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FRUIT CATEGORIZER USING pH SENSOR

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Abstract: The process of grouping or sorting fruits that is carried out at this time is still using the manual method by humans, basically humans have properties that make the process of grouping or sorting can take a long time. Based on these conditions, a sorting machine is needed that has the ability to detect and group fruits based on image classification and pH sensor. The main objective of this project is to determine the type of Fruit based on the image detected using CNN and categorize the fruits based on its ripeness. This system effectively classifies and sorts the fruits using Arduino module with the help of pH sensor and concepts of CNN.

Keywords: Image classification, CNN, pH sensor, grouping, sorting.

I. INTRODUCTION

India is the second largest fruit producer after China. Due to the lack of skilled workers, 30-35% of harvested fruits are thrown away. Again, due to the subjectivity of human perception, the identification, classification and grading of fruits is not done accurately. Therefore, the introduction of an automation system in the fruit industry is required. Machine learning methods with appropriate concepts and pH measurements have great potential to develop automated systems to provide intelligence to discriminate fruits based on type, variety, maturity and integrity.. By the usage of Convolutional Neural Network, the identification of the fruit can be done. A pH sensor can measure the pH values of the given various fruit sample input. Using this data, the type of fruit and their ripeness can be identified. All of the above process is done on a conveyor belt. There are certain pH values for healthy fruits and if it drops below or increases beyond that, it can be considered that the fruit is not edible. Based on the pH sensor and CNN, the listed information is displayed on the LCD display:

1) Determining the type of fruit

2) pH level

3) Categorizing the fruit based on ripeness.

II. LITERATURE SURVEY

[1] In the proposed study, fruit recognition is performed using image processing techniques. The study created a classification process for Convolutional Neural Networks (ConNN)* deep learning models. The proposed model is developed on the Keras platform. To implement the study in real life, 20 different fruits are tested on 2 different datasets. The latest model developed is being tested in real time on the Jetson Nano card. * Convolutional Neural Network is an abbreviation of Cooperative Neural Networks because it has been used for a long time in the literature.

[2] In this paper, we propose a new deep-learning-based Fruit-CNN architecture to identify types of fruit and evaluate real-world image quality under different visual variations, yielding 99.6% test accuracy. Compared to current deep learning models, the proposed architecture demonstrates broad applicability in precision agriculture, as it requires minimal time to train large data sets and test fruit images. It also allows you to train more images belonging to different classes with fewer parameters, which speeds up model training and reduces processing time.

[3] So, they used computer vision (CV) and deep neural network (DNN) to sort tomatoes by ripeness color. 300 tomatoes were selected and their maturity determined by an expert method. Tomato images are captured, processed, and fed into a DNN classifier to determine tomato cultivars. The proposed DNN classifier achieved a mAP percentage of 95.52%.

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This demonstrates that computer vision embedded in DNN algorithms can provide an efficient implementation for tomato variety prediction.

[4] In this paper, they created a mobile application that uses computer vision techniques to determine the ripeness of banana fruits. Image classification is performed by applying transfer learning to extract edges from a pretrained model. Convolutional Neural Network (CNN) models are used to train classifiers. Bananas were chosen as an example because of their short shelf life and are widely consumed by Malaysians. This project uses Google Colab to run the code because it runs in the cloud and is great for machine learning. TensorFlow Lite with Model Maker library simplifies the process of tuning and transforming TensorFlow neural network models to specific inputs before deploying to Android apps. The result was obtained with an accuracy of 98.25%. The application instantly recognizes the real-time image of bananas, displays the maturity level on the screen based on the best match ratio, and displays the maturity level so that users can easily and quickly check the ripeness of the bananas.

