

Industrial Fire Safety System

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What does it do?

1 Definition

An industrial fire safety system equipped with IoT technology for remote monitoring, detection, and automation.

2 IoT Importance

IoT provides the ability to connect the fire safety system to the internet for real-time data sharing, remote monitoring, and automated responses to enhance safety and prevent industrial fire hazards.



Benefits of an IoT-Enabled Industrial Fire Safety System

1

Real-Time Monitoring

Continuously monitor fire risks in real-time to ensure early detection and response.

2

Automated Alerts

Set up automated alerts to notify personnel instantly in case of fire hazards, reducing response time.

3

Remote Control

Remotely control safety measures, including activating ventilation, to prevent fire spread and damage

Components used in the project

NodeMCU ESP8266

Development board used as the main controller for the project.

MQ-5 Gas Sensor

A sensor used to measure the gas/smoke levels.

IR Flame Sensor Module

A sensor used to detect infrared radiation from flames, enabling early fire detection in industrial environments.

Servo Motor

A motor used to control the ventilation mechanism, deploying vents or shutters in response to fire detection.

Jumper wires & Breadboard

Used for connecting and arranging electronic components during prototyping.

Buzzer Module

Used to emit audible alerts in response to fire detection, warning personnel of potential hazards.

REES52 IR Sensor

Used to detect infrared radiation, enabling early fire detection in industrial environments.



1

Building the Circuit

Step-by-step guide to building and testing the circuit.

2

Programming the Circuit

Writing the code and programming the circuit using the Arduino IDE.

3

Testing

Testing all the components and calibrating them.

Working of the module

Gas Sensor: Detects hazardous gases, such as smoke or carbon monoxide, triggering alerts for immediate action.

Servo Motor: Controls ventilation mechanisms, such as deploying vents or shutters, in response to fire detection.

Flame Sensor: Detects infrared radiation from flames, enabling early fire detection and triggering safety protocols.

Proximity Sensor: Monitors the presence and movement of objects within a specific range, enhancing safety and automated responses

Working of the module contd.

Buzzer: Activates to provide audible alerts in response to critical events, such as fire detection or hazardous gas levels, ensuring immediate attention and action.

Servo Motor: Controls ventilation mechanisms or other automated features, such as deploying vents or shutters, based on sensor inputs to maintain safety and optimal conditions.

Softwares and services used

Firestore

Real-time data collection, storage, and visualization of sensor data, with capabilities for notifications and data management.

Arduino IDE

Programming and controlling microcontrollers like the NodeMCU and servo motor to automate various tasks and monitor sensors.

Protocols used

Firestore Database uses **HTTP** and **WebSocket** protocols for real-time data synchronization. These protocols facilitate the transfer and updating of sensor data, enabling dynamic data interaction and real-time updates on the hosted website.

Firestore SDK supports data communication and integration, allowing seamless interaction between the Firestore Database and the hosted website, providing a smooth user experience and live data display.

