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FARMBOT FOR ONE-STOP MULTIFUNCTIONAL FARMING SOLUTION

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Abstract - Agriculture is humankind's oldest and still important economic activity. In India agriculture is an essential occupation. With the advancement of science and up to date technologies, the eyes of scientists are getting directed towards two fields – Farming and Robotics System. But the mix of these two technologies can serve efficiently for several problems by overcoming the limitation of previous technologies. Farmbot for one-stop multifunctional farming solution is a robot designed for agricultural purposes. It is designed to minimize the labor of farmers in addition to increasing the speed and accuracy of the work. It performs the elementary functions involved in farming i.e., sowing of seeds, irrigation temperature sensing. This project is to develop a robot capable of performing operations like automatic seed sowing, fertilization, and water sprinkling. Additionally, to the present, obstacle detection and image processing is included. The aim to develop this device is that it can automatically control agricultural operations. The images of crop are captured using camera on robot and recorded in a memory card which is later run using artificial intelligence to detect any diseases in the crop

Key Words: Agriculture, Robotics, Automation, Obstacle detection, Image processing, Machine learning

1. INTRODUCTION

Agriculture is humankind's oldest and still important economic activity. Farmers today spend a lot of money on machines that help them decrease labor work and increase yield of crops. There are various machines that are available for ploughing, harvesting, spraying pesticides etc., however these machines have to be manually operated to perform the required operations and moreover separate machines are used for every function. The yield and profit returns from employing this equipment are very less as compared to the investment. Another issue is the growing demands of the world's population. The World Health Organization estimates that Earth's population will touch 9 billion in 35 years which will lead to a staggering demand in increase of growth of food crops. Developing technology can be used as a measure to assist the farmers in farming. Robotics and automation can play a significant role in enhancing agricultural production needs. Automation can be done by man in operations such as pruning thinning and harvesting, as well as mowing, spraying and weed removal. We can also implement with the advancement in sensors and control systems that allow for optimal resource and integrated disease and pest management.

1.1 LITERATURE SURVEY

[1] Agricultural Robot for Automatic Ploughing Seeding, 2015. Amrita, Sneha A, Abrasive, Ankita A, Mrs.R.Praveena, Mrs.R.Srimeena

In the method the farmers themselves verify all the parameters and calculate the readings. It focuses on developing tools to display and alert the users.

[2] The design of general purpose autonomous agricultural mobile robot: "AGROBOT", 2020. Burak Berk Üstündağ

It focuses on sustaining robot which has the capability of processing and monitoring field operations like spraying, fertilization, diseases diagnosis, yield evaluation, soil evaluation.

[3] Gesture Controlled Wireless Agricultural Weeding Robot, 2019. S. Gokul, R. Dhiksith, S. Ajith Sundaresh, M. Gopinath

This paper goals to replacement of hand weeding in organic farming by a device working with gesture control at field level.

[4] Managing a Mobile Agricultural Robot Swarm for a Seeding Task, 2016. Timo Blender, Thiemo Buchner, Benjamin Fernandez, Benno Pichlmaier and Christian Schlegel

This is an approach for self sufficient seeding task via a coordinated swarm of robot.

[5] Multipurpose Autonomous Agricultural Robot, 2020. K Durga Sowjanya, R Sindhu, M Parijatham, K Srikanth, P Bhargav

The project was developed and tested for various agricultural activities like ploughing, seeding and levelling using robot with C programming.

1.2 PROBLEM STATEMENT

In the modern era, the main problem in agricultural field includes

1. Lack of farm labor availability

2. Increase in labor wages

3. Wastage of seeds

4. More wastage in water

5. Disease detection

1.3 OBJECTIVES

To build a battery-operated Agricultural Robot for multipurpose farm activities. It should check humidity and temperature of surroundings. The seeds have to be dispensed. Spraying of water if moisture content is low. Image capturing of crops for disease detection. Disease detection using machine learning.

2.1 Methodology

This block diagram shows the overall view of the Farmbot. The blocks connected here are Arduino UNO, LCD display, PIR Sensor, Temperature and Humidity sensor, Wireless Camera, Bluetooth, buzzer, Seed Sower Unit, sprayer unit.

