FARMING ROBOT WITH PLANT HEALTH INDICATION

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Abstract : Agriculture field requires automation for increased need of making human efforts less. For fruits like strawberry we have experimented and proposed a farming robot which keeps record of plants health, environment conditions, efficient use of fertilizers and pesticides. The proposed Raspberry PI based automatic plant health indication system has automatic pesticide spraying mechanism for Strawberry plants. The amount of pesticide and fertilizer should spray on plant will be decided by system. The amount of pesticides is decided using Mobile camera for image capturing. The robot camera takes photos of plants one by one and send it to raspberry pi for image processing. Image processing is done using SURF algorithm which extracts the feature of leaves. After the image is processed it compares with database images which we have already stored in raspberry pi. Thus plant health detection is done automatically and spraying action is performed. For spraying mechanism, we are using two motors controlled by relays. Also spraying pesticides d on leaves is dependent on the height of the plants. We have observed that Our proposed system helps farmers by saving farmers time and wastage of fertilizers and pesticide. Due to ability of spraying correct amount of pesticides on plants, our proposed system offers advantage to ecosystem and health of mankind.

IndexTerms - ***Image processing, Farming Robot, SURF algorithm***

I. INTRODUCTION

In last decade in India, Particularly in Maharashtra state, land for agriculture is reducing due to rapid urbanization. There is urgent need to introduce revolutionary technological methods for getting more benefits to farmer. In our work presented here, we have introduced a method of identification of healthy plants of Strawberry and spraying right amount of pesticide only on unhealthy plant. Also, we have devised a scheme to find out plants with abnormal growth.

Particularly we have carried out visits to Strawberry farm in Mahabaleshwar, M.S, India. After visiting the fields we have observed that most of the plants are affected by diseases like leaf spot, leaf scorch. These diseases are very common and affects the plants growth and production.
The main motivation for this work is to devise a scheme to help farmers by saving farmers time and wastage of fertilizers and pesticides. Also, to devise a scheme for spraying correct amount of pesticides on plants. This proposed system is motivated of offering advantage to ecosystem and health of mankind.

Fig.1: Photo of "Leaf spot " On Strawberry leaf

Fig.2: Photo of "Leaf Scorch" on strawberry leaf

It was observed that, some of the plants remain shorter than other plants. So, we are working on providing fertilizers to this short heighted plants and spray pesticides on unhealthy plants.

II. LITERATURE SURVEY

In order to devise movable scheme that can provide fertilization and spraying of pesticide automatically to Strawberry field in Mahabaleshwar, M.S, India. We have done vast literature survey.

"Autonomous Robot Camera for Detecting the Leaf Diseases of Agricultural Plants using Image Theory Algorithm" [1] in this paper plant health detection and identification of the disease on leaves is implemented by finding the number of spot on leaf and the programming is done in Matlab. This is a very simple but effective method of detecting plant disease hence we are using the same method in our work but instead of Matlab we are using Python for programming.

"Autonomous Farming Robot with Plant Health Indication" [2] this paper mainly focused on smooth and steady working of robot in lined up farm. For implementation authors have used Ultrasonic rays, these sound wave identify different hurdles and stones in path. Fully functioning robot is the main idea presented in this paper and is proved to be very useful for removing all the difficulties.

"Intelligent Farming Robot for Plant Health Detection using Image Processing and Sensing Device" [3], this paper represents detailed information about image processing and detection of diseased plant.

III.IMPLEMENTATION

In order to devise movable fertilizer and pesticide mechanism we are suggesting following Hardware.

Hardware list includes Raspberry Pi3 B+ development kit, connecting cables, LCD, DC Motor driver IC, DC motor, Power Supply, Relays.
Proteus design of proposed system testing is as shown in following figure

