IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

ISO 3297:2007 Certified ⁜ Impact Factor 8.102 ⁜ Peer-reviewed / Refereed journal ⁜ Vol. 12, Issue 7, July 2023

DOI: 10.17148/IJARCCE.2023.12740

Multi-Purpose Farm Assist Robot

Sowjanya M N[1], Amrutha R[2], Lalitha K[3]

Assistant Professor, EIE, GSSSIETW, Mysore, India[1]

Assistant Professor, EIE, GSSSIETW, Mysore, India[2]

Assistant Professor, ECE, GSSSIETW, Mysore, India[3]

Abstract: Agriculture is one of the life factors for Indian farmers. In accordance with the climate and other resources accessible to them, farmers grow multiple crops in their field. The monitoring of plant detection is required now way days because of increase in plant disease in field crops. Farmers find difficulty in identification of plant disease naked eye observation is one of the oldest method to identify which may fail in proper identification of field crop diseases plant disease in plant effect the economic as well as production losses both in quantity and quality, so to achieve high quality and excellent quantity some technical as well as technological assistance is required. To maintain the food crop without plant diseases the crop surveillance is needed. The proposed system is built around Arduino Uno Microcontroller board. The robot is interfaced with ESP32 Camera which captures the image of leaf and sends to the user. Detection of leaf status is carried out through Convolution Neural network(CNN) of image processing techniques. The user will be drawn to e-commerce website which provides possible solution to the detected disease. The rover is also equipped with inbuilt fertilizer sprayer communicated through Bluetooth module. The commands are controlled by the user using Bluetooth Electronics Application. Soil moisture sensor is interfaced which notifies the moisture content of soil. Implementation of this method saves time, health and improves productivity.

Keywords: CNN, Arduino Uno, Robot, ESP32.

I. INTRODUCTION

In countries like India, it is of utmost importance to bring technological advancement in the fields related to crop productivity. Research initiatives and tentative study process in the important domain of qualitative farming is focused towards improving the yield and food crop standard at low cost, with greater monetary outcome. Agricultural building model stands as a result of a compound interlinking of soil with seeds, and chemicals used to enhance growth. Vegetable and fruits exist as one of the present significant agricultural achieved outputs. In directive for getting surplus and effective worthy products, a product value examination and improvement has always been importantly imperative. Diseases are disturbance to the current state of the plant that translates or inhibit its important roles such as fertilization, photosynthesis, transpiration, pollination, germination etc. The distorting diseases are spawned by pathogens like, fungi, bacteria and viruses, because of unfavourable environmental situations [1]. Accordingly, the first stage for diagnosing of plant disease is a significant and important task. Farmers need periodic monitoring by professionals which might be prohibitively costly and time absorbing. Hence, looking for fast, less costly and accurate ways to smartly detect the diseases from the crops that look to be on the plant leaf is of great importance. In our study we are proposing a system which can be used to identify the particular type of disease a leaf might have by implementing upbringing technologies like image recognition, which represent the application functioning visually. Water being an important factor for growth, needs to be monitored effectively[2]. Determination of soil moisture can be automated. An automated robot equipped with all features thus reduces human intervention and facilitates farmers

II. PROPOSED SYSTEM MODEL

To identify the disease in field crops The proposed method aims to build a IOT based multi-purpose farm assistance robot using robotics advancement and deep learning technologies which has the features of collecting the data along with the real time prediction and classification based on the algorithm implemented. Figure 1 shows the block diagram of proposed model for disease detection.

A. Hardware requirements

The hardware of the system is based on the Arduino Uno R3 microcontroller and Bluetooth module. The hardware is disrobed in the following section.

1. MICROCONTROLLER (Arduino UNO R3 CH340G): The controller used is ATmega328 on Arduino UNO platform. The controller takes input from sensors and operates accordingly.

IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

ISO 3297:2007 Certified ⁜ Impact Factor 8.102 ⁜ Peer-reviewed / Refereed journal ⁜ Vol. 12, Issue 7, July 2023

DOI: 10.17148/IJARCCE.2023.12740

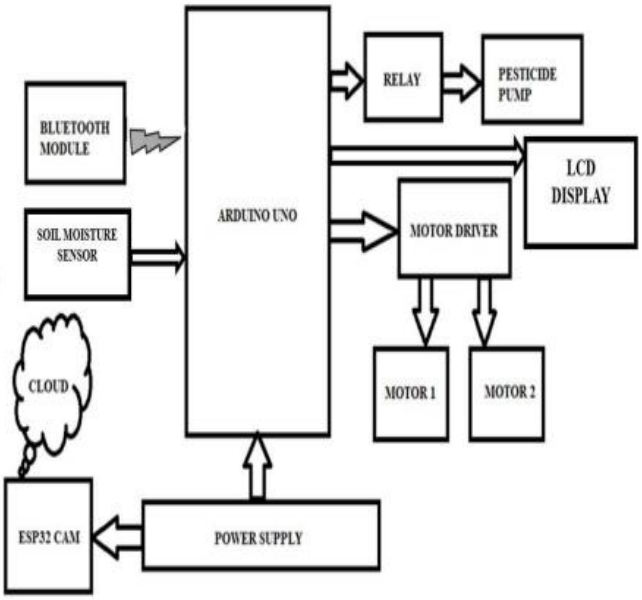

Fig.1 Block diagram of proposed model

2. BLUETOOTH MODULE hc05: HC-05 module here acts as a a transceiver, allowing device to transmit and receive data wirelessly. The supported application controls the movement of robot.
3. RELAY MODULE: This is to provide an interface between a microcontroller or low-power electronic circuit and high-power electrical circuits.
4. PESTICIDE PUMP: In the proposed system, this equipment is used to spray fertilizers.
5. ESP32 CAMERA: To capture leaf images of the plant.
6. DC MOTORS: 4 DC motors with wheels for mobility of robot in different axes.
7. BATTERY (Lithium ion): It is used to power the system.
8. MOTOR DRIVER(L293D): It gears up the 4 DC Motors
9. SOIL MOISTURE SENSOR: This sensor measures moisture content and provides the values accordingly.
10. LCD DISPLAY(16x2): Displays the value of moisture content in soil.

B. Software Requirements

1. ARDUINO IDE: It is an open-source integrated development environment (IDE); allows users to program the compatible boards. In the proposed system to read the sensor inputs & control the wheels Arduino IDE are programmed.

2. GOOGLE COLLAB NOTEBOOK: Collab notebooks are Jupyter notebooks that run in the cloud and are highly integrated with Google Drive, making them easy to set up, access, and share. The dataset of plants are collectively stored here used for analysis in future.

3. KERAS LIBRARY: It is a deep learning API written in python, running on top of machine learning platform Tensor Flow, in the focus on enabling fast experimentation it was developed. It plays a major role in comparison with dataset and display of results.

- The proposed system is built around a Arduino Uno microcontroller board which has been interfaced with different components that are required to carry out the objective of the project. The model is equipped with automation technologies to ease agriculture sector. The robot consists of several features like plant disease detection, classification, soil moisture detection and pesticides spray provision.
- Robot is interfaced with Bluetooth module for operation. Bluetooth electronics is the application through

DOI: 10.17148/IJARCCE.2023.12740

which commands are sent and robot is controlled. Robot is equipped with four motors for mobility in different axis. Motor driver L293D is used to power the motors. Power supply is provided through Lithium-ion battery.