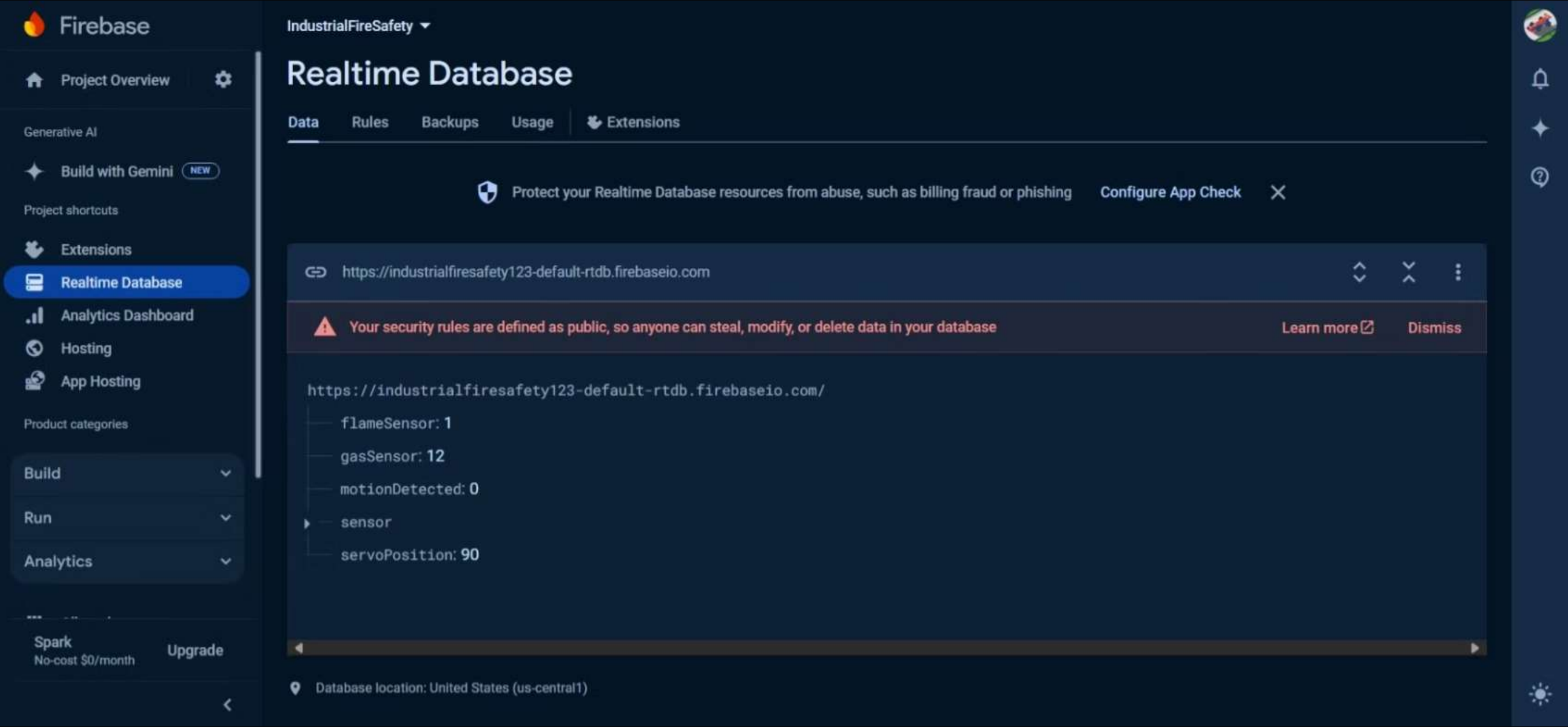
Protocols used contd.

Our industrial fire safety project utilizes Firebase Realtime Database and Firebase SDK for real-time data management and website hosting. The NodeMCU's Wi-Fi connectivity and Internet Protocol (IP) facilitate data transmission from sensors to Firebase, where it is stored and updated in real-time.

Firebase uses HTTP and WebSocket protocols to handle real-time data synchronization. HTTP is used for standard data requests and updates, while WebSocket enables continuous, bidirectional communication for live data updates. This ensures that the sensor data is consistently updated and displayed on the hosted website.

Firebase SDK integrates with the Firebase Realtime Database to support seamless data interaction and real-time updates. This setup allows us to efficiently monitor and analyze data, providing a reliable and interactive interface for managing the fire safety system.

