



**Universitas Indonesia**  
**Proyek Akhir Internet of Things**

Aslab Pendamping:  
Evandita Wiratama

# ATLAS

**Anti-cheat Tracking &  
Location Attendance System**



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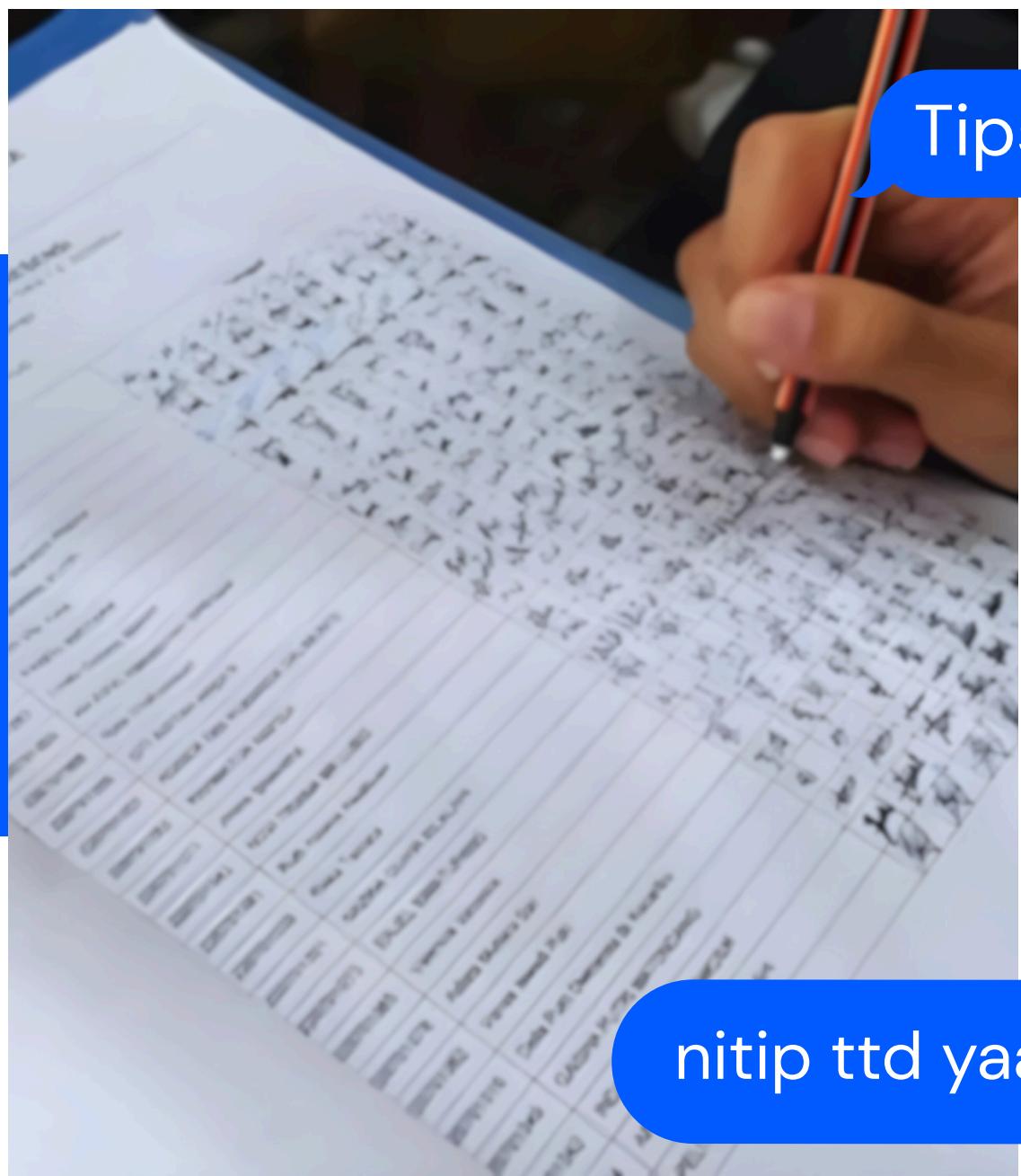
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Tipsen dong...

nitip ttd yaa hehe

### Solusi?

Diperlukan solusi yang menggabungkan beberapa lapisan verifikasi untuk menjamin kehadiran fisik mahasiswa di dalam ruang kelas.

# Problem Statement

Sistem presensi manual berbasis tanda tangan rentan terhadap titip absen, yaitu praktik menitipkan kehadiran oleh mahasiswa lain. Hal ini menimbulkan beberapa dampak negatif signifikan, yaitu:

1

**Ketidakakuratan Data**, Dosen tidak mendapat data kehadiran yang valid

2

**Lack of Fairness & Integritas**, Merusak semangat belajar dan kredibilitas sistem.

2

**Kelemahan Sistem Elektronik Lama**, Kartu RFID/ID masih dapat dipinjamkan.

# Proposed Solutions

## System Architecture

Client-server architecture dengan dua komponen:

- Client Node: Terminal presensi di ruang kelas
- Admin Node: Dashboard monitoring terpusat untuk dosen
- Communication: MQTT protocol over WiFi → Blynk Cloud Platform

## Dual-Layer Verification Mechanism

1

**Layer 1**, Physical Authentication, RFID untuk verifikasi identitas mahasiswa melalui penempelan kartu.

2

**Layer 2**, Digital Proximity Detection, BLE beacon scanning untuk memastikan kehadiran fisik mobile device mahasiswa secara simultan dengan RFID verification.

