A SURVEY ON SMART CROP PROTECTION SYSTEM DURING HARSH CLIMATIC CONDITIONS

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Abstract - Agricultural production is highly vulnerable to harsh climate conditions, such asextreme temperatures, heavy rainfall, and strong winds. These climatic changes has significant threats to crop health and productivity, leading to economic losses for farmers. To resolve this issue, smart crop protection system is proposed whereautomatic roof covering technology is used to overcome the impact of adverse weather conditions on crops also protecting the crops from heavy rainfall and preserve the same rain water for future purpose when there is a water scarce. Safeguarding the yields from weighty precipitation and save a similar water for future reason when there is a water scarce The survey has been arrived out and implementmodal is proposed.

Keywords: Environment, Model, Automatic, Comparison, Power Supply, Auto Roof, Water pump, Drip Irrigation.

1. INTRODUCTION

Protected cultivation is a process of growing plants in a protected environment from excess sunlight and heavy rains. This assists inhealthier and larger produce. The identification and implementation of technologies and system with potential to increase agricultural production and productivity, have been main strategies used to maximize the value of vegetables, flowers and fruits sub-sector. Protected cultivation can be viewed as one such strategy which is used to profitable produce crops in the region. A combination of open field conditions and conventional poly house conditions is a more robust way to deal with climate change and associated problems. The farm roof can used in the fields for protect fruits, vegetables and flowers for which we need to maintain intense climatic conditions This has a roof that can be opened and closed automatically by sensing the soil moisture, temperature and humidity conditions. If water is more than the requirement, our system will activate the roof and the water storage path. This system also alerts the farmers to take extra caring if in case of automatic roofing is failed, it will allow the farmer to manual covering through switch.

Nowadays, during the rainy season the cultivated crops get affected due to heavy rainfall at the time of harvesting or at initial stage of growing and sometimes there will be unexpected cyclones like sitrang and eve Tauktae (badly affected in May 2021 and October 2022). The principal subject of ourtask is to keep crop from weighty downpour and save the downpour water to sprinkle it back during summer season. During summer season, photosynthetic and transpiration efficiencies and negatively impact on plant root development, which collectively can negatively impact on yield. The decline in photosynthetic rate under both heat and water stresses are frequently attributed to lower the CO_2 level in plants, inhibition of photosynthetic enzymes, lower synthesis of ATP which produce chemical energy and also increases the soil andair temperature.

2. RELATED WORK

Authors in [1], proposed working of each sensors which measured information and transformation it into an electrical signal formsof information output. Agriculture sensorsmainly used in agriculture monitoring with the water and fertilizer integrated machine system and this speaks about temperature, humidityand moisture in the soil of agricultural land done by using IOT. Sensors collect the field information i.e., more accurate and measure the various parameters like temperature, moisture, humidity content in soil which helps to reduce the problem in agricultural field. The RFID technology is used to track and identify the object, or a crop and it helps in Communication by sending or receiving information. The moisture contents in the soil is sensed by using the moisture sensor and it will identify the amount of water supply required to the crop and sends data to RFID and enables the sensor to supply water which automatically turn on the water source and turnoff it when need is satisfied.

Paper [2] describes, Framers cannot protectentire farm every day. So PIR Sensor is kept in the field to watch out the

animals motion. When it detects any movement recorded in PIR sensors. It starts alarming. When it start getting wet. It will be automatically starts water pump when more amount of water in thefarm. So servo motor opens the canal when heavy rainfall flows detected by rain sensor. Gas sensor is used to detect the fire in the farm. This is a system designed to protect the field against animals. In which they use equipments like raspberry pi, PIR sensor,camera and GSM module with buzzer. This system diverts the animals from field without harming them. Thus the system is designed with affordable cost in such a way that it scare the animals without harming themand hence protecting the field.

Authors in [3], Focuses more on communication system for the purpose of protecting crop and smart irrigation from the animals. PIR sensor are placed in field to sense animals motion as the farmers always cannot keep staying protecting the farm. Moisture sensor and intimates start water pump. When there is more water plants cannot bear it so servomotor is used to open the canal. Also for detecting fire in farm gas sensor is used. This paper explained how smart umbrella whichcan reduce human effect, medium society at risk of rainfall and wind without coverage in place. In summer season the floor open areas gets to woman due to sunlight that makes difficulty for working. This umbrella covers the entire hall during the rain and sunlight, this umbrella operates with help of various sensor and motor. protecting the crops by reducing the wastage of rain

Upon understanding the requirement, after doing the literature survey, Model can be proposed for smart protection system and it is as follows.

