

EXAMENSARBETE Control your home with augmented reality**STUDENT** Daniel Tovesson**HANDLEDARE** Günter Alce (LTH)**EXAMINATOR** Mattias Wallergård (LTH)

Can augmented reality be used to control your IoT devices?

POPULAR SCIENCE PAPER **Daniel Tovesson**

Augmented reality (AR) is moving into our mobile phones. With the increasing number of connected devices (IoT) in our homes comes the need for controlling them remotely. This can usually be done with the manufacturer's applications, which can result in you having several different applications to control your IoT devices. Can AR be used to control all your IoT devices, with the benefit of displaying the IoT devices in their real context instead of in traditional lists?

Today we interact with numerous devices, usually at a distance. With the introduction of IoT, you are no longer restricted to remote controls designated for one device, you can now control your devices with mobile applications. However, this raises a problem. With IoT devices from different manufacturers, you can end up needing several mobile applications to control your IoT devices in your home. In addition to that, the more IoT devices you have the harder it can get to separate them by name, so scrolling through lists to find the IoT device you want to control can be cumbersome. With that in mind, can AR be used to control your IoT devices? With AR you can show the user virtual objects in a real-world environment, so it is easy to understand where each virtual object is located in e.g. a room.

My thesis focus on evaluating AR as a tool to control IoT devices. For this, a prototype AR application was developed that could control connected light bulbs, a connected speaker, and a motion detector alarm. The AR application starts with an AR view with a bullseye in the middle. When you align the bullseye with a sphere, that is located above each IoT device, it will select that device. Once the device is selected the user is provided with controls on the screen that can be used to interact with the IoT device.

To evaluate the AR application it was compared to the native applications created by the manufacturers of the IoT devices in a user study. The user study

was conducted on 20 test participants and it showed great promise. The user study showed that the AR application was slightly better from a usability perspective while it had a slightly higher perceived workload, mostly because of the physical demand of moving the phone around to find the different IoT devices. Furthermore, it showed that while it can be useful in your own home it would also be interesting to apply this solution to more unfamiliar places, e.g. an office. Lastly, during the user study, it was suggested that other form factors than a mobile phone can be explored, e.g. AR glasses. Test participants suggested that a mobile phone might not be the optimal form factor for this use case.

One interesting detail that was noted during the user study was that over half of the test participants had problems finding the sphere which you are supposed to select to interact with the IoT device. It had a dark gray color and was hard to separate from the background. Because of that, the first task took almost twice as a long time for the user to perform in the AR application compared to the native applications. The user also made almost twice as many errors in the AR application on the first task. With a sphere that has the same color as the background but inverted this could probably have been avoided.