## Anti Cheat



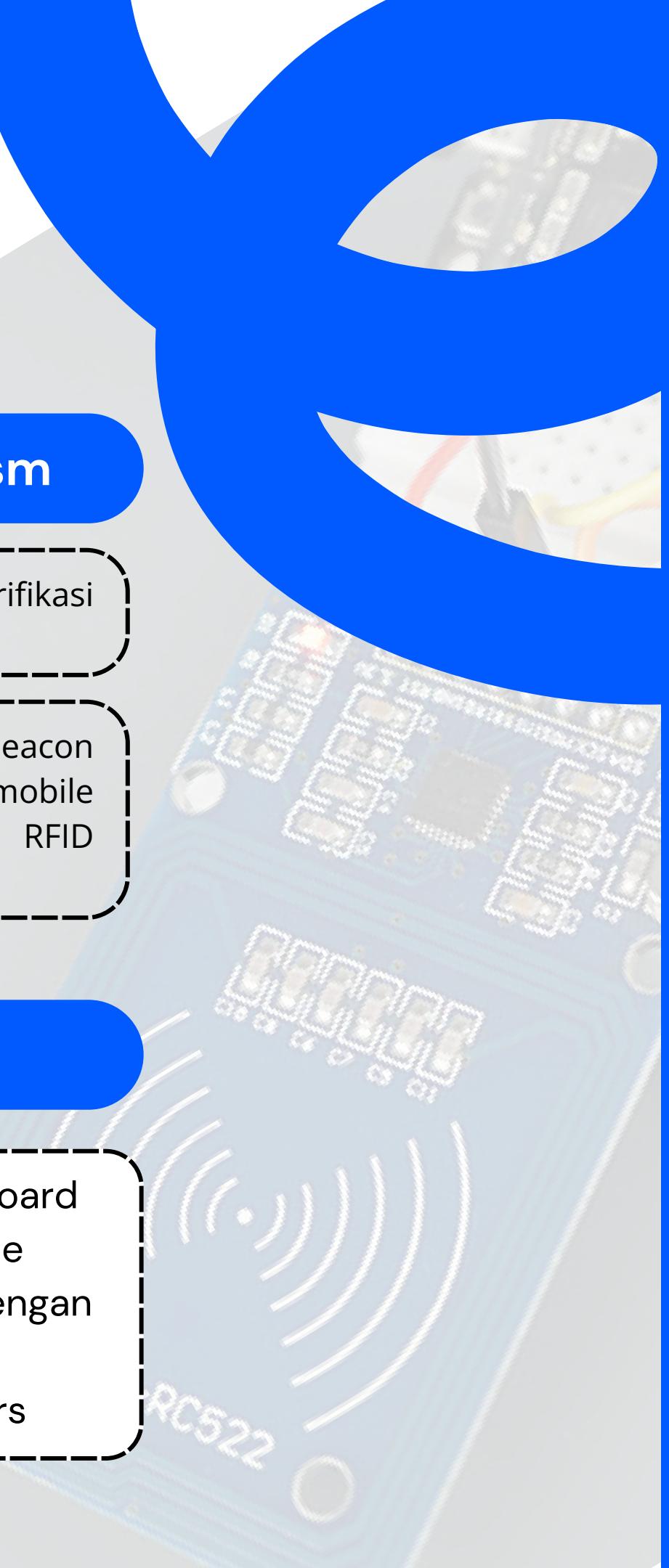
**Valid** Presensi diterima hanya jika RFID + BLE terdeteksi bersamaan



**Fraud Alert**, Reject presensi jika BLE tidak terdeteksi (mencegah card sharing)

## Key Features

- Real-time data transmission ke Blynk Dashboard
- Remote user registration dari admin interface
- Local database (RFID-to-BLE mapping) dengan opsi cloud expansion
- Visual feedback, LCD display + LED indicators

