Enhancing Industrial Data Monitoring and Automation Using IoT and Cloud Technologies.

A Case Study with SATEC PM130EH PLUS Energy Meters and ThingSpeak.

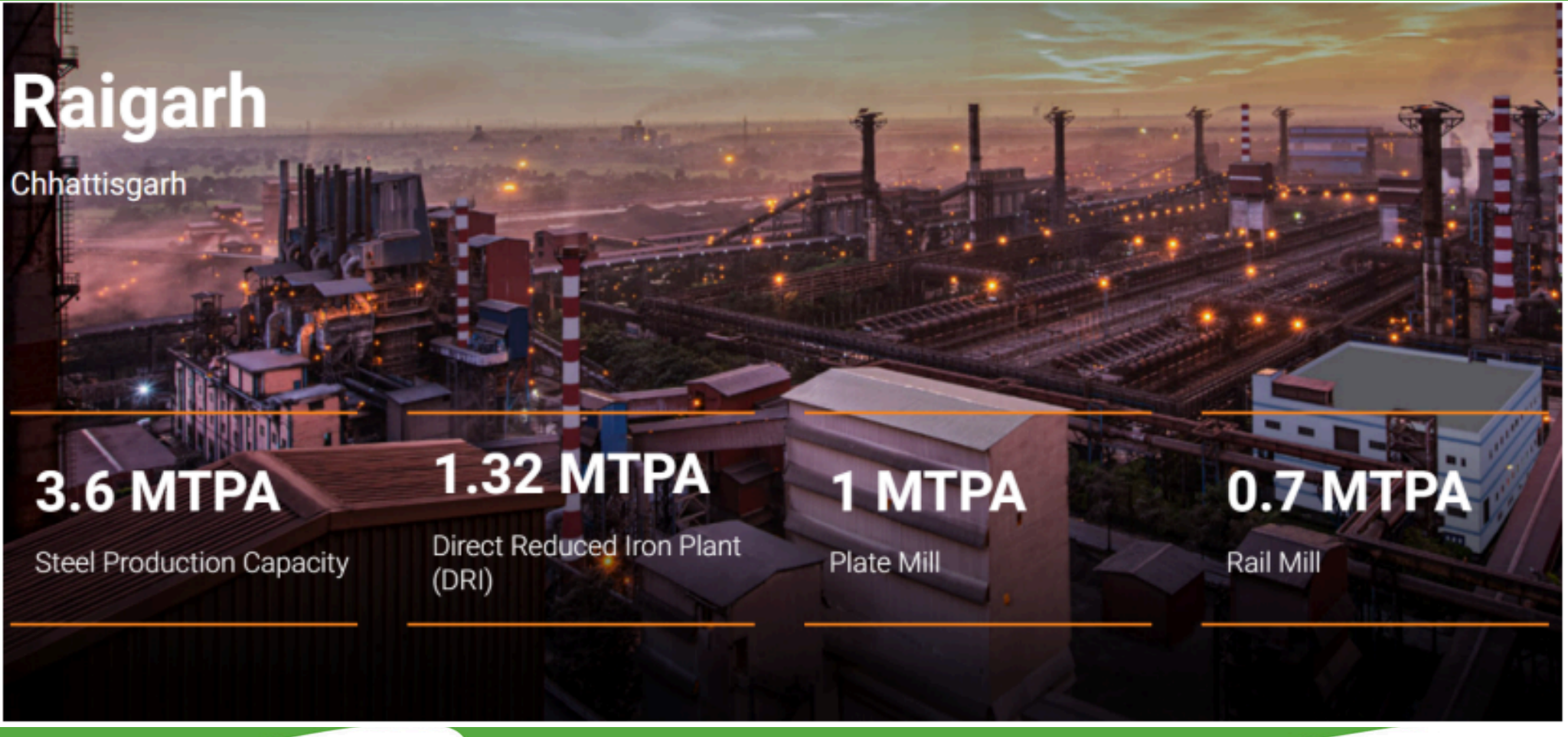
Guided By: Mr. DP Kushwaha Sir(HOD DRI)
& Mr.Gurjeet Singh Sir(DGM DRI-1 (E&I))
Presented By: Nannuri Pranay Kumar Reddy

