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**JOHOR
INNOVATION
INVENTION
COMPETITION
AND
SYMPOSIUM
2023**



"Innovation Inspires a Society
to be Critical and Creative"

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Editors-in-Chief

**AHMAD KHUDZAIRI KHALID
NUR INTAN SYAFINAZ AHMAD**



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**Cawangan Johor
Kampus Pasir Gudang**

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Preface

In the name of Allah, the Almighty who gives us the enlightenment, the truth, the knowledge and with regards to Prophet Muhammad (peace be upon him) for guiding us to the straight path. We thank to Allah for giving us guidance and strength to write this e-book.

This e-book compiles the extended abstracts that submitted to Johor Innovation Invention Competition and Symposium 2023 (JIICaS2023), where JIICaS2023 is a virtual platform for all creative minds to share and present their invention and innovation. The extended abstracts are divided into two categories, which are Category A (Higher Educational Student/ Any Recognized Institutional Students in Malaysia) and Category B (Primary/ Secondary School Students / Special Education School Students in Johor). Each abstract gives a brief background on the innovation or project.

We hope that this e-book will help the readers to get to know the innovation done by the students from both categories and get some ideas to develop future innovation products.



SMART GUIDED DELIVERY ROBOT

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ABSTRACT

Focusing on the food manufacturing sector, these sectors do play a significant part in the production of a variety of consumable goods for international markets. The food manufacturing industry places considerable physical demands on its employees, involving tasks such as lifting heavy loads and moving trolleys. These physically strenuous activities are integral to the production and logistics processes, encompassing the handling of raw materials, and finished products within the manufacturing facility. Working in an environment with few employees undoubtedly required employees to perform more tasks, such as lifting and carrying heavy objects from the store to the kitchen, which required them to expend more energy and time than if they had remained on the kitchen side and only performed their duties. To address this issue, the implementation of Smart Lean Manufacturing practices in the food industry is necessary. One viable solution involves utilizing smart guided delivery robots equipped with wireless technology. These robots can be easily monitored by users or employees in-charge, enabling them to track the robot's movement and the load it carries. The incorporation of line tracking robots, enhanced by Internet of Things (IoT) technology, offers further advancements. These innovations effectively reduce the burden of heavy workloads in the manufacturing industry, while simultaneously promoting the safety and well-being of employees in the workplace. By embracing Smart Lean Manufacturing practices and employing smart guided delivery robots, the physical strain on employees is alleviated, leading to increased efficiency and productivity.

Keywords: Smart lean manufacturing, Internet of Things (IoT), Line tracking robot.

1.0 INTRODUCTION

Focusing on the food manufacturing sector, these sectors do play a significant part in the production of a variety of consumable goods for international markets. The preparation, packaging, and distribution of a wide range of food products, including drinks, baked goods, and more are all included in this dynamic industry. Food producers use cutting-edge technology and exacting quality control procedures to satisfy customer needs while maintaining a continual emphasis on guaranteeing quality, safety, and compliance with strict requirements. The food manufacturing industry places considerable physical demands on its employees, involving tasks such as lifting heavy loads and moving trolleys. These physically strenuous activities are integral to the production and logistics processes, encompassing the handling of raw materials, ingredients, and finished products within the manufacturing facility. In Malaysia, experienced employees continue to work in this industry due to their expertise in managing these challenging tasks.

However, the recent economic pandemic that has affected Malaysia, along with other countries, has resulted in a scarcity of employees due to less appealing job opportunities amid the economic downturn. This ongoing issue directly impacts current employees who must work diligently to meet the company's service commitments to consumers. The shortage of

workforce adds pressure to the existing employees in coping with the demanding workload within the food manufacturing sector.

Due to a shortage of employees managing ingredient inventory, workers in the food industry increasingly face heavy lifting tasks during their daily responsibilities. Even older employees cannot avoid these tasks due to the lack of staff. Kitchen workers, in particular, have to personally retrieve ingredients from the store, impacting productivity and potentially their health. The physically demanding nature of these tasks calls for the adoption of proper ergonomic practices, employee training, and innovative solutions to reduce the risk of injuries and enhance the overall well-being and safety of the workforce. To address this, we have developed a Smart Lean Manufacturing idea known as the Smart Guided Delivery Robot.

This robot is an advanced version of a line tracking robot, featuring the addition of an ultrasonic sensor that enables automatic stopping when encountering obstacles on its designated path. Additionally, it incorporates a load cell and Internet of Things (IoT) technology. The robot can detect the weight of the load it carries, ensuring it stays within its capacity limits and this information is accessible via smartphones through the Blynk application by the user or person in-charge of handling this robot. In case any obstacles are detected along the robot's path, the user receives an alert notification on the user devices and the robot will stop immediately. With this innovative solution, we can effectively monitor the robot's condition, promoting a more efficient workplace for employees. By implementing this Smart Lean Manufacturing approach, we create a better work environment, increase productivity, and enhance the health and well-being of our employees facing this challenge.

