Expression of interest

Contact details

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Short description of the organisation

Istanbul University was established in 1453 during Ottoman Empire times. It is among the oldest universities in Europe. Our university was the only higher education institution when the Turkish Republic was founded in 1923. Since many academics graduated from our university and achieved many leading publications, Istanbul University has always played a crucial role in Türkiye.

Istanbul University is consistently ranked as one of Türkiye's leading universities and earlier was ranked first among 114 universities, with academic strengths, entrance, teaching, and research standards in several times. It has 80 research and application centers, 15 faculties, 12 institutes, 2 schools, and 2 vocational higher schools which are located in 9 different campuses. There are over 255.000 undergraduate, 22.000 graduate students, and 6500 foreign students.

Today, many enterprises have gone beyond borders and become multinational as a result of intense competition. Since 1999, Türkiye has been expanding its logistics sector and cooperating with over 50 countries. As it is known, European Union standards raised its standards for qualified human resources in the logistics sector. Since the EU emerges as a driving force for developing countries, day-by-day logistics education increased its popularity in Türkiye.

The Faculty of Transportation and Logistics was established in 1999 to train specialists who will take roles in shaping the logistics industry in terms of national and international relations. The Faculty carries out education and research activities in Intelligent Transportation Systems, Transport and Logistics, International Logistics Management, and Logistics Management programs. Since its foundation, 571 students have graduated from Türkiye's first logistics faculty. The faculty consistently leads the Turkish logistics industry through its efforts to educate the required human resources and contribute to transportation and logistics policies as a reputable educational institution.

Akif Fidanoglu, Huseyin Korkmaz, and Salih Ozcelik are the main researchers. Below you can find brief profile information about the main researchers:

Dr. Akif Fidanoglu (*akif.fidanoglu@istanbul.edu.tr*) is a member of the Department of Transportation and Logistics, Istanbul University, Türkiye. He completed his Ph.D. in the Civil Engineering Department at Bogazici University, Turkey. His research has focused on optimization, heuristics, meta-heuristics, autonomous vehicles, and public transportation (PT) systems. He

investigated the feasibility of autonomous public transportation as a solution to the last mile in his doctoral thesis. Also, he developed a model to predict public transportation users' origin and destination (OD) points in his master's thesis. Please, click https://avesis.istanbul.edu.tr/akif.fidanoglu/ for a more detailed CV.

Huseyin Korkmaz (*huseyinkorkmaz@istanbul.edu.tr*) is a research assistant at the Department of Transportation and Logistics and a Ph.D. candidate in the Department of Intelligent Transportation Systems at Istanbul University, Türkiye. His main research interests include intelligent transportation systems, public transportation, traffic congestion, traffic prediction, traffic safety, air transportation, aviation management, autonomous vehicles, electric vehicles, and user acceptance. He investigates vehicular accidents data-based traffic congestion prediction: A connected autonomous vehicle simulation in his doctoral thesis. Also, he researched the qualified study on the determination of airport apron safety problems: Intelligent transportation systems solution proposals in his master's thesis. Please, click https://avesis.istanbul.edu.tr/huseyinkorkmaz/ for a more detailed CV.

Dr. Salih Ozcelik (*salih.ozcelik@istanbul.edu.tr*) is a member of the Department of Transportation and Logistics. He completed his Ph.D. in the Business Administration Department at Istanbul University, Türkiye. His research has focused on optimization, machine learning, statistics, logistics network design, and intelligent transportation systems. He investigated the disaster logistics network design optimization: Tuzla district case in his doctoral thesis. Please, click https://avesis.istanbul.edu.tr/salih.ozcelik/ for a more detailed CV.

Specific skills related to the project

We have extensive experience in optimization models, including exact methods, heuristics, and metaheuristics. We completed several studies especially in Vehicle Routing Problem context, and utilized various types of optimization models. We developed new metaheuristic methods that are more suitable for the dynamic setup of the studied problem by modifying existing optimization algorithms. We coded these algorithms in Python and generated a simulation software for the related routing problem. These solution algorithms and the simulation framework can be adjusted for various other mobility problems. In our previous studies we proposed a door-to-door mobility that can transfer the public transit users to the transit hubs by using autonomous vehicles. We simulated the case study in our simulation software and tested different types of solution algorithms.

To simulate any transportation network, we need to have the trip demand of the users. There are several ways of acquiring the trip demand. For the public transportation systems, the trips of the users are recorded by the automated data collection (ADC) systems. However, very few cities have transportation systems that record both boarding and alighting stops of the users. Therefore, the recorded transit data includes only the origiins of the trips. To further determine the destionation points of the trips, we need to develop methods. In our previous studies, we developed a robust trip chaining algorithm to infer the OD points of PT users.

In our study that is concluded with the article named “User acceptance of autonomous public transport systems: Extended UTAUT2 model” we developed an integrated and expanded user acceptance model to explain the factors affecting behavioral intention to use autonomous public

transportation systems. Several factors are included in the model to examine the constructs while the model is tested with structural equation modeling (SEM). The findings of this study can guide decision makers in the PT industry by helping them understand the factors affecting the use and acceptance of autonomous public transport systems.