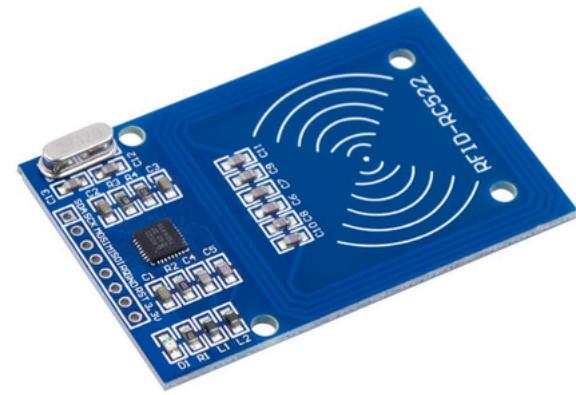


# Hardware Component



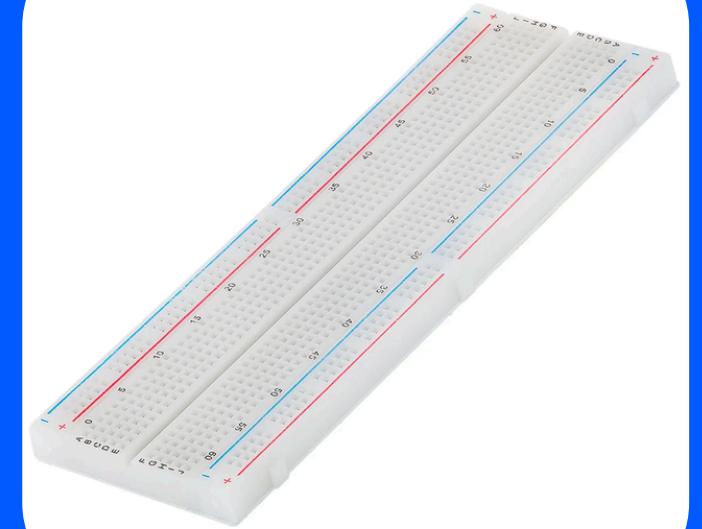
**ESP32 DevKit V1**

Memiliki module WiFi dan *Bluetooth Low Energy* (BLE).



**RFID Reader RC522**

Komunikasi melalui antarmuka SPI untuk membaca UID KTM.



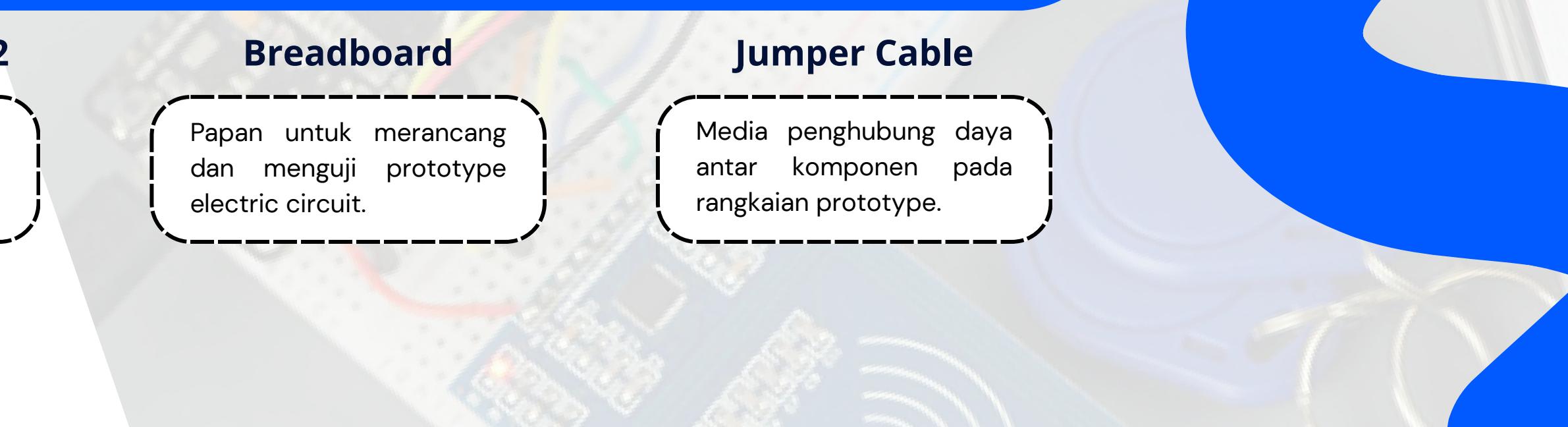
**Breadboard**

Papan untuk merancang dan menguji prototype electric circuit.



**Jumper Cable**

Media penghubung daya antar komponen pada rangkaian prototype.



