

# E-BOOK OF EXTENDED ABSTRACT

## THE 14<sup>TH</sup> INTERNATIONAL INVENTION, INNOVATION & DESIGN COMPETITION 2025



14<sup>TH</sup> **INDES** 2025

ENVIRONMENTAL • SOCIAL • GOVERNANCE



# **E-BOOK OF EXTENDED ABSTRACT**

THE 14th INTERNATIONAL  
INVENTION, INNOVATION &  
DESIGN COMPETITION 2025

**Organized by:**

Office of Research, Industry,  
Community & Alumni Network  
UiTM Perak Branch

**© Unit Penerbitan UiTM Perak, 2025**

All rights reserved. No part of this publication may be reproduced, copied, stored in any retrieval system or transmitted in any form or by any means; electronic, mechanical, photocopying, recording or otherwise; without permission on writing from the director of Unit Penerbitan UiTM Perak, Universiti Teknologi MARA, Perak Branch, 32610 Seri Iskandar Perak, Malaysia.

Perpustakaan Negara Malaysia

Cataloguing in Publication Data

No e- ISBN: 978-967-2776-52-9

Cover Design: Dr. Mohd Khairulnizam Ramlie

Typesetting : Georgia

# **EDITORIAL BOARD**

## **Editor-in-Chief**

MUHD SYAHIR ABDUL RANI

## **Managing Editors**

NUR FATIMA WAHIDA MOHD NASIR

SYAZA KAMARUDIN

NORASYIKIN ABDUL MALIK

## **Copy Editors**

SHEEMA LIZA IDRIS

AZURAWATI ZAIDI

HALIMATUN SAADIAH ABD MUTALIB

HALIMATUSSAADIAH IKSAN

IZA FARADIBA MOHD PATEL

MOHAMAD SAFWAT ASHAHRI MOHD SALIM

MUHAMMAD WAJIHUDDIN JOHARI

NAZIRUL MUBIN MOHD NOOR

NORAZIAH AZIZAN

NOOR AILEEN IBRAHIM

NOOR FAZZRIENEE JZ NUN RAMLAN

NOORLINDA ALANG

NURAMIRA ANUAR

NURDIYANA MOHAMAD YUSOF

NURSHAHIRAH AZMAN

NURUL FARHANI CHE GHANI

NURUL MUNIRAH AZAMRI

ONG ELLY

PAUL GNANASELVAM

SITI SYAIRAH FAKHRUDDIN

WAN FARIDATUL AKMA WAN MOHD RASHDI

WAN NURUL FATIHAH WAN ISMAIL

ZARLINA MOHD ZAMARI

AMIRUL FARHAN AHMAD TARMIZI

IMRAN TORIQ

# AUTONOMOUS ROBOT FOR MEDICATION DELIVERY IN HOSPITALS USING YOLOv5 OBJECT DETECTION

Muhammad Hafiizhun Aliim, Muhammad Raihan Afrinurrahman, Rona Regen, Sisdarmanto Adinandra, Elvira Sukma Wahyuni

Universitas Islam Indonesia,  
Kaliurang St No.Km. 14,5 Indonesia.

[21524038@students.uii.ac.id](mailto:21524038@students.uii.ac.id)  
[21524029@students.uii.ac.id](mailto:21524029@students.uii.ac.id)

## ABSTRACT

This study presents the development of an autonomous robot for delivering medicine boxes in hospital environments by recognising visual numeric signs and navigating through predefined indoor waypoints. The robot uses YOLOv5 to detect digit labels (e.g., “1”, “2”, “3”) representing patient room numbers. Upon detecting a digit, the robot follows a sequence: navigating to the medicine pickup point, simulating the collection, and then proceeding to the corresponding patient room. The system is built using ROS2, a camera for visual input, and mecanum wheels to enable omnidirectional movement in narrow hospital corridors. Testing was conducted in a structured environment resembling a hospital layout. The robot successfully detected all target objects—room digits and the medicine box—with 100% accuracy as shown in the YOLOv5 confusion matrix. It was able to navigate from its initial position to the pickup location and then to Room 1, 2, or 3 based on the detected digit. The integration of object detection and waypoint-based navigation worked effectively, ensuring accurate delivery according to predefined routines.