3. PROPOSED METHODOLOGY

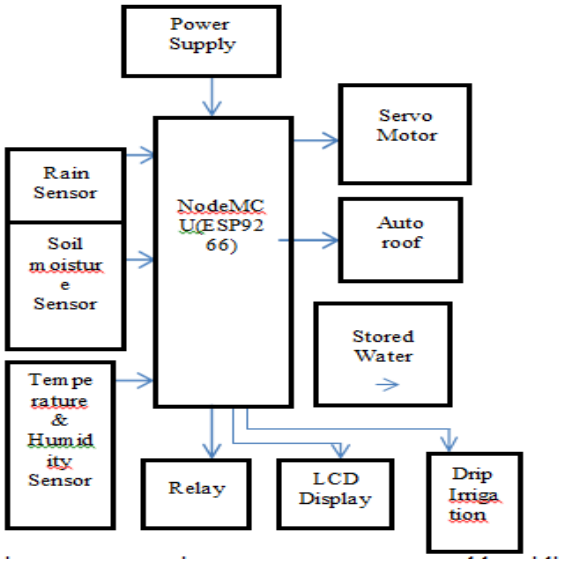

Figure 1: Block Diagram

Figure 1 shows the basic block diagram of proposed model which consists of several sensors like soil moisture sensor, rain sensor, temperature and humidity sensor. The rain sensor is activated when there is rainfall and it gives intimation to the controller. Controller closes the roof as soon as rain is detected, once the rain stops the controller automatically opens the roof. The system is based on rain sensor, temperature sensor and soil moisture sensor. Based on rainy season and summer season it will control the auto roof. Then the rain water is collected by the rain water harvesting. This way the collected rain water is saved and is used for irrigation purpose.

Selection of components for the proposed method is based on the comparative study as given in thefollowing tables.

Table 1: Comparison of Various Roofing Materials based on the durability, UV Protection, Cost.

	Aluminum Roofing sheet	**Corrugated Roofing sheet**	**Polycarbonate Roofing Sheet**	**Unplasticized Polyvinyl chloride**	**Metal RoofingSheet**
Durability	Durable comparedto tiles	Typically can last for around 25-30 years	250 times stronger than glass	Longevity and Durability last between 10~20 years	10 to 50 years
UV Protection	Expands more underthe heat	Not available	40% to 90% Both side UV coated	UV resistant and impact resistant	moisture inthe air can speed up corrosion
Cost	Much more expensive	cost is very low	are less expensive than metal	more expensive	affordable

Table 2: Comparison of Various Rain Sensor based on the operating principal, Working, Placement ofSensor and Cost of replacement.

	Plate Based	**Piezo-electric**	**Probe based**	**Optical based**	**Electro-chemical**
Operating principle	Microcontroller based	Microcontroller Based	External circuits connected to microcontroller	Microcontroller based	Independent of microcontroller
Working	Small drop of water changethe resistance	Water between plates decrease resistance	Contact of water with probe completes the rain circuit	Change in the reflection due to rain water	Rain water energy is converted into electrochemical switch
Placement of Sensor	On the windshield	On the windshield	Inside the front hood	Inside the car cabin	Inside the front hood
Cost of replacement	Moderate	Quite high	Above Rs. 1000	Around Rs. 7000	Around Rs. 1500

Table 3: Comparison of Various Temperature and Humidity Sensor based on the Communication protocol, Supply voltage, Temperature range and Accuracy.

Sensor	**DHT11**	**DHT22(AM2302)**	**LM35**	**DS18B20**	**BME280**	**BMP180**
						
Communication protocol	One-wire		Analog	One-wire	12C SPI	12C
Supply voltage	3 – 5.5V DC	3 – 6V DC	4 – 30V DC	3 – 5.5V DC	1.7 – 3.6V(for chip) 3.3 – 5V (for board)	1.8 – 3.6V(for chip) 3.3 – 5V(for board)
Temperature range	0 – 50°C	-40 – 80°C	-55 - 150°C	-55 - 125°C	-40 - 85°C	0 - 65°C
Accuracy	+/-2°C(at 0 to 50°C)	+/-0.5°C(at 40 to 80°C)	+/- 0.5°C(at 25°C)	+/- 0.5°C(at -10 to 85°C)	+/- 0.5°C 25°	+/- 0.5°C

Table 4: Comparison of Various Soil Moisture Sensor based on the Accuracy, Cost, Life expectancy and Resolution.