JINDAL STEEL & POWER

Introduction

- **Objective: To enhance data monitoring and automation in industrial settings**
- **Key technologies: Modbus, RS485, IoT gateways, ThingSpeak Cloud Service.**

JINDAL STEEL & POWI



JINDAL STEEL & POWER

DRI Overview

Stacker/Reclaimer

Wagon Tippler

Rake Transportation

Raw Material Mines

Raw Materials

Iron Ore

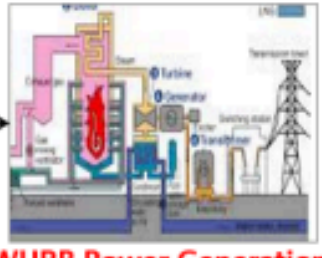
Limestone

Coal

DRI Kilns (6 X300 & 4X500 TPD)

Magnetic Separator

Quality Check

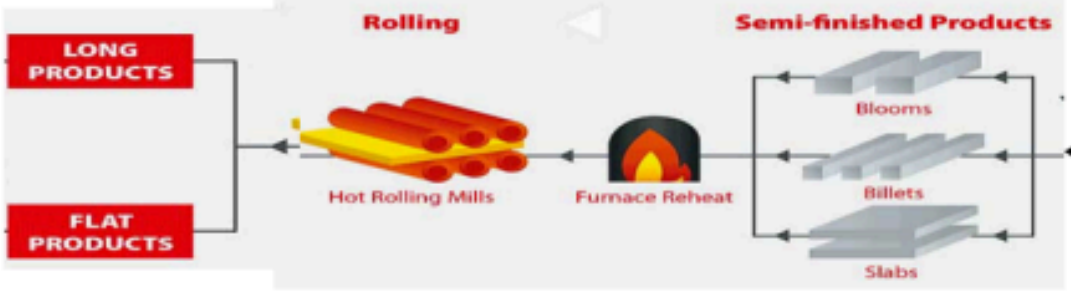


WHRB Power Generation

Direct Reduced Iron

Continuous Caster

Steel Melting Shop



JINDAL STEEL & POWER

Safety Measures

BASIC PPEs

Safety Helmet

Safety Shoes

Safety Goggles

SITE SPECIFIC PPEs

Safety Fr Jacket

Cut resistance Hand Gloves

DRI DEPARTMENT JOB SPECIFIC PPEs *(An example, other deptt also needs to identify in same way)*

