Bus Stop Monitoring

PROJECT BY:

PANTELIS GLENTIS 1066464

EVGENIA GKAGKASTATHI 1019191

Problems

Crowd congestion

Schedule delay

Bad timing of routing schedule and people movement

Unknown information about bus location and arrival time

Illegal parking on bus stations

Examples of these problems expressed in press

"Εικόνες απίστευτου συνωστισμού σημειώνονται στα λεωφορεία που μεταφέρουν φοιτητές στις πανεπιστημιακές σχολές της Πάτρας. Ο συγκοινωνιακός φορέας, με την επανλειτουργία του Πανεπιστημίου, επανέφερε το κανονικό πρόγραμμα δρομολογίων, όμως το πρόβλημα του συνωστισμού των φοιτητών σε στάσεις του κέντρου συνέχισε να υφίσταται και είναι καθημερινό φαινόμενο ιδιαίτερα στις ώρες αιχμής." https://www.ieidiseis.gr/ellada/115392/patra-synostismos-sta-leoforeia-pros-to-panepistimio-ti-apanta-to-ktel

"Ο κ. Ρήγας έθιξε και το πρόβλημα του κυκλοφοριακού που καθιστά τις αστικές συγκοινωνίες της Πάτρας μη ελκυστικές για το επιβατικό κοινό. Οπως είπε, η κατάσταση στο κέντρο είναι πλέον δραματική και ανυπόφορη, καθώς το διπλοπαρκάρισμα έχει επιφέρει δραματική αύξηση στους χρόνους υλοποίησης τακτικών δρομολογίων. Ανέφερε για παράδειγμα ότι το δρομολόγιο για Εγλυκάδα έχει αυξηθεί σε χρόνο από 25 λεπτά σε σχεδόν μια ώρα, με αποτέλεσμα το επιβατικό κοινό να έχει μειωθεί." https://pelop.gr/astiko-ktel-kindynevei-me-chreokopia-klataroun-oikonomika-ta-leoforeia-stin-patra/

Ways to overcome

AI based **cameras** for tracking buses, people and illegally parked vehicles

Sound sensors for detecting buses and people congestion with **noise** processing

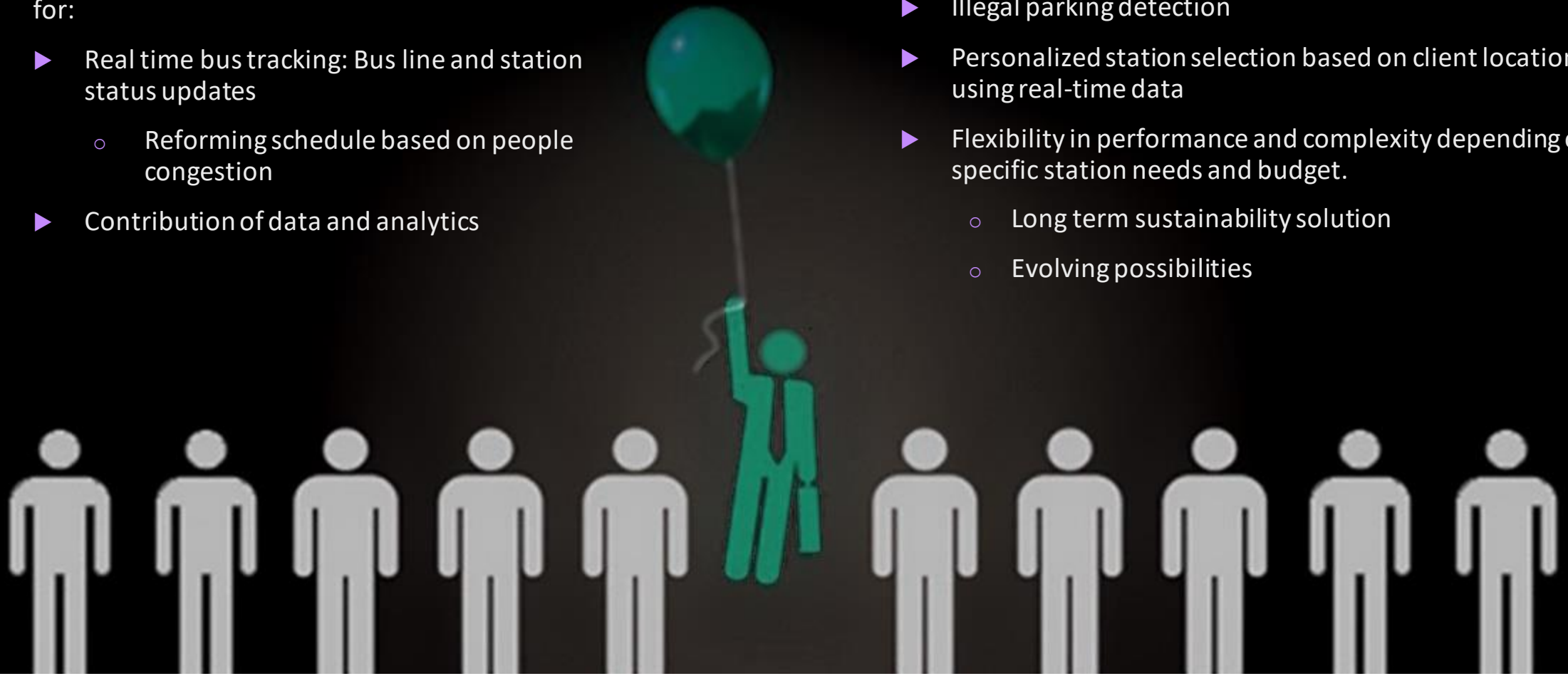
Parking sensors and bluetooth tags offering **real-time** data about each bus and its routing schedule

