Sri Lanka Institute of Information Technology

IT1040 - Fundamentals of Computing
Year 1, Semester 1- 2025

Smart Safety Helmet

Progress Report
Group_004

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01.Introduction

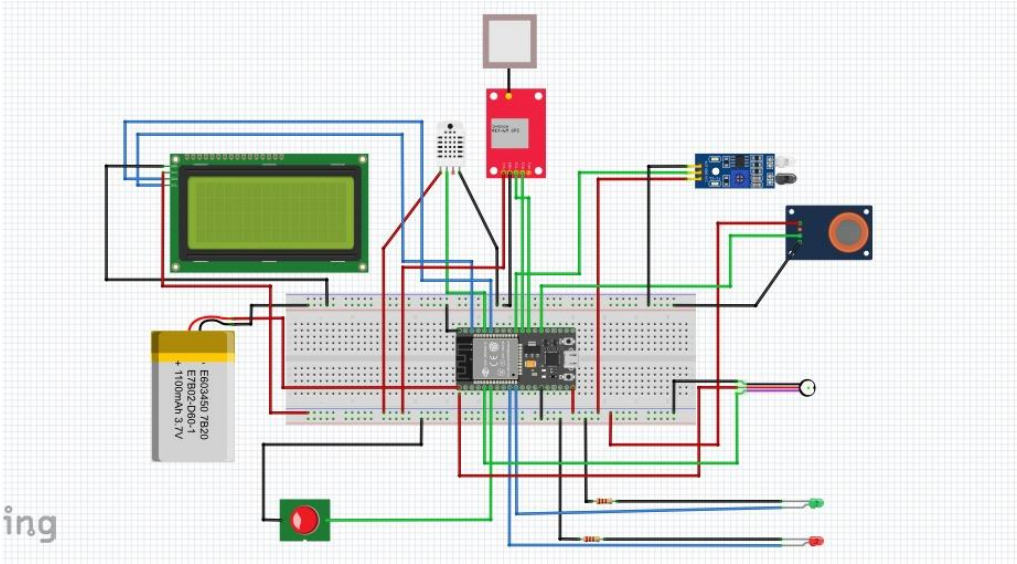
Workers in high-risk industries such as construction, heavy manufacturing, and firefighting are constantly exposed to invisible hazards. Toxic gas leaks, excessive heat, poor air quality, and sudden medical emergencies can occur without warning. Conventional safety gear is important, but it only reacts after something bad happens by then, it is often too late to prevent serious harm.

The Smart Safety Helmet project aims to bridge this gap by providing proactive, real-time monitoring of both environmental conditions and worker health. The system integrates multiple sensors to track vital information such as heart rate, helmet-wear status, air quality, and temperature humidity levels. A GPS module enables precise worker location tracking in the event of an emergency. All data is processed by an ESP32 microcontroller, which reacts instantly by activating local alerts including buzzers, status LEDs, and an LCD display while simultaneously transmitting information to an online dashboard for supervisors.

By detecting abnormal conditions early such as elevated pulse rate, exposure to harmful gases, unsafe heat levels, or a worker not wearing the helmet the Smart Safety Helmet reduces the risk of unnoticed incidents and improves emergency response times. This approach transforms the helmet from a passive safety item into an intelligent protective device designed for real-world industrial environments.

Currently, the sensors have been tested individually, with some combined tests (DHT22 and IR sensor) already performed. Calibration and verification of sensor readings are ongoing to ensure accuracy before the final integration of all sensors with the ESP32.

02.System Architecture



We use multiple input sensors:

