OptiRoutS

OptiRoutS (Optimal Routing Service) is a private routing service that proactively contributes to a better public mobility

SETTING THE SCENE

Today's in-vehicle navigation systems typically optimize routes based on the cost for the individual drivers. However, they often overlook the broader social and environmental costs associated with road network use.

As a result, these navigation systems can unintentionally create suboptimal traffic patterns, such as directing traffic through residential areas or school zones or causing congestion on roads not designed for heavy use.

Therefore, public road authorities are increasingly concerned about the negative impact of such in-vehicle navigation services, services which may conflict with the objective to promote smooth, safe, and sustainable mobility.

In addition, organizing mobility has also become a crucial consideration in other fields, including environmental sustainability (supporting green and carbon-neutral cities) and public health (enhancing social well-being and air quality).

FRAMING THE RESEARCH OBJECTIVE

The OptiRoutS (Optimal Routing Service) project aimed to address the negative impact of current in-vehicle routing services. It did so by developing an interactive ecosystem that promotes prosocial route guidance.

The project's four key objectives were:

- Accurately quantify the societal costs of traffic on the road network.
- Implement optimal, interactive routing that considers both travel time and societal costs.
- Explore the best ways to present recommended routes in navigation systems.
- Establish a sustainable governance model that aligns public, private, and individual interests for long-term societal benefits.

THREE MAIN OUTCOMES

These are the main outcomes of the OptiRoutS project:

1) OptiRoutS has developed an **ecosystem** with route recommendations aimed at creating a smoother, safer, and more sustainable traffic flow. It does so by aligning individual driver interests with the broader social objectives of road management.

   In addition, OptiRoutS has explored the best ways to **motivate drivers** by showing the impact of their driving behavior. The basis for this are valuable insights from the project into the factors influencing (pro)social routing and their relative importance, both from a scientific/monetary and a policy perspective. These allowed us to study how factors such as a longer travel time are accepted by drivers. It also helped us identify which messages and incentives are most effective in encouraging drivers to choose prosocial routes.

2) OptiRoutS managed to quantify the societal costs using sensor and floating car data, which was a major challenge. To map these costs across the entire road network, we used real-time traffic state predictions based on a combination of **data-driven and traffic models**.

   In addition to these predictions, accident locations, road infrastructure information, and traffic volume were used to calculate accident risks at each intersection and road segment. This allowed us to determine how accident risks increase or decrease in various scenarios. Specifically, in OptiRoutS, we have assessed the additional societal costs caused by extra traffic.

   As a next step, OptiRoutS has balanced the individual user needs with societal objectives on safety, emissions, noise, and

congestion within **routing algorithms**. An upgraded algorithm was developed to speed up dynamic route calculation based on the concept of customizable contraction hierarchies.

3. The research models and algorithms using the societal costs were combined in an **impact assessment tool** that visually compares the fastest route, a prosocial route, and intermediate options.

   The tool shows the costs in terms of noise, emissions, safety, and travel time. This helps users gain a clearer understanding of why the optimal route may differ from the fastest route. Social cost savings stem primarily from reduced congestion costs, followed by savings related to noise and emissions. These societal savings far outweighed the minor increases in private travel costs.

   During the project, an average of 18.6% of travelers opted for the prosocial routes, indicating a willingness to prioritize social benefits, even with longer travel times.

The insights gained from the OptiRoutS project show that the new tools are highly effective for urban traffic management. By reducing cut-through traffic and lowering vehicle volume in school zones, OptiRoutS has proven capable of significantly improving local traffic conditions.

NEXT STEPS

The study's findings provide a foundation for safer, more sustainable mobility solutions. Its prosocial routing algorithms and recommendations will support future route planners, navigation systems, and traffic safety initiatives, which are critical for road operators such as Agentschap Wegen en Verkeer.
Also, the quantified societal costs will create added-value as they can be used in smart road charging systems (Be-Mobile), in a planning context to assess urban mobility policies (Transport & Mobility Leuven), or as assessment tool and guideline, e.g., to set up traffic circulation plans (Movias). The latter is one of the data sets within the real-time traffic information (RTTI) Delegated Act, effective January 2025.
Future research will explore combining data-driven and traffic modeling approaches for real-time decision-making, with potential validation in European projects and Flemish case studies.

OptiRoutS project partners:

The OptiRoutS project was co-funded by imec, with project support from Agentschap Innoveren & Ondernemen

FACTS

NAME	**OPTIROUTS**
OBJECTIVE	Routing service optimized for safer, greener, and smoother mobility
TECHNOLOGIES USED	Public-private traffic ecosystem, real-time traffic state prediction, traffic simulation models, motivating drivers, impact assessment
TYPE	imec.icon project
DURATION	01/10/2022 – 30/09/2024
PROJECT LEAD	Bart Lannoo, Be-Mobile
RESEARCH LEAD	Ynte Vanderhoydonc, imec – IDLab – UAntwerpen
BUDGET	3.040.958,80 euro
PROJECT PARTNERS	Agentschap Wegen en Verkeer, Be-Mobile, Transport & Mobility Leuven, Movias
RESEARCH PARTNERS	KULeuven – CIB
RESEARCH GROUPS	IMEC – IDLAB – UGENT, IMEC – IDLAB – UANTWERPEN, IMEC – SMIT – VUB

WHAT IS AN

IMEC.ICON PROJECT?

The imec.icon research program equals demand-driven, cooperative research. The driving force behind imec.icon projects are multidisciplinary teams of imec researchers, industry partners and/or social-profit organizations. Together, they lay the foundation of digital solutions which find their way into the product portfolios of the participating partners.

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