Google maps roads API along with data from LoRa and Wifi/Narrowband Networks for **data processing and analytics**

How we differ

Our implementation provides a low-cost solution for:

- Real time bus tracking: Bus line and station status updates
  - Reforming schedule based on people congestion
- Contribution of data and analytics



With the unique added value provided by:

- Illegal parking detection
- Personalized station selection based on client location using real-time data
- Flexibility in performance and complexity depending on specific station needs and budget.
  - Long term sustainability solution
  - Evolving possibilities

Target group

Our product's goal is to provide data about bus traffic and offer ways to improve the quality of service. Therefore, our product is destined for:

- citizens
- bus companies
- research groups
- administration offices.

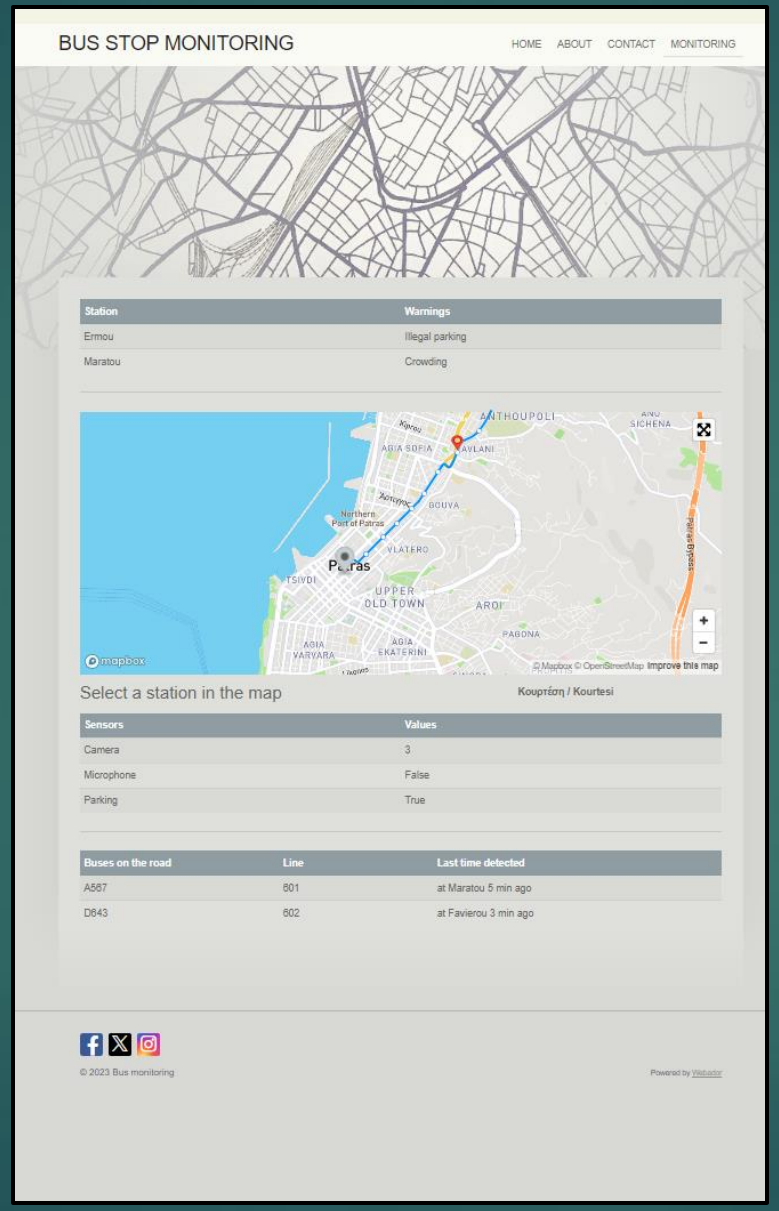
Website Draft

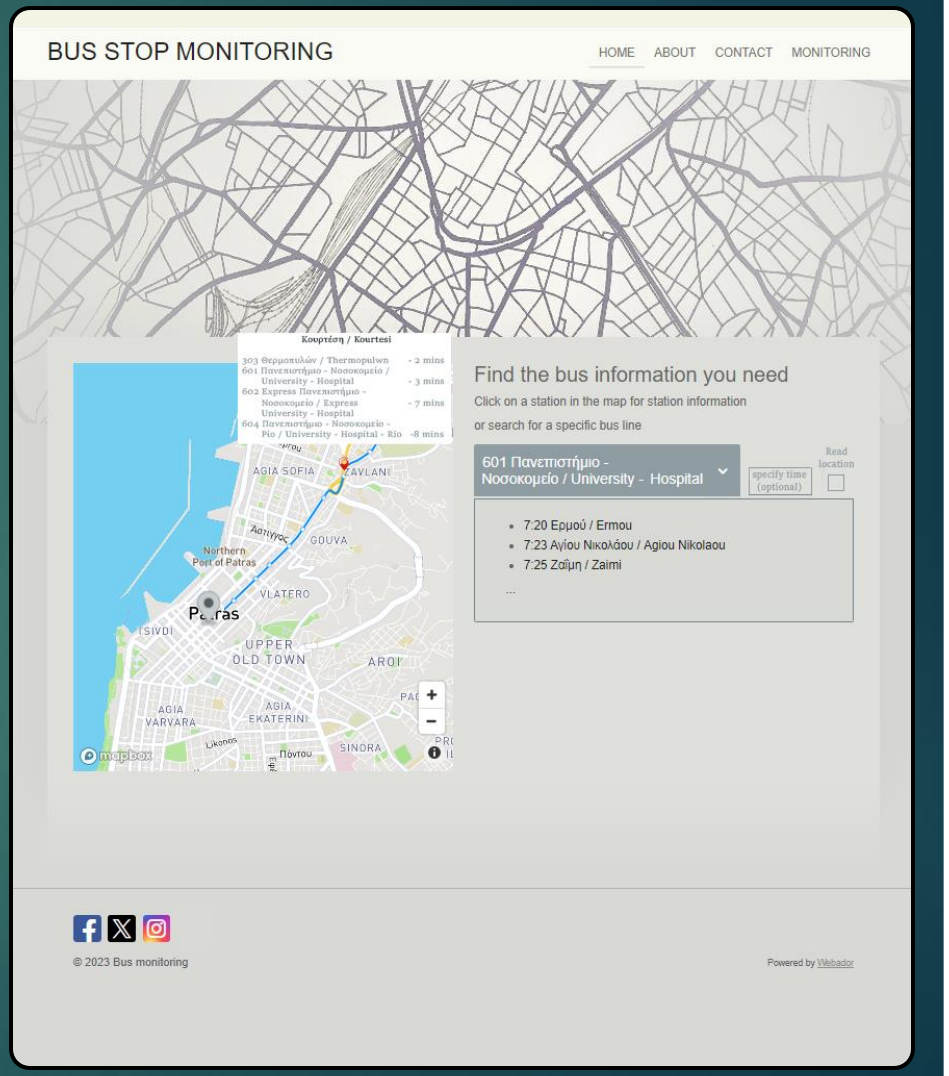
Features (Customer view)

