Crop Protection and Animal Intrusion Detection System

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Abstract: Producing food maybe the ultimate requirement but protecting the farmland is also equally important. There are numerous reports of occurrences about animals attacking crops in various parts of the world. They can damage the plants by feeding on plant parts or simply by running over the field and trampling over the crops. This causes huge losses to farmers. Another aspect to consider is that crop protection from wild animals requires a particularly cautious approach. In other words, while protecting the crops, every farmer should be aware and take into consideration the fact that animals are living beings and need to be protected from any potential suffering.

Index Terms - **IoT Technology, Arduino, Sensors, H-bridge, DC motor and Python.**

I. INTRODUCTION

In India agriculture is playing a major role. In other words, farmer is the main backbone of our country. More than 50% of Indians are depending on the agriculture. But the farmers of India face many problems as per the crops. Among those the farming lands that are nearer to the forests were facing problem of attack of wild animals on the crops.

Crop Protection and Animal Intrusion Detection System is implemented for the protection of crops and to prevent the entry of animals into the fields. The purpose is to prevent the damage of crops due to heavy rainfall and extreme weather conditions, rainwater harvesting, to protect the crops against animals, detect the intrusion of the animal and taking suitable actions and notification will be sent to the farm owner and forest officials using GSM.

Our main aim is to detect and prevent wild animal attack on the farming lands, villages nearer the forest areas.

II. LITERATURE SURVEY

The literature surveyed some different papers to get information about the existing work which have been done.
Rakhee Patil et,.al introduced a concept Embedded System design using IoT Technology usage of two sensors: a) Moisture sensor b)Rain sensor and also involves Rain water harvesting. The observations are Conservation of Energy and water pump, GSM Module. [1]

R Balathandapani et,.al have detailed about Embedded System design using IoT Technology PIC16F877A micro controller and Rainwater harvesting, Remote access concept. Limitations are Program memory is not accessible and Programs are lengthy. [2]

P. Goutham Goud, et,.al proposed" Rain Sensor automatically controlled drying shed for crop yield farms" an Automatic Crop Protection using Micro controller unit, DC Motor and Rain sensor. In this Conservation of energy is not possible. [3]

Nirit Datta et,.al introduced concept of Automatic tracking and alert system using GSM and GPS technology. But this Implemented only in National Parks and Wild life Sanctuaries. [4]

Sachin Umesh Sharma et,.al explains a simple and a low-cost approach for automatic animal detection on highways for preventing animal-vehicle collision using computer vision techniques are proposed. A method for finding the distance of the animal in real-world units from the camera mounted vehicle is also proposed. The proposed system is trained on more than 2200 images consisting of positive and negatives images and tested on various video clips of animals on highways with varying vehicle speed. As per the two-second rule, vehicle speed animal gets detected correctly; the driver does not get enough time to prevent a collision. An overall accuracy of almost 82.5% is achieved regarding detection using our proposed method. [5]
Dr. P Uma Maheshwari et,.al proposed a system called "Animal Intrusion Detection System Using Wireless Sensor Networks" includes Bird Intrusion using Wireless Sensor and Buzzer but implemented only for birds. [6]

III. PROBLEM FORMULATION

There is no protection for crops against heavy rainfall and excess heat as a result it reduces the plant growth and yield. Also, to protect the crops against animals.

IV. SYSTEM REQUIREMENTS

HARWARE:

1. Arduino Uno: The Arduino Uno is a microcontroller board based on the ATmega328.
   Features:
   - •14 digital input/output pins.
   - • 6 can be used as PWM outputs.
   - • A 16MHz ceramic resonator.
   - • An ICSP header, a USB connection.
   - • 6 analog inputs.
   - • A power jack and a reset button.
2. Water Pump: The motor is small, compact and light.
   Features:
   - • Operating DC Voltage: 2.5-6V.
   - • Flowrate: 80-120 L/H.
   - • Outer Diameter of Water Outlet:7.5mm/0.3.

3. Node MCU: Node MCU is a low-cost open source IoT platform. It initially included firmware which runs on the ESP8266 Wi-Fi SoC from Express if Systems, and hardware which was based on the ESP-12 module.

4. Moisture Sensor: The Moisture Sensor uses capacitance to measure dielectric permittivity of the surrounding medium.

5. Temperature Sensor(LM35): LM35 is a temperature measuring device having an analog output voltage proportional to the temperature. It provides output voltage in Centigrade(Celsius).

