



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

ORGANIZED BY:

Electrical Engineering Studies, College of Engineering
Universiti Teknologi MARA (UiTM) Cawangan Johor
Kampus Pasir Gudang
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A-ST076: SHADE GUARDIAN: ENHANCED CURTAIN AUTOMATION SYSTEM

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ABSTRACT

The Shade Guardian: Enhanced Curtain Automation System is a revolutionary smart home device that automates curtain movement while integrating advanced lighting, security, and information display features. The system utilizes a Light Dependent Resistor (LDR) to detect changes in ambient light, enabling automatic curtain adjustments to optimize natural lighting. It features an ESP32 microcontroller for wireless connectivity, allowing users to control curtains and receive notifications on their smartphones. Additional features include an LED lighting system that activates automatically in low-light conditions, a buzzer that functions as a wake-up alarm or alert for weather changes, and a Real-Time Clock (RTC) with an LCD display to provide real-time updates on the current time and weather conditions. Designed to improve energy efficiency, security, and convenience, this multi-functional system caters to households, offices, and hospitality spaces. Its unique combination of automation, smart control, and real-time information display distinguishes it from traditional curtain systems. The commercialization prospects are promising, with potential applications in smart homes, commercial buildings, and eldercare facilities. By addressing the growing demand for energy-efficient, multi-functional smart home devices, the Shade Guardian is poised to become a key player in the home automation market.

Keywords: Automatic Curtain, Wi-Fi module, Internet of Things (IoT), ESP32- based Sensor, RTC and Encoder.

1. Product Description

The Shade Guardian: Enhanced Curtain Automation System is a cutting-edge smart home appliance that offers smooth curtain automation along with built-in features for increased energy efficiency and convenience. In order to maximize natural lighting in a space, the system uses a Light Dependent Resistor (LDR) to sense changes in ambient light and automatically adjust curtains. Because of its wireless connectivity and ESP32 microcontroller, customers may operate the curtain and get alerts straight to their cell phones. Along with a buzzer that doubles as a multipurpose alarm to wake people or warn them of any security breaches, the system also has an LED lighting system that turns on automatically in low light. A Real-Time Clock (RTC) that allows precise time tracking is also included in the system. An integrated LCD panel shows the current time and the weather. Because of its extensive functionality, the Shade Guardian is a multipurpose, one-stop shop for modern homes, providing increased comfort and energy savings. The system combines real-time information display, lighting control, curtain automation, and alarm functions into a single, cohesive device that can handle a variety of household needs.