**Keywords:** autonomous robot, YOLOv5, waypoint

## 1. INTRODUCTION

Hospitals often face challenges in managing repetitive logistical tasks such as delivering medicine to patient rooms. Leveraging robotics in these scenarios can reduce the workload of healthcare staff and improve overall efficiency. This study presents a cost-effective solution for indoor medication delivery using an autonomous robot that detects numeric visual markers (e.g., room numbers) through the YOLOv5 object detection. Upon recognising a digit, the robot navigates through predefined waypoints to first reach a medicine pickup point and then deliver it to the corresponding room. The system is designed for structured indoor environments, particularly those with consistent layouts and fixed room locations. Additionally, the robot can be used to deliver medication to patients with a high risk of transmitting infectious diseases, such as during the COVID-19 pandemic, thereby minimising direct contact between healthcare workers and infected individuals.

## 2. METHODOLOGY

### 2.1 System Overview

The robot system consists of a Raspberry Pi-based controller integrated with YOLOv5 for visual detection, a mecanum-wheel-based mobile base for movement, and waypoint – based navigation logic controlled via ROS2.

### 2.2 Visual Detection using YOLOv5

The robot uses a camera to continuously scan its environment. When YOLOv5 detects a digit (e.g., “1”, “2”, “3”) the system interprets it as a room number and updates the navigation state to initiate the delivery routine (Jocher, 2022).

### 2.3 Waypoint Navigation

A fixed map of waypoints is defined, including the positions of the medicine box and each patient room. When a digit is detected, the robot first moves to the medicine box location using time – based motion estimation, pauses to simulate pickup, and then proceeds to the corresponding room’s waypoint (Sood et al., 2022).

### 3. FINDINGS

The robot system was successfully implemented and tested in a structured environment resembling a hospital layout. It is capable of performing waypoint-based navigation and following visual instructions in the form of digits (“1”, “2”, “3”) to deliver medicine boxes to the corresponding rooms.

During testing, the robot followed a fixed path, starting from its initial position to the medicine box location to simulate pickup. It then proceeded to one of the three patient rooms (Room 1, Room 2, or Room 3) based on the digit detected using YOLOv5.

The navigation structure operates as follows:

- i. For instance, if the robot detects the digit “1” it picks up the medicine box and proceeds to Room 1. The same logic applies to digits “2” and “3”. Refer to Figure 3 for the block diagram illustrating this process.

The object detection system demonstrated high accuracy, with YOLOv5 successfully recognising all digit labels (“1”, “2”, “3”) and the medicine box with 100% accuracy, as shown in the confusion matrix Figure 2. The integration between object detection and waypoint-based navigation yielded consistent results aligned with the predefined delivery scenario.

The detected classes include:

- i. Medicine box
- ii. “Satu”: representing room number 1
- iii. “Dua”: representing room number 2
- iv. “Tiga”: representing room number 3

