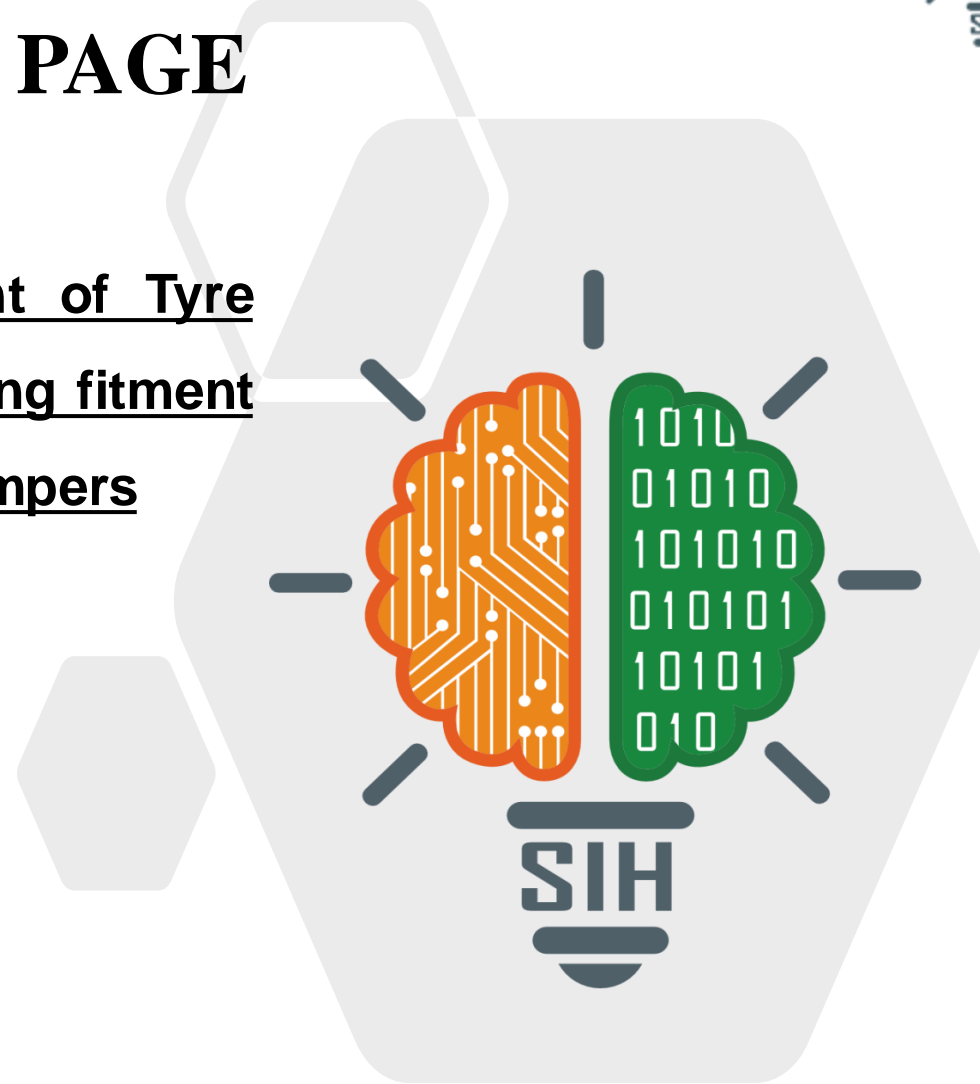


# SMART INDIA HACKATHON 2024



## 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 - 1390
- Team Name - Eureka 202





# TyreVision



Objective: Development of Tyre Maintenance and Operation App, including fitment of necessary IIoT related hardware in Dumpers.

Need: Non-biodegradable and costly, tyres significantly harm the environment and demand extensive maintenance hours.



**IoT Hardware:** TKPH Sensors track payload and speed; Tire Pressure Sensors provide real-time pressure data and alerts.  
**Mobile App:** The app offers live pressure alerts and tracks tire performance and lifespan.



