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SANJEEVANI (PLANT DISEASE DETECTING PROTOTYPE)

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Abstract - *In the present life Plant disease causes considerable economic loss and are a threat for sustainable agriculture due to which production of quality crops is been hindered. A large number of agricultural workers and farmers lose their lives as well as suffer from work accidents and harmful diseases every year. Majority of the disease is caused due to usage and exposure of dangerous pesticides and fertilizers during on-field work. Due to the harmful nature of Pesticides, they cannot be neglected as they are the major inputs of the modern agricultural production due to their high capability and trustworthiness for crop protection. However, majority of the farmers are unaware and lack certain knowledge on the usage of pesticides. The farmer tends to apply the pesticide for the entire field instead of applying for those plants which are infected, which leads to damage of the healthy crops. Hence in order to address these problems, we have come up with a prototype called "Sanjeevani". The main motto of our idea is to detect rate of infection in the plant and provide respective pesticide for the disease.*

Key Words: **Image detection, Infection rate, Entomology, In housing, Disease Identification, Pesticides.**

1. INTRODUCTION

Agriculture is the primary occupation of Indian villagers. From the advent of agriculture, there has been much mechanical and chemical advancement that has occurred to improve the yield and help farmers tackle issues like agriculture and crop diseases. But there has been little to less digitization done in the field. With boom in the technology, there is hope for creating a digital system for agriculture which will help the farmers make informed decisions about his farm and help him tackle some undesired situations in advance. This will help to increase the quality of crops and will also be beneficial for the farmers. Early detection of diseases which is a great challenge in the field of agriculture. An earlier large team of experts are called to chalk out the diseases or any harm which occurred to plants, even this practice is not known to every farmer and therefore the experts charge high and consumes much time. Where the automatic detection is more beneficial than this long process of observations by the experts, automation technique of the disease detection where the result comes out to just monitoring the change in the plant leaves makes it cheap and accurate, thus image processing technology for the early detection of diseases which occurred to plants will be known to the farmer at an early stage and can save the rest of his crops from damage.

1.1 OBJECTIVES & PROBLEM SOLVING

Farmers of India are facing problems regarding infection of crops and also during pesticide spraying which can be toxic to them, hence in order to address these problems we came up with an idea called "Sanjeevani". The main goal of our idea is to detect rate of infection in the plant and provide respective pesticides for the disease. To achieve this our team has come up with an action plan to scope our idea by making a rover which can move through an agricultural field and identify the infected plant, take its photo and send it to the expertise panel through the application where they analyze the problem and suggest respective pesticides to the farmers.

SANJEEVANI

METHODOLOGY

Sanjeevani is our prototype which automatically takes the images of the plants in the farm at different angles and then sends that data to the app automatically for disease identification, to obtain solution for that problem and another function of this prototype is that it is capable of spraying pesticides automatically. The image of the plant can also be taken through manual method with the Sanjeevani App, the methodologies are as follows;

- The prototype collects images of the infected plants from the agricultural land by passing above the plant with the help of the camera attached to it.

- The images collected are stored as data inside and is sent to the application developed by team-Sanjeevani.
- After reaching the application the images are compared with the previously collected /stored reference pictures using Machine Learning Patterns.
- Once the images are matched it lists out the disease and provides the user with the appropriate pesticide to be used to treat the affected plant.
- During complex identification, the application sends the images to the Expertise Panel who study the images and give the solutions to the affected plant after analysis.
- Panel Sanjeevani will look over the issue and provide the farmer with respective chemical composition of pesticides to be applied to the affected plant.
- The prototype carries pesticides in tanks and will spray it over the infected set of crops through pump mechanism with the help of nozzles attached at the end of the prototype.
- The Sanjeevani application will eventually form a platform where the farmer can find his respective pesticides by receiving the nearest pesticide supplier location, from where he can order his requirement at his doorsteps.

JUDICIOUS USE OF COMPONENTS

Electric Components

MSP432 P401R MICRO-CONTROLLER

They are low power consuming high performance delivering micro-controller.

