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Protection of Cultivated Fields during Heavy Rains and Air

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Abstract

Agriculture is the backbone of the Indian economy, but farmers face so many problems during the period of cultivation. Sometimes they lose their crop at the ending stage due to the impact of unseasonal heavy rains and air. This problem can be avoided by using a crop protection system. For the implementation of the crop protection system, rain and Flex sensors are used to detect the signal when heavy rainfall and high air force have occurred. Anyone of the sensors output signal is above the thresh hold value, and then this value activates the mechanical arrangement of the protection system through Arduino. This protection system protects the cultivated fields with a dome shape, and the collected rainwater is drained to the well through pipelines.

Keywords: Rain sensor, Flex sensor, Arduino, protection system,Air.

1 Introduction

In the last decades onwards, the seasonal atmosphere is changing due to the changes in environmental conditions. Based on these conditions, unexpected heavy rain and storms have occurred. From the statistical reports, some of the young formers reported unexpected heavy rainfalls, and storms are one of the major causes to reduce the output production of crops [1][7][8].

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Most of the Indian economy is depending on agriculture, but unseasonal rains and an unexpected stream of air will reduce the production of crops, which leads to reduce the economy. To overcome this problem, a new protection system is proposed.

2 Proposed System

The proposed system mainly consists of a sensors network and protection system controller. The below-mentioned fig 1 represents the sensor network, which is formed by rain and flex sensors. Here, the rain sensor is applicable for detecting the rain, and related digital output is connected to Arduino's input. The flex sensor is also used to detect the air force, and related an electrical output signal is connected to the input of Arduino. Arduino is a controller, and the output of the controller is connected to the crop protection arrangement through required hardware, and input is connected to the sensor network.

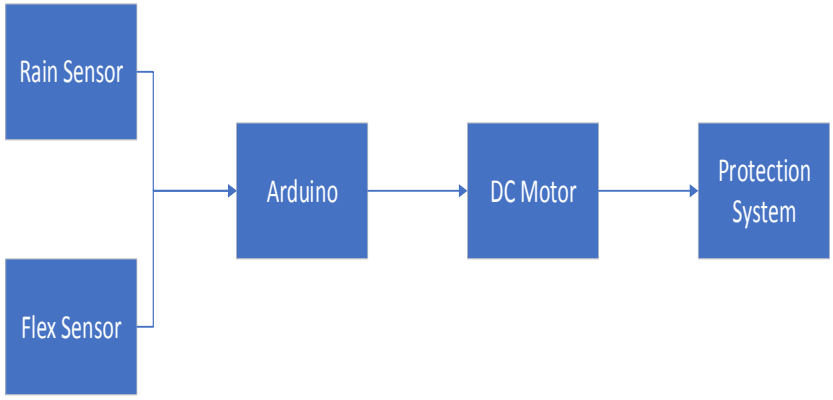

Figure 1 Block diagram of proposed system

2.1 Flow Process of Proposed System

The rain and flex sensors are activated due to the rain and air. The output electrical signals are connected to Arduino through a proper signal conditioning circuit. If both sensor output is high or any sensor output is high, the controller activates the protection system to close the crop field; otherwise, the protection system is open. Also, during the protection system opening completely rolled and placed at the sides of the field area without disturbing the crop. Figure 2 shows Flow process of proposed system.