## Implementation

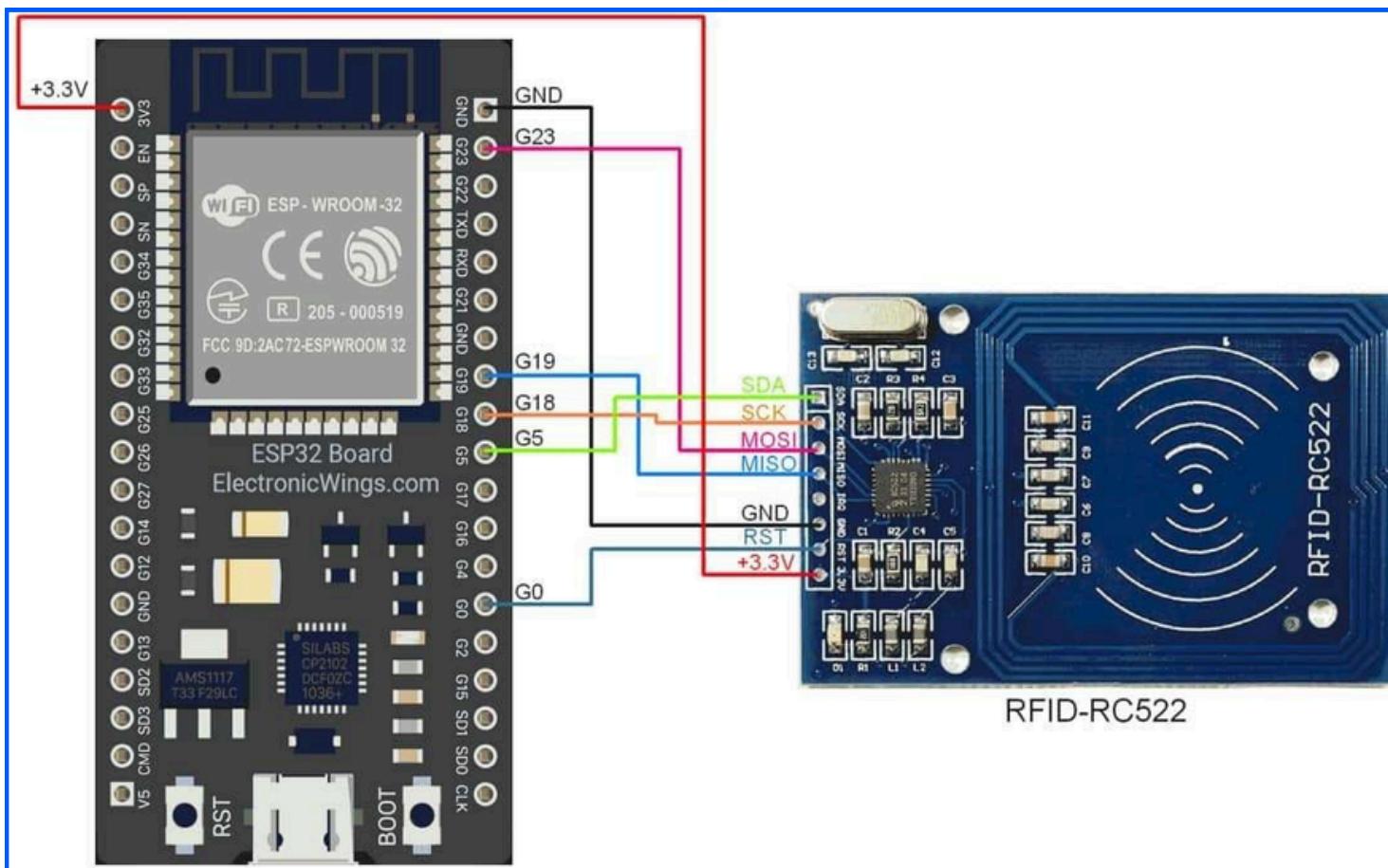
# Hardware Design

### Centralized Architecture

Menggunakan topologi Star untuk konektivitas optimal. Dan protokol MQTT via WiFi untuk transmisi data secara real-time, sehingga komunikasi latency rendah antar node.

### Client Node (Slave)

- **ESP32 DevKit V1** dengan WiFi & BLE terintegrasi.
- **RFID Reader RC522** via antarmuka SPI.
- Ditempatkan di pintu masuk kelas.