Arduino sends corresponding signal to motor driver which in turn turns on the 4 motors in the robot to rotate in independent axis in four different directions. Soil Moisture sensor is equipped in the robot which determines the moisture content present in the soil. The LCD is connected via I2C module to show the amount of moisture in terms of low and high. The percentage of moisture is also depicted at the user end. The Plant disease detection is done by taking the image of leaf from the IP camera that is ESP32 CAM board. The camera is interfaced in the robot and based on movement, it is brought near the desired leaf and capturing process is carried out. The picture will be stored in the cloud platform which is then processed by, machine learning techniques. The process fetches the image of leaf from the cloud and passes it to the trained machine learning module built using python and Keras.

- A public dataset consisting of 70000 of RGB images of healthy and unhealthy plant leaves having 38 classes are uploaded in Google colab platform. in any computer vision-based system Data preprocessing is an important task. some background noise should be removed To get precise results before extraction of features. So first the conversion of RGB image in to grayscale and then apply a Gaussian filter for smoothening of the image. Morphological transform is applied on binarized image to close the small holes in the foreground part. Later, the bitwise AND operation on binarized image and original color image is performed to get RGB image of segmented leaf followed by texture and color feature extraction. area of the leaf and perimeter of the leaf is calculated by using contours,
- In all machine learning problems feature selection is an important step. In this project we are selecting the features on the basis of correlation of variables with target variable. After feature selection, the data is now parsed to machine learning classifiers to find the patterns in the data. Based on comparison with trained data, the status of leaf is displayed at the user end.
- The CNN Model is built on VGG19 architecture. This is followed by classification of disease. For the detected disease, precautions will be notified to the user. Suitable pesticide can be sprayed on the plants with the help of inbuilt spray tank in the robot. This is connected to the relay module. which acts as switch for the immersible pesticide pump. Amount of pesticide required can be sprayed to plants and can be altered based on requirement. The system can be easily operated making it precise and repeatable.
- For the pin connection all the components are interfaced with Arduino Uno Microcontroller board. VCC and GND pins of all the sensors are shorted and connected to the +5V and GND pin of the board. The pins numbered 4,5,6, of Arduino Uno is connected to the L293D Motor driver. This in turn is connected to four motors engaged for mobility. Pin A0 of the board is connected to the soil moisture sensor. Pin number A4 ,A5 of the sensor is connected to SCD and SCL of I2C Module respectively. These are serial data pins and serial clock pins, representing the output data of sensor. Pin number 8 is connected to the relay module which intern is connected to immersible pesticide pump.Relay is configured for switch operation to control the activity of pump. Pin number 9 and 10 is connected to the blutooth module through which the model is monitored within specific range. The 5V and ground of blutooth module is connected to the ESP32 camera through which image is captured .The camera has an inbuilt WiFi system which supports the activity of capturing and sending data to the user accordingly. All the components are provided with the 5V supply from the lithium ion battery

III. RESULTS

1. The top view of the proposed system ‘Multi-purpose Farm Assist Robot’ can be depicted as in Fig.2.

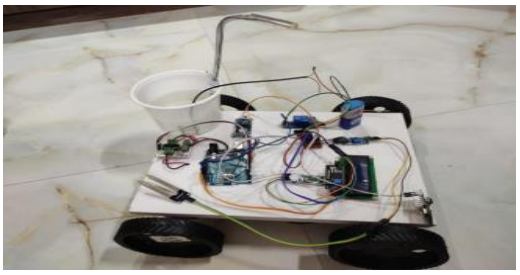

Fig .2 Top view of the proposed model

IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

ISO 3297:2007 Certified ⁜ Impact Factor 8.102 ⁜ Peer-reviewed / Refereed journal ⁜ Vol. 12, Issue 7, July 2023

DOI: 10.17148/IJARCCE.2023.12740

2. The condition of leaves can be depicted after suitable processing techniques. If a leaf is identified with no issues, it is declared as healthy and is displayed as shown in Fig.3.

Fig.3. Detection of disease in pepper leaf

.

Fig.4. Display of healthy status in Blueberry leaf

3. The terminal of the sensor is placed in soil of the agricultural field. It indicates the amount of moisture content present. It is connected to the LCD display which indicates the moisture content as low or high based on measurements.

