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Automatic fruit sorting machine based on weight

Gauri Vasant Pawar[1], Gayatri Shrinivas Posham[2], Prof. P. K. Digge[3]

Student, Electrical Dept, Shree Siddheshwar Women's College of Engineering, Solapur, India[1]

Student, Electrical Dept, Shree Siddheshwar Women's College of Engineering, Solapur, India[2]

Professor, Electrical Dept, Shree Siddheshwar Women's College of Engineering, Solapur, India[3]

Abstract: The growing demand for efficient post-harvest processing has led to the development of automated fruit sorting systems. This paper presents a fruit sorting machine that categorizes fruits based on their weight. The system is designed to enhance productivity, reduce human error, and maintain consistency in grading. It utilizes a microcontroller to weigh individual fruits and sort them into predefined categories using actuated mechanisms. The machine is cost-effective, easy to operate, and suitable for small- to medium-scale agricultural applications. This innovation not only reduces manual labour but also ensures uniformity in fruit quality for market distribution.

Keywords: Automatic sorting, fruit grading, weight-based classification, agricultural automation, microcontroller system, post-harvest technology, smart farming, quality control, embedded system, productivity enhancement.

I. INTRODUCTION

In the agricultural industry, sorting and grading of fruits is a crucial step to ensure quality control and meet market standards. Traditionally, this process has been performed manually, which is time-consuming, labor- intensive, and often inconsistent due to human error. With advancements in automation and embedded systems, there is a growing interest in developing machines that can perform these tasks more efficiently. An automatic fruit sorting machine based on weight provides a practical solution to this problem. By accurately measuring the weight of individual fruits and sorting them into designated categories, the system improves speed, accuracy, and reliability. Such a machine is particularly beneficial for farmers and small-scale industries aiming to streamline operations and enhance product value in competitive markets.

II. LITERATURE REVIEW

Over the years, various techniques have been developed for the sorting and grading of agricultural produce to improve efficiency and product quality. Researchers have explored multiple parameters such as size, color, shape, and weight for fruit classification. Among these, weight is considered one of the most reliable indicators for grading, especially for fruits where visual parameters may not reflect internal quality.

Several studies have proposed the use of load cells and microcontroller-based systems for accurate weight measurement and control. For instance, systems using Arduino or similar platforms have demonstrated the capability to automate the sorting process with high precision and low cost. In addition, research has shown that incorporating conveyor mechanisms and actuated diverters can effectively streamline fruit movement and distribution into various categories based on preset weight ranges.

Comparative analyses in existing literature also highlight the advantages of automated sorting machines over manual labor, particularly in terms of speed, consistency, and scalability. Furthermore, the integration of low- power electronics and user-friendly interfaces makes such systems suitable for deployment in rural and semi- urban agricultural settings.

Overall, the reviewed literature supports the development of a weight-based automatic fruit sorting machine as a practical and impactful tool in modern farming practices.

III. COMPONENTS USED IN THE PROJECT

1. Load Cell:

A sensor used to measure the weight of individual fruits. It converts the applied force into an electrical signal proportional to the fruit's weight.

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2. HX711 Module:
A precision 24-bit analog-to-digital converter (ADC) specifically designed for weigh scales. It amplifies and converts the load cell's signal for processing by the microcontroller.

3. Microcontroller (e.g., Arduino Uno):
Acts as the brain of the system. It receives the weight data from the HX711, processes it, and controls the sorting mechanism based on predefined weight categories.

4. Servo or DC Motors:
These are used to operate the sorting mechanism, such as flaps or arms, which direct the fruits to their respective bins.

