EE2044 - Electrical Measurements and Instrumentation

SMARTSORT:
AUTOMATED FOOD SORITNG SYSTEM

By:

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PROJECT PROPOSAL

1. Introduction

Brief overview of the project idea:

Our project focuses on developing an automated system for separating food items moving on a conveyor belt based on their shape and temperature. The system uses a sensor designed by us to detect the introduction of food items and count the number of items(cookies) passing through it. It then uses a camera to capture the shape of the items, an AI model to process the shape data. And a temperature sensor is set to detect the temperature. There is a gate, activated by a stepper motor based on the feedback of the above models,which separates the items based on its shape and temperature, while defective cookies are removed from the belt.

Importance, relevance and objective of the project:

This project provides a solution for the need of efficient and automated sorting systems in food based industries. By automating the process based on their shape and temperature, the system can improve the efficiency of food production lines, reduce wastage, and guarentee the quality of the final products.

2. Background and Context

Explanation of the problem or opportunity being addressed:

Food producing companies carried out in mass scale, normally face challenges in separating food items efficiently based on their shape and temperature. Manual methods are inefficient as they need a huge amount of labor, time-consuming, and make a lot of errors and faults. Automating this process can increase efficiency, reduce wastage, and improve product quality for mass production companies.

Relevant literature review or prior research:

The article “Study on an automatic sorting system for Date fruits" by Razieh Pourdarbani, Hamid Reza Ghassemzadeh, Hadi Seyedarabi , Fariborz Zaare Nahandi and Mohammad Moghaddam Vahed gives an overview about implementing automated systems in sorting food items, here sorting dates according to their ripe level. This research highlights the efficiency of using the image processing toolbox in MatLab in automated food sorting systems. This research inspired us to integrate AI to expand the scope of food sorting in mass scale production industries and to increase efficiency.

Explanation of why this project is necessary or timely:

With the increasing demand for food products, the demand for efficient and quick production processes for mass scale production factories, like automated sorting systems, has increased. This project is timely because it addresses the need for an efficient sorting system that can enhance the productivity and quality of food processing operations, and reduce labor demand.

3. Objectives

- The project aims to improve cookie production by implementing a conveyor belt system with infrared sensors, cookie counter and AI image classification models, thereby enhancing product quality.
- The use of counting sensors and stepper motors in cookie production will improve resource efficiency and operational effectiveness.
- Highlight the possibility for further applications and market penetration by showcasing the created technology's adaptability beyond biscuit production.
- To increase the competitiveness of Sri Lankan cookie exports

4. Project Scope and Boundaries

This project involves designing a conveyor belt system with image processing, stepper motors and IR sensors to separate cookies that are suitable for consumption from those that are not. The conveyor belt will transport those cookies into two separate baskets based on whether they are suitable or not suitable for consumption. The cookies that are not in correct shape and cookies that are not in the correct temperature range are not suitable for consumption. Key components that are included in this project are conveyor belt system, infrared sensor, image processing algorithm, stepper motors with arms and cameras.
Here are the list of boundaries in our project

- Temperature range – Project will define a temperature range that is acceptable
- Image processing Constraints –The cookie detection algorithm will be limited by the capabilities of the microcontroller used.
- Mechanical limitations: The design of the stepper motors and arms will be subject to mechanical constraints such as speed, torque, and precision of movement.
- Temperature Detection Accuracy – The accuracy of the IR sensor will depend on the distance between the cookie and the sensor. There will be margin for error in the temperature detection process

5. Methodology

First we will conduct a thorough analysis of the project requirements.Required temperature range,speed of the conveyor belt,weight limitations and collection basket design will be analyzed in the analysis phase.After that we will decide the components that are required to build the project.Choosing the correct models of motors,cameras and sensors will be decided in this phase.After that in the algorithm development phase image detection algorithm will be implemented and tested.After that the mechanical design of the system will happen.In this stage all the components are connected together using techniques likes soldering.Finally testing of the system will take place and testing will ensure functionality, accuracy, and reliability of the system.Optimization of the system will also happen in the testing phase.The chosen methodology follows a systematic approach, starting from requirement analysis and ending with testing.This ensures that all aspects of the project are aligned with the objectives of the project

6. Timeline

March	week	task
	Week 1	Component Procurement and Finalization of Design Layout
	Week 2	Implementation of LabVIEW
	Week 3	Implementation of LabVIEW
	Week 4	Construction of conveyor belt without sensors
April	Week 1	Deployment of AI model
	Week 2	AI model testing
	Week 3	Sensor calibration
	Week 4	assembly
May	Week 1	Testing
	Week 2	Final adjustments

7. Conclusion

To sum up, this proposal suggests building a conveyor belt system with several parts that would enable increased productivity and quality assurance during the cookie-making process. This system includes stepper motors that deploy removal arms mechanisms to remove cookies from the conveyor belt, infrared sensors that detect under-baked cookies, pressure sensors that measure the weight of the cookies that accumulate in the tray, and sensors that count the cookies. AI image classification models are also included in this system to identify cookies with imperfect shapes. When these elements are combined, crucial procedures like removing faulty cookies and weighing and counting finished goods may be automated. Therefore, dear sir, we urge your support and guidance for this project, recognizing its potential to drive innovation and foster competitiveness in the industry.

8. References

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