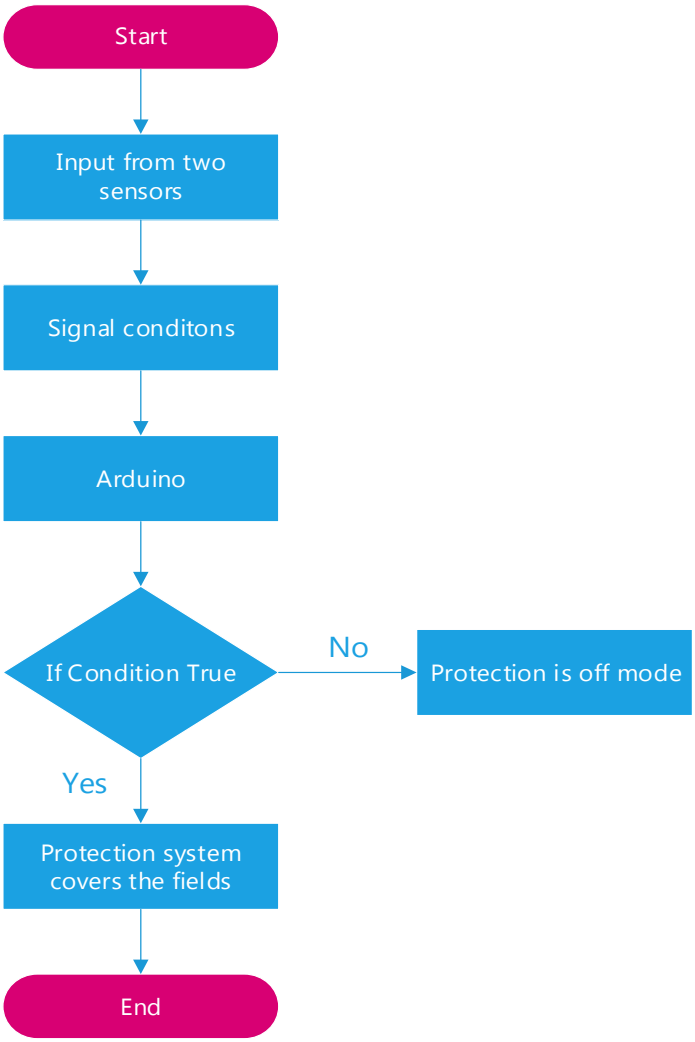

Figure 2 Flow process of proposed system

3 Implementation

3.1 Rain Sensor

A device that is activated when rain occurs is called a rain sensor. When a little amount of water is dropped on the sensor, the digital output becomes high and activates Arduino's input. Here the raindrops are reached through the rain sensor from the rain measuring tank. If the tank attained a rainwater level of 15cm (for prototype purpose), the tank releases the raindrops on the rain

sensor, and the sensor gives the High (1) input signal to the Arduino. The tank is greater than or equal to15cm depending on rain, and the raindrops continuously fall on the sensor. If the is less than 15cm, no raindrops are falling on the rain sensor, and the output of the rain sensor is Low (0). The brushes are connected to the rain sensor to remove the rainwater if rain is stopped [2]. Figure 3 shows Rain sensor.

Figure 3 Rain sensor

3.2 Flex Sensor

The flex sensor is made of copper foil, and it is working on the principle of bending. The change in resistance will depend on the angle of the flex sensor. By connecting, external resistance to the flex sensor will be forming a voltage divider circuit. This voltage divider circuit produces an electrical signal depending upon the bending angle of the flex sensor [3]. If air force is increasing in fields, the flex sensor's bending angle is also increasing, and related output electrical signal is connected to the input of Arduino. Figure 4 shows Flex sensor.

Figure 4 Flex sensor

3.3 Arduino

The supported hardware Atmega328 arduino board has been used in this application. It has 14 digital input/output pins: out of which 6 pins are often used as PWM outputs, 6 pins are for antilog inputs, uses onboard 16 MHz quartz oscillator, an ICSP header, a power jack, a USB connection, and a push- button. It includes the whole thing required to improve the

microcontroller; connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to urge started. Arduino Uno has open-source software which is available, so it is quite easy to implement control logic on this microcontroller board [4]. Figure 5 shows Arduino board.

Figure 5 Arduino board

3.4 DC Servo Motors

DC servo motors are apt for wide range of speed control and adjustable speed drives [5]. By applying a Servo motor, the protection system(roof) automatically covers the crop area during the rain or air and both. If the absence of rain and air, the servo motor drives to opens the protection system. Figure 6 shows DC Servo Motor.

Figure 6 DC Servo Motor

3.5 Tact switches

Tact switch is a mechanical type and also called as limit switch. The main components of tact switch are Actuator or operating head and normally open normally closed output contacts. The position of tact switch can be changed by changing the shape of the movable plate which is attached to the operating head [6]. Initially no pressure is applied on the operating head of tact switch and the motor runs as usual. When the pressure is applied on the

operating head of tact switch then the electrical contact of motor is disconnected and motor stops running.

For the implantation of experimental setup, two tact switches are used control the two DC servo motors operation. The protection system covers the crop field by the application of two DC servo motors. When the protection system reached to the tact switch, due to the pressure of protection system the tact switch disconnects the DC servo motor connection through the Arduino. Figure 7 shows Tact Switch. Table 1 provides Status of motor based on tact switch position.

