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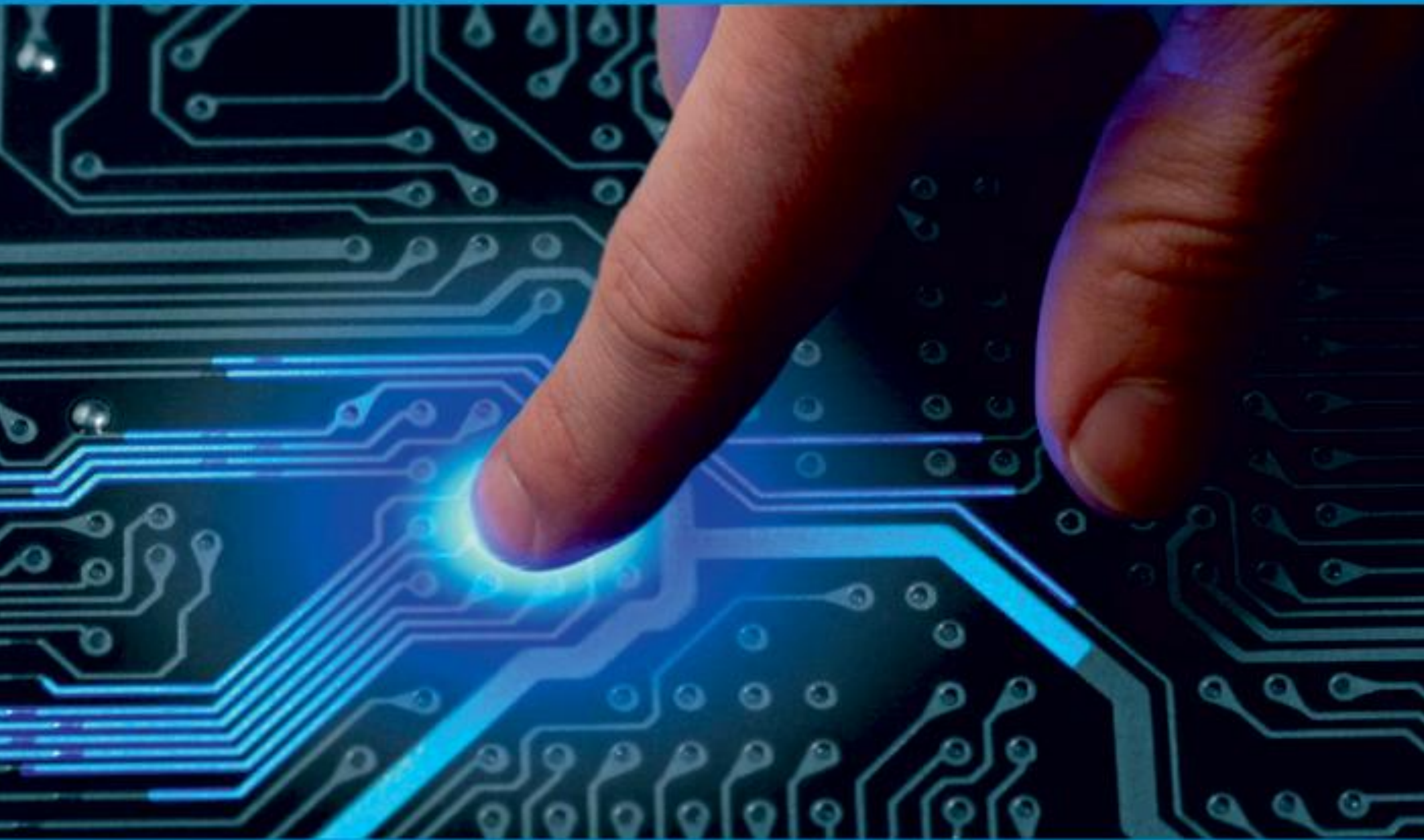

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Intelligent Robots for Flower Harvesting

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ABSTRACT: An automated system for harvest of genus Nerium pedicels with the help of image analytic methods is developed. Agricultural applications has made over thousand years and the entire processes dependent on the people. This increases labour time of the process and as well as cost of the products. To overcome this problem, the automated system of the robotic harvesting processes are needed in the place of humans. The study can be divided into two parts: The development of algorithms for the identification of Nerium pedicels in digital images and the development of procedures for harvesting Nerium pedicels with a robot. Images of plants are taken with a stereo camera system. ROS (Robotic Operating System) is used to develop the flower identification using python language. The developed image processing algorithm segments the potential pedicel regions in the images. In this, process of harvesting pedicels of different species with similar basic characteristics is imaginable.

