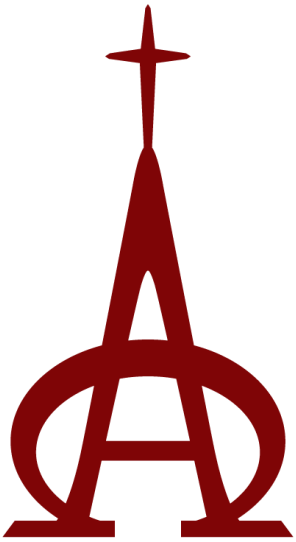
LAPORAN PROYEK AKHIR
ARSITEKTUR IOT
IEE3031



W.I.S.E (Wireless IoT Surgical Environment) Monitoring System

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INTERNET OF THINGS AND ELECTRICAL ENGINEERING
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DAFTAR ISI

DAFTAR GAMBAR

Daftar Tabel

1. Penjelasan Pelaksanaa Proyek Pribadi

1.1 Ringkasan Proyek

Judul Proyek: W.I.S.E (Wireless IoT Surgical Environment) Monitoring System

Penjelasan Singkat: Proyek ini bertujuan untuk mengawasi ruangan operasi secara real-time selama operasi berjalan. Sistem ini juga ada sistem verifikasi dan log pengguna ruangan melalui biometrics.

Sensor yang akan digunakan:

- Fingerprint Sensor FPM10A
- ESP8266
- DHT11
- M2Q Flying Fish gas sensor

Actuator yang akan digunakan:

- Buzzer
- Micro Servo SG90
- Push Button

Dashboard Pallete untuk NodeMCU:

- Dashboard: Pallete ini digunakan untuk membuat user interface pada simulasi node-red
- Random: Pallete ini digunakan untuk simulasi angka dan string random pada node-red
- Table: Pallete ini digunakan untuk membuat table untuk menunjukan database sql
- Pynodered function: Library ini digunakan untuk membuat function custom lewat python

IoT Commnication yang akan digunakan:

- MQTT
- WiFi

Cara Kerja:

Untuk dapat menggunakan ruangan operasi, User harus scan fingerprint dulu. Jika fingerprint matched dengan yang ada di database, Servo akan bergerak untuk unlock pintu ruang operasi. Data ID Pengguna, Posisinya dan Waktu User masuk akan disimpan di database. Riwayat ini dapat dilihat di UI.

Saat User terverifikasi, Sistem akan Mulai bekerja. Setiap detik, sensor DHT11 akan mengirim data humiditas ruangan dan temperatur ruangan ke MQTT Server dan Sensor gsa akan mengirim kualitas udara ke MQTT server juga. PC yang berada diluar ruangan akan melakukan proses Machine Learning untuk memberikan hasil jika ruangan tetap aman untuk dipakai. Jika tidak, Buzzer akan menyalah (bukan

di dalam ruangan operasi tetapi di Monitoring room) untuk memberi tahu bahwa hal ini harus dibenarkan secepatnya tanpa menggangu apapun yang sedang dilakukan dalam ruangan operasi.

1.1.1 Info Proyek

Nama Proyek	WISE (Wireless IoT Surgical Environment) Monitoring System
Target Penyelesaian	5 Mei 2024
Target Peran dalam Proyek	1. Memastikan ruangan operasi selalu dalam keadaan optimal
	2. Ada Riwayat dan verifikasi siapa saja yang menggunakan ruangan operasi, jam berapa dan posisinya apa.
	3. Memastikan tim monitoring mengetahui jika ada masalah dalam dengan ruang operasi.

Table 1: Info Proyek

1.1.2 Linimasa Proyek

Tanggal	Penjelasan
10 April 2024	Pembuatan Konsep Proyek
15 – 20 April 2024	Pembuatan Simulasi Proyek dengan Node-red
22 – 24 April 2024	Pembuatan EasyEDA
20 – 24 April 2024	Pembuatan FlowChart, Mindmap dan blok diagram
27 April – 3 Mei 2024	Pembuatan Rangkaian
27 April – 3 Mei 2024	Pembuatan Algoritma Sistem
2 Mei 2024	Pengujian Sistem
20 April – 4 Mei 2024	Pembuatan Laporan
5 Mei 2024	Finalisasi Proyek
8 Mei 2024	Pameran

Table 2: Linimasa Proyek

1.2 Mindmap

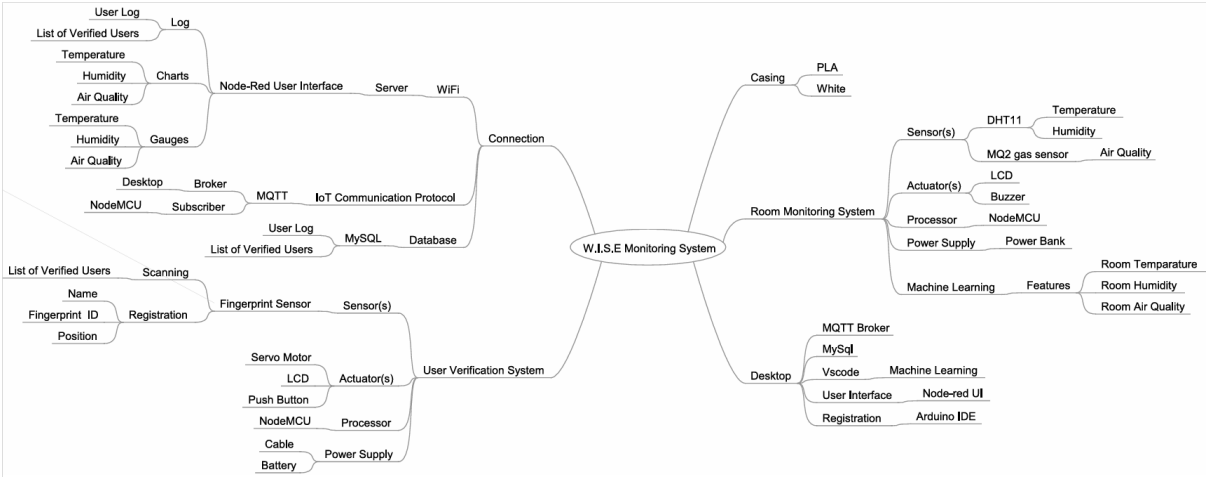


Figure 1: Mindmap

Penjelasan: Ini adalah mindmap dari WISE Monitoring System. Connection yang akan digunakan adalah MQTT, Node-red UI, MySQL Database. Casing akan dibuat dengan PLA dan akan berwarna putih. Sistem ini memiliki dua bagian besar yaitu Room Monitoring system dan User verification system.

1.3 Flow Chart

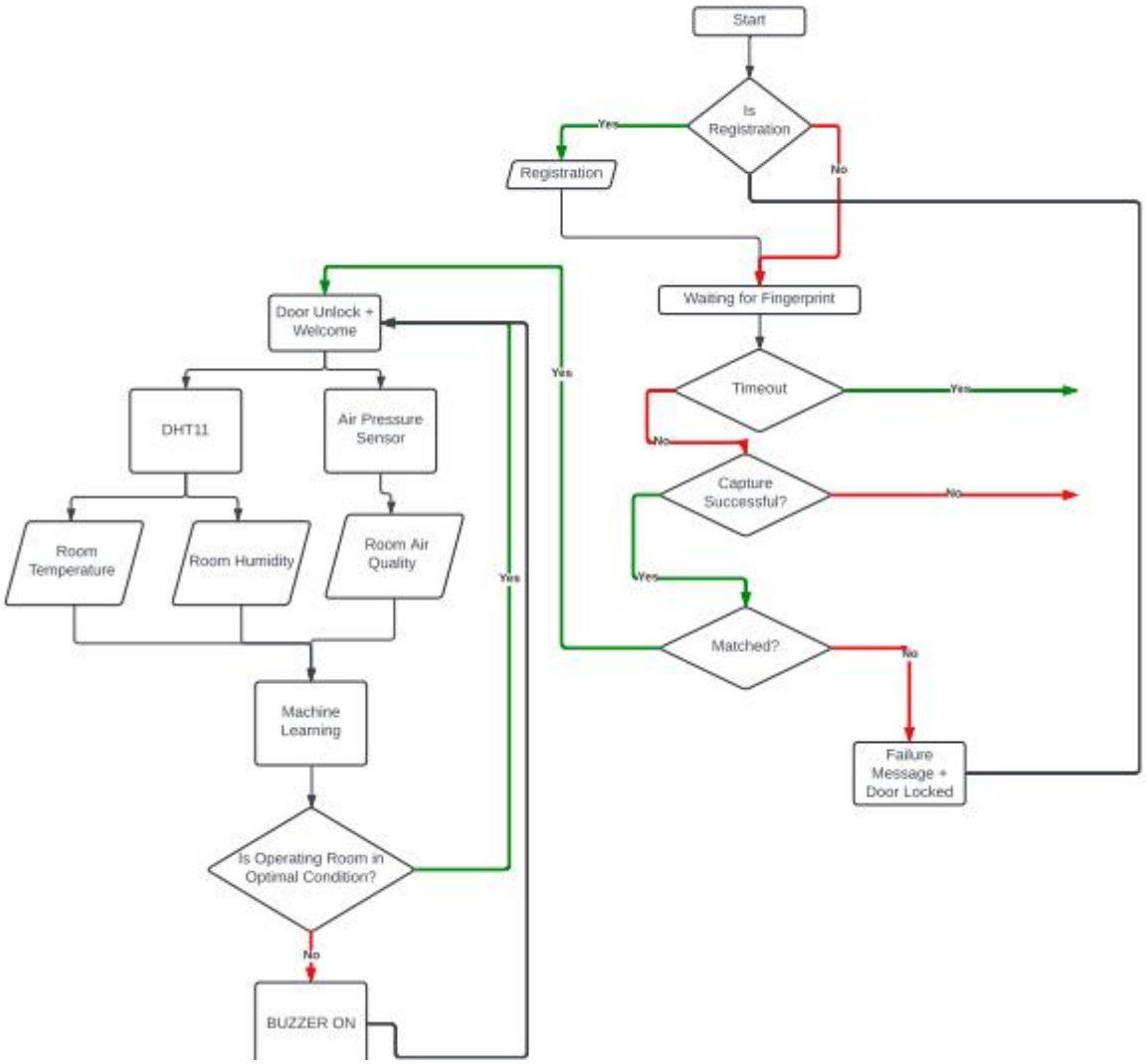


Figure 2: Flow chart

Penjelasan:

Sistem ini dimulai dengan bagian user verification. Jika dalam mode registration, fingerprint sensor akan registrasi fingerprint baru untuk database. Jika tidak dalam mode registration, fingerprint sensor akan menunggu jika ada fingerprint. Jika tidak, akan timeout. Jika iya akan melihat jika captire successful dan jika matching dengan fingerprint yang ada di database. Jika tidak, pintu akan tidak terbuka dan ulang ke start lagi. Jika iya, akan lanjut ke bagian room monitoring system. Sensor DHT11 dan M2Q akan terus mengukur suhu, humiditas dan kualitas udara ruangan operasi dan akan mengirim datanya ke machine learning. Model machine learning akan memastikan ruangan dalam kondisi yang optimal. Jika iya, akan kembali ke atas dan terus dicek setiap detik ruangannya. Jika tidak, buzzer akan menyalah untuk memberikan peringatan bagi tim monitoring untuk memperbaiki masalah secepatnya.

1.4 Komponen Proyek

1.4.1 Diagram Komponen

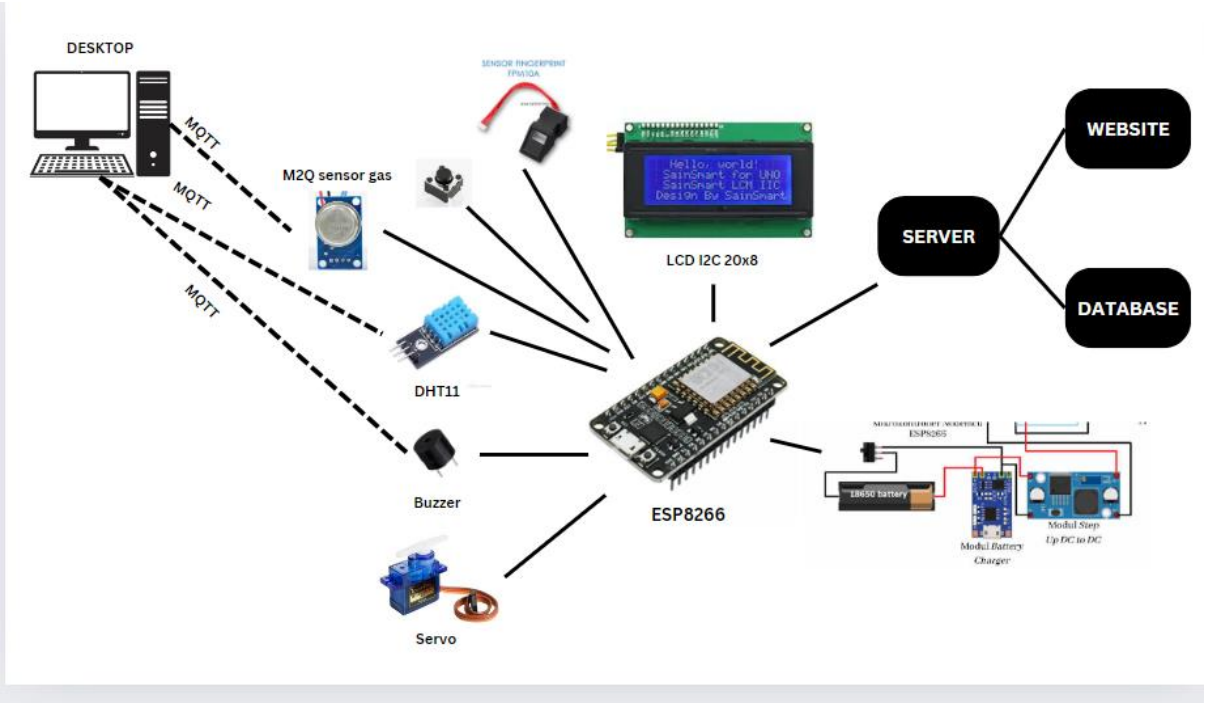


Figure 3: Diagram Komponen / Blok Diagram

Penjelasan:

NodeMCU akan terhubung dengan LCD dan fingerprint sensor yang akan mengirim data ke Server dan akan masuk ke database dan dapat dilihat lewat website. Servo juga terhubung dan akan bergerak Berdasarkan fingerprint. NodeMCU juga terhubung dengan DHT11 dan M2Q yang akan mengirim data dengan MQTT ke Desktop setiap detik. Desktop akan mengirim MQTT balik untuk mengalah buzzer atau tidak.

1.4.2 Diagram Komponen / Block Diagram

No.	Item	Rincian	Gambar
1.	NodeMCU ESP8266 V3 USB Type-C Lua Wifi Wemos Development Board - CH340C	https://www.tokopedia.com/rajacell/nodemcu-esp8266-v3-usb-type-c-lua-wifi-wemos-development-board-ch340c-3a869	
2.	Sensor gas M2Q Flying Fish - LPG BUTANE METHANE GAS SMOKE	https://www.tokopedia.com/cncstorebandung/cnc-mq-2-mq2-lpg-butane-methane-gas-smoke-sensor-module-for-arduino?extParam=ivf%3Dfalse%26src%3Dsearch	
3.	FPM10 Fingerprint Sensor Module	https://www.tokopedia.com/rajacell/r307-finger-print-fingerprint-sensor-module-sensor-sidik-jari-arduino	
4.	LCD 16x2 I2C	https://www.tokopedia.com/kyware/lcd-16x2-i2c-module-blue-green-layar-arduino-1602-biru-hijau-16x02-biru-10b4b?extParam=ivf%3Dfalse%26src%3Dsearch&refined=true	
5.	DHT11	https://www.tokopedia.com/cncstorebandung/module-dht11-dht-11-dht-11-sensor-suhu-dan-kelembaban-humidity-sensor?extParam=ivf%3Dfalse&src=topads	
6.	MOTOR SERVO SG90	https://www.tokopedia.com/ardushopid/motor-servo-sg90-arduino?extParam=ivf%3Dfalse%26src%3Dsearch&refined=true	
7.	Buzzer Module	https://www.tokopedia.com/starlectric/passive-buzzer-module-5v-pasif-module	
8.	Kabel Jumper	-	
9.	Power Bank	-	

Table 3: Tabel Komponen

2. NODE-RED

2.1 Node-red overview

Sebuah simulasi akan dijalankan dengan Node-red. Angka temperatur, humiditas dan kualitas udara akan dipilih secara random. Fingerprint binary code juga akan dipilih secara random.

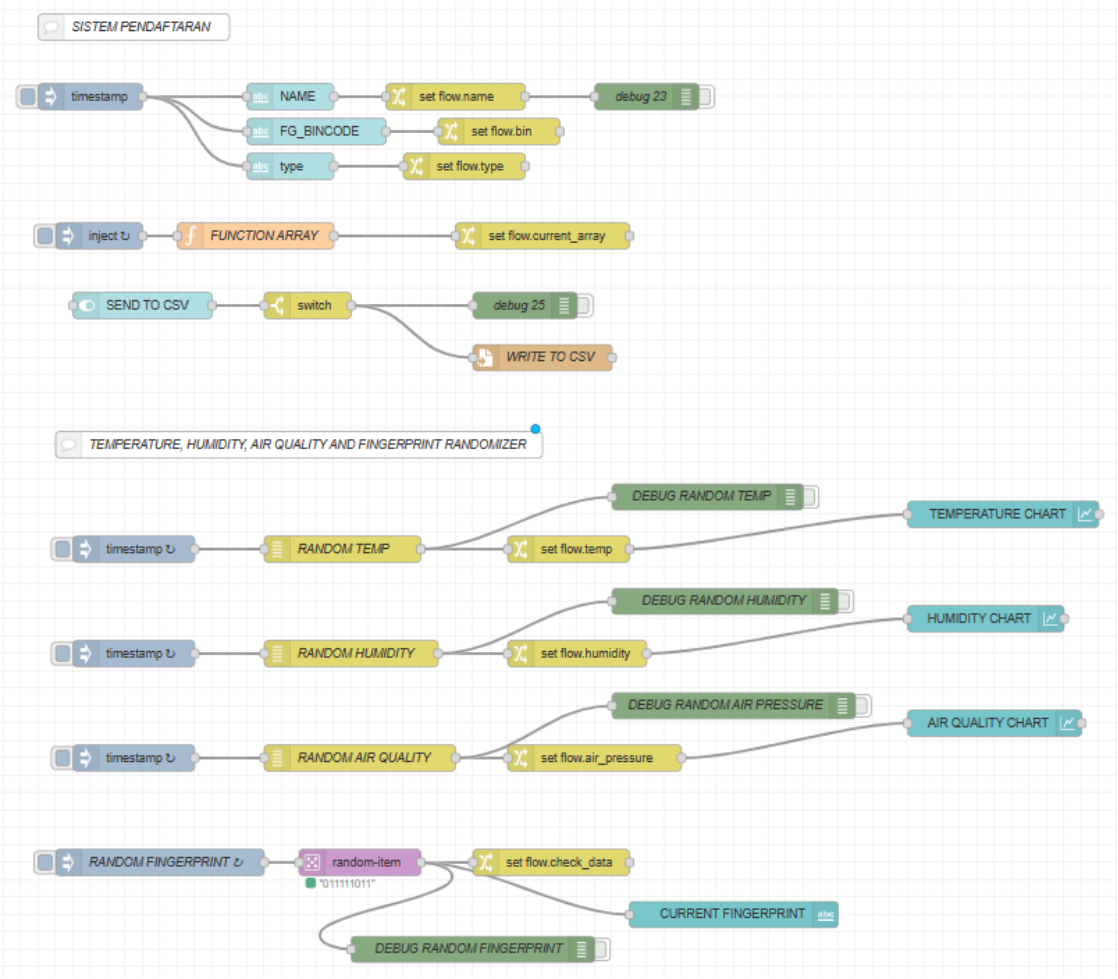


Figure 4: Full Node-red (1)