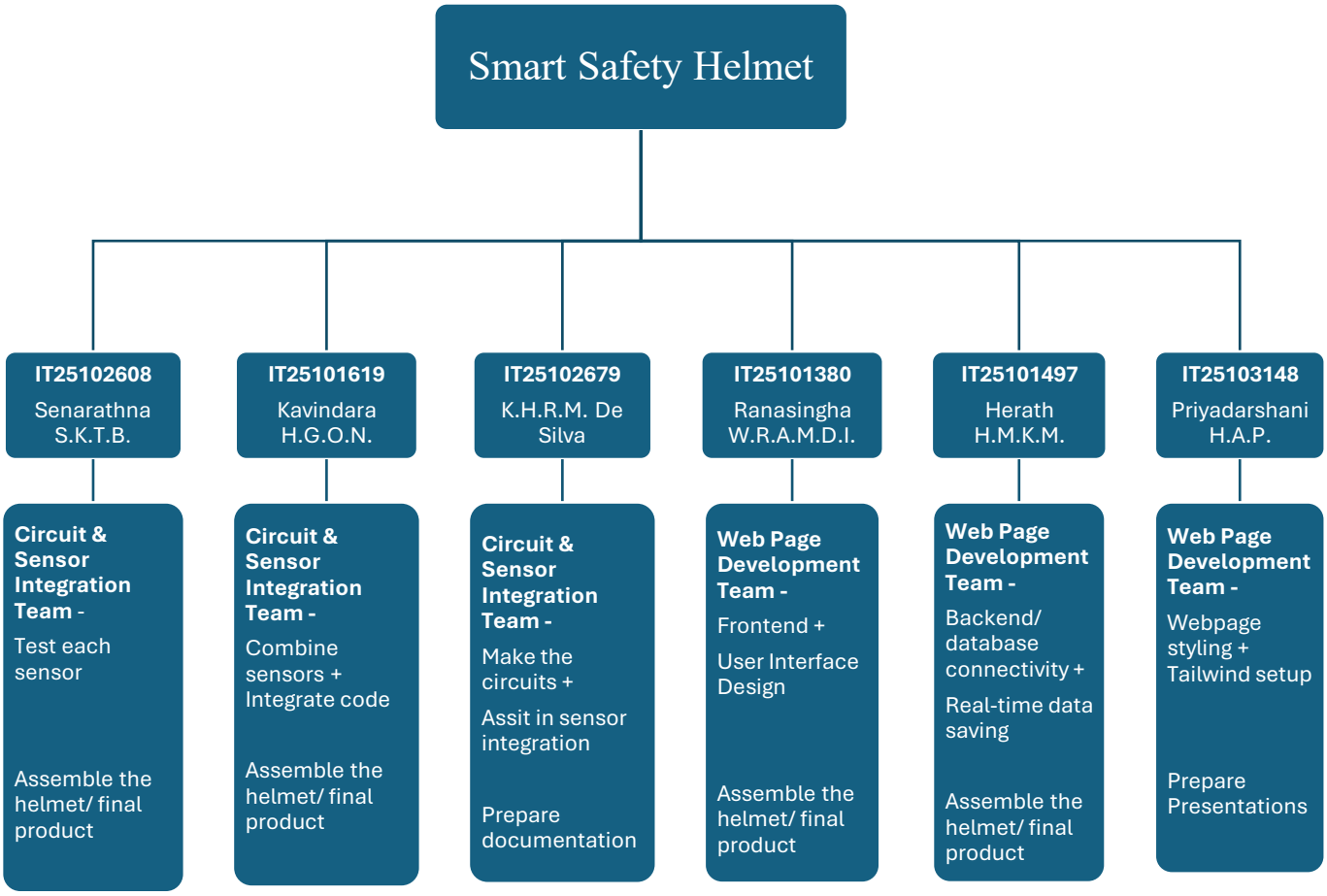
- **IR sensor** – confirms the helmet is worn
- **Pulse sensor** – monitors heart rate for abnormalities
- **MQ135** – monitors air quality and detects harmful gases
- **DHT22** – measures temperature and humidity
- **GPS module** – tracks the worker's location

All sensors are connected to an **ESP32 microcontroller**, which processes the data in real time. When a hazard is detected, such as high pulse rate, poor air quality, excessive heat, or helmet not worn, the helmet will:

- Activate a **buzzer** for critical alerts
- Flash **red LEDs** for danger or **green LEDs** when conditions are safe
- Display live sensor values on the **LCD screen**
- Send alerts to supervisors via an **IoT dashboard**