- Real-time bus-line information
- Personalized station selection based on client location

Additional administrator features:

- Monitoring:
  - General Warnings
  - Station-specific Status Report
  - Active Bus Tracking





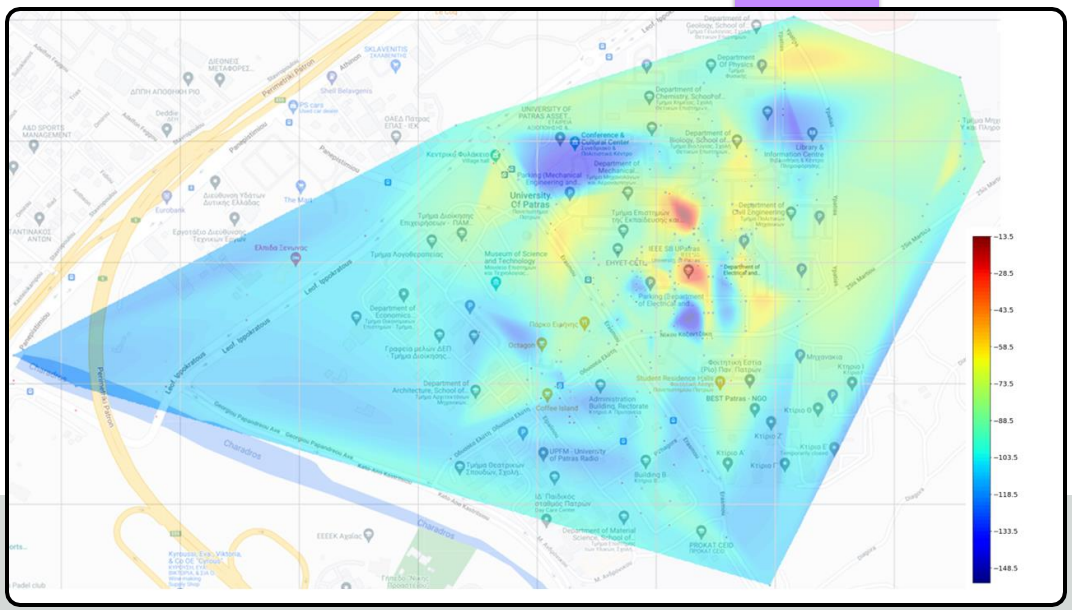
Prices

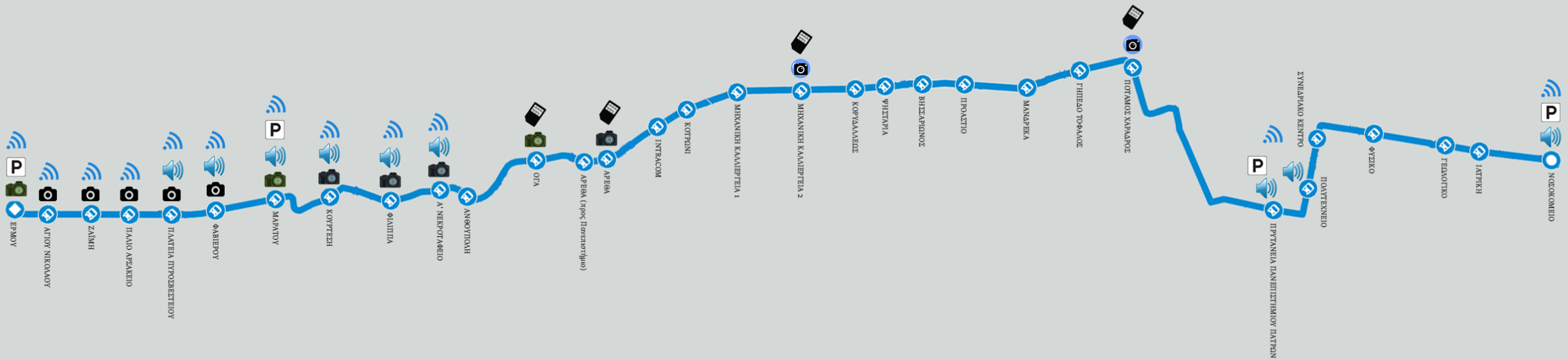
- Narrowband network - 1.24 € per month – 500 KB per month
- Sound sensors (14.96 €)
- 4 types of Cameras (17.91 € – 37.81 €):
  - Normal-view 1080p
  - Normal-view 1440p
  - Wide-view 1080p
  - Wide-view 1440p
- Raspberry pi 0 W (20.50 €)
- Parking sensors (average 200 €)
- LoRa gateway (50m range) (84.50 €)

