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Autonomous Robot based Agriculture Remote Farming

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Abstract: ***The agriculture industry plays an important role in the needs of humankind. The rising of the world population, as well as the decrease in the number of workers in the agricultural sector, calls for an increased demand for food suppliers. In this project, we propose a novel agricultural robot based on artificial intelligence, for detect the worm and grasshopper autonomously without any human intervention. The wifi device acts as a master device in this project, the robots are slaves. The robot is connected with master device through Wi-Fi hotspot. If the robot detects the worm and grasshopper using HAAR cascade algorithm and the pesticide will be sprayed, and also if any critical problem captures the image and send email to farmer through online. HAAR cascade algorithm will compare the captured image with the pre-stored image to find out the pest in images. Thus, this system ensures the pest controlled in agriculture.***
Keywords: Haar Cascade Algorithm, Slave Robort, Master Device, Pest Detection

I. INTRODUCTION

Grasshoppers and related insects such as locusts are pest insects and can damage crops and eco-systems. While grasshoppers are usually seen as individuals, they can gather in large groups1 and devastate vegetation. Grasshopper swarming behavior is uniquely found in both the nymph and adult stages2, when they reach the adult stage, they can swarm in the air3. They are highly diverse, in Inner Mongolia alone there are approximately 130 grasshopper species4, and these vary within regional environmental sub zones. Of the 130 species there are three common types: the early-season speciess Dasyhippus barbipe, the mid-season species Oedaleus asiaticus, and the late-season species Chorthippus fallax5, 6. this high diversity makes recognition of individual species challenging. In addition grasshoppers show phenotypic plasticity or polyphenism (multiple phenotypes arise from a single genotype), which is a density-dependent physiological phase that depends on environmental conditions. Grasshoppers are also known to change their appearance and color in response to changes in their social status and environmental stimuli and to adapt to environmental changes. Diversity and their response to the surrounding environment make it challenging to discriminate insects within typical environmental backgrounds (grasslands) and pose a significant challenge for the adoption of image analysis systems for pest detection.

II. RELATED WORKS

Zhou M, Liu. H and Wu.W proposed a building up a product model framework for early vermin identification on the tainted harvests in. Pictures tainted leaf are caught by a camera with container tilt and zoom and afterwards prepared utilizing image processing methods to identify nearness of pests.

L. Zhu and Z. Zhang proposed a novel method to identify insects. They used integrated region matching and dual tree complex wavelet transform for image matching. The collected images of lepidopteran insects are reduced into 248×200 pixels and filtered using mean shift algorithm. The processed image is segmented in region based on k-mean algorithm using colour feature. They used a 3pixel-wise segmentation to classify pixels into region according to their colour properties.

F. A. Carino, P. E. Kenmore, and V. A. Dyck proposed a In the study of Carino, Kenmore and Dyck there are several sampling techniques and devices for pest management decision-making; the light trap, that involves varying size sample which is good for comparing seasonal and yearly catches of insects, but catches are subject to changes in insect behaviour and do not catch none flying insects; the sweep net (catching insect using fishnet), is a fast method, very economical, and good for sampling arthropods staying in canopy of rice, but it has human error due to Variability and poor catch of arthropods at the base of the plant; tapping the rice, After tapping, arthropods are identified and counted immediately in the field; the visual counting and data recording can be done on field but also subject to human error and very costly in labour; it measures insect migration, easy sorting and counting of samples, but the attraction is due to color stimulus and does not catch any flying insects.