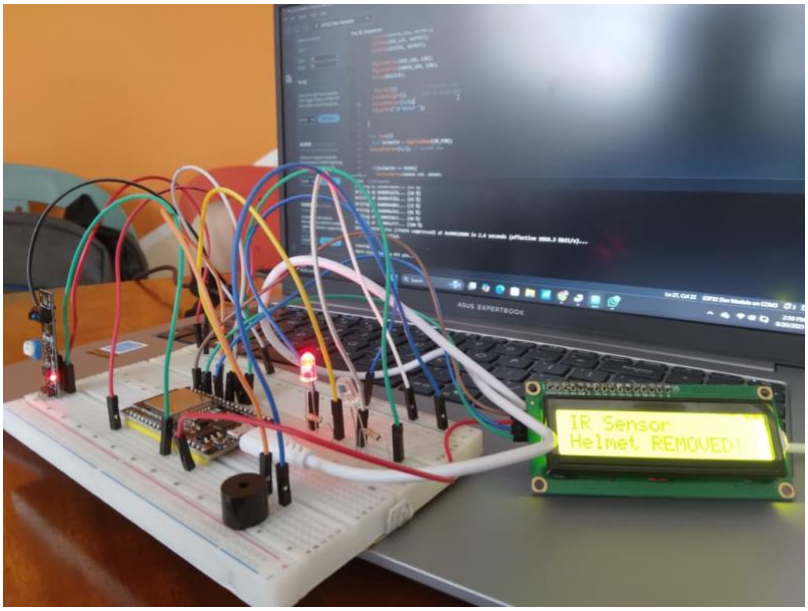
Each sensor is being calibrated and tested to ensure accurate and reliable readings before full integration. The system is powered by **two 3.7V batteries**, providing sufficient voltage and runtime to operate the helmet during testing. All components are designed to fit within a standard helmet casing, keeping the system fully wearable and reactive.

03.Work Breakdown Structure

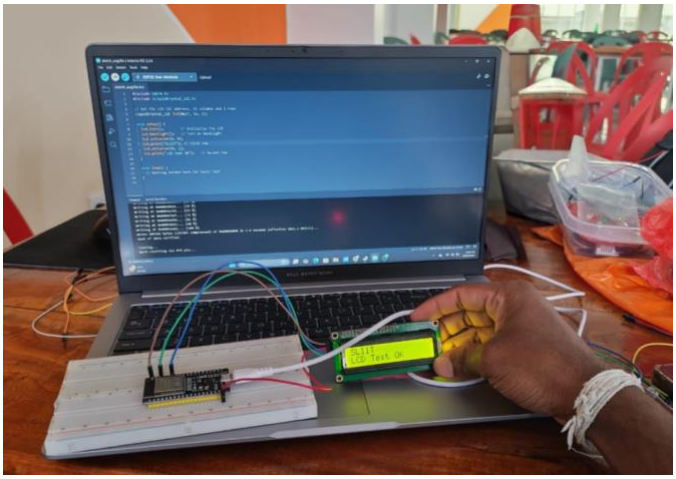


All members coordinate regularly to integrate hardware and software components and ensure that testing and documentation are up to date.