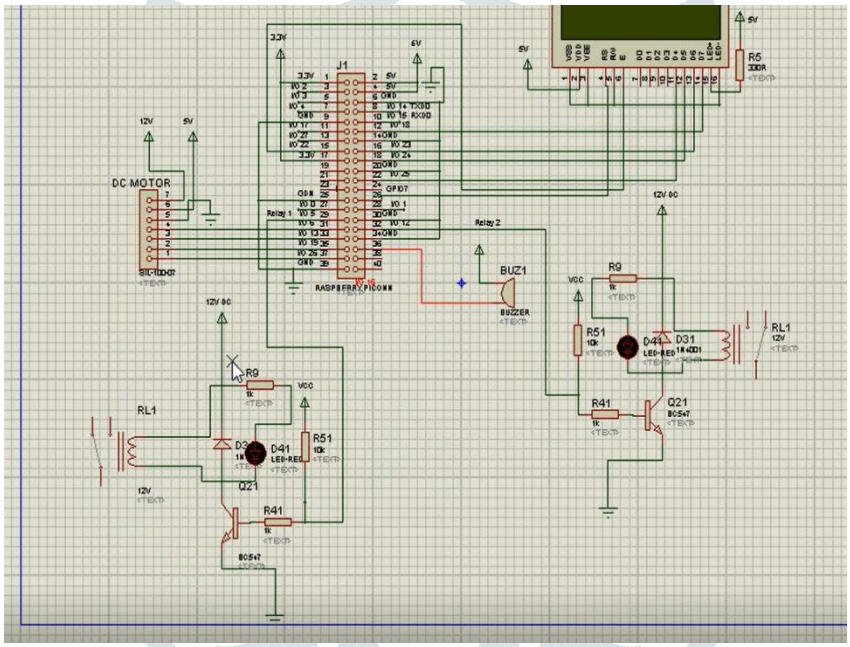

Fig 3: Proteus Design

a. Raspberry Pi 3B+

Raspberry Pi is a small computer for running games, image files, and documents.
It runs at 700MHZ with nearly 1GB RAM, with on board graphic card capabilities. Raspberry Pi 3B+ are considered one of the few low power consumption CPU's [7].
The basic layout of the Raspberry pi2 consist ofInput/Output, RAM,CPU/GPU,USB hub,Ethernet, HDMI Port.

b. LCD

The LCD used is 16 x 2 alphanumeric LCD. It

is a very basic module which overcomes the disadvantage of the seven-segment display as well as multi-segment LCD. It consists of command register to perform the user defined instructions and data register to display the data on LCD.

c. 3. DC Motor Driver

The L293D Motor drivers provide voltages ranging from 5V TO 36 V with output current of 1 A per channel. L293D provides bi directional currents and can be operated at temperature up to 70 degree Celsius.

d. 4. DC Motor

The speed of the motor can be changed by varying the voltage levels. Here the motor rotates in clockwise and anticlockwise direction at a speed of 10,000RPM, representing opening and closing of sprinkler for pesticides and fertilisers.

e. IP Webcam application

IP Webcam is free app for Android which allow to use your phone as IP Cam or network camera. Android app based application development is key point in this work. We have used wireless camera which takes images of plants from 3 or 4 different locations[2].

IV. SYSTEM DESIGN AND METHODOLOGY

The proposed block diagram is in following diagram.

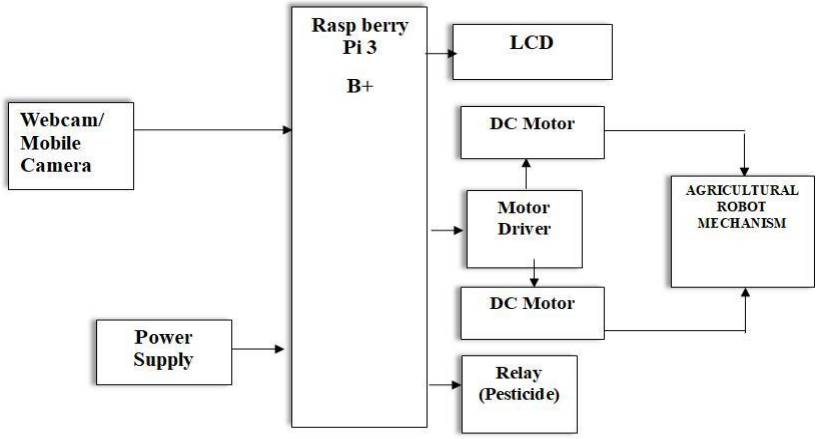

Fig 4. System design of Farming Robot with Plant Health Indication

Following photograph shows the setup we are using for the plant health related experimentation.

Fig 5 : Proposed Hardware setup for the plant health related experimentation.

V.METHODOLOGY

First the robot is started and moved across the rows of the field, the crops photos are taken. In the software database height of the plants are stored as per the ideal growth chart. This ideal growth chart database includes the ideal height span of the plant in that week.

If the actual height of the plant is not as per the ideal growth span, then extra dose of fertilisers is provided via the sprayer attached to the robot [1].

