Digital twins for disaster management

Introduction

Who are we?

An innovation driven company focused on technology for the mobility sector.
Established in 2011.

Key people

Dr Rajesh Krishnan
- PhD (Imperial College London)
- B. Tech (IIT-Madras)

Dr Mark Pleydell
- PhD (University of Bournemouth)
- BSc (University of Bath)

Mr Ayush Agrawal
- B. Tech + M. Tech (IIT-Bombay)

Outline

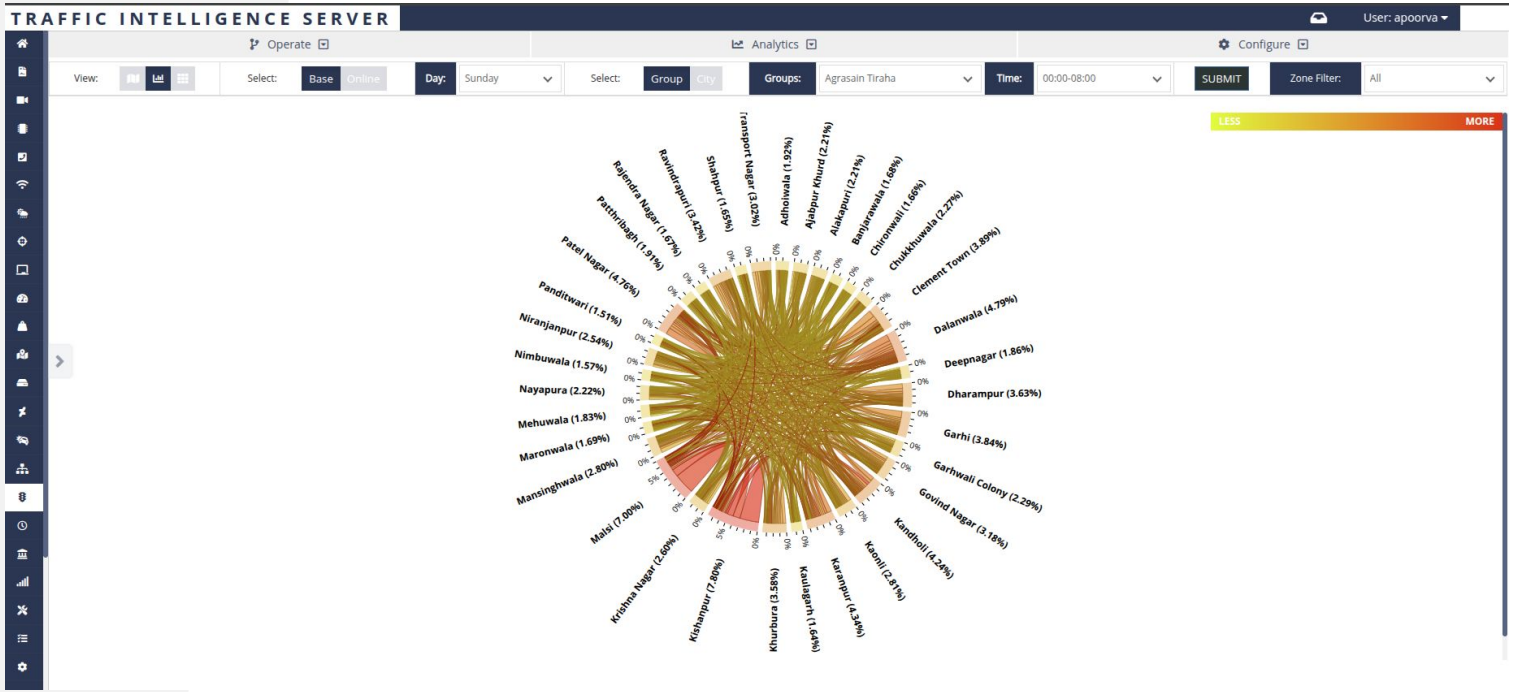
- Company overview
- Digital twins
- Network resilience
- Evacuation modelling
- Summary

