IT-3681-02

Theme : MRT

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Summary

The Singapore Mass Rapid Transit (MRT) system is relied upon by millions every day. However, it faces growing pressure from overcrowding, service disruptions, and rising commuter expectations.

Our project attempts to transform the MRT into a smarter, more connected ecosystem. By leveraging IoT sensors to capture real-time data and applying AI-driven predictive analytics.

We aim to create a responsive transport system that adapts to conditions on the ground and keeps Singapore moving efficiently.

Case presentation

Issue

Current MRT System is:
- Overcrowded
- Reactive incident handling
- Unreliable service consistency

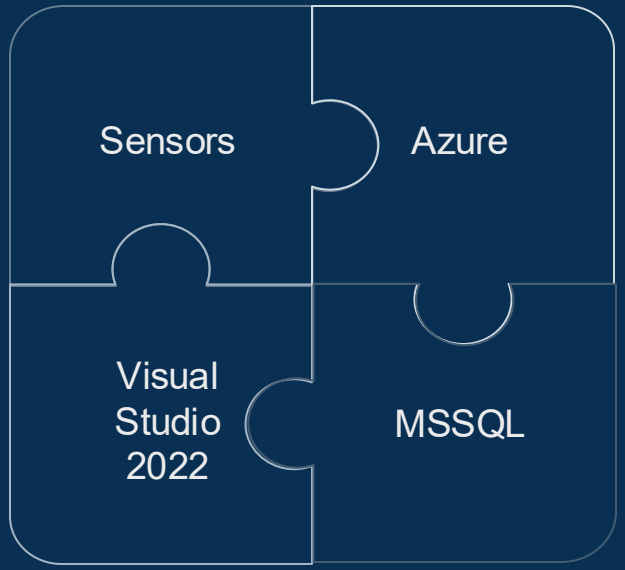
Impact

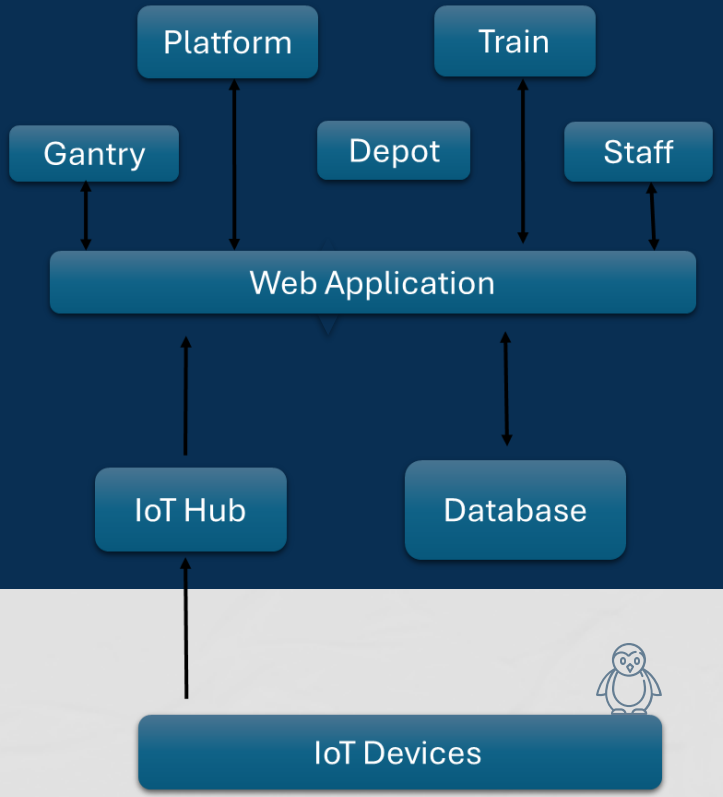
This causes:
- Commuter Dissatisfaction
- Increased cost of maintenance
- Operational Strain

Solution

Our plan is to:
- Automate incident response
- Deploy more IoT sensors across the network
- Implement predictive analytics for proactive decision-making

Technical Consideration

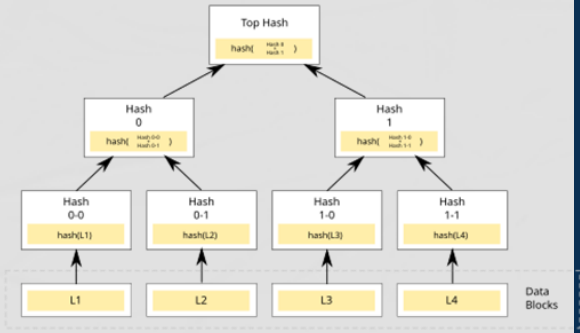




Solutions

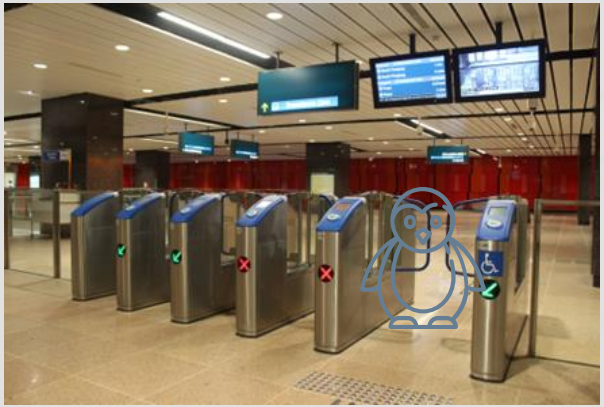
Gantry (Nixon)