6. Rain Sensor: A rain sensor or rain switch is a switching device activated by rainfall.

7. DC Motor: A DC motor is any of a class of rotary electrical motors that converts direct current electrical energy into mechanical energy.

8. H-Bridge(L293D): L293D IC is a typical Motor Driver IC which allows the DC motor to drive in any direction.

9. LCD (16x2): A 16x2 LCD display is very basic module and display 16 characters per line and there are 2 such lines.

10. Lithium ion Battery: A battery is a device consisting of one or more electrochemical cells with external connections for powering electrical devices.

11. IR Sensor: An infrared sensor is an electronic instrument that is used to sense certain characteristics of its surroundings.

12. Solar Panel: Solar panels are used to convert light from the sun, which is composed of particles of energy called "photons", into electricity that can be used to power electrical loads.

13. Buck Boost: The buck–boost converter is a type of DC-DC converter that has an output voltage magnitude that is either greater than or less than the input voltage magnitude.

14. Push button: A push-button is a simple switch mechanism to control some aspect of a machine or a process.

15. Relay: Relays are switches that open and close circuits electromechanically or electronically.

SOFTWARE:

1. Arduino IDE.
2. Embedded C.
3. Python.

V. SYSTEM ARCHITECTURE

In case of heavy rainfall, the farmer will send a signal or a message to start the operations. As soon as the GSM module receives the signal using IC MAX232, the microcontroller is enabled.

The first operation of microcontroller is to activate the dc motor in such a way that it starts rotating in clockwise direction to cover the double coated polythene sheet over the crops. Hence the crop is been covered by the sheet and crop is protected. The required protection is fabricated by four adjustable poles which enables the adjustment of height.

System Block diagram
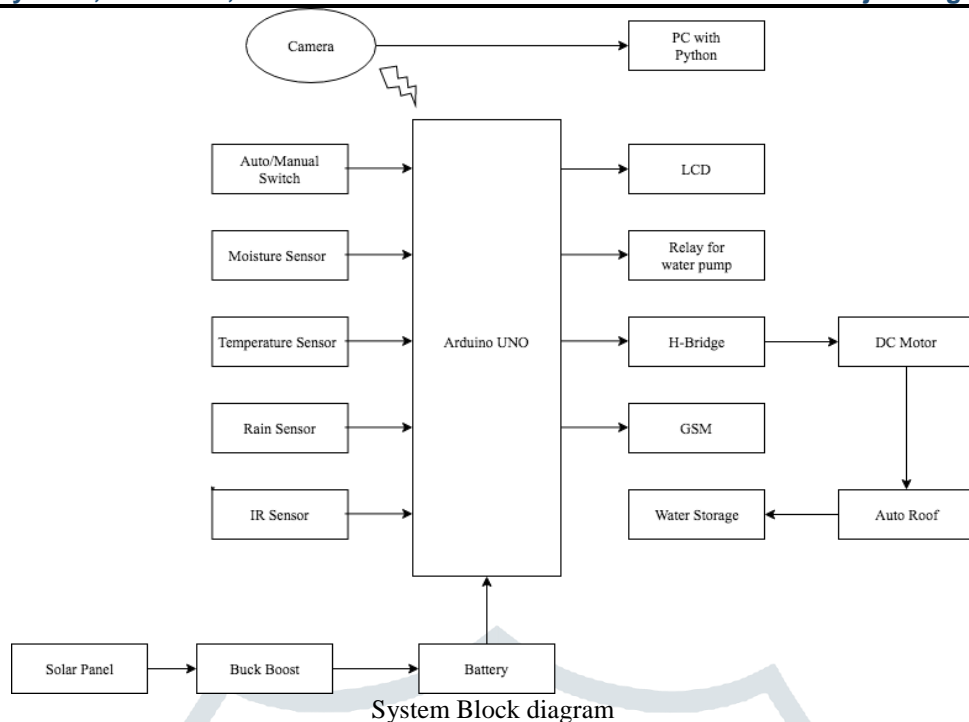
The microcontroller is used to control this operation using GSM technology which enables the farmer to control the operation from the remote place. Even system works in automated mode i.e. when farmer doesn't respond to the request from GSM, it checks the moisture content of the soil using moisture sensor and initiates appropriate action required to protect the crop.

