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E-PROCEEDINGS

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

"Fostering a Culture of Innovation and Entrepreneurial Excellence"



e ISBN 978-967-0033-34-1



9 789670 103341

23 January 2025
PTDI, UiTM Cawangan Johor
Kampus Pasir Gudang

ORGANIZED BY:

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

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e ISBN: 978-967-0033-34-1

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Published in Malaysia by
Universiti Teknologi MARA (UiTM) Cawangan Johor
Kampus Pasir Gudang, 81750 Masai



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

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ABSTRACT

The SmartHarvest is an innovative solution designed to optimize water management in agriculture using solar energy and IoT technologies. Equipped with solar panels, DHT22 sensors for temperature and humidity, LDRs for light intensity, soil moisture sensors, an ESP32 microcontroller, and DC water pumps, this system autonomously adjusts irrigation based on real-time data, promoting water conservation and improving crop health. The system's use of solar power makes it eco-friendly, reducing reliance on conventional energy sources and operational costs. It also integrates UV lights to ensure clean water, providing an efficient, sustainable method for irrigation. The invention addresses the pressing need for water-efficient agricultural practices, especially in areas experiencing water scarcity, by providing a solution that reduces waste and enhances productivity. Its socio-economic and environmental impacts include increasing agricultural yields, conserving water, and fostering sustainability. With strong commercialization potential, this system offers an ideal solution for farmers globally, particularly in regions where resources are limited or traditional irrigation methods are inefficient. Its scalability and cost-effectiveness make it a promising tool for both small-scale and large-scale agricultural operations.

Keywords: solar power, automated irrigation, water conservation, IoT technology, sustainable agriculture

1. Product Description

The SmartHarvest is an innovative, eco-friendly solution designed to revolutionize modern farming by optimizing water usage and enhancing crop productivity. The system is powered by renewable solar energy and integrates advanced sensors to monitor key environmental factors such as temperature, humidity, soil moisture, and light intensity, ensuring precise and efficient irrigation. Controlled by an ESP32 microcontroller with IoT connectivity, the system enables seamless remote monitoring and management, allowing farmers to track real-time data and adjust irrigation schedules effortlessly. Additional features, such as UV lights for water sterilization and a user-friendly LCD, ensure the system is practical and efficient. This system supports sustainable farming practices by promoting water conservation, reducing operational costs, and improving crop health. Its scalability and ease of use make it an ideal solution for farmers seeking to enhance productivity while minimizing environmental impact, making it a game-changing technology for the future of agriculture.