KEYWORDS: Robotic harvesting process; Stereo camera system; Robotic operating system; Harvesting robot;

I. INTRODUCTION

The main purpose of energy efficient algorithm is to maximize the network lifetime. These algorithms are not just related to maximize the total energy consumption of the route but also to maximize the life time of each node in the network to increase the network lifetime. Energy efficient algorithms can be based on the two metrics: i) Minimizing total transmission energy ii) maximizing network lifetime. The first metric focuses on the total transmission energy used to send the packets from source to destination by selecting the large number of hops criteria. Second metric focuses on the residual batter energy level of entire network or individual battery energy of a node [1]. In recent year, more number of people and farmers are depending on agriculture. The main purpose of harvesting robot is reduce the work time and easy to pick the flowers. Flower picking robot is one of the most popular robotic applications. In this project developing a flower identification for genius nerium flower. There are many fields of application in agriculture. Harvesting robot help agricultural products to grow more efficiently and keeps them high quality because of the controlled circumstance. Harvesting robot is very useful to agriculture field. In recent years, the shortage of farming labour counts is getting worse because of impact of the falling birth rate and the aging farmers. For the solution of this problem, some automatic harvesting robot systems have been proposed. The difficulty of picking robots exists in identification of flowers, cutting systems, moving systems, and so on. Recognition of flowers is newly carried out by image processing using stereo camera. Therefore, the picking robot system for the flower and pedicels that has special color to pick flowers. Because the color of flowers is almost same of blossom, and recognition of the flowers is difficult. (9) In HSV (Hue Saturation Value) color space, the S component can make flowers prominent from background. The fast FCM (Fuzzy C Means) algorithm based S component was proposed to segment images. Binocular stereo vision just analyses two images to acquired 3D information and does not have other mechanical time consuming problems.

In this project, ROS (Robotic Operating System) is used to develop the flower identification using python language. This project recognize and identify flower of the stereo vision. Stereo camera is a type of camera. This is a two or more image sensors. Stereo camera is a well perform in sunlight. Stereo camera use image process of nerium flower and pedicels. All technical data and related costs were based on recommendations from other research groups and experts. However the economic figures such as period of depreciation, real interest rate (10%) and maintenance costs were based on the authors' assumptions(8). This Agricultural robot technology develops a nerium flower identification and image processing. Stereo vision accurately measure the flower image and distance. To pick up a flower, the relative positions of the flower and the manipulator are detected using the stereo image processing method.

Agricultural robot technology could reflect the agricultural mechanization level, which is an important symbol of a nation agricultural modernization level. The automatic recognition by computer vision nerium flower is receiving an

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increasing attention [7]. In the agricultural sector, computer vision has been applied in many aspects, e.g., the recognition of flowers proposed a target identification method by analyzing the color difference between targets and background. This method identified flowers with an average accuracy of 70.0%. However, the target covered by leaves cannot be accurately identified.

In the same way, developed an algorithm for removing the background by R-G, which could make flower be highlighted from irrelevant background, and achieve the target localization by morphological characteristics. In order to recognize occlusion targets, Wang proposed a new algorithm based on selective cross correlation coefficients to search images under partial occlusion. Sun et al[10] found that multi-scale retinex with color restore can effectively enhance the nerium flower and pedicels images under various natural lighting conditions, and the overlap targets can be recognized with the rate of 98.91%.There are varity of image segmentation techniques the techniques is measurement space guided spatial clustering. Modern automation technology is the key to realize precision farming operations. Fusing depth information with 2D image information is a better approach to realize automatic harvesting. Current harvesting robot for flower picking methods are mainly based on image processing, binocular stereo vision system to acquire depth information. In this system, the recognition accuracy rate of clustered flowers was 87.9% when the occlusion rate was less than 30%.