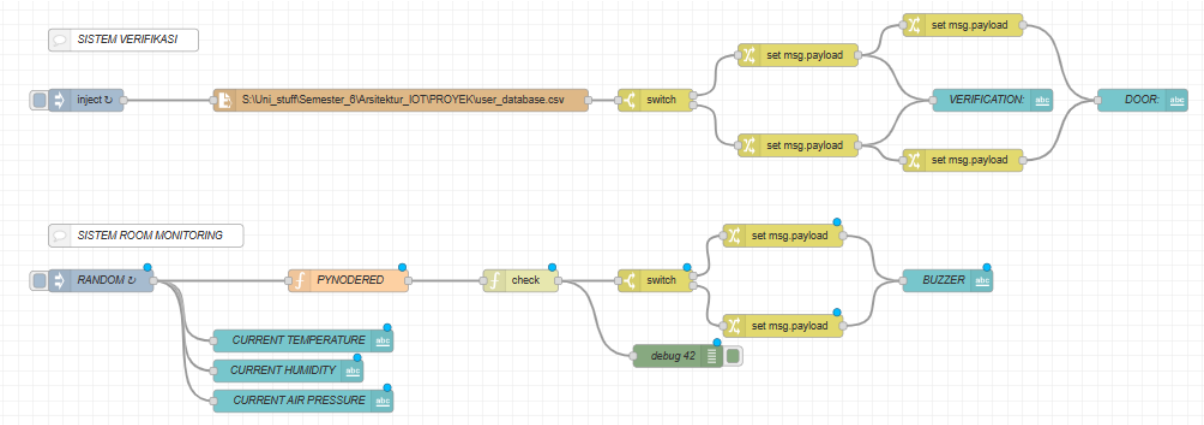


Figure 5: Full Node-red (2)

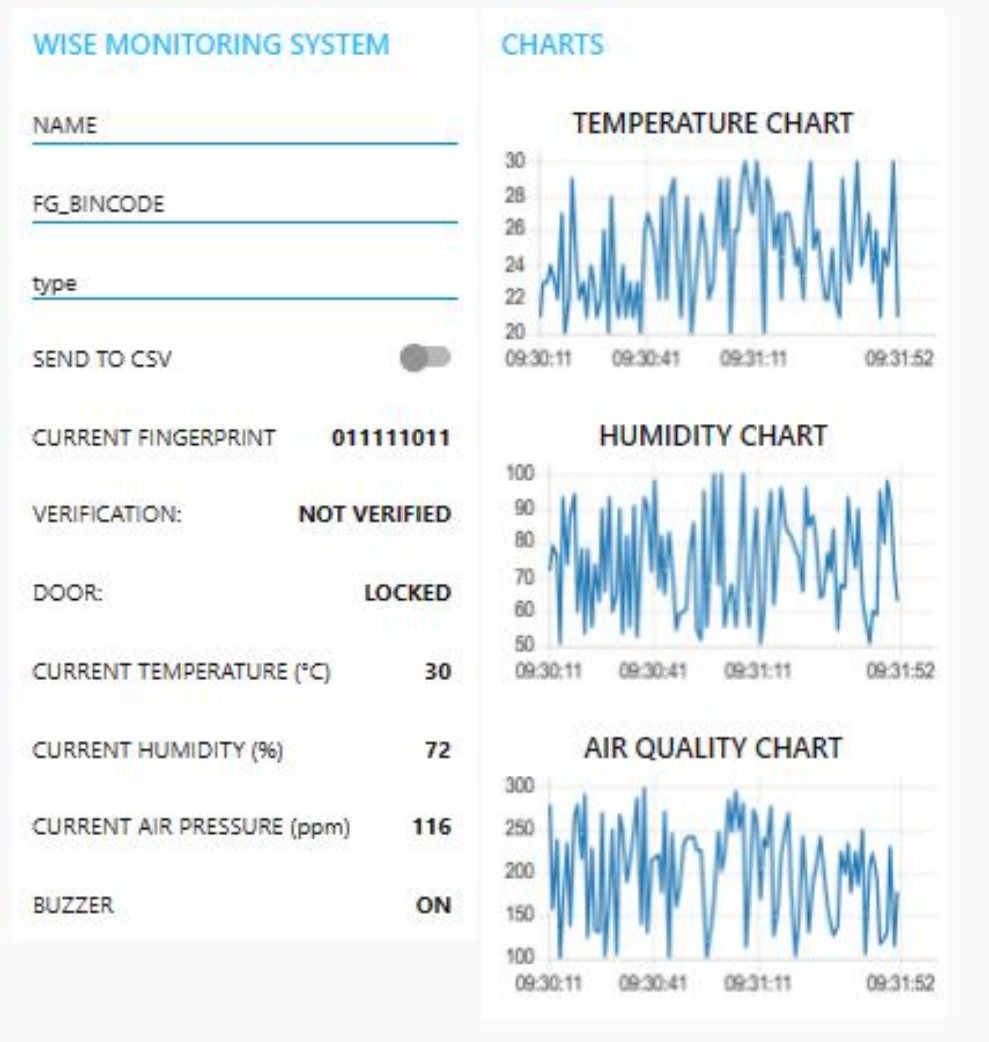


Figure 6: Node-red dashboard

2.2 Penjelasan Node-red

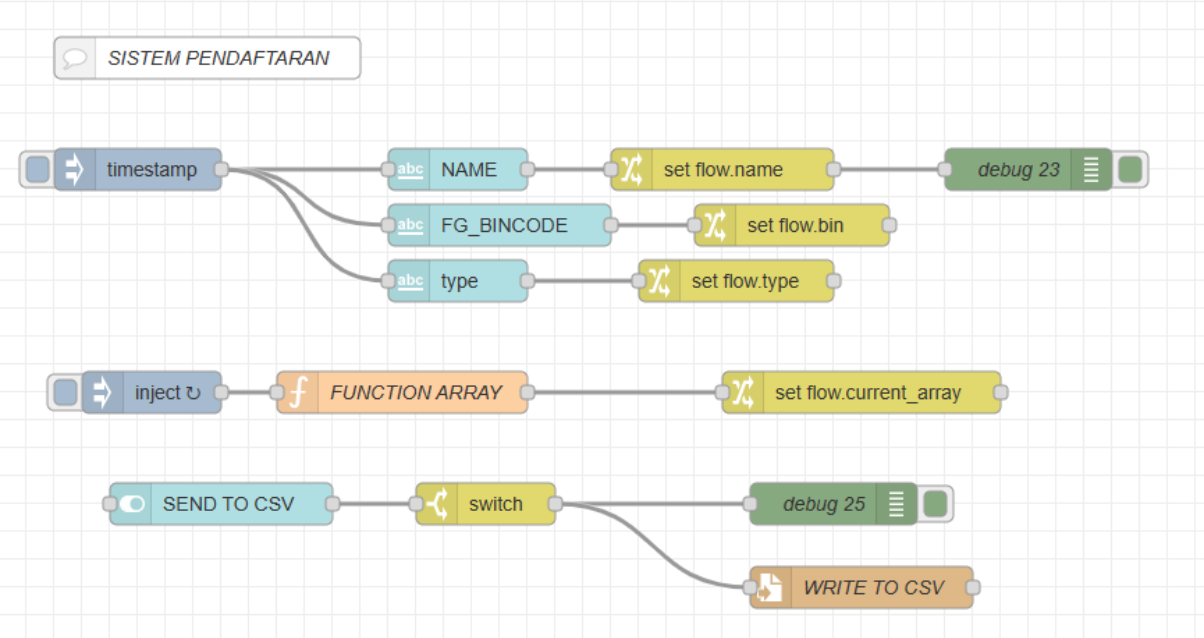


Figure 7: Simulasi sistem pendaftaran

Penjelasan: Akan ada insert nama, fingerprint binary code dan tipe di UI node-red. Semua ini akan disimpan di context dan diubah menjadi array oleh node function dan akan disimpan lagi di context yang mengabungkan semuanya ke dalam array. jika sebuah button dipencet, data ini akan disimpan di sebuah csv file.

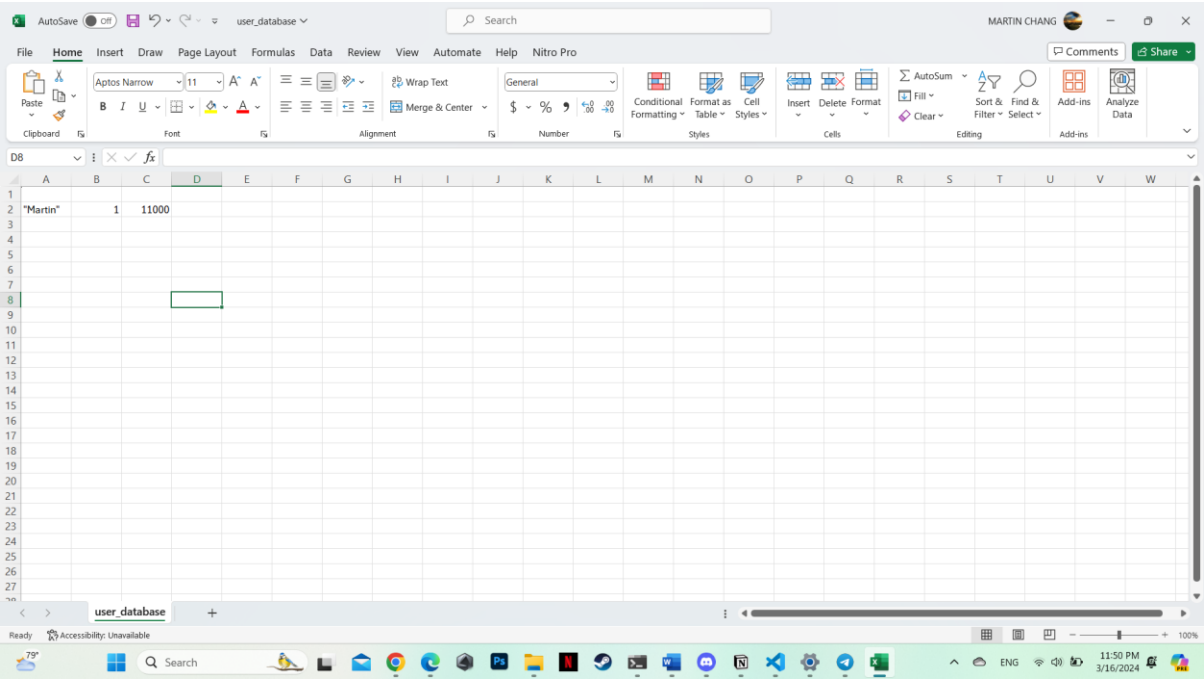


Figure 8: CSV File sekarang

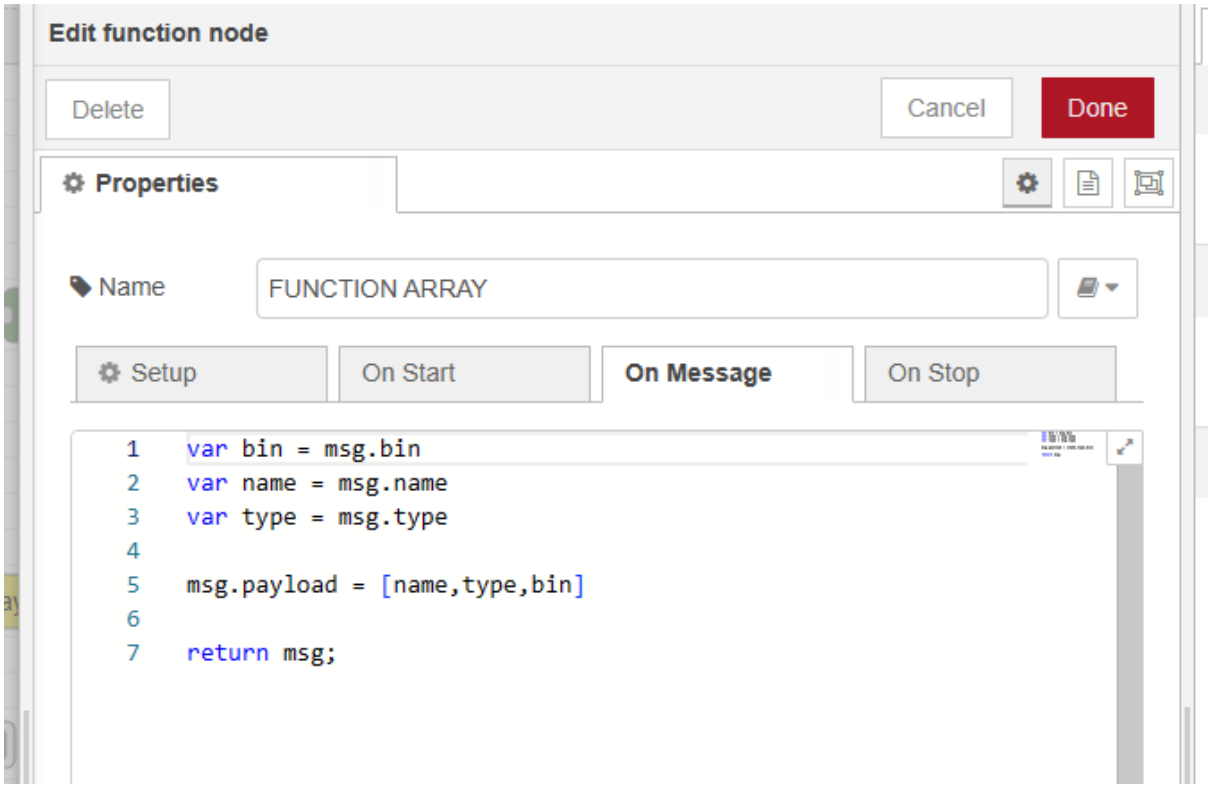


Figure 9: Function Array code

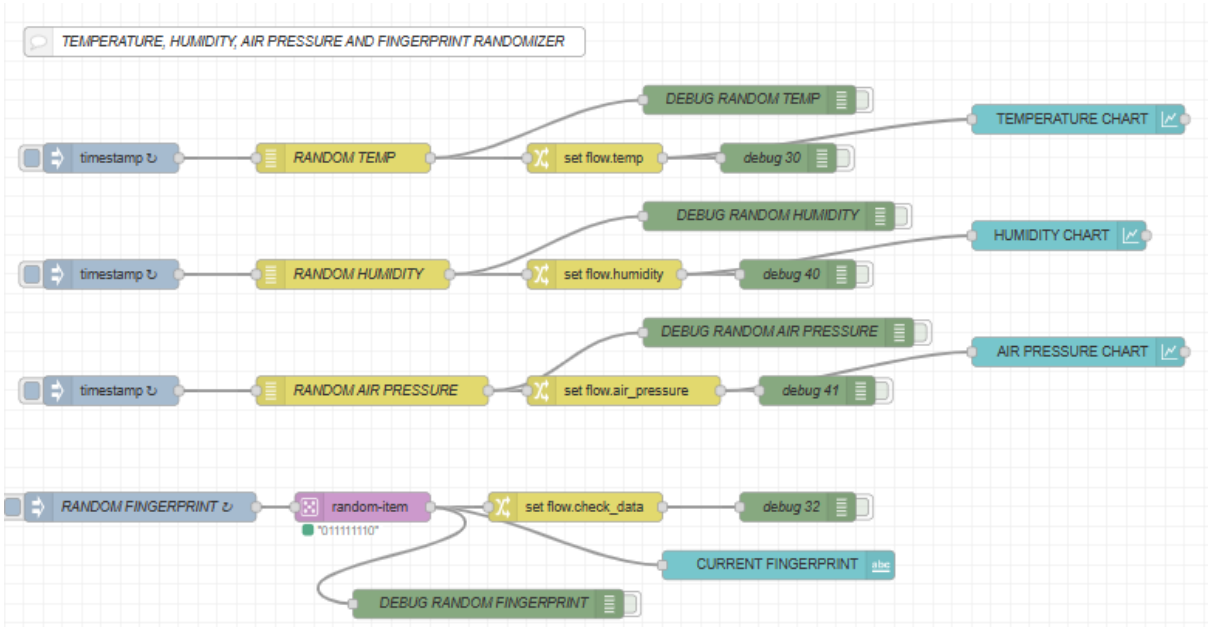


Figure 10: Node-red random data

Node-red ini akan membuat random temperature, humidity, air pressure dalam context yang akan digunakan untuk uji coba. Ini akan berjalan setiap detik.

Random fingerprint yang diinject:
["00011000","0011010","11011010","011111010","111111010","011111011","011111110","011111011"]

Random Temperature yang di inject: 20- 30 °C

Random humidity yang di inject: 50 – 100 %

Random Air quality yang di inject: 100 – 300 ppm

Figure 11: Machine Learning Accuracy

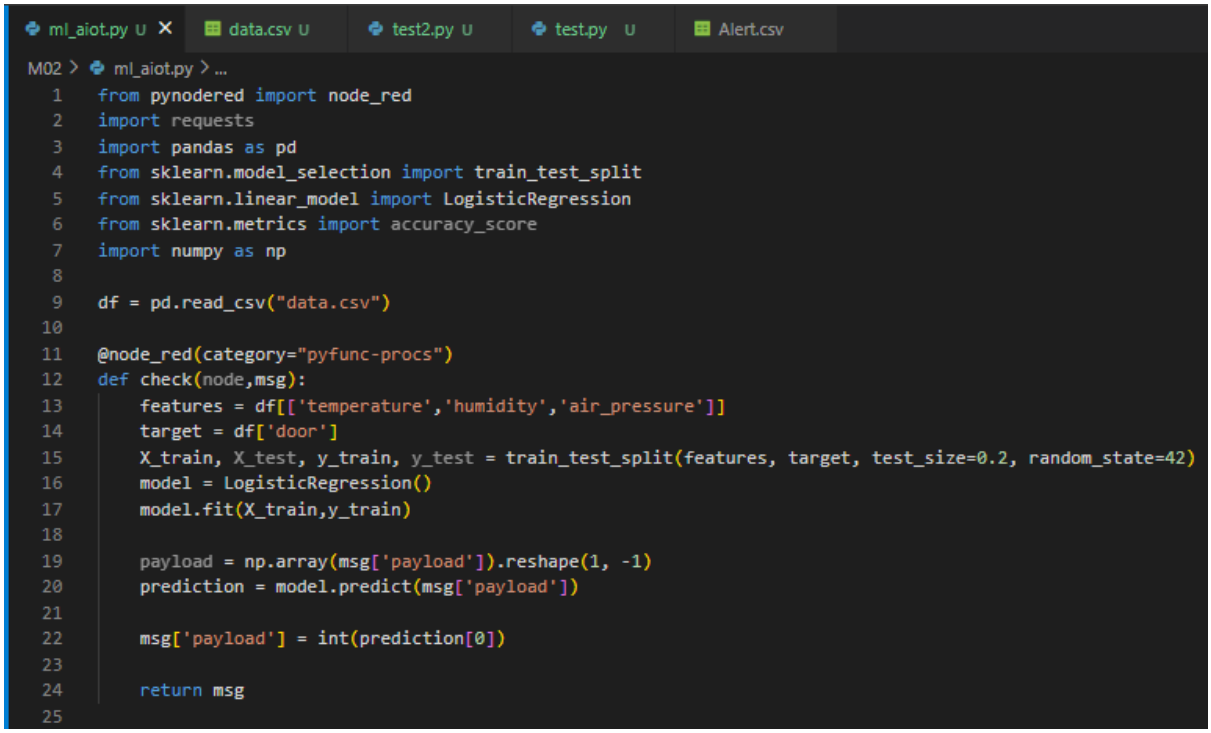


Figure 12: Machine Learning code

Penjelasan Machine Learning: Machine Learning menggunakan Logistic regression dengan data.csv untuk menentukan jika kondisi ruangan operasi masih optimal.

