

Steal my light

Speed awareness for dangerous crossroads

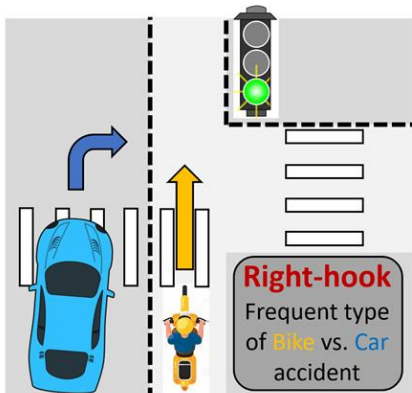
Description over the concept/service

The benefits of using bicycles as part of the Intelligent Transportation System (ITS) of a smart city are known. Bicycles improve the health of citizens, ease traffic congestion, save money, use less space, and provide efficient transportation with no fuel consumption and zero carbon emissions. In line with this plan, the city of Helsinki launched a City Bike service (*i.e.*, also known as the yellow bikes) in 2016. After seven years, Helsinki City Bike service has grown notably, with hundreds of stations, thousands of bikes, and an annual ridership of few millions.

However, one of the key drawbacks is on the “*safety*” of the bike rider, whose security is constantly put at risk while interacting with large-sized vehicles (*e.g.*, cars, buses, and trucks) on the same lanes and roads. This situation becomes specifically serious when, due to the modification experience in the (Finnish) traffic law lately, many people are not completely sure who has the right of way in given crossroads. And even in situations when the party that has the right of way in a crossroad is crystal clear, the constant distraction that drivers of motor vehicles have may generate an accident with serious consequences to the bike rider.

Poliisi selvittää yhä Meilahdessa sattunutta polkupyöräilijän kuolemaan johtanutta onnettomuutta, ketään ei ole otettu kiinni

Surmansa saaneen miehen ystävät toivat onnettomuuspaikalle valkoisen polkupyörän.



Onnettomuudessa kuolleen miehen ystävät kokoontuivat lauantaan ilansuussa turmapaikalle laulamaan laulun. Mukanaan he toivat valkoiseksi maalatun pyörän ja kynttilöitä. KUVA: JUHANI NIIRANEN / HS

A ghost bike is a bicycle roadside memorial, placed where a cyclist has been killed or severely injured, usually by the driver of a motor vehicle

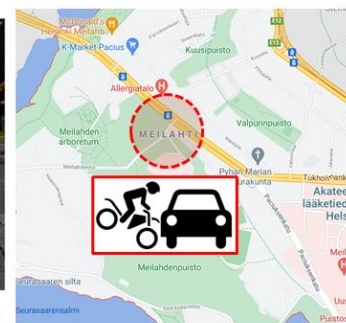
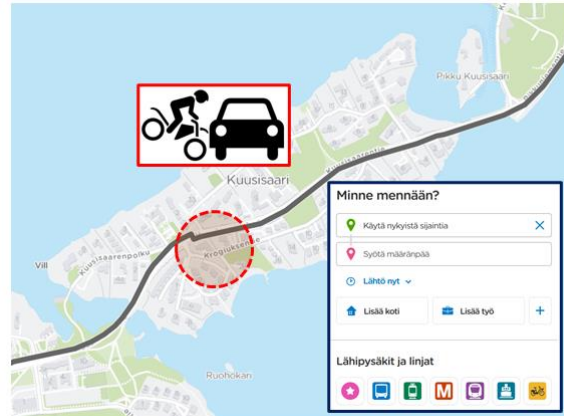
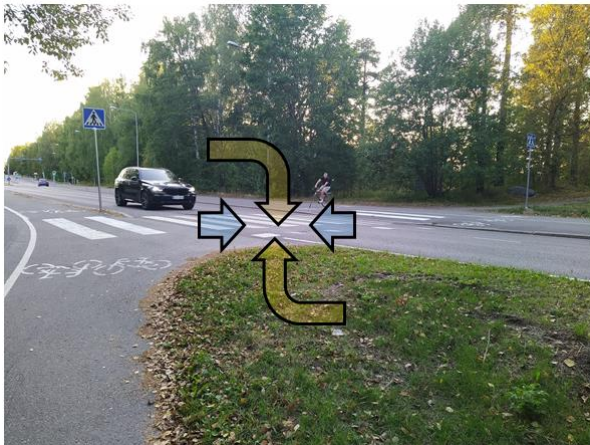


Figure 1. Sample junction crossed by thousands of city bike users daily in Meilahti. The hilly terrain of Helsinki and the lack of attention of drivers generate serious accidents involving bikes every year.

