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APPLICATION DEVELOPMENT AND EMERGING TECHNOLOGY

IT2A CC223

TERMINAL ASSESSMENT 2

Smart Home Mini Assistant

Group 2
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Submitted to
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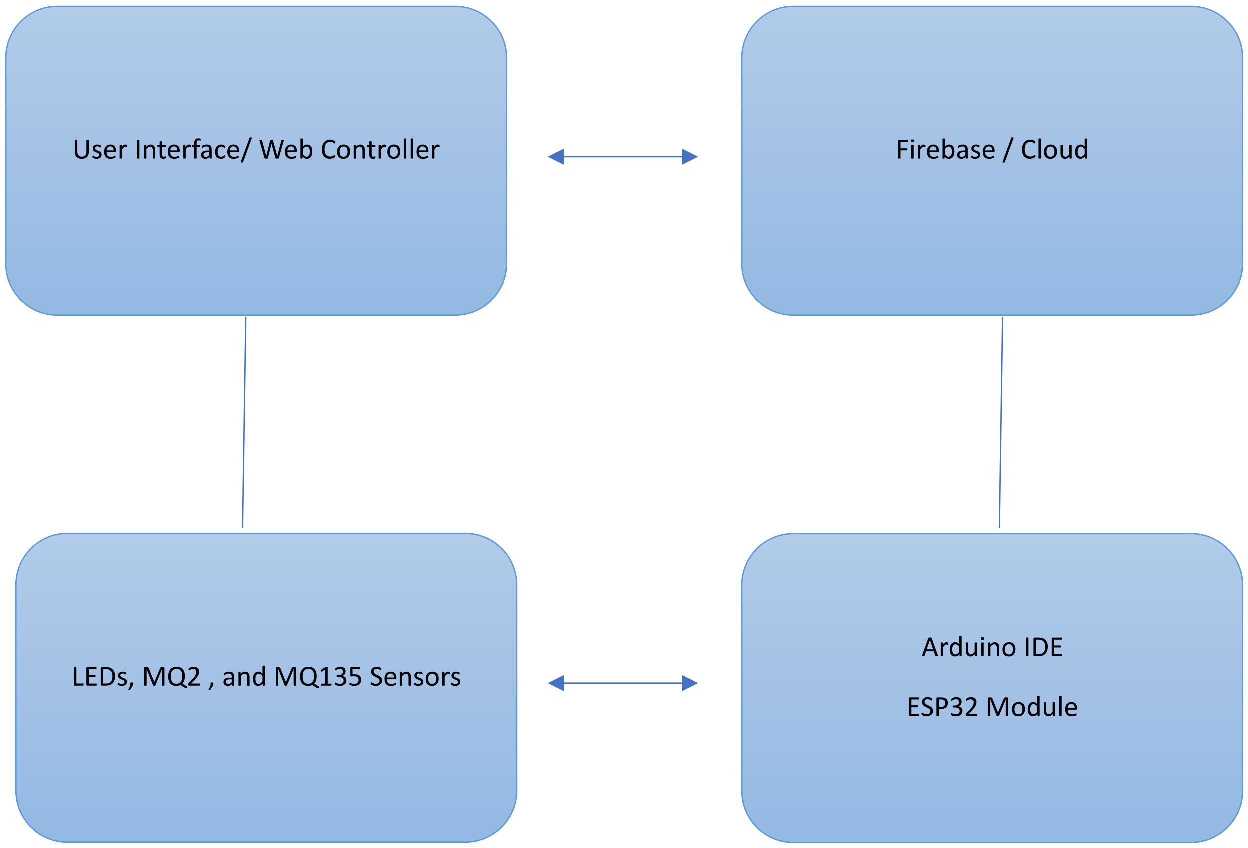
A **Smart Home Mini Assistant** that controls lighting and monitors air quality using an Internet of Things (IoT) and serverless architecture. This system provides Remote control LED Lighting, Real Time Monitoring of the gas using MQ2 sensor and air quality using MQ135 sensor. Visual status indication for air and gas quality in Web. Lastly is user friendly web interface.