BAGIAN VERIFICATION

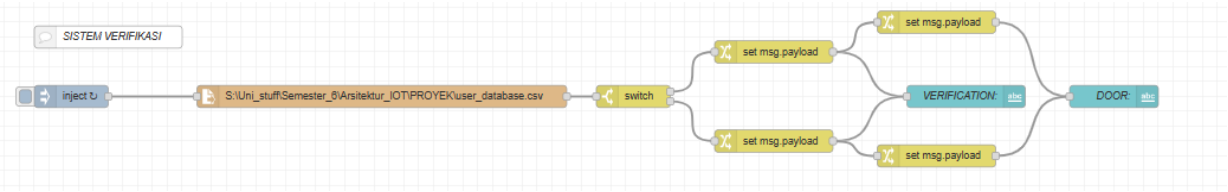


Figure 13: Node-red verifikasi

Akan dicek dengan database jika random fingerprint matching. Jika matching, door/servo akan terbuka dan user akan diverifikasikan. Jika tidak door/servo akan tutup dan user tidak verified.

BAGIAN MONITORING

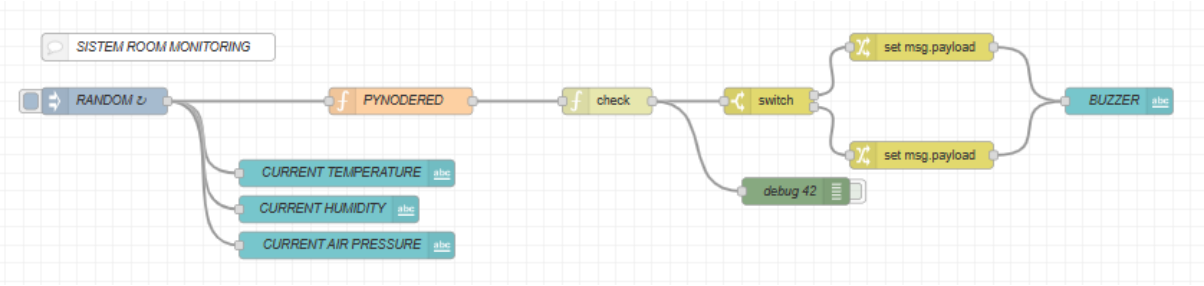


Figure 14: Node-red Monitoring

Di bagian room monitoring, akan digabungkan temperature, humidity dan air quality dalam satu array dengan menggunakan function terus akan dicek oleh fungsi pynodered dan dari itu akan diputuskan jika buzzer ON atau OFF.

2.3 Node-red Debug

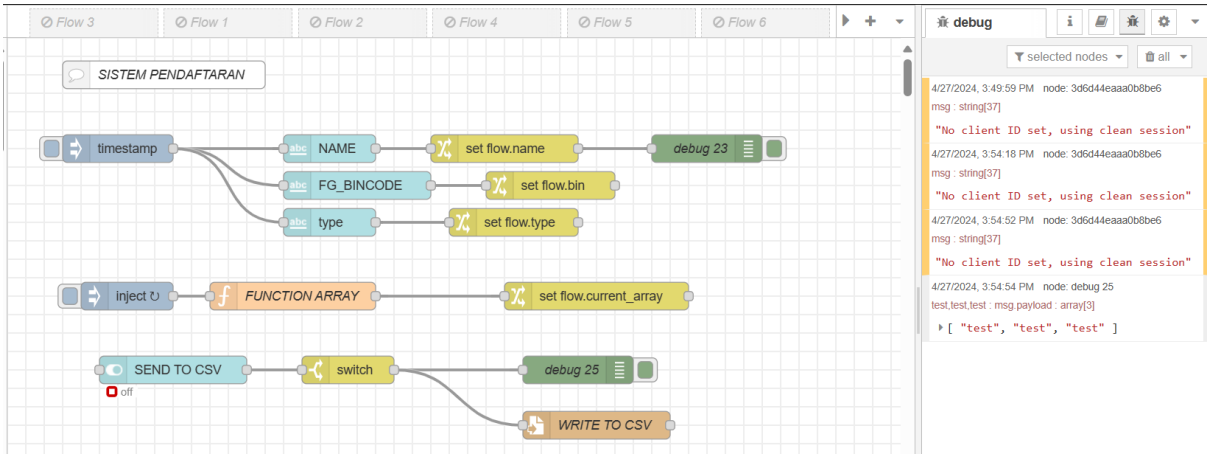


Figure 15: Debug sistem pendaftaran

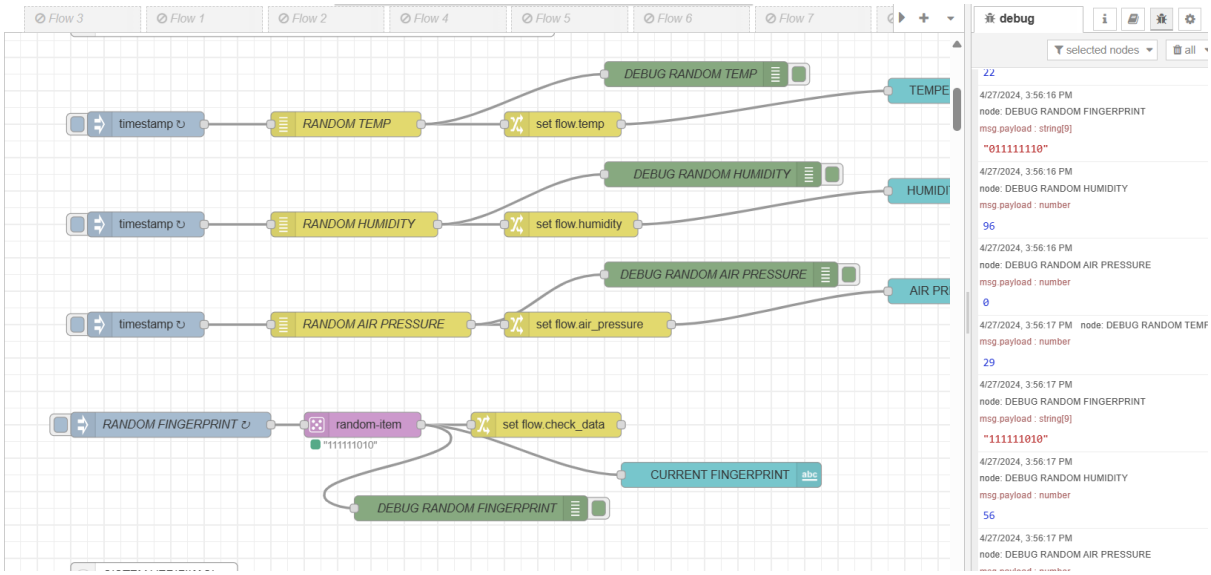


Figure 16: Debug Random

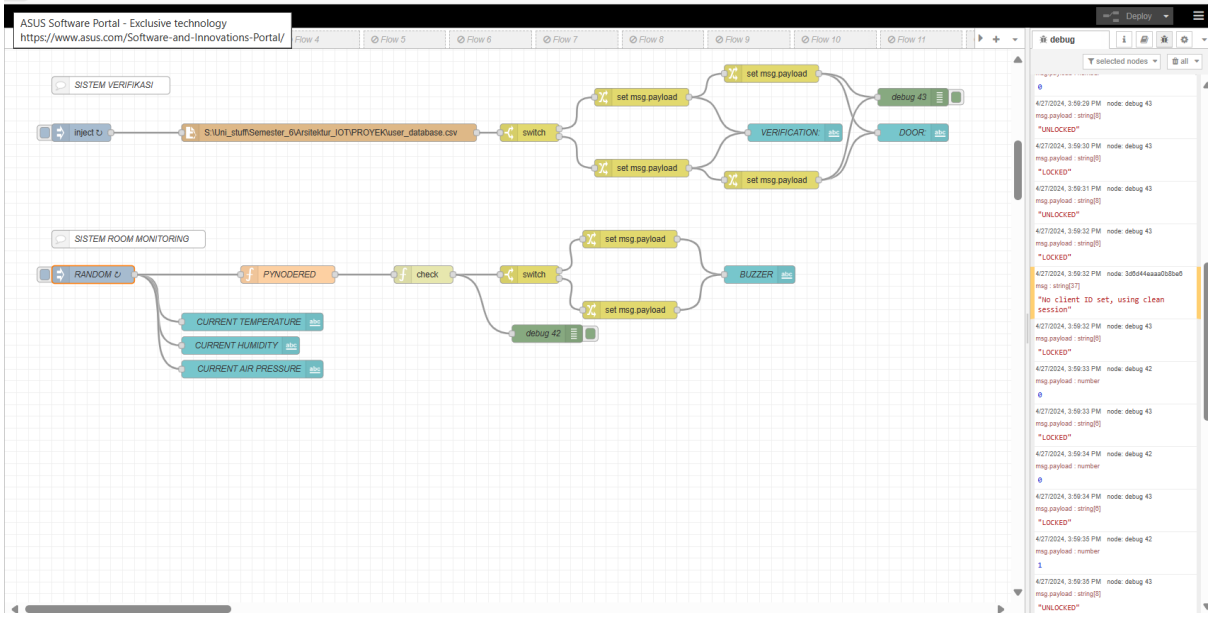
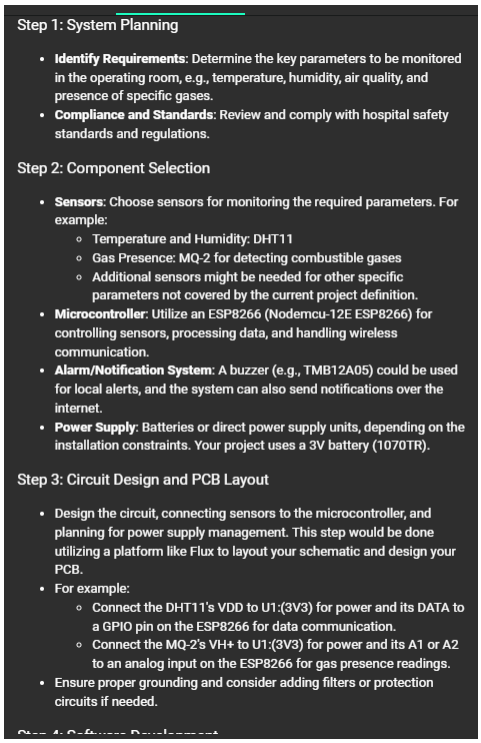


Figure 17: Debug Sistem verifikasi dan monitoring

3. PCB DAN SKEMATIK

3.1 GAMBAR PCB, SKEMATIK DAN 3D VIEW



Step 1: System Planning

- **Identify Requirements**: Determine the key parameters to be monitored in the operating room, e.g., temperature, humidity, air quality, and presence of specific gases.
- **Compliance and Standards**: Review and comply with hospital safety standards and regulations.

Step 2: Component Selection

- **Sensors**: Choose sensors for monitoring the required parameters. For example:
  - Temperature and Humidity: DHT11
  - Gas Presence: MQ-2 for detecting combustible gases
  - Additional sensors might be needed for other specific parameters not covered by the current project definition.
- **Microcontroller**: Utilize an ESP8266 (Nodemcu-12E ESP8266) for controlling sensors, processing data, and handling wireless communication.
- **Alarm/Notification System**: A buzzer (e.g., TMB12A05) could be used for local alerts, and the system can also send notifications over the internet.
- **Power Supply**: Batteries or direct power supply units, depending on the installation constraints. Your project uses a 3V battery (1070TR).

Step 3: Circuit Design and PCB Layout

- Design the circuit, connecting sensors to the microcontroller, and planning for power supply management. This step would be done utilizing a platform like Flux to layout your schematic and design your PCB.
- For example:
  - Connect the DHT11's VDD to U1:(3V3) for power and its DATA to a GPIO pin on the ESP8266 for data communication.
  - Connect the MQ-2's VH+ to U1:(3V3) for power and its A1 or A2 to an analog input on the ESP8266 for gas presence readings.
- Ensure proper grounding and consider adding filters or protection circuits if needed.

