E-PROCEEDINGS

INTERNATIONAL TINKER INNOVATION & ENTREPRENEURSHIP CHALLENGE (i-TIEC 2025)

"Fostering a Culture of Innovation and Entrepreneurial Excellence"

23 January 2025
PTDI, UiTM Cawangan Johor
Kampus Pasir Gudang

ORGANIZED BY:

Electrical Engineering Studies, College of Engineering
Universiti Teknologi MARA (UiTM) Cawangan Johor
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Editors

Aznilinda Zainuddin

Maisarah Noorezam

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CONTENTS

PREFACE	i
FOREWORD RECTOR	ii
FOREWORD ASSISTANT RECTOR	iii
PREFACE PROGRAM DIRECTOR	iv
ORGANIZING COMMITTEE	v
EXTENDED ABSTRACTS SCIENCE & TECHNOLOGY	1 - 618
EXTENDED ABSTRACTS SOCIAL SCIENCES	619 - 806

PREFACE

It is with great pleasure that we present the e-proceedings of International Tinker Innovation & Entrepreneurship Challenge (i-TIEC 2025), which compiles the extended abstracts submitted to the International Tinker Innovation & Entrepreneurship Challenge (i-TIEC 2025), held on 23 January 2025 at **PTDI, Universiti Teknologi MARA (UiTM) Cawangan Johor, Kampus Pasir Gudang.** This publication serves as a valuable resource, showcasing the intellectual contributions on the invention and innovation among students, academics, researchers, and professionals.

The International Tinker Innovation & Entrepreneurship Challenge (i-TIEC 2025), organized under the theme "Fostering a Culture of Innovation and Entrepreneurial Excellence," is designed to inspire participants at various academic levels, from secondary students to higher education students and professionals. The competition emphasizes both innovation and entrepreneurship, encouraging the development of product prototypes that address real-world problems and have clear commercialization potential. By focusing on technological and social innovations, i-TIEC 2025 highlights the importance of turning creative ideas into viable, market-ready solutions that can benefit users and society. The extended abstracts in this e-proceedings book showcase the diverse perspectives and depth of research presented during the event, reflecting the strong entrepreneurial element at its core.

We extend our sincere gratitude to the contributors for their dedication in sharing their innovation and the organizing committee for their hard work in ensuring the success of the event and this publication. We also appreciate the support of our collaborators; Mass Rapid Transit Corporation Sdn. Bhd. (MRT Corp), Universitas Labuhanbatu, Indonesia (ULB), Universitas Riau Kepulauan, Indonesia (UNRIKA) and IEEE Young Professionals Malaysia, whose contributions have been instrumental in making this event and publication possible.

We hope that this e-proceedings book will serve as a valuable reference for researchers, educators, and practitioners, inspiring further studies and collaborations in both innovation and entrepreneurship. May the knowledge shared here continue to spark new ideas and market-ready solutions, advancing our collective expertise and fostering the growth of entrepreneurial ventures.

A-ST117: FORMULATION OF NATURAL LIPSTICK USING COLOURANT AGENT DERIVED FROM ROSELLE (*HIBISCUS SABDARIFFA*) 338

A-ST122: A STRATEGIC MAINTENANCE MANAGEMENT MODEL: ENHANCING DEFECT RESOLUTION EFFICIENCY IN LOCAL GOVERNMENT INFRASTRUCTURE 344

A-ST125: MASTERING DERIVATIVES 349

A-ST128: ECOBIOCREAM: EXPLORING THE ANTIMICROBIAL SYNERGISM BETWEEN GELENGGANG LEAVES AND RED DRAGON FRUIT PEEL EXTRACTS IN A NOVEL ANTISEPTIC CREAM 354

