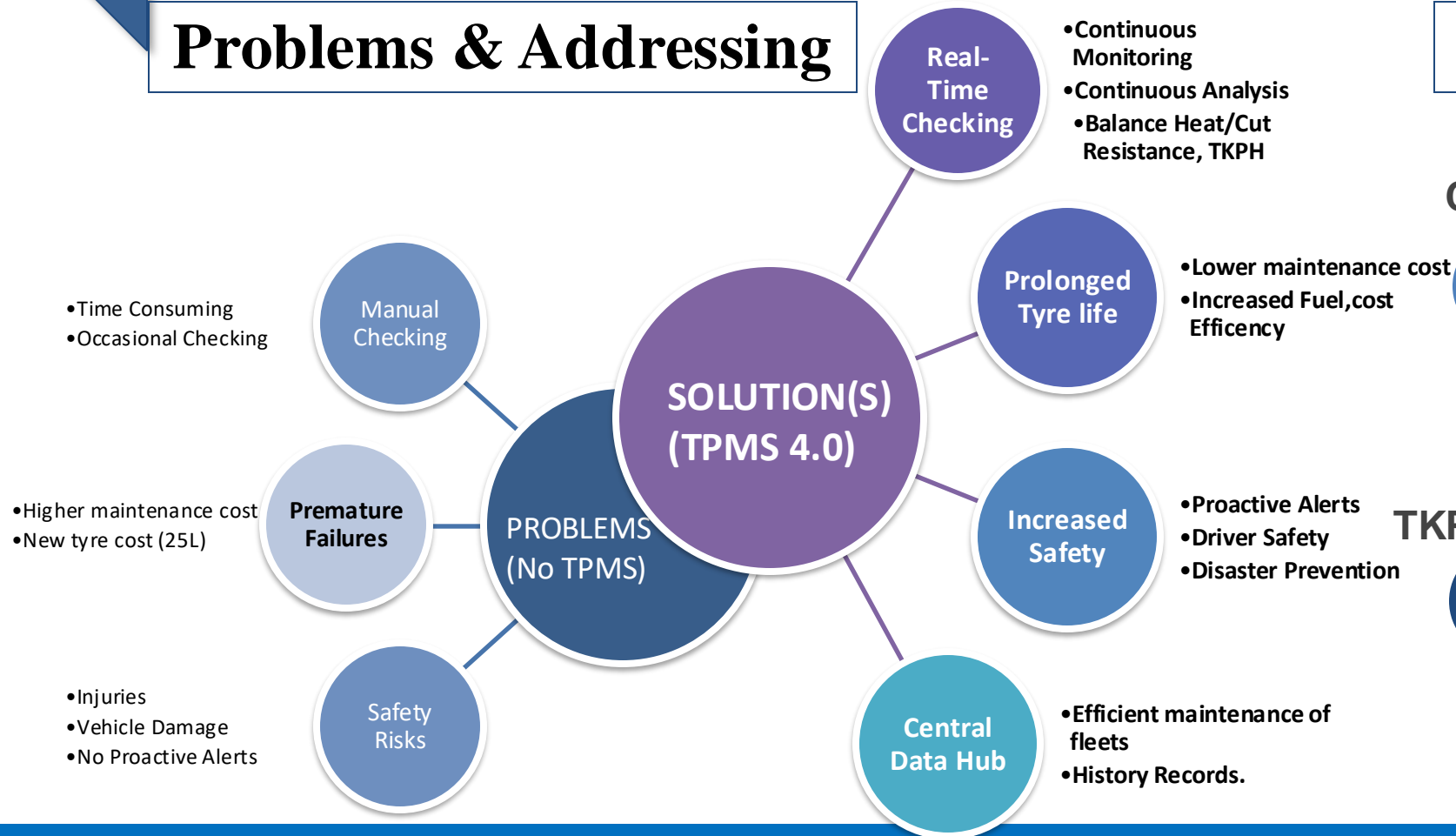


## TITLE PAGE

- Problem Statement ID – SIH1557
- Problem Statement Title - Development of Tyre Maintenance and Operation App, including fitment of necessary IIoT related hardware in Dumpers
- Theme - Smart Automation
- PS Category - Hardware
- Team ID - 7776
- Team Name (Registered on portal) - GIGABIT

Deploy IIoT sensors and a specialized app for **real-time monitoring of TKPH and tyre pressure**, integrated with **centralized data analysis for tracking performance and managing costs**. Implement **proactive alerts and actionable insights**, and ensure smooth integration with **existing systems**, alongside thorough training for **effective utilization and continuous enhancement**.