Figure 18: Ide PCB

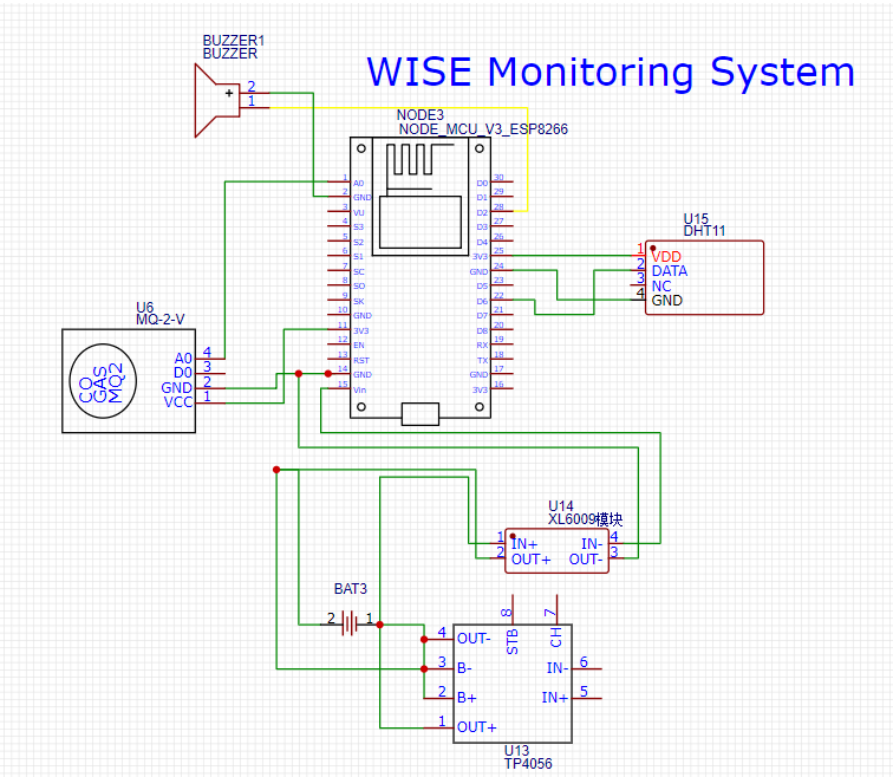


Figure 19: Skematik monitoring system

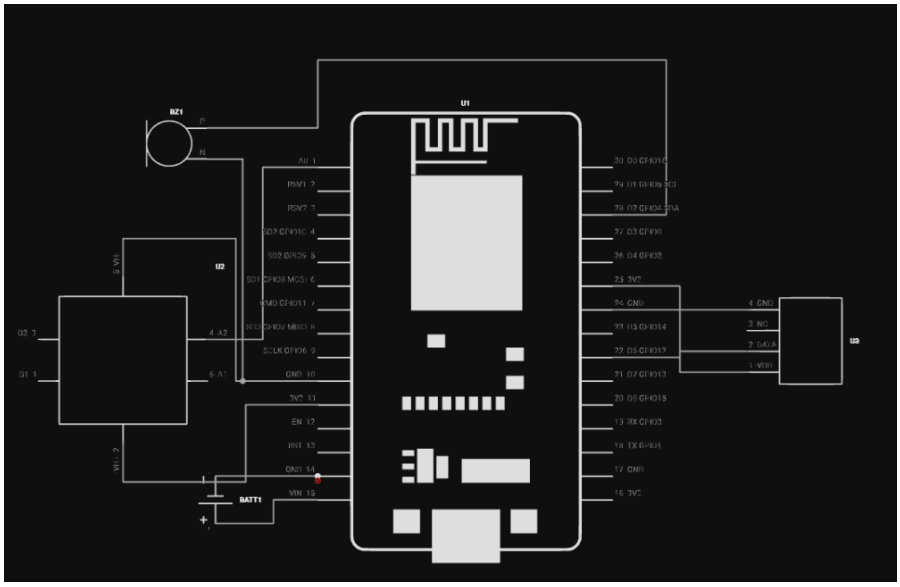


Figure 20: Flux AI Skematik Monitoring

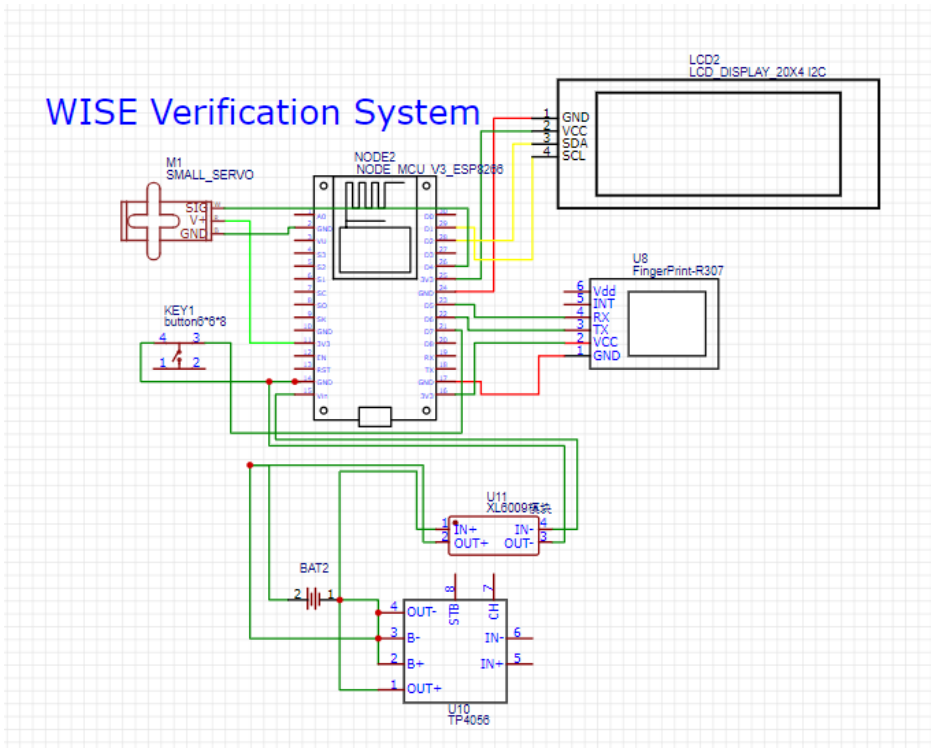


Figure 21: Skematik verification system

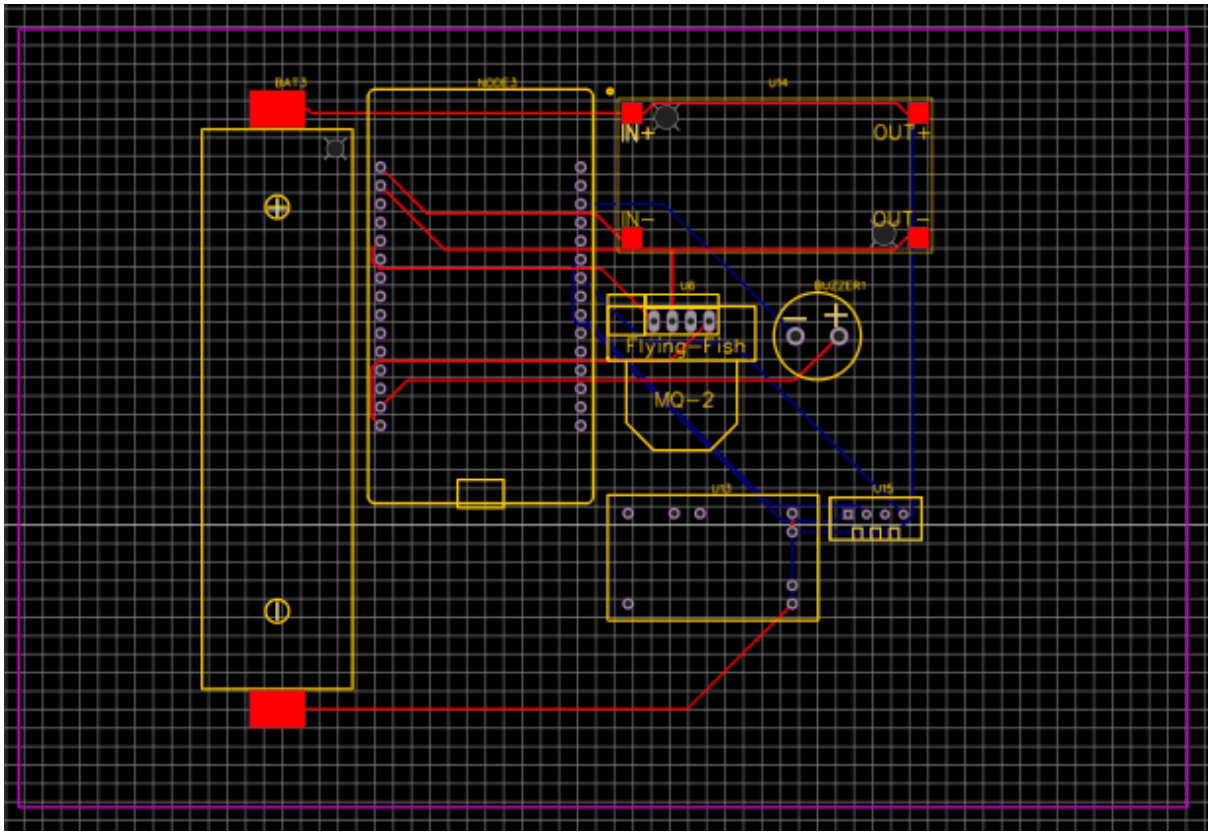


Figure 22: PCB Monitoring System

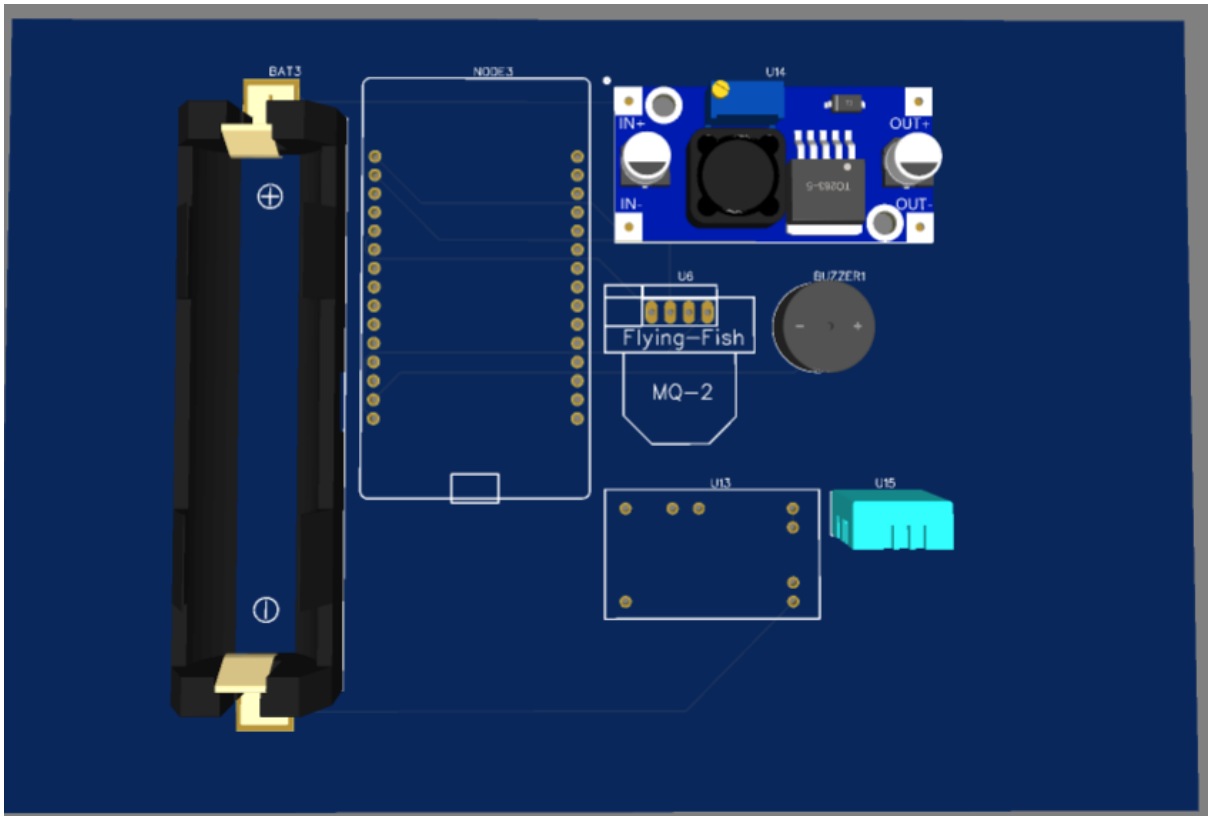


Figure 23: 3D View Monitoring System

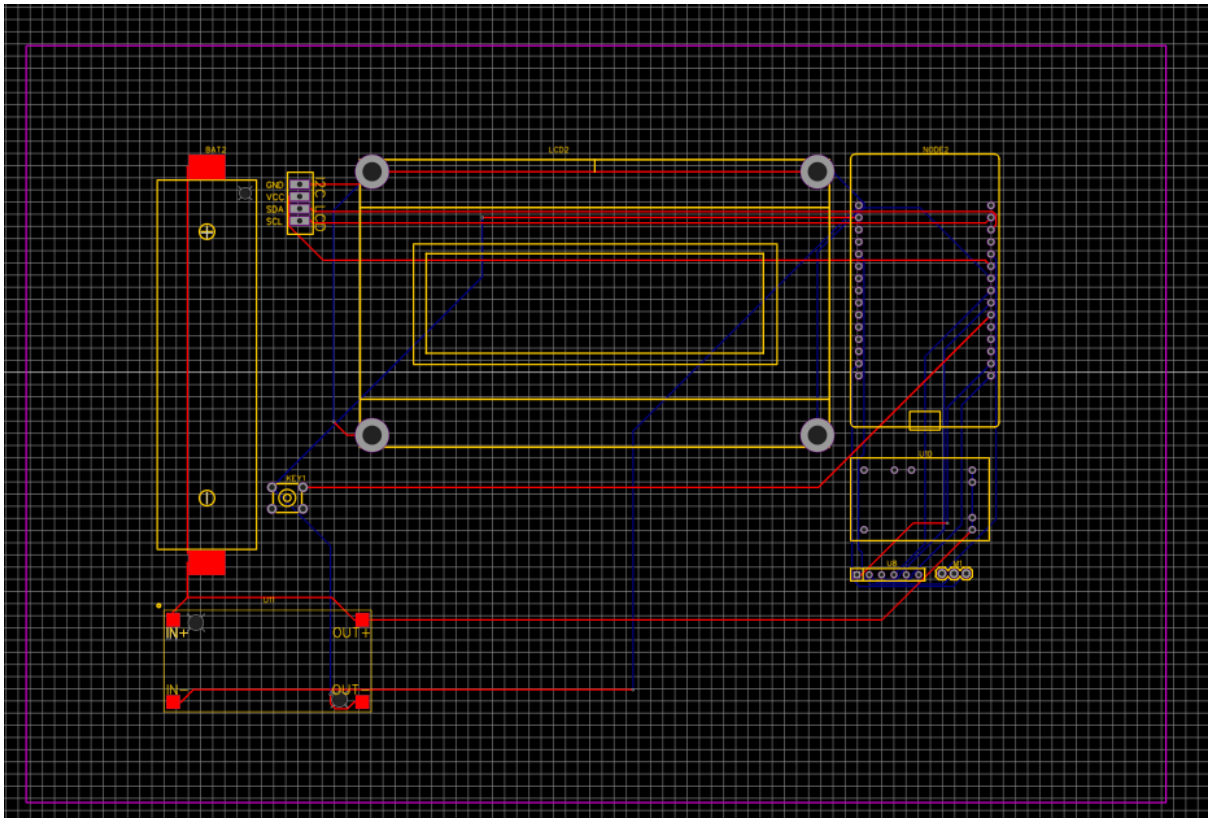


Figure 24: PCB Verification System

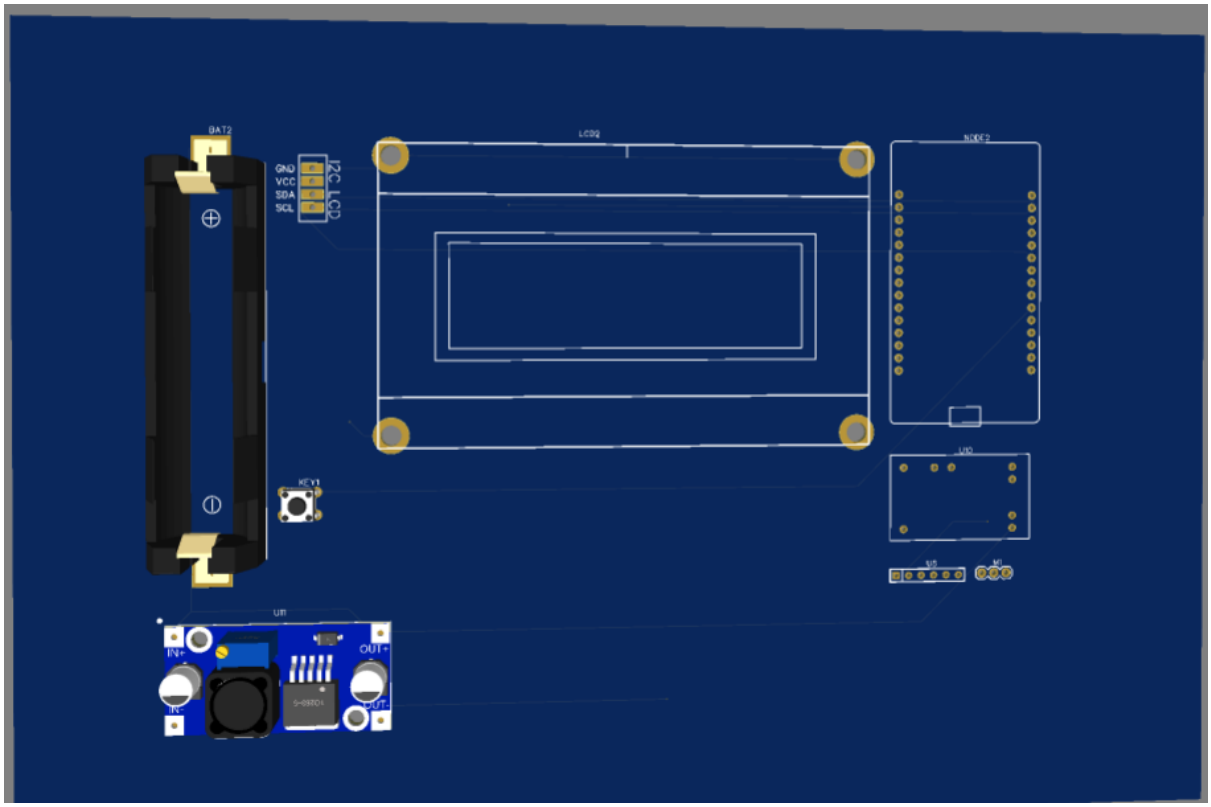


Figure 25: 3D Verification System

3.2 Penjelasan PCB(s)

1. LCD I2C

LCD I2C	NodeMCU
GND	GND
VCC	3V3
SDA	D2
SCL	D1

Table 4: Koneksi LCD

Penjelasan: LCD akan terkoneksi dengan NodeMCU dengan menggunakan koneksi I2C. selain GND dan VCC pin, pin SDA dan SCL akan terhubung ke pin D2 dan D1 di NodeMCU yaitu pin SDA dan SCL pada NodeMCU.

2. Buzzer Module

Buzzer	NodeMCU
GND	GND
VCC	Vin
DATA	D3

Table 5: Koneksi Buzzer

Penjelasan: Buzzer Module akan terkoneksi ke NodeMCU dengan pin GND dan VCC. Signal mati atau nyalah akan diterima melalui pin D3.

3. DHT11

DHT11	NodeMCU
GND	GND
VDD	Vin
DATA	D6

Table 6: Koneksi DHT11

Penjelasan: Sensor DHT11 akan terkoneksi ke NodeMCU dengan pin GND dan VDD. Sensor ini akan menerima signal melalui pin DATA yang terkoneksi ke pin D6.

4. FPM10 Fingerprint Sensor Module

FPM10	NodeMCU
GND (black)	GND
5V (red)	
RX (green)	D5
TX (yellow)	D6
LOW (blue)	-
3V3 (white)	3V3

Table 7: Koneksi R307

Penjelasan: FPM10 memiliki mode 3v3 dan 5v. Mode yang akan digunakan adalah 3v3. Rx dan Tx pins dikoneksikan kepada pin D5 dan D6 di NodeMCU.

5. Motor Servo SG90

SG90	NodeMCU
GND	GND
VCC	Vin
SIGNAL	D5

Table 8: Koneksi SG90

Penjelasan: Servo Motor SG90 akan terkoneksi ke NodeMCU dengan pin GND dan VCC. Signal untuk bergerak akan diterima melalui pin D5.

6. Gas Sensor M2Q Flying Fish

Sensor Tekanan Udara	NodeMCU
VCC	3V3
GND	GND
Digital	-
Analog	A0

Table 9: Koneksi Sensor Gas Sensor

Penjelasan: Module ini merupakan sensor gas yang dapat mendeteksi kualitas udara dan akan lebih tinggi jika mendeteksi gas seperti karbon monoxide atau smoke. Module ini memiliki dua mode input yaitu digital dan analog input. Yang digunakan untuk proyek ini hanya analog input saja yang terhubung dengan analog pin 0 di esp8266.

4. TESTING

4.1 Testing Room Monitoring System

4.1.1 Langkah Pengujian

1. Rangakain:

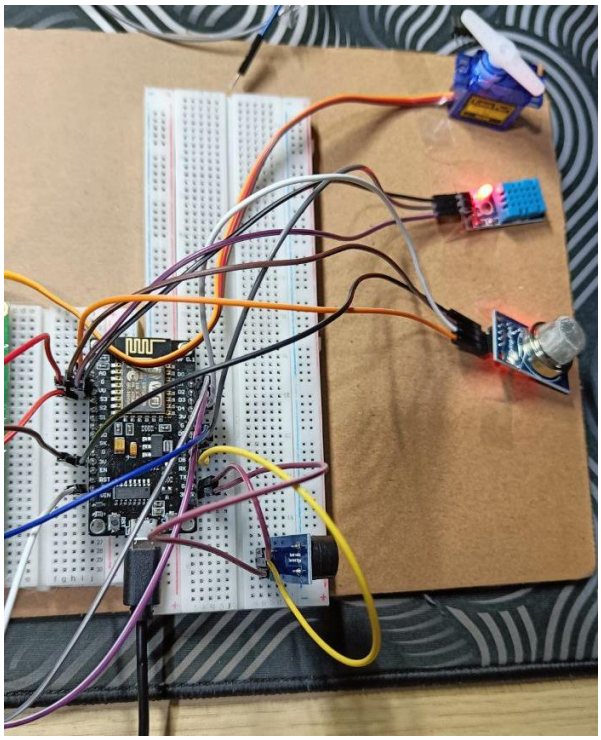


Figure 26: Rangkaian Testing Monitoring System

2. MQTT Broker akan digunakan untuk menerima dan mengirim pesan
3. Sistem ini akan menerima angka ppm kualitas uada dengan topic -gasValue, angka humiditas dengan topic -humValue dan angka temperature dengan topik -t tempValue.
4. Semua ini dapat dilihat di dashboard node-red. Log pembacaan juga dapat dilihat di User interface node-red. Selain itu node-red akan menggunakan kode Machine Learning untuk mengetahui jika buzzer harusnya nyalah atau mati. Ia akan mengirim message ini dengan MQTT dengan topik -buzzer. NodeMCU akan menerimanya dan menyalahkan atau mematikan buzzer sesuai dengan message MQTT yang diterima.
5. Untuk mendapatkan reading yang berbeda-beda saya mencoba untuk membuat kondisi dimana sensornya akan memberikan nilai yang lebih tinggi.

4.1.2 Hasil Pengujian

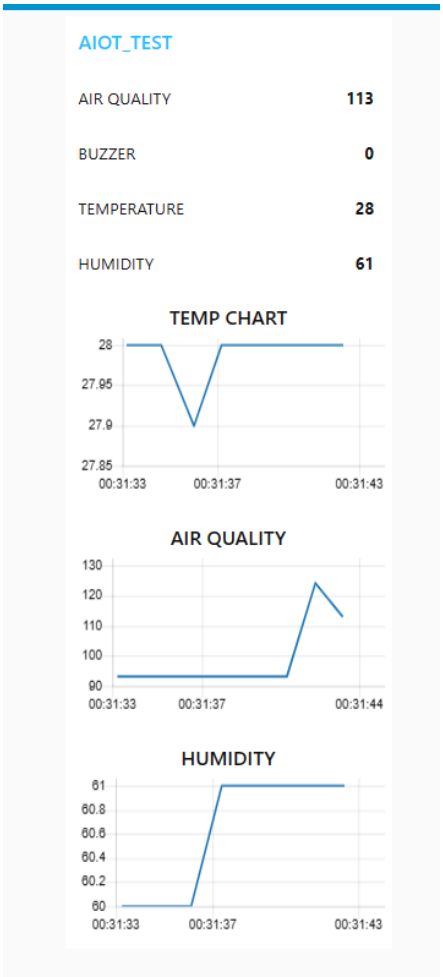


Figure 27: UI Node-red

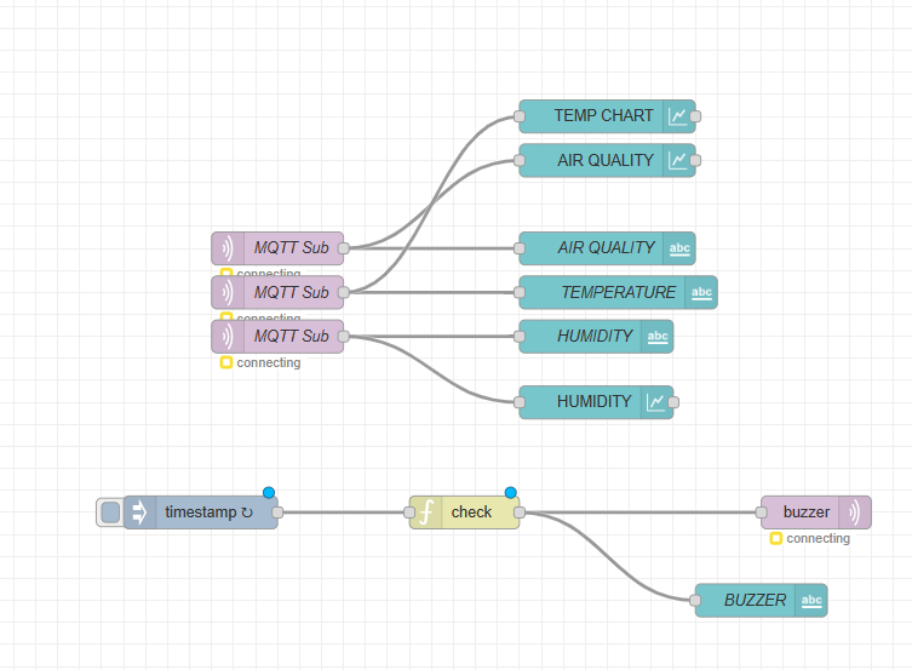


Figure 28: Node-red monitoring test

Buzzer akan selalu mati karena semua sensor tidak akan memberikan angka diatas batas yang akan membuat buzzer nyalah. Oleh karena itu, saya membuat pesan MQTT buzzer random untuk pengujian ini.

