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# DESIGN AND IMPLEMENTATION OF AN INTELLIGENT SYSTEM FOR CROP PROTECTION

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**Abstract**: Agriculture is the most important sector of our Indian economy. It plays a vital role as India exports a large quantity of agriculture materials like fruits, vegetables, pulses, spices etc. The proposed system is basically on crop protection based on environmental changes like high rainfall, high temperature and air quality as well from wild animals. In cases like unexpected heavy rainfall or high temperature protective shield is provided by which field is covered by the sheets provided for protection of crops. This shield is also provided by solar panels which helps in power generation during high temperature. This generated power is stored using battery for effective use of power. The proposed system results in complete crop protection in all the conditions by using modernization techniques like protection by environmental changes and animal attacks using sensors with buzzer, water supply control based on pH level in soil, and power generation through solar panels. Any change in these above factors results in crop loss in turn which effects our economy. Hence proper measures should be taken for protecting crops by these environmental changes for economic growth. Sensors collect the data and is passed on to microcontroller which processes data and the crop condition is intimated to farmers by SMS through GSM applications.

**Keywords:** Agriculture, ARM controller, Sensors, GSM.

## I. INTRODUCTION

Farmers have lack of knowledge about climate variations, Wild animals often destroy standing crops, due to which annual production of crops reduces thus causing economic losses to farmers. Farmer suicide is a big problem due to low productivity among farms. This low productivity is because of two main reasons, Crop destroyed by wild animals and Crop destroyed by climate variations**.** Automatic rain protected drying sheds are to be developed to protect the crops from heavy rain which is demonstrated in [1]. The rain sensor and soil moisture sensor is used to prevent the crops from the heavy rain and save the rain water for the working of automatic roof. This system protects the crops by the auto roof which covers the whole field is demonstrated in [2]. The animals from the wild area are continuously attacking to crop from so many years and the protection of this crop field from wild animals is the serious issue. The wild animals face the shortage of water and food due to which they move towards the agriculture area which creates great loss to the crops and annual income

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of farmers, when wild animals enter a farm there is a need for an alert system to prevent crops from damages from wild animals. The technical solution is given to the farmers by using wireless sensor network (WSN) and Internet of Things (IOT). This paper [3] focuses on algorithm to detect the presence of animals near the crop. Crops are protected from wild animals by using the raspberry pi and GSM is demonstrated in [4]. The traditional way of water supply through the ground channels result in wastage of water and also insufficient absorption by the crops. To prevent this, they have introduced the usage of sprinklers-based water flow management system in the fields. Sprinklers ensure quick absorption of required water by upper region of the crop. There by avoiding the soil erosion due to excess of water flow [5].The actual concept of proposed system is crop protection. In this proposed system, various sensors are used prevent the spoilage of crops from environmental variations. This is achieved with embedded system design using GSM technology. Sensor deployed at various position in field detects changes in environment and passes these data. If any changes are detected, farmers are informed through mobile applications by which further needed action could be performed. This proposed system also can make use of renewable energy sources drawn from solar panel which is fixed on foam sheet. The solar power generated from the solar panel can be used as an alternative power supply instead of external power supply

## II. PROPOSED APPROACH

The system helps in prevention of spoilage of crops due to heavy rain and high temperature. This is achieved with ARM LPC2148 Microcontroller using GSM technology. The actual concept in this project is, depending on the climate variation, sensors like pH, temperature, air or dust, rain, soil moisture will detect the changes and take the decision to protect the crop by opening and closing the foam sheet through dc motor, and send the alerts to the user through GSM. This proposed system also protects the crops from wild animal attack by giving a large beep sound as an alert to the farmer. Water pump is used to supply the water for the crops depending on the soil moisture content and pH level of land. This system uses renewable energy source. Solar power that is generated from solar panel as the alternative power source to this system. Thus the proposed system will be used as economic gain to the farmers.

