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A review on automation in food processing using Arduino

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Abstract
The food business has typically trailed behind other industries in embracing new technology, and plant automation is no exception. However, fast improvements in computer technology, as well as increased customer and regulatory agency demands for enhanced food quality and safety, have prompted the food sector to contemplate automation of most industrial operations. Though the food business presents numerous specific hurdles to complete automation, the industry has been successful in implementing several automatic operations Electronic sensors, Arduino, computer vision, expert systems, computer integrated manufacturing, flexible manufacturing systems, systems engineering, and other new technological tools have made it possible to integrate many batch operations into an overall manufacturing system design, allowing for on-line and continuous control capability. In this study, we conducted a literature survey and analyzed data from automation in food processing for a variety of applications utilizing Arduino, electronic sensors, and other modules. Then we discovered an Arduino-based system that works as a Fruit Sorter machine, an Automatic Bottle Filling Machine, a Bean Cooker, a Food Waste Management System, A Food Cooking Machine, sorting and grading agricultural products, controlling and monitoring atmospheric conditions or the quality of fruits and vegetables during storage, and so on. This work has improved quality control throughout the manufacturing process. Keep your employees safe, and boost your end- to-end traceability to unrivalled heights. Increase productivity and output rates, safeguard your brand from potentially negative product recalls, increase adaptability and flexibility, and improve supply and demand management to reduce waste.

Keywords: Introduction, review of literature, conclusion, references

1. Introduction
The food sector has typically been slow to accept new technology, and plant automation is no different. However, fast improvements in computer technology, as well as increased customer and regulatory agency demands for improved food quality and safety, have compelled the food sector to contemplate automating most manufacturing processes. Despite the fact that the food sector presents numerous specific hurdles to complete automation, the industry has been successful in implementing several automatic operations. Automation is a term for technology applications where human input is minimized. Automation, includes the use of various equipment and control systems such as machinery, processes in factories, boilers, and heat-treating ovens, switching on telephone networks, steering, and stabilization of ships, aircraft, and other applications and vehicles with reduced human intervention. In the simplest type of an automatic control loop, a controller compares a measured value of a process with a desired set value and processes the resulting error signal to change some input to the process, in such a way that the process stays at its set point despite disturbances. Computer vision, Electronic sensors, Arduino, expert systems, computer integrated manufacturing, flexible manufacturing systems, systems engineering, and other new technological tools have enabled the integration of many batch operations into an overall manufacturing system design to provide on-line and continuous control capability. This tendency is expected to accelerate further in the coming years. Several fundamental needs for competitive success and, in some industries, manufacturing plant viability motivate the need to automate industrial operations. They are those who need to improve their productivity, product quality, and profitability. The advantages of food processing automation improve quality control throughout the manufacturing process. Keep your employees protected from harm. Increase your end-to-end traceability to unparalleled heights. Improve efficiency and output rates protect your brand from potentially damaging product recalls. Improve your adaptability and flexibility. Improve

supply and demand management to cut waste.