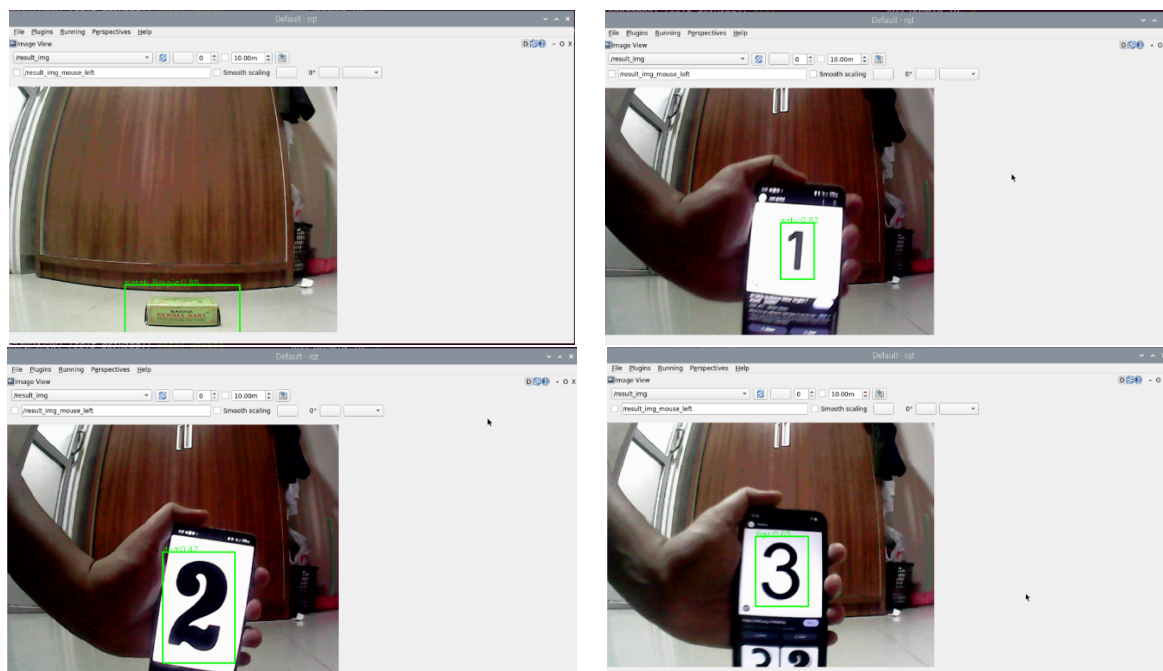
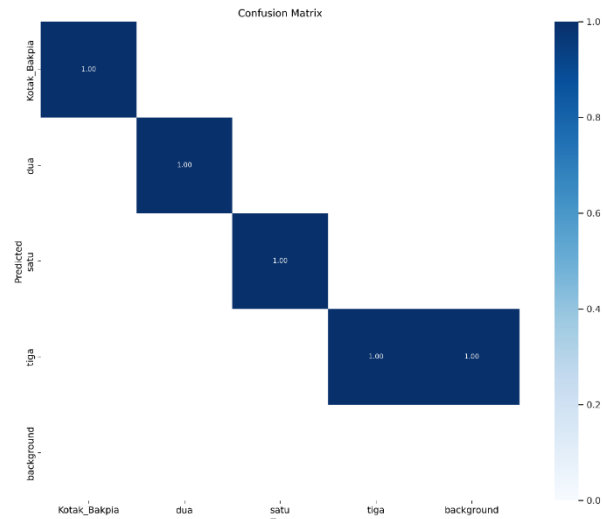
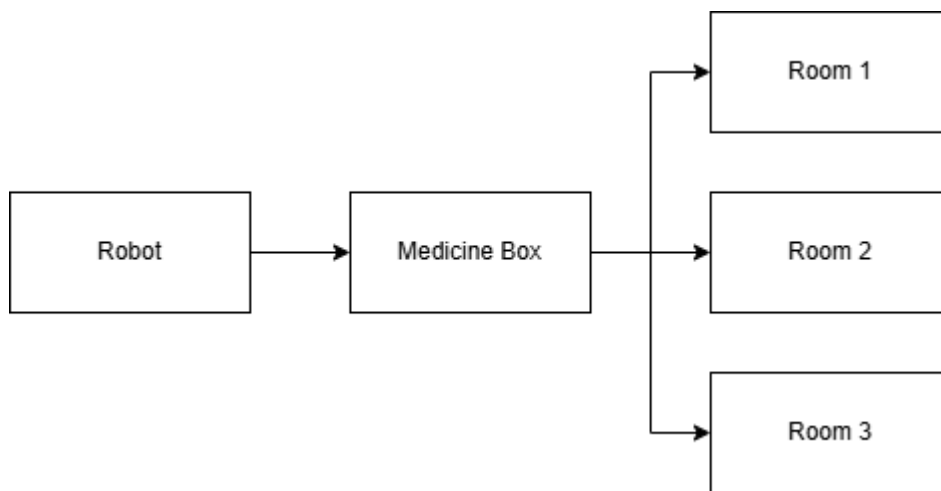


Figure 1 Results of detection object



**Figure 2** Confusion matrix of YOLOv5 model for detecting room and numbers and medicine box



**Figure 3** Diagram block autonomous robot

#### 4. CONCLUSION

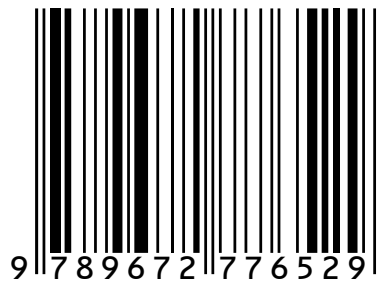
This research successfully developed an autonomous robot system for medication delivery in hospital environments by utilising YOLOv5 for object detection and waypoint-based navigation. The system is capable of recognising visual numeric labels ("1", "2", "3") representing patient room numbers, as well as the medicine box, with 100% accuracy. Upon recognising a number, the robot systematically navigates from the starting point to the medicine pickup location and then to the corresponding patient room. Testing in a structured environment demonstrated effective integration between the detection system and the navigation logic.

#### REFERENCES

- Jocher, G. (2022, November 22). Ultralytics YOLOv5. *GitHub*. <https://github.com/ultralytics/yolov5>
- Sood, S., Singh Sodhi, J., & Maheshwari, P. (2022). *Multiple Waypoint Navigation in Unknown Indoor Environments*.

E-Book of Extended Abstract THE 14th INTERNATIONAL INVENTION, INNOVATION &  
DESIGN COMPETITION 2025

e ISBN 978-967-2776-52-9



Unit Penerbitan UiTM Perak

(online)