RV College of Engineering, Bengaluru - 560059.

Smart Rain Shed Controller

IDEA LAB SEE Project - II SEM

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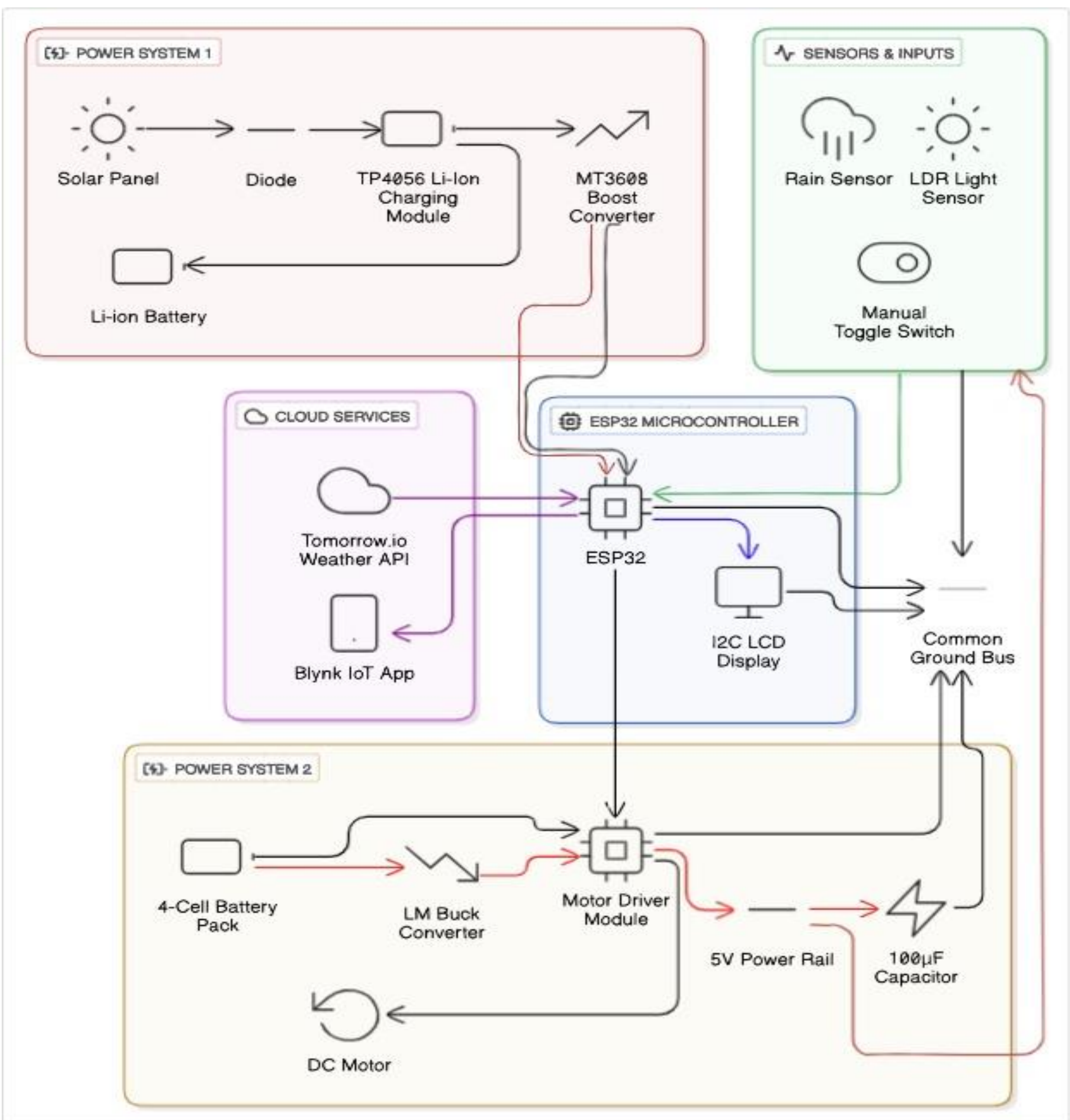
Introduction

In urban households, terraces are often used for drying clothes but remain exposed to sudden rain or low sunlight. This project introduces a smart, IoT-based shed system that automatically responds to rainfall, ambient light, and real-time weather data. Built using an ESP32, rain and LDR sensors, and Tomorrow.io API, it supports manual override, remote control via the Blynk app, and time-based automation. Powered by solar energy, the system is cost-effective, efficient, and ideal for residential use.

