IoT based Raspberry Pi Crop Vandalism Prevention system

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Abstract—Agriculture is a major source of food production in our country. Growth in population increase the demand for food production and agriculture is the main source. Irrigation in agriculture is an important process that affects the development of crops. In particular, farmers visit their agricultural fields regularly to check the level of soil moisture and water is pumped by motors to irrigate their respective fields on the basis of requirements. But the limitation of protecting crops from animals becomes a major concern for yield. This works presents the protection system in addition to the automated irrigation system.

I. INTRODUCTION

Existing irrigation systems can monitor the crop growth, supply of water and maintaining required temperature, moisture etc., Few systems were added with protection process but they exhibit certain limitation where only the neighbors will be warned in the system phase and there is no photo capture to locate for later. The proposed design is a security alarm system that is capable of monitoring isolated fields or home gardening. The camera and the other components are connected to the microcomputer which is turned on 24×7 for the whole day. The camera monitors the fields continually. The Raspberry Pi continually checks for motion in the field or orchard actin g as the system's brain. The raspberry pi tests for the presence of animals in the picture if any movement is observed in the area. This provides real-time field photos over the internet if any animal is detected, which can be accessed using a web browser on devices such as computers and mobile phones, and also alerts the nearby people via buzzer vibrations. The proposed system process by image capture involved in order to detect the animal and alert the farmer in the isolated far fields in hilly areas or at night times when animal vandalism is more

II. DESIGN OF PI BASED CROP PROTECTION SYSTEM

The design is made up of 4 major components: RaspberryPi, DHT11Sensor, Moisture Sensor, Camera.

Sensors placed in the soil type of soil sensed information. These sensors collect the data and thus directly pass the data to Raspberry Pi's control node. Raspberry Pi analyses the incoming data and compares the values with the built-in threshold value and transfers the information to the console request of the farmer.

The sensors are connected to raspberry pi and power supply is given. The raspberry pi reads the values from Sensors and posts the information to the cloud server. If the values are less than the already set threshold values, then the relay gets ON, and the relay switches ON the motor. The motor stays in ON condition till the factor that is less than the threshold value reaches the threshold value. When the threshold value is reached, the relay automatically switches off the motor.

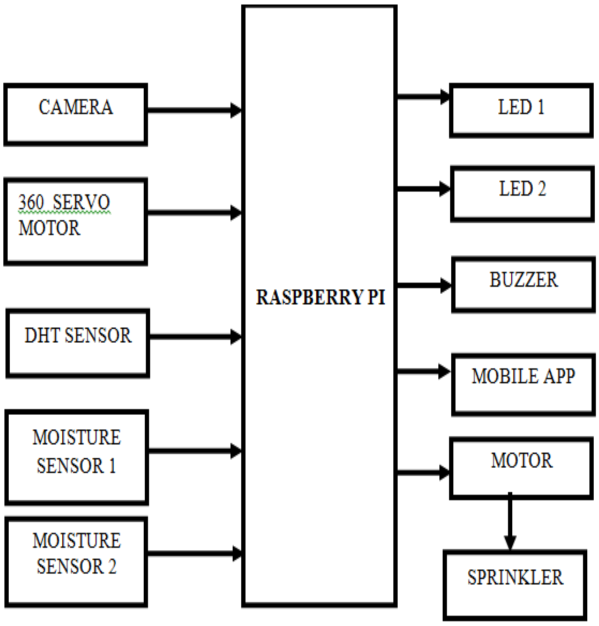

Fig.1 Crop Protection System

Fig.2. Sensors Setup

From this point on, it is our design approach that decides whether or not the engine needs to be autonomous or controlled by the farmer. This varies between situation and scenario.

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We are developing a small embedded system device ESD that looks after a whole irrigation cycle and makes life easier for farmers. As eyes of this ESD, the Raspberry Pi interfaced with several sensors such as temperature, humidity and humidity.

The farmer simply needs to send predefined commands to this ESD via notification from his / her mobile phone in order to effectively perform the irrigation operation. If and only if the ESD's eyes see all parameters within a safe range, the irrigation process starts with the Raspberry Pi starting the irrigation pump. Continuous sensor values are sent to our android app. Upon meeting the minimum price. Then the engine is automatically switched off or from our android app we can also turn on or off the engine. The farmer receives feedback from ESD from time to time through NOTIFICATION on Raspberry Pi's action. This new technology makes life easier for farmers by providing more powerful and easy irrigation system. Fully Automated Irrigation is presented in this work with motor access, which includes the number of sensor nodes placed in different farm field regions. The amount of soil moisture sensors used for testing in various directions of the farm fields is abstracted.