For the Technology Selection we used two technologies Internet of Things (IoT) and Cloud Computing (Serverless Firebase). Internet of Things (IoT) Connects and controls physical devices such as LED lights and Sensors. For Cloud computing the purpose of that is to store and retrieve the data collected in IoT devices using Firebase Realtime Database.

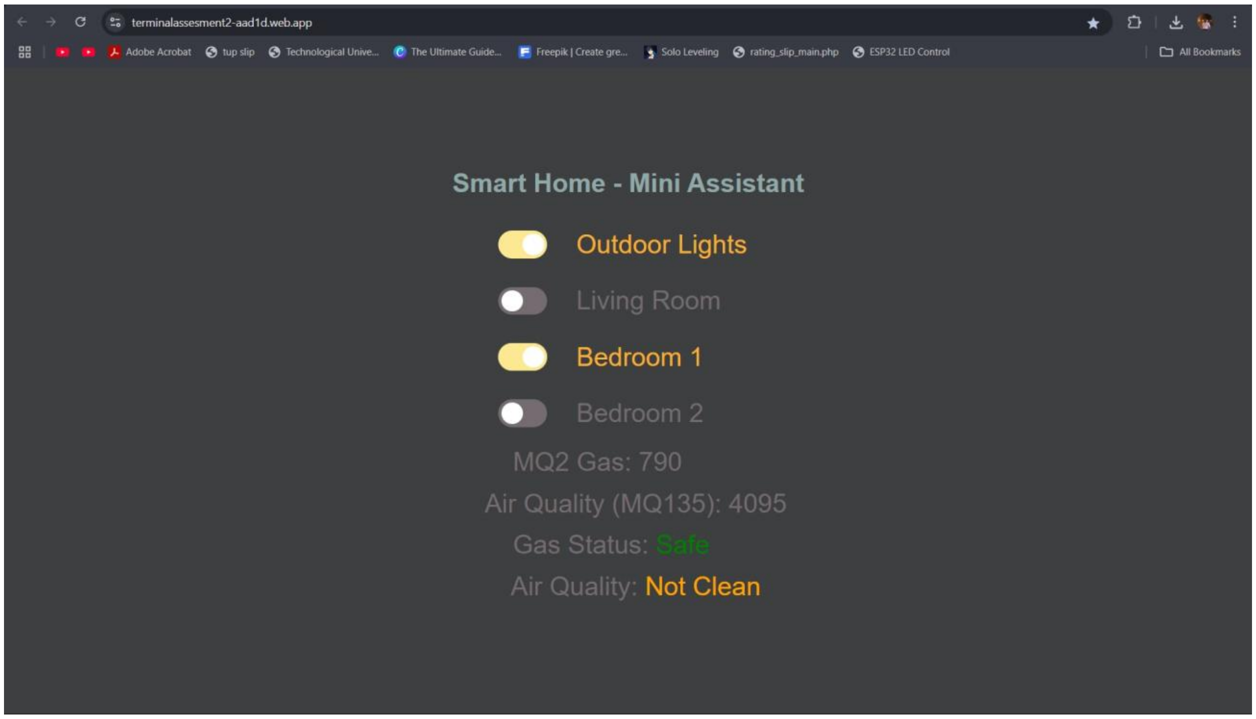
List of Tool

Tools/ Platform	Purpose
Arduino IDE	Programming module for uploading code to the ESP32
Firebase	Backend for Data storage and real syncing
LED	Lighting Device for demonstrating Lights devices on Home
MQ2	Detects the Flammable Gas
MQ135	Monitors air quality
Html/CSS	Frontend interface design