MSP432 has a total of 10 GPIO (General purpose Input/ Output) ports.

GPIO pins and ports allow micro-controller to make an interface with all kind of external devices.

GPIO pins on micro-controllers are broken out into header pins which allows the user to connect external wires.

ULTRASONIC SENSOR HC-SR04

They are used to detect the presence of any obstacle coming across their path or at their respective frequencies, as the ultrasonic frequency increases the attenuation increases. Thus, low frequency sensors (30-80 KHz) are more effective for long range, while high frequency sensors are effective for short range.

L298 N DRIVER MODULE

It is a controller that makes use of a H- bridge to easily control the direction as well as the speed of two DC motors.

Here the L298 N driver module id used to control the Johnson DC 100rpm motor which moves the prototype.

BATTERY SUPPLY

To power the prototype EXIDE 12Volts rechargeable battery is used, since it is rechargeable, we have sourced it up with Solar panels hence giving significance to renewable energy, the specifications of the solar panel is 3watt- 10volt capacity.

SERVO MOTOR MG995

Servo motor MG995 is used here to get a precise movement for easy rotation of the camera around the desired crop, due to this convenient motion we were successful in obtaining images of the plant in the various angles.

Movement range of 180 degrees satisfies the requirement to capture images of the plant at multiple locations.

Due to the closed loop system, we get precise rotation. Motor can be controlled by PWM (Pulse-width Modulation) signals.

The torque generating capacity around 9 Kg-cm is sufficient enough to support both rotating bar and the attached camera.

DC MOTOR

Johnson DC 100rpm motor

Low revolutions per minute with high load carrying capacity.

Mechanical Components

Movement Wheels & Stepper Motor Wheels which are the crucial components which allows the prototype move. These wheels are detachable and any sort of wheels can be attached depending on the type of land the prototype should travel in. There are 2 dummy wheels attached in the front.

Wooden plank is used which creates space for the installation of the electric components, connections, pesticide storage tank and the spray nozzle.

Support beam legs (vertical & horizontal) and a divergent nozzle used to spray pesticides.

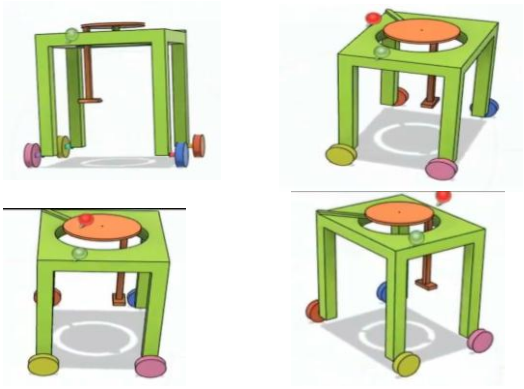
Sanjeevani Prototype

WORKING

- 75% of Indian population is dependent on Agricultural occupation. We find farmers as our prime users for the platform and getting the Pesticide suppliers onboard would make our potential customer.
- To address this issue, the proposed prototype will be deployed in the agricultural fields.
- As the prototype moves over the plant there is a main concern of the crop's height, hence the upgradation of the beams will be made completely hydraulic which will adjust the height accordingly to that of the plant.
- The prototype moves in the agricultural terrain with suitable wheels and places itself in such a way that clear pictures of the plant can be taken.
- This can be achieved by the HCSR04 Ultrasonic sensors located at the bottom support beam which helps in detecting the obstacle which is the plant in this case and stops the movement of the wheels due to the developed program.
- When the motion stops, the MG995 servo motor with attached bar holding the camera gets actuated and rotates complete 180 degrees to capture various angular pictures of the plant.
- The camera capturing timings is set to certain intervals and captures the infected part or leaves of the plants.
- These images are transmitted to the computer software through FTP (File Transfer protocol).
- These images are nothing but the diseased leaves of the plant which will be compared with the reference images stored in the system. Later when the analysis is done the cure for the disease is given to the user in the form of a report where he will be suggested to apply the mentioned pesticides its usage along with its chemical composition which makes it convenient for the user to take good care of his plants.
- For further upgradation we will also have an Expertise Panel who studies the images and give the solutions to the affected plant after analysis.
- The Johnson motor attached to the wheels runs at 100rpm which helps the prototype moves.
- The user can get another advantage of getting his farm and plants fertilized as our prototype carries pesticides in tanks and sprays it over the infected set of crops through pump mechanism with the help of nozzles attached at the end of the prototype.
- The pesticide sprayer sprays the suitable pesticides automatically upon detecting the infected leaves.
- The prototype with the help of its software identifies the infection rate and suggests the respective pesticides.