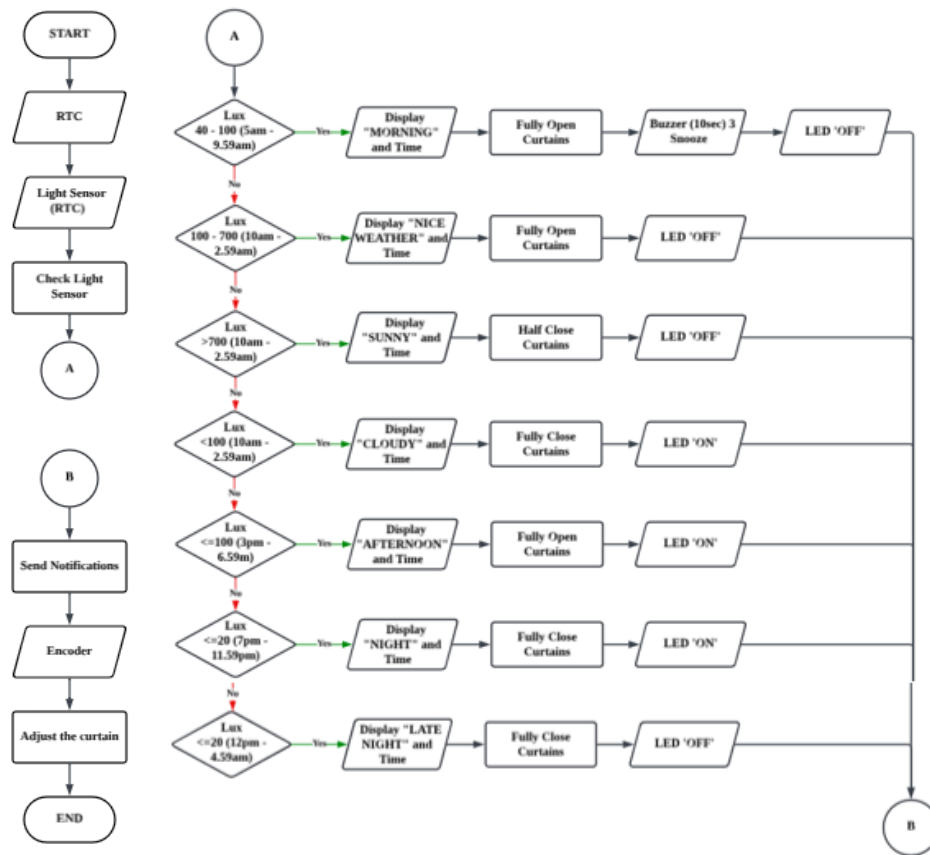


Figure 3. Flowchart of the Shade Guardian: Enhanced Curtain Automation System

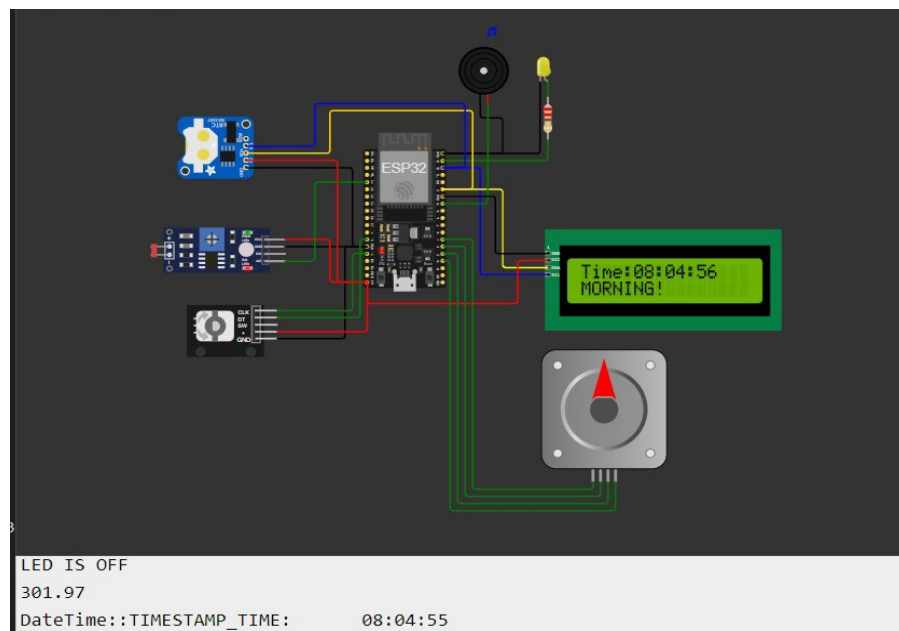


Figure 4. Simulation Result of the Shade Guardian: Enhanced Curtain Automation System

Table 1: Results of the Shade Guardian: Enhanced Curtain Automation System

<i>Real-Time Clock (RTC)</i>	<i>Light Sensor (lux)</i>	<i>Buzzer</i>	<i>LED</i>	<i>DC Motor (Curtain)</i>	<i>Display (LCD)</i>	<i>Notifications</i>
5.00am – 9.59am	40 – 100	ON	OFF	Fully Open	'MORNING' and Time	"MORNING!"
10am – 2.59pm	100 – 700	OFF	OFF	Fully Open	'NICE WEATHER' and Time	"NICE WEATHER!"
10am – 2.59pm	>700	OFF	OFF	Half Close	'SUNNY' and Time	"It's SUNNY Day"
10am – 2.59pm	<100	OFF	ON	Fully Close	'CLOUDY' and Time	"CLOUDY outside!"
3pm – 6pm	<=100	OFF	ON	Fully Close	'AFTERNOON' and Time	"Good AFTERNOON!"
7pm – 11pm	<=20	OFF	ON	Fully Close	'NIGHT' and Time	"Good NIGHT!"
12am – 4.59am	<=20	OFF	OFF	Fully Close	'LATE NIGHT' and Time	"You need to sleep, LATE NIGHT!"

