

iGUZO: Mobile Crowded Sensing for Intelligent Transport Systems: Case Study

Salahadin Seid,
PhD Candidate, IP Network & Mobile Internet
Addis Ababa University, Ethiopia
salubinseid@gmail.com



Outline

- Background
- Challenges
- Solution
- Benefits
- Future Approach

Background

- An **intelligent transportation system (ITS)** is an integrated application of technologies using electronics, communications, and sensors .
- It enable users to be better **informed** and make *safer, more coordinated*, and *'smarter'* use of road networks.
- Enabling technologies for ITS
 - Wireless communication
 - Computational technologies
 - Sensing technologies

Background ...

- **Wireless communications**

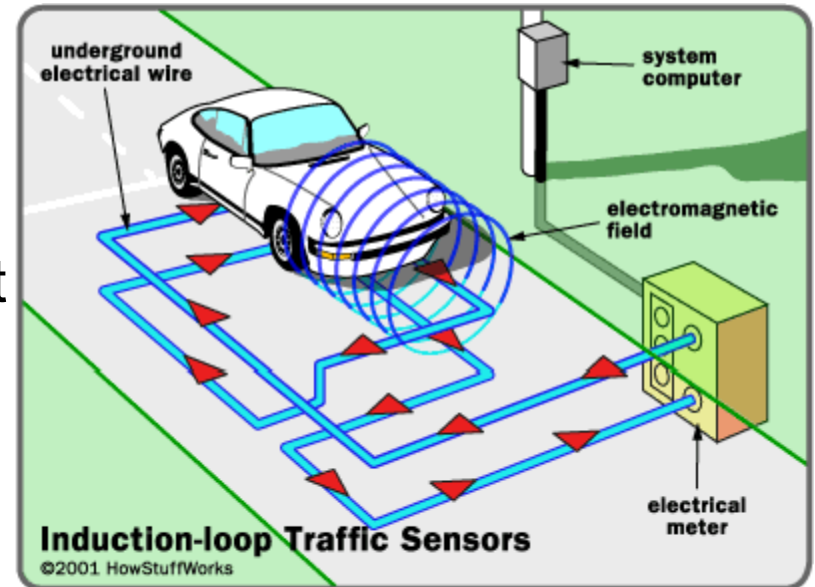
- wireless communications technologies have been proposed for ITS .
 - **IEEE 802.11 protocols** - Mobile ad hoc networks or Mesh networking.
 - **WiMAX** (IEEE 802.16),
 - Global System for Mobile Communications (**GSM**), or
 - **3G**.

Background ...

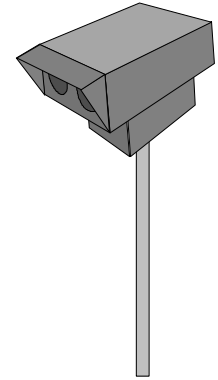
- **Computational technologies**
 - Embedded yet powerful computer on a vehicle with **real-time operating systems**.
 - More sophisticated software applications to be implemented (**artificial intelligence**, and **ubiquitous computing**)

Background ...

- **Sensing technologies**
 - Inductive loop detection
 - **Inductive loops** can be placed in a roadbed to detect vehicles as they pass through the loop's magnetic field.
 - It can **count** the number of vehicles
 - And also estimate the **speed, length, and class of vehicles and the distance** between them.



Background ...



- **Sensing technologies**

- Video vehicle detection

- Measure Traffic-flow and **automatic incident detection** using video cameras
 - Most video detection systems require some initial configuration to "**teach**" the processor the baseline background image.
 - It can measure **lane-by-lane vehicle speeds, counts, and lane occupancy** readings.

Background ...

- **Sensing technologies**

- Audio detection

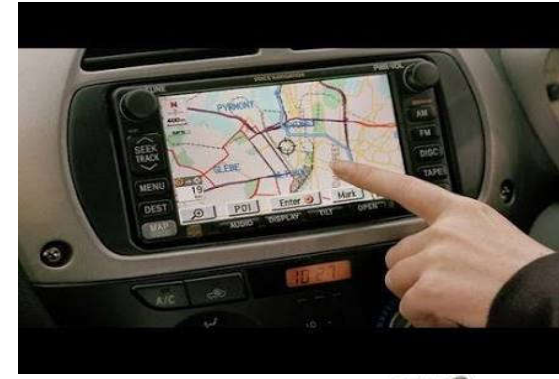
- Measuring traffic density on a road using the **audio signal**.
 - A roadside-installed **microphone** with audio signal processing techniques

- **Location detection**

- Vehicles with **GPS** (satellite navigation)

Background ...

- ITS technologies:
 - Car navigation
 - Traffic signal control systems
 - Automatic number plate recognition
 - Speed cameras
 - Parking guidance systems
 - etc



Challenges & Opportunity

- Unparallel vehicles number with roads condition/management in Addis Ababa
- limited traffic control infrastructure but 3G cellular network
- 57.34 million mobile subscribers in 2017.
- Mobile service coverage: 85%

ITU report <https://telecomworld.itu.int/exhibitor-sponsor-list/ethio-telecom/>

Challenges ...

