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A novel design for carrying out automated agricultural tasks using an agriculturally developed robot

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Abstract
This paper gives the design and development of a precision farming robot. Since a long time ago, agriculture has been a significant part of the Indian economy. 18% of India's gross domestic product is produced by the agriculture sector (GDP). A better answer for precision agriculture is provided by robotics and the internet of things. Selective harvesting is necessary when picking fruits or vegetables like tomatoes and apples. In traditional farming, each fruit is hand-picked by a worker, requiring a huge amount of labour to carry out selective farming. We suggest a robot that helps farmers with a variety of labor-intensive chores, such as selective crop harvesting and qualitative segregation, while also simultaneously providing data on crop health, soil nutritional status, and crop shelf-life detection. An android application is used to analyse, process, and send the obtained data to the farmer. Later, the weight, colour, and health of the particular crop are checked to grade its quality. The fruit is subsequently moved into the designated container after being graded. Spoiled or overripe fruits and vegetables would be plucked and dropped so as not to interfere with the plant's growth. A harvesting arm on the proposed robot would reach the fruit or vegetable and pick it from the plant or tree. The fruit would then be transferred to the appropriate container. With the aid of the app, the user would be able to give the device a certain task based on his requirements. Crop health monitoring, segregation, and selective harvesting all require image processing using a camera. Additionally, using image processing, illnesses are found. The image segmentation and pre-processing are being done by us. The guided, supervised, and advanced machine learning technique k-nearest neighbours (KNN) is used to build solutions for both classification and regression issues. This gives the farmer useful information that is essential for choosing the correct insecticides, herbicides, and fertilisers for higher yield. Every nation's primary issue and developing topic is agriculture automation. The need for food is rising rapidly as the world's population is growing at an extremely rapid rate. Farmers must apply toxic pesticides more frequently since their traditional methods are insufficient to meet the growing demand. This damages the soil. This has a significant impact on agricultural practises, and as a result, the land remains unproductive and desolate. You can employ a variety of automation techniques, including IOT, wireless communications, machine learning, artificial intelligence, and deep learning. The work given here is a mini-project that is taken up as a part of the curriculum completed by

lectronics and communication engineering students in the second year of the electronics & communication engineering department at Dayananda Sagar College of Engineering in Bangalore.
Keywords : Deep Learning, Machine Learning, AI, Wireless, IoT

1. Introduction - Objectives & Scopes

There is a severe labour shortage because of a lack of knowledge and the lack of sustainability of the farming industry, and farmers must raise a variety of crops each year. We created our robot with these issues in mind so that it can undertake selective harvesting and segregation of the matured fruits, as well as identify plant health diseases and send a notification to the farmer along with any parasites found in the plant. Additionally, this robot would be able to monitor the soil throughout the farm, collect important data like temperature, humidity, N, P, K, and pH values, and determine the best crop to plant in the field. A mobile application would be created to serve as an interface between the robot and the farmer.

2. Research Review- Segregation and selective harvesting

First, a comparison of the various strategies employed by the robot is provided. An extensive analysis of the algorithms utilised for selective harvesting and other tasks, such as the creation of Android apps, is also given.

Selective harvesting is the practise of just picking ripe fruit at a time [1]. An overview of the most recent developments in robotic selective harvesting in three different production systems—greenhouse, orchard, and open field—is given in this review study. This paper focussed on the use cases of selective harvesting and did not provide any technique [1]. This was merely a conceptual discussion of current agricultural robotics trends. The author of this article offered their ideas for additional advancements in this field. To do this, we need to focus more on robotic harvesting in [2] and automated optical fruit detection for harvest estimation.

They put out an entirely automated, semi-supervised (object learning model) system that could find specific occurrences of objects in previously unviewed photos. By offering two methods for dissecting clusters into individual object instances, we can increase the identification of single object instances within clusters. As a local feature descriptor, they used binary patterns in an adaboost cascade classifier model. By comparing regions of pixel intensities in the greyscale image, this type of classifier compares gradient information rather than colour information. but This system was a semi-supervised model, it didn't use neural networks, and it was focused on analysing grayscale images. It was reliant on how bright the light was [2].

