Diary Number:27107/2023-CO/L

Project Title: Computer Vision Based Cotton Harvesting Rover

Abstract:-

Cotton Harvesting has always been a labor-intensive and time-consuming task which involved significant challenges. Manual harvesting resulted in inconsistencies in yield and quality. In traditional systems the cotton blooms could not be detected accurately due to obstruction due to leaves, or detecting the sky instead of the cotton based on features like color, etc. To address thisissue Cotton Harvesting Rover implements a robotic system which can detect cotton blooms accurately using computer vision technology. The system autonomously identifies the cotton blooms amongst the fields based on particular features and then picks them using a robotic arm. The novelty of this project is that it identifies the cotton blooms from all perspectives so that inaccuracy can be avoided. With the help of the rover it becomes convenient to keep plucking the mature cotton blooms and detecting them simultaneously. This solution helps in reducing thelabor work, increasing yield and quality and reduction of usage of harmful chemicals. The expected outcomes of this idea is that the model should identify the mature cotton blooms accurately and the robotic arm should pick the cotton without much delay thus ensuring improved cotton harvesting.

Introduction:-

Traditionally cotton picking was done by using methodologies such as hand picking, chemical defoliation, mechanical stripping, manual picking machines etc.The idea of the project is to develop an advanced cotton picking robot that incorporates computer vision to enhance and upgrade the efficiency and accuracy of cotton harvesting. Computer vision can be used in various applications such as detection of face, video capturing, tracking moving objects. Using image processing and computer vision the cotton bolls can be detected based on its features andthe robotic arm aims to pick them and store it in a container. The rover's functionality will be tomove autonomously through the cotton fields. The system will be equipped with cameras and image processing capabilities to analyze each cotton bloom particularly and identify the ripe ones.

Aim and Objectives:

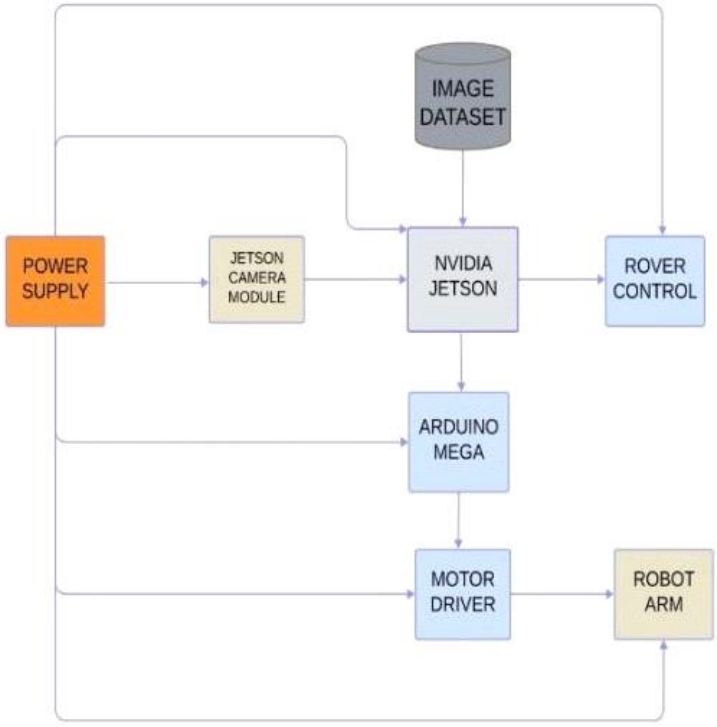
Aim:

"To develop a cotton harvesting rover using computer vision which identifies and selectively picks up mature cotton blooms from the plants, hence reducing l[illegible]pendencies and improves crop yield."