## Problems & Addressing



## INNOVATION

### Compatibility

01

Android Application

02

### Central Data

Centralized Database

03

### TKPH Inclusion

Analysis with Heat/Cut Balance

04

### Low Cost

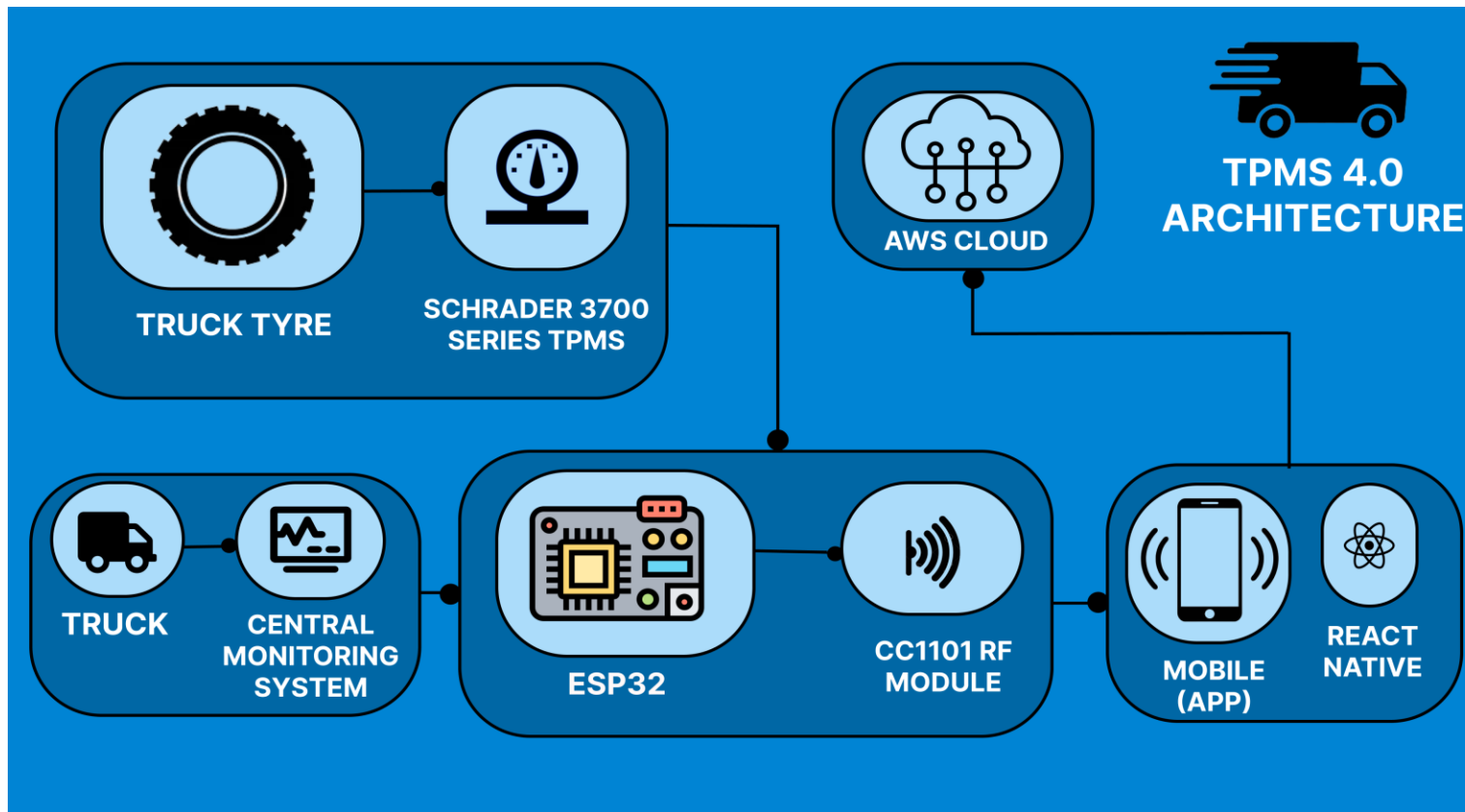
0.7% of all Tyre Cost

\*Check last page for Prototype links

Programming languages : Embedded C, HTML, Tailwind CSS, Javascript & ReactJS

Technologies : Arduino IDE ,MIT App Inventor , Classic Bluetooth , Cloud Service provider

Hardware: Schrader 33700Series Sensor, Arduino ESP 32 SoC, CC1101 RF Module and OBD connector.