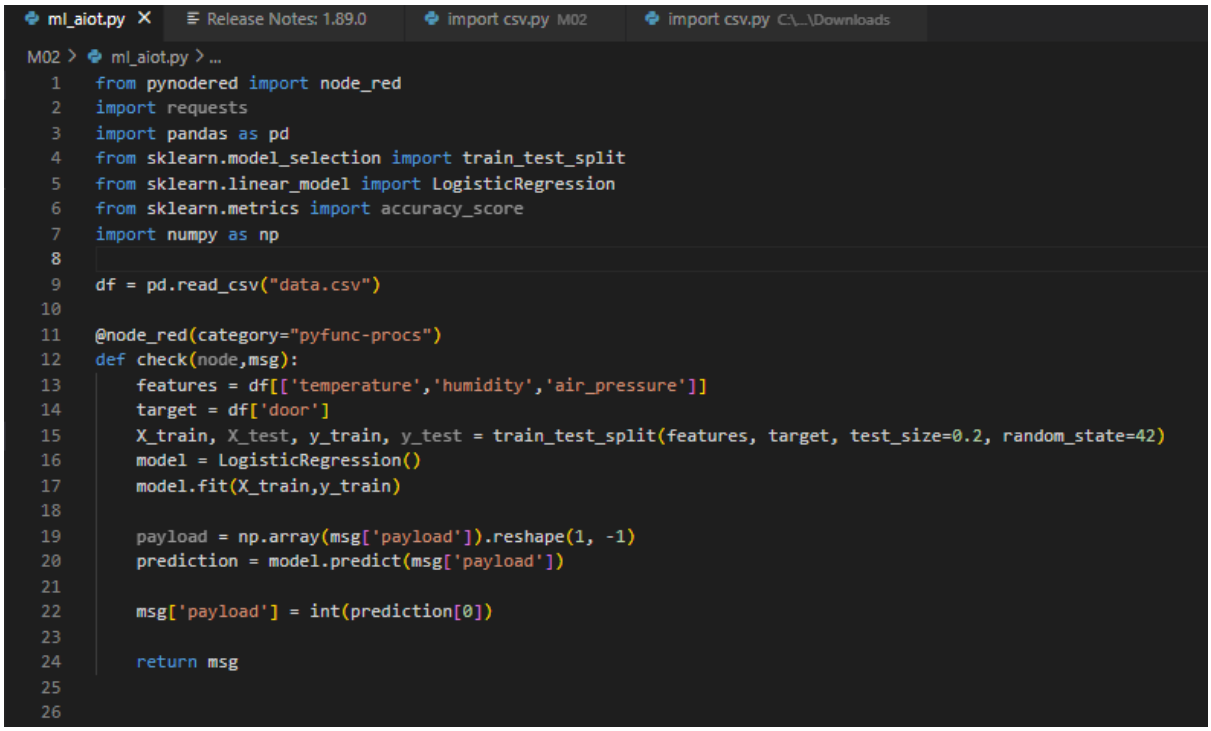


Figure 29: Pynodered Machine Learning

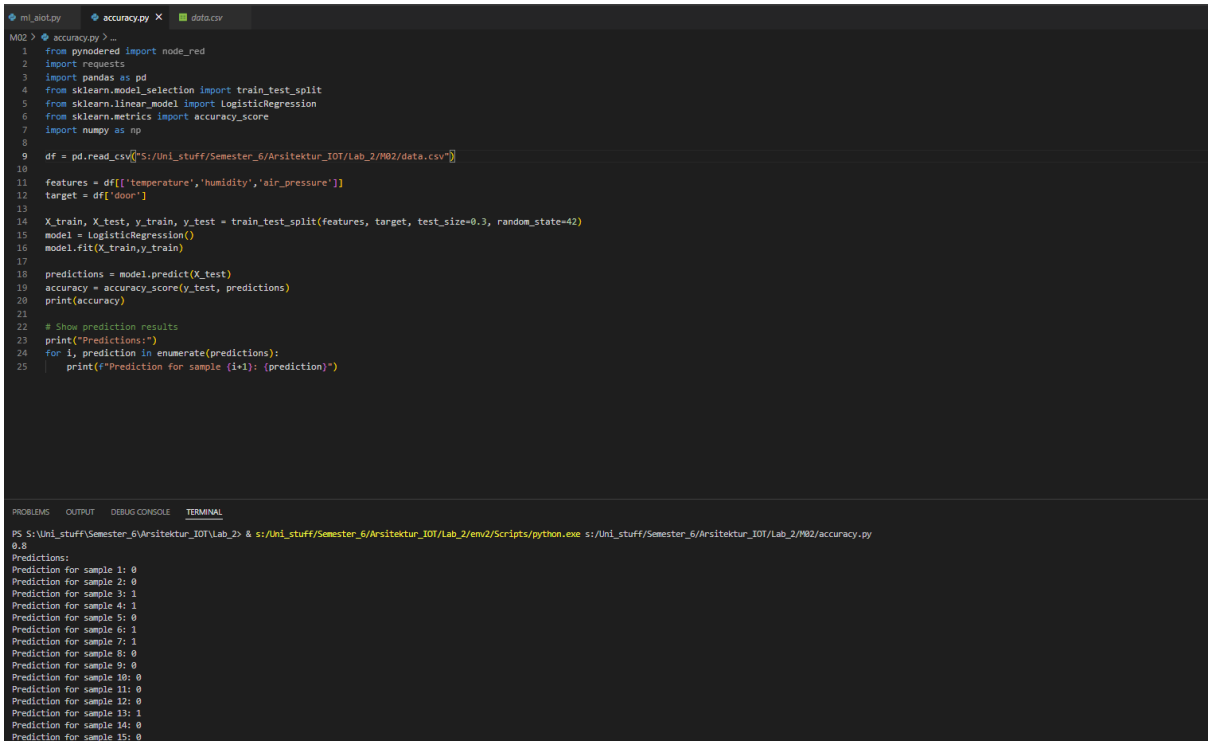


Figure 30: Machine Learning Accuracy

4.1.3 Analisis Pengujian

Reading No.	gasValue	tempValue	humValue	Buzzer (random)
1	90	26	60	0
2	120	26	60.2	0
3	121	26.5	60.2	1
4	120	26	61	1
5	115	27	65	0
6	110	27.5	64	1
7	110	28	62	1
8	112	27	61	0
9	150	26	60	1
10	145	26	60	0

Table 10: Table Analisis Monitoring System test

Analisis:

Dari pengujian ini, bisa dilihat bahwa gasValue akan diantara 100 dan 150 dan ini lebih kecil dari pada ppm aslinya mungkin karena Voltage yang kurang. Akan tetapi hal ini bisa diadjust. Temp dan Hum value dapat terdeteksi dengan baik. Saat saya membuat udara di dekat sensor lebih panas dan lembab, angka yang dikirm juga berubah. Walaupun buzzer masih dalam keadaan random, message dapat diterima dengan baik.

4.2 Testing User Verification System

4.2.1 Langkah Pengujian

1. Rangkaian:

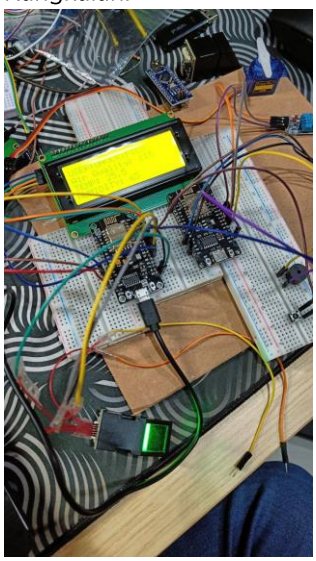


Figure 31: Rangkaian uji verifikasi

2. Push button, servo motor dan lcd akan terkoneksi ke NodeMCU. Push button akan digunakan untuk mengatifkan registrasi fingerprint. Servo motor akan bersifat sebagai door lock yang akan terbuka jika fingerprint matching dengan yang disimpan.
3. LCD akan menunjukan angka Temperatur, Humiditas, Kualitas Udara dan juga jika user sudah verified atau tidak.

4.2.2 Hasil Pengujian

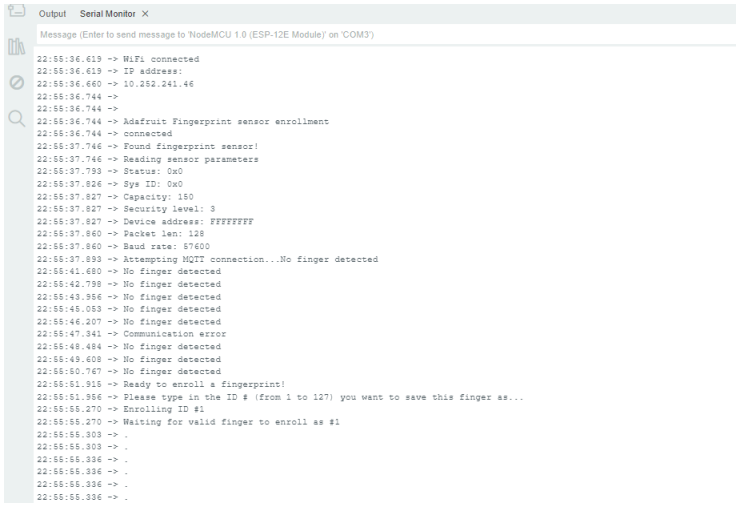


Figure 32: Arduino Serial test

Figure 33: Layar LCD

4.2.3 Analisis Pengujian

Dari Pengujian ini, perlu diperhatikan fingerprint sensornya karena sering error dalam mendeteksi ada jari atau tidak. Sepertinya masalah hardware. Selain itu, Pengujian dapat berjalan dengan baik. Waktu sistem bekerja juga cepat. Servo terkadang error juga dengan tidak berhenti berputar. LCD dapat terupdate dengan baik jika MQTT terus menerima data dari sistem monitoring.

5. DATABASE

Aplikasi yang digunakan untuk dataset adalah MySQl yang diakses dengan menggunakan MySQL Workbench. Database yang dibuat adalah database User Log yang berisi tabel siapa saja yang masuk ruanganya, jam berapa dan Tanggal. Database user database juga dibuat yang berisi daftar nama, posisi dan fingerprint id semua user yang sudah terdaftar untuk diperizinkan masuk ruangan.

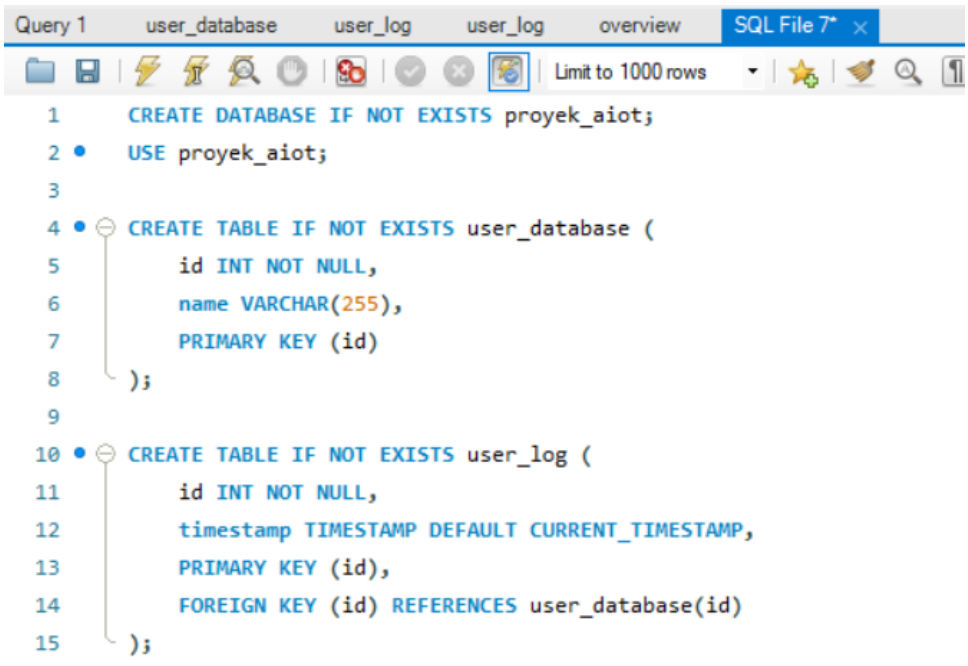


Figure 34: MySQL Code

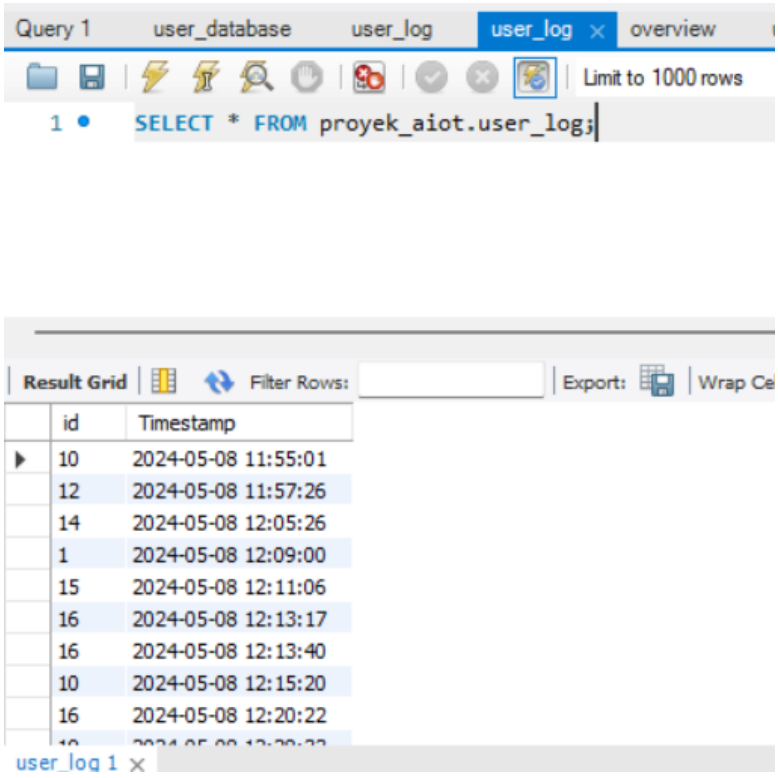


Figure 35: Database user log

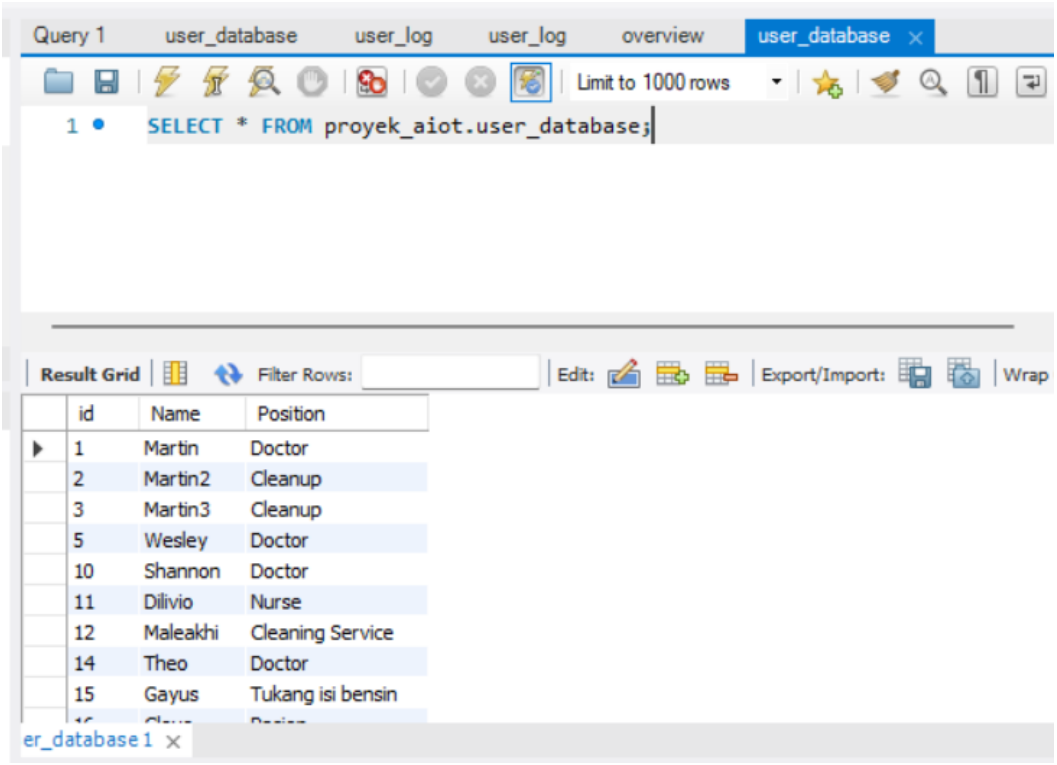


Figure 36: Database user database

6. USER INTERFACE

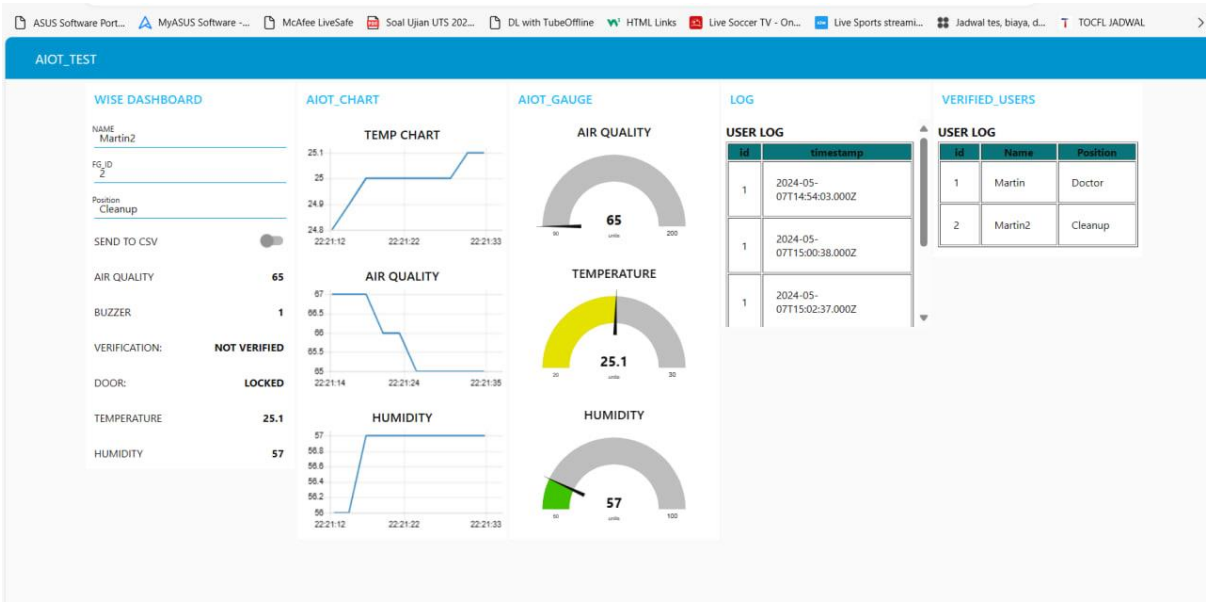


Figure 37: Final System Dashboard UI

Node-red:

