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MODERATE KNOWLEDGE BASED REAL TIME MONITORING FOR AGRICULTURE UTILIZING IOT

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ABSTRACT

The different climatic conditions of horticulture in India has become a difficult assignment. The advancement has accompanied wise Smart Farming IoT based gadgets intermittently might be step by step. The primary point of this paper is to propose a Smart IoT based framework for knowing the dirt boundaries like Soil Moisture, pH, Temperature. To settle on shrewd choice ranchers need data all through the whole homestead semester. An information-based model gives the examination of the dirt boundaries and chooses which weed is appropriate for a specific soil. This model additionally prepares the framework to give astute choices bases on the previous history. An item recognition is evaluated in the field by utilizing Pascal VOC. Here we recognize the creature which is ruining the field by eating or running in the field.

Keywords: IoT(Internet of Things), Soil Moisture, Knowledge System, Pascal VOC.

I. INTRODUCTION

The serious challenge to modern agriculture is climatic conditions. If we consider very past history, in India 70% of the crop was damaged due to cyclone at different times. Moreover the farmers especially in India are not well educated. They are now having knowledge to take proper decisions to make agriculture yield more. Rather they purely depend on past history or experience from others or themselves to spray the pesticides. Even few farmers don't know soil test. These techniques which farmers are using over centuries demand a large number manual labour and monitoring is compulsory. Over 11 Bilion dollars of revenue is lost due to crop damage every year [1]. Due to lack of effective supervision farm is unable to get optimal conditions. Previously authors who have done research in this domain they gave couldn't give solutions for our nations[2][3].

The frequent and rapid change in climate is experience by the farmers in India. In various parts of India rainfall is unpredicted and by which farmers are not having ample of time to make wise decisions to save from rainfall. Rapid change in the atmosphere is like a curse to the farmer where they are not able to withstand. Another issue with the farmers is that they keep on growing only one kind of crop every year. They doesn't do any kind of soil analysis and seed testing on particularity of soil. Firstly this proposed model is a hardware system which builds a solution to estimate the water present in the soil in real time, detects the humidity level, pH and temperature of the environment. We consider a threshold value Th_{val}, if the water in the soil or temperature is less than this Th_{val} the an SMS alert is sent to the farmer. A similar proposal by A. N. Arvindan et al [4] is proposed. With the help of the web application and/or Android app the farmer can monitor the crop. Secondly we can predict the type of the crop which are suitable for a particular soil conditions. This model ensures to provide minimalistic human intervention with best and accurate results.

IoT and Machine Learning algorithms plays a vital role in providing a novel solution to develop smart solution which is capable of automating different procedures like watering of crops to predicting the health of the crop. This model also predicts the type of crop is optimal for a particular type of soil along with the environment with the help of ML(Machine Learning). The farmer is also facilitated to control the devices like water pump set present in the farm staying global with the help of network access ie internet.

II. RELATED WORK

A- UAV-Based Crop and Weed Classification

Phillip et al [5] proposes a new use of low cost UAV system with vision-based classification for the segregation of essential crops from weed. The aim of this method is to prevent the unselective spread of pesticides and herbicides on crop spraying to provide quality. There are many methods to detect crop by taking the image of crop from a selectively masked out of background which include soil and other objects. There are 2 methods for vegetation mask which undergoes feature extraction. Object-based and Keypoint-based.

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B- Prediction and Soil Moisture Collection

By using SVM(Support Vector Machine) and RVM(Relevance Vector Machine) [7] Zhihao et al

Made a data driven methods to build framework for soil moisture. Using wireless sensor nodes data is collected and would be tested on Illinois historical data. The model also uses a particle drop for spraying pesticides. Figure 1 and 2 illustrated the normal methods and ML methods for spraying pesticides or herbicides.

Figure 1: This approach estimates the deposition of the particle (drop) using ML Techniques.

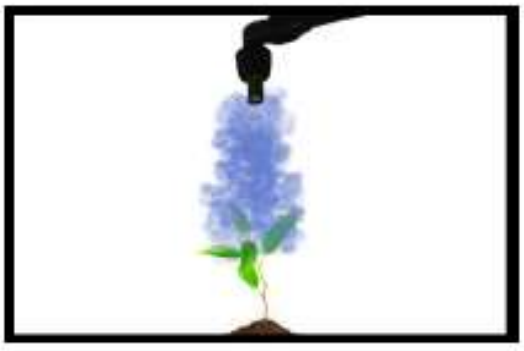

Figure 2: Calculation of movement and transformation of each pulverized particle (drop) until it reaches a stopping condition

III. IMPLEMENTATION AND COMPONENTS

This model consists of components like RaspberryPi, DHT11Sensor, Soil Moisture Sensor and temperature sensor. The block diagram is as follows.