To improve the feeling of safety of the “*vulnerable*” city bike users, “*Steal my Light*” pilot aims at monitoring the speed at which city bike riders enter pre-defined “*hot*” areas of the city for bikes (*i.e.*, areas of the city in which the average number of incidents and accidents involving people riding a bike is above average). The goal is to provide some visual (or sound) notification when the bike riders are approaching a dangerous crossing point. When compared to other systems based on Global Navigation Satellite Systems (*e.g.*, GPS or Galileo) or radio-based communications (*e.g.*, Wi-Fi, Bluetooth, 3G/4G/5G), the proposed “*Steal my Light*” solution does not require the installation of any speed sensing device and/or communication device on the city bikes. In contrast, it uses the front light that city bikes have active when being in use to infer the speed at which the bike is moving. Thanks to the high directivity of the front lights of city bikes, the direction from which the bike rider is approaching the dangerous crossing point can be easily detected. This way, the notification is only triggered

when the rider is indeed approaching the road junction through the dangerous direction, preventing frequent false alarms that would have a negative effect on the trust of the solution.



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Bicycle accidents often cause disability –

An analysis of medical and social consequences of nonfatal bicycle accidents

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Who has the right of way in designated bike lanes?

CBS 5 Exacerbates Deadly Confusion About Bike Lane Right-of-Way

Do Cyclists Have The Right Of Way?

Figure 2. Bike lanes and car roads usually cross each other. After some modifications to the traffic laws, most drivers and bike users are not 100% sure who has the right of way in some situations. In such circumstances, accidents may happen with serious consequences to the bike rider. Aim of “Steal my Light” is to aware city bike users about their speed when approaching dangerous junctions.

The technology that is used to infer the speed of the city bike has been developed *ad hoc* as part of the piloting project. The speed sensing principle is based on the effect that the moving bike creates on some “features” of the light beam that is emitted by the front light. Thanks to this passive speed sensing approach, there is no need to install speed sensors and/or communication devices one each city bike, minimizing the capital expenditures and operational expenditures to install a bike speed monitoring system (see Fig. 3). Note that apart from notifying the city bike riders about their speed, it is also possible to notify motor vehicle drivers or pedestrians who are approaching a city bike lane about the proximity of a city bike rider that is moving fast. Finally, statistics about the traffic of city bikes can also be collected by city traffic planning authorities preserving the privacy of users; note that such information can be very valuable when proposing improvements to the city infrastructure for bikes.

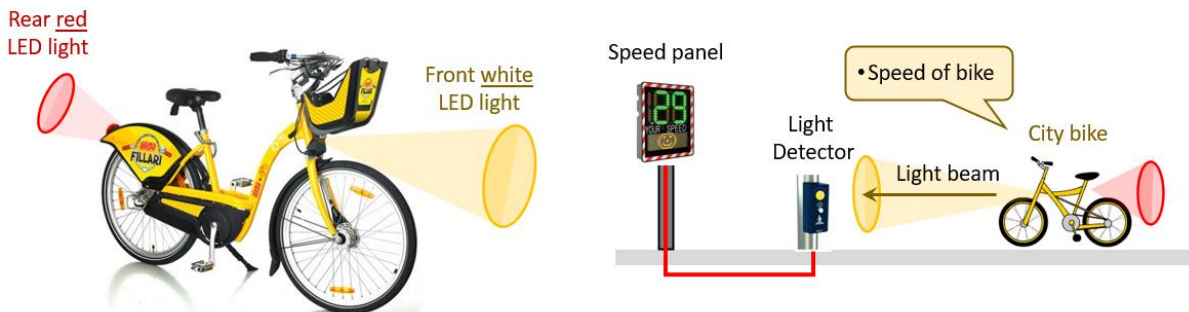


Figure 3. Simplified “Steal my Light” concept. The front light of a city bike emits a speed-dependent signature on its intensity that can be detected by a light detector that is placed next to a dangerous crossroad. The inferred speed is then shown in a LED panel, such that the city bike rider may become aware of its speed. The LED panel message (interface) can be optimized to achieve the target effect.



Target groups

The aim of the “*Steal my Light*” pilot is to provide the speed monitoring as a service to city bike users. However, the installation of sensors that acquire the speed-dependent parameters of the front light of bikes, as well as the installation of LED visualization panels, will have to be discussed with the authority of the city that regulates the use of bike lanes and roads. Other authorities, such as the Helsinki Region Transport (HSL) could be contact to receive feedback on the most convenient spots in which the city bike sensors should be installed. Finally, sponsorship from companies could be searched, such as *CityBikeHelsinki* and possibly *Alepa*, who is the main current sponsor of the city bike services in the city of Helsinki.