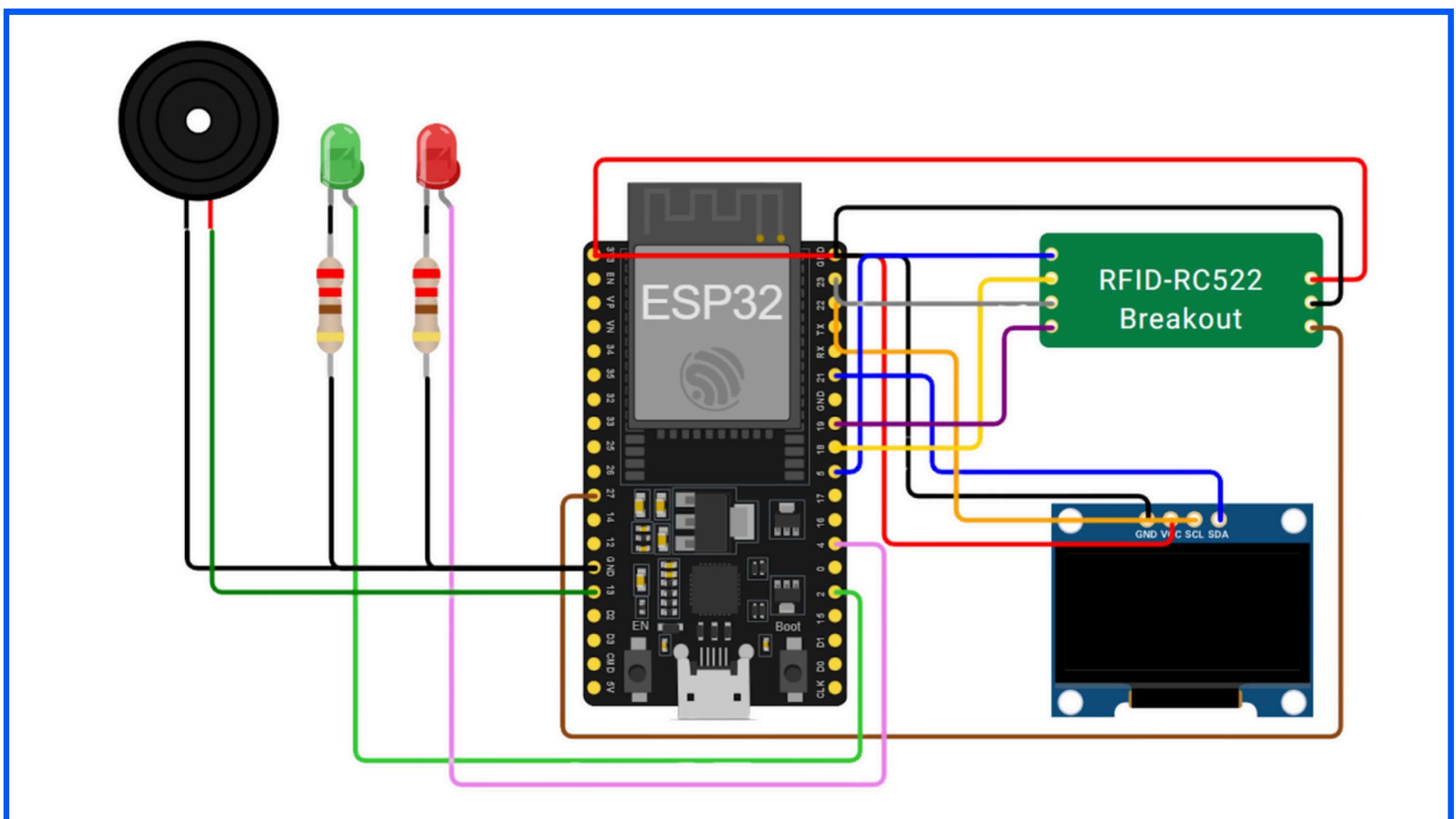
Rangkaian pada Client Node

### Admin Node (Master)

- **ESP32 DevKit V1** sebagai MQTT Subscriber.
- Gateway ke Platform IoT Blynk.
- Ditempatkan di meja dosen.

## Implementation

# Hardware Schematic



### Konfigurasi Pin ESP32 ke RFID-RC522

SCK

GPIO 18 Serial Clock

MOSI

GPIO 23 Master Out Slave In

MSIO

GPIO 19 Master In Slave Out

SS/SDA

GPIO 21 Chip Select

RST

GPIO 22 Reset

VCC

3.3V Sumber Daya

GND

GND Ground

# Software Development

## Library Utama

- **PubSubClient:** Protokol MQTT
- **MFRC522:** Pembaca RFID
- **Preferences:** Penyimpanan Lokal
- **NimBLE-Arduino:** Pemindaian BLE
- **BlynkSimpleEsp32:** Antarmuka Cloud
- **ArduinoJson:** Pemrosesan Data

## RTOS Architecture

### Slave Tasks

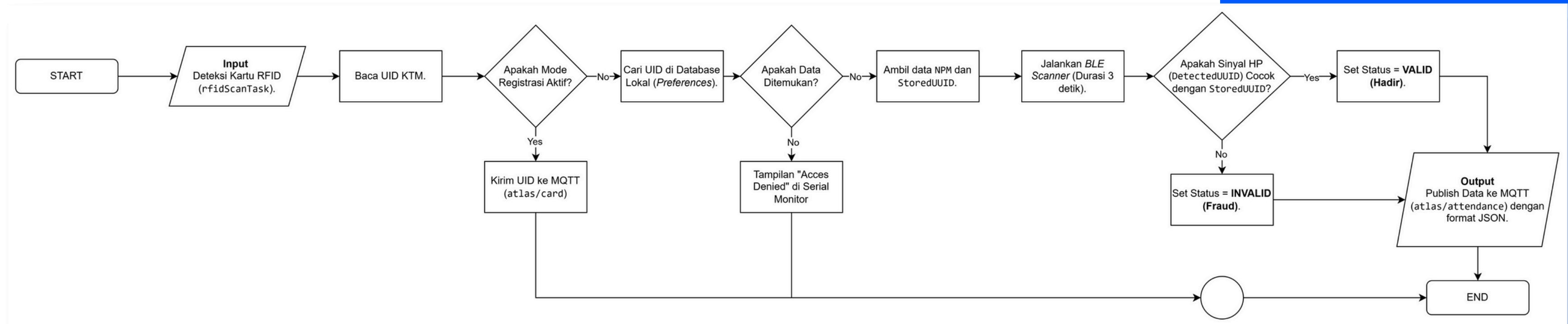
- **rfidScanTask (Core 0, Priority 2)**
  - Scan RFID reader
  - Push card data ke queue
- **validationProcessTask (Core 1, Priority 1)**
  - Process card queue
  - Handle register/validation mode
  - BLE scanning
  - ESP-NOW communication

