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E-PROCEEDINGS

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

"Fostering a Culture of Innovation and Entrepreneurial Excellence"



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23 January 2025
PTDI, UiTM Cawangan Johor
Kampus Pasir Gudang

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Electrical Engineering Studies, College of Engineering
Universiti Teknologi MARA (UiTM) Cawangan Johor
Kampus Pasir Gudang
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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.

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A-ST159: GREENHOUSE MONITORING SYSTEM

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ABSTRACT

Greenhouses play a vital role in modern agriculture, providing a controlled environment for optimal plant growth and crop production. However, maintaining ideal conditions within a greenhouse requires continuous monitoring and precise control of various environmental parameters. This project aims to develop an advanced greenhouse monitoring and control system using the ESP32 microcontroller and IoT technology. By integrating sensors for temperature, humidity, soil moisture, and light intensity, the system continuously collects critical data. The ESP32 processes this data in real-time and automates the control of actuators, including fans, water pumps, lights, and a humidifier, to maintain optimal growing conditions. Additionally, the ESP32's built-in Wi-Fi functionality transmits data to a cloud platform, enabling real-time remote monitoring and control via a user-friendly mobile application. The proposed system offers significant advantages over traditional methods, including reduced manual intervention, enhanced resource management, and improved crop yield and quality. By leveraging real-time data analysis and automated adjustments, this project aims to enhance the efficiency and sustainability of greenhouse farming practices.

Keywords: greenhouse monitoring system, ESP32 microcontroller, Wi-Fi module, controlled environment, IoT technology.

1. Product Description

The Greenhouse Monitoring System is a state-of-the-art solution designed to modernize and optimize agricultural practices in controlled environments. Powered by the ESP32 microcontroller, this system integrates a suite of sensors to monitor essential environmental parameters, including temperature, humidity, soil moisture, and light intensity. The ESP32 processes the sensor data in real-time and enables automated responses to maintain optimal conditions. Output devices such as fans for cooling, lights for illumination, water pumps for provide water to the plant, and a humidifier for stabilizing humidity levels work together seamlessly to ensure the ideal growing environment. The system features an LCD display for on-site monitoring, allowing farmers to view essential data at a glance. Additionally, the ESP32's built-in Wi-Fi capabilities enable IoT connectivity, allowing users to remotely access real-time data through a mobile app or web platform. This functionality ensures that users can monitor greenhouse conditions, receive alerts, and control environmental parameters from anywhere. By integrating advanced automation, real-time monitoring, and remote accessibility, the system reduces manual labor, optimizes resource use, and supports

sustainable farming practices. The addition of a humidifier further enhances the system's ability to maintain consistent humidity, improving crop health and yield reliability in varying environmental conditions.