A-ST133: GREENDRIVE EV: AN INNOVATIVE PALM OIL ESTER BLEND FOR EV TRANSMISSION FLUID 360

A-ST139: INNOVATIVE API NITRATE TEST KIT VORTEX MIXER FOR ENHANCED AQUAPONIC WATER QUALITY MANAGEMENT 365

A-ST140: ROOF SPRINKLER COOLING SYSTEM USING GREYWATER RECYCLING 370

A-ST141: IOT-DRIVEN EGG INCUBATOR WITH EMBRYO MONITORING FOR SMALL-SCALE POULTRY FARMING 376

A-ST142: POLYURETHANE MODIFIED COLD MIX ASPHALT ROAD PATCHING (PU-ASPHALT PATCHING) 381

A-ST146: PURFEEDER: AUTOMATIC CAT FEEDER 386

A-ST147: INTEGRATED SOLAR POWERED FAN AND LIGHTING SYSTEM. 392

A-ST151: SEGRE-BAG: AN INNOVATIVE SOLUTION FOR ENHANCED WASTE SEGREGATION AND LANDFILL WASTE REDUCTION 398

A-ST154: SMARTHARVEST: AGRICULTURE IOT-ENABLED SOLAR IRRIGATION SYSTEM 408

A-ST155: INTEGRATED GARAGE SYSTEM WITH GAS DETECTION ALERT 413

A-ST156: SOLARALIGN: DUAL-AXIS INNOVATION FOR SUSTAINABLE ENERGY SOLUTIONS 419

A-ST157: ADAPTIVE SUN-TRACKING SOLAR PANEL 424

A-ST158: SUNLIGHT-RESPONSIVE TRACKING AND MONITORING SYSTEM FOR SOLAR PANELS 430

A-ST159: GREENHOUSE MONITORING SYSTEM 435

A-ST155: INTEGRATED GARAGE SYSTEM WITH GAS DETECTION ALERT

Ahmad Zayd Mohd Pazli, Siti Hazurah Indera Putera, Ahmad Iskandar Muhammad Andy Fairoz, and Hanunah Othman
Electrical Engineering Studies, College of Engineering, Universiti Teknologi MARA, Johor Branch, Pasir Gudang Campus, Masai, Malaysia

Corresponding author: Siti Hazurah Indera Putera, hazurah@uitm.edu.my

ABSTRACT

In 2024, over 10,000 vehicles were reported stolen in Malaysia, with the majority being motorcycles, sport utility vehicles (SUVs) and trucks. It is highly desirable to store vehicles in garages to ensure their safety. However, enclosed spaces can pose the threat of exhaust gas poisoning, which includes carbon-monoxide and nitrogen-dioxides, both of which can have adverse health effects. Each year many deaths were reported due to carbon-monoxide poisoning from exhaust gases. Considering these issues, this study proposes an automatic garage with Blynk-automated and Radio Frequency Identification (RFID) enabled security doors, also an Internet-of-Things (IoT) enabled gas detection alert system. The integrated ESP32 microcontroller unit (MCU) which is wi-fi associable is selected as the system's brain, while a servo motor opens and closes the garage door with an infrared sensor signaling the presence of vehicles. The system is equipped with an MQ135 gas sensor which measures the garage's air quality and an exhaust fan to expel gases from the garage. Air quality alert is sent to the Telegram application for fast notification. A motion sensor is employed to turn on the light automatically when movement is detected. This mechanism enables the garage to optimize the usage of electricity effectively, thus ensuring an environmentally friendly operation.

Keywords: Air quality, motion sensor, IoT, automatic door, RFID

1. Product description

The ESP32 MCU is connected to the Blynk application to open and close the garage door remotely. An RFID-enabled security system is also integrated to perform the same function in-person. An RFID card is used to activate the servo motor of the garage door. If an unregistered card is used, an alarm will turn on. When a vehicle passes through, an infrared sensor waits for the vehicle to fully enter the garage before signaling the MCU to close the door. The garage is equipped with an air quality monitoring system that detects gases using the MQ135 gas sensor. The sensor sends measurements of gases to the MCU, which sends notifications to the mobile Telegram application to alert the owner. The exhaust fan is then turned on to remove unwanted gases. An automatic lighting system is operated using a motion sensor. When movement is detected in the garage, the lights will turn on and when no movement is detected the lights will automatically turn off.

2. System diagram, flowchart and product prototype.

Figure 1 and **Figure 2** show the block diagram and schematic diagram of the system. **Figure 2** depicts the operations flowchart while **Fugure 4** shows the developed prototype. **Figure 5** indicates the mobile user interfaces for the remote operation of the garage door and the gas detections alert.

