

Augmented Reality for Cyclists

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Proposal

Motivation

Currently in the UK there are around 7.1 million people who regularly participate in cycling, either for sport, leisure or travel. The vast majority of them will at some point utilize and ride on a public road. The roads themselves are shared between cyclists and various vehicles that are currently being driven by human beings, this makes communication between cyclists and drivers possible to some degree. Communication between these two separate parties in certain scenarios, such as negotiating right of way, can be critically important in order to ensure the safety of both the cyclist and the occupants of the vehicle.

Perhaps the most talked about aspect of future technology is the progress and effort that is being made in the autonomous vehicle market. Self-driving vehicles are defined as a vehicle that is capable of travelling without the need for human input. Currently various companies are heavily invested in the autonomous vehicle market, progress is being made and driverless taxi's are being deployed across the United States. If we look further ahead into the future, it is not hard to imagine the possibilities and popularity that driverless vehicles may bring.

While the premise of autonomous vehicles sounds fantastic there are however various problems that the vehicles themselves will bring into existence. The main issue that I aim to look into with this project is that of the problem of communication between a cyclist and a vehicle when there is no driver present.

Aims

The aim of the project is to look into the feasibility and effectiveness of introducing augmented reality headsets to cyclists for communication with vehicles, and therefore autonomous vehicles.

The preferred method of interacting with augmented reality is Microsoft's HoloLens II, a mixed reality head-mounted display.

Breaking down the aim further, the overall scope of the project is to create a piece of software which will make use of artificial intelligence and machine learning to identify a vehicle, and then produce a graphic on the HoloLens display that will notify the cyclist using the device as to the intentions of the driver, i.e. when negotiating right of way.

To further add to this aim, the main focus of the project is to research and look into the way in which humans and computers interact. Therefore, the artificial intelligence part of the

aim is not the priority and instead the focus is more on the effectiveness of using the HoloLens to keep both parties safe when out on the road.

Progress

- Initial research was performed on artificial intelligence and machine learning as my knowledge of this area before the project began was non-existent.
- A breakthrough was made when I discovered YOLO (You Only Look Once). YOLO is an algorithm which makes predictions of bounding boxes and class probabilities all at once.
- Work was conducted looking into the feasibility of getting YOLO to work on video footage.
- Initial attempts to get it working on my webcam ran into problems and I quickly realized that YOLO has very specific requirements to run that would make the portability poor when thinking about the end software produced for the project. YOLO was also nowhere near fast enough in order to give produce real time object detection when running on a processor, this means that a dedicated graphics card would be required, further diminishing this option's portability.
- My supervisor suggested, that as the artificial intelligence aspect of the project is minor in comparison to the interaction between humans and computers, I should look into using a Zed 2 camera in order to detect the vehicles and feed the positional data to the HoloLens.
- After picking up the Zed 2 from my supervisor, I began familiarizing myself with the device and how to write software for the camera itself in order for me to create a program which, when run, will provide a position for every vehicle that the camera detects.

Problems and risks

Problems

A massive problem that I have had is my lack of knowledge in the areas of artificial intelligence and machine learning. As this makes up an essential part of the project, countless hours have been poured into learning and understanding AI and machine learning.

Another major problem that I had was spending lots of time attempting to get YOLO to work as part of the project, before later discovering that it was not the best method in order to achieve the aim. In hindsight, I feel as though a lot of time has been wasted by looking into YOLO without gaining anything from the project as it ultimately led to a dead end.

Software compatibility has also been a major issue. In some cases software that I might have used for the project has only been usable when running certain operating systems. I

have found this particularly challenging myself as I use a MacBook, some of the software I have come across is only usable using Windows or Linux. This meant that I had to look into options of using a virtual machine before my supervisor lent me a Windows department laptop in order to conduct the project on.

Risks

There is a possibility that it may take me some time to get to grips with the new Zed 2 camera, for the object detection aspect of the project, before I can begin developing software for the device. I have read that getting the Zed 2 API to an editable state on current development environments can be quite challenging. Unfortunately, there is not much I can do to mitigate this risk as, currently, the Zed 2 camera is the route in which I intend to go down to perform my vehicle detection.

Plan

December

Over the course of the 3 weeks Christmas holidays, I intend to write the software required for the Zed 2 to detect vehicles and interact with an application made in unity for the HoloLens in its augmented reality mode.

During this period, I will also write the research part of my dissertation.

January

When I return to university, I will begin testing my project. This will involve gathering participants in order to test the effectiveness of the software I have written. I will also receive feedback from the participants after the testing which I intend to act upon and make changes to the project itself.

I will also continue to write up my dissertation, including adding the research experiment and the feedback and findings given by the participants.

February

Once changes have been made, provided I have the time, I wish to further test the project to get feedback from participants on its effectiveness.

I will also, again, continue to write my dissertation this time including feedback and results received from the second round of testing.

March

I will finish writing up the dissertation and hand in the project.