The above mentioned methods using cameras as the main sensing devices show the trend of being affected by illumination variations, which would decrease the accuracy of localization. To avoid or reduce the influence of natural lighting conditions, used a laser-based computer vision system to detect flowers. In this system, range and reflectance images which were produced by infrared laser rangefinder sensor were applied to detect spherical targets under various illuminations conditions. Stereo vision system to acquire nerium 3D position, this system used a laser range-finder to collect distance information when the harvesting robot moved horizontally. Although the position accuracy of this system was less than 4 mm, it increased complexity during data acquisition and cost less harvesting time. As mentioned above, many studies focused on detecting various kinds of flowers. However, little research is available about genus nerium harvesting robot. Therefore, this study conducted some related researches and identification of genus nerium.

II. RELATED WORK

In [2] The crop and weed segmentation problem by using an ensemble of small CNNs compressed from a more complex pre trained model and report an accuracy of nearly 94% propose a method to distinguish carrot plants and weeds in RGB and near infra-red (NIR) images. They obtain an average accuracy of 94% on an evaluation dataset of 70 images. Apply a deep CNN for classifying different types of crops to estimate their amounts of biomass. They use RGB images of field plots captured at 3 m above ground and report an overall accuracy of 80% evaluated on a per-pixel basis present a multi-step visual system based on RGB+NIR imagery for crop and weed classification using two different CNN architectures. A shallow network performs the vegetation detection and then a deeper network further distinguishes the detected vegetation into crops and weeds.

In [3] A harvesting robot collecting fruit in an individualized way must be able to guide its mechanical arm towards each piece of fruit on the tree. Therefore, the three-dimensional fruit location must be computed. This project using the computer vision method was performed. The main features is sensor and accessories utilized for capturing the images and image processing. This review is presented in chronological order to show the research evolution in this area. A review of previous studies to automate the location of fruit on trees using computer vision methods was performed. The majority of these works use CCD cameras to capture the images and use local or shape-based analysis to detect the fruit.

In [1], Robotic Harvesting mainly uses color clustering and stereo matching method. This should be performed using image processing techniques which must be sufficiently robust to cope with variations in lighting conditions and a changing environment. One of the key tasks in this robotic application is to identify the fruit and to measure its location in three dimensions. Color segmentation is usually performed by mapping the three color components of each pixel (RGB; red, green, and blue) into the HSV (hue, saturation, and value) color space. stereo matching is performed on each image pair for the same arm (and camera), to associate corresponding centers to unique oranges in space. On a larger scale, the layout of the orchards includes rows of trees which are of a broad range of sizes, and the limited spacing between rows hinders an overall sensing of the environment.

This paper [4] describes the laser based computer vision system. The output of this vision system includes the 3-D position, radius and surface reactivity of each spherical object. It has been applied to the AGRIBOT orange harvesting robot, obtaining good fruit detection rates and unlikely false detections. Computer vision techniques are being used to analyze images of agricultural products for grading purposes under controlled illumination with successful results, automating real-time sorting tasks previously done by human operators.

However, the automatic recognition of fruit for agricultural harvesting is a problem not satisfactorily resolved yet, due to the complexity of this environment. Therefore, the harvesting of delicate fruit such as oranges, peaches or apples is now being performed by hand. The methodology used in this research [9] was found to be powerful and offered an

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objective way to evaluate and optimize the kinematic structure of a robot to be used for cucumber harvesting. In 2001 a 5 years research project on autonomous cucumber harvesting was concluded with a successful field test of the harvesting robot in a research greenhouse.

III. PROPOSED ALGORITHM

In this proposed system, new modern automation technology is used to reduce the cost using every basic model of hardware like Raspberry Pi as the core of ROS and using A1 model which also a 360-degree functional lidar. For Robot control, Simple Hardware is used to receive commands from the laptop. The Mapping is done in Python using the Robotic Operating System in Software Package of the Python. By using ROS Network configurations ROS Bot is communicated from the Python.

A. *Design Considerations:*

- Communications Infrastructure
- ROS middleware
- Standard Message Definitions for Robots
- Robot Geometry Library
- Robot Description Language
- Preemptable Remote Procedure Calls
- Diagnostics, Pose Estimation
- Localization, Mapping and Navigation

B. *Composition And Working Principle*

The workflow of the robot is as follows: the robot moves automatically along the path, and the binocular stereo camera acquire images. Once images are acquired, images segmentation and stereo location are performed by vision system. According to the spatial coordinates of flowers, the mechanical arm is guided to the location of targets. The flowers will be picked by end-effector. After all flowers are picked, the robot stops working.