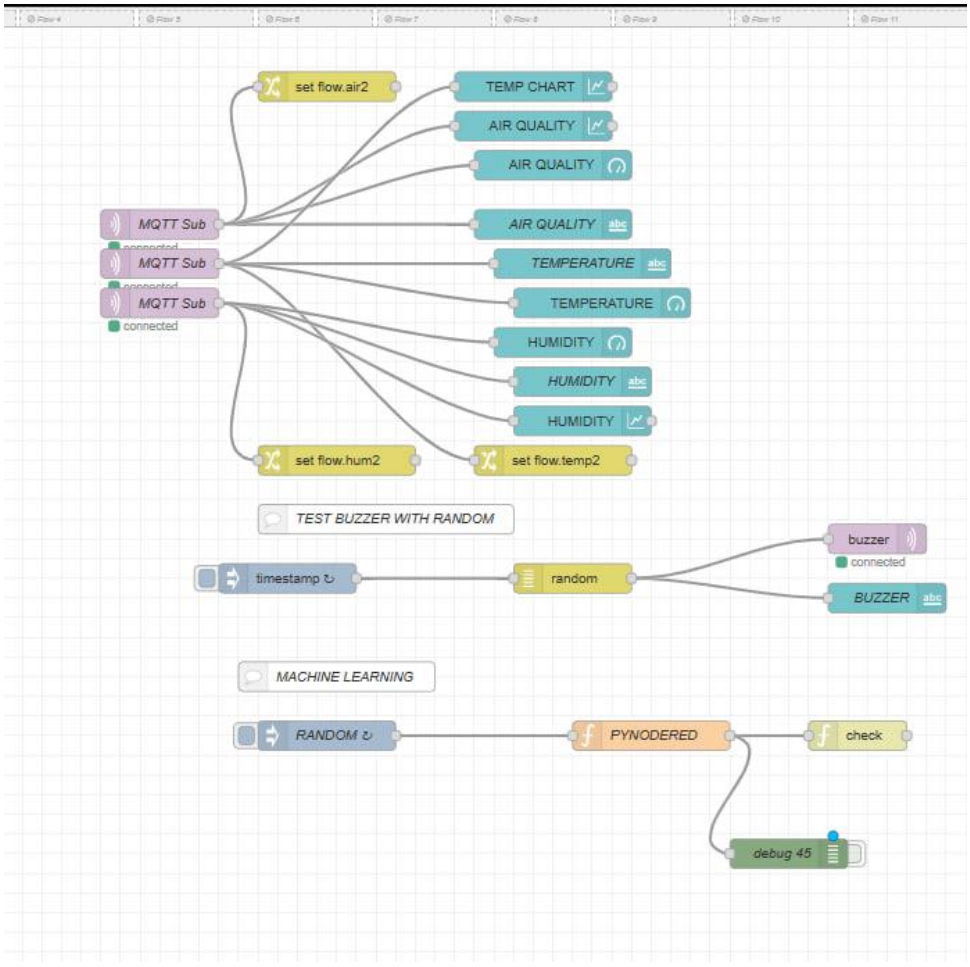


Figure 38: UI Node-red (1)

Penjelasan:

Bagian ini merupakan visualisasi Data dari sensor DHT11 dan MQ2 yang dikirim ke MQTT subscriber. Data akan divisualisasikan dengan chart agar dapat dilihat riwayatnya dan juga gauge untuk mudah diketahui value sekarang berapa.

Untuk buzzer, fungsi pynodered akan menerima data dari set flow untuk setiap sensor dan membuatnya menjadi array. Lalu fungsi pynodered check akan menerapkan machine learning untuk menentukan jika buzzer harusnya nyalah atau mati. Juga ada mode random number saja untuk simulasi saja.

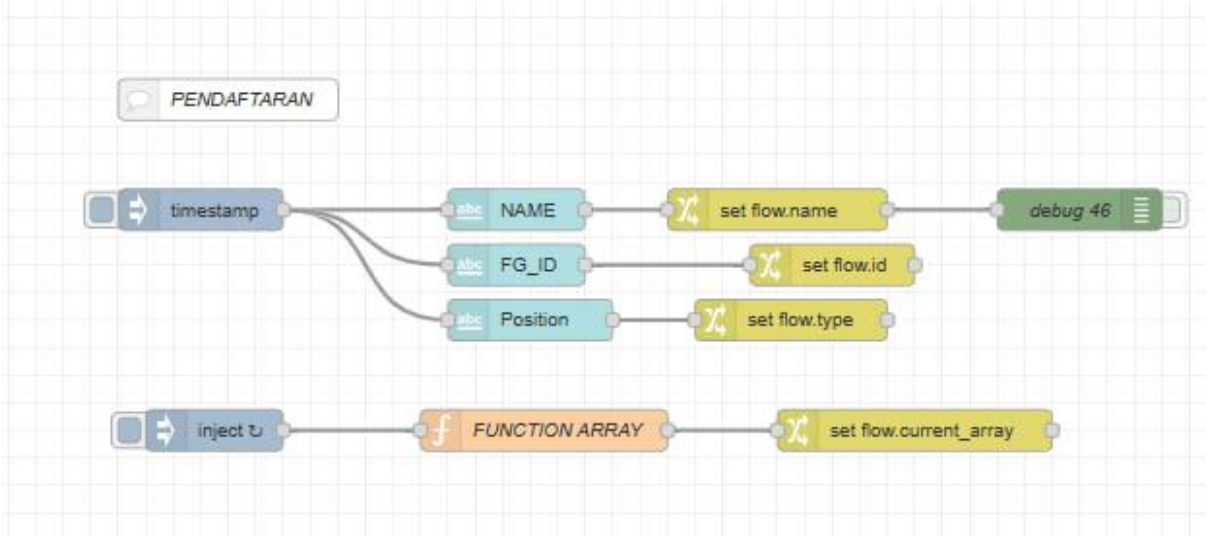


Figure 39: UI node-red (2)

Penjelasan:

Jika ingin daftar, user akan isi name, fingerprint id dan position. Semua ini akan disimpan di set flow dan akan masuk lagi ke function array untuk dibuat dalam bentuk array.

Ini adalah sistem pendaftaran Dimana seseorang

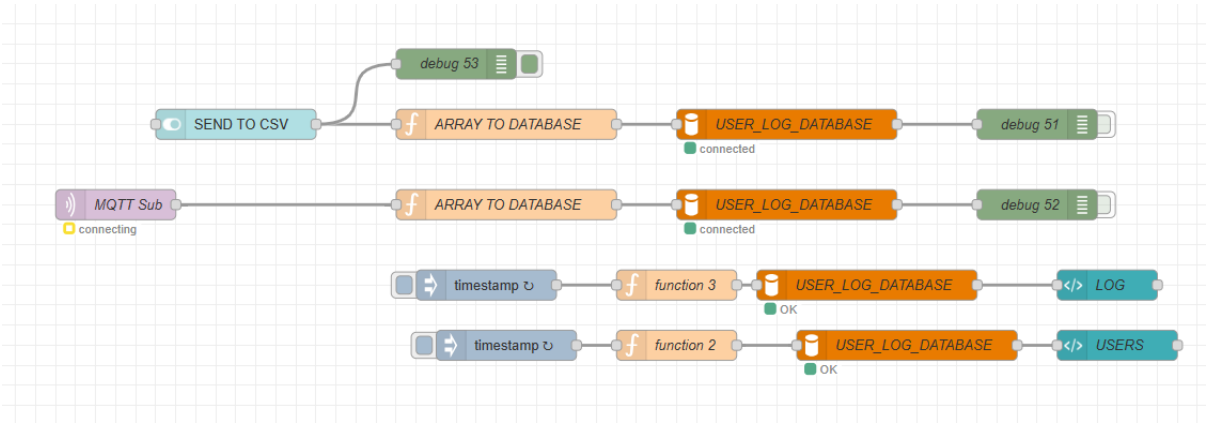


Figure 40: UI Node-red (3)

Penjelasan:

Jika ingin kirim informasi user verified ke database, bisa dipencet tombol SEND TO CSV. Ini akan kirim data ke fungsi untuk diubah menjadi array yang terus akan dikirimkan ke database. Kalau untuk database user_log, setiap kali ada message MQTT yang masuk yang berarti ada fingerprint id yang masuk, ini akan menjalankan sistem yang akan update database. Dua database ini juga akan di tampilkan dengan menggunakan template table di dua baris bawah dalam node-red.

7. CASING

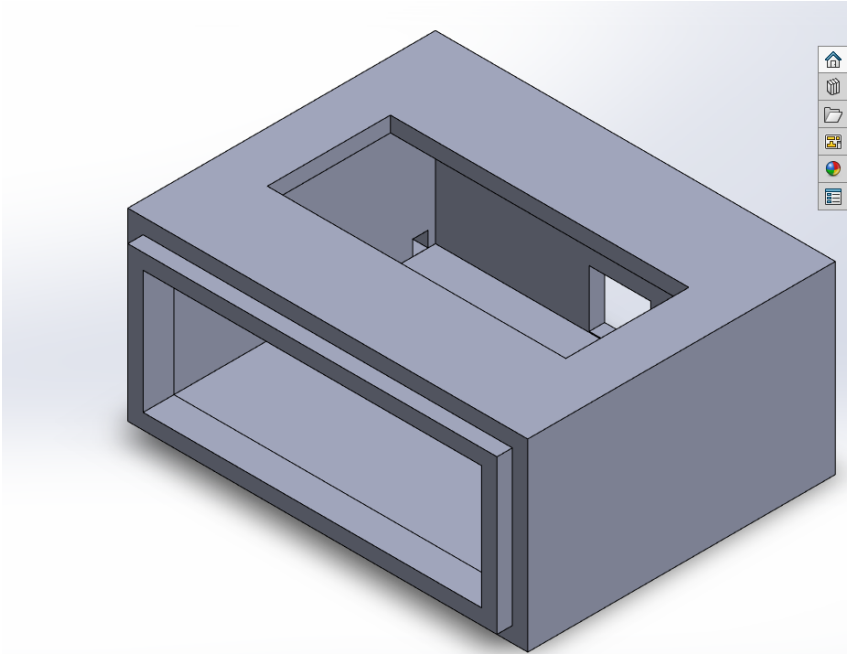


Figure 41: Isometric View Casing Verification System

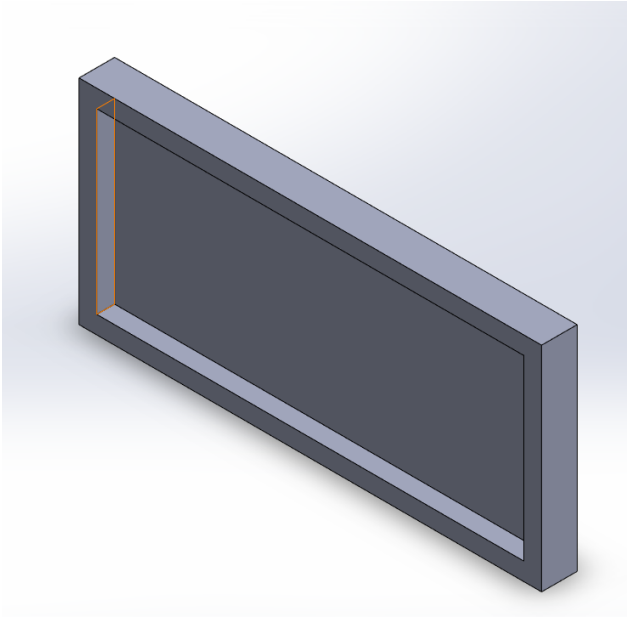


Figure 42: Isometric View Casing Lid Verification System

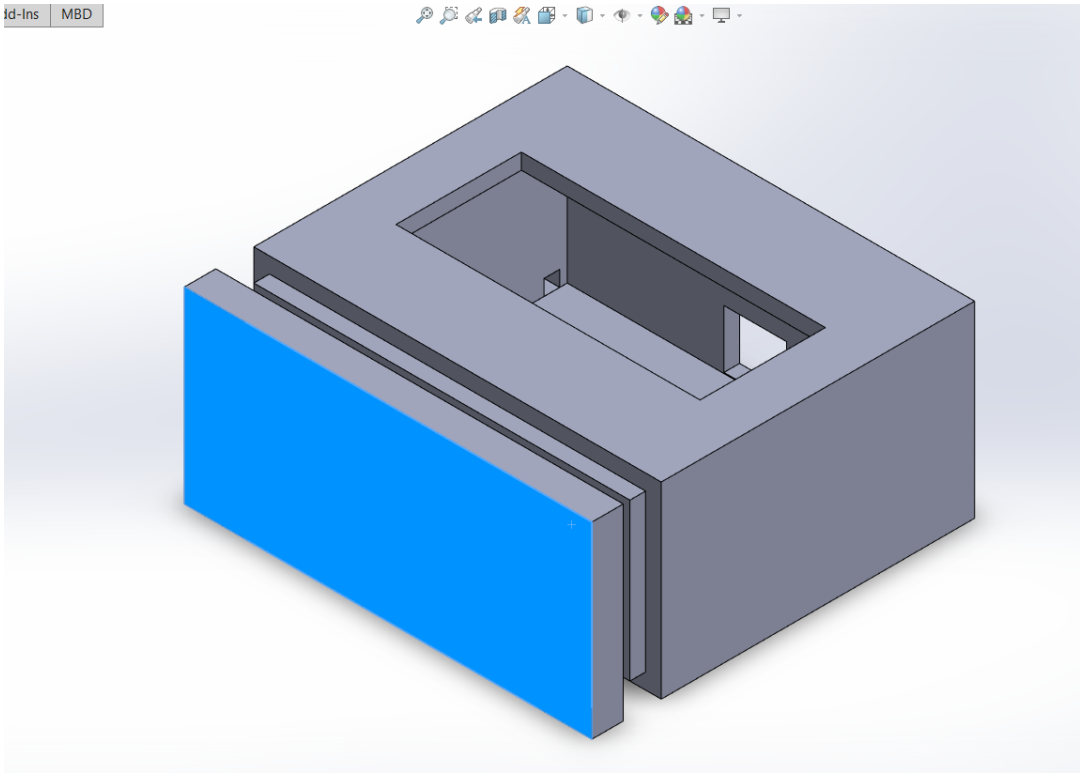


Figure 43: Isometric View Assembly Verification System

Penjelasan:

Casing ini dibuat dengan menggunakan software SolidWorks. Casing ini terdiri dari lid dan housing untuk LCD dan fingerprint sensor. Akan tetapi karena ukuran yang kurang tepat dan waktu yang tidak cukup, ukuran casing tidak terlalu pas. Casing yang masih perlu dibuat adalah Casing monitoring system juga yang akan masuk ke aspek keberlanjutan. Casing ini di print dengan menggunakan 3D printer dan filament pribadi.