The moisture level is sensed by the sensor node in each direction of the field and the sensed data is transmitted to Raspberry Pi via wireless networking device. The controller node checks it with the required soil moisture value when receiving the sensor value.

If soil moisture is not up to the required level in a specific field, then the controller node switches on the motor to irrig ate the farm. All data and notification SMS are processed by the RASPBERRY-Pi to the registered mobile phone registered in RASPBERRY-Pi. The RASPBERRY-Pi monitors the current irrigation status with a screen and uses it to change the user setting required. For communication, the inventor of the MIT app is used.

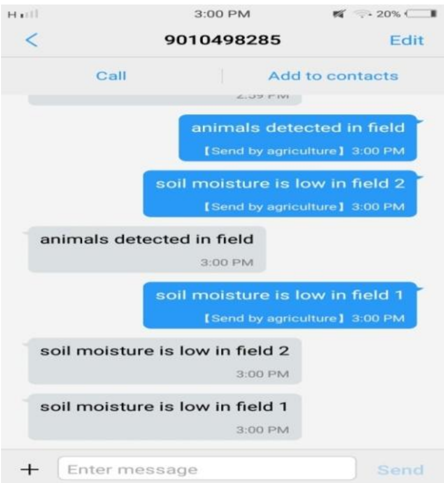

Fig. 3. Message Alert/Notification

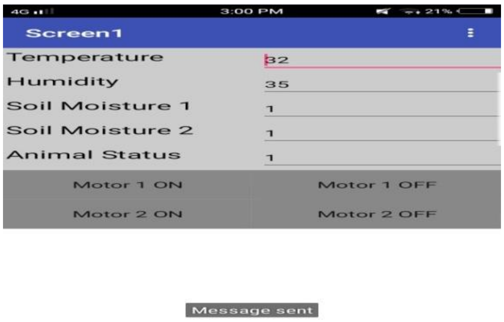

Fig.4. Mit App Invemntor Output

In the mobile app, if it indicates that soil moisture value is 1 then it means that there is no moisture content in the soil. Then, farmer i.e. user can manually turn on the motor in order to water the farm/crop. In the same way when the soil moisture value is 0 then it means that there is enough moisture content in the soil. Moisture sensors are used which are placed at different regions of the crop. Soil moisture sensors placed in the crop region will let us know the irrigation required regions as in below figure.

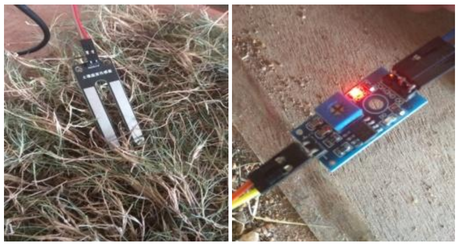

Fig.5. Soil Moisture Sensor placed in the crop

Along with above mentioned process, another sensor that is used to indicate the temperature and humidity values i.e. DHT11 sensor. This sensor is placed in the crop in order to predict the values of temperature and humidity.

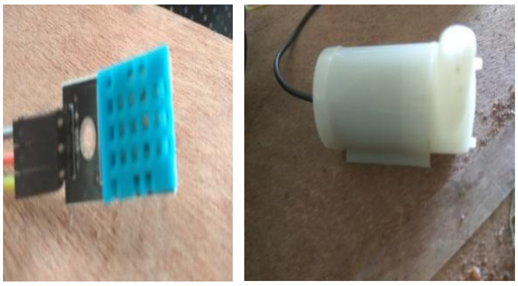

Fig.6. Dht11 Sensor & Motor

Along with the moisture values, temperature and humidity values are also sent to the mobile app used by farmer. With these indications farmer can turn on/off the motor based on these values in order to meet the basic requirements of the farm/crop.

III. PROCESSING OF IMAGES

The main part of this work deals with image processing done by Raspberry Pi. This work is designed considering two major problems faced by farmers in India. lack of power supply and crop vandalization by animals.

With recent trends and developing technologies, many solutions raised for the mentioned problems. The major component used for achieving this solution is Camera. This is connected to raspberry pi. This camera records the video of the crop continuously rotating 360 degrees with the help of servo motor which is also connected to the raspberry pi. With a delay of few seconds, camera is rotated in order to detect any animal present in crop. The camera is connected to raspberry-pi as shown in the figure 7.