3. Execution steps

To execute automatic fruit harvesting by a robot, a study in [7] suggests "fruit detection and localization" and "fruit harvesting by a robot manipulator with a hand which is able to collect without hurting the fruit and its tree." They had used a robotic hand to harvest the apple after detecting its location. The size of the fruit and its exposure to direct sunlight have an impact on this procedure. Fruit detection with a colour camera uses a variety of different features. To segment an apple, it used brightness and the RGB (red, green, and blue) colour difference. The suggested fruit harvesting algorithm also demonstrated that it takes about 16 seconds to harvest one fruit, however new SSD methods can speed up the process.

The convolutional neural network is crucial. Vegetable quality inspections are carried by by human professionals in [3]. The problem of inconsistent and inaccurate judgement by various humans makes this manual sorting by human inspection time-consuming. It is anticipated that automation of the quality identification process will lower labour costs and increase sorting process accuracy and efficiency [4]. Vegetable quality checks are carried out by human professionals. The problem of inconsistent and inaccurate judgement by various humans makes this manual sorting by human inspection time-consuming [5]. It is anticipated that automation of the quality identification process will lower labour costs and increase sorting process accuracy and efficiency. However, we are switching to Faster R-CNN in place of R-CNN because it eliminates the need for independent network training for classification and localisation. Due to CNN's end-to-end learning, these two enhancements decrease overall training time and boost accuracy in compared to SPP net [6].

4. Monitoring Soil Nutrients

To monitor the soil in [6] To cut down on water waste and automate the irrigation system for sizable crop regions, a smart irrigation and monitoring system has been proposed. The system primarily keeps track of how air temperature, air humidity, and soil moisture behave. This includes the traditional approach, which entails taking soil samples, determining the temperature, humidity, and NPK values, and then comparing the results to the standard table, which already includes pre-calculated conditions like dry soil and wet soil [7]. This approach doesn't provide greater precision because soil nutritional status varies owing to soil erosion; it would be preferable to collect samples in the field [8]. Precision agricultural robot [8].

This one takes care of all the fundamental requirements of farming, including employing sensors to measure the soil's moisture content, minerals, etc., and sowing crops in the ground in accordance with the information gathered from the fertility and moisture sensors [9]. After analysing the type and genome of the infected crop, which is done by a different set of sensors that function similarly to the fertility measuring sensors, basic irrigation is then applied [10]. The area of the farm is also taken into consideration for calculation purposes [11]. Farmlands are checked for diseases and pesticide infections. With a pre-installed configuration, the fundamental agricultural practises like sprinkler irrigation and drip irrigation are also carried out automatically [12]. The Arduino Uno R3 microcontroller utilised in this circuit configuration is based on the Android operating system [13].

5. Information receiving @ the desk

They are receiving information on how the agribot functions via Bluetooth [14]. We are performing selective harvesting with a robotic arm, checking the nutrition of the soil, and making recommendations to the farmer based on the nutrition app, giving the user the choice of what he wants the robot to do [15]. The code for that button will automatically run after the user selects a task, and the robot will carry out that task [16].

6. Recommendations and Next Steps

We are creating a prototype for a robot that will perform precision farming in this project report [17]. In the final year of the 7th and 8th semesters of the UG-BE course, a synopsis of the project work that will be completed is presented. In this exciting field, a thorough literature review was conducted regarding the various algorithms that can be used for selective harvesting and segregation. During this time, all pertinent papers from various sources were gathered and studied in greater detail. A thorough analysis was then made, and the project problem was finally determined [18].

References

[1]Gert Kootstra & Xin Wang & Pieter M. Blok & Jochen Hemming& Eldert van Henten, Selective Harvesting Robotics: Current Research, Trends, and Future Directions, Published online: 29 January 2021, at Current Robotics Reports.