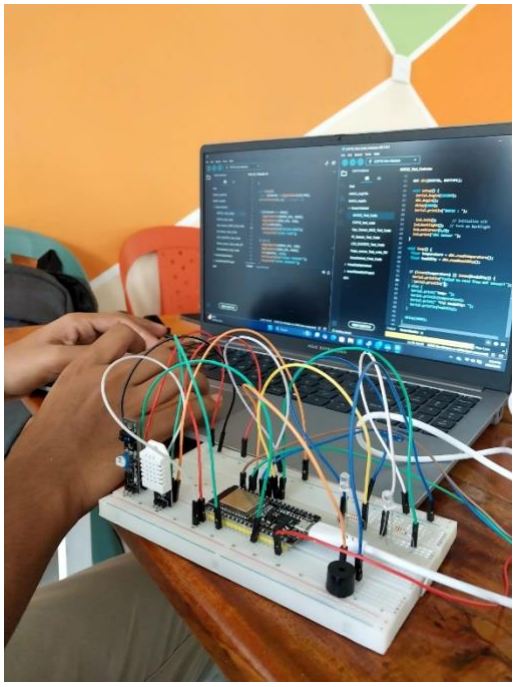
04.Proof of Work



- **IT25102608**

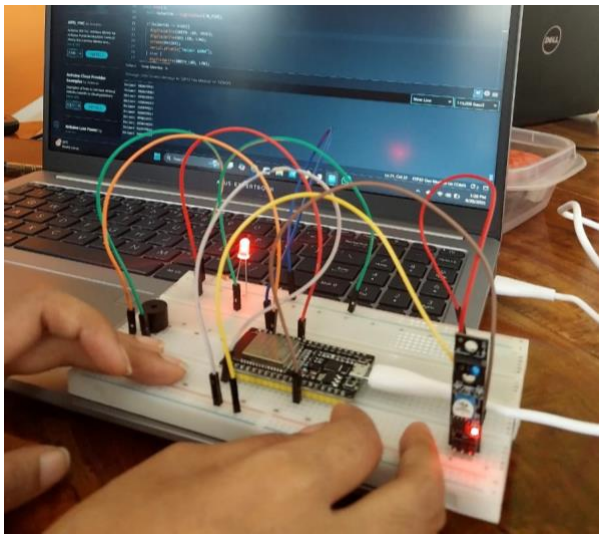


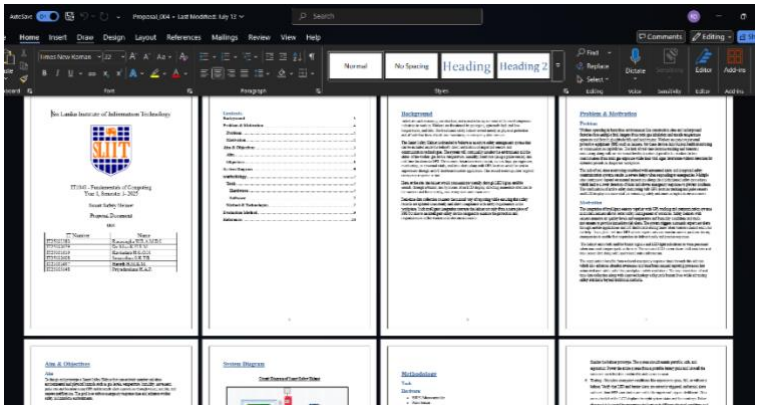
- **IT25101619**



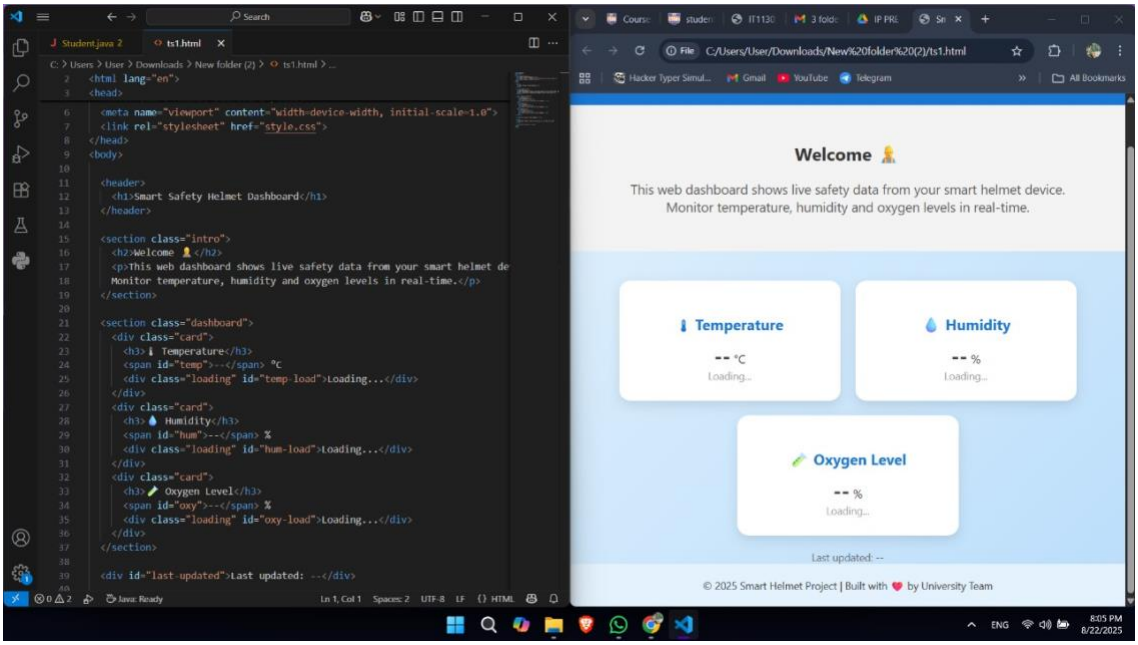
```
Test_DHT22_IR.ino
34    lcd.backlight();
35    lcd.setCursor(0,0);
36    lcd.print("dht Sensor ");
37
38  }
39
40  void loop() {
41   delay(2000);
42
43   bool helmetOn = (digitalRead(IR_PIN) == LOW);
44   float temp = dht.readTemperature();
45   float hum = dht.readHumidity();
46
47   if(isnan(temp) || isnan(hum)){
48    Serial.print("Failed to read from DHT22!");
49    temp = 0; hum = 0;
50    lcd.print("error");
51    }
52
53   Serial.print ("Helmet:"); Serial.print(helmetOn ? "on" : "OFF");
54   Serial.print ("| Temp:"); Serial.print(temp); Serial.print("*C");
Output   Serial Monitor
```