> By failing to prepare, you are preparing to fail
>
> - **Benjamin Franklin**

Digital twins

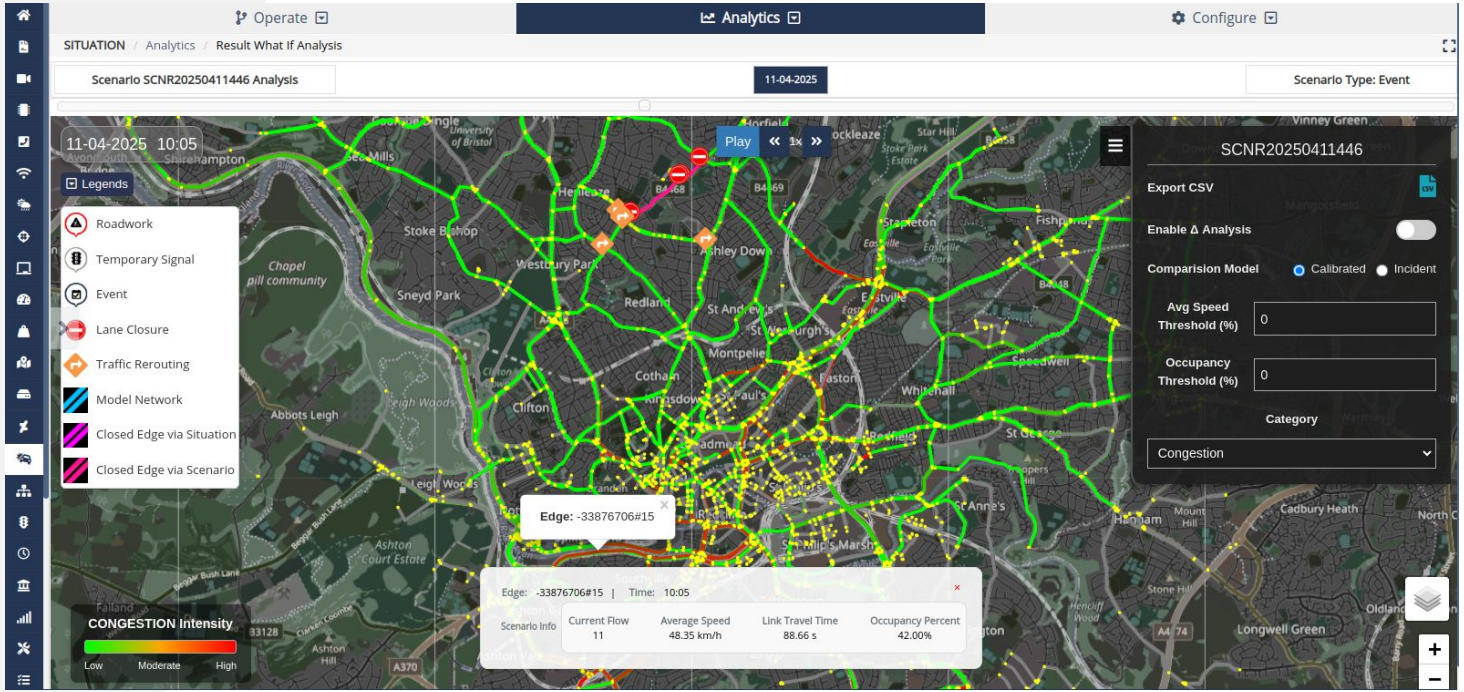
- A model of the real-world: a transport network in our case
- The model updates itself based on real-time data
  - Detectors & crowd-sourced data
- Digital twins can be used for operational decision making
- An-offline model calibrated on historic data can be used for planning
  - Modelling resilience and disaster management