[2]Automated visual fruit detection for harvest estimation and robotic harvesting, December 2016, Conference: International Conference on Image Processing Theory, Tools and Applications (IPTA'16)

[3]Dr. S. Pariselvam , Mr. P.Anandajayam, Mrs. S. Kalaivani and Manakula Vinayagar, Detection of Fruit Quality by CNN Algorithm, Institute of technology Puducherry.

[4]Harpreet Kaur, Plant diseases detection based on Region based segmentation and KNN Classifier, January 2019, Chandigarh university

[5]Madhushree K V, Poornima G, Seema N, Subash K B, Srinath G M. Green leaf disease detection and infection identification using raspberry pi, International Research Journal of Engineering and Technology (IRJET)Volume: 07 Issue: 06 | June 2020
[6]Yesudas, Santhiya S, Parimala R., Mohammad Harris S., Leaf Disease Detection Using Raspberry Pi LAYA APR 2019, IRE Journals, CCCA – 2019, Volume 2 Issue 10, ISSN: 2456-8880
[7]Reddy, G. Rama Mohan, Nettam Sai Sumanth, and N. Sai Preetham Kumar Reddy, G. Rama Mohan, Nettam Sai Sumanth, and N. Sai Preetham Kumar., Plant leaf disease detection using cnn and raspberry pi. International journal, 5.2 (2020).
[8]Kanungo, Tapas, Campisi, T. Severino A, et.al., An efficient k-means clustering algorithm: Analysis and implementation, IEEE transactions on pattern analysis and machine intelligence, 24.7 (2002): 881-892.
[9]Dr. Pankaj Mohindru , Gagandeep Kaur , Dr. Pooja, Simulative Investigation of Plant Diseases using KNN Algorithm.
[10] Raju Anita, D Suresh, P Gnaneswar, M Puneeth., IoT Based Automatic Soil Moisture Monitoring System using Raspberry Pie.
[11] Yuki Onishi, Takeshi Yoshida, Hiroki Kurita, Takanori Fukao, Hiromu Arihara & Ayako Iwai, An automated fruit harvesting robot by using deep learning Nov 2021.
[12] Autobot for precision farming by Mohammed Abu, Basim, Abhishek Hariharan G, Deva Dharshini U., 2021 International Conference ICEEIMT, Multi-Tasking Agricultural Robot, International Journal of Research in Engineering, Science and Management Volume-3, Issue-1, January-2020
[13] Yan Dutta, Swapnoneel Roy, Patrick Kreidl, Ladislau Boloni, Multi-Robot Information Gathering for Precision Agriculture Smart Phone Operated Multipurpose-Agricultural Robot International Journal of Engineering Research & Technology (IJERT).
[14] Devaraj, Abirami, et.al., Identification of plant disease using image processing technique, 2019 International Conference on Communication and Signal Processing (ICCSP). IEEE, 2019.
[15] Adithya T. G., Pavithra G., T. C. Manjunath, Praveen N., “Stewart Platform Conceptualized Robotic Type of Designs for Aerospace Applications”, Journal of Remote Sensing GIS & Technology, Vol. 8, No. 1, pp. 1-5, 2022.
[16] Ramya P; Priyadarshini V; Varun Kumar K; Vinitha Alamelu G K. "Life Saving Ambulance Monitoring Using Image Processing". International Research Journal on Advanced Science Hub, 2, 3, 2020, 5-11. doi: 10.47392/irjash.2020.17
[17] R. Devi Priya, R. Sivaraj, Ajith Abraham, T. Pravin, P. Sivasankar and N. Anitha. "Multi-Objective Particle Swarm Optimization Based Preprocessing of Multi-Class Extremely Imbalanced Datasets". International Journal of Uncertainty, Fuzziness and Knowledge-Based Systems Vol. 30, No. 05, pp. 735-755 (2022). Doi: 10.1142/S0218488522500209
[18] Deshmukh K P. "Wireless Transceiver Module HC-12 based Automatic Water-level Monitoring and Control System". International Research Journal on Advanced Science Hub, 2, 10, 2020, 24-28. doi: 10.47392/irjash.2020.184
[19] Naveenkumar S; Kirubhakaran R; Jeeva G; Shobana M; Sangeetha K. "Smart Health Prediction Using Machine Learning". International Research Journal on Advanced Science Hub, 3, Special Issue ICARD-2021 3S, 2021, 124-128. doi: 10.47392/irjash.2021.079
[20] Hari Prasada Raju Kunadharaju; Sandhya N.; Raghav Mehra. "Detection of Brain Tumor Using Unsupervised Enhanced K-Means, PCA and Supervised SVM Machine Learning Algorithms". International Research Journal on Advanced Science Hub, 2, Special Issue ICSTM 12S, 2020, 62-67. doi: 10.47392/irjash.2020.262
[21] Sona Solanki; Asha D Solanki. "Review of Deployment of Machine Learning in Blockchain Methodology". International Research Journal on Advanced Science Hub, 2, 9, 2020, 14-20. doi: 10.47392/irjash.2020.141