The end-effector consists of clamping mechanism, suction nozzle and air cylinder, shown in Fig.1. The clamping mechanism is made up of two globoid claws which were installed with the distance of 30 mm. The suction nozzle was adopted to cut flowers, it can avoid destruction to other flowers during clamping process.

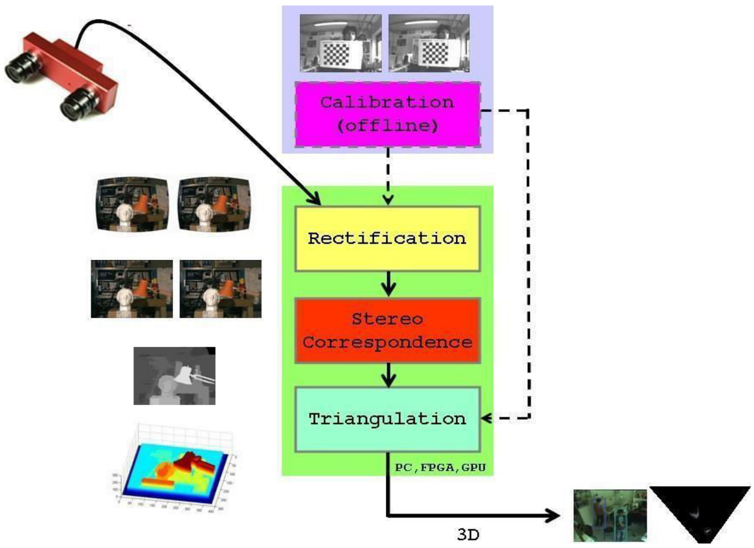

Fig 1: **Stereo vision block diagram**

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The processing architecture of picking flowers consists of three stages. In the first stage as the end-effector is guided to the picking position and the claws closed. There is a round hole with diameter of 10 mm in the middle of claws. The claws opened and the suction nozzle would hold the surface of flower pedicels. Then the target would be separated from cluster offlowers. In the third stage elbow type gas claws drove two globoidal claws to close. Finally, the flower would be picked.

C. M*odule Description*

The binocular stereo camera acquires images. Once images were acquired, images segmentation and stereo location were performed by vision system. According to the spatial coordinates of flowers, the mechanical arm was guided to the location of targets. The flowers would be picked by end-effector.

Sample Preparation

200 Genus nerium images will be acquired by Sony DSC-T9 digital camera (CCD, 6 million pixels, resolution of 2816 × 2112). The images will be stored in JPG format and their size was 720×480 pixels. In outdoor, the process of harvesting is probably taken place in different illuminations. So the images will be captured in different time periods (8:00, 13:00 and 17:00)

Targets Recognition And Localization Method - Image Segmentation

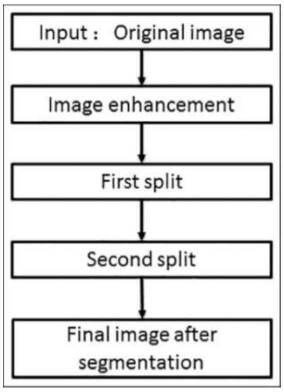

Fig 2: **Image segmentation**

RGB color model is the primary one, the main the values of S component, it can be found that one part whose purpose of RGB color model is just for the sensing, representation value is greater than 0.75 belongs to the stamen, another part and display of images in electronic systems, such as televisions and whose value is less than 0.18 belongs to the petal. The Figure computers The HSV color space, proposed by Smith in 6d showed that there were three obvious peaks. According to the definition of which was helpful to use the fast FCM clustering algorithm to saturation, it can be known that bright color generally has a high segment images as shown in fig 2.