VI. METHODOLOGY
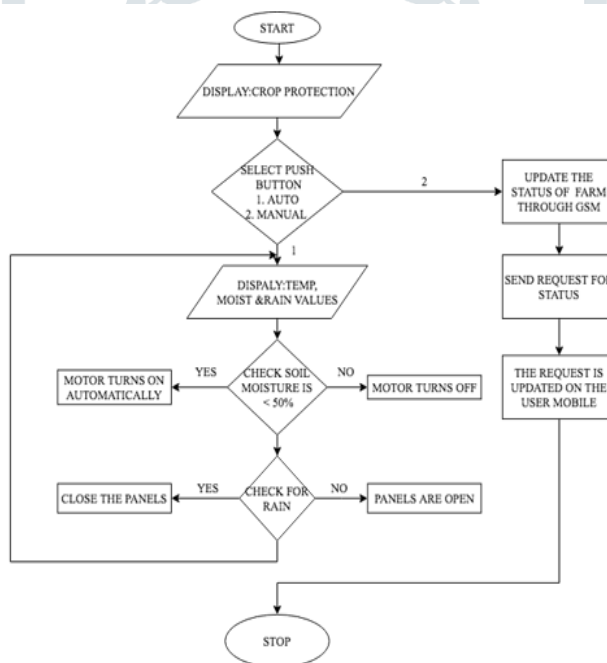
Crop Protection Flowchart

Above Flow chart explains the work flow of crop protection. It works both in auto and manual mode. IR Sensor and camera act as first round of security where the animal movement is detected using the sensor and the sensor in turn triggers the camera to take the picture of the animal. The image that is sent by the camera is received by the PC for classification of animal.

Database is created and the set of sample images are stored in it. The program consists of functions such as Index Image, Image Set and Retrieve Image. The Image Set is used to hold collection of images. Index Image is used to create an image search index. Index Image is used with the Retrieve Image function to search for images IR Sensors and camera act as first round of security where the animal movement is detected using the sensor and the sensor in turn triggers the camera to take the picture of the animal. The image that is sent by the camera is received by the PC for classification of animal. Database is created and the set of sample images are stored in it.
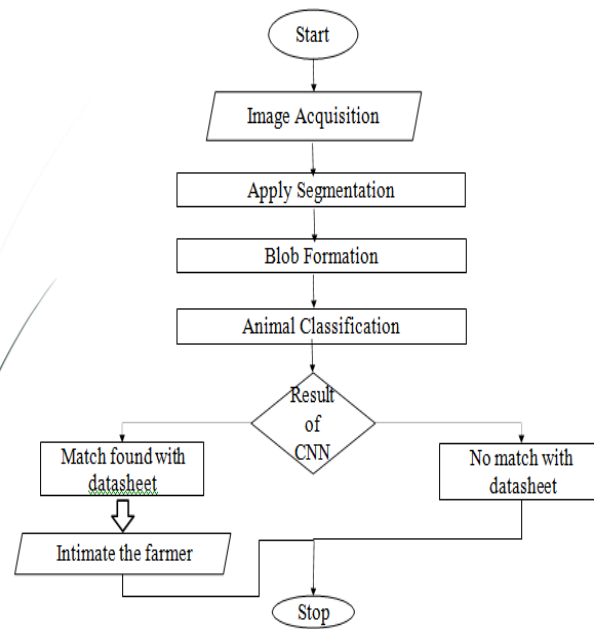
Animal Intrusion Flowchart

The value match range is from 0-1. If the value is 0, then the image is not matched. If it is 1, then the query image is same as that of the stored image. If the value is found between that of 0-1, then the query image falls under the category of the stored image i.e., the contents in the query image are same as that of the stored image.

If the name of the image matches with that of the regular expression of the image then the animal is elephant otherwise it is a leopard. If the score is in the range of 0.1 to 0.9, then the image is matched with that of the stored image. Once the wild animal is identified then then, a SMS is sent to the forest officials and also to the field owner as alert information. If the detected object is not a threat then no SMS is sent. By this way false alarm can be prevented.
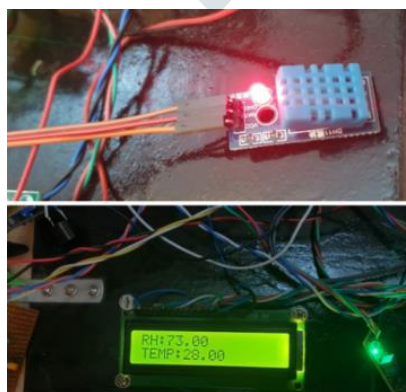
VII. RESULTS AND DISCUSSION
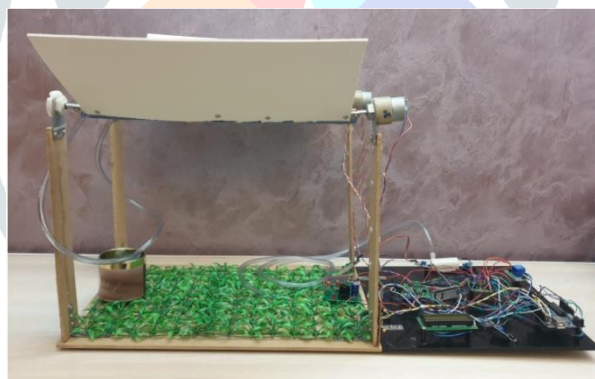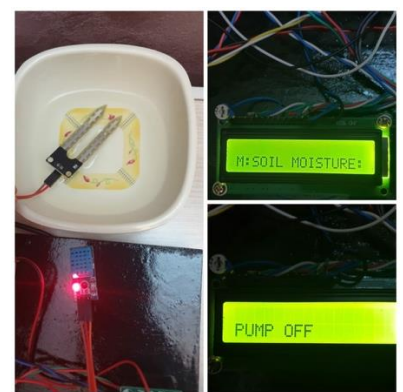