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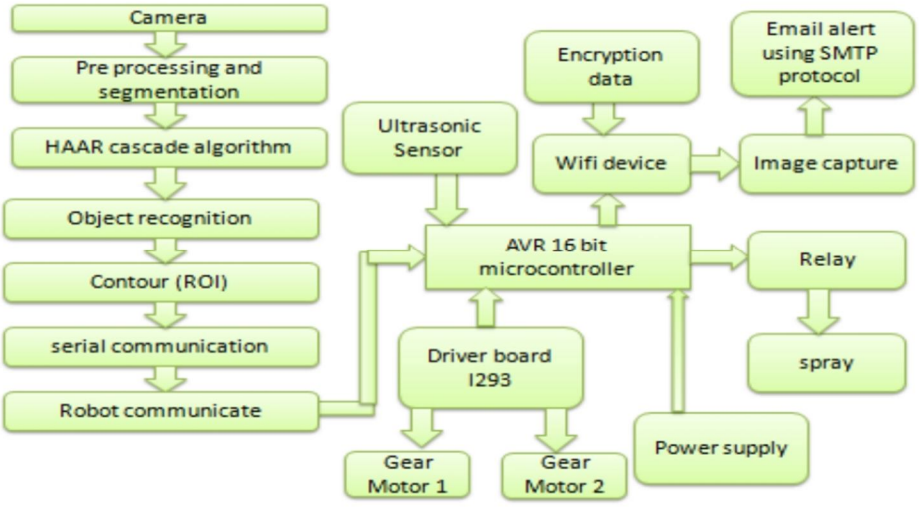
Rupesh G. Mundada, Dr. V. V. Gohokar proposed a Various methods exist to detect and identify different types of pests like whiteflies, aphids and borers. Whiteflies and aphids are detected on yellow sticky traps by Rupesh G. Mundada et. al. using pan tilt camera with zoom features. The features like eccentricity, color, mean, standard deviation etc, are extracted and stored in the support vector machine (SVM) and these features are used for detecting and classifying whether the bio aggressors are aphids or whiteflies.

Pratibha GP, TG Goutham, Rajas PR, Mrs. Kamalam Balasubramani proposed a image processing techniques to detect borers on tomato plants. The image is captured and obtained by the system followed by RGB to grayscale image conversion. Then the image undergoes segmentation process to extract the interested area. Filtering is done by distinguishing the border and the tomato pixels so as to remove noise. The target object is extracted which is the borer. It also gives a count of the borers in the tomato.

III. PROPOSED SYSTEM

In this proposed system a novel agricultural robot based on artificial intelligence, for detect the worm and grasshopper autonomously without any human intervention. The Wi-Fi device acts as a master device in this project, the robots are slaves. The robot is connected with master device through Wi-Fi hotspot. If the robot detects the worm and grasshopper using HAAR cascade algorithm. The input image from the camera will be preprocessed and compared with the images stored in data base. The sample images can be trained with HAAR cascade algorithm and the pesticide will be sprayed, and also if any critical problem capture the image and send email to farmer through online. The farmer easily updated about the lands.

A. Block Diagram



In order to perform runtime operations, the device's Web camera is used. To capture a Photo. Where the camera is to recognize the bugs and grasshopper where the AI is used for the reorganization technique using HAAR cascade algorithm. After this they are given to the contour mapping, which means hopping against the structure to have progressive goals, next is the serial communication is a process where the hardware and the laptop communicate. At the rate of 9600 frequency the data will be transferred to the robot and the robot will communicate through serial communication.

IV. HARDWARE DESCRIPTION

A. AVR 16 BIT Microcontroller

The low-power Atmel 8-bit AVR RISC-based microcontroller combines 8KB of programmable flash memory, 1KB of SRAM, 512K EEPROM, and a 6 or 8 channel 10-bit A/D converter. The device supports throughput of 16 MIPS at 16 MHz and operates between 2.7- 5.5 volts.

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B. IC Voltage Regulators

Voltage regulators comprise a class of widely used ICs. Regulator IC units contain the circuitry for reference source, comparator amplifier, control device, and overload protection all in a single IC. IC units provide regulation of either a fixed positive voltage, a fixed negative voltage, or an adjustable set voltage. The regulators can be selected for operation with load currents from hundreds of Milli amperes to tens of amperes, corresponding to power ratings from milli watts to tens of watts. A fixed three-terminal voltage regulator has an unregulated DC input voltage, VI, applied to one input terminal, a regulated DC output voltage, Vo, from a second terminal, with the third 16terminal connected to ground. The series 78 regulators provide fixed positive regulated voltages from 5 to 24 volts. Similarly, the series 79 regulators provide fixed negative regulated voltages from 5 to 24 volts.