## Prototype Phases:

1 Sensor Data acquisition

2 Android App with Alert System

3 Website for centralized monitoring

4 TKPH inclusion to the above phases

**WE ARE HERE** \*Check last page for Prototype links

## Analysis of the feasibility of the idea

- ☐ **RF Compatibility:** Use an external RF module with the ESP32 to match the TPMS sensor's frequency.
- ☐ **TDMA for Data Management:** Implement TDMA to avoid data collisions from multiple sensors.
- ☐ **Low Power Operation:** ESP32 and RF module operate efficiently with low power consumption.
- ☐ **Cost-Effective Solution:** Utilize readily available components for an affordable setup (0.7% of tyres cost).
- ☐ **Durability and Signal Integrity:** Ensure robust antenna design and durable enclosure for reliable communication in harsh conditions.

## Potential challenges and Strategies for overcoming these challenges

Potential challenges	Solution
The RF signal from the TPMS Sensor can be significantly weakened by the tire and vehicle body, impacting communication.	Implementing error-correction techniques (Reed-solomon) and redundancy in the communication protocol to enhance signal reliability in the presence of interference.

## Potential impact on the target audience

- Enhanced Safety
- Operational Efficiency
- Cost Savings
- Data-Driven Decision Making
- Compliance and Reporting

Social Benefits	Economic Benefits	Environmental Benefits
<ul style="list-style-type: none"><li>• Increased Driver Safety</li><li>• Driver Comfort and Confidence</li><li>• Improved Job Satisfaction</li></ul>	<ul style="list-style-type: none"><li>• Reduced Maintenance Costs</li><li>• Fuel Efficiency</li><li>• Extended Vehicle Life</li></ul>	<ul style="list-style-type: none"><li>• Lower Emissions</li><li>• Sustainable Operations</li><li>• Efficient Resource Use</li></ul>

## PROTOTYPE LINKS:

### MASTER DOCUMENT (With All Photos) :

<https://drive.google.com/file/d/1W0S7C1oNFDIDPoMqHbE7wOuOKC7GoJlg/view>

**YOUTUBE LINK :** [https://youtu.be/09Ck3kHFj\\_I](https://youtu.be/09Ck3kHFj_I)

ANDROID APK : <https://drive.google.com/file/d/1NBDg7HxMljlUPvveWsDMD1GNm9lx97H9/view?usp=sharing>

LIVE WEBSITE : <https://sihtpms.netlify.app/>

LIVE SENSOR DATA SHEET: [https://docs.google.com/spreadsheets/d/1OcQ5n-DG\\_6Gpt6exVGyPmTBwACwZTnu8DF8ypQL8Q0E/editusp=sharing](https://docs.google.com/spreadsheets/d/1OcQ5n-DG_6Gpt6exVGyPmTBwACwZTnu8DF8ypQL8Q0E/editusp=sharing)

## Research:

### Master Research Document :

[https://docs.google.com/document/d/1nXs6kJR5QhFii0UWV7JYIMb0dhqWRqMKL\\_IV7OBEC14/edit](https://docs.google.com/document/d/1nXs6kJR5QhFii0UWV7JYIMb0dhqWRqMKL_IV7OBEC14/edit)

Schrader 3700 Series TPMS Sensor : <https://www.schradertpms.com/en-gb/our-products/heavy-duty-tpms>

CC1101 RF Module : <https://www.ti.com/lit/ds/symlink/cc1101.pdf>

ESP32 WROOM 32: [https://www.espressif.com/sites/default/files/documentation/esp32\\_technical\\_reference\\_manual\\_en.pdf](https://www.espressif.com/sites/default/files/documentation/esp32_technical_reference_manual_en.pdf)