### Master Tasks

- **blynkManagementTask (Core 0, Priority 2)**
  - Blynk.run()
  - Process attendance queue
  - Process registration queue
  - Update Blynk widgets
- **espnowReceiveTask (Core 1, Priority 1)**
  - Handle ESP-NOW callbacks
  - Lightweight monitoring task

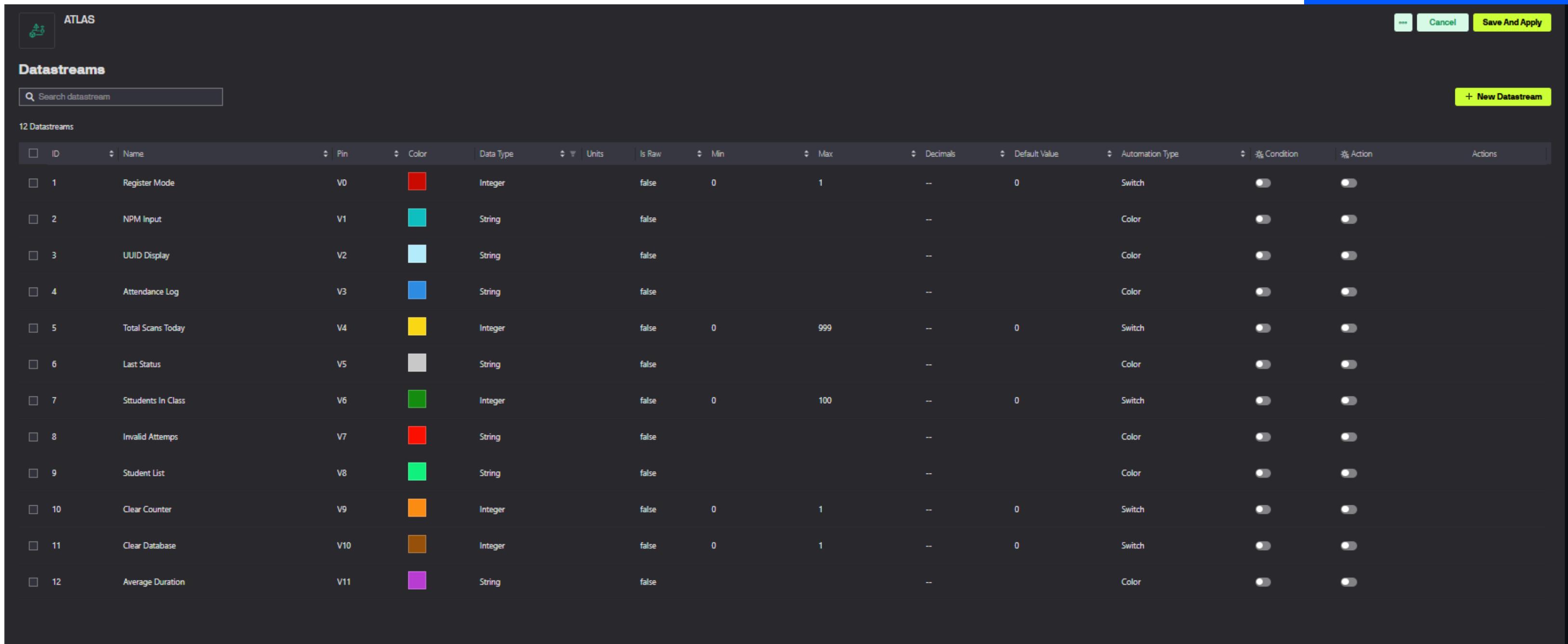
# Software Development

Flowchart Logika Dual-Factor pada Client Node



# Software Development

## Datastreams pada Blynk



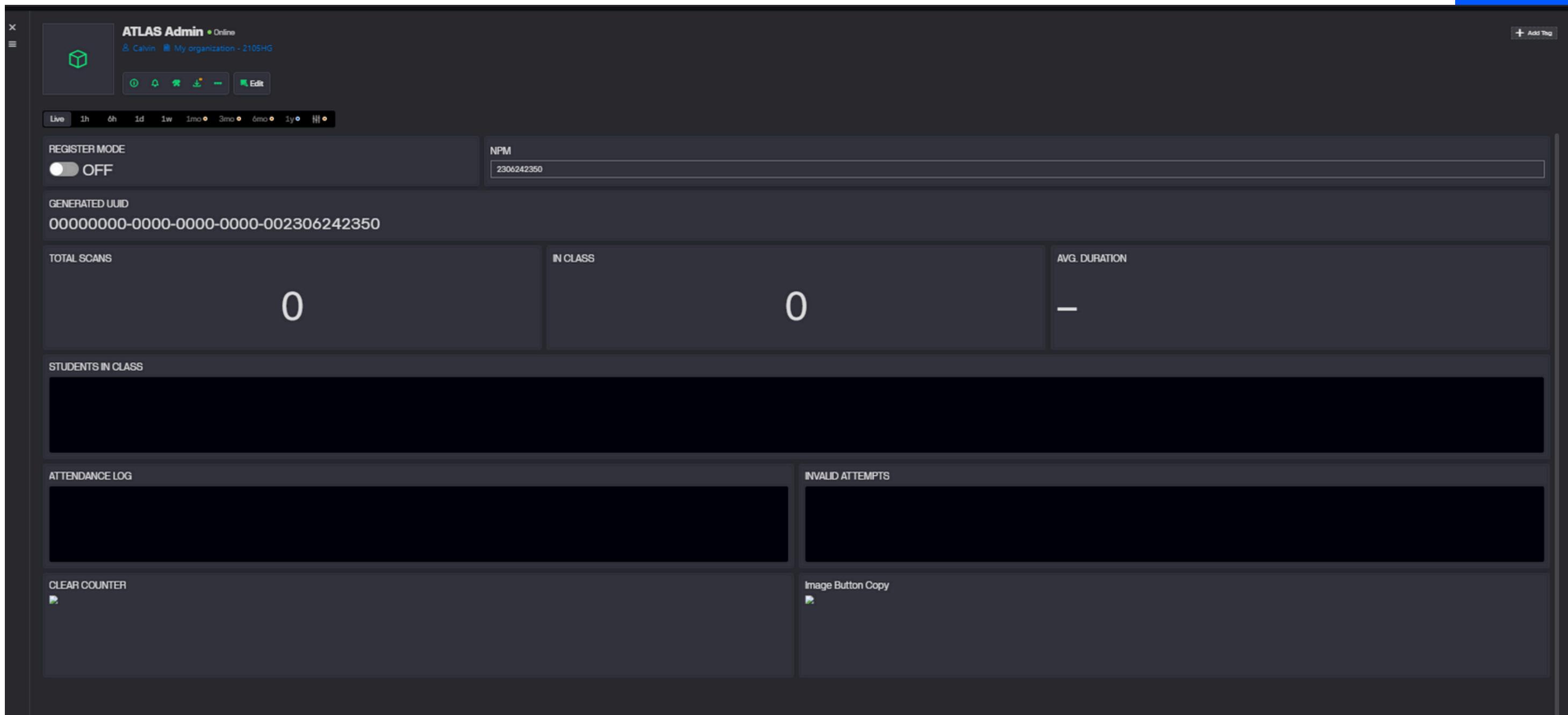
The screenshot shows the ATLAS Datastreams configuration interface. At the top, there is a header with the ATLAS logo, a search bar labeled "Search datastream", and buttons for "Cancel" and "Save And Apply". Below the header, the title "Datastreams" is displayed, followed by a subtitle "12 Datastreams". A search bar with the placeholder "+ New Datastream" is located on the right side of the title area. The main content is a table listing 12 datastreams, each with a checkbox, ID, name, pin, color, data type, and various configuration parameters like raw value, min, max, decimals, default value, automation type, condition, and action.