In this sense, we can contribute mobility-related projects in the following aspects:

- Developing a new generation mobility service, especially on demand services with shared AVs in last mile mobility.
- Acquiring the trip demand by using OD inference methods for transit users. Artificial intelligence can be utilized to forecast the OD pairs of the users.
- Developing the solution algorithms required to solve the related problem
- Constructing the simulation software that can simulate the model on a real network.
- Performing simulations with different setups.
- Assessing the effects of the proposed system (e.g. shared AVs) on energy efficiency, total traveled distance, service quality etc.
- Evaluating the factors that can impact the behavioral intention to use new mobility services.
- Developing a better and more optimized public transportation management model.

The project team is also highly experienced in statistical analysis and optimization algorithms. Their main research areas are intelligent transportation systems, transportation and logistics, autonomous vehicles, connected vehicles, public transportation systems, emergency/disaster logistics.

Research experience and important publications of the main researchers:

- Integrating Shared Autonomous Vehicles in Last-Mile Public Transportation (2023, submitted)
- Post-Earthquake Casualty Transport Optimization (2023, submitted)
- A method for Public Transit OD Estimation Using Transit Smart Card Data (2023, submitted)
- User Acceptance of Autonomous Public Transport Systems: Extended UTAUT2 Model (2022)
- Integration of Public Transportation Using Autonomous Vehicles (2021)
- VRP Approach to Cargo Transportation with Drone (2019)
- Effective Use of Global Positioning Systems (GPS) Used in Public Transport Vehicles in terms of Public Transport Management (2019)

Proposed activities for the project

Even though shared use services have become popular in recent years they still have some disadvantages compared to fixed-route transits or private cars. With the elimination of human-related performance limitations, AVs are likely to boost ride-sharing and offer more efficient mobility. In addition, AVs will have an efficient operation by the potential energy savings resulting from selecting the most energy-efficient routes. Therefore, Shared Autonomous Vehicles could achieve more sustainable transportation by improving energy efficiency. Besides AVs can offer potential mobility for disabled passengers, young adults, and elderly users. Furthermore, operational policies for a fleet are made for efficient fleet management. Full compliance with the operational policies of the fleet manager is hard to achieve with a conventional fleet with drivers but can be fulfilled with a fleet of AVs.

Since in most cases, the last mile trips of the chained trips in PT are inflexible and slow, the discomfort and the disutility of these trips make PT unattractive for the users. By introducing more efficient paratransit transport to and from mass transit hubs, the last mile problem can be resolved. A better integrated public transit network could provide cost-effective, energy-efficient, and sustainable door-to-door transportation.

In this sense, we investigated the feasibility of shared autonomous vehicles (AV) in terms of providing an alternative on-demand transportation service for last-mile mobility to the conventional bus routes that have fixed routes and schedules. We developed an agent-based simulation software to evaluate the performance of the solution methods proposed for the problem. The simulation is coded in Python 3.9. The solution algorithms used for the passenger-vehicle assignments and routing were embedded in the simulation.

Trip requests that are used in the model are derived from the origin and destination points of the PT users. We developed a method for the inference of OD points of the users. By extending the assumptions made in previous OD studies, a robust trip chaining algorithm is developed to find the OD pairs of the bus passengers.

The origin and destination matrix of public transportation users can be utilized in various other ways. OD matrices can provide an insight into the performance of the bus routes. The number of passengers onboard, maximum loads over the route, interchange locations, average interchange duration, and various other information can be acquired from the inferred OD matrices. These metrics guide the transit agencies in service design, bus scheduling, route optimization, etc. Therefore, OD matrices provide valuable information for transit agencies to improve the service quality of public transportation systems.

References

Project acronym / starting date	Main objectives	Main activities	Role in the project
LGE / 24.09.2019	To determine an indicator that reveals the conditions of the logistics sector	Determination of the methodology and statistical analysis	Researcher
LGE / 22.02.2022	To create confidence indices for the sub-divisions of the sector in order to identify opportunities in maritime, land, air and rail transportation and to meet the need for early warning	Determination of the methodology and statistical analysis	Researcher
ITS-PI (submitted) / 2023	Development of the Intelligent Transportation Systems Performance Index (ITS-PI)	Data analysis, Parameter weighting, ITS-PI evaluation model Development, ITS-PI performance metrics, Index development	Principal Investigator
Rail logistics between Turkey and Iran (submitted) / 2023	To design optimal international railway logistics between Turkey and Iran	Data gathering, Mathematical modeling of the problem, Formulating the solution algorithm and evaluating the model and algorithm	Principal Investigator
The Readiness Assessment Model Development in Turkey and Korean (submitted) / 2023	The Readiness Assessment Model Development to Utilize Mobility as a Service	Model development and matrix construction, Data gathering and data analysis	Principal Investigator
Sustainable Transport and Logistics Index (submitted) / 2023	To develop Data-Oriented Sustainable Transport and Logistics Index	Index Model Development and Framework Design, Data gathering and data analysis	Principal Investigator