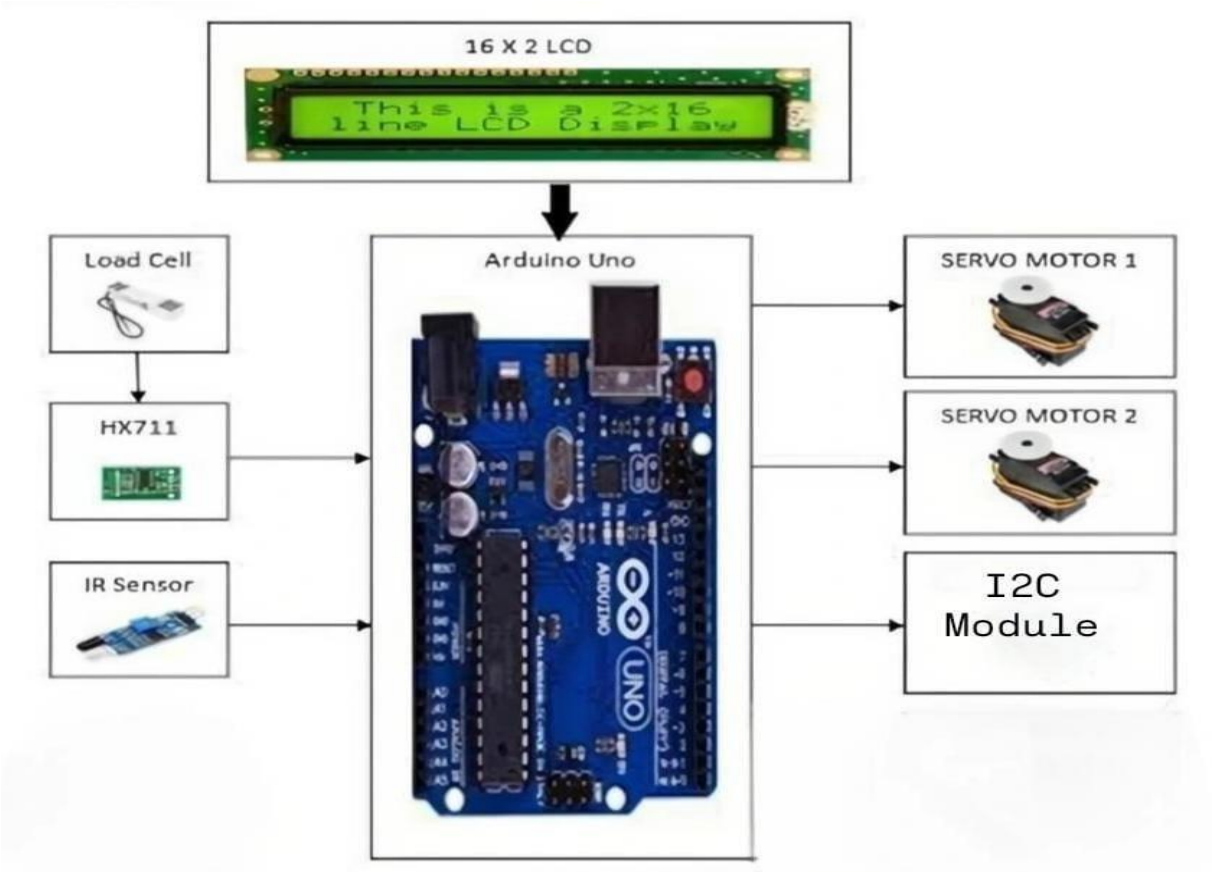
5. Conveyor Belt (optional):
Helps in transporting the fruits from the feeding area to the weighing platform and then to the sorting section, enabling continuous operation.

6. Power Supply Unit:
Provides the necessary electrical power to all components, including sensors, microcontroller, and motors.

7. Display Unit (e.g., LCD):
Shows real-time weight readings and system status, providing a user-friendly interface.

8. I2C module
The I2C (Inter-Integrated Circuit) module is a communication interface that allows multiple devices to connect using just two wires: SDA (data) and SCL (clock). It enables efficient data transfer between microcontrollers and peripherals like sensors or displays. The I2C module reduces wiring complexity and supports multiple devices on the same bus.

IV. DIAGRAM



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V. WORKING

This project illustrates the working of an automatic fruit sorting machine based on weight, using Arduino Uno as the main controller. The system begins its operation when a fruit is placed on a load cell. The load cell measures the fruit's weight by converting the force into an analog electrical signal. This signal is sent to the HX711 module, a 24-bit analog-to-digital converter, which amplifies and converts it into a digital value that the Arduino can read. Simultaneously, an IR sensor detects the presence of the fruit and informs the Arduino to start the weighing process.