[5] They proposed a Pure Convolutional Neural Network (PCNN) with minimal parameters. PCNN consists of 7 convolutional layers, some straight through. We also used a newly developed Global Average Pooling (GAP) layer to reduce overfitting and averaging of the full feature map, which proved to be very efficient. We demonstrate classification performance using PCNN on the recently introduced fruit-360 dataset. Experimental results on 55244 colored fruit images in 81 categories show that PCNN achieved a classification accuracy of 98.88%.

III. METHODOLOGY

Fruit will be placed on the conveyor belt on a particular spot through which the IR sensors can detect the fruit's location. The conveyor belts run with the help of motors and IR sensors; we can give delays to the conveyor belts such that it can be made to move in a desired way. Our model makes use of Convolutional Neural Network (CNN) to identify the type of fruit based on its shape and colour. The Web Camera Module recognizes the presence of the fruit and image processing is performed using CNN. The CNN is used to compare the data of the fruits that are already being fed to the computer and the data we give as input. The fruit can be determined if its ripened or not based on its colour. After the fruit is recognized, it is sent towards the robotic arm which helps in pricking the fruit. Only the fruits which are ripened are sent to pricking and raw fruits are sent to the waiting room. The ripened fruits are pricked with the pH sensor and then the pH sensor determines whether the fruit is edible or not. If the fruit is edible it is sent to one basket and if it is not edible it is sent to the other basket. There are a certain pH values for a healthy fruit and if the pH values drop below or increase beyond that it can be considered unhealthy or non-consumable. The output will be displayed on a 16x2 LCD display. The model displays – The type of fruit which we are giving as data, the pH value of that fruit and whether that fruit is edible or not.