Raspberry Pi

This is a low cost, credit-card sized computer. It can plug into a computer monitor or TV. We can use a standard keyboard and mouse. Using this computer, we can do small computing and perform network operations. We can have internet access and connected automation system.

Relay:

Relay is a switch operated electrically. It acts as a switch to control a device like motor by the circuit. It generated a low power signal.

DHT 11 Sensor:

The DHT11 is a basic low-cost digital temperature and humidity sensor. It sense out the digital value and hence we can give its output directly to data pin. This sensor generate temperature for every 2 seconds.

Soil Moisture Sensor:

This sensor measure the moisture in the soil. The water content in the soil. The model is assigned with a threshold value. If the moisture is less than the threshold value then a signal is passed to the relay to turn on the motor. The measured property and soil moisture is calibrated. Soil moisture is dependent on factor in environment like temperature, soil type and electric conductivity.

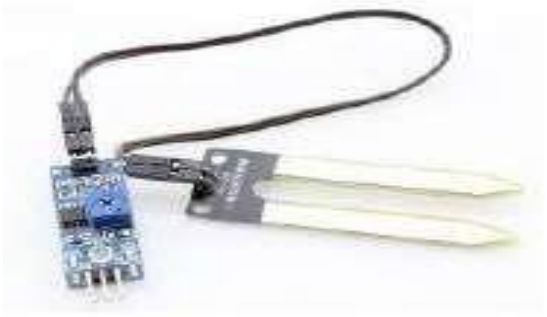

Figure 3 Soil Moisture Sensor.

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pH Sensor:

Sensor which provide pH value of the water in the soil. This is one of the parameter to test the soil.

Signal Convertor:

A signal convertor is used to convert the analog signals to digital. The sensors transmit the analog signals and these must be converted to digital signals so that Raspberry Pi can understand the signal and read data. If an Arduino is used board itself has an analog-to-digital converter.

Temperature Sensor:

The DS18B20 is a temperature sensor. This sensor provides 9 bit to 12 bit Celcius temperature measured. It can also alarm for a non volatile user programmable limits of upper and lower. Temperature measurement ranges from -55^{O}C to +125^{o}C.

Figure 4: Temperature Sensor

Bread Board Power Supply:

This is power module designed for breadboard. Compatible to 5V or 3.3V. Output Voltage is 5V and 3.3V. Max Output Current: <700mA. This is compatible for Arduiono, ARM, PIC, AVR.

Figure 5: Bread Board Power Supply

Cloud Database:

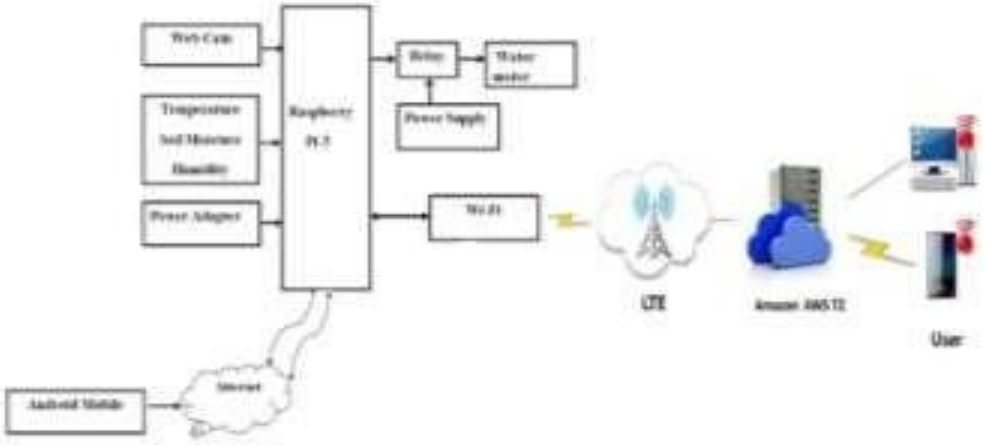
The web applications are deployed to server Amazon AWS T2.Micro EC2 instance[8]. This server is also treated as repository to store the data received. This strored data is used for analysis for prediction.

Software:

a: Python: Phython 3 or later version required to install on the server. We use python to train the machine for learning models.

b: PyCharm or Tensorflow: Tensorflow is an open-source machine library for learning. This is developed by the Google Brain Team.

IV. IMPLEMENTATION



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The point of implementation starts from sensing. Initially the Soil moisture sensor data is collected and if the soil moisture is less than Th_{val} through the relay signal by the Raspberry mother board send signal to the pump. The pump starts to pump water for moisture.