8. FINAL PRODUCT

8.1 Dokumentasi Final Product

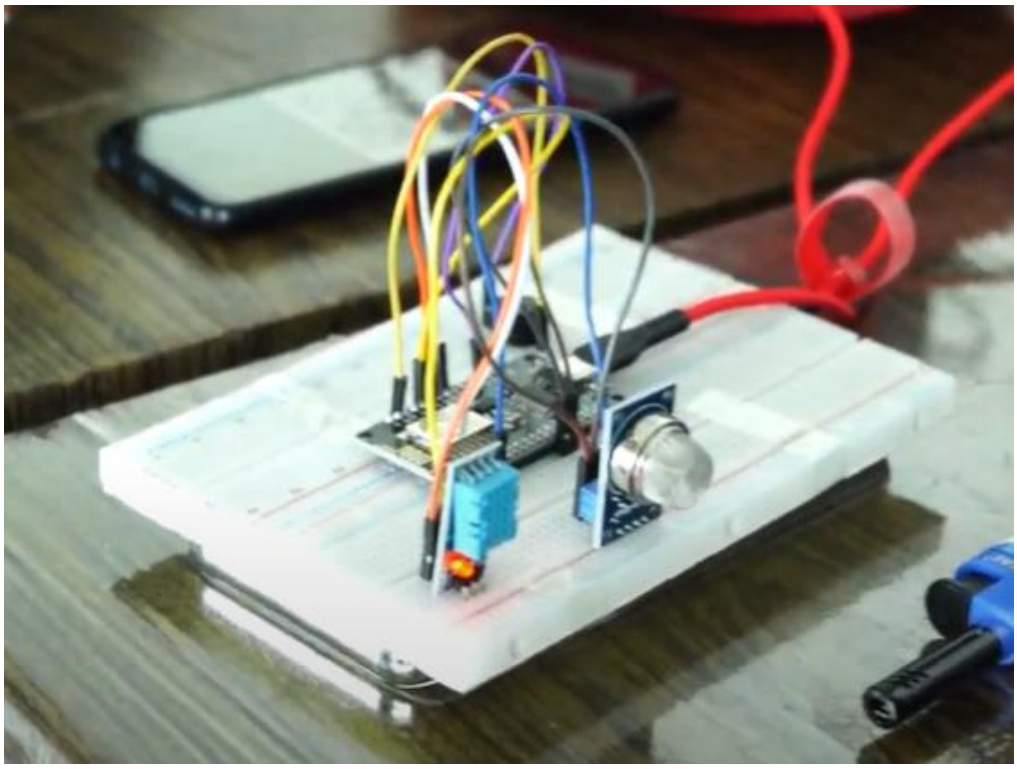


Figure 44: Monitoring System Showcase

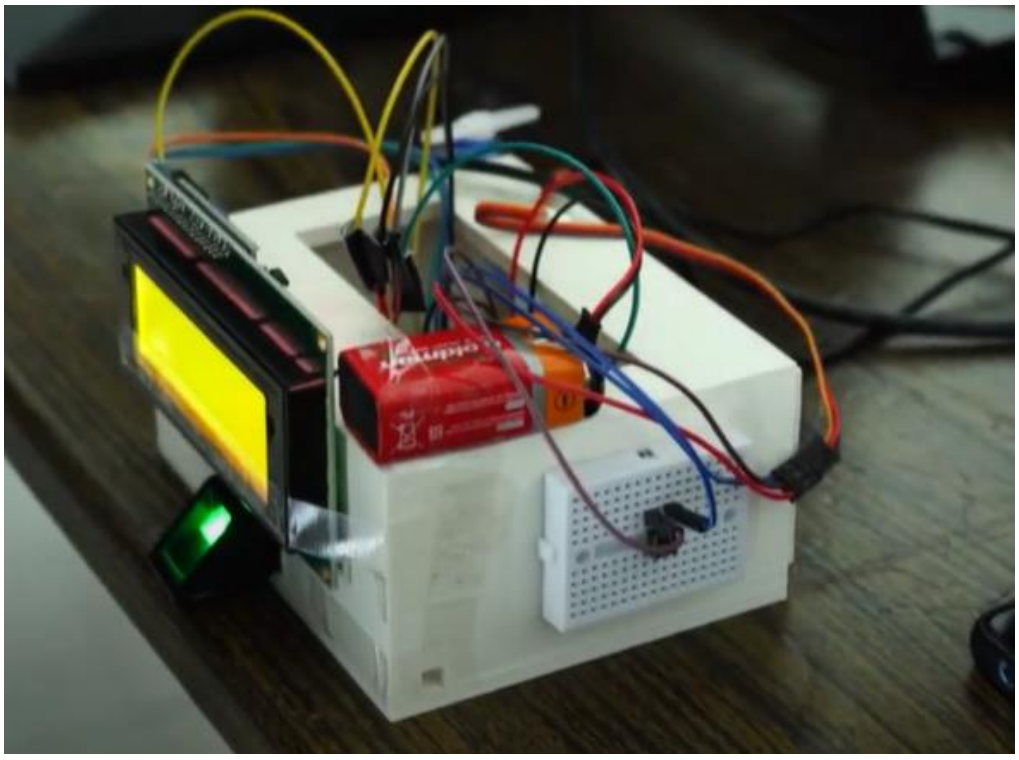


Figure 45: Verification System Showcase

8.2 Link Penjelasan Youtube

https://youtu.be/PbNtyO-PUiQ

9. PAMERAN

9.1 POSTER

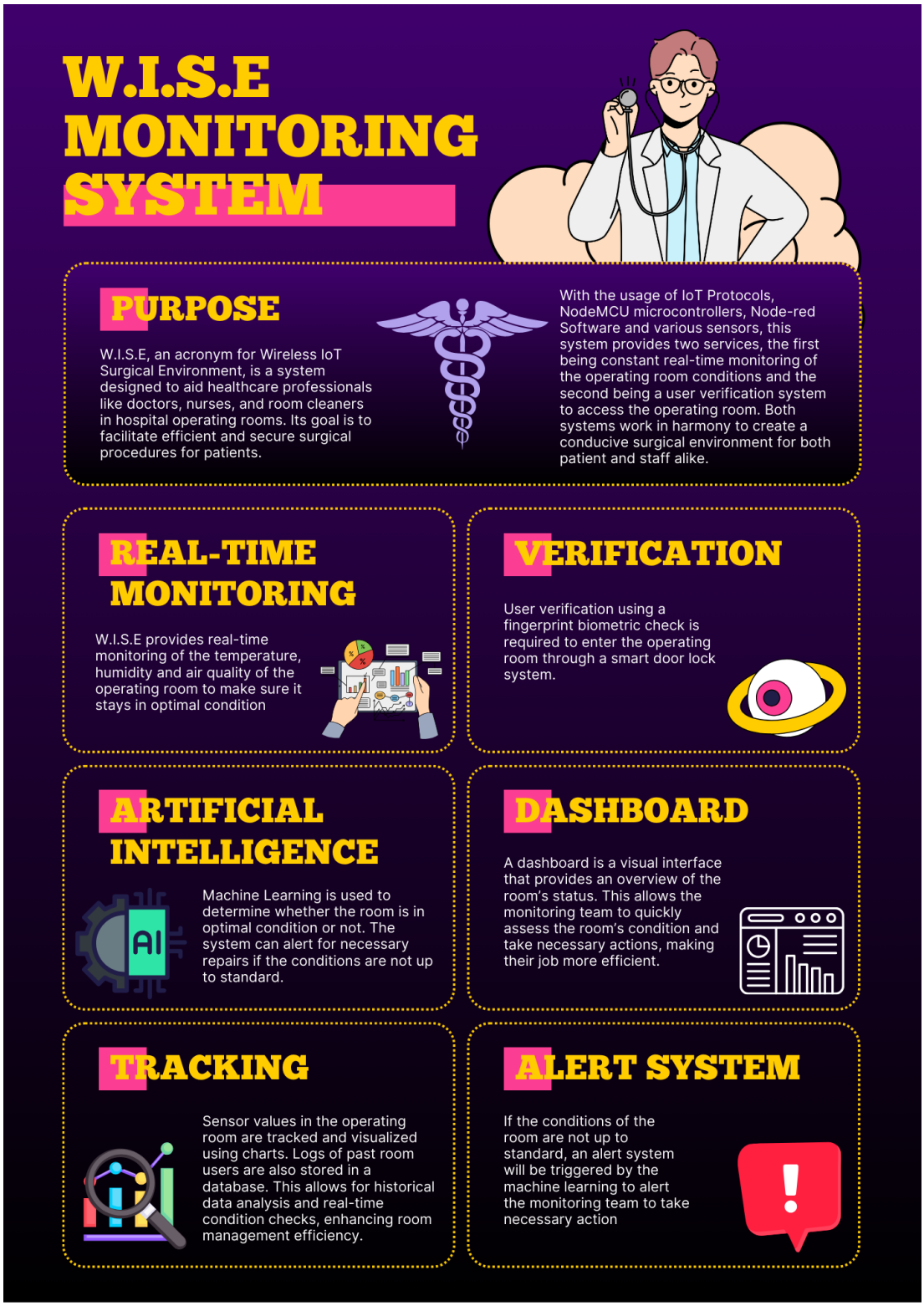


Figure 46: Poster W.I.S.E

9.2 DOKUMENTASI

Figure 47: Dokumentasi Pameran (1)

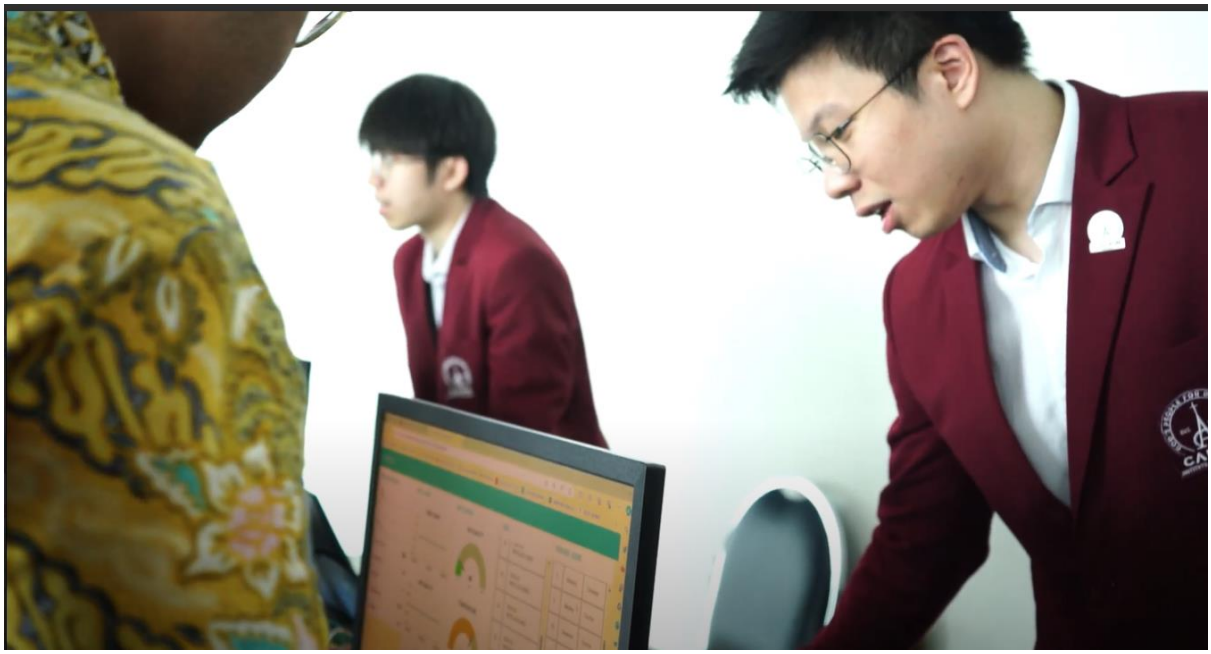


Figure 48: Dokumentasi Pameran (2)

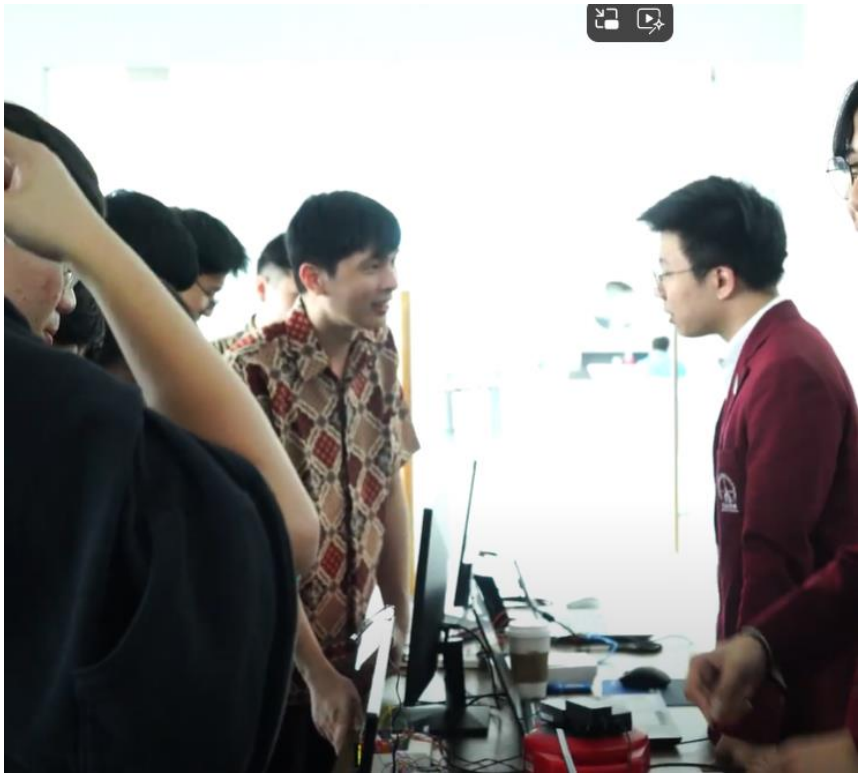


Figure 49: Dokumentasi Pameran (3)

9.3 EVALUASI

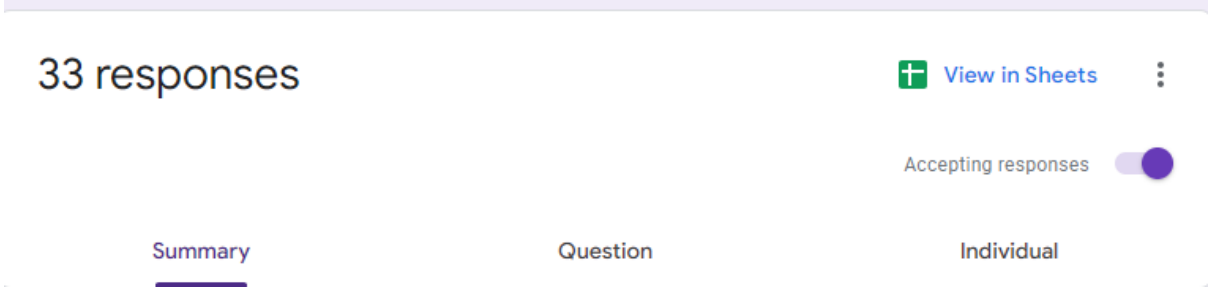


Figure 50: Form Evaluasi (1)

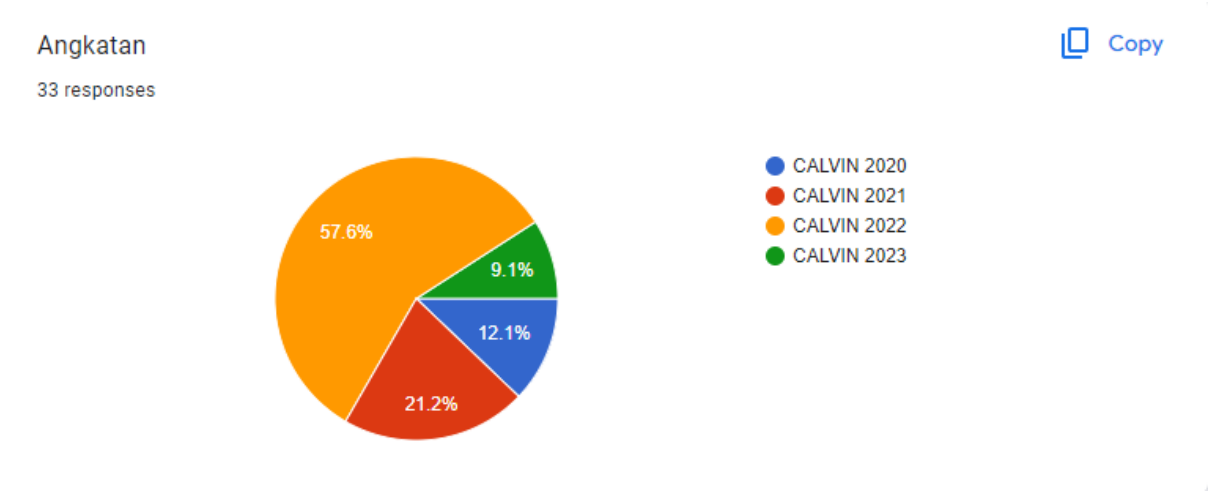


Figure 51: Form Evaluasi (2)

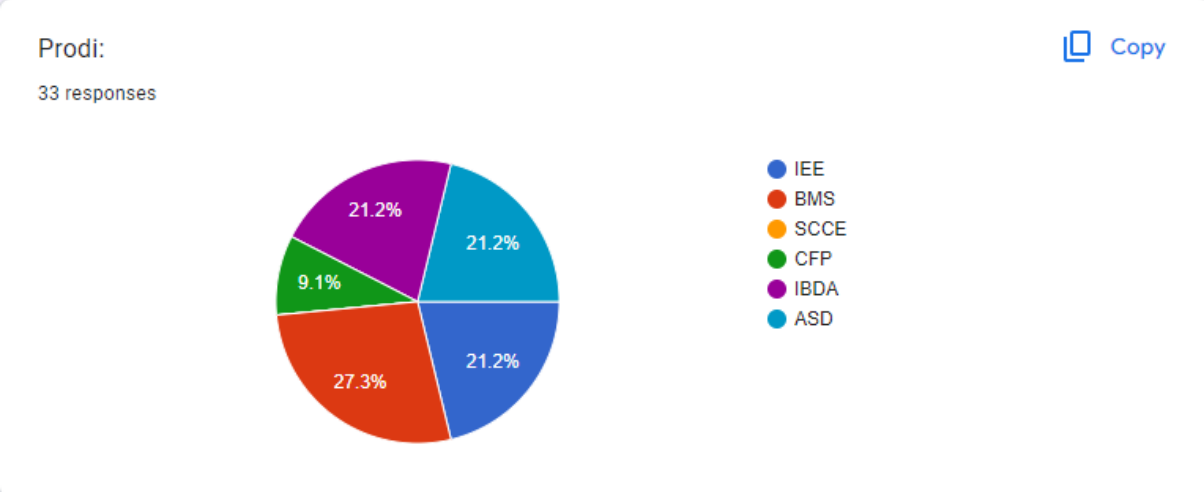


Figure 52: Form Evaluasi (3)

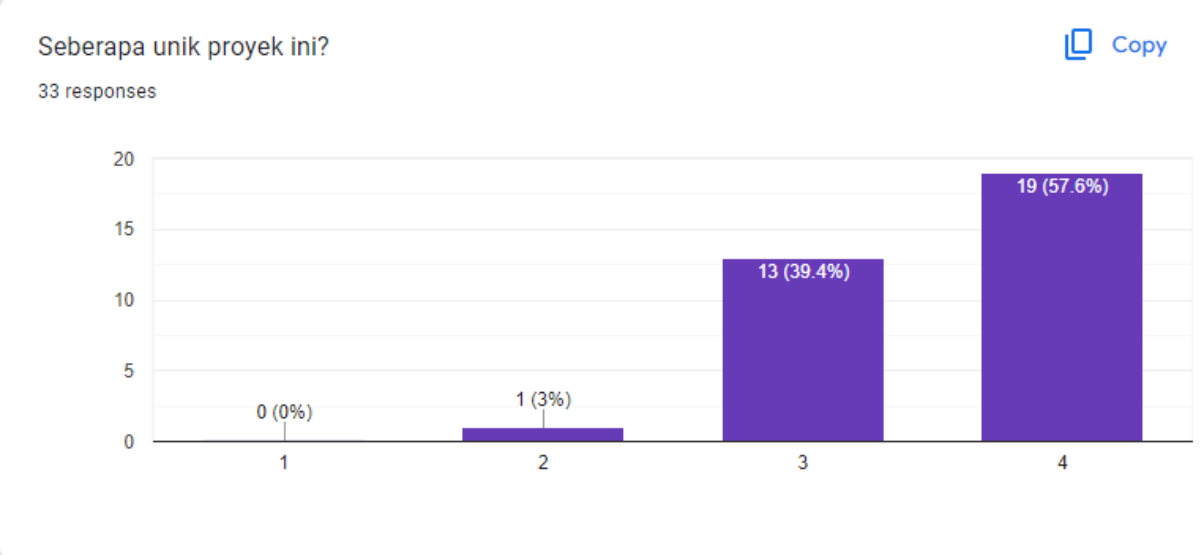


Figure 53: Form evaluasi (4)

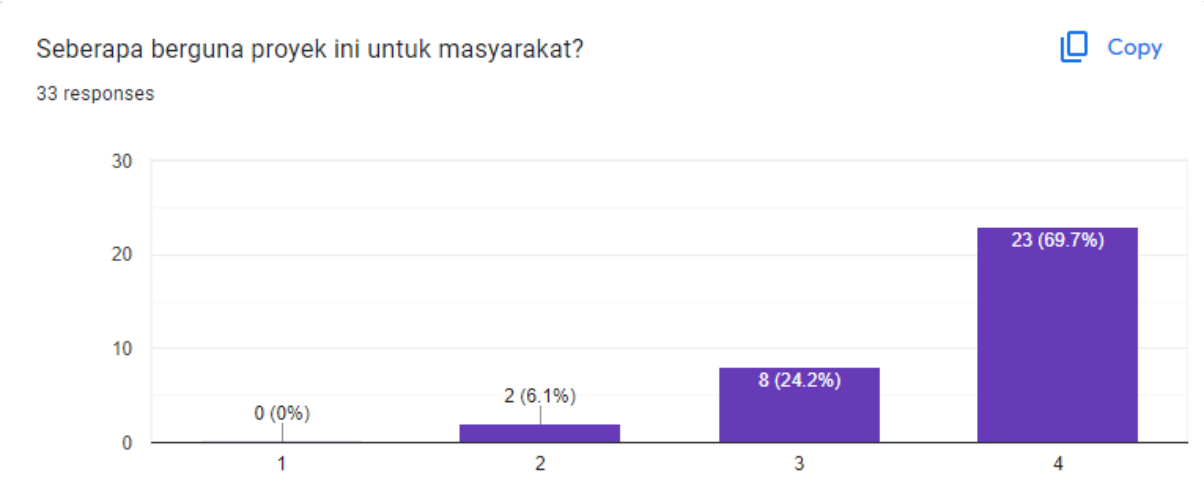


Figure 54: Form evaluasi (5)