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Stereo Matching

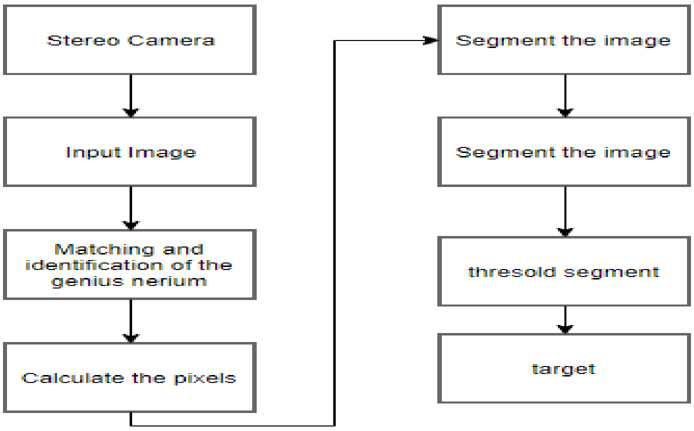

Fig 3: **Stereo Matching**

According to the description way of images, Stereo matching algorithm can be divided into regional, feature and phase matching algorithms. The nature of stereo matching is establishing the correspondence and calculating the parallax for feature points. Each feature point only has one specific point to match theoretically. In fact, one feature point probably has more than one point or has no point to match due to the effect of the surroundings and target attitude.

IV. CONCLUSION AND FUTURE WORK

Flower harvesting and flower identification is the main scope of this project. Genus Nerium flower increase the growth now, to overcome this problem this project has been developed. This project will be helpful for all farmers, agriculture fields and environment. As the most of workers are decreased, many robotics are developed in future. Based on User requirements, some high quality camera and sensor will be added in further project.

A recognition and localization system for genus nerium flower identification of stereo vision is designed independently in this study. Four experiments will be performed to validate the proposed methods. In the aspect of flowers segmentation, a fast FCM algorithm based on S component will be proposed in the future study. The frequency of pixels every grayscale is used as the sample data set, which can avoid redundant computing. According to the shape of genus nerium, feature matching method based on centroid will be adopted, and centroid is used as feature point to match and calculate the depth. It could meet the requirements of positioning accuracy for genus nerium flower identification. The overall experiment shows that average time from mechanical arm start-up to identify nerium flower. And genus nerium flower can be successfully identified and learning the stereo camera with the rate of 90%. Further studies will improve the adaptability of algorithm on occluded targets and the positioning accuracy on high-speed synchronous camera.

REFERENCES

1. Alessio Plebe, Giorgio Grasso, (2001) “Localization of spherical fruits for robotic harvesting”, Machine Vision and Applications 13:70–79.
2. Andres Milioto, Philipp Lottes, Cyrill Stachniss,(2018) “Real-time Semantic Segmentation of Crop and Weed for Precision Agriculture Robots Leveraging Background Knowledge in CNNs, IEEE International Conference on Robotics and Automation.
3. Jimenez A.R,R.Ceresand J.L.Pons, “A Survey of Computer Vision Methods for Locating Fruit on Trees”, Institutode Automatica Industrial (CSIC) Ctr. Campo Real, Km. 0.2 La Poveda 28500 Arganda del Rey, Madrid, Spain,http://www.iai.csic.es/lopsi.
4. Jimenez A.R, R. Ceres and J.L. Pons, “A vision system based on alaserrange-Finder applied to robotic fruit harvesting,“Machine Vision and Applications,Vol.11, pp.321-329, 2000”
5. Johan Baeten, Kevin Donné, Sven Boedrij, Wim Beckers, Eric Claesen, Submitted on 7 Dec 2007 “Autonomous Fruit Picking Machine: A Robotic Apple Harvester, https://hal.inria.fr/inria-00194739.
6. Pedersen S.M, S.Fountas H.Have, B.S.Blackmore, (2006) “Agricultural robots—system analysis and economic feasibility”, Springer Science+Business Media, LLC.

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| DOI: 10.15680/IJIRCCE.2023.1106054 |

7. Qinghua Yang, Chun Chang, Guanjun Bao*, Jun Fan, Yi Xun , (2018) "Recognition and localization system of the robot for harvesting Hangzhou White Chrysanthemums", Vol.11 No.1, January, Int JAgric & Biol Eng Open Access at https://www.ijabe.org.
8. Shinsuke Kitamura, Koichi Oka, July(2005)"Recognition and Cutting System of Sweet Pepper for Picking Robot in Greenhouse Horticulture" Proceedings of the IEEE, International Conference on Mechatronics & Automation, Niagara Falls, Canada.
9. Van Hentena, E.J, ∗, D.A.Van't Slotc, C.W.J.Hold, L.G.Van Willigen burge,(2009) "Optimal manipulator design for a cucumber harvesting robot", computers and electronics in agriculture 65247–257.
10. M.A.A.Galama,(2014) "Picking a flower with a KUKA youBot" Bachelorthesis, Credits:18EC

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