2. Review of Literature

Ajay *et al.* (2021) The sensor is used to sort the lemons in this paper. Automation is becoming increasingly popular in industry around the world. Organizing objects according to their colour tone is a difficult undertaking. This document gives us an idea of how to choose fruits based on their colour palette. They build and implement an efficient colour sorter based on the Arduino NANO and the TCS3200 colour sensor." This design gives the highest level of precision, performance, and reproducibility." Simple to use and construct, lowering human mistake, human effort, and industrial costs [1]. Ashish *et al.* (2021) Studied automatic bottle filling machines. These were most widely utilized in the beverage and soft drink industries, according to the author. These machines use a conveyor belt to fill bottles, which is a cost-effective and quick method. PLCs are typically used for automatic bottle filling machines, however an Arduino may be utilized to create a simple and versatile bottle filler. You may configure the Arduino to automatically detect the bottle using an infrared or ultrasonic sensor and allow the bottler to fill by temporarily pausing the conveyer belt. The belt is then moved again and stopped when the next bottle is spotted [2]. Sabadoti *et al.* (2021) The proposed method by the author was a low-cost and simple solution that allows for calibration based on the size of the studied grains. Magnets, hall effect sensors, potentiometers, and an operational amplifier were used to monitor the locations of the plungers. The time required to boil each grain is displayed on an LCD display, and all of the components are linked together by an AT mega 328 microcontroller from the Arduino UNO R3 board. According to author the proposed solution can be assembled in an existing device for less than $200. They tested using two different grains: carioca beans (Phaseolus vulgaris) and lentils (Lens culinaris). Despite the size discrepancies, both grains were adequately examined using the devised technique [3]. Shazmina *et al.* (2021) The Arduino UNO is utilised as a microcontroller in this project. We employ the eNose system, which consists of MQ4 and MQ135, to detect gas emissions from various food items, including meat, rice, rice and meat, and bread. In this system, the MQ4 sensor detects CH4 gas, while the MQ135 sensor detects CO2 and NH3. To detect the weight of food wasted, they utilise a 5 kg strain gauge load cell sensor and a HX711 A/D converter as a weight sensor. To ensure the accuracy and efficiency of our system, they calibrate our sensors according to recommendations before running them in the flow environment. They acquire data from us by using prepared, uncooked, and rotten food. The Arduino UNO board retrieves sensor data and transfers it to the computer system for interpretation and analysis in this study. The machine learning method is then used to forecast the food item [4] Livinsa *et al.* (2020) They proposed a model of a new completely automated cooking machine built entirely on Arduino Mega. They said primary reason for this is to create a modernism in the kitchen. Such kitchen invention will aid in lowering human effort, which is really beneficial to everyone. This contraption can pump raw materials into a skillet, mix them, and then cook them. This machine also maintains the quality of cooked food while increasing the quantity. The major goal of this approach is to make cooking more straightforward, trouble-free, and less time- consuming [5]. Monika *et al.* (2020) Many things in our daily lives are manufactured in a variety of major and small enterprises. The company makes quality a recurring topic. There are far too many objects to sort. Organizing elements in an enterprise is a time-consuming, physical procedure. However, classifying goods using physical methods takes more time. They introduce an automatic colour sorting system to reduce time and improve sorting accuracy. A colour sorter is a device that sorts objects according to their colour. They utilize the TCS3200 colour sensor to detect the colour of any item and after detecting the colour. The servo motor turns, and the object is allotted to a specific box based on the mechanism. They can be utilised in a variety of applications that need colour discrimination and classification. Agribusiness (grain colour sorting), food industry, diamond and mining sector, recycling, and so on are some of the application fields [6].

Venkat *et al.* (2019) Author stated that the Internet of Things (IoT) is a critical component of the next generation of industrial automation systems (IASs). If implemented appropriately, evolving IoT standards may address numerous issues in the development of IASs. Where frameworks are linked via the internet and can communicate with one another to make key decisions. The device was designed by the authors utilising the Raspberry Pi Microcontroller rather than the Arduino microcontroller [7] Shakoor *et al.* (2019) The author of this paper mentions the disadvantages of current quality detection, sortation, and dispensing systems are low yield, time consumption, high cost, and complication. The goal of the research on Arduino machine-controlled fruit sorting using image processing is to improve fruit sorting quality, maintain quality, increase productivity, and reduce labour concentration. It is essential for a machine-controlled system to perform quick and accurate feature detection as well as quick fruit delivery. This study provides a comprehensive evaluation of current work on automated sorting and grading of agricultural goods. They also offer an end-to-end automated and efficient fruit sorting and grading system based on image processing. The preliminary experimental findings demonstrate the effectiveness of the proposed structure [8] Karim *et al.* (2018) According to the authors, cold storage is essential in the food industry. The major goal of this type of storage is to keep raw meals fresh for a set amount of time. However, food safety is frequently compromised due to a lack of technology and ignorance about the effects of humidity and temperature on raw foods. The primary goal of this project is to reduce man monitoring by developing an internet-based real-time monitoring of temperature and humidity utilising the widely accessible DHT-11 sensor and ESP-8266 NodeMCU module. This report also makes clear distinctions between traditional and IoT-based food storage monitoring systems [9] Rafeeq *et al.* (2016) This study suggests an Automation of Waste Material Segregation in the Scrap Industry. This approach is a quick and straightforward way to separate three forms of waste: glass, metal, and plastic. As per Author it is intended to segregate trash into metallic waste, plastic waste, and glass waste, which will then be handled individually for the following process of operation. To differentiate between and dry garbage, the Method employs inductive sensors, metallic items, and capacitive sensors. The Automation of material segregation (AMS) approach was successfully used to segregate garbage into metallic, plastic, and glass waste, according to experimental results [10].

3. Conclusion

In this work, we investigated the various types of research papers based on Arduino for Automation in Food Processing. We can use this study to create various projects or improve the Arduino-based system for commercial or market sale to all small and large food processing sectors at a low cost.

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