3. Novelty and uniqueness

The Shade Guardian: Enhanced Curtain Automation solution introduces smart home automation by combining essential domestic chores into a single, integrated solution. At the core of this innovation is the ESP32 microcontroller, which acts as the central processing unit and synchronizes data from the encoder, Real-Time Clock (RTC), and Light Dependent Resistor (LDR). This allows real-time weather and time updates to be displayed on an LCD panel, precise curtain movement, and automated lighting management. Unlike conventional systems, Shade Guardian incorporates a Wi-Fi-enabled ESP32 for smartphone access, allowing users to control and monitor the system from a distance. The seamless integration of curtain automation, lighting, and information display into a single device is a significant departure from traditional methods. With the addition of a buzzer for multipurpose alarms and warnings, its versatility is further enhanced, making it ideal for usage in residential, commercial, and hospitality environments. This complete approach provides a full smart home experience, optimizes energy efficiency, and enhances user ease. By managing many home demands with a single intelligent device, Shade Guardian offers a degree of functional convergence that sets it apart from other smart curtain systems available on the market.

4. Benefit to mankind

Through encouraging energy efficiency, improving comfort, and supporting a healthier lifestyle, the Shade Guardian: Enhanced Curtain Automation System gives humanity advantages. By automatically altering curtains based on light levels, the technology

optimizes natural illumination, reducing the need for artificial lighting during the day and contributing to electricity conservation. In addition to promoting economic savings, this tackles the issue of excessive electricity waste caused by consumers forgetting to turn off lights. The buzzer serves as a working alarm to alert or wake users, and the LED lighting system ensures vision in low light. The Real-Time Clock (RTC), which displays accurate time information on an LCD, promotes better time management and awareness. By automating curtain movement and improving light diffusion, the device aids energy conservation efforts while fostering a comfortable living environment. In residential, commercial, and hospitality settings, this comprehensive approach improves daily routines, encourages sustainable energy use.

5. Innovation and Entrepreneurial Impact

The Shade Guardian: Enhanced Curtain Automation System drives innovation and entrepreneurship in communities, institutions, and industries. Combining automation, IoT, and energy efficiency, it advances smart home technology. Its all-in-one system integrates lighting, alarms, curtain control, and real-time information display, showcasing high functionality. This project fosters creative problem-solving and entrepreneurial skills like product design, prototyping, and business strategy. As a market-ready solution, it offers business opportunities through start-ups, licensing, and partnerships with smart home manufacturers, boosting local innovation and economic growth.

6. Potential commercialization

One innovative option for contemporary smart homes and businesses is the Shade Guardian: Enhanced Shade Automation System. The system's potential for commercialization is influenced by its unique features and operation, market demand, competitive advantage, and revenue potential. These sophisticated components include LCDs for time and weather display, DC motors for automatic curtain movement, LED lights, buzzers for alarms, ESP32 microcontroller for remote control and smartphone notifications, and Light Dependent Resistor (LDR) for light-based curtain adjustment. This multifunctional strategy appeals to energy-conscious customers, smart home enthusiasts, the elderly, and people with disabilities, in addition to finding applications in commercial sectors including hospitality and office space. The system's energy efficiency and all-in-one design provide it a competitive edge over conventional curtain systems. Shade Guardian is in a strong position to satisfy the expanding needs of the smart home industry thanks to its integration capabilities and scalable production utilizing current hardware components.

7. Acknowledgment

We would like to express our sincere thanks to everyone who has contributed to the successful development of Shade Guardian: The Enhanced Shade Automation System. First, we thank our supervisor for their valuable guidance and expertise, which significantly shaped this project. Furthermore, it has played an important role in ensuring that Shade Guardian can make a positive impact by promoting energy efficiency, comfort and convenience. We are very grateful for the collaboration and resources provided by various institutions and partners, whose contributions were essential for the research, prototyping and improvement phases.

8. Authors' Biography



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