2. Block diagrams and Flow Charts

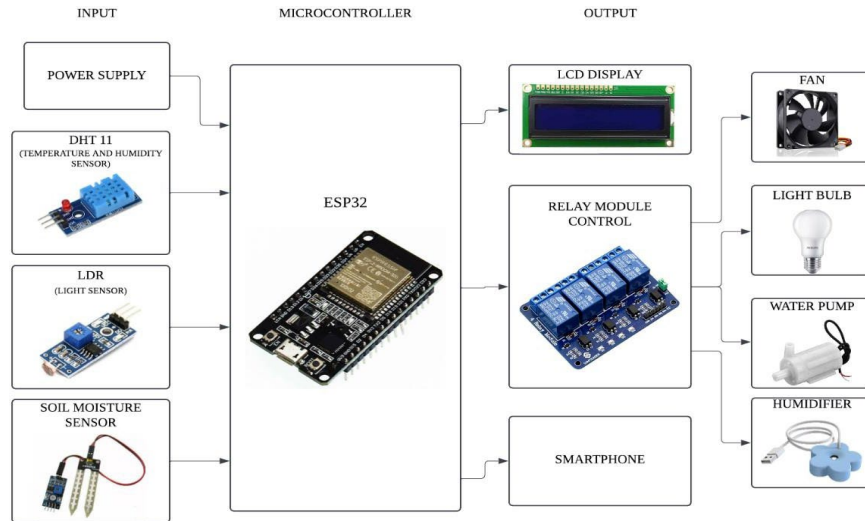


Figure 1. Block Diagram of Greenhouse Monitoring System

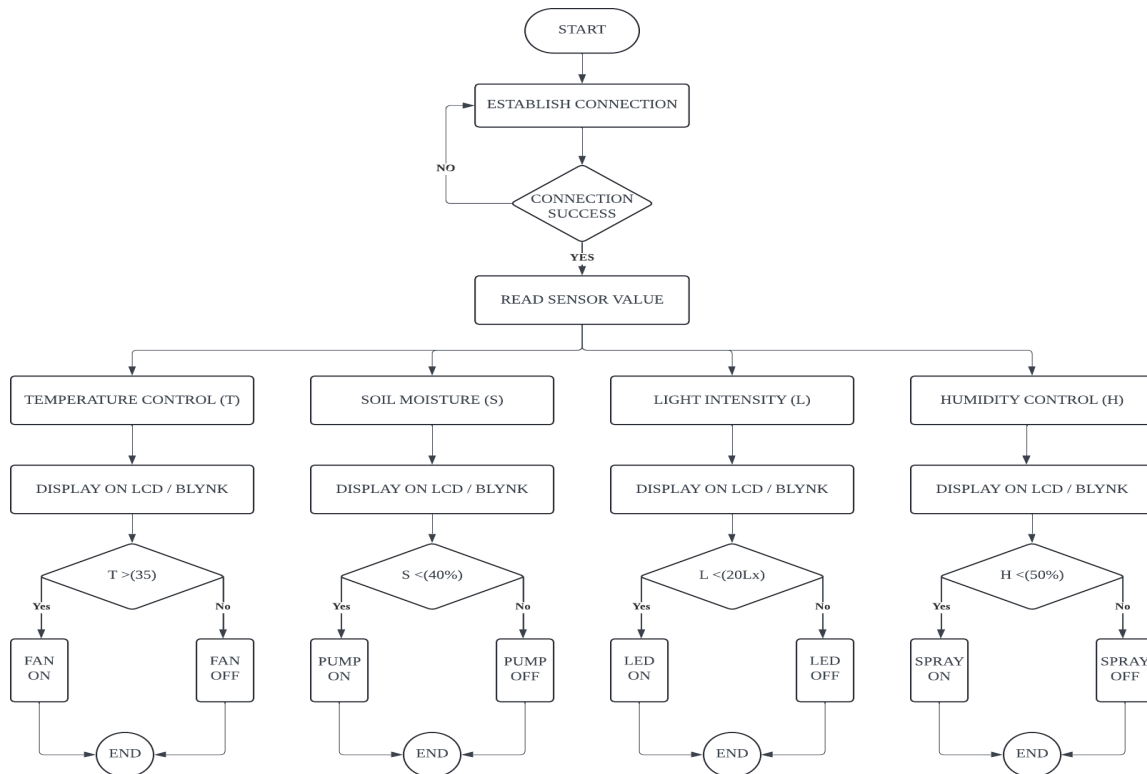


Figure 2. Flowchart of Greenhouse Monitoring System

3. Novelty and uniqueness

The Greenhouse Monitoring System is distinguished by its innovative use of the ESP32 microcontroller, which enables real-time monitoring, IoT connectivity, and automation in a single, scalable solution. Unlike traditional greenhouse setups that require extensive manual intervention, this system integrates multi-sensor data to automate the control of key environmental parameters such as temperature, humidity, and soil moisture. One of the unique features of the system is its ability to monitor multiple greenhouses simultaneously through its IoT-enabled remote access. Users can not only receive real-time updates but also adjust settings for specific crops, creating tailored conditions to optimize growth and yields. Another standout innovation is the system's dual functionality in providing both local monitoring via an LCD display and remote accessibility through mobile applications or web platforms. Its compact and user-friendly design ensures compatibility with existing farming setups, making it easy to adopt. Overall, the system offers a smarter, more efficient, and highly customizable approach to greenhouse management.

