D^2 ITS

Data Driven Transport Operations and Planning – CDAC's Initiatives

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D^2 ITS

- ITS is changing from a conventional technology-driven system into a more powerful multifunctional data-driven intelligent transportation system
- Infrastructure-generated data is quickly being replaced by sensor-generated data
  - Vehicle Tracking
  - Surveillance Cameras
  - Counting / Classifier
  - Parking Management
  - Mobile Phone
  - Electronic Ticketing
  - Enforcement Systems
  - Adaptive Signaling
  - Incident Detection
  - WiFi / Bluetooth
  - ANPR / Toll
  - ----------

Challenges

- Filtering, Cleaning and Assembling of raw data
- Deriving information
- Ensuring accuracy of derived information
- Verification
- Anonymity of data / Information
- Distribution
- Tracking
- Security

CDAC's Initiatives

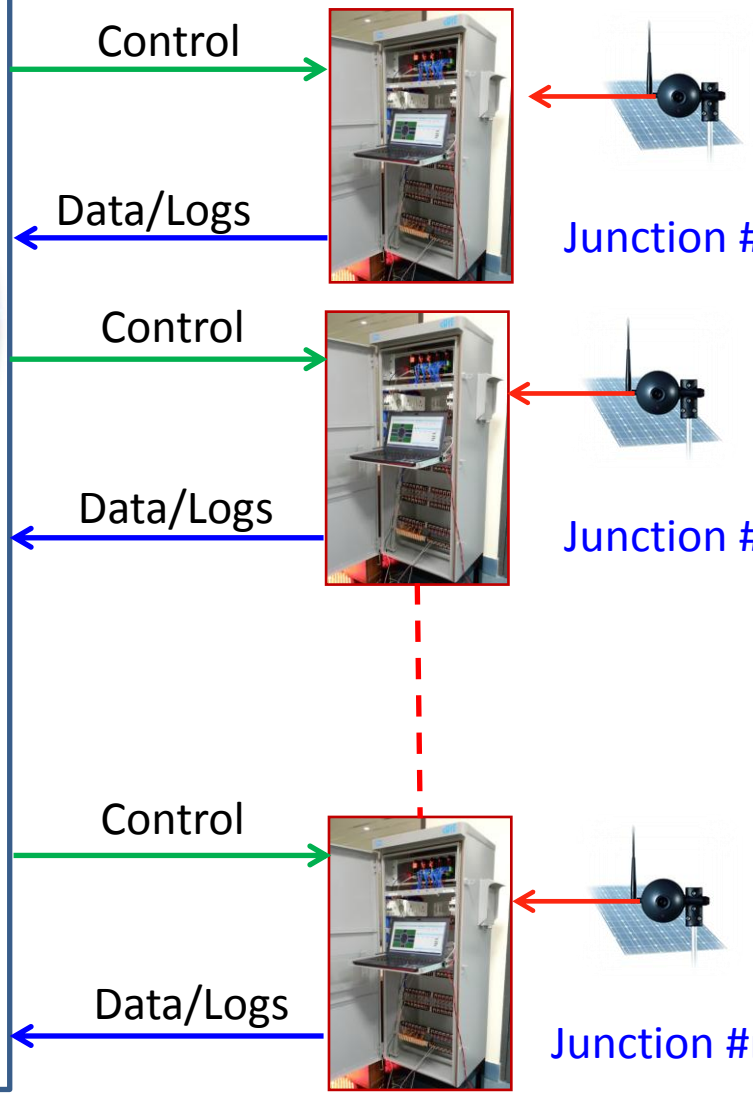
System

- ATCS
- Ambulance Priority
- Red light Enforcement
- Accessible Pedestrian Controller
- Parking Management