N95 Mask

Ear Plug

Helmet mounted face shield

Aluminum Suit

Full Body Harness

JINDAL STEEL & POWER

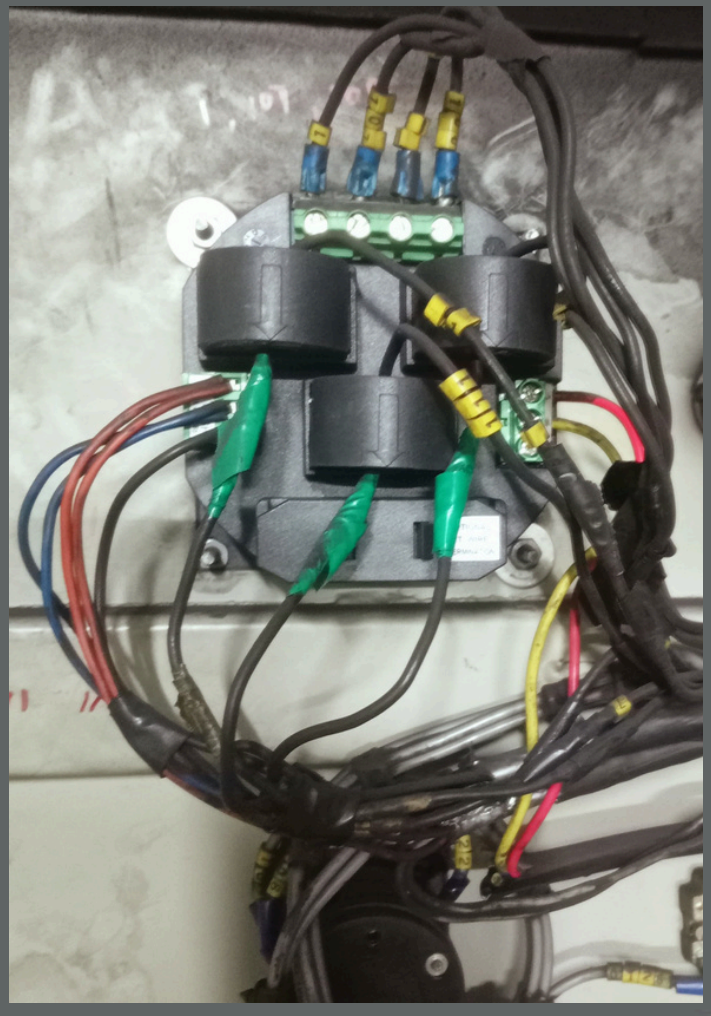
Project Motivation

- Identified manual data collection tasks at JSP's DRI department.
- Observed manual processes such as collecting vibration data, temperature measurements, and energy meter readings.
- Aimed to automate energy meter data collection for better efficiency and reliability.
- Proposed solution: leveraging IoT and cloud technologies for real-time data access and remote monitoring.

JINDAL STEEL & POWI

Energy Meter Capabilities

- **Advanced Communication Protocols: Supports Modbus RTU/TCP for easy IoT integration.**
- **Data Logging: Built-in data logging with large storage for historical data.**
- **Multiple Communication Ports: RS485 and Ethernet ports for connecting to IoT devices.**
- **Flexible Power Supply: Wide voltage range (85-265V AC/DC) for industrial compatibility.**
- **Remote Monitoring: Real-time data access and remote configuration via IoT platforms.**