## III. SYSTEM ARCHITECTURE

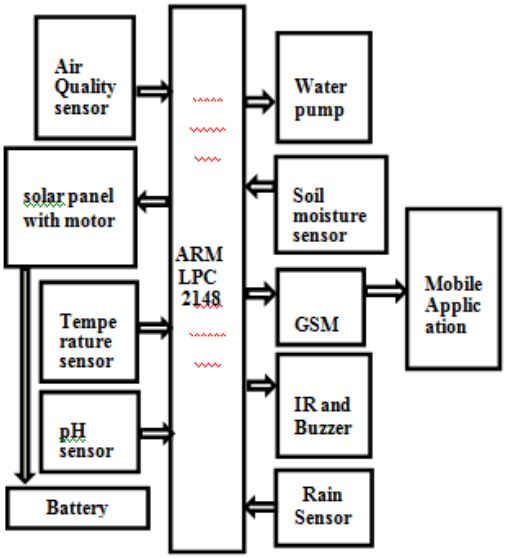


**Fig 1: Basic Block diagram for crop protection**

Figure1 shows the basic block diagram for crop protection. Various sensors like rain, soil moisture, pH, temperature, air quality are given as inputs to the ARM LPC 2148. The outputs of ARM LPC2148 are given as input to the water pump, IR and Buzzer,

solar panel with motors and GSM. The data collected from soil moisture and pH sensors are verified with the threshold values. If moisture level and pH is low, then the system switches on a water pump to provide water to the crop. Water pump gets automatically off when system finds enough moisture content and pH level in the soil and a message is sent to the user through GSM and updating the status of water pump, pH and soil moisture. When there is a rainfall, then the proposed system automatically closes the foam sheet. Likewise other sensors the temperature sensor will detect the temperature level and sent the data as input to ARM LPC2148, then the collected data is verified with threshold value. If the temperature is above the threshold value then the foam sheet will get automatically closed. The object sensor uses buzzer will give an alert to the farmer to avoid wild animal attack. Here solar panels are installed on foam sheets the solar power generated from solar panel can be used as an alternative power supply to the proposed system. All these actions are monitored using sensors and sending the status to the farmers using GSM.

The following hardware components are implemented to design the proposed system.

1. ARM LPC2148 Microcontroller:

   The LPC2148 microcontroller is a 16-bit/32-bit ARM7TDMI-S CPU with embedded trace support and real-time emulation. The microcontroller has high speed flash memory ranging from 32 kB to 512 kB. It has 32 bit timer, 10 bit ADC, 10 bit DAC and PWM channels.

2. Solar Panel:

   A solar panel converts solar light energy into electricity using photovoltaic effect. They are placed on the foam sheets for generation of electricity, this electricity produced which in turn can be used for various applications of this proposed system and can be stored for external purpose.

3. Air quality sensor:

   Air or dust quality sensor (MQ135) is a Semiconductor Sensor and it has Sensitive material SnO2 (stannic oxide). This proposed system has a high sensitivity and detects harmful gases. Voltage range is 5V AC or DC.

4. Temperature sensor:

   A temperature sensor detects the amount of heat in the atmosphere. In this proposed system, LM35 temperature sensor provides measurement of temperature through electric signal.

5. Soil moisture sensor:

   Soil moisture sensor measures the level of water content in soil. In this system the sensor output will be logic HIGH/LOW when the water content is higher/lower than the threshold value.

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6. Buzzer:

A Buzzer is an audio signalling device. Buzzers are used in alarm devices and timer. It works on the principle of magnetic buzzers. In this proposed system it makes a beep sound when the wild animals enter near the crops.

7. DC Motor:

A DC motor converts direct current electrical energy into mechanical energy. The proposed system uses the DC motor for opening and closing of Foam sheets.

8. LCD display:

LCD is a liquid crystal display. It uses the light modulating properties of liquid crystals and display as electronic visual panel.

9. GSM: The GSM unit in the proposed system connects to the mobile application by sending and receiving SMS message. Further GSM can also receive voice calls by using an external speaker and microphone.

The following Software is used to design the proposed system.

Keil MicroVision 4: It is a combination of computer hardware and software which does a particular task like displaying message on LCD. It also enables source code editing and program debugging. It converts the high level language into object code. Embedded C/C++ programming language are used. It is very easy to use and can accelerates the Embedded software development. It is designed to solve the complex problems facing by software developers. It offers numerous features and advantages that helps quickly and successfully to develop embedded applications. They are guaranteed to achieve design goals.

## IV. EXPERIMENTAL RESULTS

This session explain the results obtained through the proposed system like object detection, rain detection, soil pH detection, temperature detection and solar panel installation on foam sheet.


**Fig 2: Object detection output display on LCD screen.**

The figure2 shows the result object detected. When any animal has entered the agricultural field. The buzzer and IR will detect the presence of animal and sends the signal to the microcontroller LPC2148. Therefore, the buzzer will give a large beep sound to divert the animal and the results as the object detected on LCD screen.