C. Driver Board L293

Double H driver module uses ST L298N dual full-bridge driver, an integrated monolithic circuit in a 15- lead Milliwatt and PowerSO20 packages. It is a high voltage, high current dual full-bridge driver designed to accept standard TTL logic levels and drive inductive loads such as relays, solenoids, DC and stepping motors. Two enable inputs are provided to enable or disable the device independently of the input signals. The emitters of the lower transistors of each bridge are connected together and the corresponding external terminal can be used for the connection of an external sensing resistor. An additional supply input is provided so that the logic works at a lower voltage.

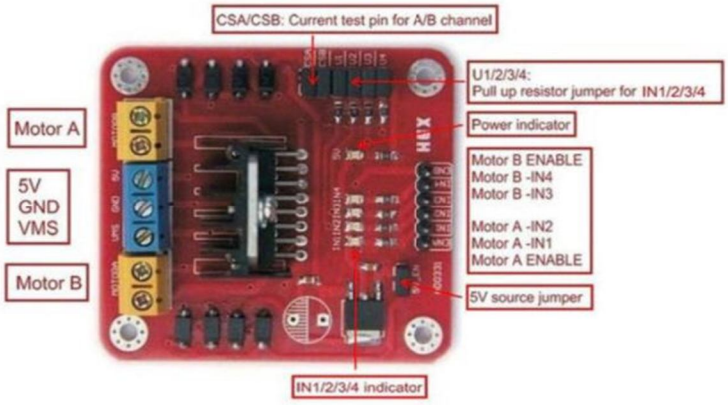

Figure 1 Driver Board L293

D. Gear Motor

Geared DC motors can be defined as an extension of DC motor which already had its Insight details demystified here. A geared DC Motor has a gear assembly attached to the motor. The speed of motor is counted in terms of rotations of the shaft per minute and is termed as RPM .The gear assembly helps in increasing the torque and reducing the speed. Using the correct combination of gears in a gear motor, its speed can be reduced to any desirable figure. This concept where gears reduce the speed of the vehicle but increase its torque is known as gear reduction. This Insight will explore all the minor and major details that make the gear head and hence the working of geared DC motor.

Figure 2 Gear Motor

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E. Wifi Device

ESP8266 is Wi-Fi enabled system on chip (SoC) module developed by Espresso if system. It is mostly used for development of IoT (Internet of Things) embedded applications.

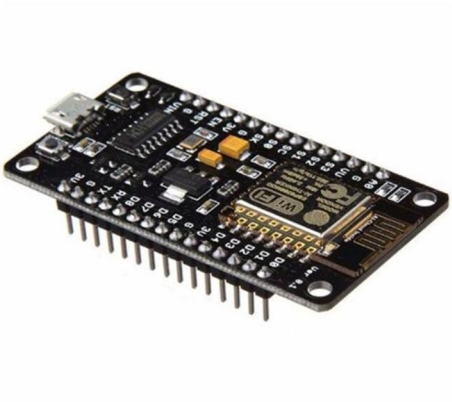

Figure 3 Wifi Device

F. Relay

The basics for all the relays are the same. Take a look at a 4 – pin relay shown below. There are two colors shown. The green color represents the control circuit and the red color represents the load circuit. A small control coil is connected onto the control circuit. A 20switch is connected to the load. This switch is controlled by the coil in the control circuit. Now let us take the different steps that occur in a relay.

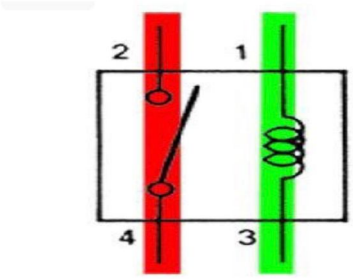

Figure 4 Relay

G. Water Pump

The water pump is a portable device and can be applied in several household applications. These pumps are used for pumping the huge amount of water from one place to another. The main purpose of a water pump is versatile. A quality pump which can be selected carefully may be perfect for draining water from a low flooded region, refilling the swimming pool, and bathtub, circulating pesticides otherwise fertilizers.