System Architecture Design

Screenshot and Code Snippets



Smart Home - Mini Assistant

Outdoor Lights

Living Room

Bedroom 1

Bedroom 2

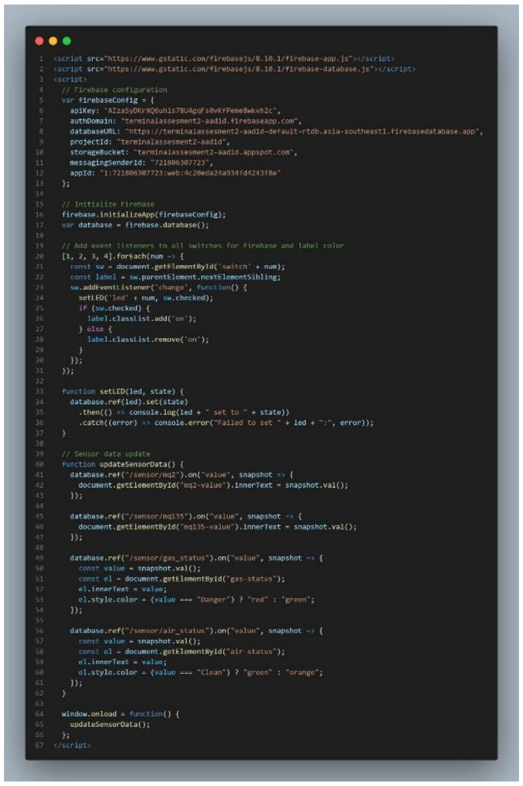
MQ2 Gas: 790

Air Quality (MQ135): 4095

Gas Status: Safe

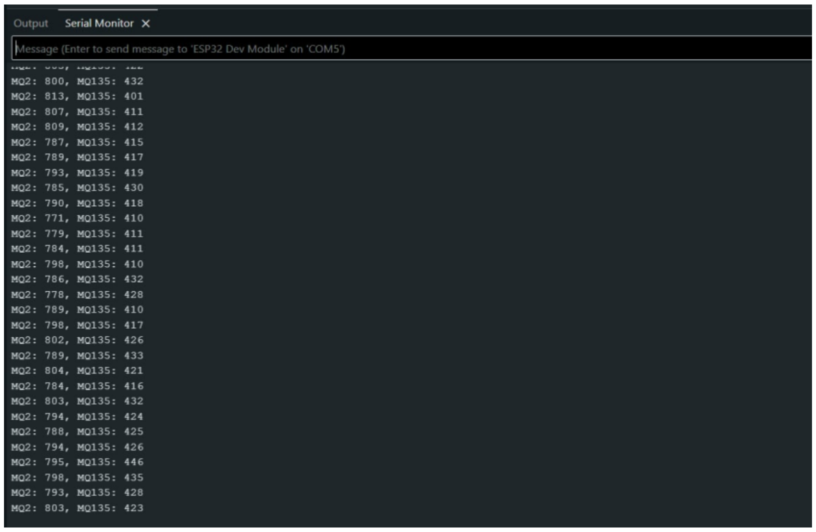
Air Quality: Not Clean

Web Controller



```html
<script src="https://www.gstatic.com/firebasejs/8.10.1/firebase-app.js"></script>
<script src="https://www.gstatic.com/firebasejs/8.10.1/firebase-database.js"></script>
<script>
  // Firebase configuration
  var firebaseConfig = {
    apiKey: "AIzaSyDKrXQ6uhls7BU4gqFs0vKfPeme8wkvh2c",
    authDomain: "terminalassesment2-aad1d.firebaseapp.com",
    databaseURL: "https://terminalassesment2-aad1d-default-rtdb.asia-southeast1.firebasedatabase.app",
    projectId: "terminalassesment2-aad1d",
    storageBucket: "terminalassesment2-aad1d.appspot.com",
    messagingSenderId: "721806307723",
    appId: "1:721806307723:web:4c20eda24a934fd4243f8e"
  };

  // Initialize Firebase
  firebase.initializeApp(firebaseConfig);
  var database = firebase.database();

  // Add event listeners to all switches for Firebase and label color
  [1, 2, 3, 4].forEach(num => {
    const sw = document.getElementById('switch' + num);
    const label = sw.parentElement.nextElementSibling;
    sw.addEventListener('change', function() {
      setLED('led' + num, sw.checked);
      if (sw.checked) {
        label.classList.add('on');
      } else {
        label.classList.remove('on');
      }
    });
  });

  function setLED(led, state) {
    database.ref(led).set(state)
      .then(() => console.log(led + " set to " + state))
      .catch((error) => console.error("Failed to set " + led + ":", error));
  }

  // Sensor data update
  function updateSensorData() {
    database.ref("/sensor/mq2").on("value", snapshot => {
      document.getElementById("mq2-value").innerText = snapshot.val();
    });

    database.ref("/sensor/mq135").on("value", snapshot => {
      document.getElementById("mq135-value").innerText = snapshot.val();
    });

    database.ref("/sensor/gas_status").on("value", snapshot => {
      const value = snapshot.val();
      const el = document.getElementById("gas-status");
      el.innerText = value;
      el.style.color = (value === "Danger") ? "red" : "green";
    });

    database.ref("/sensor/air_status").on("value", snapshot => {
      const value = snapshot.val();
      const el = document.getElementById("air-status");
      el.innerText = value;
      el.style.color = (value === "Clean") ? "green" : "orange";
    });
  }

  window.onload = function() {
    updateSensorData();
  };
</script>
```