DESIGN INNOVATION

- An innovative camera holding setup is implemented such that it captures images of the crops at different angles eventually covering all sides of the plant.
- Usage of proper wheel bracket for proper movement of the prototype.
- Johnson 100 rpm motor is used which carries heavy load.
- The Servo motor used will generate 9Kg-cm torque and rotates the entire camera setup.
- The rover has a capacity to analyse infection rate at the rate of 30 crops/10min.
- The prototype comprises of various task performing capabilities, some of our cutting-edge technologies employed are unique angle of image capturing high-efficient image recognition and processing.
- The prototype is capable of multi-terrain movement.
- We are making use of python as programming language as it consists of huge number of modules thereby adding new feature is easier.
- Open-cv will give access to more than 2500 state of the art and classical algorithm due to which we are using for image analysis.



3D Model of the prototype

ECONOMICAL IMPLEMENTATION OF THE PRODUCT

- Use of fasteners, sheet metals, reduces fabrication cost.
- Components can be sourced from local dealer
- Inhouse development of the program reduces out sourcing
- Procurement of components from Tier -2 or Tier-3 manufacturers reduces the component cost.

PRODUCT DIFFERENCIATION WITH KEY FACTORS

FACTORS	SANJEEVANI	EXISTING PRODUCT (MOBILE APPLICATION)
AUTOMATED	Our product is semi-automated	Requires human intervention for every action
ACCURACY	Each and every plant is scanned & detected for diseases. Accuracy rate is 60%	Not every plant is detected for diseases
TIME	As it is automated, it consumes less time	As it is based on human intervention it requires much time to capture each plant for disease detection
RELIABLE	Customer can easily relay on our product	Relatively reliable
SERVICE	As we are in the growth phase it will be on rental basis	Service depends on the person(technical) knowledge.

Several researchers suggest the optimal use of pesticides and solutions found technically resembling our concept, therefore we have come up with a unique idea that identifies the infection rate in the plant and lists down the respective pesticides in a report format. This shows our competitiveness. For feasibility of capturing the image of the whole plant we have designed the positioning of the camera in such a way that the plant fall under the moving prototype which makes it convenient to obtain perfect photos of the infected area of the plant. These images are sent through FTP.

KEY FACTORS

- Fast and accurate identification of infection rate in the plant.
- Farmers, expert panel and pesticide suppliers in the agricultural ecosystem can reach each other easily through a single platform.
- Revenue model designed in such a way that there is no cost deduction from the farmers.

PHASES OF SANJEEVANI

Phase I: PROTOTYPE VERSION

- In the early stage, the design consisted of the prototype and the software platform for image analysis and pesticides spraying.
- In this proposed work the camera attached with the prototype takes images of the plants automatically and this data will be sent to the laptop for analysis through our software.
- Rate of infection is generated in the form of report on the basis of analysis.