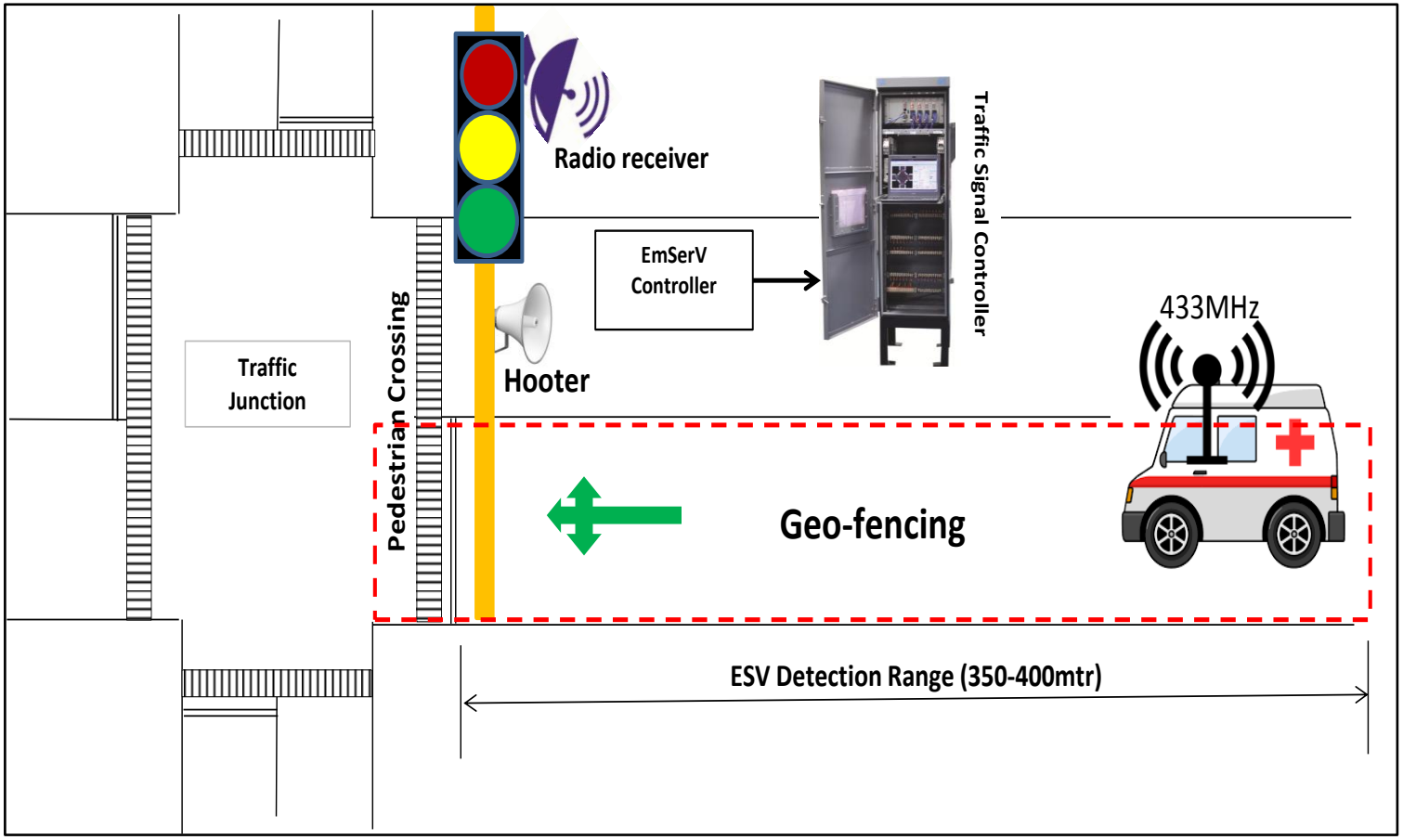
Data

- Congestion Maps
- Traffic Patterns
- Travel Times
- ESV routes, frequency
- Hotspots
- Demand
- Parking Load
- Efficiency