[22] Shreekar Kolanu; Shikhar Jyoti Dutta; Saurav Roy; Maheswari M.. "A Diabetic Diet Suggester and Appointment Scheduler Chatbot using Artificial Intelligence and Cloud". International Research Journal on Advanced Science Hub, 3, Special Issue 6S, 2021, 77-81. doi: 10.47392/irjash.2021.170
[23] Praveen Kumar Mishra; Prabhakar Tiwari. "Cyber Security in Smart Grid". International Research Journal on Advanced Science Hub, 2, 6, 2020, 26-30. doi: 10.47392/irjash.2020.33
[24] Salini Suresh; Suneetha V; Niharika Sinha; Sabyasachi Prusty. "Latent Approach in Entertainment Industry Using Machine Learning". International Research Journal on Advanced Science Hub, 2, Special Issue ICARD 2020, 2020, 304-307. doi: 10.47392/irjash.2020.106
[25] Gayathri N Shenoy; Chithu Rajan; Shibi Varghese; Vignesh M.V; ShanmugaPriya M; Priya S; Aparna George. "STERILOID: Room Sanitization Robot". International Research Journal on Advanced Science Hub, 2, 8, 2020, 100-104. doi: 10.47392/irjash.2020.101
[26] Mohan Kumar B.N; Rangaraju H.G. "Array Multiplier and CIA based FIR Filter for DSP applications". International Research Journal on Advanced Science Hub, 3, Special Issue ICEST 1S, 2021, 52-59. doi: 10.47392/irjash.2021.020
[27] T.C. Manjunath, Pavithra G., Ravi Rayappa, Rajasekhar Koyyeda, Satvik M. Kusagur, Praveen N., Gopalaiah Gopalaiah, Arun Kumar G., Spoorthi Jainar, “Safety Features Design During the Installation of Fixed Robots in Industrial Sectors Using Image Processing”, MAT Journals, Journal of Analog and Digital Devices, Vol. 5, No. 3, pp. 13-15, 2020.
[28] Spoorthi Jainer T.C Manjunath, Pavithra G, Ravi Rayappa, Rajasekar Koyyeda. Satvik M Kusagur, Praveen N, Gopalaiah, Arun Kumar G, “Transfer Function Based Controller Design for a Mobile Robot Using Image Processing and Computer Vision”, Journal of control system and control instrumentation, Vol. 6, No. 3, pp. 10-12, 2020.
[29] Praveen N., T.C. Manjunath, Pavithra G., Ravi Rayappa, Rajasekhar Koyyeda, Satvik M. Kusagur, “Medical Robots & its Applications in the Current Health Sector”, Journal of Analog and Digital Devices, Vol. 5, No. 3, pp. 1-6, 2020.