SATEC PM130EH PLUS ENERGY METER

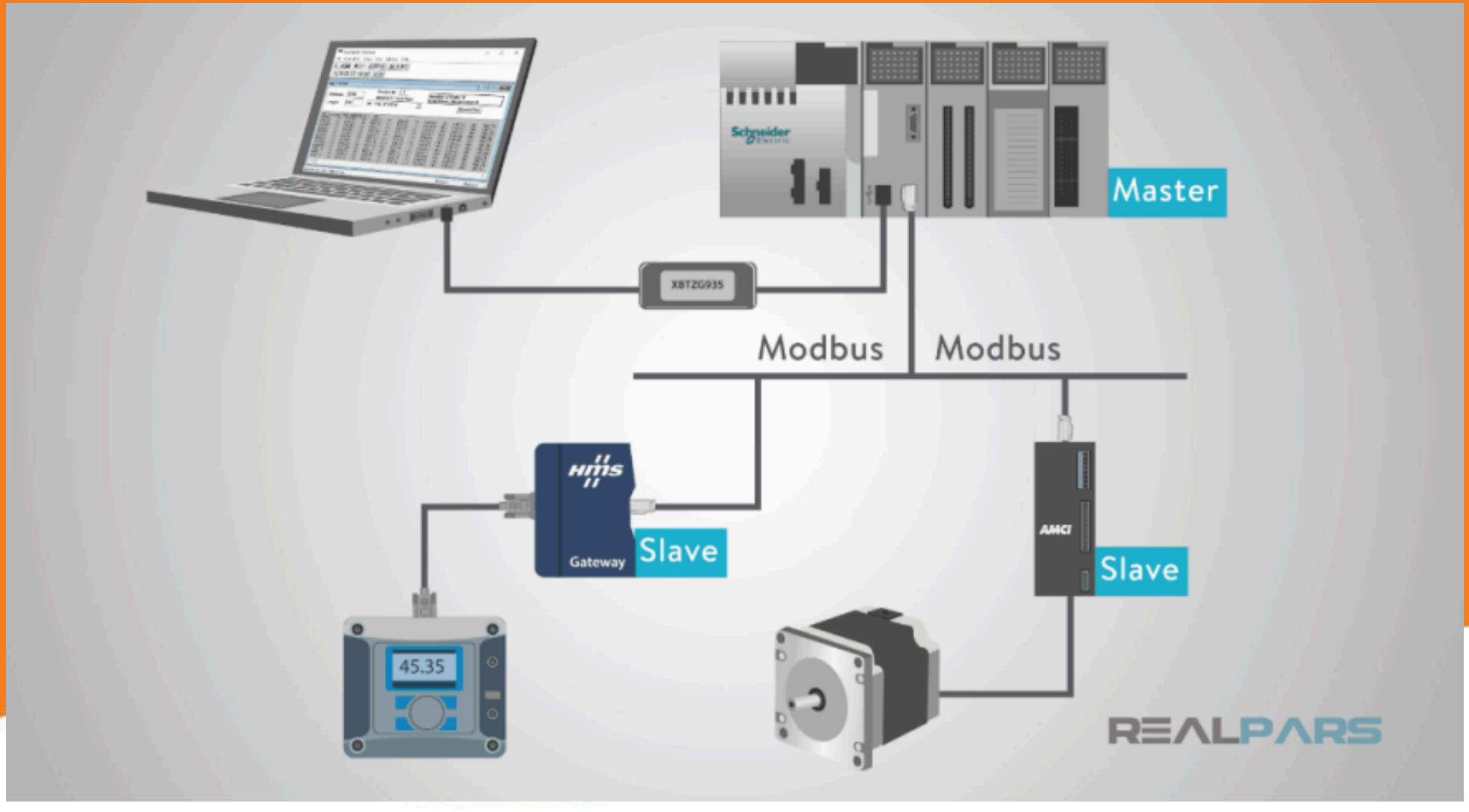
JINDAL STEEL & POWER

Modbus Protocol

- Developed by Modicon in 1979, Modbus is a widely used industrial communication protocol.
- Master-slave architecture: master device initiates a request, and slave devices respond.
- Ensures efficient data exchange over serial lines.
- RS485 complements Modbus with robust, noise-resistant communication over long distances.
- Supports multiple devices on the same bus, enabling complex network configurations.

JINDAL STEEL & POWI

Modbus Communication Protocol



JINDAL STEEL & POWI

Key Features of WiFi Module for Energy Meters

1. **Protocol Compatibility**:Supports Modbus RTU/TCP and MQTT.
2. **Multiple Interfaces**:RS485, RS232, and Ethernet ports.
3. **Wide Voltage Range**:5-36V DC power supply.
4. **Robust Wireless Standards**:802.11b/g/n compliance.
5. **Secure Communication**:WPA/WPA2 encryption, TLS/SSL support.
6. **Configuration & Management**:Web-based setup, remote firmware updates.
7. **Data Logging & Storage**:Internal memory, real-time clock.
8. **LED Indicators**:Power, link, RXD, TXD, and error LEDs.
9. **Environmental Robustness**:Industrial-grade, wide temperature range.
10. **Mounting Options**:DIN rail mounting, compact design.