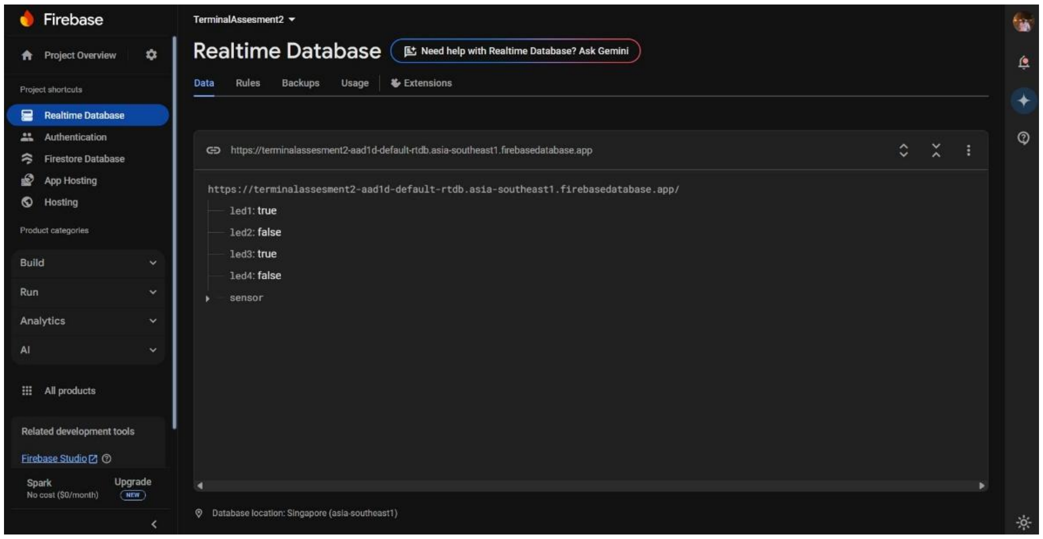
Code Snippet



Output
Serial Monitor
Message (Enter to send message to 'ESP32 Dev Module' on 'COM5')

```
MQ2: 800, MQ135: 432
MQ2: 813, MQ135: 401
MQ2: 807, MQ135: 411
MQ2: 809, MQ135: 412
MQ2: 787, MQ135: 415
MQ2: 789, MQ135: 417
MQ2: 793, MQ135: 419
MQ2: 785, MQ135: 430
MQ2: 790, MQ135: 418
MQ2: 771, MQ135: 410
MQ2: 779, MQ135: 411
MQ2: 784, MQ135: 411
MQ2: 798, MQ135: 410
MQ2: 786, MQ135: 432
MQ2: 778, MQ135: 428
MQ2: 789, MQ135: 410
MQ2: 798, MQ135: 417
MQ2: 802, MQ135: 426
MQ2: 789, MQ135: 433
MQ2: 804, MQ135: 421
MQ2: 784, MQ135: 416
MQ2: 803, MQ135: 432
MQ2: 794, MQ135: 424
MQ2: 788, MQ135: 425
MQ2: 794, MQ135: 426
MQ2: 795, MQ135: 446
MQ2: 798, MQ135: 435
MQ2: 793, MQ135: 428
MQ2: 803, MQ135: 423
```

Serial Monitor

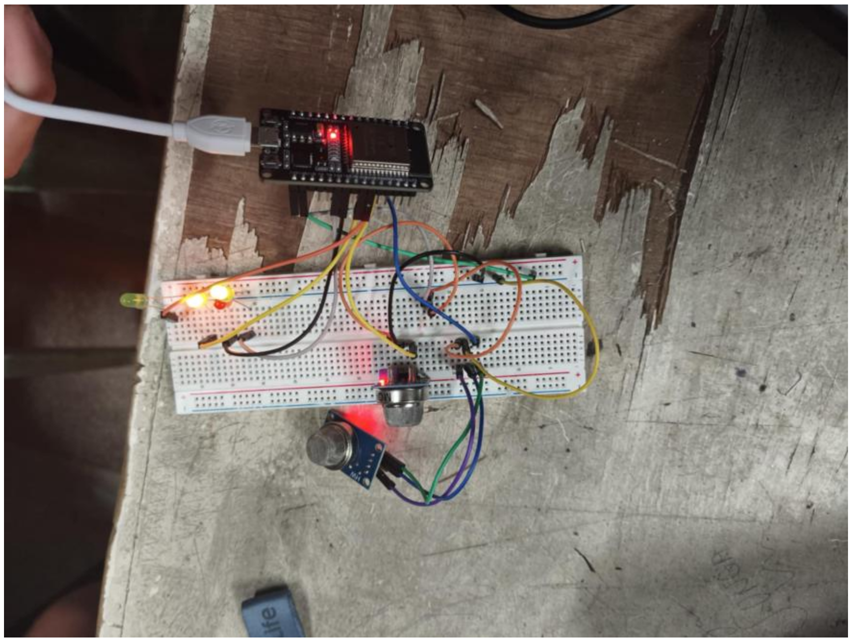


https://terminalassesment2-aad1d-default-rtdb.asia-southeast1.firebasedatabase.app

```
https://terminalassesment2-aad1d-default-rtdb.asia-southeast1.firebasedatabase.app/
  led1: true
  led2: false
  led3: true
  led4: false
▸ sensor
```

Database location: Singapore (asia-southeast1)

Firebase - Realtime Database



Picture of working IoT Devices

While doing this project we encounter a several first problem we encounter is when integrating IoT sensors and establishing a stable connection with Firebase was unfamiliar to our team. We addressed this by thoroughly researching the sensors' datasheets and learning about the proper wiring and setup procedures. This helped us understand how to correctly connect the sensors and send data to Firebase. Another Problem we encounter is the IoT device and code were not functioning as expected, causing delays and unexpected behavior during testing. Solution we identified missing dependencies and responded by installing the required libraries and board packages. This ensured compatibility and allowed successful communication between our IoT device and the Firebase Realtime Database.

References:

Saifullah, K. M. (2021, November 18). LED control over the internet(iot). Hackster.io.

https://www.hackster.io/kmsaifullah/led-control-over-the-internet-iot-68ee09

(N.d.-a). Retrieved from
https://www.researchgate.net/publication/348078218_Air_Quality_Monitoring_System_in_Thingspeak-Based_Applications_Using_Internet_of_Things_IOT