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SMART ROBOTIC VEHICLE FOR PLANT DISEASE DETECTION AND SPRAYING USING DEEP LEARNING

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ABSTRACT

Artificial Intelligence is gaining popularity day by day. Right from Industrial Automation to Software to manufacturing, Artificial intelligence is making its way. How ever the agricultural practices used even today are far way from the deployment Of AI for the benefit. People still follow the obsolete agricultural practices. The crop Diseases will affect the larger percent of agricultural produce and is hard to determine For most of the farmers, the type of disease their crops are affected with to find a proper Solution to the particular disease. This project proposes the concept of use of artificial Intelligence and robotics for agricultural operations including crop disease detection And analysis. The proposed project consists of a Robotic vehicle navigating through The field and determining the health status of the plants. If the plant is diseased the Type of disease will be automatically detected using multilayer convolutional neural Networks and automatically intimated to the farmer using IOT APP developed. Also The solutions and proper corrective approach to keep the crops healthy from such Disease will be suggested by the machine learning algorithms. This proposed project Is expected to bring artificial intelligence to agriculture, thereby solving advanced Agricultural problems which can be solved easily by human intervention. Automated Spraying is also designed and deployed which will automatically initiate spraying once the disease is defected.

Keywords: *Smart Robotic Vehicle, Plant Disease Detection, Deep Learning*

I. INTRODUCTION

One of the important sectors of Indian Economy is Agriculture. Employment to almost 50% of the Countries workforce is provided by Indian agriculture sector. India is known to be the world's largest Producer of pulses, rice, wheat, spices and spice products. Farmer's economic growth depends on the Quality of the products that they produce, which relies on the plant's growth and the yield they get. Therefore, in field of agriculture, detection of disease in plants plays an instrumental role. Plants are Highly prone to diseases that affect the growth of the plant which in turn affects the ecology of the Farmer. In order to detect a plant disease at very initial stage, use of automatic disease detection Technique is advantageous. The symptoms of plant diseases are conspicuous in different parts of a Plant such as leaves, etc. Manual detection of plant disease using leaf images is a tedious job. Hence, It is required to develop computational methods which will make the process of disease

detection and Classification using leaf images automatic. Research in agricultural robots has been growing in the last years, thanks to potential applications and Industry efforts in robot development. Their role was investigated for many agricultural tasks, mainly Focused in increasing automation of conventional agricultural machines and covering processes such As ground preparation, seeding, fertilization, and harvesting. Systematic, repetitive, and time-Dependent tasks seem to represent the best fields of application for robots, especially in an arable Farming context with temporary crops. Beside agronomic practices, robotic plant protection has also Been investigated, but may represent the most complex challenge for researchers Sustainability.

II. LITERATURE SURVEY

G. Sandhi et al., in [1] have proposed visually guided operations in green-houses. In this project they have developed a vision based system for tomato farming. They have used two PAL cameras which has the work of sending the signals to the server for fast processing of images. These cameras are high resolution cameras which captures the images and send it for the processing unit.

K. Rangan et al., in [2] have discussed An Embedded Systems Approach to Monitor Green House. To monitor and control the green house parameter they developed these system. In this system they have monitored temperature and humidity of the green house. Also PH of water and moisture of soil they have monitored. In this they have used GSM system to send the msg to the farmer/owner of that green house. These messages are send in particular format that is difficult to understand for il-literals.

Akshay et al., in [3] have proposed Wireless sensing and control for precision Greenhouse management. In this system they have used ZigBee for wireless communication. And control processing unit for monitoring. This system aims to monitor and control temperature and humidity of greenhouse. Data collected from the sensors are sent to the CPU for monitoring using the wireless communication technology. The main disadvantage of this system is the range of ZigBee. It provide the range of 10 to 100 meters only.

Aji Hanggoro et al., in [4] have discussed Green House Monitoring and Controlling Using Android Mobile Application. This system is developed for indoor farming to monitor the humidity. They have used android phone which is serially connected to the microcontroller humidity sensor. They have used WiFi technology to send the data to user. The disadvantage of this system is range because the Wi-Fi provide very low range.