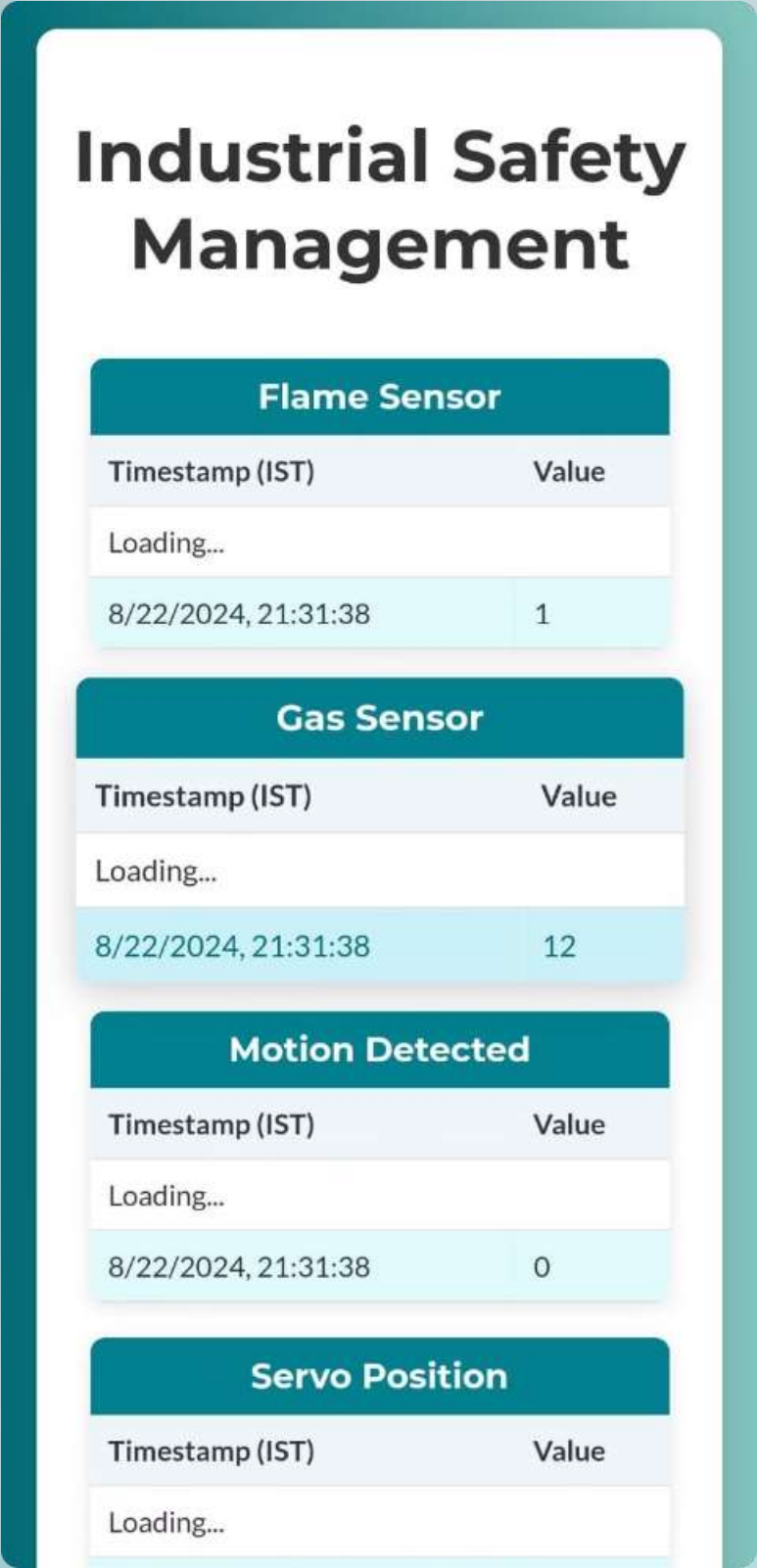
Firebase Console



Database website using HTML CSS

The industrial fire safety management system employs gas/smoke, flame, and proximity sensors to monitor potential fire hazards. Sensor data is processed and stored in Firebase, which also hosts the web interface. Using HTML and CSS, the system displays real-time data, allowing for immediate monitoring and quick response to fire threats, ensuring enhanced safety and compliance in industrial settings

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Challenges

Sensor Calibration: Ensuring accurate sensor readings, such as those from flame sensors, smoke/gas sensors, and proximity sensors, required meticulous calibration to avoid false alarms or missed detections.

Network Connectivity: Establishing reliable Wi-Fi connections in industrial environments posed challenges due to potential signal interference and range limitations, critical for real-time monitoring.

Complex Data Integration: Integrating multiple sensors, microcontrollers, and online services added complexity to data flow and synchronization, necessitating a robust architecture for seamless operation.

Power Management: Implementing power-efficient solutions, including backup power, was vital to ensure uninterrupted operation, especially during emergencies.

Security Measures: Protecting the integrity and privacy of data was crucial, demanding strong security measures to prevent unauthorized access and ensure reliable operation.

Maintenance and Support: Providing ongoing maintenance and support for the system was essential to ensure long-term reliability and effectiveness, particularly in preventing and responding to fire hazards.

Conclusion

By incorporating IoT technology into your industrial fire safety system, you gain the advantages of real-time monitoring, automated response, and enhanced safety measures. The potential for the future of smart fire safety systems with IoT is vast, offering unparalleled protection and peace of mind.

Thank you