Objectives

- Automate shed movement based on rain and light detection
- Use real-time weather data via Tomorrow.io API
- Provide manual override through switch and Blynk app
- Log events and data to Google Sheets in real-time
- Ensure solar-powered, energy-efficient operation
- Implement time-based automation to limit operation to specific hour

Methodology



Empirical, Calculations, Tools & Techniques

Rain Intensity Mapping
Analog rain sensor values (0–4095) mapped to 0–100% scale for precise detection
Rain % = map(analogValue, 4095, 250, 0, 100)

Tools Used

Hardware: ESP32, L298N, Rain Sensor, LDR, LCD, DC Motor
Software: Arduino IDE, Blynk IoT App, Google Sheets, Tomorrow.io API

False Trigger Prevention: 5-second debounce + API cross-check

Real-time Data Logging: Auto-send to Google Sheets every 30 seconds

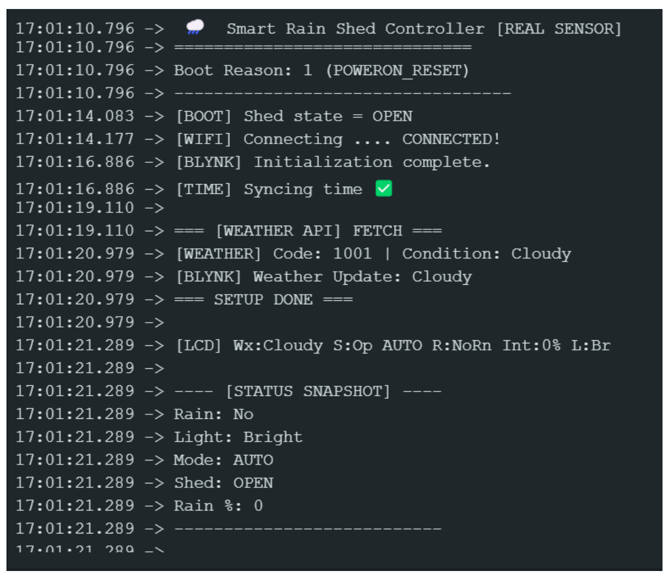
Fail-Safe Mode: Shed operable via button during Wi-Fi/app failure

Results & Discussions

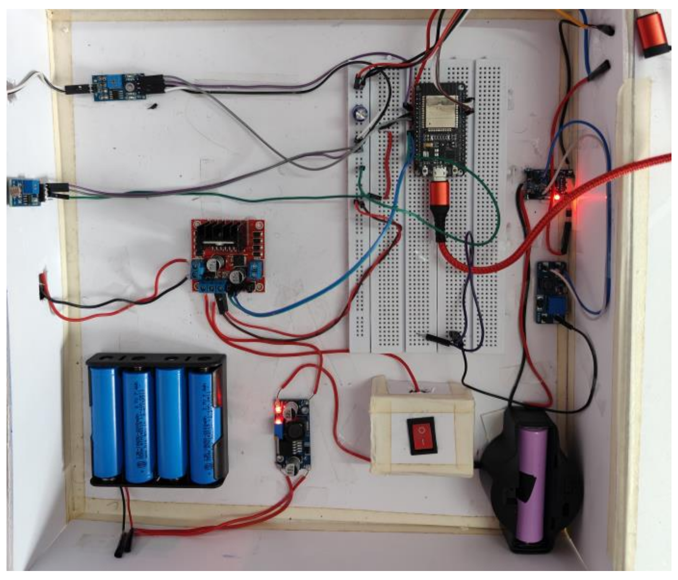
- The system accurately detected rain and light conditions, responding in real time
- Weather API integration improved reliability of shed control decisions
- Manual override via switch and Blynk app worked seamlessly
- Data logging to Google Sheets and live LCD updates were consistent
- The solar-powered setup ensured stable and energy-efficient operation.