Present status and future plans

The starting Technology Readiness Level (TRL) for the “*passive*” speed monitoring approach was between TRL-1 (basic principle observed) and TRL-2 (technology concept formulated). At this point, a detailed analysis was done to prove the feasibility of the proposed “*Steel my Light*” concept, which was based on the detection of some notable effect on the front light intensity of a city bike that depended on the speed at which the front wheel was moving.

At the end of the mini-pilot, after few experimental proof-of-concepts were first carried out (TRL-3) and then demonstrated in a controlled environment (TRL-4), the technology was partially validated in a relevant city-bike environment (TRL-5). This validation took place at the premises that Forum Virium Helsinki (FVH) has next to the railway station of Malminkartano.

Unfortunately, the timing that was finally selected to execute the first-mini pilot activity was not the most convenient. Due to that, we have identified the following key steps to move forward:

- 1) Finish with the development of the hardware platform, such that it can have an autonomy to work for few days without human intervention. This way, it can be installed in a properly selected place, enabling a passive supervision of the piloting activity.
- 2) Plan a second piloting activity in Spring, possibly, in a popular location where many people usually circulate with Helsinki city bikes (e.g., bike lanes in Otaniemi campus).
- 3) Participate in networking events for entrepreneurs, where new collaborators and/or people who are interested in joining our “*Steal my Light*” project could be contacted.
- 4) Actively search for new funding opportunities to improve the maturity level of innovations towards commercialization (either national or international funding calls).

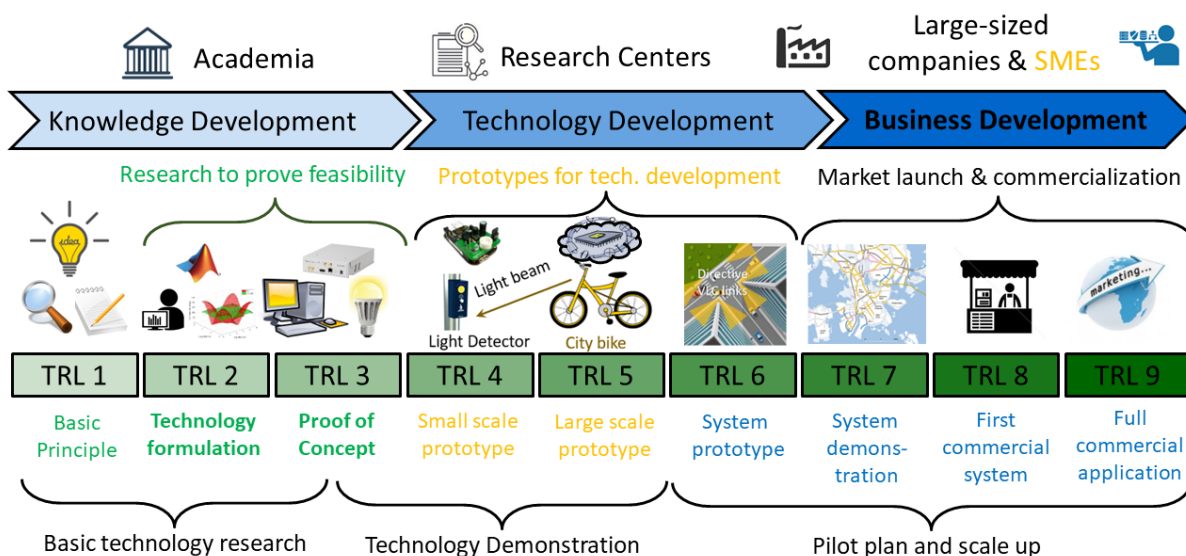


Figure 5. Summary of the technology readiness level of the “Steal my Light” concept. Currently, the small-scale prototyping (TRL 4) has been fully achieved in a controlled environment, and partially achieved in a representative environment (TRL 5). Long-term aim is to move forward into the commercialization, starting with the planning of new pilot activities with a passive supervision of the way in which customers use the technology. Increasing the members of the company and searching for new funding opportunities for scaling up is also something important to be addressed in the near future.

Further questions?