Adaptive Traffic Control System



ESV Priority



Pedestrian Signal Controller

Braille Inscription

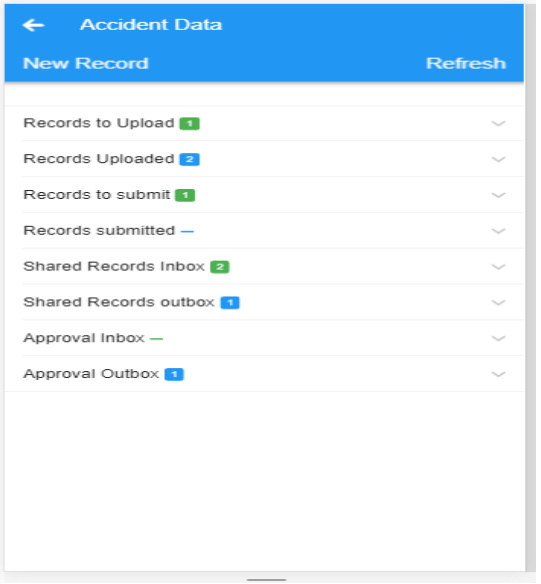
SmartCane Reader

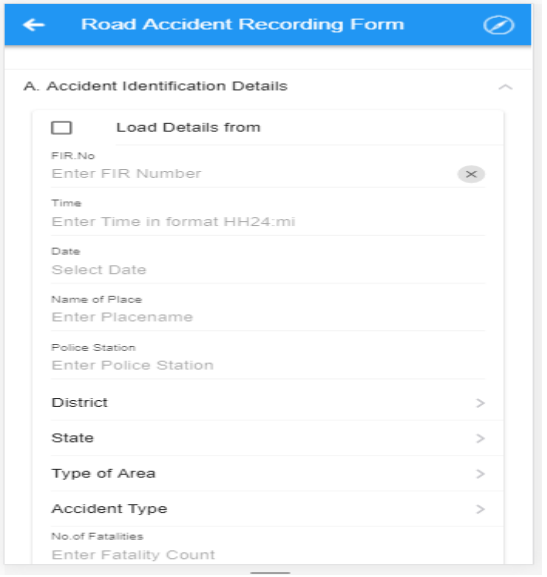
Pushbutton Switch

RFID Reader

iReady

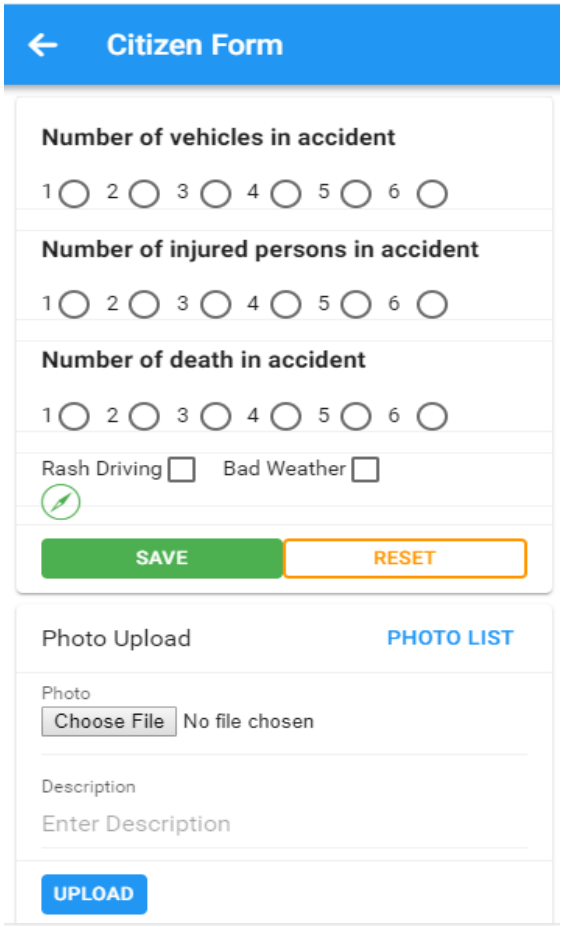
- **I**ntegrated **R**oad Accid**e**nt Inform**A**tion Management and **D**ata Anal**Y**sis (**iReady**) is an integrated platform for
  - Accident Intimation
  - Accident Recording
    - Multi-stakeholder involvement
    - Alerts and messages
    - Analysis & Reports
    - Support for Road Safety Research





Road Accident Detection & Reporting

- VTU Tilt/Impact Sensor Data
- VTU SOS Button Press
- Citizen Reporting (Mobile App)
- Air Bag Release
- CAN Bus Data



Road Accident Management & Data Analysis System (iReady)

* SURAKSHA - MITR

Accident Reporting

Alerting & Aid Dispatch

Victim Identification

Analysis Platform

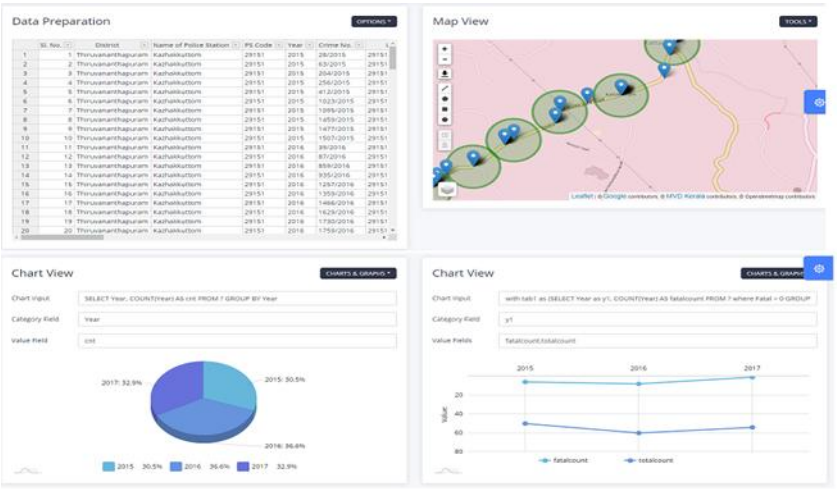
*Suraksha Mitr For Public Transport

Aid Dispatch Management

- Static Aids
  - Hospitals, Police/MVD Control Room, Disaster Management Team
- Moving Aids
  - Ambulance (108), Highway Patrol, Fire Fighting
- Real-time location of moving aids
- Identification of nearest aid(s) to the accident spot
- Alerting both static and moving aid on accident
- Moving Aid Dispatch based on severity of event
- Shortest route suggestion to moving aids based on road traffic condition