	Standing Wave	**Capacitance**	**YL69**	**TDR**	**Neutron probe**
Accuracy	Good, excellent with the calibration	Satisfactory (good-with calibration)	Excellent	Good	Excellent
Cost	Moderate	Low	LOW	High	High
Life expectancy	20 years	20 years	20 years	20 years	20 years
Resolution	Moderate	Good	Excellent	Excellent	Excellent

Table 5: Comparison of Various Servo Motor based on Shaft rotation.

Positional servo motors	**Continuous servo motors**	**Linear servo motors**
		
The shaft's output is about180°.	It can go in any direction.	It uses rack and pinion mechanism to Change the o/p back-and-forth instead of circular.

From Comparative study of various Sensor and motor, following components are chosen.

NodeMCU ESP8266 Microcontroller: It uses a 32-bit processor with 16 bit instruction. 17 GIPO pins but only 11 is used. It has both analog and digital pins on its board.

Soil Moisture Sensor (YL-69): Soil moisture sensor comprises two electrodes, which function as a probe and also acting as variable resistor.

Temperature and Humidity Sensor (DHT11): This device convert temperature and humidity into electrical signals. DHT11 sensor has a capacitive humidity sensing element and a thermistor for sensing temperature.

Rain Sensor (Plate based): The rain sensor module is consists of two parts, one is sensing padand another one is the sensor module. It consists of conductive plates arranged in a grid format.

Servo motor (Positional): Motor rotate an object with great precision

LCD Display (16*2): it can show 16 characters In this LCD each character is shown in 5X7 pixel network. This LCD has two registers, in particular Order and Information.

I2C Serial Adapter: It consists of 4 configuration (VCC, SDA, SCL,GND). We just have to plug in the I2C in the ports of the LCD and solder it intoplace.

Relay: A relay is an electrically Switch.

PCB: Printed Circuit Board is a medium used to connect electronics components to one another in controlled manner. Its layer is coated with copper and allows proper soldering without any short circuit.

4. IMPLEMENTATION PROCESS

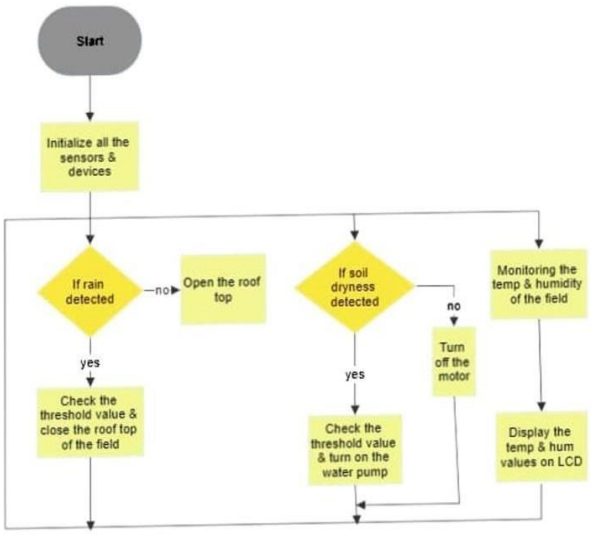

Figure 2: Flowchart

From figure 2, Once we initialize all the sensors and devices, it starts checking given conditions. During

summer, when rain sensor detects the rainfall, if moisture level in the soil is very less and if the temperature is very high, which permits the rain fall till it arrives thethreshold value of soil moisture and temperature. If it exceeds the threshold, thissensor intimates the motor to close the roof. Soil moisture sensor take a look at wetness in the soil, if is in threshold, then moisture level ofthe selected crop is perfect, if soil moisture is less than threshold value, then water pump initiates drip irrigation Condition of all the sensor shows on the LCD show.

5. CONCLUSION

Survey is carried out on "Crop Protection System during harsh climatic condition". Based on the survey, model is proposed and the comparative study helps to choose the components of proposed model. Further as per the implementation process the model can be implemented in future.

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