Highest rate of traffic fatalities per vehicle in the world *



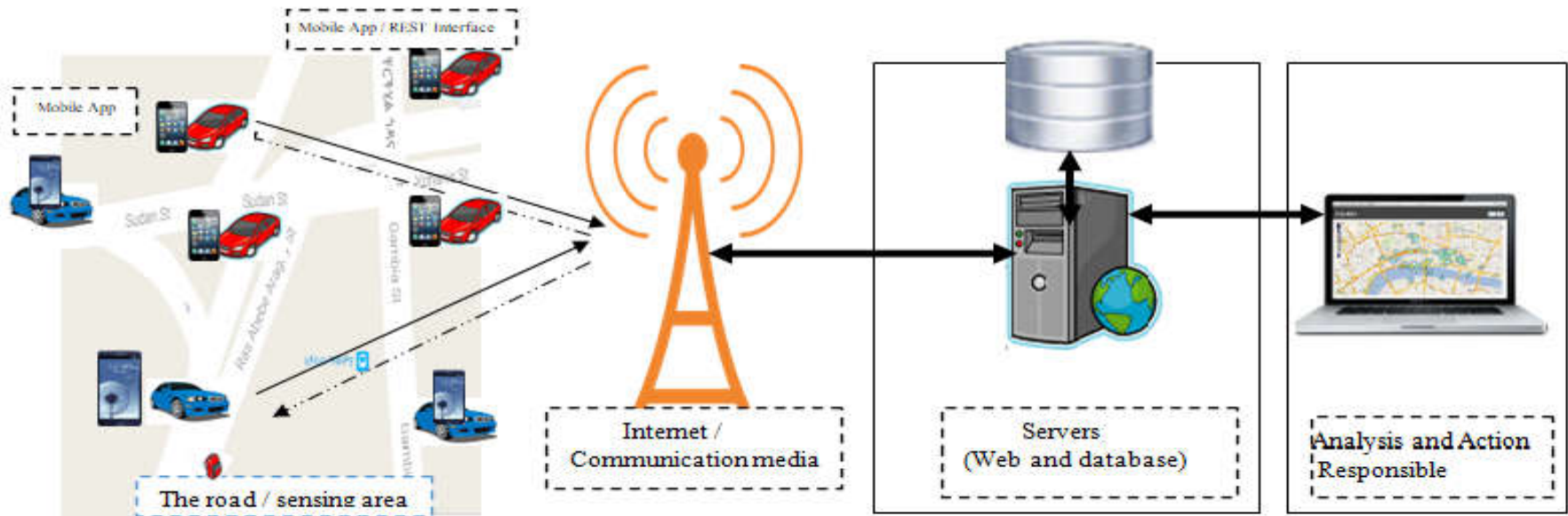
Poor Traffic Mgt in Addis **



<https://addisfortune.net/articles/ethiopia-among-worst-in-traffic-safety/>

<http://addisababaonline.com/the-poor-traffic-management-in-addis-abeba/>

Solution



- Mobile crowd sensing (MSC) - new paradigm of **mobile computing** where Anytime, Anywhere computing
- Mobile Phones – ideal devices
 - Always with us
 - Internet enabled
 - locatable (GPS or other systems)
 - Various sensors



Sensors on iPhone 4:

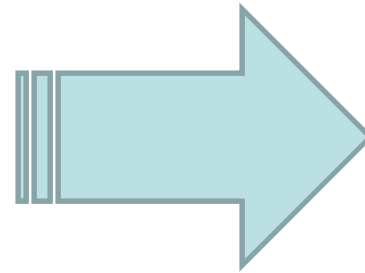
- Camera
- Audio
- Accelerometer
- GPS
- Gyroscope
- Compass
- Proximity
- Ambient light

Solution ...

Simulation experiment

- **City layout**
 - Streets of the city as set of coordinates
 - Road lane and condition
- **Vehicle mobility**
 - Vehicle type
 - Vehicle length
 - # of vehicle
 - Car following model
 - ...
- **ML model**