Digital twins - travel patterns

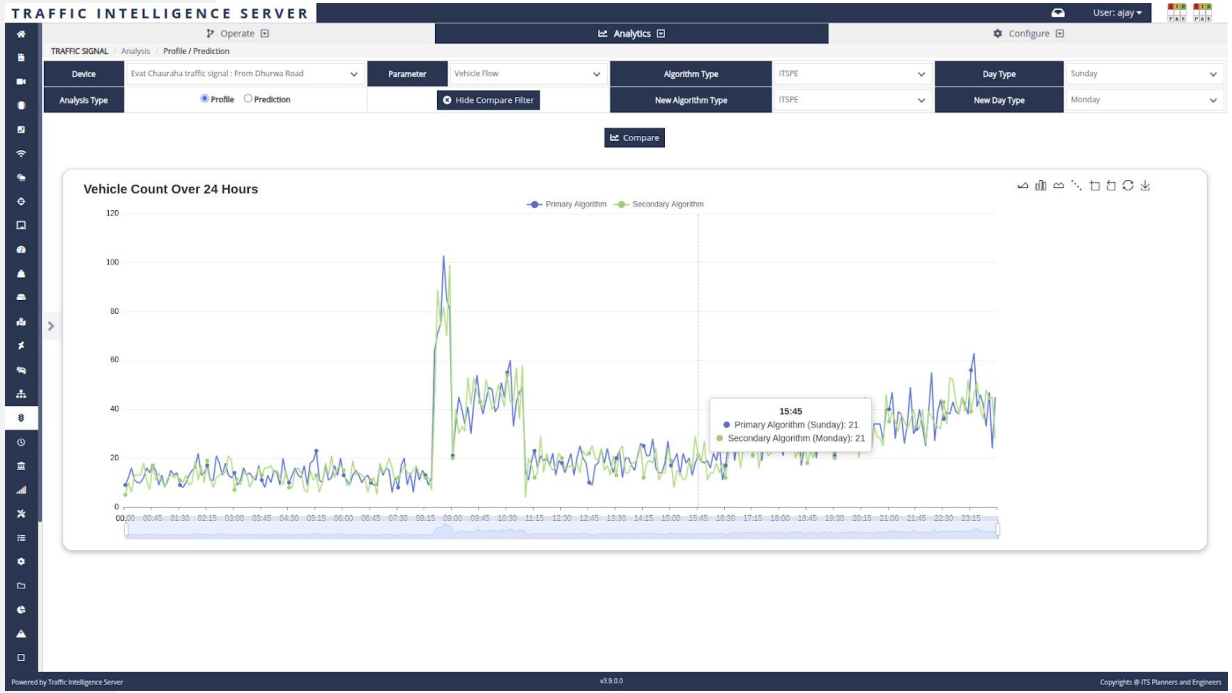


Digital twins - travel patterns

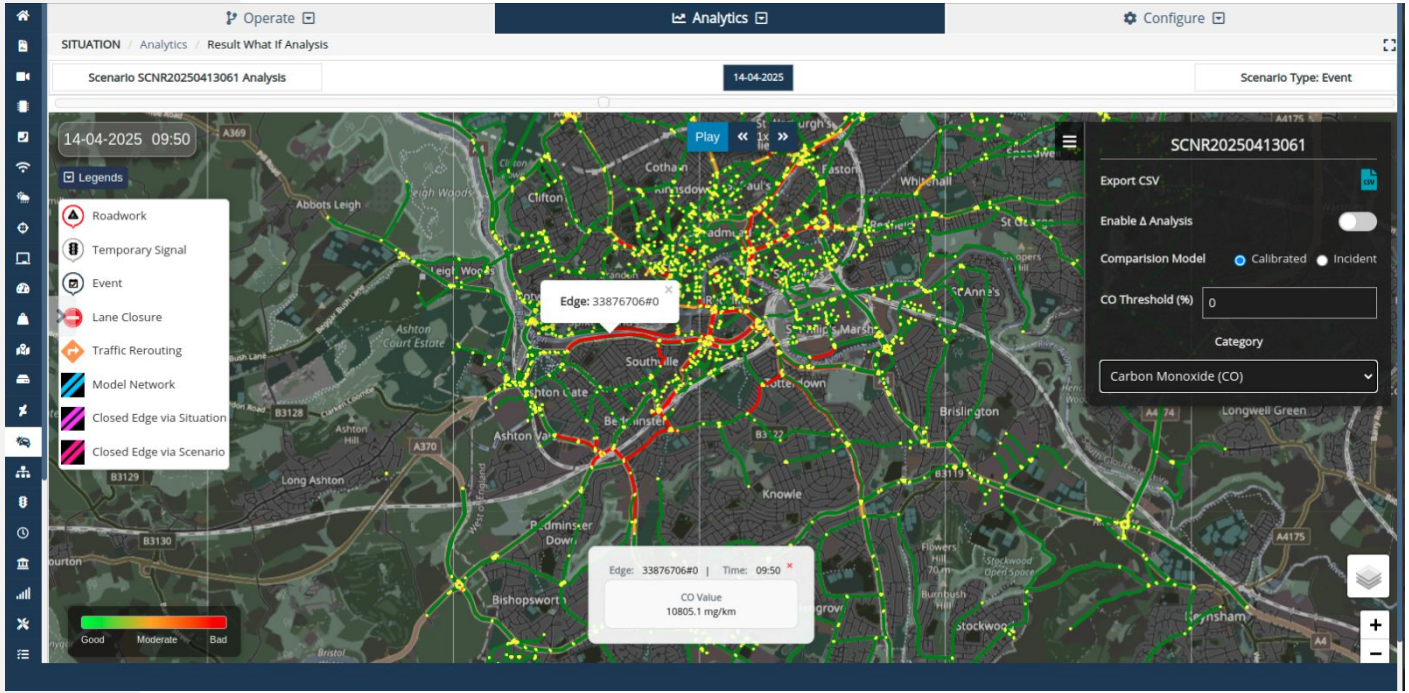
Digital twins - congestion estimation



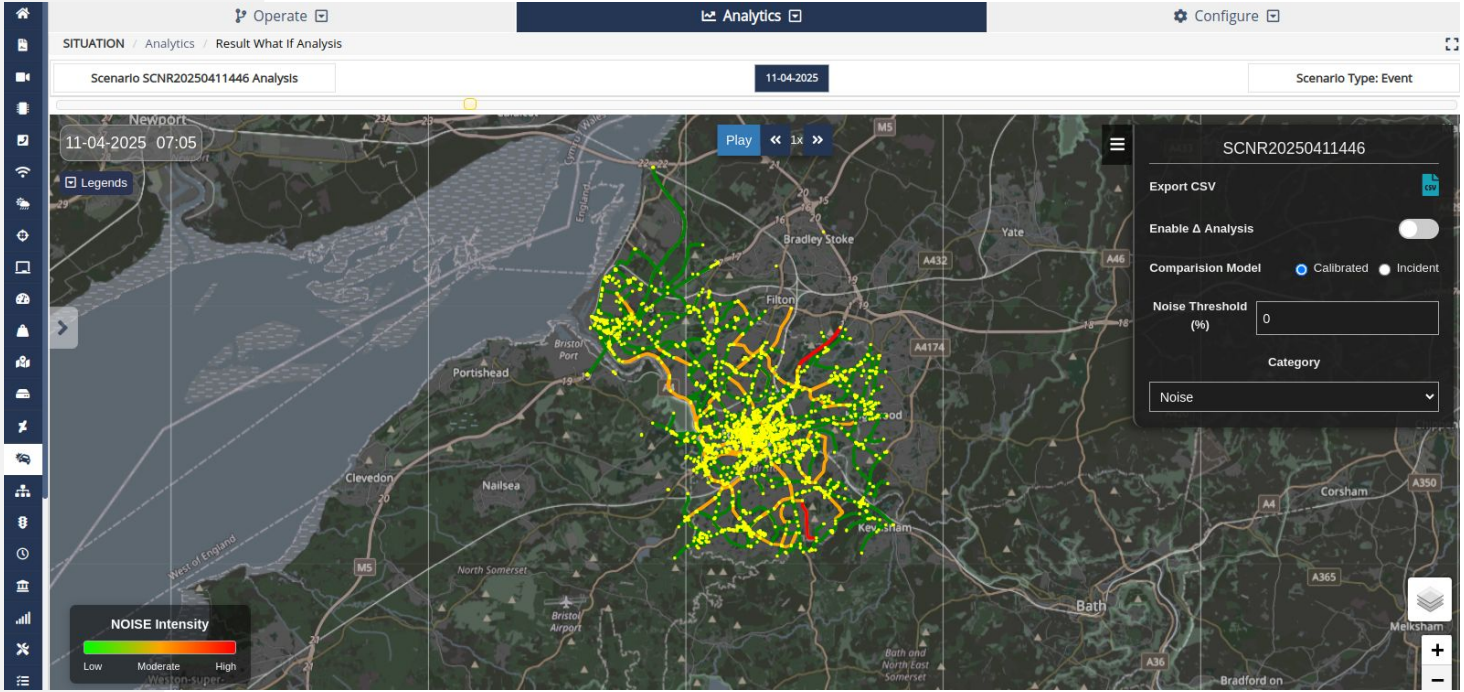
Digital twins - traffic flow



Digital twins - pollution



Digital twins - noise



> A transport network's ability to withstand disruptions and rapidly recover its essential functions

Network resilience

- Betweenness centrality of links: Number of shortest paths between nodes through a given link
  - Not all nodes are equally important. Links connecting important nodes and hence more important
- Edge connectivity: Number of links that should be closed to isolate a part of the network

A transport network model or a Digital Twin can help answer these questions

Disaster planning

01	Zonal information	• How many people? • Where they live?
02	Network information	• Network model • Resilience metric
03	Scenario modelling	• What are the types of disasters you are planning for? • Floods, industrial accidents, war? • What is your response plan? • What do you plan to do in these scenarios?
04	Response & Evacuation plan	• What are the planned movement of emergency vehicles? • What is the plan for evacuation of the public?

Summary

What do you need to do as a city?

- Collect and maintain spatial information and build a transport model
  - Zone-wise demographics, public facilities such as hospitals, shelters etc.
  - Geo-spatial information - elevation data, hydrology
  - Transport network, along with typical travel demand patterns
- Plan for disasters
  - Type of anticipated disasters
  - Develop response plan using the models
  - Keep the model up-to-date and review the response plans periodically

Thanks!

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