IoT Gateway Evaluation

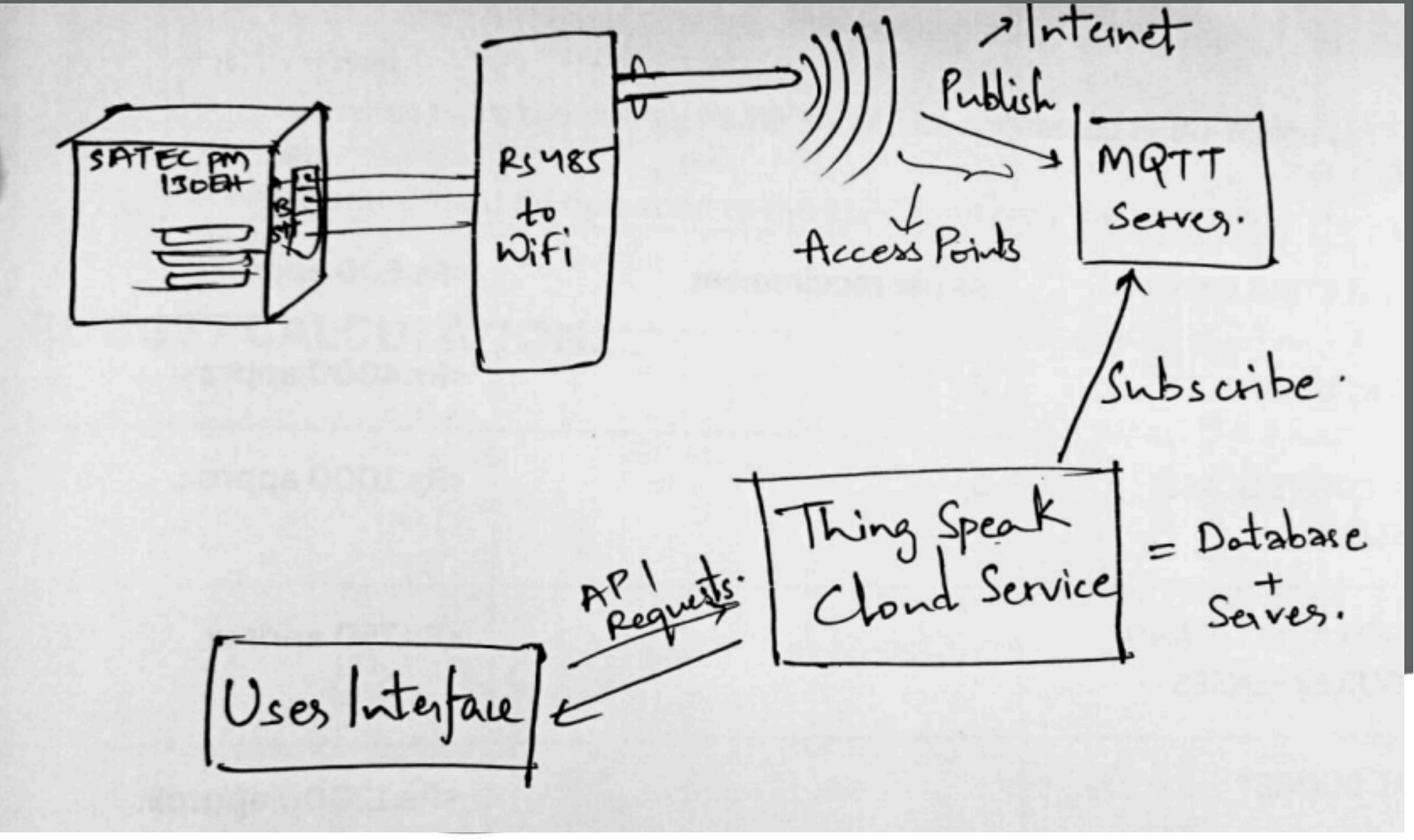
- **Studied Waveshare Rail-Mount Serial Server and USR-W610 devices.**
- **Features: RS485 to WiFi/Ethernet conversion, support for Modbus, MQTT, TCP, UDP.**
- **Selected Waveshare for the solution due to detailed research and manufacturer inquiry.**
- **Emphasized rich indicator LEDs, wide voltage support, and suitability for harsh industrial environments.**