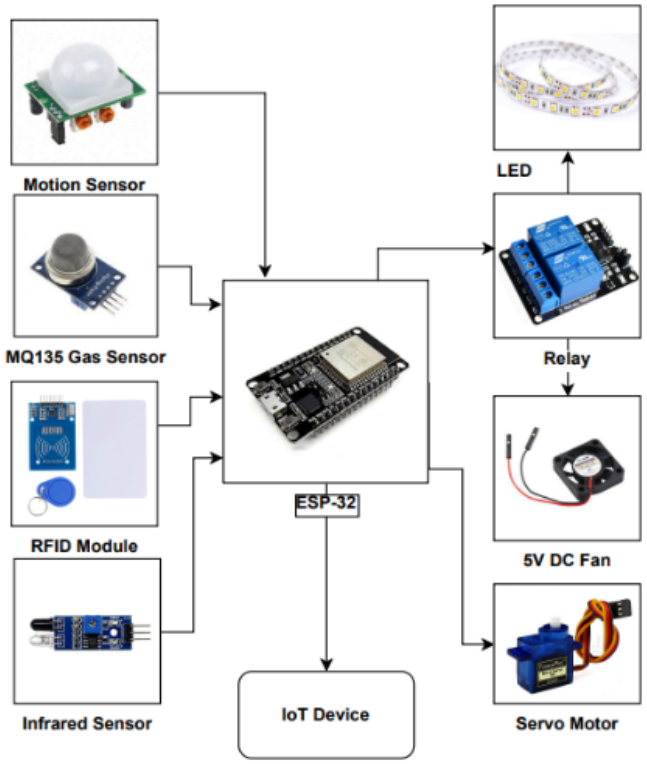


Figure 1. Block Diagram of the Integrated Garage System with Gas Detection Alert

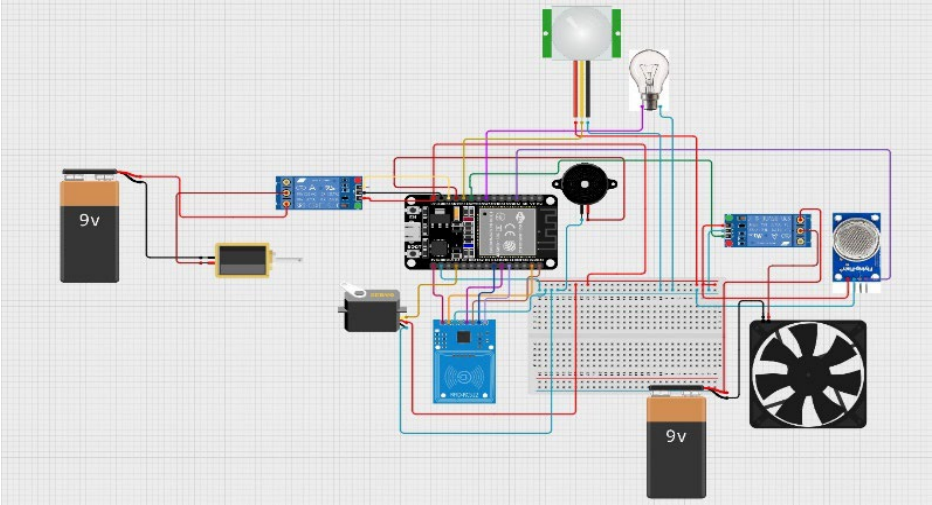


Figure 2. Schematic Diagram of the Integrated Garage System with Gas Detection Alert