Fig.5.Moisture content display

IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

ISO 3297:2007 Certified ⁜ Impact Factor 8.102 ⁜ Peer-reviewed / Refereed journal ⁜ Vol. 12, Issue 7, July 2023

DOI: 10.17148/IJARCCE.2023.12740

4. The Robot is equipped with immersible pesticide pump through which suitable pesticides can be sprayed to the disease identified plants. The tank is filled with suitable pesticide. The liquid is spryed through the nozzle. The mode of pump is controlled by the user through Bluetooth Electronics application. It can be powered on when needed and turned off by the user

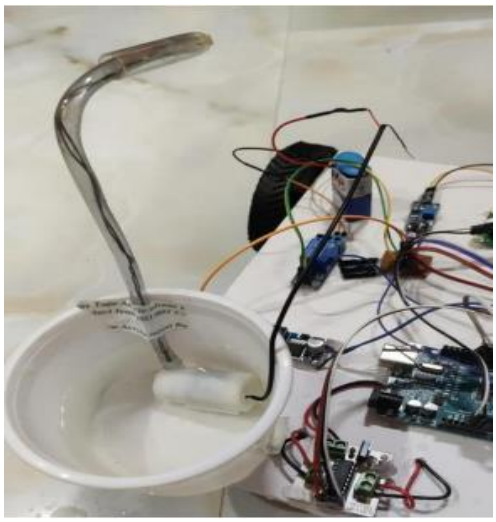

Fig.6.E. Pesticide Spray Technology

.IV. CONCLUSION

Compared with traditional image processing methods, which deal with plant diseases and pests detection tasks in several steps and links, plant diseases and pests detection methods based on deep learning unify them into end-to-end feature extraction, which has a broad development prospects and great potential. Although plant diseases and pests' detection technology is developing rapidly, it has been moving from academic research to agricultural application, there is still a certain distance from the mature application in the real natural environment, and there are still some problems to be solved. By combining these technologies, farmers can adopt a more proactive and data-driven approach to agriculture, which leads to higher crop yields, improved resource utilization, and reduced environmental impact. Overall, the integration of plant leaf disease detection, pesticide spraying, and soil moisture sensors represents a promising solution for modernizing and improving agriculture practices.

REFERENCES

[1]. https://onlinelibrary.wiley.com/doi/pdf/10.1002/9780470514474.ch13.
[2]. https://cosmos.ceh.ac.uk/whymeasuresoilmoisture
[3]. Lakshmana Rao, A., M. Raja Babu, and T. Srinivasa Ravi Kiran. "Plant Disease Prediction and classification using Deep Learning ConvNets." 2021 International Conference on Artificial Intelligence and Machine Vision (AIMV). IEEE, 2021.
[4]. Saima, Fatema Tauze Zohora, et al. "Advanced Solar Powered Multipurpose Agricultural Robot." 2022 3rd International Conference for Emerging Technology (INCET). IEEE, 2022.
[5]. Militate, Sammy V., Bobby D. Gerardo, and Nanette V. Dionisio. "Plant leaf detection and disease recognition using deep learning." 2019 IEEE Eurasia conference on IOT, communication and engineering (ECICE). IEEE, 2019.
[6]. Caballero, E. M. T., & Duke, A. M. R. (2020, April). Implementation of Artificial Neural Networks Using NVIDIA Digits and OpenCV for Coffee Rust Detection. In 2020 5th International Conference on Control and Robotics Engineering (ICCRE) IEEE
[7]. Sannakki, Sanjeev S., and Vijay S. Raj purohit. "Classification of pomegranate diseases based on back propagation neural network." International Research Journal of Engineering and Technology (IRJET) 2.2 (2019)
Bini, D., D. Pamela, and Shajin Prince. "Machine vision and machine learning for intelligent agrobots: A review." 2020 5th International Conference on Devices, Circuits and Systems (ICDCS). IEEE, 2020.