Phase II: SANJEEVANI APPLICATION VERSION

IMAGE CAPTURED BY THE FARMER OR BY THE ROVER WILL BE SENT TO EXPERT PANEL

↓

AFTER THE ANALYSIS IS DONE , SOLUTION WIIL BE SENT TO PESTICIDE SUPPLIER

↓

THE SUPPLIER WILL CONTACT THE FARMER REGARDNG THE PESTICIDE REQUIREMENT

↓

ESTABLISHING BUSINESS BETWEEN PESTICIDE SUPPLIER AND FARMER

↓

THE WHOLE PROCESS TAKES PLACE THROUGH THE APPLICATION

PROTOTYPE IN ACTION

The ultrasonic sensors detecting the plant(obstacle)

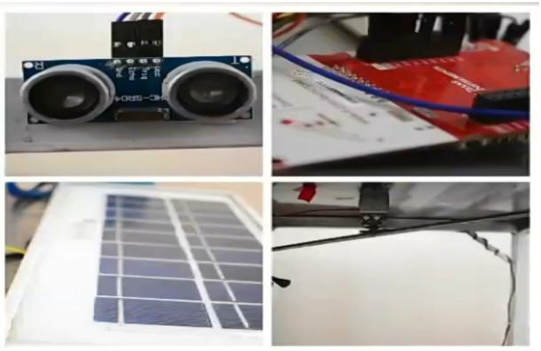
The prototype in motion and capturing the images of the plants using the rotoey motion with the help of Servo motor.

Rotation of the camera upto 180 degrees to obtain photos of the respective plant from all possible angles.

TRIALS CARRIED OUT WITHOUT SUNLIGHT

Transfer of the photos to the laptop where the analysis gets initiated.

The nozzle used for spraying of the pesticides to the respective plants.



Components used as per requirement

CONSTRUCTION OF THE PROTOTYPE

- To build the frames of the prototype we have made use of CR (Cold rolled) Steel due to its high tensile strength which makes it easy of it to move on any agricultural terrain.
- In the fabrication part of the prototype arc welding is used for the convenient mounting of the DC motors and other equipment. The arc welding helps the prototype to withstand high load capacity.
- The rear wheels are fixed wheels run by DC motors and can be altered according to the terrain.

SANJEEVANI REPORT ANALYSIS

Image File	Infection Rate
leaf1.jpg	1.571
leaf2.jpg	56.75
leaf3.jpg	70.15
leaf4.jpg	9.696
leaf5.jpg	6.987
leaf6.jpg	61.39
leaf7.png	2.892

YOUR CROPS ARE INFECTED AND ITS TIME TO TAKE PREVENTIVE MEASURES. AVERAGE RATE OF INFECTION IS 29.92%, THANK YOU FOR USING SANJEEVANI.

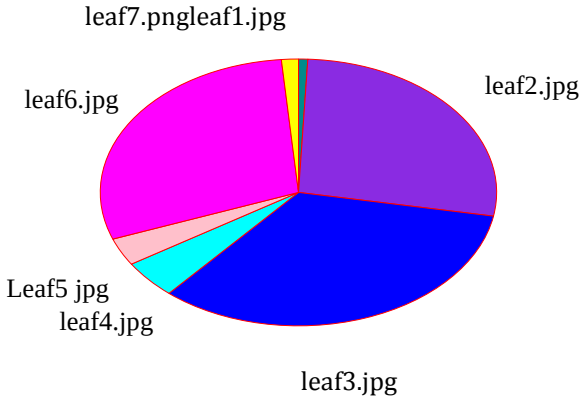


IMAGE ANALYSIS

An overview of the infection rate display in the application on the laptop.

Sl.no1. Image name: leaf1.jpg
Percentage_of_Infection_rate:1.5713610586011342

Sl.no2. Image name: leaf2.jpg
Percentage_of_Infection_rate:56.75675675675676

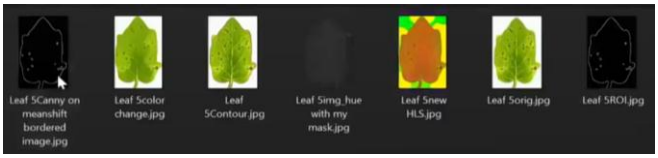
Sl.no3. Image name: leaf3.jpg
Percentage_of_Infection_rate:70.15994504955353