2.0 OBJECTIVES

The Smart Guided Delivery Robot is being proposed in order to accomplish the following objectives:

1. To minimize workplace injuries and alleviate physical strain experienced by employees during their work.
2. Enhancing efficiency and productivity in the food manufacturing industry through the implementation of an automated delivery robot.

3.0 DESCRIPTION OF INNOVATION/METHODOLOGY

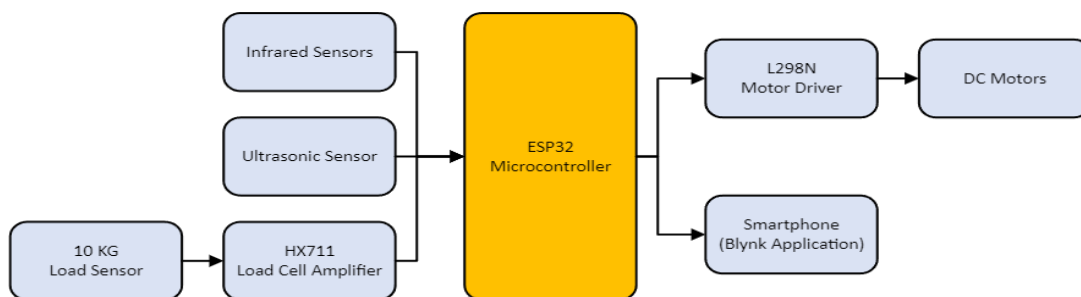


Figure 1: Block diagram of the Smart Guided Delivery Robot

The figure above shows the block diagram of the Smart Guided Delivery Robot, designed with various components that collaborate to ensure its efficient operation. The robot takes input from IR sensors, which detect a line on the ground, enabling it to follow a predetermined path accurately. An ultrasonic sensor is employed to detect obstacles in front of the robot, ensuring collision avoidance. To accurately measure the weight of delivered items, a 10kg load cell and an HX711 load cell amplifier are utilised, which amplifies the load cell's electrical signals for precise weight measurements. At the heart of the system is the ESP32 microcontroller, which is responsible for processing the input data from the sensors. It analyses the information and

decides based on the detected line, obstacle presence, and weight measurements. The microcontroller then controls the outputs accordingly.

The outputs of the system include an L298N motor driver and DC motors. The L298N motor driver allows for precise control of the DC motors, enabling the robot to adjust its speed and direction as needed to follow the designated path. This integration of the L298N motor driver and DC motor ensures accurate navigation and delivery. Furthermore, the robot is connected to Wi-Fi with a smartphone running the Blynk application, which acts as a monitoring tool. The smartphone provides real-time status updates and allows users to monitor the robot's activities remotely. It offers convenience and accessibility, ensuring users can stay informed about the robot's performance and make necessary adjustments if required.

4.0 ADVANTAGE/IMPACT/RESULTS/NOVELTY

The advantages stemming from this project extend to both employees and employers alike. For employees, the benefits are manifold. Firstly, it enhances their work efficiency by delegating repetitive and time-consuming tasks, such as the transportation of items within a facility or goods delivery, to smart delivery robots. This, in turn, liberates employees to concentrate on more intricate and value-added responsibilities, resulting in an overall boost in job satisfaction. Additionally, manual material handling or long-distance deliveries, which often lead to physical strain and fatigue, are taken over by smart robots, mitigating the risk of workplace injuries and promoting the well-being of employees. Moreover, robots are less prone to accidents caused by human errors, such as collisions or falls, thereby fostering a safer working environment for employees who share their workspace with these robots. Furthermore, working alongside smart delivery robots offers employees the opportunity to acquire new skills related to robot operation, maintenance, or supervision, potentially enhancing their job marketability and career growth potential.

For employers, the advantages are equally compelling. To start with, there's a significant increase in productivity. Smart guided delivery robots operate tirelessly without breaks or fatigue, resulting in heightened operational efficiency and productivity. This translates into quicker order fulfillment and reduced lead times. Additionally, these robots offer consistency and reliability in tasks as they consistently follow programmed routes and perform with precision, reducing errors and operational variability. This commitment to precision can lead to higher product quality and increased customer satisfaction. Lastly, the scalability factor is a game-changer. Employers can effortlessly expand their operations by simply adding more smart robots as needed, sidestepping the challenges associated with hiring and training additional human workers. This adaptability proves invaluable in meeting fluctuating demand and maintaining competitiveness.

5.0 CONCLUSION

In conclusion, the Smart Lean Manufacturing system is an effective and innovative approach to reduce wasteful movements and enhance productivity within a company. This simple yet powerful idea has shown significant improvements, transforming into a massive and brilliant solution to enhance various aspects of a workplace. With this clear understanding, we then defined specific criteria and prerequisites that needed to be met to solve each identified problem. Extensive research on available products in the global market led us to find the best example that we could enhance with advanced technology. After going through a rigorous process to find solutions, we successfully developed our own product. The result is a delivery robot that not only minimizes workplace injuries and reduces physical strain experienced by employees but also significantly improves efficiency and productivity in the food manufacturing industry. With the implementation of this automated delivery robot, we have achieved our goal of optimizing operations and creating a safer, more efficient workplace.