Fig.7. Camera Connected To Raspberry Pi

In the process of recording video if there is any animal found, then the camera captures the image of the animal with accuracy and immediately sends the data to raspberry pi. Raspberry pi as soon as receiving the animal detection data, starts the buzzer for few seconds in order to make the animal go away from crop.

When the farmer is not available in crop or is travelling somewhere else. For the purpose of detecting the animal even in the night, LED lights are connected which shows the path to camera to record the video. These LEDs are made to ON with particular delay in regular intervals which accounts for efficient power consumption.

Along with the functionality of LEDs there is another functionality which is Buzzer. This buzzer will be operated depending on the detection of animal. If the animal is found in the crop then the buzzer will be made ON for few seconds to avoid the damage of crop by animals. The captured image of animal is observed in the output which shows the image of the animal detected along with that accuracy can also be seen in figure.8.

Fig.8. Image of animal detected

The accuracy is shown in terms of percentages. Along with the image the output is also displayed. These are the values of the sensors and image of the animal. As shown in fig.10 when an animal is detected the image is captured. The captured image then can be seen. Along with image an accuracy point is also shown which varies from 0 to 1. The accuracy is the percentage with which the animal is detected. Below table shows the list of values of accuracy.

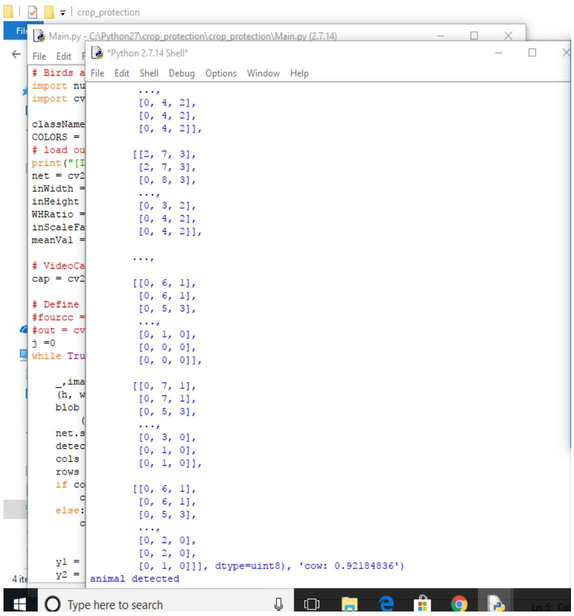

Fig.9. Output of Sensors

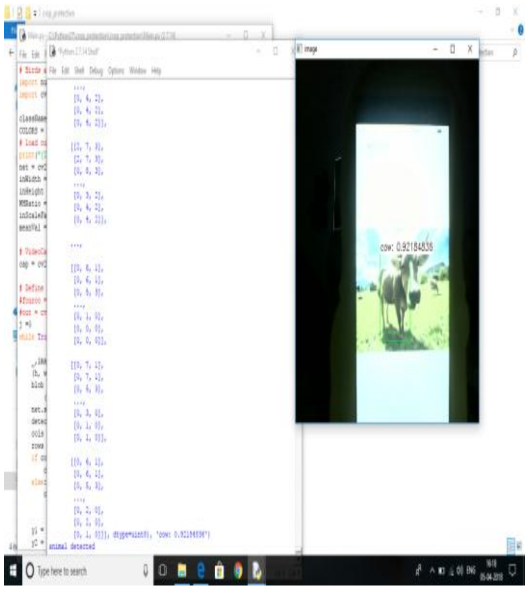

Fig.10. Animal Status

Table 1. Accuracy Values

ACCURACY POINT	ACCURACY PERCENTAGE
0.1	10%
0.35	35%

0.6789	67.89%
0.92	92%
1	100%

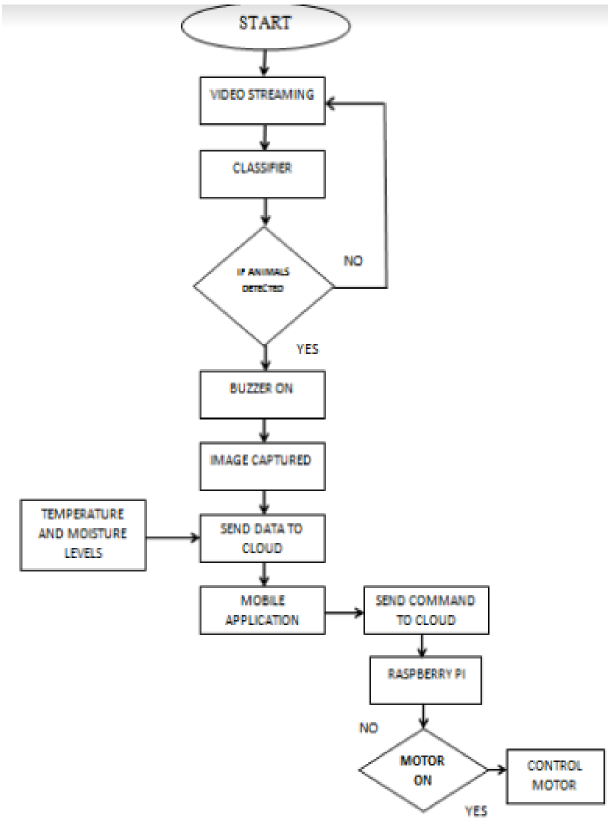

Fig.11. Flow chart

V. RESULTS

Mechanism is done such that soil moisture sensor electrodes are inserted in soil. The sensors give different values for different atmospheric conditions. Based on the values the motors are alerted. Table2. are the values of DHT11 sensor with which graph plots are drawn.