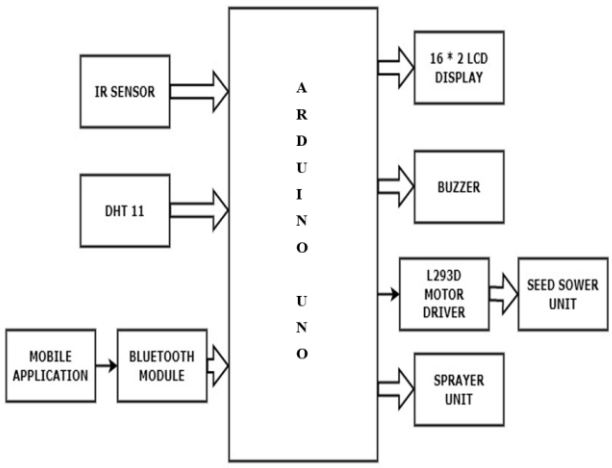

Fig 1- Block Diagram of Farmbot

The below diagram shows control of robot using Bluetooth communication

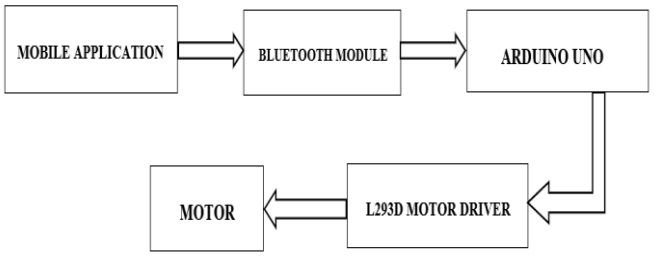

Fig 2- Blutooth Communication Block Diagram

Fig shows the training phase, few images are trained by extracting their feature and stored in a dataset. Which is used as reference data for the classifier to classify the input images.

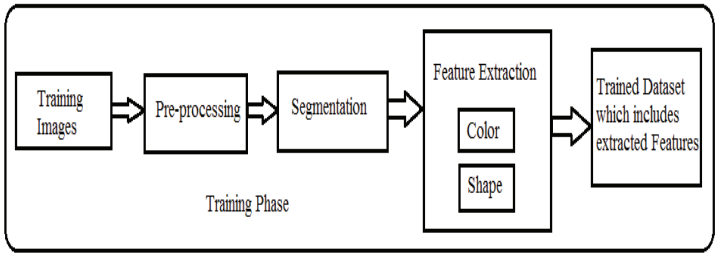

Fig 4- training phase

Fig shows the testing phase, the test image is sorted out and features are is given as input to the classifier. The classifier compares using the features stored in dataset during the training phase and results are given.

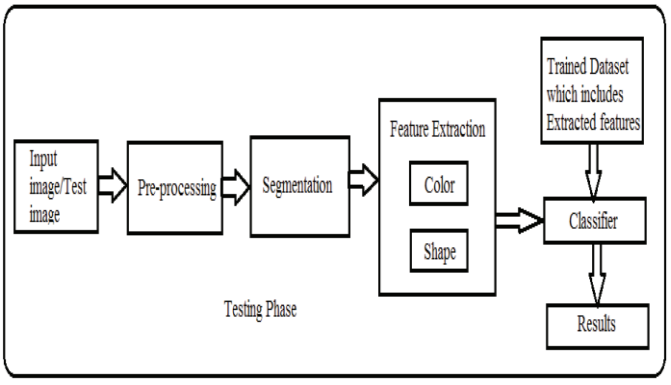

Fig 5- testing phase

In this project the software implementation is categorized for two modes based on the factors, operations that are being performed and the circuit configuration. The modes are namely,

Mode-1: In this mode we focus on the components that's situated near the Arduino chip. We only focus on the IR sensor, DHT11 sensor and the Display.

Mode-2: In this mode we focus on the heavy operational components such as the seed Sower unit and the sprayer unit.