By using logistic regression based model we train the model using Tensorflow with the given dataset. Model is given with data for the parameters like Temperature, moisture and soil. The model predicts whether these conditions are optimal for the crop or not. By using SVM (Support Vector Model) [10] we also train the system with inputs parameters of current soil conditions and suggest the optimal plants for these soil conditions. This optimal plants are treated as output. We create anNumpy array for the sensor data to be stored. After every T seconds, data is sensed and it is transmitted to the cloud server. This data is analysed. We consider a constant seconds. is basedon the bandwidth of the network at the location of this model in the farm.

Images are captured from the webcam attached to the raspberry Pi with WIFI module. These images are also sent to the cloud database. The image data from the webcam is a 2 dimensional array of pixel and is a tuple of 3 values. These 3 values are to represent the intensity of red, green and blue colors in the range of 0 – 255. The given pixel in the image is accessible by treating image as array.

For this we have to provide a tuple of the x and y position of the pixel. We give image as input. The model gives list of regions (various scales) that are likely to contain objects. This is the idea to propose algorithms to filter the parts of the image not likely to contain object. Here we train the model for object detection performance using on Pascal VOC. We train the model with some images with animals like cows, buffalos, goats and birds. If the animals are traced after image processing an alert is made to the farmer in the form of SMS. Along with the SMS a buzzer is blow in order to chase the animals or birds. If the farmer is having enough knowledge to view the farm with the help of web application, he can see his farm live and detect the animals eating the crop.

Table 1: Sample code lines to represent pixels of an image

```
# get the value of the pixel at x position 120 and y position 64 in the
image pixel = my_image[120, 64]
# pixel is now a tuple of the red, green and blue of the requested pixel

# An alternative method
                    red, green, blue = my_image[120, 64]
# red, green and blue now contain the intensity of the red, green and
blue # channels respectively
```

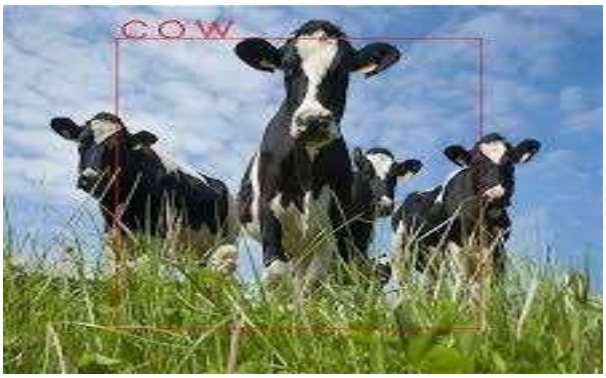

Figure 8 : Objection Detection Performance

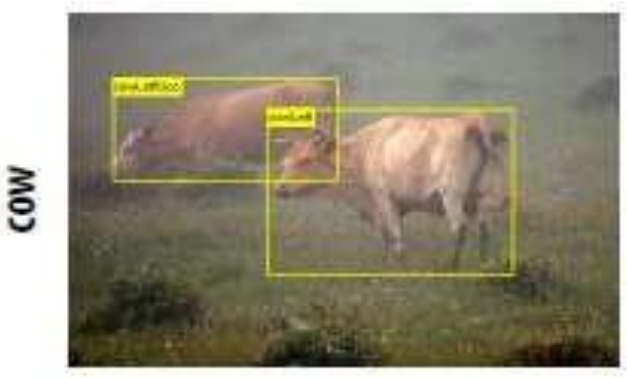

Figure 7: Objection Detection Performance for individual object

To take the sensor values as input a Logistic Regression(**LR**) model is taken for training. Once the data from sensors are given as input the LR to predict whether the crop is in optimal condition or not.

Based on the prediction, LR models even also the required features for the crop to be in optimal condition. The necessary steps are considered automatically. Eg like if moisture level is low, the water pump is turned on and water is pumped to the plants for enough moisture. When the system detects an abnormal condition, an SMS is sent to the farming to inform about the abnormal condition.

V. CONCLUSION

Agriculture farmers need help during growing crops in different states. Due to lack of guidance and experience most of the youth are not taking agriculture as their career. Main reason behind this is that farmers are suffering a lot financially, socially. Knowledge base is a structured with various crops. It tells us about knowledge acquisition. This paper ensures assistant to the farmers in increase of crop yield.

VI. FUTURE SCOPE

Here we have used webcam with low resolution and is fixed to a particular place. Here we are able to identify animals only the area around web camera. Further if we can implement with increase in number of cameras and with high resolution we can also capture the crop and classify the images and cluster. By which we can identify the virus or diseases with the crop. The healthiness of the crop also plays a vital role so health of the crop can be monitored by using high resolution web cameras.

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