Temperature	Humidity
22	45
22	40
22	45
21	45
21	45
21	40
21	45
22	45
21	45

Table 2. Values Of Dht11 Sensor

Fig. 12. Temperature Measurement Chart

Fig. 13. Humidity Measurement Chart

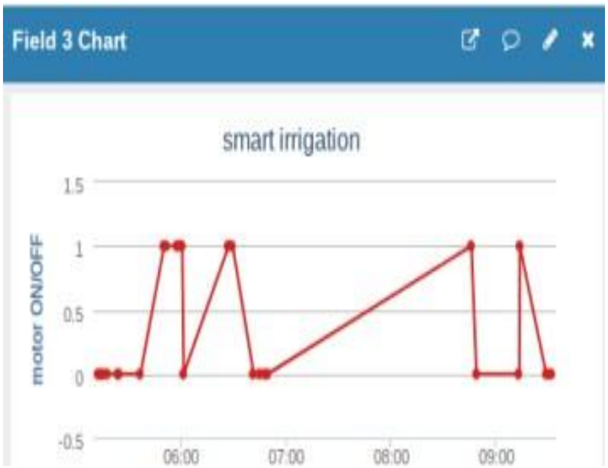

Fig. 14. Moisture Measurement Chart

The graph plots obtained by temperature, humidity and moisture sensors are shown in the above plots. The sensor values are sent to the farmer's smart device through which he can take over the control of the crop.

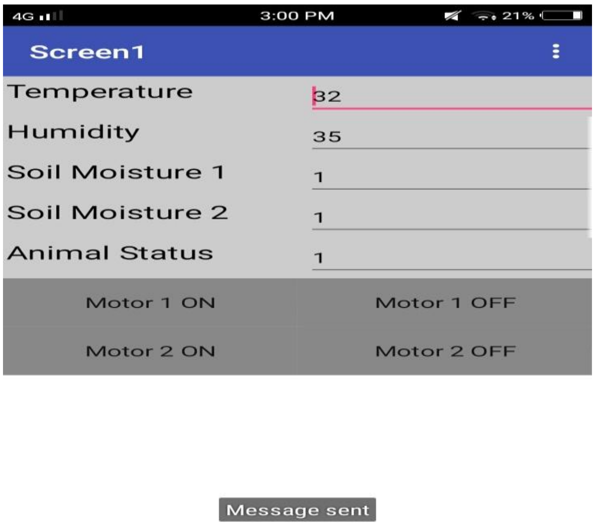

Fig. 15. Notification output

VI. CONCLUSION

Using this method, energy, resources can be saved to boost efficiency and eventually increase profit. The automated crop system is easy and with less cost to maximize the agricultural production of water resources.

This will provide control system with feedback that would effectively check the irrigation system efficiently. The main advantages of this device are the remote control of the irrigation pump, feedback facility to know the condition of the pump and the moisture level in the field, authentication facility to avoid unauthorized activity, standardized water distribution, prevention of waste water and electricity. This system is of great help to farmers whose irrigation pumps are far from home and workplace. This system is used in a remote area and the farmers have several advantages. Irrigation system is automated depending on the sensor Report the pump is operated by soil, rain and temperature conditions the water pump will operate and the data is communicated by wireless zigbee and the sensor readings are uploaded by Wi-Fi technology to the cloud network. Crop are protected from animal vandalism by using image processing and automation by alerting the farmer and taking a quicker action by raspberry pi by buzzer sound and throwing light to frighten the animal invasion and get them out of the field.

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