Testing/Validation & Feedback

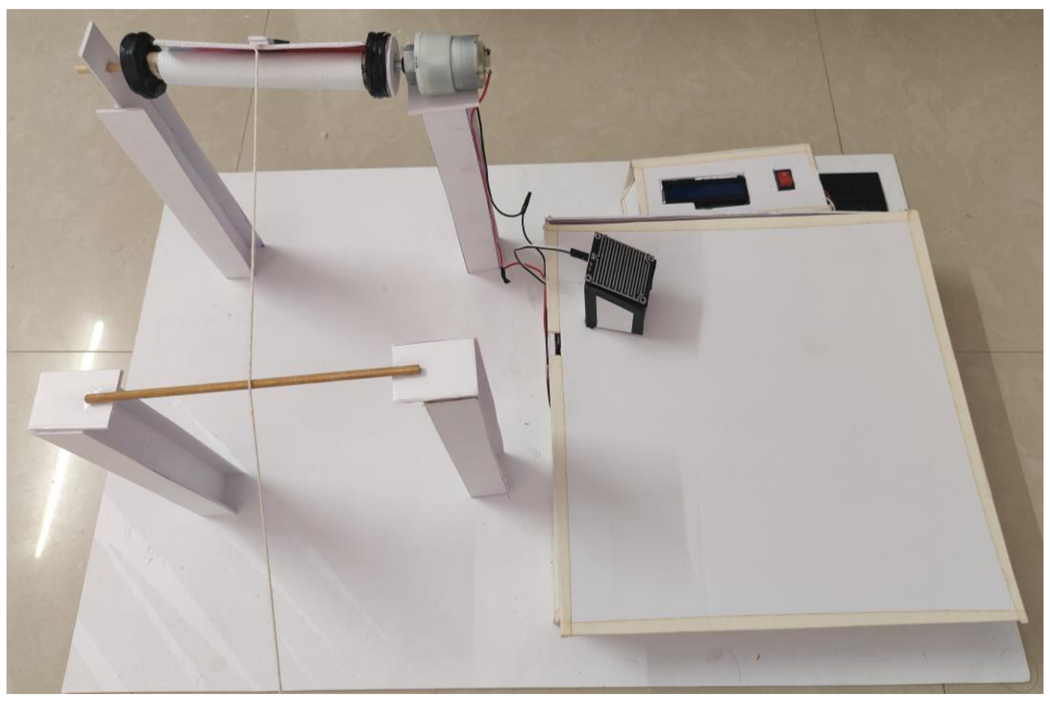
- System was tested under real rain and simulated weather conditions
- Sensor readings matched expected environmental changes accurately
- False trigger prevention logic (5s debounce + API check) worked effectively
- Manual and auto modes were validated by repeated open/close cycles
- Time-based automation validated using user-set hours in Blynk app
- Data logging to Google Sheets confirmed every 30 seconds with accurate records



```
17:01:10.796 ->  Smart Rain Shed Controller [REAL SENSOR]
17:01:10.796 -> ==============================
17:01:10.796 -> Boot Reason: 1 (POWERON_RESET)
17:01:10.796 -> ----------------------------------
17:01:14.083 -> [BOOT] Shed state = OPEN
17:01:14.177 -> [WIFI] Connecting .... CONNECTED!
17:01:16.886 -> [BLYNK] Initialization complete.
17:01:16.886 -> [TIME] Syncing time ✅
17:01:19.110 ->
17:01:19.110 -> === [WEATHER API] FETCH ===
17:01:20.979 -> [WEATHER] Code: 1001 | Condition: Cloudy
17:01:20.979 -> [BLYNK] Weather Update: Cloudy
17:01:20.979 -> === SETUP DONE ===
17:01:20.979 ->
17:01:21.289 -> [LCD] Wx:Cloudy S:Op AUTO R:NoRn Int:0% L:Br
17:01:21.289 ->
17:01:21.289 -> ---- [STATUS SNAPSHOT] ----
17:01:21.289 -> Rain: No
17:01:21.289 -> Light: Bright
17:01:21.289 -> Mode: AUTO
17:01:21.289 -> Shed: OPEN
17:01:21.289 -> Rain %: 0
17:01:21.289 -> ------------------------
```



Measurable Outcomes



References

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