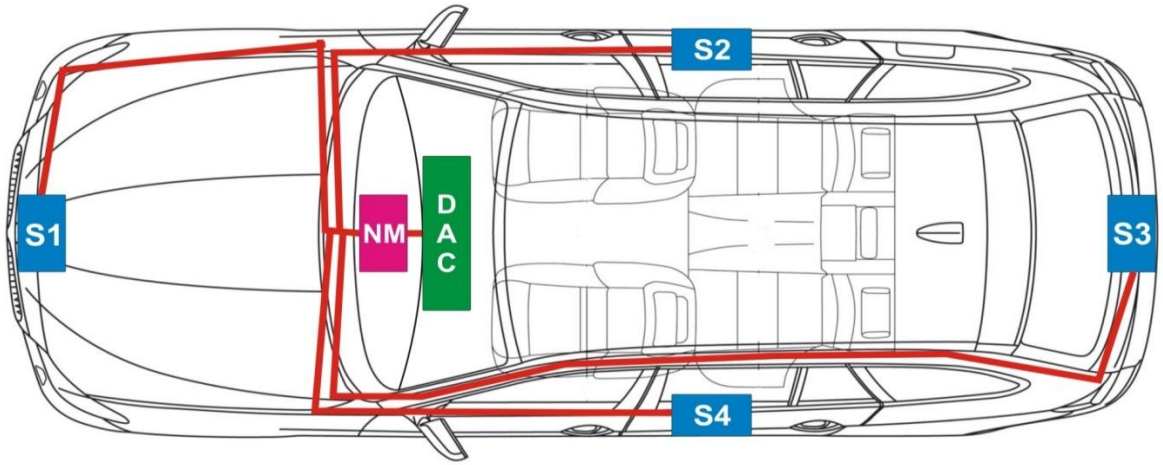
Accident Data Analysis

- Black spot Identification & prioritization
- Cluster Analysis
- Grid Analysis
- Heat Map of Crash Zones
- Risk Map
- Route wise analysis
- Classified trend analysis based on
  - Road user category
  - Fatality/injury details
  - Month, date, time of incidents
  - Weather conditions
  - Road Category
  - General cause/category of crash



Onboard Driver Assistance and Warning System

(IIT Madras leads the research)



S1,S2,S3,S4	-	Millimeter Wave Radar
NM	-	Navigational Data Logger
DAC	-	Driver Assist Console

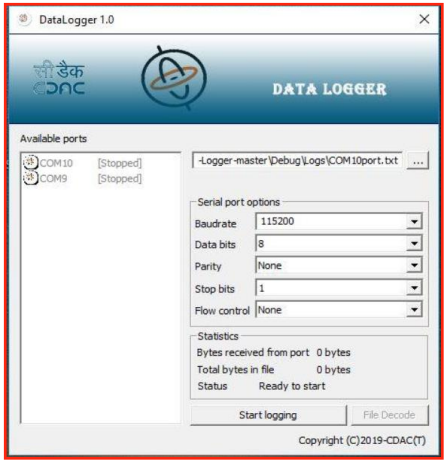
Objectives

- Build driving behavior models to assess driver propensity to near-miss collisions, thereby evaluating driver safety
- Develop and instrument on-board driver assistance and warning systems (ODAWS)
- Evaluate ODAWS' safety enhancement features under various scenarios of traffic conditions

Navigational Data Logger

- Combo of **Inertial Measurement Unit (IMU)** and **GPS** receiver
- Can be used to log vehicle dynamics, position, driving characteristics, road condition, data for vehicle crash analysis etc.
  - Acceleration, Angular velocity, Heading, GPS coordinates, GPS speed, Universal time
- A PC based application software will time sync and log the data coming from Navigational Sensor module
- The software can run on any Windows based computer with USB connectivity

