very tedious and exhaustive. In developed countries farmers are more technical savvy and therefore we can observe that their method is more efficient than those who are practicing conventional methods of farming. It is evident that technologically advanced methods will help in more production. Since irrigation is a major part of farming therefore introducing new and advanced technologies for irrigating fields will definitely bring a revolution in the agriculture sector.

8. CONCLUSION

This project proposed a automated smart irrigation system which means there is no human interference while watering the plants. It automatically monitor and maintain the moisture level. The system is built as a low-cost model and also helpful in the zone where there is shortage of water. This process is saving lot of water and preventing plant death through overwatering. In future, this project method can implement in agriculture field where farmer can easily monitor and improve crop quality.

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