Expression of Interest

Contact details

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Short description of the organisation

Provide a short description of the equipment available, the relations with the industry, the profile of the main researchers

Sabancı University (SU) is internationally recognized as one of the most research-oriented and innovative universities in Turkiye. SU has 63 FP6 and FP7 projects of which 31 Marie Curie Grants (17 IRG, 9 CIG, 3 ITN, 1 IOF, 1 IRSES). Under Horizon 2020 innovation and research framework program, SU has received ~8 Million Euro EU contribution with its 41 funded projects. In Horizon EUROPE, SU has recently funded 4 projects of which 1 as Coordinator. Besides the Framework Program SU has also 26 other EU funded projects: 12 Jean Monnet Projects. 2 ERASMUS+, 9 EEN (COSME), 1 IPA and 2 EIT Urban Mobility.

Smart Mobility and Logistics Lab (SML) in SU focuses on transport logistics and mobility planning including urban transport, first-mile, long-distance and last-mile pickup/delivery operations, electromobility, and sustainable logistics chains. SML team is equipped with extensive domain knowledge in logistics and transportation research, and experienced in addressing multifaceted problems through systematic modelling approaches and effective solution methods using optimization/operations research tools and techniques. SML Lab conducts research projects particularly on urban mobility and sustainable transport planning with a special emphasis on logistics network design, route optimization, electrification of logistics vehicles, and battery performance analysis as well as shared mobility, mobility as a service, and parking. Additional information may be found at the SML Lab web page: http://sml.sabanciuniv.edu/

Specific skills related to the project

Indicate the specific skills and competence in relation with "HORIZON-CL5-2024-D6-01-06: Optimising Multimodal Network and Traffic Management, Harnessing Data from Infrastructures, Mobility of Passengers and Freight Transport" topic

We have 10+ years of experience in developing optimization-based approaches, models, and solution methodologies to reduce the carbon footprint of logistics activities on road transportation networks.

Within the scope of this project, we can contribute in the following aspects:

- Providing solutions to increase freight inter modality with a focus on zero-emission first/last-mile transport such as electric vehicles (EVs).

- Demonstrating solutions that optimize routes and improve the vehicle utilizations, and help achieve city sustainability targets by reducing emissions, congestion, and risk;

- Developing route optimization methods for EVs by considering the practical limitations associated with range anxiety and recharging needs;

- Developing innovative logistics solutions for urban areas with specific challenges including dense city centers, congestion charge zones, low emission zones;

- Assessing the benefits of the proposed solutions in comparison to conventional logistics operations;

- Demonstrating the operational performance, and perform the impact analysis through collected data and user surveys;

- Building a competitive local consortium comprising logistics operators, municipalities, and other research institutions.

Our portfolio of research activities related to the topic may be found in the “References” section.

Proposed activities for the project

Indicate which activities you would like to implement during the project

Within the context of developing new tools and services for optimising the mobility of passengers and freight, we can:

- develop and test novel solution methods and algorithms for the first/last-mile collection and last-mile delivery planning of freight in urban and rural areas using modal shift across different types of EVs including medium-duty, light commercial as well as micro-mobility vehicles;
- assess the role of internal and external factors such as vehicle type, cargo weight, road gradient, traffic conditions, on-board auxiliary systems, and ambient temperature in performance and range anxiety of the EVs;
- demonstrate the performance of the proposed algorithms by establishing a digital twin;
- integrate the developed methods within a decision support system;
- develop last-mile solutions for passengers with existing public transportation network using shared micromobility vehicles;
- perform scenario-based analyses using the operational data collected by the partners or provided by fleet operators;
- evaluate the environmental benefits of utilizing EVs in the last/first mile logistics operations.

EV market penetration in Turkey is low and the utilization of EV fleets is not common in logistics operations. We would like to play a catalyst role in increasing the awareness of local logistics companies, fleet managers, manufacturers and public authorities on new transport concepts and electromobility; and disseminating the results of the project in our region.

References

Related Research Project

Project acronym / starting date	Main objectives	Main activities	Role
MeHUB: Integrating a Connected Micromobility Infrastructure to the Existing Public Transport / 04-12.2021 (EIT Urban Mobility)	Help organize public space in the urban environment, lower operation costs for micromobility operators and create a better MaaS experience for citizens with the connected and universal micromobility charging infrastructure solution.	- Developing mathematical models and algorithms to determine the optimal locations and quantities of charging stations - Performing exploratory data analysis to investigate the utilizations of the stations	Partner
New Models and Efficient Solution Methods for the Electric Vehicle Routing Problem / 2018-20 (TÜBİTAK 1001 Program Grant #118M412)	Optimizing the routes of electric freight vehicles considering different problem variants that are affected by varying external and internal factors	- Developing mathematical models that consider the influence of different factors such as ambient temperature, cargo weight, road gradient and battery degradation on route planning - Developing exact and heuristic algorithms to solve them efficiently	Leader
New Approaches and Methodologies to Reduce Energy Consumption and Greenhouse Gas Emissions on Transportation Networks /2013-15. (TÜBİTAK 2515 Program Grant #113M522 - related with COST Action TU 1204 : "People Friendly Cities in a Data Rich World")	Reduce greenhouse gas emissions of logistics vehicles on road networks through effective route optimization	- Developing mathematical models and algorithms to determine the greenhouse gas emission minimizing paths on time-varying (dynamic) road networks - Validating its performance on Washington, DC and Istanbul road networks - Implementing it within a route planner where the vehicle routes and the corresponding node-to-node travel paths were determined simultaneously -Investigating potential savings and sustainability benefits on test data	Leader
Building Resilient Economic Agglomerations on Transportation and Health Effects: Urban Form, Location Choice and Transport Solutions for High Air Quality and Low-carbon Cities / 2016-19 (ERA-NET Cofund, Smart Cities and Communities)	Support policy makers in their design of integrated local urban energy and transport systems, assessing the combined effect on economic welfare.	- Developing surveys to study (environmental) preferences and (location) behavior of firms and households in four different European cities (Amsterdam, Istanbul, Gothenburg, Barcelona) - Developing a spatial general equilibrium model for policy simulations in cities across Europe	Partner