System Setup
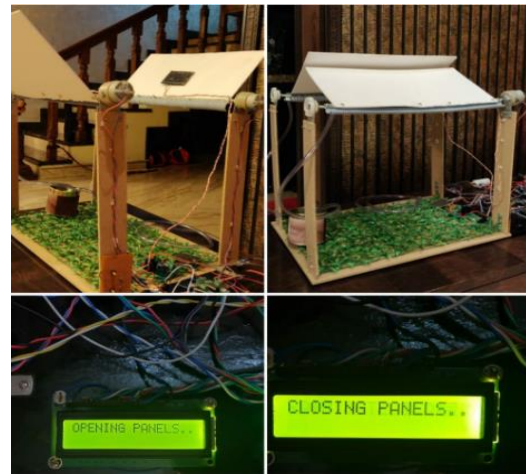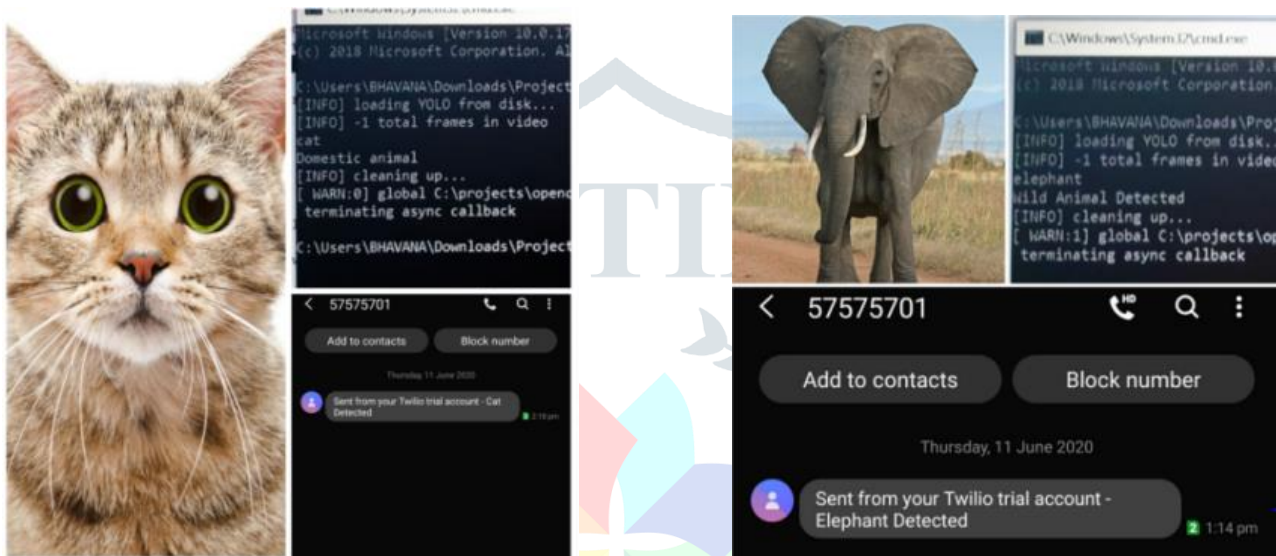

Mode Selection

Temperature Sensor

Moisture Sensor

Rain Sensor

Closing and Opening of Panels

Animal Detection

The system is low cost and also consumes less energy. Helpful to the farmers by protecting their fields and save them from financial losses.

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