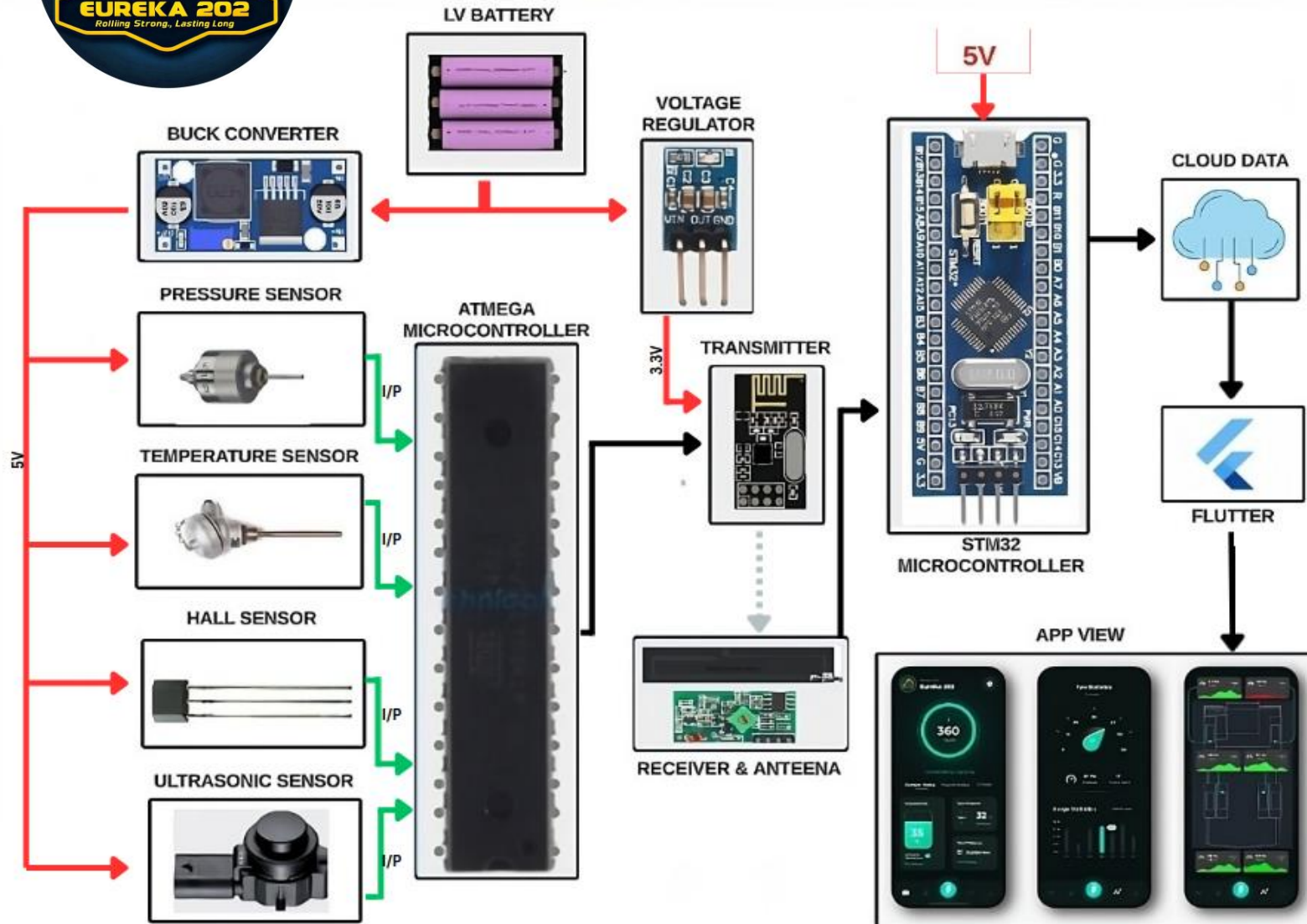
**Precision:** Accurate TKPH calculations ensure suitable tyres and improved performance.  
**Efficiency:** Real-time monitoring and alerts minimize downtime and manual checks.



## Innovation and Uniqueness

**Integrated IoT:** Combines payload, speed, and pressure monitoring with analytics in one app for comprehensive tyre management.  
**Real-Time TKPH:** Uses live data for dynamic TKPH calculations, ensuring tyres are suited for current conditions.  
**Automated Tracking:** Records and analyzes tyre performance automatically, reducing manual effort and providing insights.  
**Enhanced Alerts:** Immediate alerts for tyre pressure issues improve safety and reduce downtime.  
**Cost Insights:** Detailed analysis helps in making informed decisions on tyre procurement and maintenance.