JINDAL STEEL & POWI

Waveshare Rail-Mount Serial Server

USR-W610 RS232/485 to Wi-Fi/Ethernet Converter

JINDAL STEEL & POWI



Architecture,Process

JINDAL STEEL & POWI

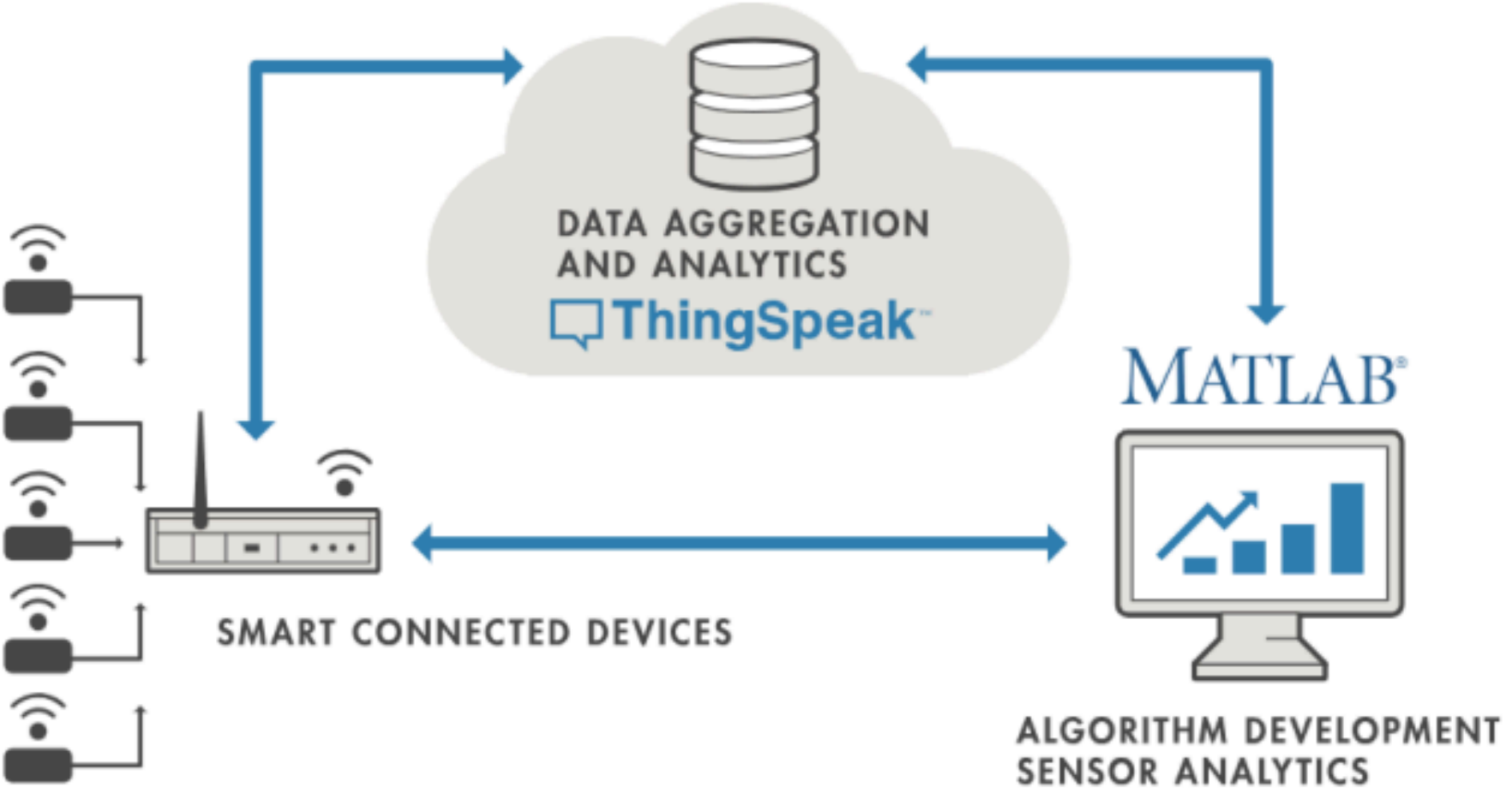
ThingSpeak Cloud Platform

- **ThingSpeak is a cloud-based IoT analytics platform for real-time data visualization and monitoring.**
- **Supports MQTT and HTTP protocols for secure data transmission.**
- **Provides tools for data analysis, including machine learning algorithms for predictive maintenance.**
- **Enables viewing of live data from any location, facilitating remote monitoring and decision-making.**