- **IT25102679**

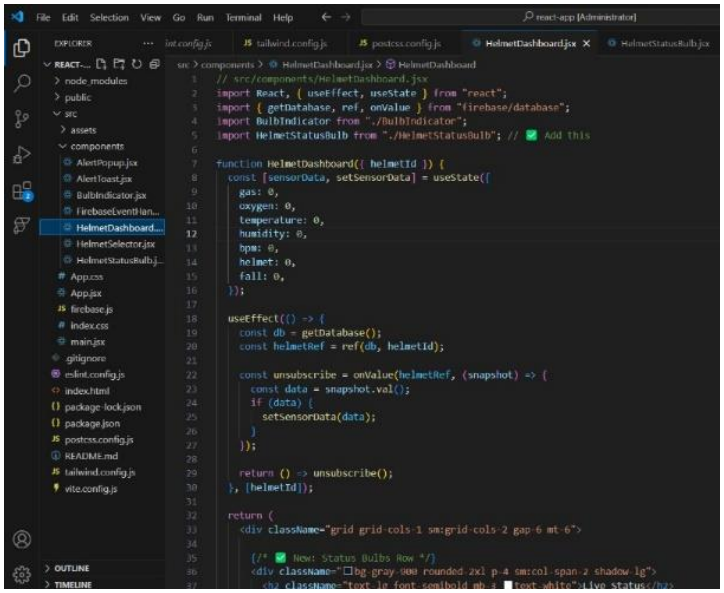


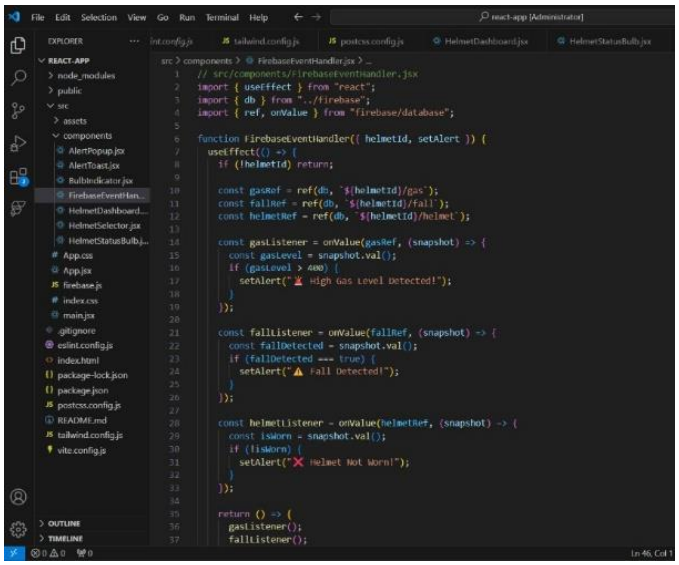


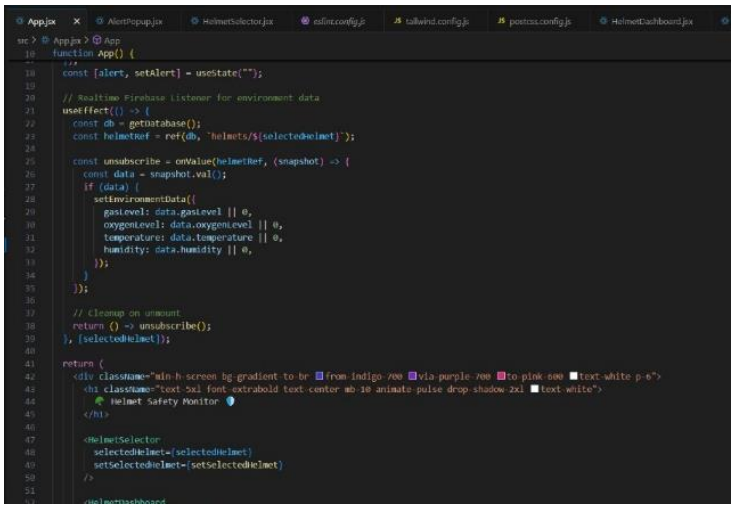
- **IT25101380**



- **IT25101497**

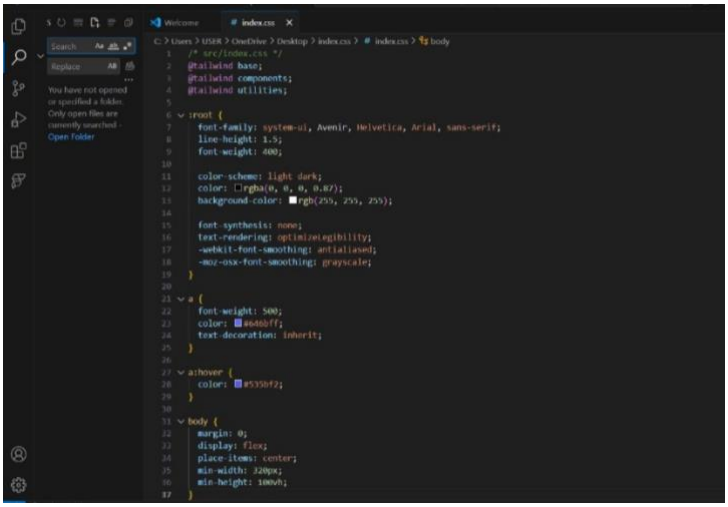


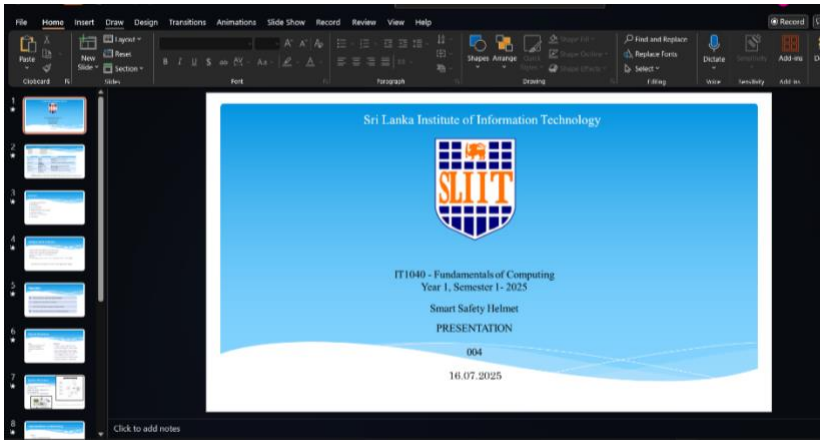



App.jsx
AlertPopup.jsx
HelmetSelector.jsx
eslint.config.js
tailwind.config.js
postcss.config.js
HelmetDashboard.jsx
src > App.jsx > App
function App() {
const [alert, setAlert] = useState("");
// Realtime Firebase listener for environment data
useEffect(() => {
const db = getDatabase();
const helmetRef = ref(db, `helmets/${selectedHelmet}`);
const unsubscribe = onValue(helmetRef, (snapshot) => {
const data = snapshot.val();
if (data) {
setEnvironmentData({
gasLevel: data.gasLevel || 0,
oxygenLevel: data.oxygenLevel || 0,
temperature: data.temperature || 0,
humidity: data.humidity || 0,
});
}
});
// Cleanup on unmount
return () => unsubscribe();
}, [selectedHelmet]);
return (

<h1 className="text-5xl font-extrabold text-center mb-10 animate-pulse drop-shadow-2xl text-white">
Helmet Safety Monitor
</h1>
<HelmetSelector
selectedHelmet={selectedHelmet}
setSelectedHelmet={setSelectedHelmet}
/>

- **IT25103148**


Welcome
index.css
C: > Users > USER > OneDrive > Desktop > index.css > # index.css > body
/* src/index.css */
@tailwind base;
@tailwind components;
@tailwind utilities;
:root {
font-family: system-ui, Avenir, Helvetica, Arial, sans-serif;
line-height: 1.5;
font-weight: 400;
color-scheme: light dark;
color: rgba(0, 0, 0, 0.87);
background-color: rgb(255, 255, 255);
font-synthesis: none;
text-rendering: optimizeLegibility;
-webkit-font-smoothing: antialiased;
-moz-osx-font-smoothing: grayscale;
}
a {
font-weight: 500;
color: #646bff;
text-decoration: inherit;
}
a:hover {
color: #535bf2;
}
body {
margin: 0;
display: flex;
place-items: center;
min-width: 320px;
min-height: 100vh;
}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PRESENTATION
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