Also, the leaves are observed for the spots or any abnormalities and are compared to the stored images of the respective disease type. As per the diseases type the amount of the pesticides are sprayed on the leaves. Now the robot moves to the next plant. This action is repeated till the row finishes. For next row, same action continues if user wants to continue. The flowchart for spraying pesticides and fertilizers be in following figure.

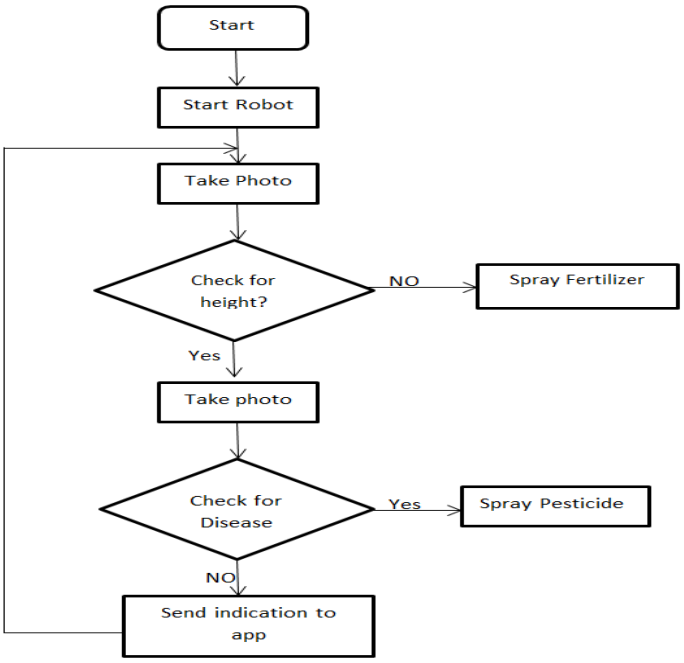

Fig 6: The flowchart for spraying pesticides and fertilizers

VI. SOFTWARE DESIGN

We are using SURF algorithm to extract various features. As robot moves in the field, and takes photos, SURF algorithm extracts the features. Raspberry Pi 3B+ hardware is used to compare real time photo with database. Based on this comparison, we are spraying pesticide for diseased plant and fertilizer for short height plants.

The captured images are processed by using image processing technique. In Raspberry Pi coding is predefined using python Open CV platform, according to this coding robot which connected to Raspberry Pi is controlled. Robot has two motors for spraying purpose which are activated by using relays. The software algorithm design for this system consists of

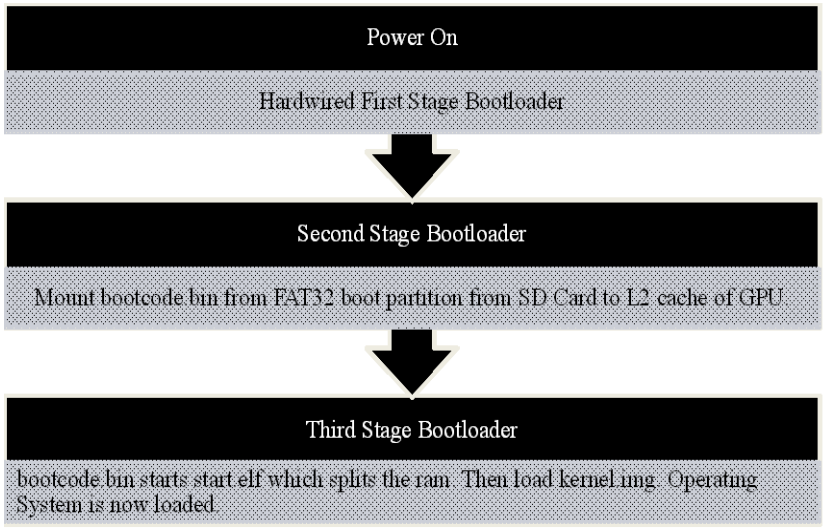

Fig 7: Stepwise Software procedure

For coding following steps are used to locate plants leaves and the type of diseases on it.