Figure 5 Water Pump

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V. SOFTWARE DESCRIPTION

A. Haar Cascade Classifier Algorithm

Object Detection using HAAR feature-based cascade classifiers is an effective object detection method proposed by Paul Viola and Michael Jones in their paper, "Rapid Object Detection using a Boosted Cascade of Simple Features" in 2001. It is a machine learning based approach where a cascade function is trained from a lot of positive and negative images. It is then used to detect objects in other images. Here we will work with face detection. Initially, the algorithm needs a lot of positive images (images of faces) and negative images (images without faces) to train the classifier. Then we need to extract features from it. For this, Haar features shown in the below image are used. They are just like our convolutional kernel. Each feature is a single value obtained by subtracting sum of pixels under the white rectangle from sum of pixels under the black rectangle.

B. SMTP Protocol

SMTP stands for Simple Mail Transfer Protocol. SMTP is a set of communication guidelines that allow software to transmit an electronic mail over the internet is called Simple Mail Transfer Protocol. It is a program used for sending messages to other computer users based on e-mail addresses. It provides a mail exchange between users on the same or different computers, and it also supports: It can send a single message to one or more recipients. Sending message can include text, voice, video or graphics.

C. Pycharm Introduction

PyCharm is the most popular IDE used for Python scripting language. This chapter will give you an introduction to PyCharm and explains its features. PyCharm offers some of the best features to its users and developers in the following aspects .Code completion and inspection , Advanced debugging, Support for web programming and frameworks such as Django and Flask.

VI. RESULTS AND DISCUSSION

The output of the proposed system is shown in figure 6.

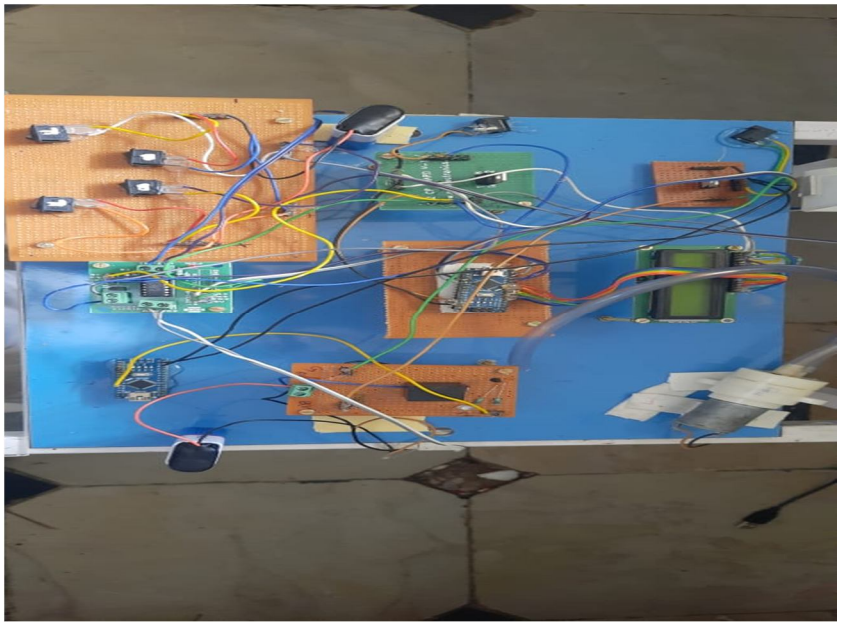

Figure 6 Output Of The Proposed System

VII. CONCLUSION

This project presents a real-time grasshopper and worm detection robot. The framework can be used image processing to detect and localize. Grasshopper and worm is detected using HAAR cascade algorithm in artificial intelligence for image classification, color histogram and feature extraction. This developed robot system helps to save the cost and environment for the farmer in order to protect the crop. Time and accuracy were considered as important. By using the HAAR cascade algorithm the process going to work so efficiently to boost up the process and provide the effective outcome and clear one.