SoiLum

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visual material (photos, graphics)

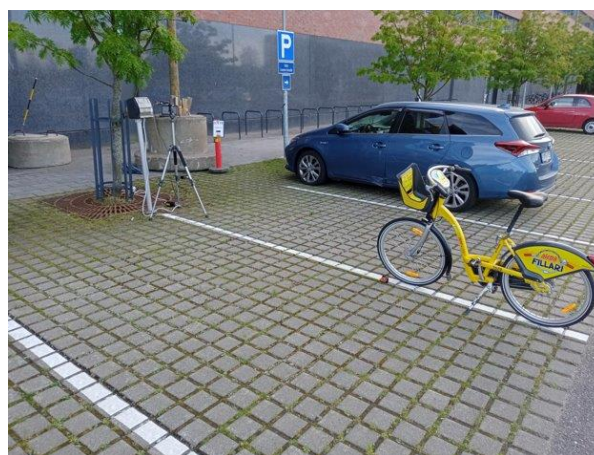
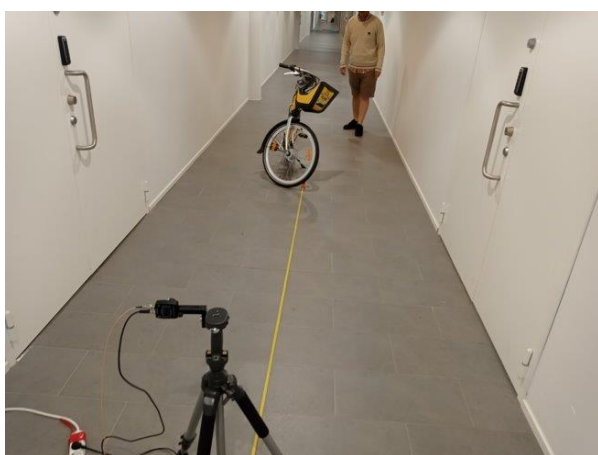


Figure 6. Pilot preparation of the “Steal my Light” concept in an indoor controlled environment (left-hand side) and in an outdoor setting that resembles the condition of the piloting site (right-hand side).



Figure 7. More pictures of the pilot preparation in the outdoor environment. All the components used here, including photodetector, pre-amplifiers and laptop computer are commercial off-the-shelf.



Figure 8. Visit to the Malminkartano piloting site in late summer 2022 to plan the on-site pilot.

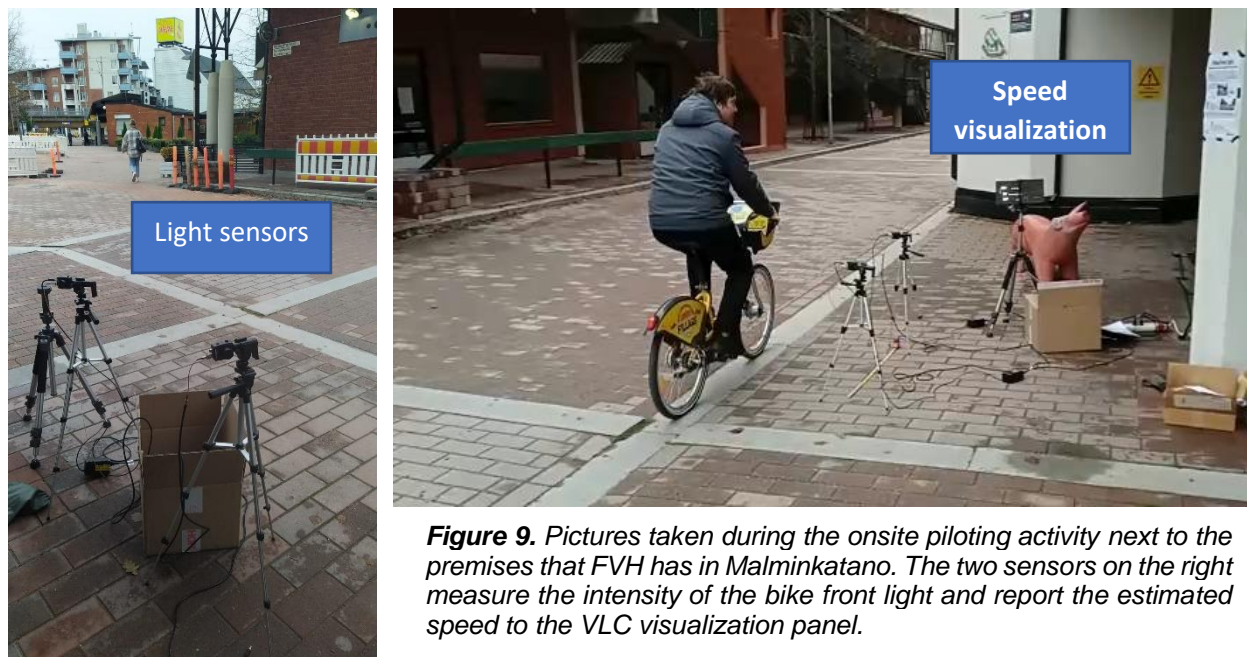


Figure 9. Pictures taken during the onsite piloting activity next to the premises that FVH has in Malminkatano. The two sensors on the right measure the intensity of the bike front light and report the estimated speed to the VLC visualization panel.