2. Methodology

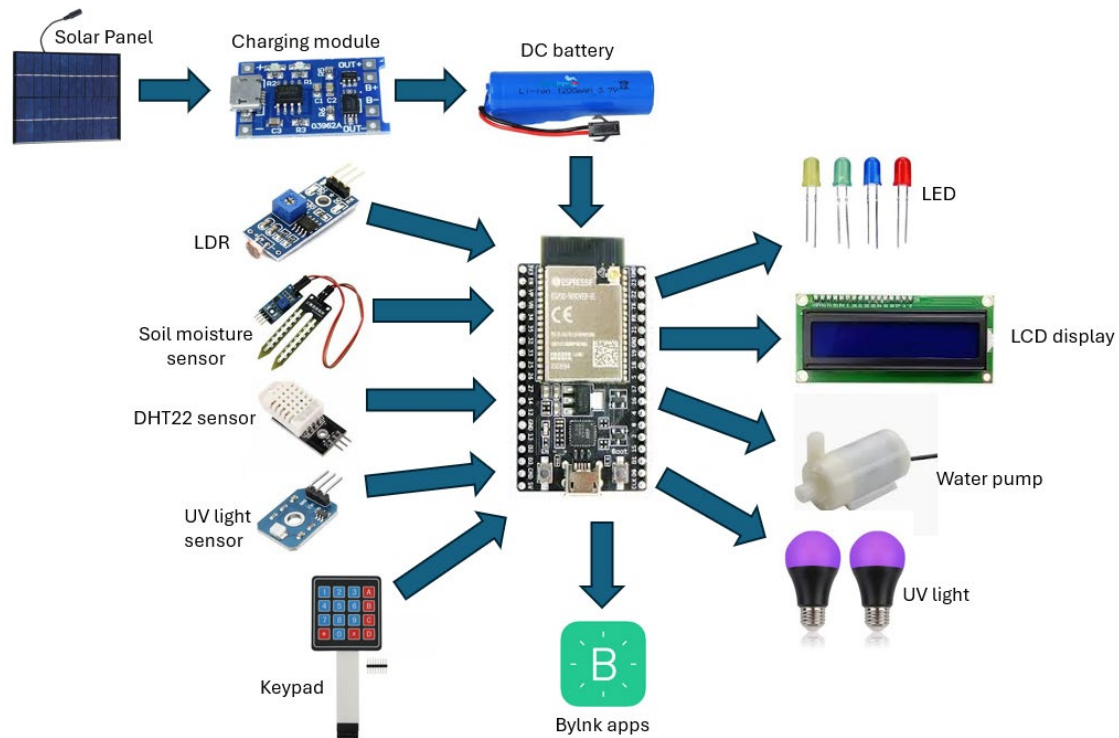


Figure 1. Block diagram of SmartHarvest

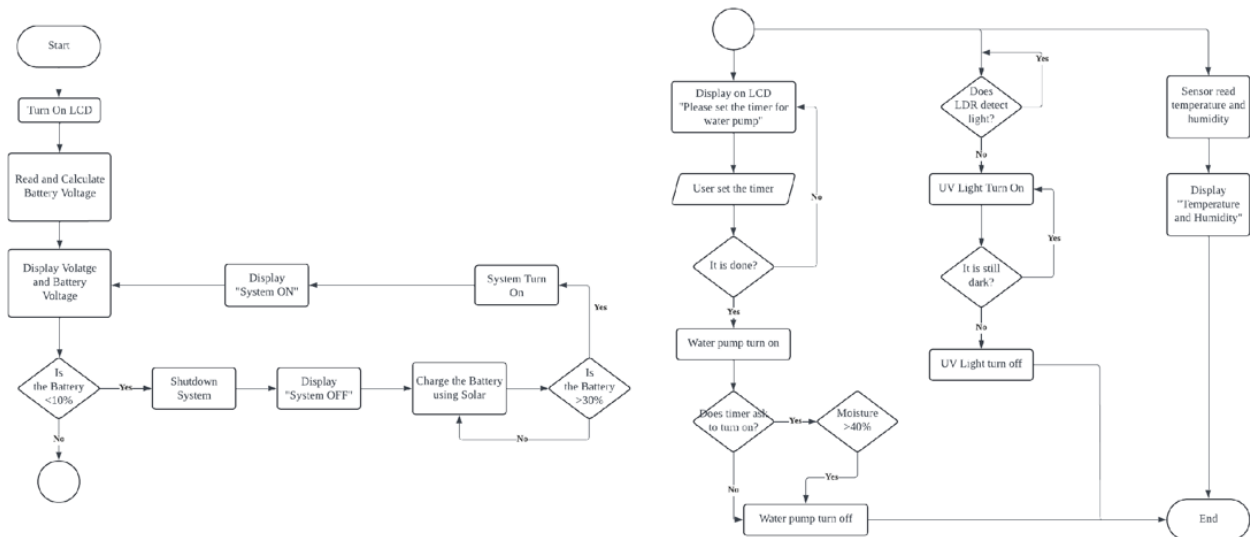


Figure 2. Flowchart of SmartHarvest

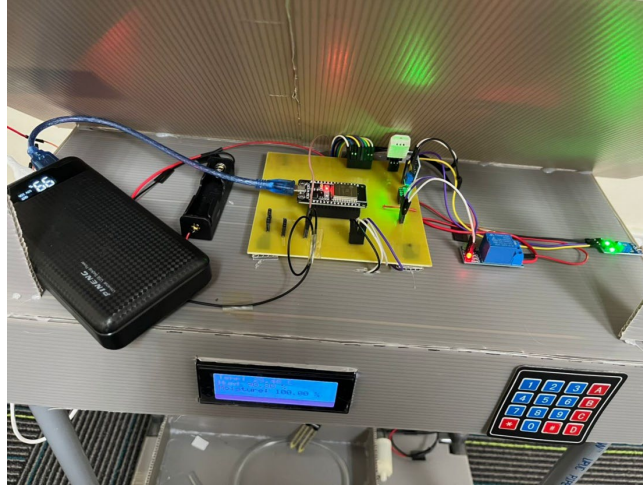


Figure 3 : Full circuit SmartHarvest

3. Novelty and uniqueness

The SmartHarvest stands out for its innovative combination of renewable energy, IoT-based automation, and advanced features designed for sustainable agriculture. Operating entirely on solar power, it ensures energy independence and cost efficiency, particularly in areas with limited electricity access. The system integrates advanced sensors to monitor soil moisture, temperature, humidity, and light intensity, enabling precise, real-time irrigation tailored to crop needs. Its IoT connectivity allows for remote monitoring and control, reducing labor demands and enhancing user convenience. Uniquely, the system includes UV lights for water sterilization, ensuring clean, pathogen-free irrigation, and a user-friendly LCD display for real-time performance feedback. This comprehensive solution addresses water conservation, environmental sustainability, and improved crop health, making it a pioneering innovation in modern farming.

4. Benefit to mankind

The SmartHarvest benefits mankind by addressing key challenges in agriculture, resource management, and environmental sustainability. By harnessing renewable solar energy, it reduces reliance on fossil fuels, helping to combat climate change and lower operational costs. The system conserves water through precise, automated irrigation, preserving one of the planet's most vital resources while improving crop health and productivity. Its IoT connectivity and automation empower farmers with efficient, remote field management, reducing labor demands and enhancing agricultural practices, particularly in underserved or rural areas. The integration of UV sterilization ensures clean water use, promoting public health and reducing the spread of waterborne diseases. By fostering sustainable farming practices, enhancing food security, and supporting economic growth, this system contributes to a more resilient, equitable, and sustainable future for communities worldwide.

5. Innovation and Entrepreneurial Impact