- **Blockchain**
  - All transactions are secured in a tamper-proof Merkle Tree ledger for auditability.
- **Issues Report**
  - A structured log of detected problems for tracking, collaboration, and resolution.
- **Real Time Dashboard Charts**
  - Presents data in a human friendly manner
- **Facial Recognition gantry**
  - Enables fast, contactless access and live detection of flagged individuals.
- **Honey pot**
  - A decoy system designed to detect, divert, or study malicious activity without risking real assets.
- **Dynamic Fare Pricing**
  - Fare adjusts live based on route congestion using Dijkstra



Gantry

- **Transaction generation**
  - Realistic fare logs generated from peak-hour patterns and foot traffic simulation.
- **Alerts System through dashboard**
  - Real-time notifications triggered by system events to ensure prompt attention and response.
- **Commuter Surge Horizon**
  - Predicts short-term crowd spikes so we can act before congestion builds up.
- **Gantry Allocation Balancer**
  - Dynamically switches tap-in/out roles based on entry/exit traffic ratios.
- **Encrypted Communication**
  - Inter-service data is secured via JWT tokens to ensure only trusted modules interact.

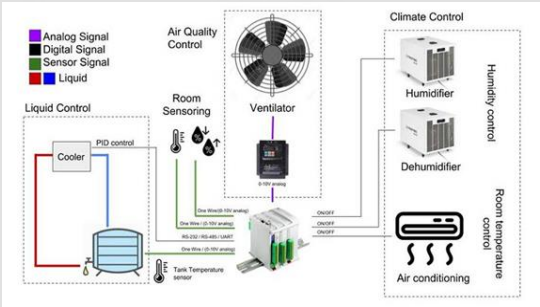


Gantry

- **Temporal Access Token**
  - Fare tokens expire if commuters delay, preventing abuse and ensuring route validity
- **Accounts Management**
  - Used Microsoft Identity to manage Accounts and Sessions
- **Role Based Access Control**
  - Only certain roles can view and access pages on the navigation bar
- **Integration**
  - Did most of the integration as the group leader

Platform (Kirsty)

- **Dynamic HVAC Controls**
  - Using dynamic controls to ensure a safe and comfortable commute
- **Station (CRUD)**
  - Create, read, update, and delete station information for efficient management.
- **Incident Detection System**
  - Automatically identifies and reports unusual events for rapid response.
- **Crowd Detection**
  - Detect crowd level in the station.
- **Platform Database**
  - Centralized storage of platform-related data for easy access and analysis.

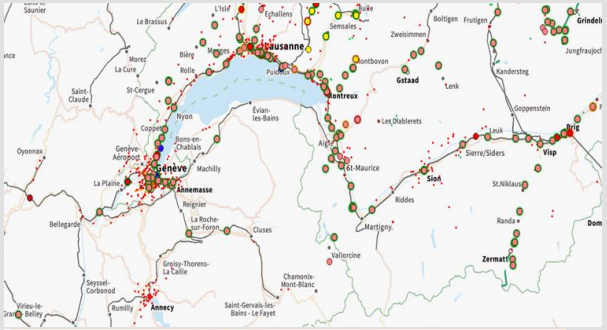


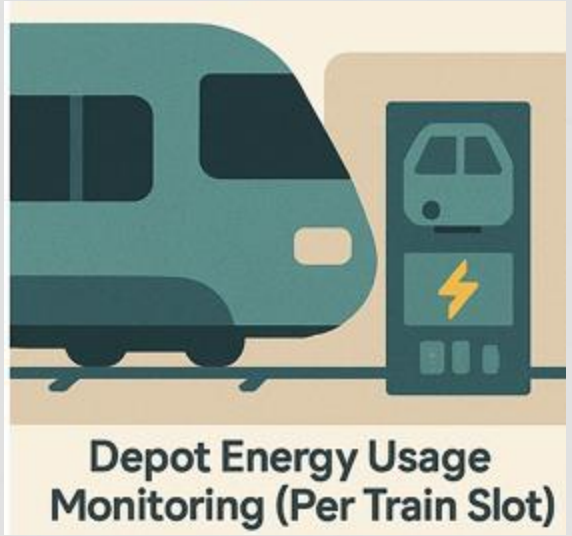
Platform

- **Train arrival timing**
  - Using GPS, measure and estimate how long the train will reach the station
- **Evacuation guidelines**
  - Downloadable step-by-step instructions to ensure safe and orderly exits during emergencies.
- **Phone notification**
  - Notifications are sent to the phone number of the user
- **Manpower Deployment for station**
  - An AI powered System that recommends where to send staff based on load, alerts, and density zones.

Trains & Depot (Darel)

- **Train GPS & Live Location**
  - Integrate with live station-mapping data to calculate station arrival predictions
- **Train Weight Monitoring**
  - Tracks Train weight to monitor crowdedness
- **Wheel Monitoring (LiDAR) for proactive repair.**
  - Scan for flat spots, cracks, or surface anomalies on the wheels
- **Depot Energy Usage Monitoring.**
  - Detects abnormal consumption patterns, and supports sustainability goals by optimizing resource usage
- **Train Weight and Wheel Alert Management system** (CRUD)
- **Depot Energy Usage Alert Management system** (CRUD)





Trains & Depot (Joel)-

- **Brake Pressure monitoring**
  - For predictive maintenance and safety assurance.
- **Cabin Temperature Monitoring**
  - Adjusts HVAC automatically, ensuring comfort and detecting HVAC failures.
- **RFID monitoring**
  - Automates train entry/exit logging via RFID at depot gates
- **Crud for trains**
  - Create , update and delete train, allows administrator to manage trains
- **Depot bay monitoring using CV**
  - Tracks which bays are free/occupied.

RFID - Entry/Exit Registration

Digital Twin of Depot Space Management

Staff (Kaiyi)

- Admin
- Training Course
- One Tab Policy

Staff

MOVING ON...

To Our Project Prototype !