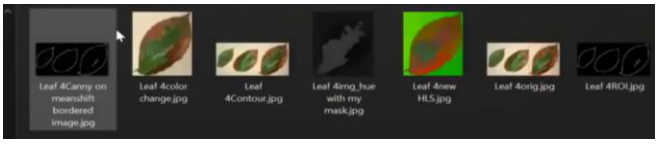
Sl.no4. Image name: leaf4.jpg
Percentage_of_Infection_rate:9.696077400357556

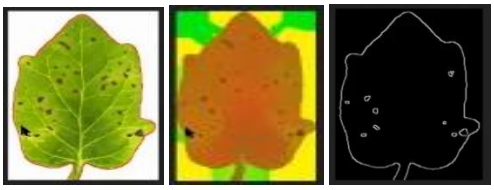
Sl.no5. Image name: leaf5.jpg
Percentage_of_Infection_rate:6.987577639751553

Sl.no6. Image name: leaf6.jpg
Percentage_of_Infection_rate:61.39846743295019

Sl.no7. Image name: leaf7.png
Percentage_of_Infection_rate:2.8924457097457625







Detection of infection rate through image processing

GLIMPSE OF THE REPORT GENERATED AFTER ANALYSIS

SANJEEVANI

ANALYSIS REPORT

Images

Date: 2020-09-18

Time: 13:20:15

| Specimen name | Infection Rate |

| leaf1.jpg | 1.571 |

| leaf2.jpg | 56.75 |

| leaf3.jpg | 70.15 |

| leaf4.jpg | 9.696 |

| leaf5.jpg | 6.987 |

| leaf6.jpg | 61.39 |

| leaf7.png | 2.892 |

AFTER ANALYSING YOUR CROPS FOLLOWING REPORT WAS OBTAINED:

YOUR CROPS ARE STARTED TO GET INFECTION START TAKING PREVENTIVE MEASURES AVERAGE RATE OF INFECTION IS: 29.92%

THANK YOU FOR USING SANJEEVANI SYSTEMS----------

CONCLUSION

Being Mechanical Engineers, we have pushed our limits deep in analyzing and learning programming, we have tried to eliminate the usage of electronic chips for data transmission as we found an alternate method for it through laptop in wireless mode. Fine tuning the RGB of the pixels in image and masking the disturbances and organizing the data in tabulated format by representing the same in graphical interpretation. Leaf disease detection is achieved with high success rate through image processing techniques, all the above procedures and methods used for the process proves that this is the solution for smart agriculture. This system has the potential to help the user increase his crop yield by simultaneously maintaining his plants. Firstly, using this system young farmers can quickly acquire practical farming knowledge and then using the collected images and referring to the previously stored image through image processing increases convenience along with the number of potential applications. This simple yet innovative design also enables experienced older farmers to operate the system easily and provides useful informed suggestions. The developed prototype and system can play a significant role in solving the Nation's agricultural problems.

REFERENCES

[1] Apeksha Thorat, Sngeeta Kumari, Nanda Kishore D. Valakunde Computer Engineering Dept, Vishwakarma Institute of Technology, Pune India. Dec 20-22, 2017

[2] Gwo-Jiun Horng, Member, IEEE, Min-Xiang Liu, and Chao-Chun Chen, Member, IEEE. National Cheng-Kung University, Taiwan.

[3] Vijai Singh, Varsha, Prof. A K Misra, "Detection of unhealthy region of plant leaves using Image Processing and Genetic Algorithm", 2015 International Conference on Advances in Computer Engineering and Applications (ICACEA) IMS Engineering College, Ghaziabad, India.

[4] Sudeep Marwaha, Subhash Chand, Arjit Shaha, "Disease diagnosis in Crops using Content based image retrieval", Intelligent Systems Design and Applications (ISDA), 2012 12th International Conference on 27-29 Nov. 2012, IEEE, Kochi, India.

[5] Sachin D. Khirade, A. B. Patil, "Plant Disease detection using Image Processing", 2015 International Conference on Computing Communication Control and Automation.

[6] K. Lokesh Krishna, Omayo Silver, Wasswa Fahad Malende, K. Anuradha "Internet of Things application for Implementation of Smart Agriculture System", International conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud) (I-SMAC 2017).