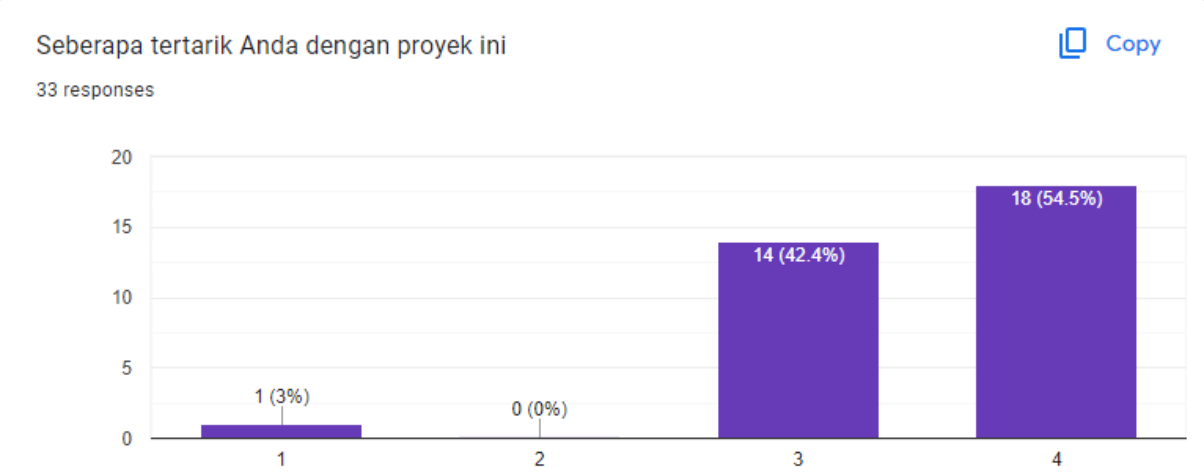


Figure 55: Form evaluasi (6)

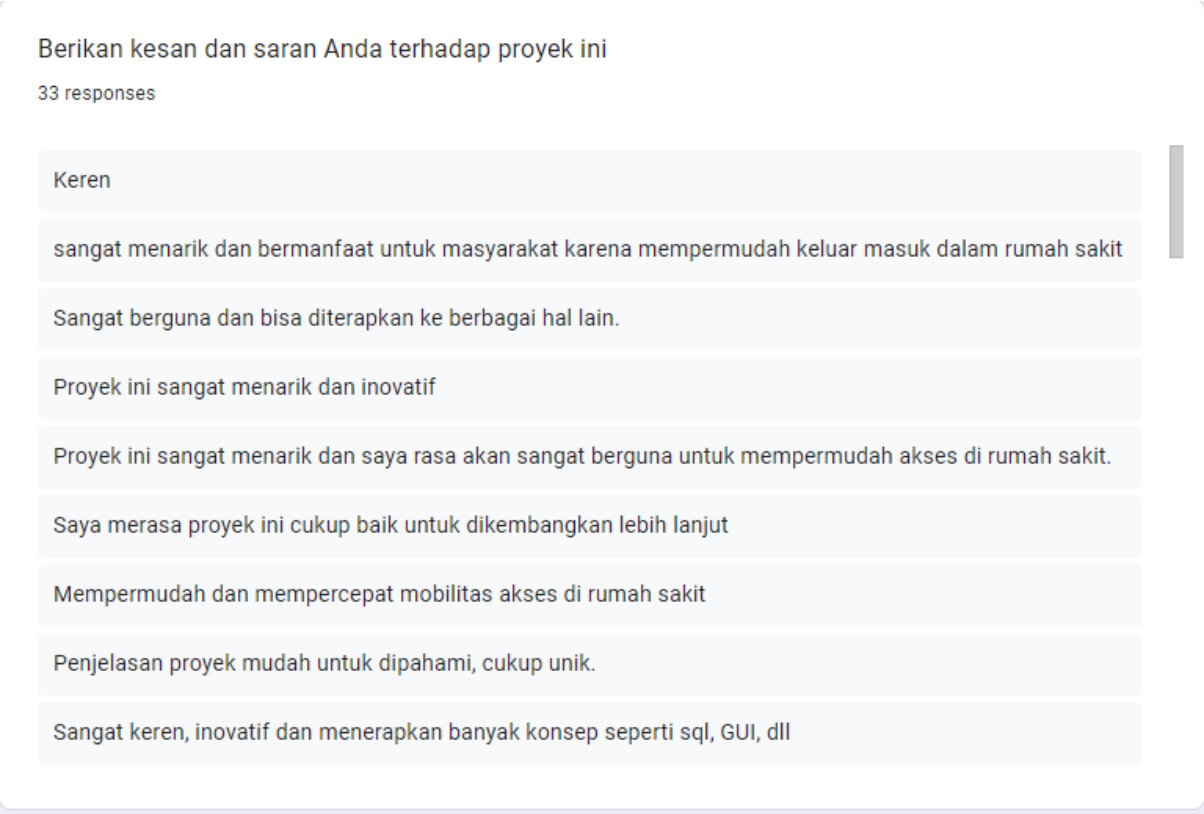


Figure 56: Form evaluasi (7)

9.4 ANALISIS HASIL EVALUASI

Rata-rata keunikan proyek: 3.55

Rata-rata kebergunaan proyek: 3.63

Rata-rata ketertarikan terhadap proyek: 3.48

10. KESIMPULAN

10.1 Kesimpulan Simulasi Node-red

Melalui simulasi Node-red ini, Sistem WISE Monitoring sistem saya dapat diuji dan disimulasikan. Bagian Registrasi Fingerprint dapat berjalan dengan baik dan data dapat dikirim ke database. Bagian random juga dapat memberikan angka pembacaan yang random dan juga fingerprint binary code yang random. Bagian verifikasi user dapat mencocokan fingerprint yang ada dengan yang di database dan dapat gerakan door lock dengan benar. Bagian room monitoring system dapat menggunakan machine learning untuk memutuskan jika buzzer mati atau nyalah. Node-red dapat berjalan dengan lancar dan machine learning juga dapat diterapkan dengan baik walaupun masih 93% akurat. Database dapat ditambahkan kedepanya untuk mendapati akurasi yang lebih tinggi. User interface node-rednya baik sekali dan chart dapat memberikan kita Riwayat pembacaan.

10.2 Kesimpulan Pengujian Monitoring System

Berdasarkan hasil pengujian yang telah dilakukan, ada beberapa poin penting yang dapat disimpulkan. Pertama, Sistem monitoring yang telah dikembangkan dapat berjalan dengan baik. Ini menunjukkan bahwa sistem ini mampu melakukan pemantauan secara efektif dan efisien, yang tentunya sangat penting dalam konteks operasional sehari-hari. Kedua, MQTT, yang merupakan protokol messaging yang ringan dan mudah digunakan, dapat digunakan untuk publish dan subscribe message antara desktop dan NodeMCU. Ini berarti bahwa sistem ini mampu melakukan komunikasi data secara real-time antara berbagai perangkat, yang tentunya sangat penting dalam konteks Internet of Things (IoT).

Ketiga, Machine Learning yang digunakan dalam sistem ini memiliki akurasi yang cukup tinggi untuk menentukan jika buzzer harusnya mati atau nyalah. Ini menunjukkan bahwa sistem ini mampu membuat keputusan berdasarkan data yang diterima, yang tentunya sangat penting dalam konteks otomatisasi dan kecerdasan buatan. Keempat, sensor yang digunakan dalam sistem ini dapat memberikan angka dengan baik. Ini berarti bahwa sistem ini mampu mengumpulkan data dari lingkungan sekitar dengan akurasi yang tinggi, yang tentunya sangat penting dalam konteks pengumpulan data dan analisis.

Dengan demikian, dapat disimpulkan bahwa sistem monitoring ini telah berhasil dikembangkan dan diuji dengan baik. Meskipun masih ada ruang untuk peningkatan dan optimasi lebih lanjut, hasil pengujian ini menunjukkan bahwa sistem ini sudah berada di jalur yang benar. Diharapkan dengan pengembangan lebih lanjut, sistem ini dapat memberikan manfaat yang lebih besar lagi bagi penggunanya.

10.3 Kesimpulan Pengujian Verification System

Dari hasil pengujian yang telah dilakukan, kita dapat menarik beberapa kesimpulan penting. Pertama, sistem verifikasi yang telah dikembangkan dapat berjalan dengan baik. Ini berarti bahwa sistem ini mampu melakukan verifikasi dengan akurasi yang tinggi, yang tentunya sangat penting dalam konteks keamanan. Kedua, LCD yang digunakan dalam sistem ini dapat menampilkan data dengan baik. Ini berarti bahwa informasi yang disajikan kepada pengguna dapat ditampilkan dengan jelas dan mudah dibaca. Hal ini tentunya sangat penting untuk memastikan bahwa pengguna dapat memahami informasi yang disampaikan oleh sistem.

Ketiga, servo dalam sistem ini dapat bergerak untuk membuka saat terjadi fingerprint matching. Ini menunjukkan bahwa mekanisme pembukaan yang digunakan dalam sistem ini dapat berfungsi dengan baik. Hal ini tentunya sangat penting untuk memastikan bahwa akses dapat diberikan dengan cepat dan efisien saat verifikasi berhasil. Keempat, sistem registrasi juga berjalan dengan baik. Ini berarti bahwa proses pendaftaran pengguna baru dapat dilakukan dengan mudah dan cepat. Hal ini tentunya sangat penting untuk memastikan bahwa sistem ini dapat digunakan oleh sebanyak mungkin pengguna.

Kelima, MQTT broker yang digunakan dalam sistem ini dapat bekerja dengan baik untuk subscriber dan broker. Ini berarti bahwa komunikasi antara berbagai komponen dalam sistem dapat berjalan dengan lancar. Hal ini tentunya sangat penting untuk memastikan bahwa sistem dapat beroperasi dengan efisien. Dengan demikian, dapat disimpulkan bahwa sistem ini telah berhasil dikembangkan dan diuji dengan baik. Tentunya masih ada ruang untuk peningkatan dan optimasi lebih lanjut, namun hasil pengujian ini menunjukkan bahwa sistem ini sudah berada di jalur yang benar. Diharapkan dengan pengembangan lebih lanjut, sistem ini dapat memberikan manfaat yang lebih besar lagi bagi penggunanya.

10.4 Kesimpulan Evaluasi Pameran

Dari Pameran yang diadakan pada Tanggal 5/10/24, form evaluasi mendapatkan 33 respons dan dari situ ada berbagai macam kesan dan saran untuk proyek W.I.S.E ini. Kebanyakan response dari pengunjung adalah positif saat ditanya tentang kegunaan dan keunikan. Ada beberapa saran untuk menambahkan fitur sensor lain karena ruang operasi memerlukan monitoring yang lebih daripada hanya humiditas, temperature dan kualitas udara.

10.5 Aspek Keberlanjutan

Untuk kedepanya, Sistem ini dapat diintegrasikan dengan sistem manajemen rumah sakit yang ada untuk memungkinkan pemantauan dan pengelolaan yang lebih efisien dari ruangan operasi dan staf medis. Selain itu, keamanan data adalah aspek penting dalam sistem semacam ini. Maka dari itu, peningkatan pada enkripsi data dan otentikasi pengguna dapat dilakukan untuk memastikan bahwa data pasien dan informasi lainnya tetap aman. Dan meskipun sensor yang digunakan sudah cukup baik, ada kemungkinan untuk menggunakan sensor yang lebih canggih atau akurat untuk memantau kondisi ruangan.

11. DAFTAR PUSTAKA

Youtube:

How To Electronics. 2019. IoT Based Biometric Fingerprint Attendance System with NodeMCU ESP8266.

Innovation Electronics. 2019. Portable IoT based fingerprint biometric attendance system using NodeMCU.

Paper:

Idhom, M.; Purbasari, I.Y.; Fauzi, A. and Mas Diyasa, I.G.S.. 2021. IoT-Based Portable Fingerprint Attendance System Using the Minutiae Based Algorithm.

Khan, A. K., Shaem, T. A., Rahman, M., Khan, A. Z., & Alamgir, M. S. 2018.A Portable and Less Time Consuming Wireless Biometric Attendance System for Academic Purpose Using NodeMCU Microcontroller

https://newbiely.com/tutorials/esp8266/esp8266-gas-sensor

AI yang digunakan:

ChatGPT: https://chatgpt.com

AI ini digunakan untuk menyusun kata-kata dalam bagian pendahuluan proyek dan penjelasan singkat.

Copilot: https://copilot.microsoft.com/

AI ini digunakan untuk membuat kesimpulan dan untuk penjelasan sistem juga.

Gemini AI: https://gemini.google.com/

AI ini digunakan untuk menyusun kata dalam analisis percobaan.

Flux AI: https://www.flux.ai/

AI ini digunakan untuk menolong dalam desain PCB dan juga sebagai contoh outline.

12. LAMPIRAN

KODE SIMULASI NODE-RED:

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PRESSURE","active":false,"tosidebar":true,"console":false,"tostatus":false,"complete":"payload","targetType":"msg","statusVal":"","statusType":"auto","x":860,"y":820,"wires":[]},{"id":"d2103396ee93e111","type":"ui_chart","z":"71c591fa6f110faa","name":"","group":"6f2faec1ee1d5238","order":27,"width":0,"height":0,"label":"AIR PRESSURE CHART","chartType":"line","legend":"false","xformat":"HH:mm:ss","interpolate":"linear","nodata":"","dot":false,"ymin":"","ymax":"","removeOlder":1,"removeOlderPoints":"100","removeOlderUnit":"3600","cutout":0,"useOneColor":false,"useUTC":false,"colors":["#1f77b4","#aec7e8","#ff7f0e","#2ca02c","#98df8a","#d62728","#ff9896","#9467bd","#c5b0d5"],"outputs":1,"useDifferentColor":false,"className":"","x":1170,"y":840,"wires":[[]]},{"id":"347d65152b02f250","type":"comment","z":"71c591fa6f110faa","name":"SISTEM VERIFIKASI","info":"","x":180,"y":1180,"wires":[]},{"id":"06694063ef9115c9","type":"file in","z":"71c591fa6f110faa","name":"","filename":"S:\\\Uni_stuff\\\Semester_6\\\Arsitektur_IOT\\\PROYEK\\\user_database.csv","filenameType":"str","format":"utf8","chunk":false,"sendError":false,"encoding":"none","allProps":false,"x":550,"y":1260,"wires":[["8285eabfbf8eeee3"]]},{"id":"062916b56dfb5a23","type":"change","z":"71c591fa6f110faa","name":"","rules":[{"t":"set","p":"payload","pt":"msg","to":"VERIFIED","tot":"str"}],"action":"","property":"","from":"","to":"","reg":false,"x":1080,"y":1200,"wires":[["078a60bb60451e8c","eb6b59ff3fb63d46"]]},{"id":"f34143e537e3c110","type":"inject","z":"71c591fa6f110faa","name":"","props":[{"p":"payload"}],"repeat":"1","crontab":"","once":true,"onceDelay":0.1,"topic":"","payload":"","payloadType":"str","x":130,"y":1260,"wires":[["06694063ef9115c9"]]},{"id":"8285eabfbf8eeee3","type":"switch","z":"71c591fa6f110faa","name":"","property":"payload","propertyType":"msg","rules":[{"t":"cont","v":"check_data","vt":"flow"},{"t":"else"}],"checkall":"true","repair":false,"outputs":2,"x":890,"y":1260,"wires":[["062916b56dfb5a23"],["9679dcdbb1ec23e6"]]},{"id":"9679dcdbb1ec23e6","type":"change","z":"71c591fa6f110faa","name":"","rules":[{"t":"set","p":"payload","pt":"msg","to":"NOT 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{"id":"d12a513f2927b87e","type":"ui_text","z":"71c591fa6f110faa","group":"c21ffe38bc7abf17","order":29,"width":0,"height":0,"name":"CURRENT HUMIDITY","label":"CURRENT HUMIDITY (%)","format":"{{msg.hum}}","layout":"row-spread","className":"","style":false,"font":"","fontSize":16,"color":"#000000","x":400,"y":1620,"wires":[]},{"id":"00019f840377457e","type":"ui_text","z":"71c591fa6f110faa","group":"c21ffe38bc7abf17","order":29,"width":0,"height":0,"name":"CURRENT AIR PRESSURE","label":"CURRENT AIR PRESSURE (kPa)","format":"{{msg.airp}}","layout":"row-spread","className":"","style":false,"font":"","fontSize":16,"color":"#000000","x":420,"y":1660,"wires":[]},{"id":"c4949087b7dd9845","type":"function","z":"71c591fa6f110faa","name":"PYNODERED","func":"var humidity = msg.hum\nvar temp = msg.temp\nvar air_pressure = msg.airp\n\nmsg.payload = [[temp,humidity,air_pressure]]\nvar delayTime = 1000;\n\nreturn msg;\n","outputs":1,"timeout":0,"noerr":0,"initialize":"","finalize":"","libs":[],"x":480,"y":1500,"wires":[["b113bafaee8fca9e"]]},{"id":"51c7677ef7ad40f8","type":"ui_text","z":"71c591fa6f110faa","group":"c21ffe38bc7abf17","order":32,"width":0,"height":0,"name":"BUZZER","label":"BUZZER","format":"{{msg.payload}}","layout":"row-spread","className":"","style":false,"font":"","fontSize":16,"color":"#000000","x":1280,"y":1500,"wires":[]},{"id":"b113bafaee8fca9e","type":"check","z":"71c591fa6f110faa","x":710,"y":1500,"wires":[["5806a60e4327adac","4cfd8399a4c42ea9"]]},{"id":"5806a60e4327adac","type":"switch","z":"71c591fa6f110faa","name":"","property":"payload","propertyType":"msg","rules":[{"t":"eq","v":"1","vt":"num"},{"t":"eq","v":"0","vt":"num"}],"checkall":"true","repair":false,"outputs":2,"x":890,"y":1500,"wires":[["e14d2346d54506db"],["e2868561c9852298"]]},{"id":"e14d2346d54506db","type":"change","z":"71c591fa6f110faa","name":"","rules":[{"t":"set","p":"payload","pt":"msg","to":"ON","tot":"str"}],"action":"","property":"","from":"","to":"","reg":false,"x":1060,"y":1440,"wires":[["51c7677ef7ad40f8"]]},{"id":"e2868561c9852298","type":"change","z":"71c591fa6f110faa","name":"","rules":[{"t":"set","p":"payload","pt":"msg","to":"OFF","tot":"str"}],"action":"","property":"","from":"","to":"","reg":false,"x":1060,"y":1560,"wires":[["51c7677ef7ad40f8"]]},{"id":"4cfd8399a4c42ea9","type":"debug","z":"71c591fa6f110faa","name":"debug 42","active":false,"tosidebar":true,"console":false,"tostatus":false,"complete":"payload","targetType":"msg","statusVal":"","statusType":"auto","x":920,"y":1600,"wires":[]},{"id":"1396e80b212a1ddf","type":"debug","z":"71c591fa6f110faa","name":"debug 43","active":false,"tosidebar":true,"console":false,"tostatus":false,"complete":"false","statusVal":"","statusType":"auto","x":1540,"y":1200,"wires":[]},{"id":"c21ffe38bc7abf17","type":"ui_group","name":"S-GUARD","tab":"0a923f52a7842d79","order":1,"disp":true,"width":"6","collapse":false,"className":""},{"id":"6f2faec1ee1d5238","type":"ui_group","name":"CHARTS","tab":"0a923f52a7842d79","order":2,"disp":true,"width":"6","collapse":false,"className":"CHARTS"},{"id":"0a923f52a7842d79","type":"ui_tab","name":"ATTENDANCE SYSTEM","icon":"dashboard","disabled":false,"hidden":false}]

KODE UI NODE-RED:

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spread","className":"","style":false,"font":"","fontSize":16,"color":"#000000","x":950,"y":360,"wires":[]},
{"id":"1968b7ca4fbc34a8","type":"mqtt
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