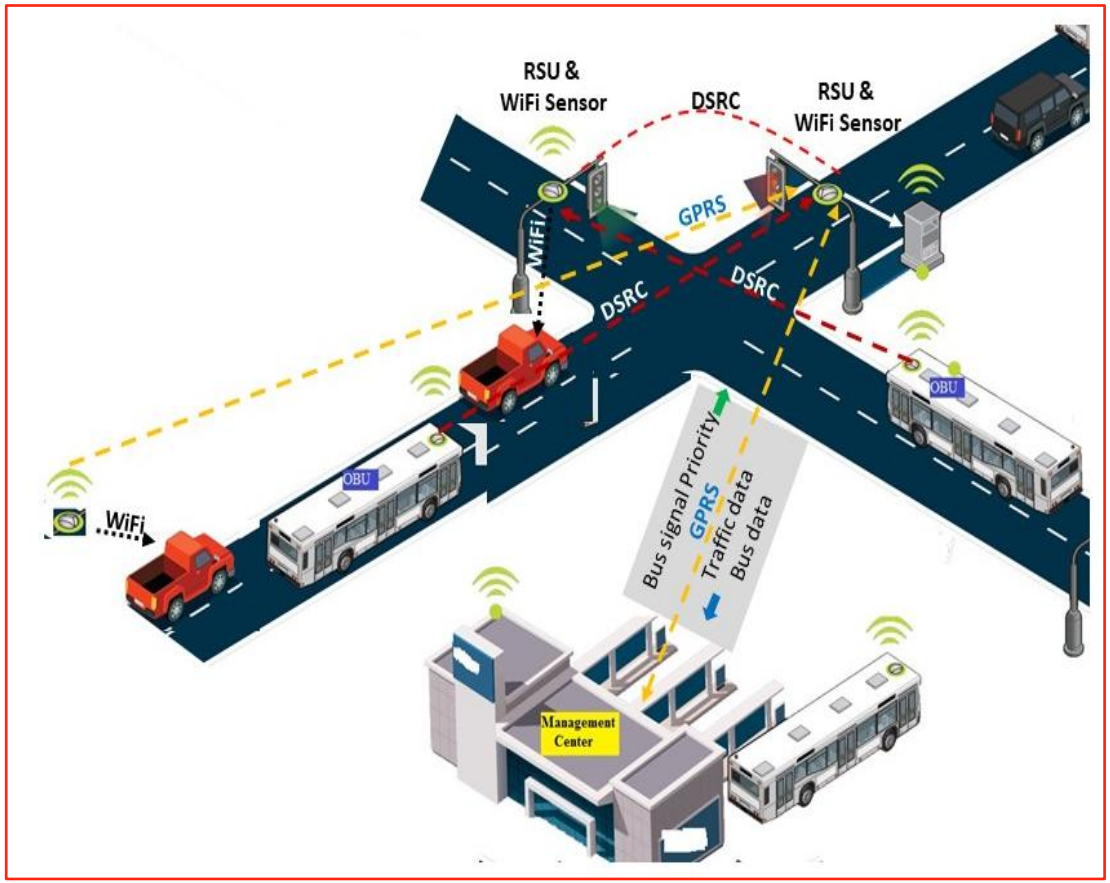
Navigational Data Logger

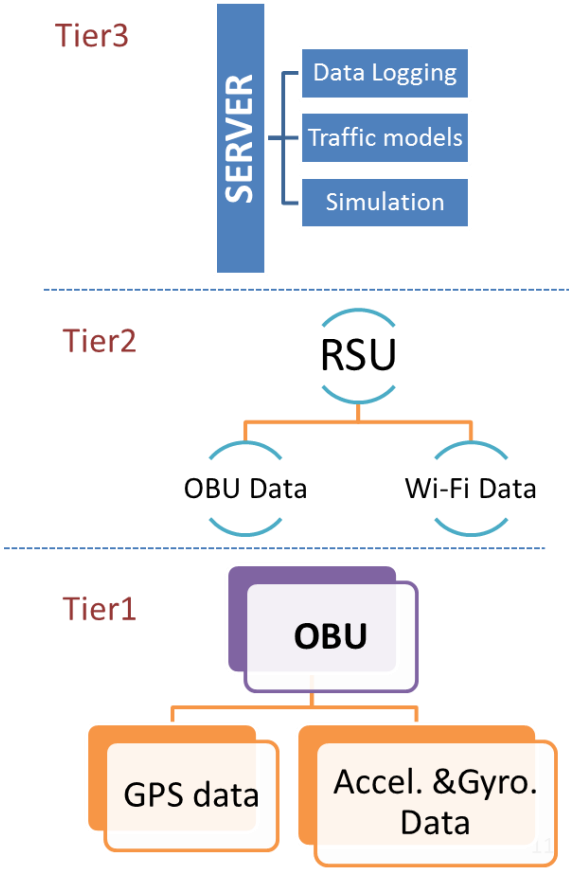


- **Sensors**
  - Triaxial Accelerometer
  - Triaxial Gyroscope
  - Triaxial Magnetometer
  - Temperature/Humidity/Pressure
  - GPS
- **Features**
  - USB interface
  - 10Hz Update Rate
  - Data Logger Software
  - Time stamping

Bus Priority System at Signalized Intersections using V2I Communication

(IIT Madras leads the research)