The SmartHarvest system embodies significant innovation and entrepreneurial impact by offering a sustainable, cost-effective solution to modern agricultural challenges. Its integration of solar energy, IoT technology, and advanced sensors showcases a novel approach to water management, addressing critical issues like water scarcity and high energy costs. The system's automation and real-time monitoring capabilities enable farmers to improve productivity while reducing labor and resource usage, creating opportunities for increased profitability and scalability. Additionally, its eco-friendly design aligns with global sustainability goals, appealing to environmentally conscious markets. The system's potential for widespread adoption, particularly in rural and resource-constrained areas, opens avenues for job creation, technology transfer, and economic empowerment. By driving efficiency, promoting sustainability, and fostering innovation, this system contributes to building a resilient agricultural sector while positioning itself as a commercially viable product with global market relevance.

6. Potential commercialization

The SmartHarvest has strong commercialization potential as a sustainable and cost-effective solution to global agricultural challenges. Its eco-friendly design, powered by renewable solar energy, reduces water and energy consumption, appealing to farmers and enterprises seeking efficient resource management. Scalable for small and large farms alike, its IoT connectivity and remote monitoring features address the rising demand for smart farming technologies. UV sterilization for clean water adds a unique selling point, enhancing its appeal in markets prioritizing water quality and sustainability. Aligned with global sustainability goals, the system attracts interest from governments, NGOs, and organizations promoting renewable energy and precision agriculture. With applications in water-scarce regions, greenhouse farming, and urban agriculture, it offers broad market scope. Strategic partnerships and targeted marketing efforts can further position it as a leading solution in innovative agricultural technologies, ensuring significant commercial success.

7. Acknowledgment

The authors would like to express their sincere gratitude to the Electrical Engineering Studies, Universiti Teknologi MARA (UiTM), Cawangan Johor, Kampus Pasir Gudang, for their invaluable support and assistance throughout this project. Their guidance and resources played a key role in ensuring the successful completion of this work.

8. Authors' Biography



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