Once the Arduino receives the digital weight data from the HX711, it compares the weight with predefined threshold values stored in its memory. Based on the result, the Arduino activates the appropriate servo motor to direct the fruit into the correct category bin. Two servo motors are used in this setup, each responsible for handling different weight ranges. The sorting mechanism operates quickly and accurately, reducing the chances of human error.

To provide user feedback, a 16x2 LCD is connected to the Arduino using an I2C module. The I2C interface reduces the number of connection wires and uses only two pins (SDA and SCL), making the setup simpler and more efficient. The LCD displays the weight of each fruit along with operational messages, such as sorting status or error alerts.

This entire system automates the process of fruit sorting based on weight. It improves efficiency, saves time, and ensures uniform grading, which is essential for quality control in agricultural production. The system is cost-effective and can be implemented in small-scale fruit processing units. With simple components and easy programming, it serves as an ideal solution for farmers and agribusinesses looking to adopt automation in their workflow. The use of sensors, microcontrollers, and electromechanical parts in this design reflects the growing trend of smart farming and digital agriculture.

VI. APPLICATIONS

1. Agricultural Farms:
   - Helps farmers sort fruits by weight quickly and accurately, reducing manual labor and saving time during post-harvest processing.
2. Fruit Packaging Units:
   - Ensures uniformity in fruit packaging by categorizing fruits into weight-based grades, improving product quality and presentation.
3. Food Processing Industries:
   - Used in initial stages of production to sort raw fruits, ensuring consistent input for further processing like juicing or canning.
4. Local Markets and Vendors:
   - Small-scale vendors can use it to sort fruits before selling, offering consistent quality and enhancing customer trust.
5. Cold Storage Facilities:
   - Useful in organizing and storing fruits based on weight, which can help in inventory control and spoilage management.
6. Export Businesses:
   - Assists exporters in meeting international grading standards by ensuring accurate weight classification before shipping.
7. Research and Educational Institutions:
   - Ideal for demonstration and research purposes in agricultural engineering, automation, and embedded systems projects.
8. Smart Farming Initiatives:
   - Forms part of automated agricultural systems aimed at improving productivity through technology- driven solutions.
9. Co-operative Societies:
   - Can be used in rural co-operative centersto collectively sort produce from multiple farmers, ensuring fair pricing.

VII. CONCLUSION

The automatic fruit sorting machine based on weight offers an efficient, reliable, and cost-effective solution for grading fruits in agricultural and industrial settings. By automating the sorting process, it reduces manual labor, minimizes human error, and ensures consistent quality. The integration of components like load cells, microcontrollers, and servo

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motors allows for precise classification of fruits according to predefined weight categories. Additionally, the use of an LCD with an I2C module enhances user interaction and system monitoring. This technology supports small- and medium-scale farmers and businesses in improving productivity and maintaining market standards. Overall, the system contributes to modernizing post-harvest practices and promotes the use of smart automation in agriculture.

REFERENCES

[1]. Gholap, A.V., & Shinde, R.S. (2020). "Design and Development of Automatic Fruit Sorting System Based on Weight." International Journal of Engineering Research and Technology (IJERT), Vol. 9, Issue 5.
[2]. Kumar, R., & Verma, P. (2019). "Automation in Agriculture: Fruit Sorting System Using Arduino." International Journal of Scientific & Engineering Research (IJSER), Vol. 10, Issue 4.
[3]. Patil, A., & Deshmukh, P. (2021). "Embedded System Based Fruit Sorting Machine." International Research Journal of Engineering and Technology (IRJET), Vol. 8, Issue 6.
[4]. HX711 Load Cell Amplifier Datasheet – Avia Semiconductor.
[5]. Arduino Uno Technical Specifications – www.arduino.cc.
[6]. Yadav, D., & Gupta, S. (2018). "Smart Farming Applications Using Automation." International Journal of Computer Applications (IJCA), Vol. 182, No. 24.
[7]. Singh, J., & Sharma, K. (2022). "Development of Weight-Based Sorting System for Agricultural Use." Journal of Agricultural Engineering and Technology, Vol. 12, Issue 1.
[8]. LCD I2C Module Technical Manual – www.electronicsforu.com