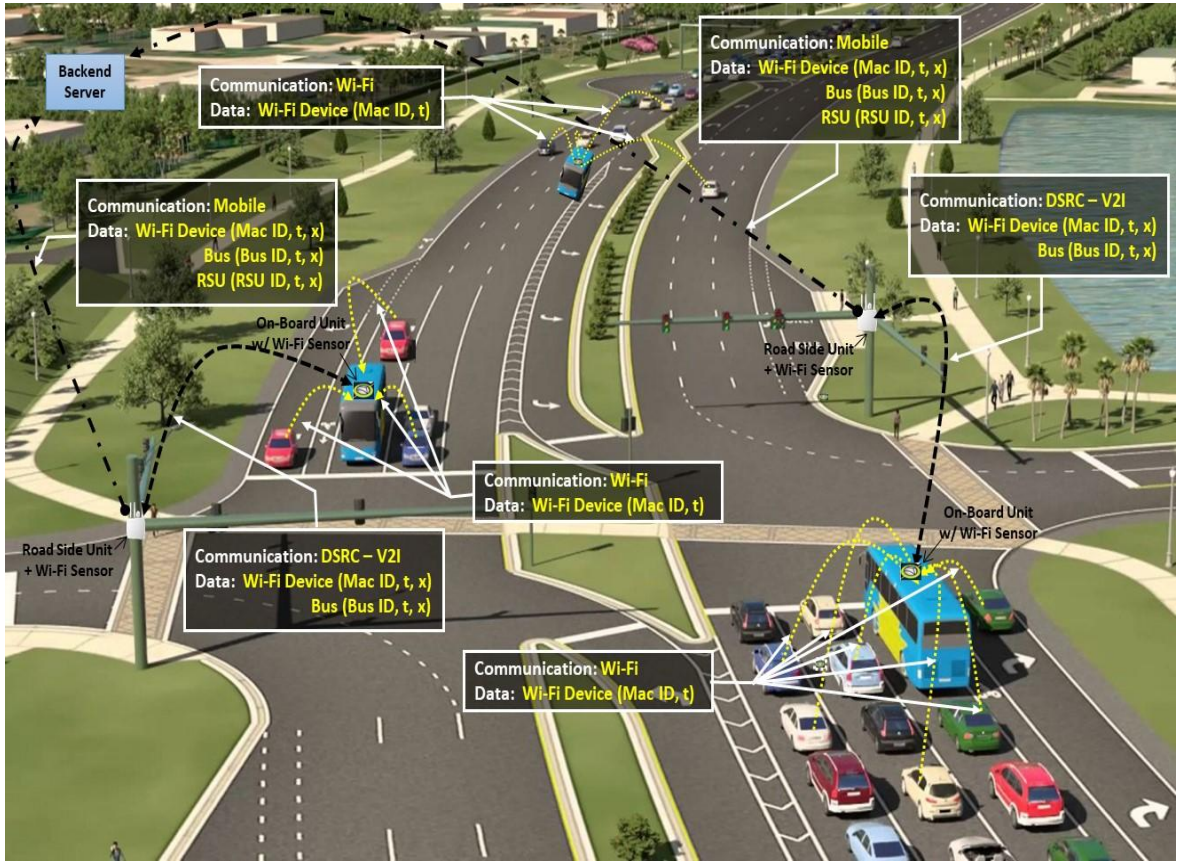


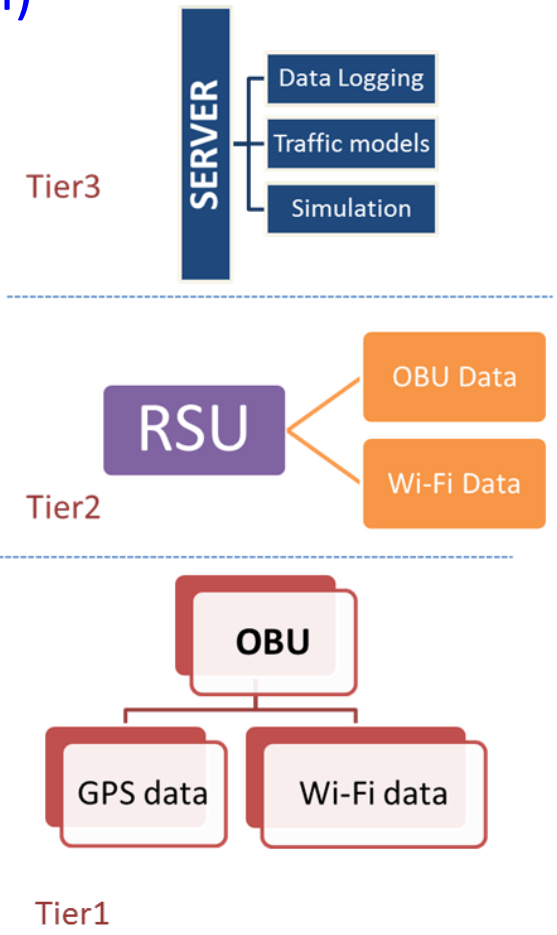
Objectives

- Develop an automated bus priority system that is optimal for the predicted traffic state and bus arrival time, considering practical constraints
  - Reduce bus delays at intersections
  - Improve reliability, Prevent bus bunching, Minimize person delay
    - Collect and store data from the sensors in the On Board Unit (OBU), which will be mounted on the buses and also integrate external WiFi sensors to the OBU
    - Communicate (V2I) traffic state information and bus arrival information at signalized intersections via the Road Side Unit