Ship2Rail: An integrated Service Platform for the Sea-Rail Multimodal Transport Service Providers Based on Revenue Management / 2016-17 (TÜBİTAK 2232 Program)	Design and develop a seamless service platform for joint reservation as well as co-sharing in sea-rail multimodal transport in order to create integrated and unified communication opportunities for transport actors	Developing a decision support system prototype to support quick, safe and easy reservation system among the transport actors in sea-rail multimodal transport using real-time planning algorithms in order to justify the changes in transport planning, adopt different price strategies for transport service providers and reduce empty transport.	Leader
Task 41: Electric Freight Vehicles / 2019-22 (International Energy Agency, Hybrid and Electric Vehicle Technology Collaboration Programme)	Monitor progress and review relevant aspects for a successful introduction of electric freight vehicles into the market	- Organizing workshops through contacts with other international networks - Collecting and exchanging information in workshops	Partner
Task 27: Electrification of Transport Logistic Vehicles (eLogV) / 2014-17 (International Energy Agency, Hybrid and Electric Vehicle Technology Collaboration Programme)	Summarise the status of electrified transport logistic vehicles and infrastructure technologies, implementation and hurdles, identify early niche markets and commercialisation opportunities for electrified transport logistic vehicles, and provide policy recommendations for further research and deployment activities.	- Organizing workshops through contacts with other international networks - Collecting and exchanging information in workshops	Partner

Relevant Papers (Last 5 years)

Duman EN, Taş D, Çatay B (2022) Branch-and-price-and-cut methods for the electric vehicle routing problem with time windows. *International Journal of Production Research* 60(17), 5332-5353.

İslim RB, Çatay B (2022) The effect of battery degradation on the route optimization of electric vehicles. In: MM Cruz-Cunha et al. (eds.) *Proc. of the 2022 International Conference on Industry Sciences and Computer Science Innovation 2022 (iSCSi 2022)*, *Computer Science Procedia* 204, 1–8.

Sadati MEH, Akbari V, Çatay B (2022) Electric vehicle routing problem with flexible deliveries. *International Journal of Production Research* 60(13), 4268–4294.

Seyfi M, Alinaghian M, Ghorbani E, Çatay B, Sabbagh MS (2022) Multi-mode hybrid electric vehicle routing problem (in press).

Yıldırım UM, Çatay B (2022) An enhanced network-consistent travel speed generation scheme on time-dependent shortest path and routing problems. *IEEE Transactions on Intelligent Transportation Systems* 23(2), 873-884.

Charaf S, Taş D, Flapper SD, Van Woensel T (2022) A branch-and-price algorithm for the two-echelon inventory-routing problem, Technical Report,

https://doi.org/10.48550/arXiv.2206.12316

Taş D (2021) Electric vehicle routing with flexible time windows: a column generation solution approach, Transportation Letters, 13(2), 97–103

Rastani S, Çatay B (2021) A large neighborhood search-based matheuristic for the load-dependent electric vehicle routing problem with time windows. *Annals of Operations Research*, 1-33. (Published online).

Sadati MEH, Çatay B, Aksen D (2021) An efficient variable neighborhood search with tabu shaking for a class of multi-depot vehicle routing problems. *Computers and Operations Research* 133, 105269.

Keskin M, Çatay B, Laporte G (2021) A simulation-based heuristic for the electric vehicle routing problem with time windows and stochastic waiting times at recharging stations. *Computers and Operations Research* 125, 105060.

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Tinic GÖ, Koca E, Yaman H (2021) An exact solution approach for the inventory routing problem with time windows. *Computers and Operations Research* 134, 105371.

Van Ommeren J, McIvor M, Mulalic I, Inci E (2021) A novel methodology to estimate cruising for parking and related external costs. *Transportation Research Part B: Methodological* 145, 247-269.

Xu M, Inci E, Chu F, Verhoef ET (2021) Editorial: Parking in the Connected and Automated Era: Operation, Planning, and Management. *Transportation Research Part C: Emerging Technologies* 127, 103115.

Rastani S, Yüksel T, Çatay B (2020) Electric vehicle routing problem with time windows and cargo weight. In: Golinska-Dawson P., Tsai KM., Kosacka-Olejnik M. (eds) *Smart and Sustainable Supply Chain and Logistics – Trends, Challenges, Methods and Best Practices. EcoProduction (Environmental Issues in Logistics and Manufacturing)*, Springer, Switzerland, 175–190.

Bakis O, Inci E, Senturk RO (2019) Unbundling curbside parking costs from housing prices. *Journal of Economic Geography* 19(1), 89–119.

Inan MO, Inci E, Lindsey RC (2019) Spillover parking. *Transportation Research Part B: Methodological* 125, 197-228.

Keskin M, Akhavan-Tabatabaei R, Çatay B (2019) Electric vehicle routing problem with time windows and stochastic waiting times at recharging stations. In: *Proc. of the 2019 Winter Simulation Conference* (WSC), National Harbor, MD, USA, 1649–1659.

Keskin M, Laporte G, Çatay B (2019) Electric vehicle routing problem with time-dependent waiting times at recharging stations. *Computers and Operations Research* 107, 77–94.

Rastani S, Yüksel T, Çatay B (2019) Effects of ambient temperature on the route planning of electric freight vehicles. *Transportation Research Part D: Transport and Environment* 74, 124–141.

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