4. Benefit to mankind

The Greenhouse Monitoring System offers significant benefits to society by addressing global agricultural challenges such as food security, resource efficiency, and sustainability. By automating critical tasks like irrigation, temperature regulation, and lighting control, the system reduces the reliance on manual labor, saving farmers valuable time and effort. Its real-time monitoring capabilities help prevent crop losses by allowing users to quickly respond to environmental changes or anomalies, ensuring optimal conditions for plant growth. This can lead to higher crop yields and improved food production, directly contributing to global food security. Additionally, the system promotes sustainability by minimizing resource wastage; for example, it ensures precise water usage, preventing over-irrigation or drought stress. Its remote access functionality empowers farmers to monitor and manage their greenhouses from anywhere, improving efficiency and convenience. By enhancing productivity and reducing environmental impact, the Greenhouse Monitoring System supports the development of a more resilient and sustainable agricultural sector for future generations.

5. Innovation and Entrepreneurial Impact

The Greenhouse Monitoring System drives innovation by integrating IoT technology with real-time data collection and automated control mechanisms to optimize greenhouse conditions, surpassing traditional methods in precision and efficiency. Its scalable design accommodates a wide range of agricultural applications, from small-scale farms to large commercial operations, with potential for future enhancements like AI-driven analytics. This project fosters entrepreneurship by offering a market-ready solution that integrates seamlessly into existing agricultural infrastructure, creating opportunities for startups in the agritech sector. Additionally, it bridges the gap between theory and practice by providing hands-on experience in IoT, automation, and smart farming. By addressing global agricultural challenges with sustainable and efficient solutions, the system inspires a culture of innovation and entrepreneurial thinking, empowering individuals and businesses to develop impactful technologies for modern farming.

6. Potential commercialization

The Greenhouse Monitoring System has immense potential for commercialization due to its practical features, affordability, and wide range of applications. The integration of IoT technology makes it an attractive solution for farmers, agribusinesses, and agricultural technology companies. Its real-time monitoring and automation capabilities address the growing demand for smart farming solutions, providing a modern alternative to traditional greenhouse systems. The system's scalability and adaptability enable it to cater to diverse farming needs, from small-scale greenhouse operations to large commercial setups. Its ease of installation and compatibility with existing infrastructure further enhance its marketability. Additionally, with the rising awareness of sustainable farming practices, this system appeals to environmentally conscious buyers by promoting efficient resource utilization. Target markets include individual farmers, agritech firms, and industrial-scale agricultural operations. Entrepreneurs can capitalize on the increasing demand for IoT-enabled farming tools, positioning this system as a cost-effective, efficient, and innovative product in the growing smart agriculture market.

7. Acknowledgment

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8. Authors' Biography



Hakimi Alfisyhar Bin Shariffuddin is a student of Electrical and Electronic Engineering at Universiti Teknologi MARA (UiTM). His final year project focuses on developing an advanced greenhouse monitoring and control system utilizing IoT technology. Combining innovation with practical engineering solutions, Hakimi aims to contribute to sustainable agriculture and smart farming practices. His project highlights the importance of optimizing crop growth through automation and real-time monitoring, bridging academic research with real-world applications. By integrating environmental sensors, automated control mechanisms, and IoT connectivity, his work emphasizes the potential of technology in enhancing agricultural efficiency and sustainability.



Hannah Hazirah Mohamad Huzaimi is a student of Electrical and Electronic Engineering at Universiti Teknologi MARA (UiTM). Her final year project focused on improving the waste segregation of wet, dry and metal waste at laboratory settings. The system integrates Blynk IoT platform to provide real-time monitoring, mobile notifications, and alerts for waste classification and bin capacity. By optimizing waste collection and promoting sustainability, this system enhances waste management efficiency while reducing environmental impact in laboratory settings.



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