S. Thenmozhiet al., in [6] have discussed Greenhouse Management Using Embedded System and ZigBee Technology. In this system the monitoring process takes place in two modes automatic and manual. The status of the system is send using Wi-Fi. All activities of the system is managed from control room. Activities are controlled through PC M.K.

Wei Ai et al., in [3] have proposed Green House Environment Monitor Technology Implementation Based on Android Mobile Platform. They proposed this system to monitor temperature and humidity, in this they have used cable type sensors. Data collected from sensors are send to the used via GPRS. They have overcome the problem of range limitation. But for the GPRS system the network facility should be provided. If the Network becomes unavailable the data could not be send to the user.

III. METHODOLOGY:

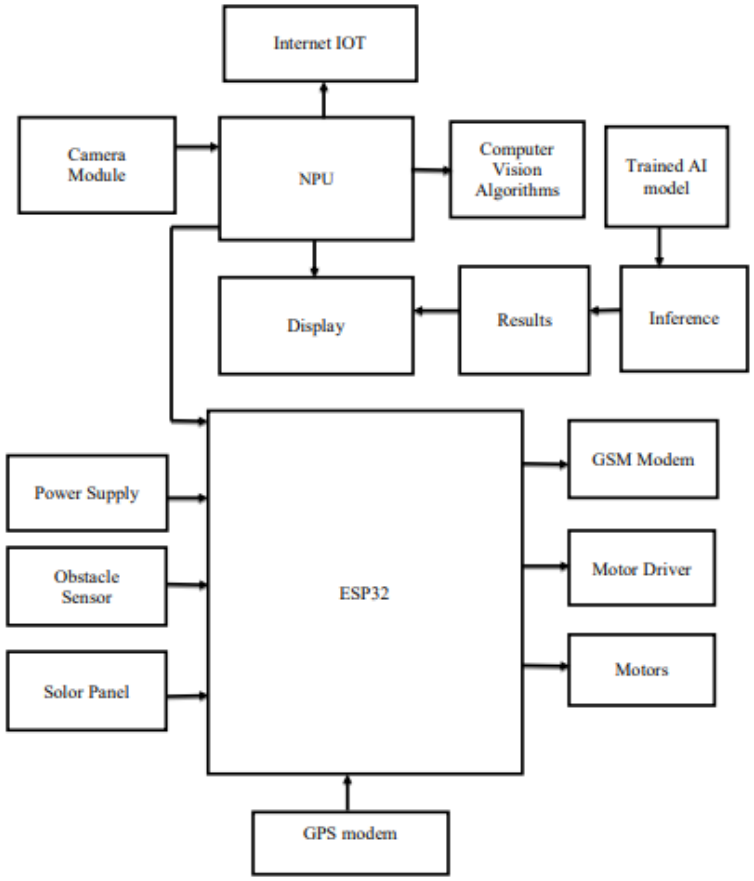
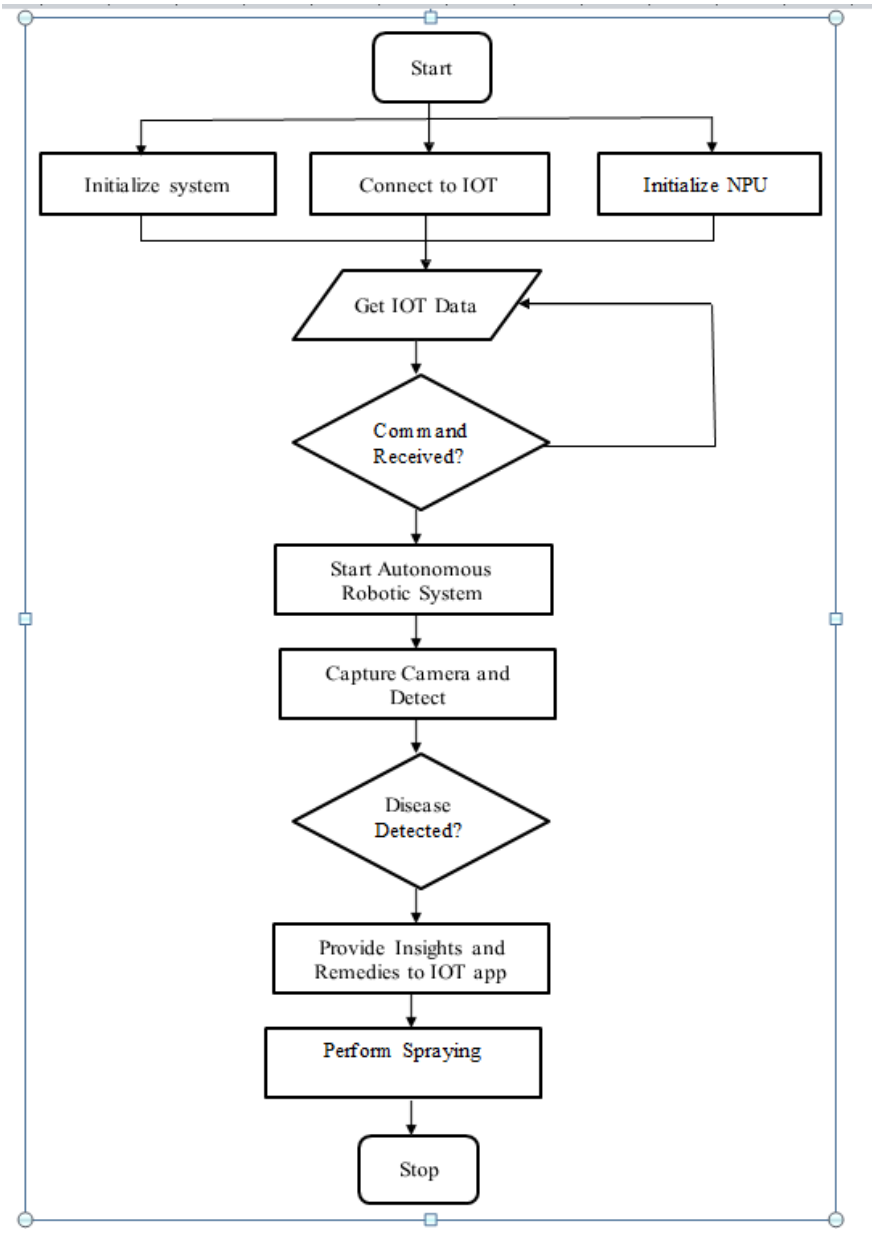


