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A Study of Solar Powered Smart Irrigation System

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***Abstract*: This project proposes intelligent and smart irrigation system which can be used for controlling the watering or irrigation of plants in an environmentally friendly manner as it is powered by solar energy. It controls the irrigation of plants automatically, by using Arduino processor along with other components like the soil moisture sensor. It is a system which works on the principles of smart irrigation and focuses mainly on fully automating the irrigation system in an eco-friendly way so as to reduce the human support needed in irrigation as much as possible while saving water. As a result, this aids time saving, efficient automated irrigation system, environmental protection and saving of water.**

***Keywords*: Arduino, Eco-friendly, Smart irrigation, Soil moisture sensor, Water management.**

1. Introduction

Agriculture is an important source primarily for food, is also helps in providing job opportunities. The supply of water to agricultural land is called irrigation.

There are various methods of irrigation which, are selected on the basis of type of crop to be sowed and land on which crop is grown. The process requires numerous tools, some of the common tools are pipes, pumps, sprinklers and many more.

Irrigation's main purpose is to give the water to crop and with it reduce the wastage of water. As the field is growing its importance and people are accepting the important factors like global warming and water scarcity, many researchers are finding a way to minimize wastage of water and use eco-friendly tools for irrigation. There comes in picture the Smart Irrigation. Where use of smart technologies such as Arduino, IOT, Soil moisture sensor, Humidity sensor, Temperature sensor takes place. These devices help in finding out the amount of water required to crop and then gives the command to distributes that much amount of water to crop. For making this project Solar panels are used as a renewable source of energy. Which contributes in saving the non-renewable sources like fuels and cost of electricity.

2. The Need for Automated Irrigation

As previously mentioned, Agriculture is the important sources of food. So, to make the maximum utilization of land without causing the damage to land Smart Irrigation systems are used. Smart Irrigation makes the use of the land by a) Reducing the wastage of water b) Maintaining the water content of soil c) Increasing the yield of crop. All this can be done by using the Smart Irrigation tools. For example, the soil moisture sensor will detect the proper amount of water needed and send signal to Arduino further which will send signal to water to release that much amount of water from either a storage tank or well or any other water source. This will reduce the need of manpower needed of keeping a check on irrigation. However, increase in the production will produce new job opportunities.

3. The Use of Solar Energy

The use of Solar energy in this project helps us keep the project environmentally friendly and save electricity while keeping in mind the important things such as saving the water and reducing the need of human support so that the farmer doesn't constantly have to worry about whether the crops are fully watered or not. Solar panels fully power the entire project and simply a one-time investment as it has very low maintenance cost hence it can be adopted by farmers easily.

4. Components of Solar Powered Smart Irrigation System

Soil Moisture Sensor: Soil moisture sensor has two probes which are used to sense the water level of the plants. With the help of current passed between probes the resistance vales are determined which gives moisture level. If the resistance value is less meaning water level is more and vice versa, hence it measure the volumetric water content indirectly by using some other property of the soil, such as electrical resistance, dielectric constant, or interaction with neutrons, as a proxy.

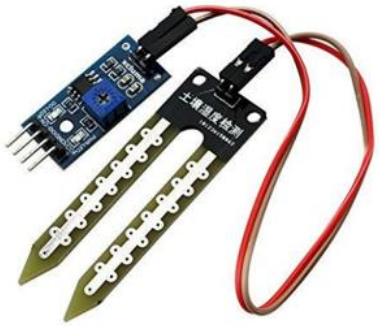

Fig. 1. Soil moisture sensor

Arduino nano: The Arduino Nano is a small, complete, and breadboard-friendly board based on the ATmega328P released in 2008. It is similar to Arduino Uno board in a smaller version. In this project it is basically the brain of the whole model which

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controls all components. It receives data from the soil moisture sensor about the moisture content in the soil and based on the input data we provide during the code it decides whether to turn the pump on or off.

Fig. 2. Arduino nano

Solar Panel: In our project we have used solar panel to charge the batteries which helps to make our project environment friendly. In the model version we are using a small generic panel to charge our battery when it drains out. And as we know that installation of solar panels is just a onetime investment because as maintenance will be low and also the life span of system is longer.

Fig. 3. Solar panel

Water pump: The smart irrigation system is able to automatically start/stop water pumps with the help of signal given by Arduino. It will be used to supply the water to the plants.

Fig. 4. Water pump

LCD: In this project we are using the LCD to give the output to the farmer that whether the pump is currently on/off

Fig. 5. LCD

5. Results and Outcomes

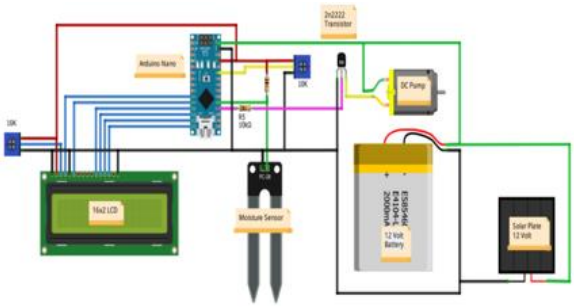

Fig. 6. Circuit diagram

Code for the Arduino

```
#include <LiquidCrystal.h>

LiquidCrystal lcd(7,8,9,10,11,12);

int Sensor = A1;
int Calib = A6;
int Pump = A0;

void setup() {
  lcd.begin(16, 2);
  lcd.setCursor(0,0);
  lcd.print("AUTO IRR. SYSTEM");

  pinMode(Pump,OUTPUT);
}

void loop() {
 if (analogRead(Sensor) > 800)              { digitalWrite(Pump,HIGH); lcd.setCursor(0,1); lcd.print("PUMP ON  ");}
 if (analogRead(Sensor) < analogRead(Calib)) { digitalWrite(Pump,LOW);  lcd.setCursor(0,1); lcd.print("PUMP OFF ");}

}
```

1. Here we have taken random variable sensor which will store the value of the moisture content of the soil.
2. When the soil moisture sensor receives the value of 1023 that means that the soil is 0% moist but since the real conditions are not ideal, we will take the value of 800. That is soil is dry if the value received by the sensor is more than 800 and if the value received is less than 800 that means the soil has moisture content and the pump will stop.
3. A loop function is then applied such that the values received from the sensor is than stored in a new variable analog Read.
4. Furthermore, if the value we receive from the sensor is high, i.e., The display will show ‘Pump ON’ if value is higher than 800 and the water pump will start. And if the value we receive is less than 800 then display will show ‘Pump OFF’ and no water will be supplied.
5. The above presented code can be modified for different crops according to their water requirements which are shown above in the Report.

Working demonstration of the project:

https://drive.google.com/file/d/1_WV-wKLT5H-Yo6DK4lMwNHF9HsD1nuXg/view?usp=drivesdk

6. Conclusion

Smart Irrigation systems offer a variety of advantages over traditional irrigation systems. One of which is the attention needed to the crop’s during irrigation is reduced which is achieved with our project whilst keeping the project environmentally clean as we used solar energy as power source

along with saving water as we would suggest using Drip irrigation as the method of irrigation if the crop does support it, as we found out that it is the most efficient method of irrigation with minimum water wastage.

Hence, we conclude that if the farmer can afford the initial one-time investment of setting up the smart irrigation system over traditionally fueled manually supervised irrigation, then he should opt for the solar powered smart irrigation system as it also provides him with the subsidy from the government. Which will further help in reducing the overall cost of the setup and the system will also require less maintenance cost. So, in the long run it does help him financially as well as in saving the water and protecting the environment.

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