# TECHNICAL APPROACH

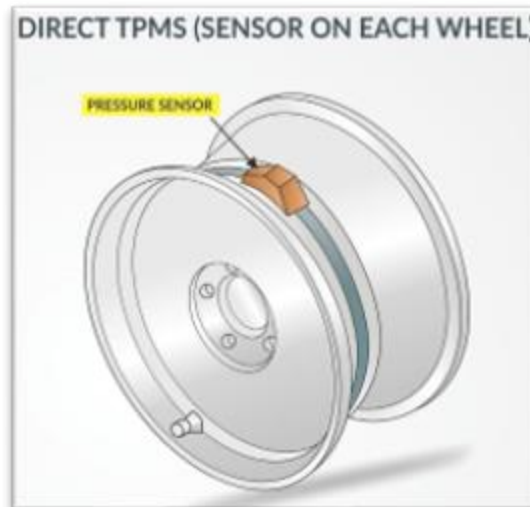


1. Microcontroller STM32F103 (H SERIES)
2. Temperature Sensor: -50 to +150 degrees C
3. Pressure Sensor: 200 PSI
4. Ultrasonic Sensor: Measures ultrasonic sound intensity for crack detection.
5. RF Communication: -  
Transmitter: Uses a 433 MHz RF module for wireless data transmission.  
Receiver: Utilizes a 433 MHz RF module for wireless data reception.  
Antenna: Includes a suitable 433 MHz antenna for effective transmission and reception.
6. Data Handling: - Analog-to-Digital Conversion. -  
Preprocessing: Includes filtering and calibration for accurate sensor readings and data quality.
7. Integration: - Utilizes a Flutter app to display and interact with sensor data.
8. Data Visualization: - The app can be used to visualize sensor readings and system status.



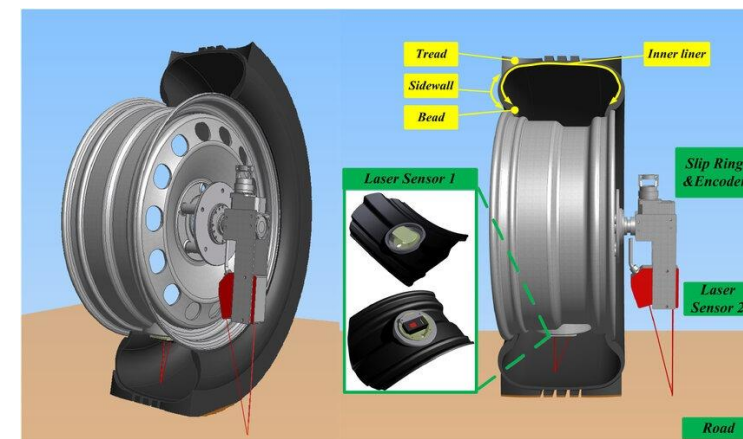


# FEASIBILITY AND VIABILITY



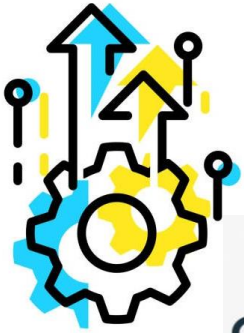
- **Technical:** Sensors can be integrated, and real-time data processing is possible.
- **Operational:** Installation requires planning, and user training is essential.
- **Economic:** Initial investment is substantial but can lead to significant savings.
- **Legal and Regulatory:** Compliance with industry standards is necessary.

- **High Market Demand:** Strong need for efficient tire management solutions.
- **Scalability:** Adaptable to various industries.
- **Technical Support:** Essential for effective operation.
- **ROI:** Potential for significant cost savings.
- **Partnerships:** Key for successful implementation.





# IMPACT AND BENEFITS



Safe Workplace



- **Operational Efficiency:** Real-time TKPH and tyre pressure monitoring reduce downtime and improve productivity.
- **Cost Savings:** Optimized tyre management lowers tyre-related expenses and extends tyre lifespan.
- **Safety Enhancement:** Automated alerts prevent accidents and improve safety standards.
- **Data-Driven Decisions:** IoT integration allows for accurate, informed decision-making in tyre maintenance.

- **Financial Gains:** Reduced downtime, lower accident rates, and decreased tire costs boost profitability.
- **Worker Safety:** Enhanced safety and reduced incidents through better tire management.
- **Environmental Impact:** Lower tire waste and emissions, and reduced fuel consumption through optimized tire pressure.
- **The system is highly adaptable and scalable, ensuring optimal performance across diverse applications.**



Environmental Impact



# RESEARCH AND REFERENCES



- Design and Implementation of Tire Pressure Monitoring System Using Wireless Sensor Networks  
by - Zhang Wei, Lei Xie, and Yang Yu
- Coal India Limited Annual Reports: <https://www.coalindia.in/InvestorRelations/AnnualReports.aspx>
- Mining Technology - India: <https://www.mining-technology.com>
- Wireless Tire Pressure Monitoring System Based on Radio Frequency Communication  
by- Junzhi Liu and Guoqing Xiang
- Challenges in Realizing Accurate Tire Pressure Monitoring Systems in Heavy Vehicles  
by- Sunil Sharma and colleagues
- Data Processing and Filtering: <https://hevodata.com/learn/filtering-techniques-in-data-mining/>
- STM32WL Series: <https://www.st.com/en/microcontrollers-microprocessors/stm32wl-series.html>