

**MASTER'S THESIS** E-bike Simulator – a virtual reality application

that evaluates user interfaces in an urban traffic environment

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# E-bike Simulator – a virtual reality application that evaluates user interfaces in an urban traffic environment

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POPULAR SCIENCE SUMMARY **Mustafa Al-Kefagy and Sava Pokrajac**

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Navigating through congested streets in speeds up to 25 km/h can be both difficult and dangerous. This thesis aimed to alleviate this problem by developing a VR tool that could compare and evaluate different UI designs on a bike display.

With an increasing population in cities, more effective methods of transportation are needed. Politicians and urban planners have put in a lot of effort and money trying to convince people to use more sustainable methods of transport to meet this demand. One increasingly popular option is the electric bicycle (e-bike). It is fast, environmentally friendly and convenient to use. But riding alongside cars and pedestrians while simultaneously trying to navigate the streets makes you as a bike rider exposed to a variety of risks. This puts high demand on the designers when developing a interface for a bike navigation device.

This thesis aimed to give user interface (UI) designers a tool which could evaluate different designs solution for the e-bike navigation devices. A virtual reality application was developed using the real-time game engine unity and the virtual reality headset HTC Vive. To test the application, a real bike was set up on a bike stand that was connected to the computer via two HTC Vive trackers. The simulation was displayed on the VR headset, and an external monitor so that the designer could follow along and observe the interaction. The final application could be used by designers to upload

their new interfaces and test them without having any prior experience with VR.

This thesis acted as a proof of concept that investigated how effective VR is for testing UIs. Therefore it is important to address the difficulties one would face when creating a simulator such as this. One of the biggest issues was the overwhelming motion sickness a user would feel within the virtual environment. This was confirmed by the test results, which showed that 7 out of 25 users could not complete the test due to motion . The other issue was related to people not being use to ride a bike without leaning with the body. As a result people felt quite motion sick and had a hard time trying find balance on the bike.

This thesis indicates that a bike ride is a complex mechanic to simulate. In order for this application to become a useful testing device, it needs to better manage the issues regarding balance and motion sickness.