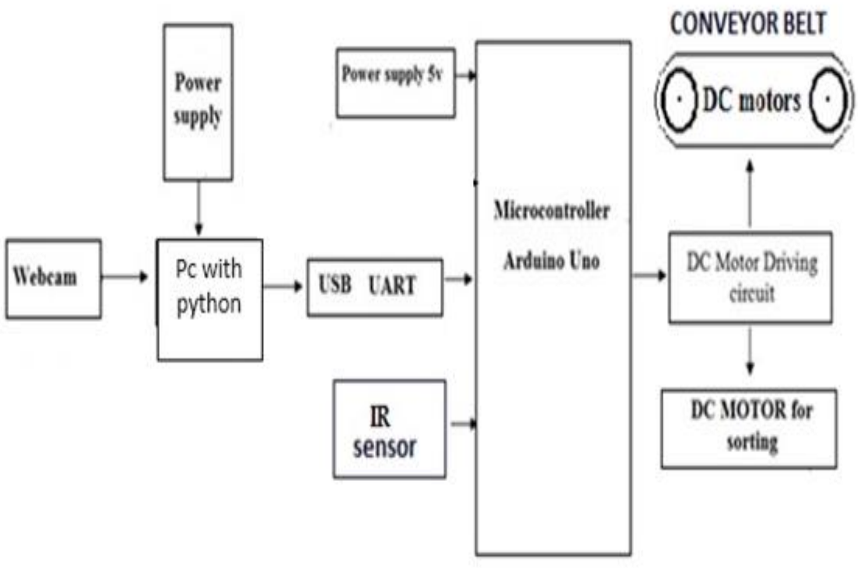

Fig1.Block Diagram

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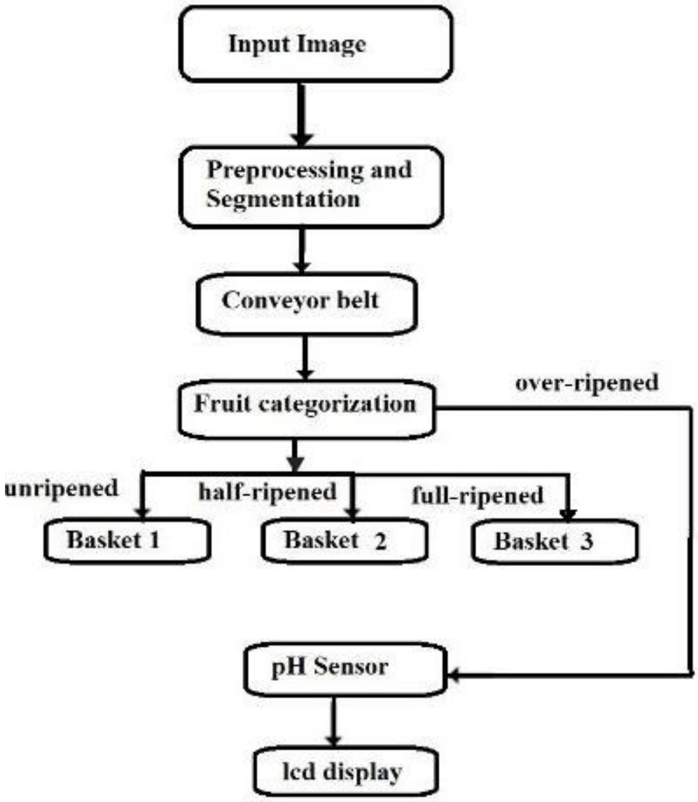

Fig2.Flowchart

IV. RESULTS

The fruit is placed on the conveyor belt which is sensed by the IR sensor and categorized using CNN.

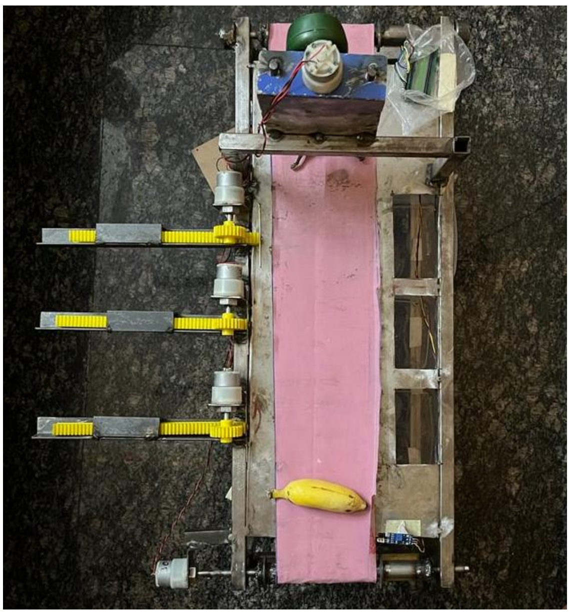

Fig 5.1 Fruit placed on the conveyor belt sensed by IR sensor

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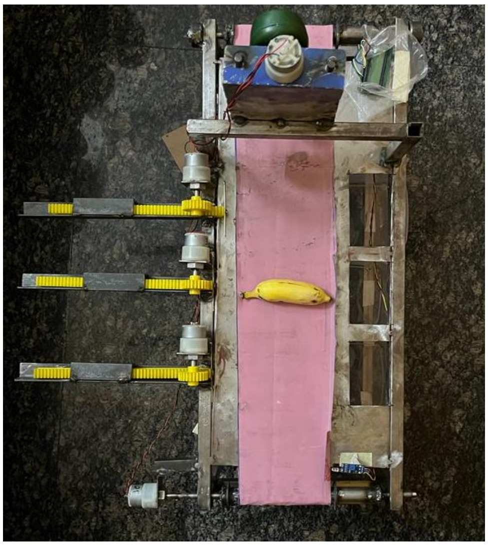

Fig 5.2 Fruit categorized under ripened category by CNN and moved towards second basket