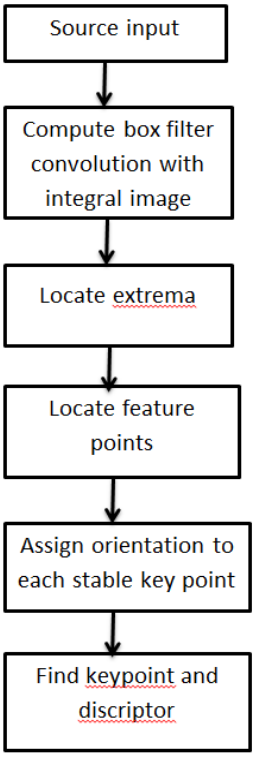

Fig.8: Flowchart for locating leaves and diseases

VII.ALGORITHMS USED FOR PLANT HEALTH DETECTION AND INDICATION

a. **SURF algorithm –** Speeded Up Robust Feature mainly **(**SURF) algorithm is used for object detection purpose. It finds key points in different images of same object, It is more likely blob detector. In our work, it detects yellow dots on green coloured leaf. We use SURF.compute() and SURF.detect() in python's open CV to find descriptors[5].

b. **SIFT algorithm –** low approximated Laplacian of Gaussian (LoG)with difference of Gaussian is used for finding scale-space. SURF is more accurate and approximates LoG with Box Filter. There is an advantage of this approximation that is convolution with box filter is easy to calculate also the support of integral image is provided.

c. **db.py** # To create database of images. In this file images of the strawberry plant on the field are taken and stored. The images are stored in .jpg format.

δ. **.height.py** # It is used for detecting height of plants so that we can determine short heighted plants. Here the green area of leaves is measured, and number of pixels are counted. The threshold value of green pixels for healthy, diseased and unhealthy plant is already stored in program. It simply checks this value and will give the results.

e. **Symbol_surf.py** # It is used for detecting diseased plant. cv2.VideoCapture() is called for capturing the real time image. Then using SIFT it calculates descriptors and key points of the image and matched them with the images stored in db.py. Basically, it acts as a blob detector in which small dots on the leaves are detected.

ϕ. **text1 and text-** These text files are used for storing result in 1 or 0 format.

To code for the Hardware setup, python language is used. The code is written on the python editor of the raspberry pi and the version Py 2 is used. The capturing of the image and the processing the image to identify the disease and to proceed with spray mechanism, it is done in following method.

VIII.RESULTS

Here we are discussing having following case studies of pictures captured by our proposed system of plant health monitoring robot.

a. Spots on the leaf of diseased plant
b. No spots on the leaf of healthy plant
c. Short heighted plant

Case 1: Spots on the leaf of diseased plant

Captured image of plant by the system of leafs of diseased plant is as shown in below fig.

Fig.9: Captured image of Spots on the leaf of diseased plant

Capture image send to the controller then processing is done using image processing. The number of spots on leaf are visible and are counted.

As per the incoming data system displays on following results on the monitor screen.

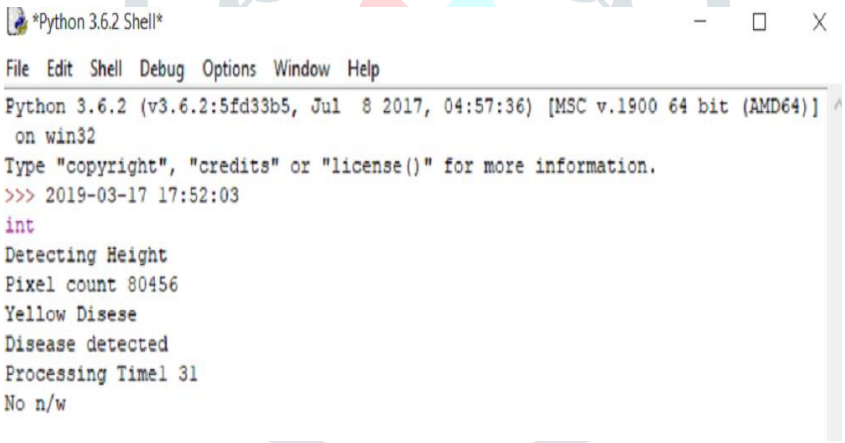

Fig. 10 : Result displayed for Leafy disease on monitor

Case 2 : No spots on the leaf of diseased plant (healthy plant)

Captured image of plant by the system, for healthy plant
is as shown in below fig.