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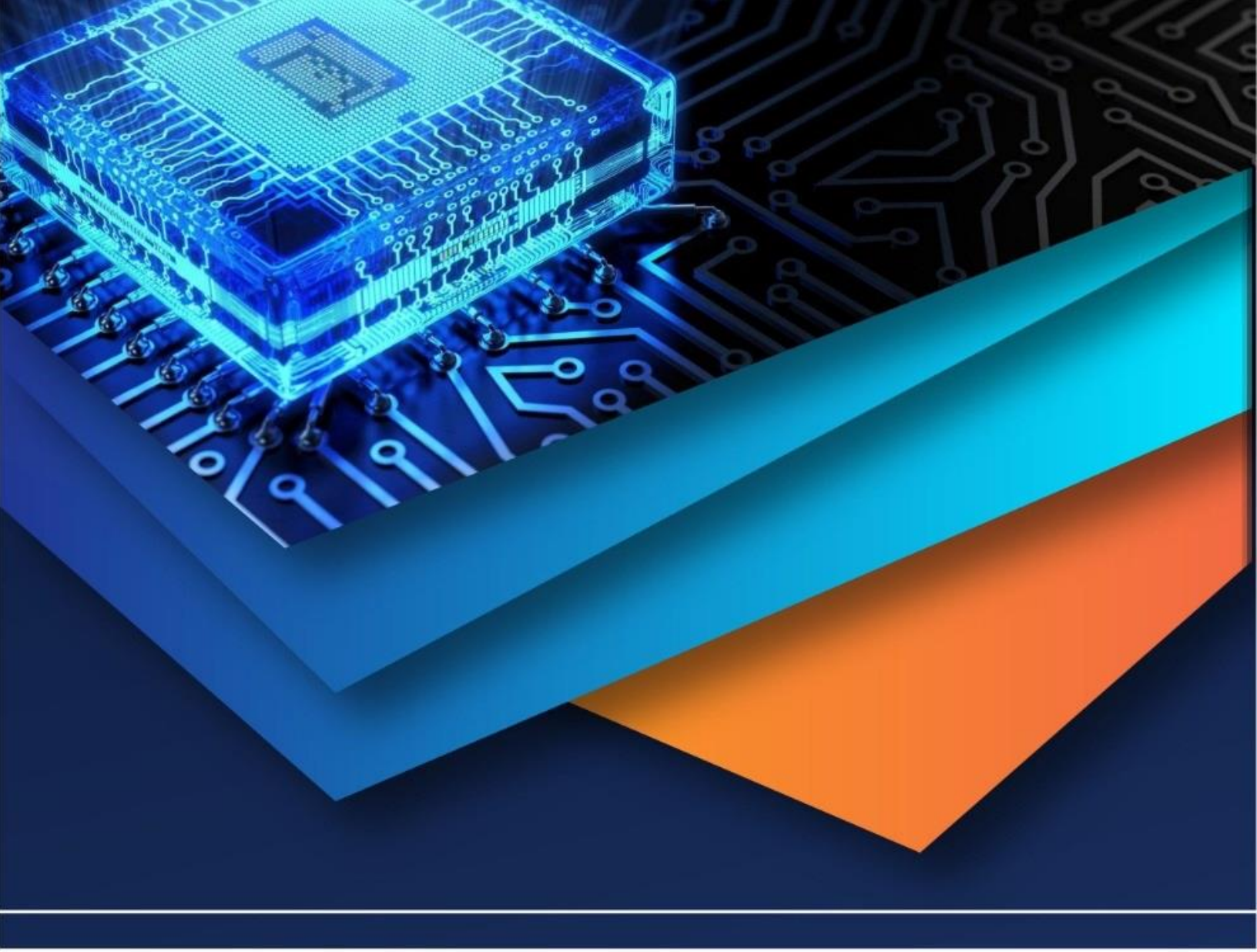

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