- MQTT: Message Queuing Telemetry Transport
- HTTP: HyperText Transfer Protocol

JINDAL STEEL & POWI

ThingSpeak Cloud Service



JINDAL STEEL & POWI

BUDGET ESTIMATION

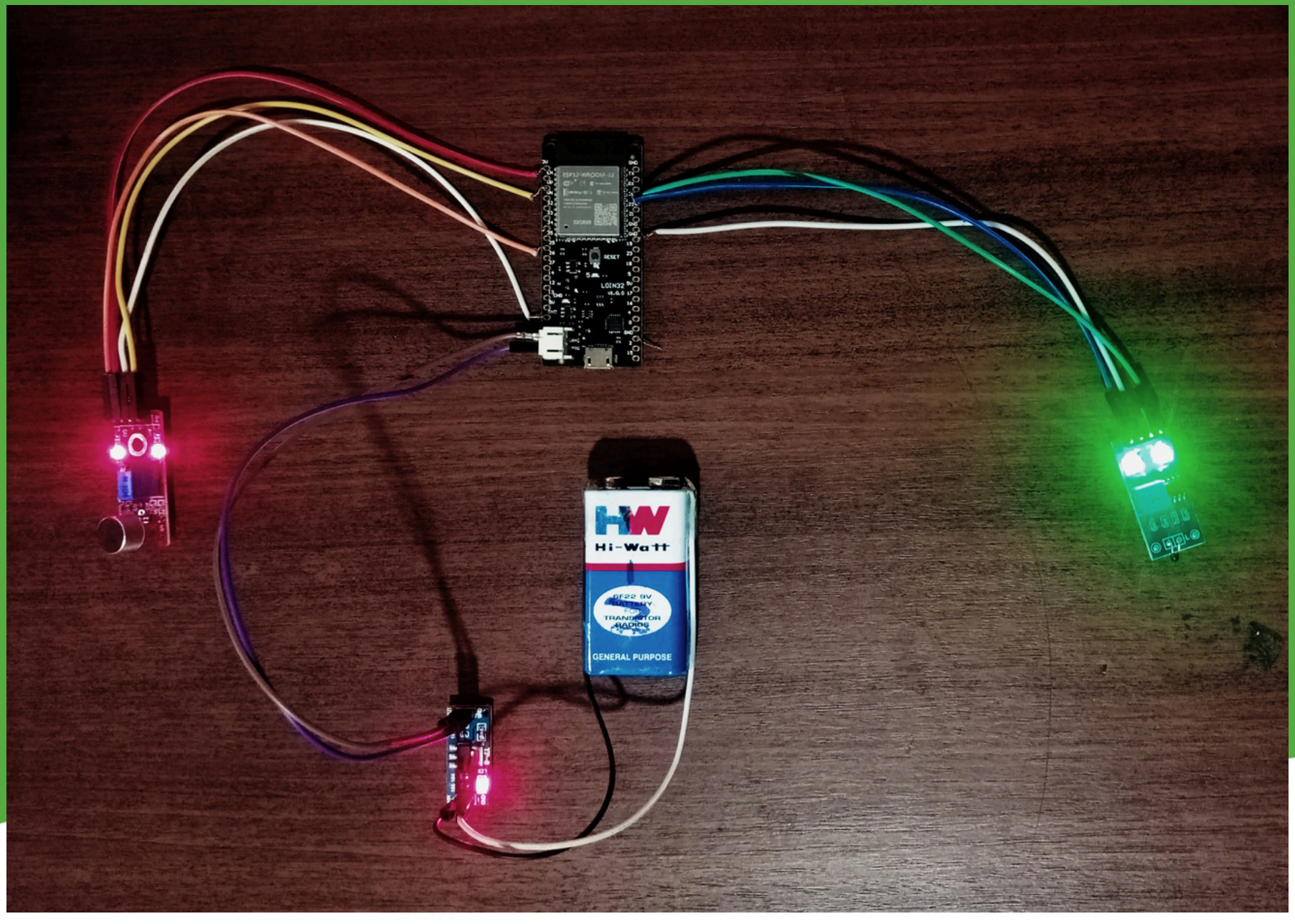
Equipment	Requirement	Cost in Rs.
Waveshare Wifi module	3	3500*3
WiFi Router	3	2000*3
Connecting Wires,AC to DC adapters	As Required	2000
Miscellaneous Cost	Including Labour	1500
Total		20,000

JINDAL STEEL & POWI

Prototype Development

- Created a prototype using ESP32, temperature sensor, and sound sensor.
- Demonstrated data collection and transmission to ThingSpeak.
- Validated real-time data visualization on ThingSpeak.
- Emphasized ease of setup and potential for scalability.