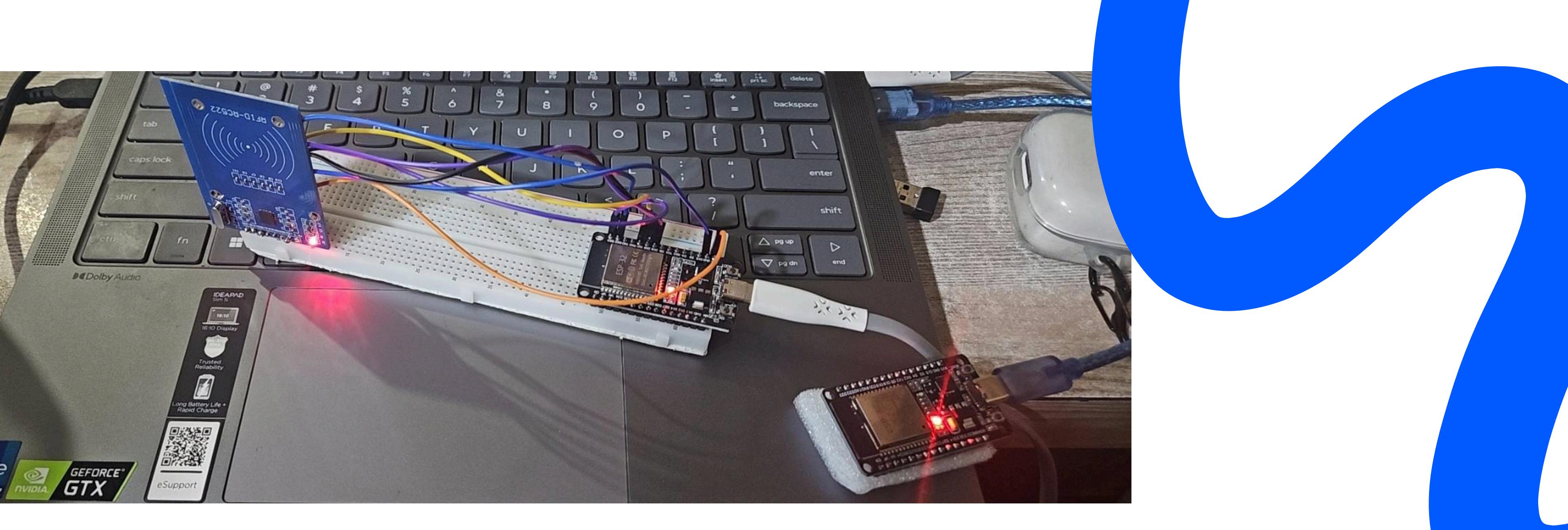
ID	Name	Pin	Color	Data Type	Is Raw	Min	Max	Decimals	Default Value	Automation Type	Condition	Action	Actions
1	Register Mode	V0	Red	Integer	false	0	1	--	0	Switch	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<a href="#">Edit</a>
2	NPM Input	V1	Cyan	String	false			--		Color	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<a href="#">Edit</a>
3	UUID Display	V2	Light Blue	String	false			--		Color	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<a href="#">Edit</a>
4	Attendance Log	V3	Blue	String	false			--		Color	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<a href="#">Edit</a>
5	Total Scans Today	V4	Yellow	Integer	false	0	999	--	0	Switch	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<a href="#">Edit</a>
6	Last Status	V5	Grey	String	false			--		Color	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<a href="#">Edit</a>
7	Students In Class	V6	Green	Integer	false	0	100	--	0	Switch	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<a href="#">Edit</a>
8	Invalid Attempts	V7	Red	String	false			--		Color	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<a href="#">Edit</a>
9	Student List	V8	Green	String	false			--		Color	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<a href="#">Edit</a>
10	Clear Counter	V9	Orange	Integer	false	0	1	--	0	Switch	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<a href="#">Edit</a>
11	Clear Database	V10	Brown	Integer	false	0	1	--	0	Switch	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<a href="#">Edit</a>
12	Average Duration	V11	Purple	String	false			--		Color	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<a href="#">Edit</a>

Implementation

# Software Development

Dashboard Admin pada Blynk





# Hardware & Software Integration

```
KARTU TERDETEKSI

UID: A1 B2 C3 D4

[VALIDATION] Checking database...
NPM: 2306242350
Stored UUID: 00000000-0000-0000-002306242350

[BLE] Scanning...
[BLE] Found: 00000000-0000-0000-002306242350, RSSI: -65

HASIL VALIDASI

Status: ✓✓✓ VALID ✓✓✓
RSSI : -65 dBm
✓ Kartu: OK
✓ BLE : OK
ABSENSI DITERIMA
```

# Testing & Result

## Konektivitas Awal

Menguji kecepatan koneksi ke WiFi dan Broker HiveMQ (< 5 detik).

## Remote Registration

Admin input NPM di Blynk -> Mahasiswa tap kartu → Data tersimpan otomatis di Client.

## Validasi Presensi

- Valid: Kartu + HP (Beacon Simulator Aktif) maka Sukses.
- Fraud: Kartu saja (HP mati/jauh) maka Access Denied.

```
[CARD] 04 6C 0D 9A 10 18 90
[BLE] Scanning 3s...
VALID #5 [MASUK] - 2025-12-08 23:02:14 | NPM: 2306242350 | RSSI: -58 dBm
```

```
[CARD] 04 6C 0D 9A 10 18 90
[BLE] Scanning 3s...
VALID #6 [KELUAR] - 2025-12-08 23:02:25 | NPM: 2306242350 | RSSI: -62 dBm
```

```
[CARD] 04 6C 0D 9A 10 18 90
[BLE] Scanning 3s...
INVALID - 2025-12-08 23:02:20 | BLE mismatch
```

# Testing & Evaluation

## Evaluation

- Dual Verification (RFID + BLE) berhasil membedakan presensi valid vs fraud, maka tujuan pencegahan titip absen tercapai
- FreeRTOS Task Management membuat BLE scanning & MQTT berjalan paralel tanpa blocking
- WiFi/MQTT berhasil mengirim data presensi & fraud alert ke Blynk secara real-time
- Remote Registration Control dari Admin Node berjalan sukses dan memvalidasi centralized architecture

### Limitasi sistem:

- Belum ada visual feedback (LCD/LED) di Client Node
- Database masih lokal (Preferences.h), belum scalable
- BLE range 2 meter berisiko false negative saat ada interferensi



# Conclusion

- ATLAS berhasil diimplementasikan sebagai IoT-based attendance system untuk mengatasi proxy attendance
- Dual-layer verification (RFID + BLE) dapat menjamin kehadiran fisik mahasiswa
- MQTT client-server architecture + FreeRTOS menghasilkan sistem yang stable, real-time, and reliable
- Sistem mampu melakukan validasi presensi otomatis + fraud alert

## Future development:

- Tambah visual feedback interface
- Migrasi ke centralized cloud database
- Perkuat security terhadap spoofing UUID





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# Thank You

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