Fig.: 3.1: block diagram of smart robotic vehicle

As shown in the project the project consists of a Robotic Vehicle with capabilities to implement Artificial Intelligence in Agriculture. The project involves used of AI for the determination and analysis of Crop diseases and suggestion of probable solution to overcome the same. The proposed project consists of a Robotic Vehicle which can move across the field, scan for the crops and then detect the diseases present in the crops using computer vision and artificial intelligence. The proposed set up consists of a Robotic vehicle as shown in the figure with the camera mounted on the top of it. When triggered the robotic vehicle can be move autonomously or using wireless control thought the field. The overhead camera can scan the field of crops and use machine learning systems to determine the diseases. If the crop is diseased the robotic vehicle captures the GPS location of diseased crop and notifies the farmer via app developed. Additionally the developed system used Artificial Intelligence to also suggest the remedy to the farmer to a particular crop disease and hence save the burden of farmers. The proposed project can be controlled manually as well as autonomously there by making it a full-fledged futuristic solution to the currently existing problems. Additionally, since the robot is solar powered it is green and eco-friendly and doesn't require any external Aid of power. Automated spraying is also implemented so that the system can automatically spray on the selected disease location.

The proposed project is divided into number of phases so that it can be carried out with minimum Errors. Since AI is a vast field it is necessary for us to divide the entire project into different phases And carry out through

testing of each and every individual phase so that the project works Successfully. The brief methodology to carry out the entire project is as given below.



Fig> 3.2: Flow chart of the work

- Problem Definition: In this phase the overall problems faced in crop disease analysis are outlined. This phase involves doing a market study of crop disease detection
- Literature Review and Scope determination: This phase involved studying the literature review on technology implementation in agriculture and number of national as well as international research papers to find the current problems faced.
- Material Survey and market Study: This phase involves carry out the material survey of different materials suitable for the project
- Hardware selection: This phase involves selection of different materials suitable the for the project

- Fabrication of Robotic Vehicle: In this phase the robotic vehicle is fabricated which will form as a base of the entire project. The proposed project involves development of robotic vehicle powered by solar energy thereby making the system green and eco-friendly
- Development of Autonomous and manual navigation system: The proposed robotic vehicle can be controlled manually as well as autonomously. This phase involves development of manual as well as autonomous control system for the robotic vehicle
- Camera interfacing and computer vision pre-processing: This phase involves interfacing the Camera to the NPU and implementing computer vision algorithms for image and video pre processing
- Data input and Feeding to neural Networks: The preprocessed data is fed to the neural networks for training and classification purposes. This phase involves development of python modules for feeding the data to neural network
- Training the AI-model: In this phase a AI model is developed in python which can recognize different crop diseases. The model is responsible for processing the data from the camera module and recognize the presence of crop diseases.
- The Python program Development: The python program is developed to communicate with the robotic vehicle as well as the farmer in case the diseased crop is detected.
- Prediction and Disease Analysis: In this phase a new ML model is created to suggest the farmer regarding the possible solutions to get rid of crop disease in an effective way.
- Retrain and Reliability Prediction: This phase involves retraining the AI model for performance optimization and is usually done after the first bench test.
- Deployment of the Model on the Robot Developed: This phase involves connecting the Python program with the Robot module to establish a communication channel between the two to connect the results inference with the robot module.
- Assembly and testing and optimization: This phase involves the assembly of entire project which is further followed by testing and optimization of the same.

IV. RESULT

The implementation of automatic plant disease detection and spraying robotic vehicles in agriculture has revolutionized the way farmers manage crop health. These advanced systems offer significant improvements in efficiency and precision, enabling the early detection of diseases and the targeted application of treatments. By automating these tasks, farmers can reduce labour costs and minimize the potential for human error, leading to more consistent and effective disease management. The precision of these robots ensures that treatments are applied only where needed, reducing the overall use of chemicals and potentially enhancing crop yields and health.

However, the adoption of these technologies is not without challenges. The high initial investment and ongoing maintenance costs can be prohibitive, particularly for small and medium-sized farms. These systems require significant capital outlay for purchase and installation, and their complex nature means

that specialized training is necessary for effective operation and maintenance. Technical issues such as software bugs, hardware malfunctions, and connectivity problems can also disrupt their operation, leading to potential downtime and additional repair costs.

Fig. 4.1: Normal leaves

Fig. 4.2: Infected leaves

V. CONCLUSION

Our project on using deep learning for plant disease detection and spraying highlighted some Important disadvantages. We found that while deep learning technology shows promise, it's not without its challenges. Firstly, we discovered that deep learning models require lots of high-quality data to work well. This Means accurate and diverse information about plant diseases and environmental conditions. However, Getting this data can be tricky and expensive. Secondly, deep learning systems are complex and need technical expertise to develop and maintain. This could be a barrier for farmers who aren't familiar with advanced technology. Lastly, we realized that even with good data and expertise, deep learning models might still make Mistakes. This could happen if the data used to train them is biased or incomplete. In conclusion, while deep learning offers exciting possibilities for improving plant disease detection And spraying, we need to be aware of these challenges and work to overcome them. By addressing Issues like data quality, technical complexity, and potential errors, we can make deep learning Technology more reliable and beneficial for agriculture.

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