JINDAL STEEL & POWI



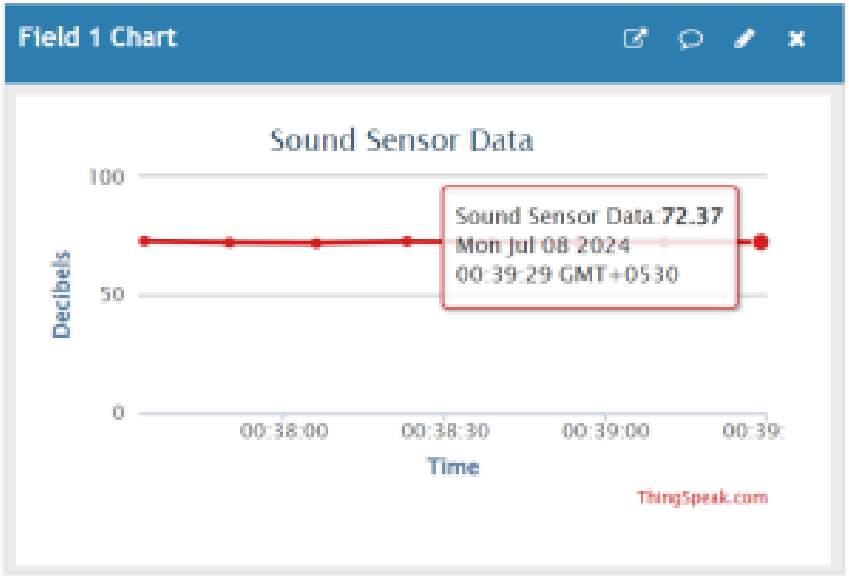
Prototype for Demonstrating Process

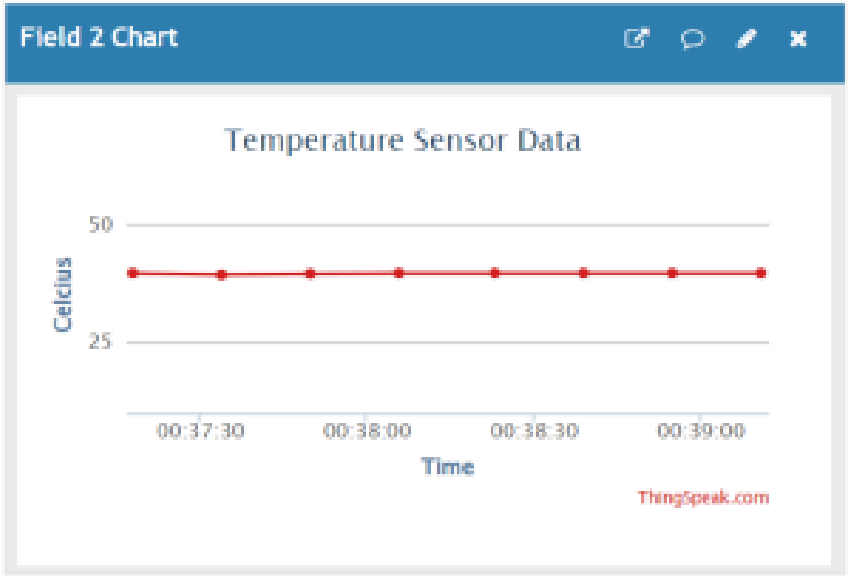
JINDAL STEEL & POWI

ThingSpeak™ Channels Apps Devices Support Commercial Use How to Buy PN

Last entry: less than a minute ago

Entries: 110





ThingSpeak Dashboard

JINDAL STEEL & POWI

Integration Strategy

- Proposed strategy for integrating SATEC PM130EH PLUS meters with IoT gateways.
- Deployment of Waveshare or USR-W610 gateways for RS485 to WiFi/Ethernet conversion.
- Detailed steps for hardware setup, configuration, and testing.
- Emphasized benefits of real-time monitoring and remote access.

JINDAL STEEL & POWI

Future Steps

- Practical implementation steps: hardware setup, configuration, and testing.
- Ensuring data accuracy and system reliability.
- Roadmap for scalability: expanding to additional meters, integrating advanced analytics and machine learning for predictive maintenance.
- Long-term vision: transitioning to Industry 4.0 with fully automated, cloud-based monitoring systems.

JINDAL STEEL & POWI

CLOUD BENEFITS

JINDAL STEEL & POWI

Conclusion

- **Thorough research and a strategic approach were employed to integrate energy meters with IoT and cloud technologies.**
- **The prototype successfully demonstrated practical feasibility and tangible benefits.**
- **Future prospects include enhancing industrial data monitoring for improved operational efficiency and sustainability.**

JINDAL STEEL & POWI

Thank You

JINDAL STEEL & POWER