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Development of Colour based Tomato Harvesting Robot

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Abstract: ***Now a days the robots are covered almost in every field in that agriculture plays major role in utilization of the robots. In this project a tomato harvesting robot was developed. For households, the project aims to protect the privacy of people who have their own gardens at home, and do not prefer to have workers coming to their home gardens to harvest the fruits. In addition, the weather in India is very hot, which makes it difficult for harvesters to work for long periods of time. This creates a problem because if the gardener does not finish harvesting on time; the tomatoes become rotten causing wastage and loss. Therefore, using a harvesting robot provides an excellent solution for harvesting in such conditions. The developed robot picks out the tomatoes that are ripe enough without causing any damage to the surroundings, and leaves the ones that are not ripe enough. Moreover, the robot identifies the ripe tomatoes by image sensing using a camera. After that, the robot picks the ripe tomato and places it in a basket. The robot repeats the previous steps until there are no tomatoes left on the plants. The robot has additional features, such as picking the rotten tomatoes and placing them in a separate basket. In this paper, we present the design and implementation of this harvesting robot.***

I. INTRODUCTION

The harvesting robot is a robot that harvests ripen tomatoes in greenhouses. It harvests the ripe ones and puts them in a designated box. It also harvests the rotten tomatoes and puts them in a separate box. Harvesting in large greenhouses needs a large number of workers to pick up the ripe crops. Manual labour causes money loss if they do not pick up the crops once they are ripe. In our region, workers face many obstacles, one of them is the poor climatic conditions that prevent them from effectively performing their job Furthermore, many of the people who have home gardens prefer not to hire a harvester in order to protect their privacy, based on all aforementioned factors, the goal of this project is the following. Harvesting in the hot weather, delivering the ripe and fresh vegetable to the market on time, increasing the efficiency of harvesting in greenhouses and home gardens, protecting the privacy of people who have home gardens, to solve these problems and to achieve the desired goals. The developed robot has to satisfy the following objectives. The robot has to have a flexible mechanism to efficiently pick the ripen tomatoes and place them in the specified container, the robot has to have some sort of a force sensor that prevents the harvesting mechanism from damaging the vegetable when picked, the robot has to have a mechanism for detecting the current state of the boxes (space available vs. full), the robot should have a mechanism to notify the owner of the current state of the harvesting process

II. BACKGROUND

AGROBOT SW 6010 is the strawberry harvesting robot developed by company Agrobot. It can locate and identify the strawberries by using cameras and sensor present in it. When the robot detects ripen strawberry, the robotic arm moved towards detected fruit, grab it and release the fruit in storage. The end effecters of the robot consists of blades to cut the stem of the fruit. The harvested strawberries are transported by a conveyor belt. Two peoples seating in the front of the machine to separate fruits by its quality. This machine is not available in the market

The company Octinion is also developed a robot to harvest strawberry. This robot grab fruits from the plant and put it in the basket. This robot can identify ripen fruits accurately, it uses three cameras for machine vision. In this robot 3d printed soft grippers are used to pull the fruit which results in divided pressure on the fruit. It is the good method of harvesting compared to cutting or burning of stem. An autonomous navigation system is also implemented in this robot.

The company FFRobotics is an agricultural technology based company that develops the fully automated fresh fruit harvester robot. This design is especially made for harvest apples, but according to the FFRobotics company the robot should be able to harvest variety of tree fruit after setting the specialized end effectors, this machine consists of a linear robotic arm that stretch towards the recognized fruit into the tree and remove the fruit. In this robot deep-learning algorithm is applied to identify the ripe fruit,

SWEEPER robot is also a harvesting robot. Which is used to harvest sweet peppers. This robot is combination of mobile autonomous system, a four degree of freedom robotic arm and vision system. Two different cameras are used in vision system which recognize the fruit accurately. In end effector the blades are used to cut stem of the pepper

III. METHODOLOGY

Our tomato harvesting robot is divided into three main sub systems, recognition system, harvesting system and moving system, The recognition system is the main unit in the robot which detects the ripen tomatoes in the plant and removes all unwanted background objects through image processing technique with matlab, this system made up of two cameras based on stereo vision method which also help us to identify the position of detected tomato. The second system is picking system, this system is made up of 5 degree of freedom robotic arm. The end effectors of robotic arm is specially designed to divide pressure around the surface of the tomato while picking. After detection of ripen tomato the robotic arm is moved towards detected tomato to remove it from plant, the end effector hold tomato, twist the tomato and finally remove the tomato from the plant. Here we are using raspberry pi kit and python programs to control harvesting system and moving system. Moving system is made up of four wheel moving chassis which support the body of a robot, we install body of the robot in it, it is a vehicle frame, under part of a motor vehicle, on which the robot is mounted. If the ripen tomato is detected by recognition system the stop command is passed to moving chassis, after picking all tomato start command is passed to moving system.