[illegible]ves:

- To develop an image processing model which accurately identifies cotton bolls amongstother plants.
- To ensure that plucked cotton bolls are not damaged.
- To minimize total initial cost for the system.
- To ensure that hardware setup and software model are well integrated.
- To distinguish mature cotton blooms from pre-matured ones
- To make certain that the system is portable, robust and has increased mobility.
- To make sure that repair and maintenance is easy and cost efficient**.**

Block Diagram/Flow Diagram:



ation:-

The system is equipped with cameras which capture images i.e., data required for processing from the cotton fields. These images include various features like color, shape, size. The captured images are then processed using computer vision which identifies the cotton blooms from the data. It also helps in classifying the mature cotton blooms and the pre-matured ones, as the robot must only pick the ripe cotton bolls. Convolutional Neural Network (CNN) is a type of machine learning model which is trained using the labeled dataset of images which are further annotated to identify the mature cotton boll. Once model is trained it is deployed on the module which processes the information received from the camera feed. When ripe cotton boll is detected, the

robotic arm is activated and it carefully picks the boll from the plant and stores it in a container. The functionality of the rover is to move efficiently through the field.

Advantages:-

- There is no need for human intervention as the robot can work autonomously.
- Real-time image processing improves crop yield and making the process moreefficient.
- Improved accuracy of cotton detection and chances of missing or damaging thecotton is less.
- Using computer vision the probability of unripe cotton being harvested is less,thereby ensuring minimal wastage.
- Reducing need for chemical defoliation, machine learning based detectioncontributes to environment friendly practices.

Disadvantages:-

- The initial setup and training of the model is time consuming.
- Gathering sufficient labeled dataset for the model requires significant effort.
- Changes in the weather conditions may alter the accuracy and impact onperformance.
- The system requires regular maintenance and the models must be retrained withupdated data.

Implementation cost of hardware, software can be costly.

tions:-

- Crop yield estimation
- Textile industry
- Disease and pest detection
- Crop health monitoring

References :-

- Xu, Zhongjian, et al. "Detecting white cotton bolls using high-resolution aerial imageryacquired through unmanned aerial system." *IEEE Access* 9 (2021): 169068-169081.
- Barnes, Edward, et al. "Opportunities for robotic systems and automation incotton production." *AgriEngineering* 3.2 (2021): 339-362.
- Issac, Amanda, et al. "Dimensionality Reduction of High-throughput Phenotyping Data inCotton Fields." *IFAC-PapersOnLine* 55.32 (2022): 153-158.
- Fue, K. G., et al. "Visual row detection using pixel-based algorithm and stereo camera for cotton-picking robot." 2019 ASABE Annual International Meeting, Boston, Massachusetts,2019.
- KIVRAK, Oğuzhan, and Mustafa Zahid GÜRBÜZ. "Performance Comparison of YOLOv3, YOLOv4 and YOLOv5 Algorithms: A Case Study for Poultry Recognition." *Avrupa Bilim ve Teknoloji Dergisi* 38 (2022): 392-397.
- John, Anand, and Divyakant Meva. "A comparative study of various object detection algorithms and performance analysis." *International Journal of Computer Sciences and Engineering* 8.10 (2020): 158-163.
- Wang, Yong, Xiaorong Zhu, and Changying Ji. "Machine vision based cotton recognition for cotton harvesting robot." *Computer And Computing Technologies In Agriculture, VolumeII: First IFIP TC 12 International Conference on Computer and Computing Technologies inAgriculture (CCTA 2007), Wuyishan, China, August 18-2007 1*. Springer US, 2008.

- Fountas, Spyros, et al. "AI-assisted vision for agricultural robots." *AgriEngineering* 4.3(2022): 674-694.

Applicant Details:-

Name of Party	Address of Party	Nationality
ABHIMANYU KANASE	OASIS PALACE, FLAT NO.8,UDYAM NAGAR, PIMPRI, PUNE-411018	INDIAN
ANSHU VARGHESE	PREM PARK, F-2, MASULKAR COLONY, PIMPRI, PUNE-411018	INDIAN
ADITYA DESHMUKH	209/4, SANT TUKARAM NAGAR, OPP. TO DURGA MATA TEMPLE, BHOSARI,PUNE-411039	INDIAN
RAHUL HAPARI	B-501, BHONDAVE ORCHID, NEAR RAVET CHAWK BRT, RAVET, PUNE-412101	INDIAN