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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
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Electrical Engineering Studies, College of Engineering
Universiti Teknologi MARA (UiTM) Cawangan Johor
Kampus Pasir Gudang
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A-ST052: SMART MEASURE: PRECISION MEASUREMENT SYSTEM WITH CLOUD INTEGRATION

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ABSTRACT

Accurate measurement is vital in industries such as engineering, manufacturing, and healthcare, where precision ensures quality and efficiency. Traditional tape measures often fall short due to low accuracy, manual errors, limited unit conversion, and the inability to store measured values, leading to inconsistent workflows and inefficiencies. This project aims to develop an automatic calibration system using an ultrasonic sensor and an ESP32 microcontroller. By employing a time-to-distance conversion method, the system ensures precise measurements while eliminating the need for traditional measuring tools. Enhanced functionality includes unit conversion capabilities and integration with the Blynk cloud platform for storing and retrieving measured data, which improves workflow productivity and usability. The project scope involves the use of essential tools such as an ultrasonic sensor, DHT22 temperature sensor, LED, buzzer, LCD display, and the Blynk app, all programmed using the Arduino IDE. This innovative system addresses the limitations of conventional measurement methods, offering improved accuracy, expanded functionality, and greater efficiency for modern industrial applications. This solution represents a significant step toward advancing measurement technology, enhancing practicality, and meeting the growing demands for precision and adaptability in various fields.

Keywords: Automatic Calibration, Ultrasonic Sensor, Distance Measurement, Blynk Integration, ESP32 Microcontroller

1. Product Description

The Automatic Calibration on Measuring Tape system is an innovative solution designed to replace traditional measuring tools with a modern, efficient, and accurate alternative. This product incorporates advanced ultrasonic sensor technology and an ESP32 microcontroller to deliver precise distance measurements. The system calculates distances using a time-to-distance conversion method, ensuring reliable performance across diverse applications. The product's key features include unit conversion capabilities, which enable the display of measurements in various SI units for enhanced versatility. The integration of the Blynk cloud platform adds smart functionality, enabling users to store and retrieve measured values conveniently for future references. The LCD display creates a user-friendly interface, and additional components such as the DHT22 temperature sensor, LED, and buzzer enhance usability and feedback. Designed to meet the demands of industries requiring precision and practicality, this system eliminates manual errors commonly associated with traditional tape

measures and improves workflow efficiency. Compact, portable, and adaptable, the Automatic Calibration on Measuring Tape system represents a significant step forward in measurement technology, combining accuracy, functionality, and convenience in one comprehensive tool.

2. Project Flow Charts

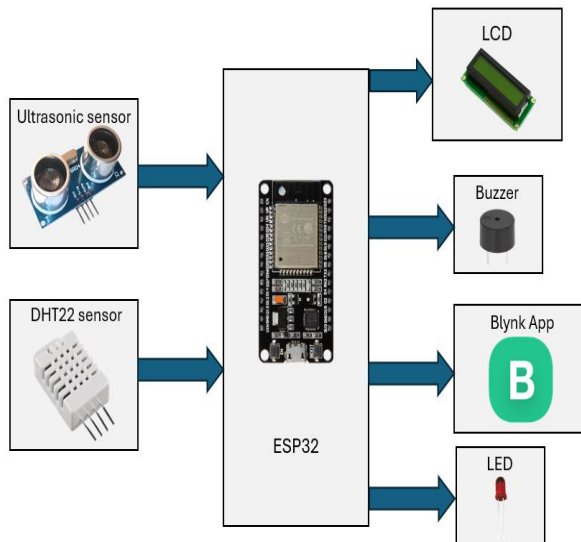


Figure 1a.