IV. RESULTS AND DISCUSSION

The robot was designed to pick only ripen tomatoes, and it should not disturb the unripen tomatoes so to identify ripen tomatoes we build a code matlab. The hardware system of the robot was automatically controlled by raspberry pi through python programs. The python programs was designed in such a way that the robot was move towards the plant automatically, identify the ripen tomato and pick it from the plant automatically. So according to our implementation, the robot is working successfully without any issue. And all components working fine. In working there is minimum error.

V. CONCLUSION

Harvesting robots which have been of great use especially in green house large agricultural field. The main intention of this project was to build the robot at low cost which was done. This harvesting robot was capable of being applied in verity of fields because of its mobility on both straight line and turning areas. The main advantage of our work is that one's the code is dumped there is no need of interaction during operation, hence this robot is diagnosed self-governed robot

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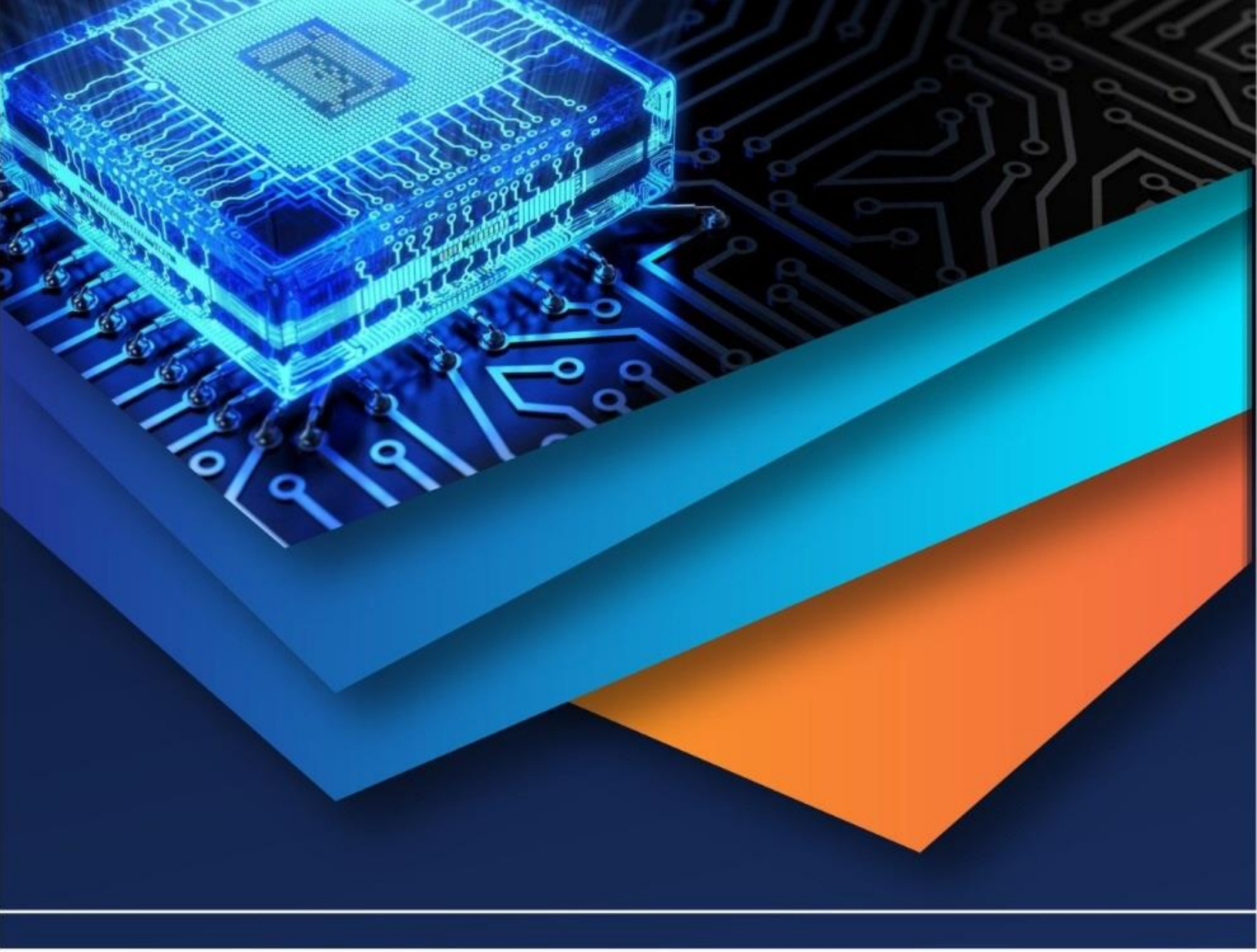

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