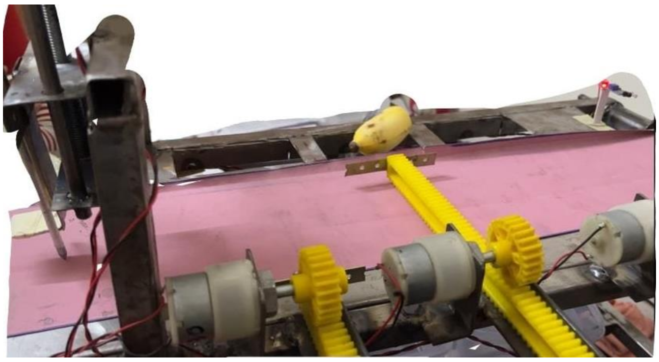

Fig 5.2 Fruit categorized under ripened category by CNN and pushed towards second basket

Fig 5.4 Fruit categorized under ripened category by CNN and fell in the second basket

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V. CONCLUSION

The unique capabilities of electronic tongue systems, such as the ability to deal with complex and changing background. Different sensing techniques, possible use of unconventional fabrication methods and numerous data treatment procedures indicate that electronic tongue systems can be tailored to various application areas. Moreover, precise and rapid analysis not requiring specially trained personnel make them a promising alternative for time-consuming and expensive analytical methods. Sensing arrays presented in this manuscript are developed to solve real-life problems ranging from humble analysis of foodstuffs' quality, to far-fetched applications. The coming years may disseminate this kind of systems even further, bringing them closer to consumers thanks to specific and advanced technology included in smart tools such as personalized smart watches or disposable low-cost sensor systems.

VI. FUTURE SCOPE

Fruit sorters using pH sensors have the potential for many future applications and advancements. Some of these include:

- increased accuracy and efficiency: As pH sensor technology advances, fruit accuracy can be improved, resulting in better fruit quality and grading. This is beneficial for farmers and consumers.
- Integration with other sensors: The pH sensor can be integrated with other sensors such as color sensors to provide better fruit identification. This can lead to better management and more profits for farmers.
- Spread to other agricultural products: Methods used to classify fruits can be extended to other agricultural products such as vegetables or rice. This will help improve the distribution and classification of various agricultural products.
- IoT Integration: Thanks to the integration of Internet of Things (IoT) technology, fruit cutters can be connected to other devices such as smartphones or computers, providing real information and analysis. This can be used to improve the identification and grading process and provide valuable information to farmers and exporters.
- Sustainability: The fruit sorter using a pH sensor can help reduce food waste by ensuring that only quality fruit is delivered to customers.This can have a positive impact on the environment by reducing the amount of food waste going to landfills.

Overall, the future of fruit sorters using pH sensors is promising and could make great progress in agriculture.

REFERENCES

[1] H. B. Ünal, E. Vural, B. K. Savaş and Y. Becerikli, "Fruit Recognition and Classification with Deep Learning Support on Embedded System (fruitnet)," *2020 Innovations in Intelligent Systems and Applications Conference (ASYU)*, 2020.

[2] A. Kumar, R. C. Joshi, M. K. Dutta, M. Jonak and R. Burget, "Fruit-CNN: An Efficient Deep learning-based Fruit Classification and Quality Assessment for Precision Agriculture," *2021 13th International Congress on Ultra-Modern Telecommunications and Control Systems and Workshops (ICUMT)*, 2021.

[3] W. K. Tan, M. Amir Hakim Ismail, Z. Husin and M. L. Yasruddin, "Automated Tomato Grading System using Computer Vision (CV) and Deep Neural Network (DNN) Algorithm," *2022 IEEE 12th Symposium on Computer Applications & Industrial Electronics (ISCAIE)*, 2022.

[4] M. F. Mohamedon, F. Abd Rahman, S. Y. Mohamad and O. Omran Khalifa, "Banana Ripeness Classification Using Computer Vision-based Mobile Application," *2021 8th International Conference on Computer and Communication Engineering (ICCCE)*, 2021.

[5] A. Kausar, M. Sharif, J. Park and D. R. Shin, "Pure-CNN: A Framework for Fruit Images Classification," *2018 International Conference on Computational Science and Computational Intelligence (CSCI)*, 2018.