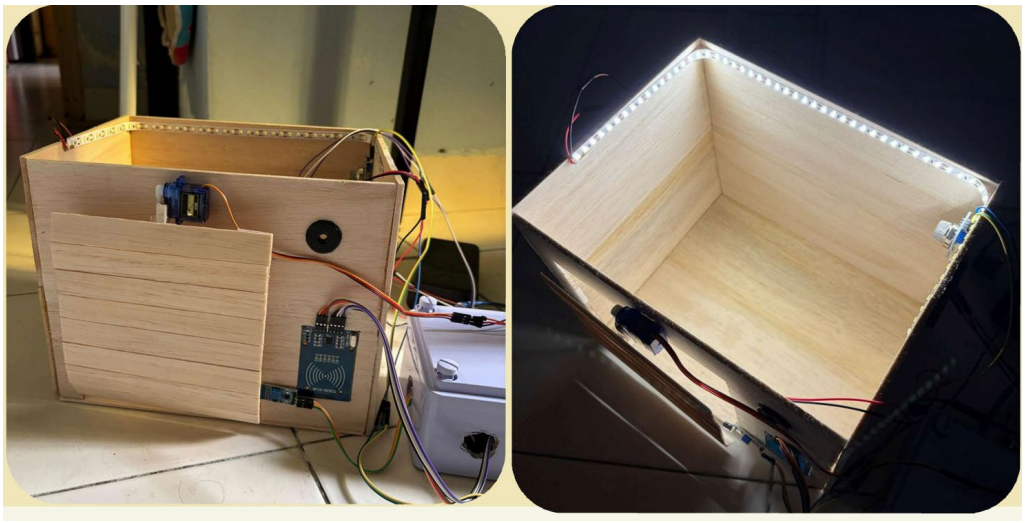


Figure 3. Prototype of the Integrated Garage System with Gas Detection Alert

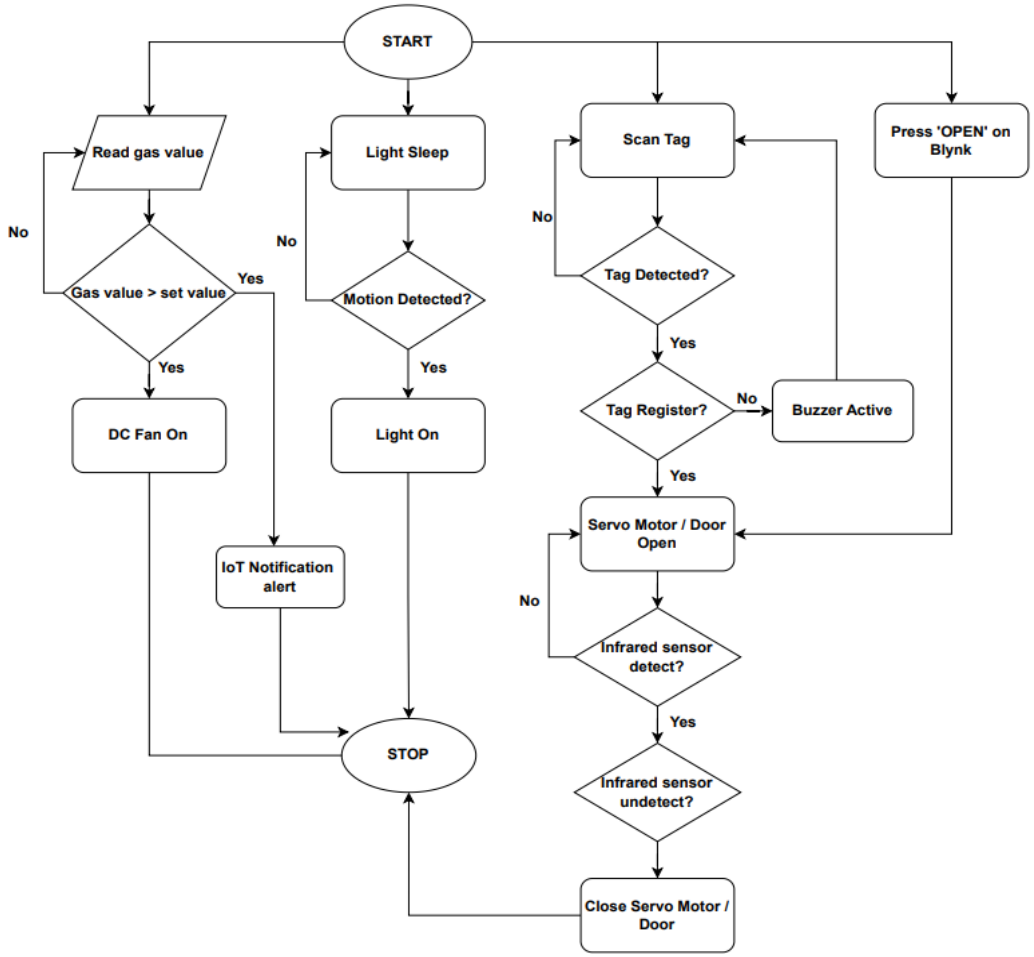
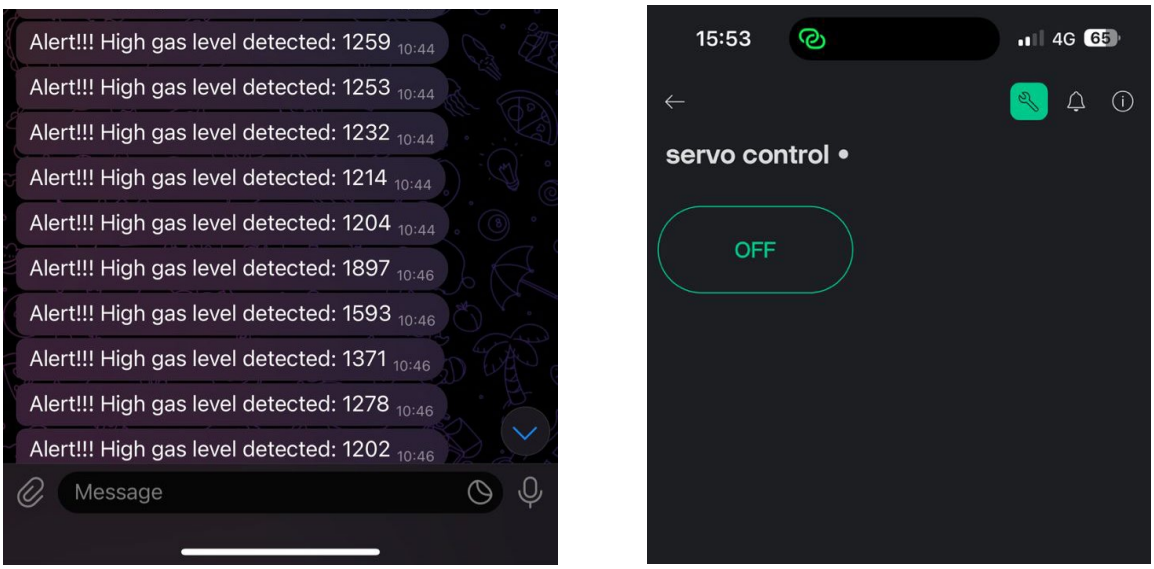