Fig.11: No spots on the leaf so it is healthy plant

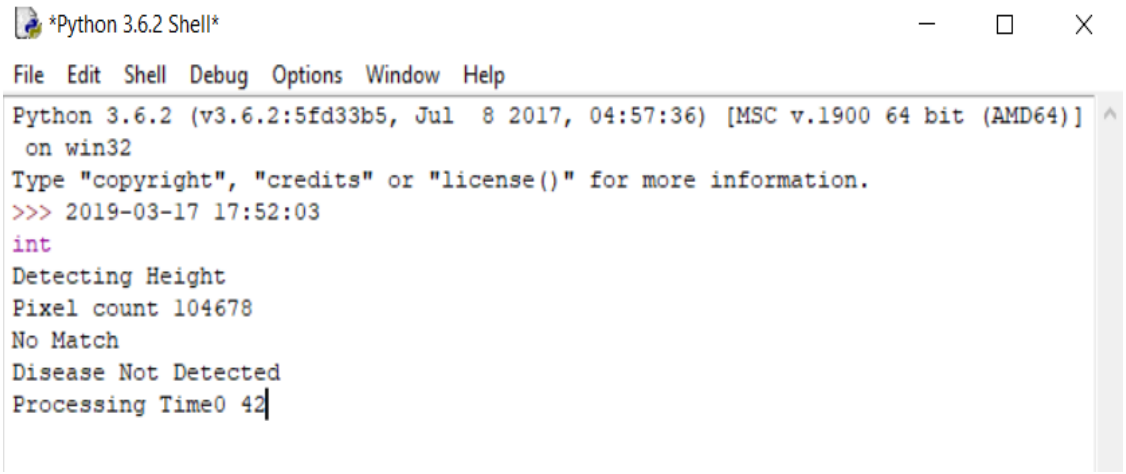

Fig12 : Result displayed for Healthy Plant on monitor, Processing done in python

Case 3 : Short heighted plant

As per the incoming data system displays on following picture on the monitor screen.

Fig.13: Short height plant

In our Python script ,comparison of current height with standard database is done. We find following output on monitor for short heighted plants.

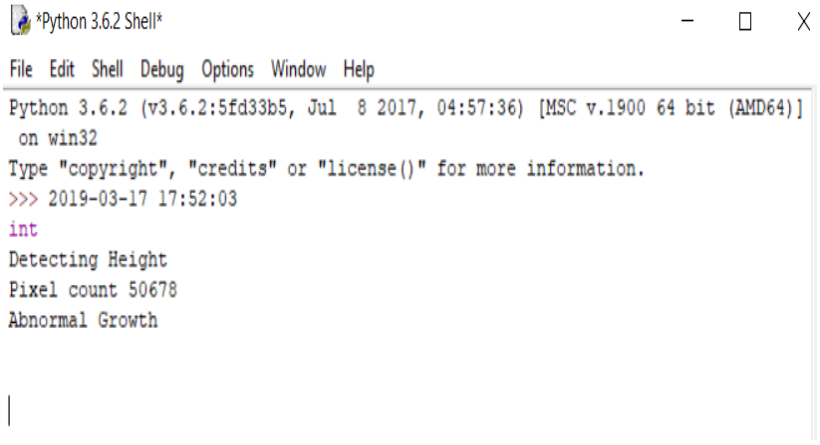

Fig. 14: Short height plant result displayed for Short height plant on monitor, Processing done in python

IX.OBSERVATIONS

In order to reduce farmers efforts in field we have devise a scheme of right amount of fertilisers and pesticides. We have propose the movable Robot that is recognizing healthy and unhealthy plants and provide needed amount of fertilisers and pesticides. So proposed system will be able to save farmers time and wastage of fertilizers and pesticide.
The Comparison Of manual and Our proposed Robot prototypecan be presented in table 1 .

Table1.Comparison Of manual and Our proposed Robot prototype

Sr No	Parameter	Traditional Manual System	Prototype Robot
1	Man Power	Large	Less
2	Time Requirement	More	Less
3	Spraying Technique	Manually	Automatic
4	Pesticide Wastage	More	Less

We Particularly we have carried out visits to two Strawberry farms in Mahabaleshwar, M.S, India. After visiting the fields, we have observed following results in two farms.

Table.2 Observations in two Strawberry farms

No of plants	Plants having disease	Plants with short height	Healthy Plants
Farm1,Row1	19	42	36
Farm2,Row2	24	28	29

X. CONCLUSION

Agriculture field requires lot of human effort. In order to reduce human effort, we design a movable robot for spraying pesticide and fertilizer. By using this system we can manage time, save pesticides and fertilizers.

XI. REFERENCES

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