

Workshop on Intelligent Cyclist Support Systems and Applications

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ABSTRACT

Although the number of cycling accidents increases, technology to improve traffic flow and safety was predominantly researched in the context of motor-powered vehicles in the past. While new assistance systems are being installed for driving safety in passenger cars, a similar development is lacking for bicycles. Although cycling support systems are slowly becoming an important research topic, there is still limited work addressing intelligent and collaborative applications for bikes. In this workshop, we will discuss and prototype potential intelligent support systems and their applications in the cycling domain. Our goal is to bring cycling and technology enthusiasts together to discuss and develop possible intelligent support systems that can enhance the cycling experience and make bikes a safer mode of transport.

CCS CONCEPTS

• **Human-centered computing** → *Human computer interaction (HCI); Ubiquitous and mobile computing.*

KEYWORDS

Intelligent Transport Systems, Cyclist Safety, Mobility, Vulnerable Road Users, Workshop

1 BACKGROUND

More and more people use bicycles as a means of transportation to avoid traffic jams, and to be independent of public transportation [5, 12]. Due to the COVID-19 pandemic, even more people started to ride bicycles. An increase in bicyclists is highly welcome, as it is a promising mode of transportation that could solve important social, economic and environmental challenges of the future while contributing to a healthy lifestyle. Nevertheless, cyclists belong to the group of vulnerable road users (VRUs), which are involved in many traffic accidents [1] and are often hurt severely. Unfortunately, they have hardly benefited from road safety improvements in recent

decades. When looking at Europe, between 2010 and 2018, the number of recorded road fatalities for pedestrians, motorcyclists, and cars decreased by 19 to 24%; however, the amount of cyclist road fatalities halted [2].

In recent years cycling infrastructure was improved, by introducing segregated bike lanes or priority lanes for cyclists. However, infrastructural changes are for one costly, and also hard to apply everywhere. Another promising but futuristic approach to increasing cyclist road safety is utilizing intelligent transport systems (ITS) [3, 4]. ITSs were introduced as systems allowing communication and exchange of information between automated vehicles (AVs) and other intelligent infrastructure, such as road sign units, to enable automated driving and prevent accidents on the road.

Bicyclists can benefit from the smartness of traffic, not only through the promised decrease of road accidents by AVs, but also from prior knowledge of a possible hazard ahead. This information could be provided directly to cyclists by ITS and potentially increase their situational awareness. Nonetheless, accident prevention is not the only application case in which intelligent systems could support the cyclist. Other areas, such as navigation, sightseeing, traffic education, could benefit from intelligent support systems. There may also be use cases that could benefit from applying concepts designed for AVs to cyclists (for example, platooning, i.e., grouping cyclists with the same average speed to improve traffic flow).

Recent research addresses HCI on the bike lane [15] and has proposed support systems assisting child cyclists by providing lane-keeping cues for areas without cycling infrastructure [8], support for using safety gestures [10], navigation [9], warning signals [7], or even active safety features [11]. Others utilize notifications on helmet-mounted displays to convey information for safer crossing of intersections via ITS [18], or to prevent so-called dooring accidents, when passing still occupied vehicles [17].

In the proposed workshop, we will discuss intelligent cyclist support systems by brainstorming potential applications and prototyping concept ideas. We assume that using ITS technologies that enable sharing information directly with the cyclist could positively impact cyclists' road safety and, in turn, could make cycling more appealing and attract more people for a greener mode of transport. We believe that hosting a half-day workshop can promote the ideas of cycling research among the German HCI community, while being a promising platform to generate new ideas. We hope these efforts will assist in contributing to safer cycling in the future. Considering

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the exploratory nature of the workshop, participation is open to anyone interested in intelligent cyclist support systems. We aim for up to 30 participants. We will publish a *Call of Interest* on the associated website for the workshop to acquire participants. We further intend to publish the results of the prototyping sessions on the website and to host all videos (if allowed by the respective participants) on an online channel (i.e., “youtube”) and include the link in the published version of this workshop proposal.

2 PRELIMINARY SCHEDULE

The workshop is planned as follows:

- (1) **Introduction (~45 min):** We will give a short introduction to the research topics of cyclist support systems and ITS. Additionally, participants and organizers introduce themselves.
- (2) **Brainwriting (~45 min):** Based on brainwriting [16] we will brainstorm potential ideas for intelligent cyclist support applications.
- (3) Coffee break (~15 min)
- (4) **Prototyping (~90 min):** In groups of 3 to 5, participants will work on small prototypes of intelligent cyclist support systems. Ideas are not limited to the results of the brainwriting session. For prototyping, we will provide participants with sets of Lego figures/bricks, pens&paper, pipe cleaners, etc. The goal of the prototyping session is to sketch promising ideas and create a short video of the prototypes.
- (5) **Presentations (~45 min):** The short videos of all groups will be presented and discussed with the audience. Based on these ideas, we hope to foster collaboration between the organizers and participants to further research in this direction.

3 ORGANIZERS

Tamara von Sawitzky is a Ph.D. student at Johannes Kepler University Linz and a researcher at Technische Hochschule Ingolstadt (THI). Her research focuses on HMD-based assistance systems for cyclists in a C-ITS context, their impact on cyclist safety and UX, as well as system evaluation in VR/MR simulation.

Philipp Wintersberger is a researcher at TU Wien focusing on human-automation interaction, in particular attention management [20] and trust in technology [19]. Before, he pursued his Ph.D. at the center for automotive safety CARISSMA at THI, and his publications addressing driver-vehicle interaction in automated driving have received several awards in the past years.

Andrii Matviienko is a postdoctoral researcher at Technical University of Darmstadt. His research focuses on the assisting technology in urban environments, in particular on designing, constructing, and evaluating multimodal and mixed reality interfaces for vulnerable road users. He is also a co-organizer of the SIGCHI sponsored International HCI Summer School on Cycling ¹.

Andreas Löcken is a postdoctoral researcher in the Human-Computer Interaction Group at Technische Hochschule Ingolstadt (THI). His research focuses on Ambient Displays for

Human-Computer Interaction in general, and specifically the interaction between vulnerable road users and automated vehicles. He has co-organized several workshops at AutomotiveUI and MobileHCI, with last year’s “WeCARE” workshop being the most related [6].

Andreas Riemer is a professor for Human-Machine Interaction and Virtual Reality at THI with co-appointment at the CARISSMA Institute of Automated Driving (C-IAD). He conducts hypotheses-driven quasi-experimental research in human-computer interaction in the broader context of mobility. He is steering committee co-chair of ACM AutomotiveUI and chair of the ACM SIGCHI German chapter. He has co-organized several workshops at Mensch und Computer [13, 14], CHI, and AutomotiveUI.

Florian Michahelles is a professor of ubiquitous computing at TU Wien. His research focuses on human-machine companion technologies. Before, he led the artificial and human intelligence research group of Siemens in Berkeley/ California.

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¹<https://cycling.offis.de>

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