**Fig 3: Rain detection output display on LCD screen.**

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The figure3 shows the result raining is shown above, when the rain sensor detects the rain, sensor sends the input signal to the microcontroller LPC2148. The result rainfall will be displayed on LCD screen. In case of heavy rainfall which is not required for the crops then foam sheet is intimated by the DC motor covers the field in order to protect the crops. If there is no rainfall then the foam sheet will remains open.

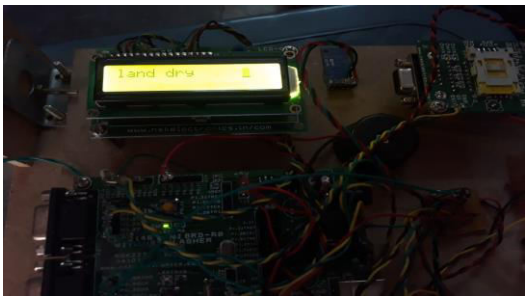


**Fig 4: Soil pH detection output display on LCD screen.**

The soil moisture sensor and pH meter measures the moisture level of the soil, the result land dry will be displayed on the LCD screen shown in figure 4. If the pH level is acidic then the result will be displayed as land dry on LCD screen. The system automatically switch on the water pump until the land gets wet. If the water content of the soil is low then the result land dry is displayed on the LCD screen. If the water content of the soil is enough sufficient to crops then the result land wet is displayed on the LCD.

**Fig 5: Temperature detection output display on LCD screen.**

The figure5 shows the result temperature 32.58 is displayed when the temperature sensor detects the temperature level and the input signal is sent to microcontroller LPC2148, the result temperature level (ex: - Temperature 32.58 as shown in figure 5) will be displayed on LCD screen. However, if the temperature level is beyond the threshold value that is above 36 degree Fahrenheit, then the foam sheet will automatically get closed there by protecting the crops from very high temperature. If the temperature level is either in between 26f to 36f or below 26f, the foam sheet will remain open.

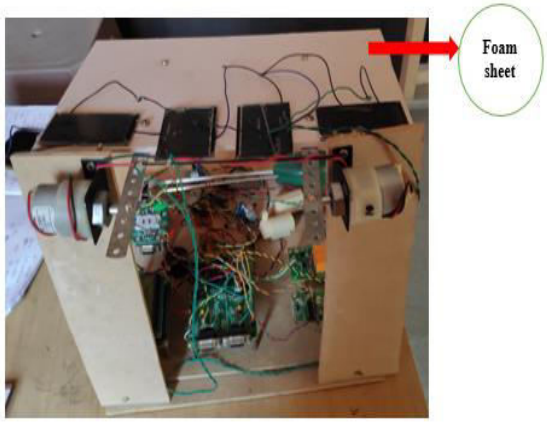


**Fig 6: Solar panel installation on foam sheet and DC motor Used for opening and closing of the foam sheets.**

The figure 6 represents the installation of Solar panel on the foam sheet intimated by the DC motor which covers the field in order to protect the crops by heavy rainfall and high temperature. Solar panel used to generate the electricity which can be used as an alternative power supply to this proposed system.

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The table1 shows the threshold values of Temperature sensor, pH sensor, and Soil moisture sensor to compare these threshold values with real time values.

| Sl. No. | Components | Threshold Values | |
|---|---|---|---|
| 01 | Temperature | $26^0$F | $36^0$F |
| 02 | Soil moisture | 150 | 250 |
| 03 | pH value | 0 | 14 |

Table1: Threshold values

## V. CONCLUSION

The proposed system has enabled the crop monitoring easily and very efficiently to enhance the crop productivity and thus profits the farmer. ARM LPC2148, programmable software keil MicroVision 4 and sensors are used to collect the information of environmental changes and crop conditions. This information is transmitted to the farmers through GSM network that come out with corrective action. Farmers will have the knowledge of the agricultural crop conditions at anytime and anywhere in the world. By using this project thousands of hectares of agricultural field can be protected from heavy rainfall and also wastage of water can be controlled by monitoring temperature level and soil moisture level. The rate of crop production can be increased by which the economic standards of the farmer can also be improved. The shield is provided by solar panels which helps in power generation during high temperature. This generated power is stored for effective reutilization of power.

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