Figure 4. Flowchart of the Integrated Garage System with Gas Detection Alert



(a)

Figure 5. Mobile application interfaces of the Integrated Garage System with Gas Detection Alert: (a) Telegram application for gas detection alert, and (b) Blynk application for garage door remote operation

3. Novelty and uniqueness

The Integrated Garage System with Gas Detection Alert system offers an inclusive solution not only for the security of vehicles but more importantly for the safety and wellbeing of the people who are using the garage. Unlike traditional garages, this system also combines advanced automation and mobile connectivity to increase the ease of operation. Users can easily operate the garage door from anywhere that has an internet connection. This can also be very useful in the case of large deliveries where items cannot be left outside to be exposed to the elements. Owners are also notified if any harmful gases are detected in their garages. This feature can also be very convenient if the garage is also used as storage for household chemicals or liquid petroleum gas (LPG) tanks used for cooking, which might leak into the air.

4. Benefit to mankind

The safety and security of vehicles are some of the main priorities of vehicle owners, with vehicle theft being rampant in our society nowadays. Securing a vehicle's safety in the long run can also help lower the incidents of theft in the area which in results may motivate insurance providers to lower their premiums. A safe environment is also essential in preventing unwanted tragedies of gas poisoning. Since carbon-monoxide is colorless and odorless it is almost impossible to detect its presence until it is too late. A sensor coupled with a mobile alert system and exhaust fan is necessary to ensure the wellbeing of users of the facility. An integrated system which can be developed with minimal cost such as this can provide ease of mind to individuals and business owners alike.

5. Innovation and Entrepreneurial Impact

This project fosters innovative ideas by utilizing advancement in automation and Internet of Things while optimizing the cost and design features. With proper exposure it has the possibility to enter the industry for vehicle safety and security.

6. Potential commercialization

This system has the potential to be installed in homes with built-in garages, also in workshops, laboratories and small factories which require automatic closing and opening of doors or facilities that handle vaporizable chemical and gases than can be of possible hazards.

7. Acknowledgment

The authors would like to acknowledge the Electrical Engineering Studies, College of Engineering, Universiti Teknologi MARA, Pasir Gudang Branch for its support.

8. Authors' Biography

Ahmad Zayd Mohd Pazli is a student of Diploma in Electrical Engineering (Electronic) program at Universiti Teknologi MARA (UiTM), Pasir Gudang branch. He is a receiver of the Dean's award for 4 consecutive semesters and is currently on track to complete his studies in August 2025.

Dr. Siti Hazurah Indera Putera is a Senior Lecturer at Universiti Teknologi MARA (UiTM) Pasir Gudang branch. She has over 20 years of experience as an academician and has taught courses such as Digital Systems, Process Control, Basic Programming and Linear Systems. She obtained her PhD in Automatic Control and System Engineering from The University of Sheffield in 2019, Master of Engineering in Mechatronics and Automatic Control from Universiti Teknologi Malaysia (UTM) in 2008, and Bachelor of Engineering in Electrical (Electronics) Engineering, also from UTM in 2003.

Hanunah Othman is a Senior Lecturer at Universiti Teknologi MARA (UiTM) Pasir Gudang branch. She has 24 years of experience as an academician and has taught courses such as Communications Engineering, Circuits and Systems, Measurement and Instrumentation, also Engineering Mathematics and Physic. She received her Master of Engineering in Communication and Computer Engineering from Universiti Kebangsaan Malaysia (UKM) in 2007 and Bachelor of Engineering in Electric, Electronics and System Engineering also from UKM in 1999.

Ahmad Iskandar Muhammad Andy Fairoz is a student of Diploma in Electrical Engineering (Electronic) program at Universiti Teknologi MARA (UiTM), Pasir Gudang branch. He is a receiver of the Dean's award for 2 consecutive semesters and is currently on track to complete his studies in August 2025.