BE-SAFE Project
UNITA Starting Grant DT

BicyclE SAFEty for Mobility and Active Riding in Smart Cities

PROJECT OVERVIEW

PROPOSAL'S ABSTRACT

Cyclist safety is a growing concern in urban mobility, particularly in the context of smart cities that promote sustainable and active transportation. Despite increasing bike usage, infrastructure and traffic systems often remain inadequately adapted, leading to preventable accidents and reduced adoption of cycling. The BE-SAFE project (BicyclE SAFEty for Mobility and Active Riding in Smart Cities) addresses this critical issue by developing a data-driven, technology-enabled framework to assess and improve cyclist safety.

Through a multidisciplinary collaboration among four UNITA universities, the project will build a data-driven decision-support framework to assess cycling risks, model intervention scenarios, and guide urban infrastructure planning. The approach combines accident data analysis with GIS and machine learning to detect risk patterns and factors, psychological analysis of cyclists' behavior and perceived needs, IoT-enabled cyclist behavior tracking via sensorized bike-sharing systems and V2X (Vehicle-to-Everything) communication, and simulation of safety interventions in multimodal traffic environments. By articulating collective knowledge, this project will specifically identify the primary challenges in enhancing bicycle sensing and cycling safety, fostering the development of more extensive future initiatives.

Expected outcomes include the design of a unified decision-support framework and initial testing to evaluate the potential to produce policy recommendations for municipalities and user guidelines, ultimately fostering safe and sustainable cycling practices.

BE-SAFE's modular and interdisciplinary design ensures that the methods and tools developed can be adapted and scaled to other cities and regions, supporting safer cycling infrastructures globally and contributing to smart and greener urban mobility strategies.

PROJECT TASK

The BE-SAFE project is structured around five interrelated tasks, each contributing to the development of a comprehensive framework for improving cyclist safety and promoting active mobility in smart cities.

Task 1: Data collection and analysis of bicycle-related accidents, followed by predictive risk modelling using ML and GIS focuses on identifying accident patterns by analysing historical data from police reports and mobility databases. By applying machine learning to variables like traffic volume, weather, and infrastructure, the task develops predictive models and dynamic risk maps to estimate injury probability and guide safety interventions.

Task 2: Cyclist Psychology & Behaviour Analysis utilizes structured surveys to investigate the human element of urban cycling, focusing on stress, perceived safety, and attention levels. These psychological

factors are then correlated with actual cycling behavior to identify specific risk profiles and determine where infrastructure improvements or behavioral campaigns would be most effective.

Task 3: Deployment of sensors in bike-sharing fleets to collect behavioural data and test V2X communication involves equipping bicycles with sensors to monitor real-time metrics such as braking, acceleration, and proximity to obstacles. This phase also tests Vehicle-to-Everything (V2X) communications through advanced simulations to enhance situational awareness, feeding data into a Smart City platform designed for real-time hazard identification.

Task 4: Design and simulate different urban mobility interventions using the outcomes obtained in tasks 1, 2 and 3 integrates the previous findings into a multidisciplinary simulation environment using the SUMO-Veins-PLEXE framework. This activity allows for the digital testing of new road designs, communication networks, and behavioural models to evaluate how different urban interventions impact the safety of vulnerable road users.

Task 5: Unified framework and initial validation consolidate all project outputs into a single risk-assessment and decision-support tool. The framework is validated through small-scale laboratory testing to ensure its practical utility for city planners and transport agencies, concluding with a scientific publication to share these transferable methods with other urban contexts.