Departure Time Planner for Public Buses using V2V & V2I Communication

(IIT Madras leads the research)

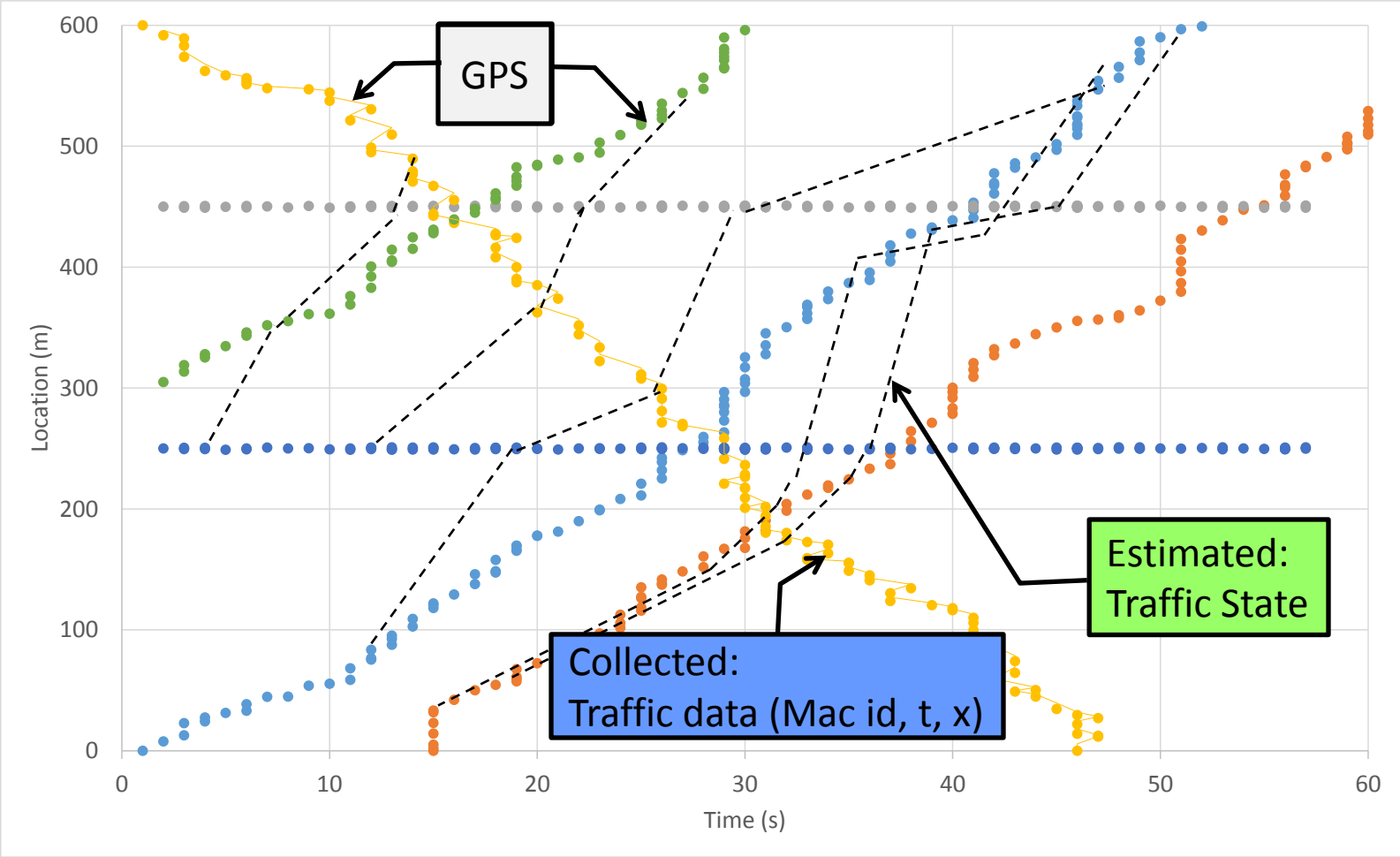




Objectives

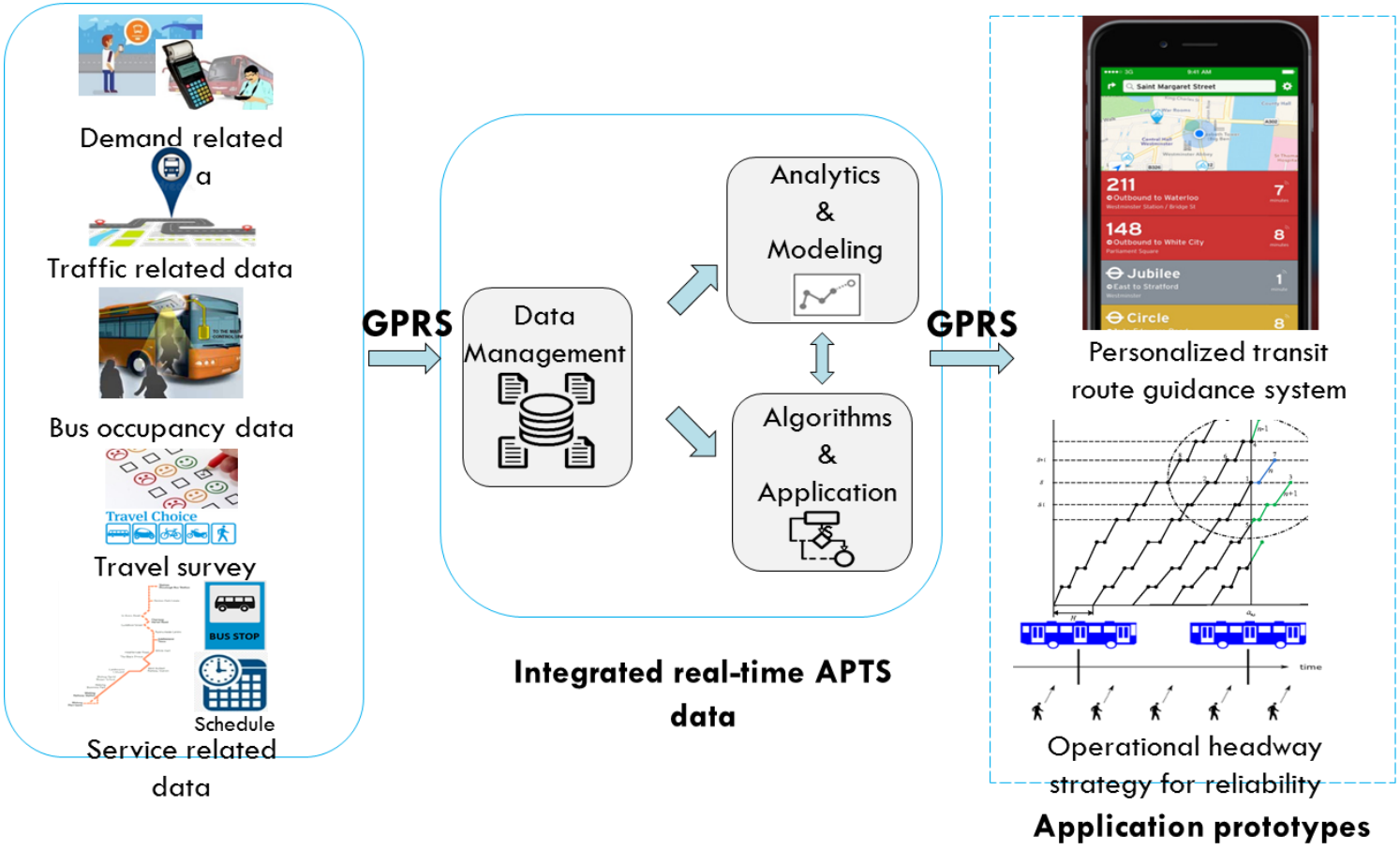
- Develop a traffic state estimation and prediction methodology incorporating the continuous spatiotemporal data and advanced traffic flow models and theory
  - Integrate WiFi-based sensors with DSRC devices
  - Collect and communicate (V2V and V2I) real-time spatiotemporal traffic stream information

Corridor State Estimation



Personalized Route Guidance and Transit System & Operational Headway Reliability Improvement System

(IIT Madras & IISc Bangalore leads the research)



Real Time Integrated Transit Information Database

Passenger Demand

Transit Flow

Operator Decisions

Route choice

Timing of travel

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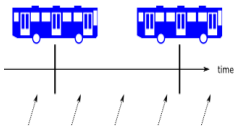
Real Time Integrated Transit Information Database

Dispatch changes

Headway policies

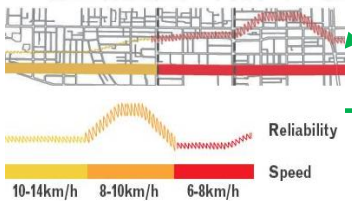


Raw data from different sources

Transit System Performance

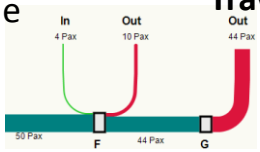
Traffic Flow

Travel time



Travel time reliability

Congestion



Crowding

Objectives

- Provide passengers with optimal routes with due consideration of reliability and user preferences
- Investigate the potential of using real-time information for transit demand management by using data-driven models to learn about users' route choice and provide personalized route guidance
- Develop algorithms for routing of transit passengers based on operator objectives while being consistent with user choice processes
- Propose and evaluate operational headway management strategies based on real-time information for increased reliability

Thank You