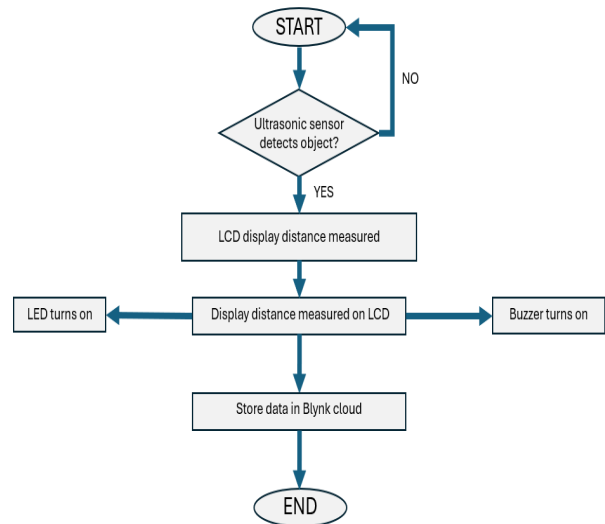


Figure 1b

Figure 1a and 1b. The block diagram and flow chart of the system

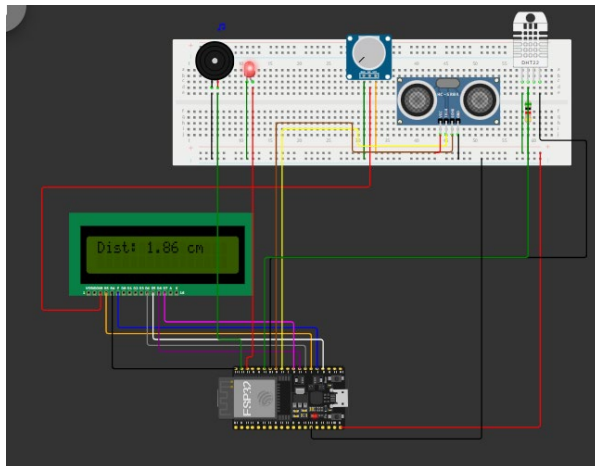


Figure 2a.

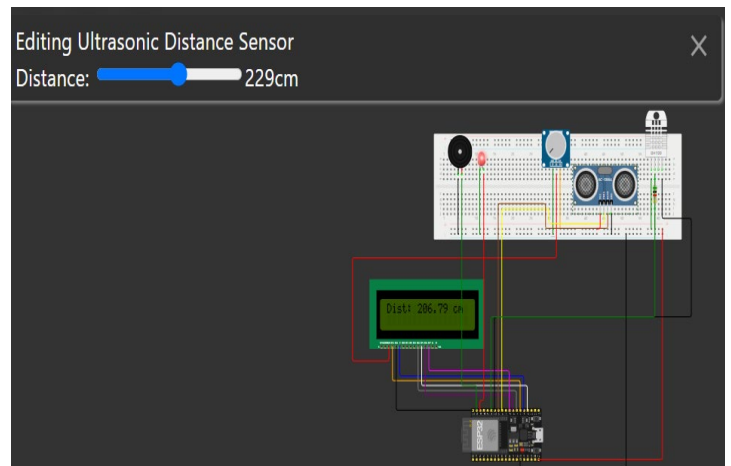


Figure 2b

Figure 2a and 2b. Simulation results showcases the adjustment made on the distance measured by the ultrasonic sensor.

3. Novelty and uniqueness

The automatic calibration on measuring tape introduces a transformative approach to distance measurement by integrating ultrasonic sensing with IoT technology. Unlike traditional tape measures, it achieves high precision through a time-to-distance conversion method, factoring in ambient temperature adjustments for enhanced accuracy. The system uniquely combines an ESP32 microcontroller with the DHT22 temperature sensor and ultrasonic sensor to provide real-time measurements, displayed on an LCD. The integration of the Blynk cloud for data storage ensures accessibility and usability beyond immediate measurement tasks. This project stands out for its dual emphasis on precise, multi-functional measurement capabilities and smart connectivity, addressing the limitations of traditional tools while incorporating innovative solutions for modern applications.

4. Benefit to mankind

This project enhances accuracy and efficiency in distance measurement, which is critical in fields such as construction, interior design, and manufacturing. By eliminating manual errors and offering functionalities like unit conversion and data storage, it streamlines workflows and reduces operational inefficiencies. The integration of IoT capabilities enables users to save and retrieve data effortlessly, fostering better record keeping and decision-making. Furthermore, the project's focus on user-friendliness and adaptability guarantees its utilization across diverse sectors, thereby enhancing productivity and precision in everyday applications.

5. Innovation and Entrepreneurial Impact

This project fosters a culture of innovation by merging engineering principles with modern technology to solve real-world problems. By leveraging IoT and sensor integration, it inspires new applications in measurement systems and encourages advancements in smart tools. It demonstrates to the academic and industrial community how accessible technology can lead to the development of innovative solutions. The project's potential scalability and versatility open avenues for entrepreneurial ventures, encouraging students and professionals to explore commercialization and adaptation to various industries.

6. Potential commercialization

Automatic calibration on measuring tape has significant commercialization potential due to its practical applications and user-centric design. Professionals in construction, interior design, and manufacturing can market it as a smart tool that provides an advantage over traditional tape measures. The added functionalities, such as data storage and unit conversion, make it an attractive choice for businesses seeking precision and efficiency. Its IoT connectivity aligns with the growing demand for smart tools, paving the way for partnerships with technology firms and hardware manufacturers. This project, due to its scalability and adaptability, has the potential to become a mainstream product.

7. Authors' Biography



Muhammad Farhan Hakimi Bin Mohd Radzi is a final-year student of the Diploma in Electrical Engineering (Electronic) at UiTM. He has excelled in numerous subjects, including Microprocessor Systems, Electronics, and Digital Systems. He plans to pursue his engineering degree in 2025.



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