Stage 1

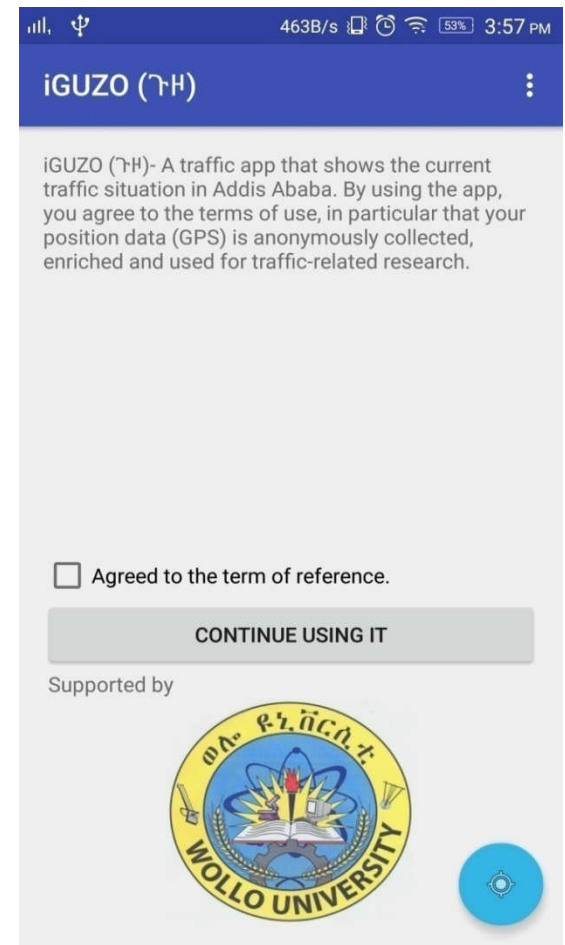
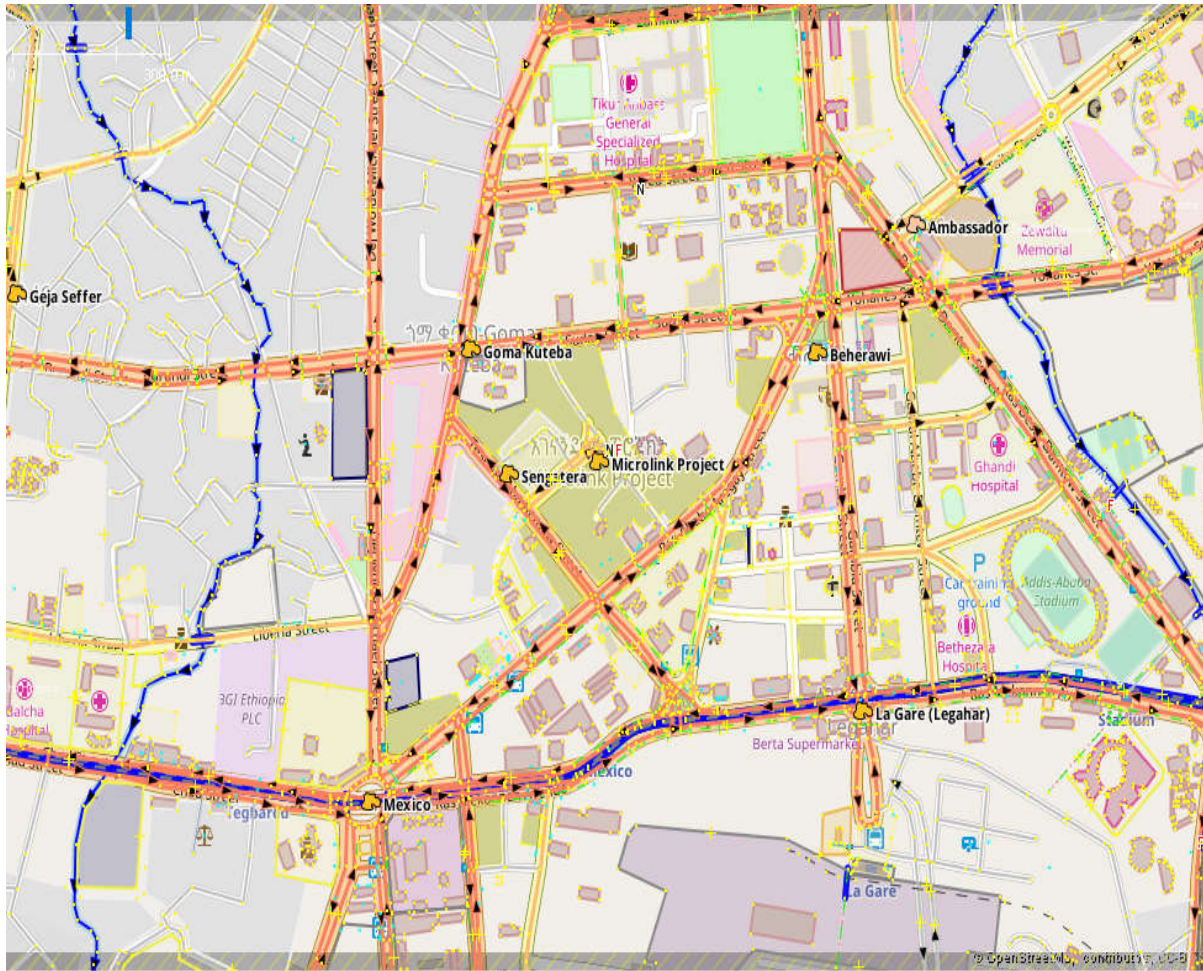


Field experiment

- **ML model (cloud)**
- **Mobile App (Voluntary)**

Stage 2

Solution ...



Benefits

- It provides **real-time information** about vehicles, **overall traffic**, and **roadway conditions**.
- It can manage traffic efficiently and safely, with a reduced rate of jam.

Future Approach



<https://medium.com/@uncleunvoid/lora-phone-the-deconstruction-paradigm-b360dbc93c4b>

Thank You