601 bus-line total cost: 1836,74 €

601 bus-line subscription: 59,52 €/year

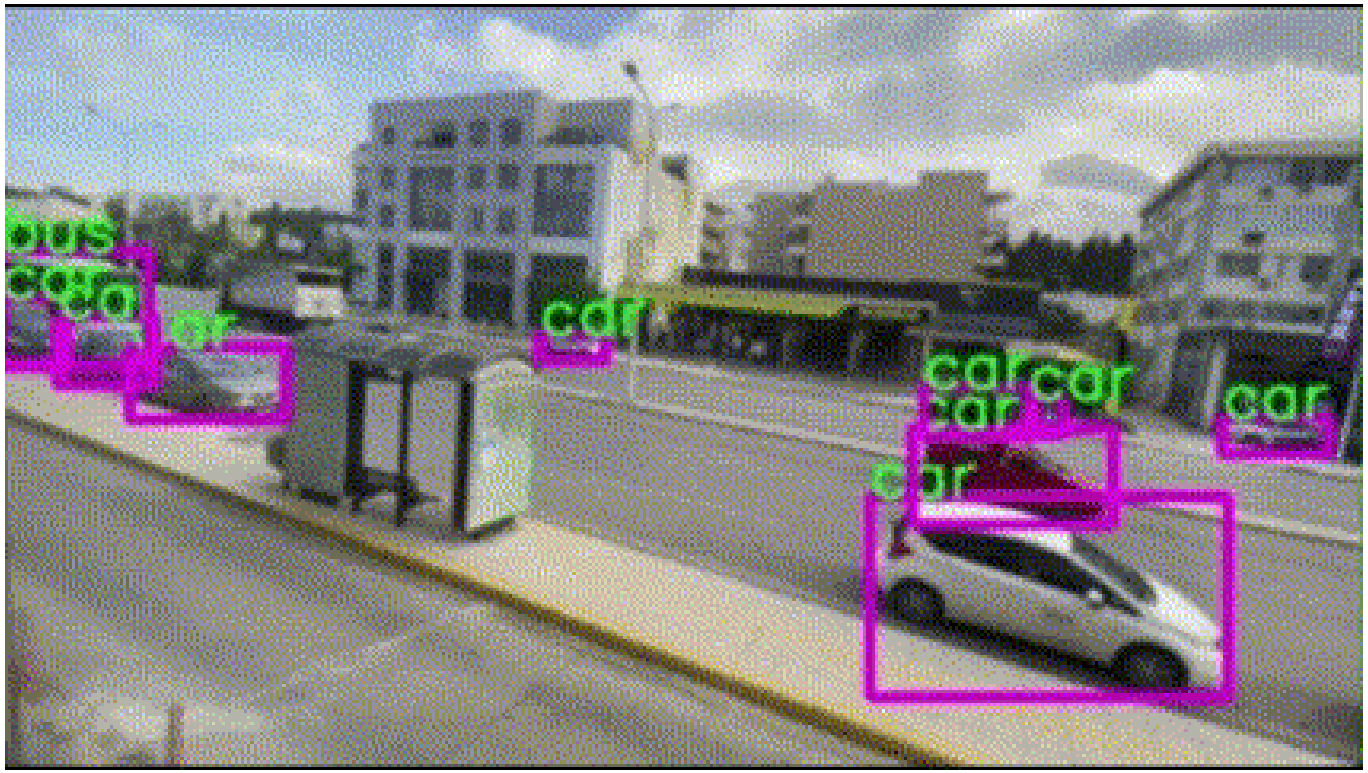
Bus-line 601 implementation



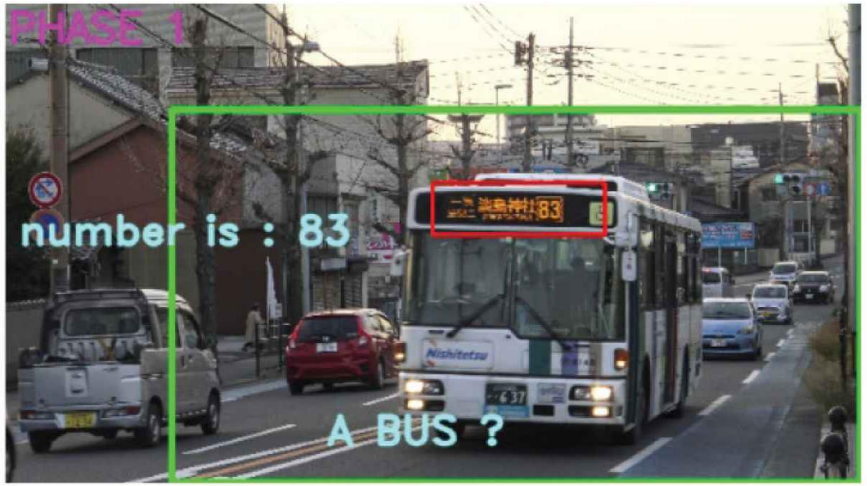


CAMERA OPERATION - AI

YOLOv.8



OCR Implementation



Similar applications

- www.astikopatras.gr
  - It offers real-time schedule about bus-lines for each and every bus of Patras
    - Not financially-efficient implementation due to the use of GPS trackers with high-maintenance, while our implementation focuses on low-cost use of sensors.
- https://jv-technoton.com/solutions/bus-monitoring-system/
  - Passenger load measurement (Similar to people flow sensor - counting passengers)
  - Maintenance optimization (maintaining vehicle or machinery fleet health, based on monitoring current operation parameters and detecting signs of forthcoming malfunctions)
  - Precise fuel monitoring (fuel level measurement - requirement to GPS vehicle tracking system)
  - Driving behavior monitoring (Notifications on dangerous driving – harsh braking, acceleration, turns, speeding)
  - Dispatching (Precise measurement of remaining fuel in tank and fuel consumption, sending data to dashboard. Notifications on fuel fill-up and measuring from tank)

  Use of:

  1. Transmitters continuously transmit measurement results (data) to Receivers (via BLE radio)
  2. Receivers: store the settings of all Transmitters
  3. Mobile application for Android/iPhone OS