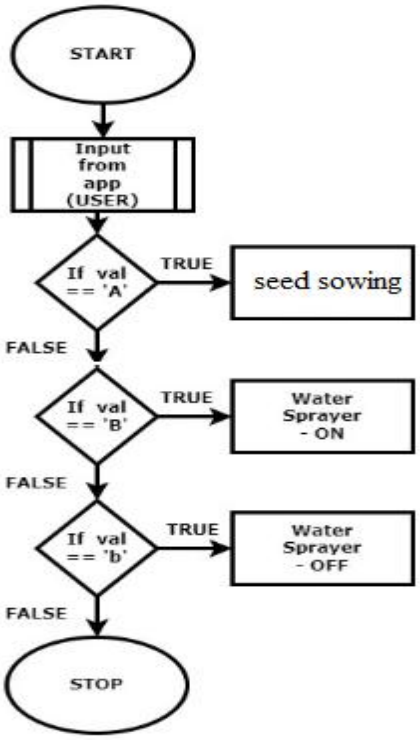

Fig 6- Mode 1 Flowcart

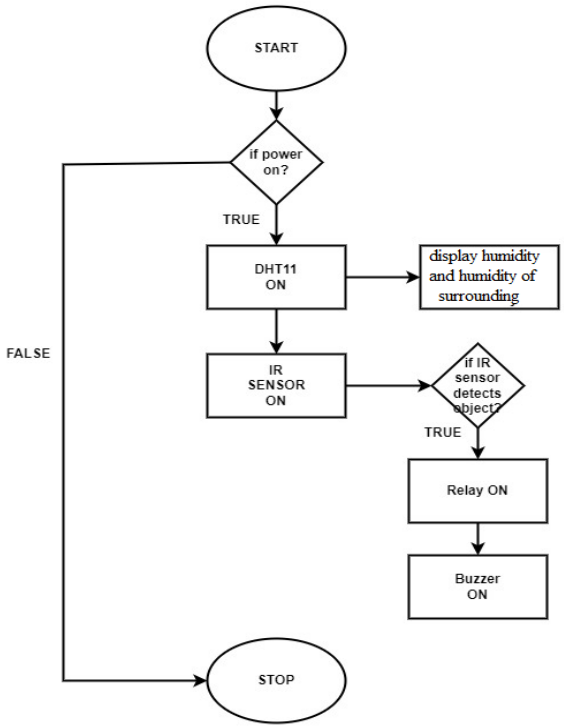

Fig 7- Mode 2 Flowchart

2.2 HARDWARE IMPLLEMENTATION

The working of the agricultural robot is mainly dependent on the Arduino UNO. When we on the robot and connect to supply from battery, we have to connect it to mobile application named 'FARMBOT' using Bluetooth. The application gives voice command saying "connected". The application as a image of man which when we give long press shows the value of temperature and humidity. This agriculture robot has two units:

1. Seed sowing unit

2. Water Sprayer unit

These 2 units can be controlled with the help of Bluetooth module.

The seed sowing unit has a motor unit and a hole within the unit for seed storing. As soon as the seed sowing icon is pressed the flap opens. The robot moves certain distance, flap opens seeds are dropped and flap closes and robot moves forward. This operation is continued until we press stop icon.

A unit for water is provided. This has the pipe with small holes attached to it. And when the sprinkler icon is turned on the relay turns on which in turn turn on the motor to spray water. Again this action is stopped when we press the stop icon.

This particular robot has one more feature i.e., "Obstacle sensing". For this purpose, the ultrasonic sensor is used. The sensor detects the object from the adjusted distance and robot turns towards left or right. The movement of the robotic vehicle is controlled with the help of Bluetooth module and mobile application. It can go front, back, right and left. It also has a camera fixed using which it collects images of crop.

2.3 SOFTWARE IMPLEMENTATION

For this robot the software used is Embedded C.
There is an additional feature i.e disease detection using machine learning. In training phase few images are trained by extracting their feature and stored dataset, which is used as reference data for the classifier to classify the input images.

In testing phase the test image is sorted out and features are given as input to the classifier. The classifier compares using features stored in dataset during the training period and results are given.

We have used phyton programming for this operation.

ADVANTAGES

Efficient in serving its purposes like seed sowing and water spraying.

It reduces human efforts.

It is easy to use Bluetooth control unit to control the complete movement of bot is user friendly.

Transportation of the robot is easy and can be handled smoothly due to the design planning and structure of robot.

Performs primary functions agriculture.

It is cost efficient.

Increase yield in crops.

Image processing and machine vision have a greater prospective in determining rice blast disease.

3. CONCLUSIONS

Agricultural robots are feasible machinery and devices for agricultural uses that provide precise accuracy in seeding, weeding, watering, harvesting, and reducing farm waste. The discovery highlighted the significant benefit of robots in agricultural techniques for effective mechanized farming in the agricultural industry. Agricultural robots are critical equipment for performing repetitive jobs faster, cheaper, and more correctly than people in farm cultural practices, inspection, and harvesting as well as post-harvest processing.

An attempt is made in developing a Farmbot with is Bluetooth operated agricultural robot which performs sowing of seeds, water sprinkling operations. The proposed system is battery operated ad controlled by Bluetooth device. Using this robot, farmer can carry out other secondary activity along with operating robot. By carrying out multiple activities at the same time, farmer can increase his income which results in development of economy.

Tremendous development has to be done in identifying and flagging of blast resistance genes with different molecular markers. The most significant is neck blast. Biological control introduction is environment friendly in rice production. Rice cultivation techniques should be altered with modern approach cropping system. Crop rotation is one of the vital techniques for reducing the occurrence of rice blast disease. And adapt new varieties as climate changes.

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