Table 1 Status of motor based on tact switch position

Mode	Tact Switch Position	Motor Status
No Pressure applied	Normally open	ON
Pressure applied	Normally Closed	OFF

Figure 7 Tact Switch

3.6 Motor Driver

The L293D is a 16-pin Motor Driver IC used to control a set of two DC servo motors simultaneously in any direction. This prototype requires four DC servo motors to drive the dome-shaped mechanical arrangement.

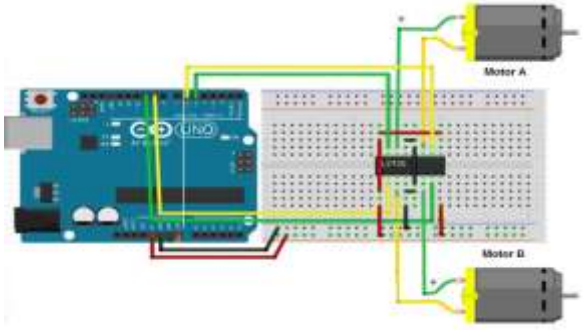

Figure 8 DC Servo Motors connected to Arduino

3.7 Protection Roof

The Roof is made up of either foldable and high-quality plastic material or non-corrosive metal. The folded roof is initially placed at the two sides of farm area and the sensors output is activated the roof slowly covers the entire farm. The movement of roof is driven by DC servo motors. In experimental setup, domed shape is suggested but the roof preparation is depending on dimensions (Like Height) of the crop. Domed shape is suggestable for wheat crop, rice crop, peanuts crop, etc.

3.8 Water Collection Pipes

Water collection pipes are used to collect the rain water from roof and send to the well for water recycling purpose. Figure 8 shows DC Servo Motors connected to Arduino.

4 Results

The dome-shaped field protection arrangement is mainly depending on the input signals of rain and flex sensors. Arduino drives the dome-shaped protection system depending on the sensor's input signals during heavy rain and air. The table describes different protection systems based on sensors signal, which is activated both or individually based on the rain and air conditions. By implementing this protection system, the crop is protected from unseasonal rains, storms, and heavy air. So, there is no crop loss for the former. This system is applicable not only open fields but also for greenhouse and organic farms. Table 2 gives detail about Sensors signals and protection system.Figure 9 shows Protecting the field by closing dome shaped protection system. Figure 10 shows protected the field by domed shape. Figure 11 shows Without of rain and air

Table 2 Sensors signals and protection system

Rain sensor output signal	Flex Sensor output signal	Condition of protection System
Low	Low	OFF
Low	High	ON
High	Low	ON
High	High	ON

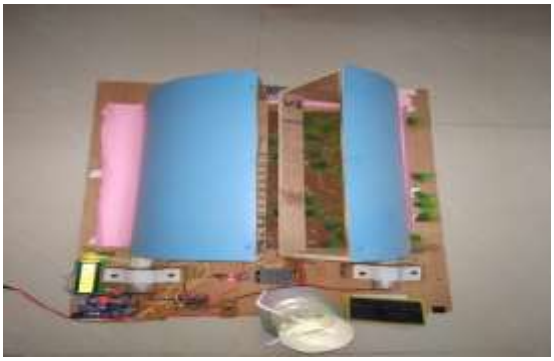

Figure 9 Protecting the field by closing dome shaped protection system.

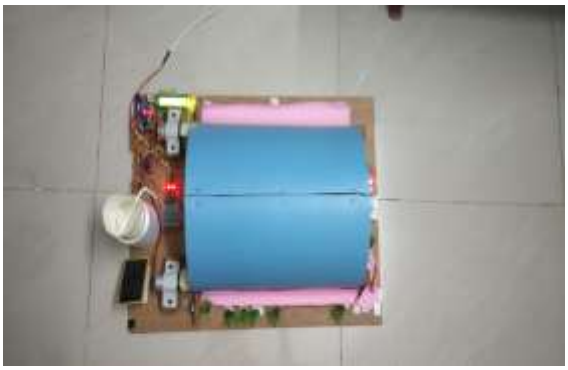

Figure 10 Protected the field by domed shape

Figure 11 Without of rain and air

5 Conclusion

By implementing this prototype in real-time fields, crop production output increases, and spoilage of crop is reduced due to the unseasonal rains and unexpected stream of air. So, the revenue of the country is increasing in agriculture-based countries. This method is not suitable for flooded areas. This system is also protecting from the swarm of locusts.

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