# **Sensed Data Visualisation in Augmented Reality**

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## **Table of Contents**

[**Sensed Data Visualisation in Augmented Reality** 1](#_Toc96515880)

[**Table of Contents** 2](#_Toc96515881)

[**Background** 3](#_Toc96515882)

[**Motivations** 3](#_Toc96515883)

[**Challenges** 3](#_Toc96515884)

[**Literature Review** 4](#_Toc96515885)

[**UX Design** 4](#_Toc96515886)

[**Heads Up Displays (HUDs)** 4](#_Toc96515887)

[**Pattern Predictions** 4](#_Toc96515888)

[**Approach** 5](#_Toc96515889)

[**Main Functions** 5](#_Toc96515890)

[**Optional Function** 5](#_Toc96515891)

[**Gantt Chart** 6](#_Toc96515892)

[**Resources** 7](#_Toc96515893)

[**References** 8](#_Toc96515894)

## **Background**

In this paper, a mobile application will be developed. This application will help research the use of Augmented Reality (AR) in the user’s daily life, and also attempt to improve their quality of life.

General data about the user will be gathered and displayed. For example, if the user is going for a walk, it would display their heart rate, movement speed, step count, etc. Along with this feature, a machine learning algorithm will be implemented to predict the user’s location and possibly suggest relevant information.

The application will have 2 states; Mounted, where the user views the real world through the phone (AR); Handheld, where the user doesn’t have to look through the phone and is able to interact with the interface through touch (Traditional Application). Development will be mainly focus on the “Mounted” state, but “Handheld” will be attempted to maximise user accessibility.

### **Motivations**

Gathering the user’s readily available information into one place, transforming it into human readable information, and displaying it to the user in an aesthetically pleasing way.

### **Challenges**

* Creating a useful interface
* Making the interface unintrusive to the user’s daily life (A)
* Grouping of information in a sensible way
* Pattern prediction complexity
* Battery Optimization

## **Literature Review**

### **UX Design**

User Experience (UX) Design can be described as how the content to be displayed   
is created to fit comfortably and naturally, that aims to influence the user’s behaviour   
and perception of the product (Unger and Chandler, 2012). UX is not about how the   
product works internally, but how it works externally when the user is interacting with it (Garrett, 2010).

A study found that a good UX can help with immersion especially when in a mobile   
environment (Engl and Nacke, 2013). AR is often used in a mobile environment, so it further illustrates that good UX design is essential for this technology.

### **Heads Up Displays (HUDs)**

A person can only digest a certain amount of information at a time, so when developing a HUD, the information displayed must be carefully selected and also shown in a non-intrusive way (Julier *et al.*, 2000).

Over the years AR HUD systems have been developed and improved upon, especially in situations where there are strict deadlines, unyielding guidelines and high risks (De Crescenzio *et al.*, 2011). Some examples of these can be found in Foyle, Andre and Hooey's (2005) paper, where a HUD system was developed for pilots in commercial airlines to display important information regarding the flight, and in Rizov, KJosevski and Tashevski's (2017) paper, where they developed an AR HUD system on windshields of multiple vehicles to display relevant information about the journey.

### **Pattern Predictions**

Song *et al.* (2006), Noulas *et al.* (2012), Sadilek and Krumm (2012), implement multiple location predictors using different approaches, such as Markov-based, compression-based, PPM, and SPM predictors. Song *et al.* (2006), found that Markov predictors which are a lower-order type of predictor, overall has the same or better accuracy than higher-order, more complex, and storage heavy compression-based predictors.

## **Approach**

The application will be built in Android Studio (Kotlin) using the Android 11.0 (R) SDK. The main functionalities (minimum requirements) will be prioritised during development, whilst the optional functionalities will be implemented if time allows.

### **Main Functions**

* Gathering and Displaying Sensory Data
  + The sensory data is gathered through the phone’s sensors and the wristband’s sensors. This data is denoised and then converted into a human readable format. After that, it can be implemented into the UI for user visibility.
* Aesthetically Pleasing UI
  + The UI will be developed with multiple people overlooking the process and testing it. This is to improve the quality of the UI and prevent build-up of bugs.
* Pattern Prediction
  + Pattern prediction would be based on past data collected by the application, such as location of the user and if that location is a place of interest, weather conditions, time of day. A dataset must be built and then a model trained on it.

### **Optional Function**

* Battery Optimization
  + Similar consumer-ready applications would be researched to see how they tackle the battery drainage issue. If they are in-scope, they would be implemented into the application.
* AI Suggestions
  + The predictions made by the model could be used to suggest things to do for the users. This would be tailored specifically for every user. More complex data could be used to improve suggestions.
* Handheld Usability
  + The doesn’t have to use a VR headset (or something similar) to use the application, instead it can be used and a traditional application using touch.

### **Gantt Chart**

Timeline

Description automatically generated

## **Resources**

The main resources required for this project are, a phone, a Google cardboard (VR), and wristbands to monitor biomedical signals. Phones of different sizes will be used to test out the application but if an issue is found, a standard size that fits the Google cardboard will be used.

## **References**

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