**Abstract**

CycLED is a wearable technology direction system. Lights in the helmet direct the user which way to turn along the journey to their destination. It consists of an app, which the user uses to select their destination and waypoints in their journey, and a helmet which has a small central computer connected to Bluetooth and GPS receivers. The system can be used either tethered, where the phone sends each direction as the user approaches a turn, or untethered, where the waypoints and destination are sent to the on-board computer and the GPS module is used to dictate when a user is at a turn location.

Two LED lights at the front of the helmet signal the user to turn left or right. They also flash to signal while the route is being sent, to inform when the phone has been disconnected from the helmet, and to inform when the helmet’s GPS has gotten a fix.

**Motivation**

My project was undertaken with the aim of providing a wearable solution for cyclists to get to their destination without the need to frequently look at their phone. I cycle very frequently and have known the frustration of constantly needing to take my phone out of my pocket when I am cycling to a destination I have never been. Phone stands on the handlebars provide some solution to this, but cycling can be very dangerous and taking your attention away from the road for even a few seconds to process the user interface increases the risk of accidents leading to serious injury or even death. With CycLED, the lights being in the front of the helmet means the user never has to take their attention away from straight ahead on the road.

Another benefit of my system is that the cyclist can leave their phone at home and still navigate to their destination. Phones are extremely expensive these days, and when cycling can be carried in very precarious places such as on the handlebars or in pants pockets, which can easily lead to it falling or breaking if the cyclist is involved in a small bump or collision.

**Research**

Bluetooth

* Gatt
* LE

Arduino

* Wiring
* Stitching
* Serial
* Baud rate
* Software serial
* Interrupts, hardware/timer
* Gps, distance between lats, convert to decimal
* accelerometer

Services

**High-Level Design & Planning**

Memory mgmt.

**Implementation**

The app is divided into 9 different classes. Consisting of one main activity, two services and six helper classes. The Flora code consists of one .ino file written in a subset of C++.

**CycLED App**

**MapsActivity**

MapsActivity is the main activity in the app and is the UI class. Its UI features include a map from the google maps API, a search bar and buttons to turn on Bluetooth and to send the route chosen by the user to the computer on the helmet. There is also a button to refresh the screen.

When the app starts up the first method called is *onCreate()*. Here the content view is connected to its XML layout and the toolbar is also initialized.

The next method called is *onStart()* which checks the permissions and if they pass calls *onStartSetup()* which places the map on the screen. In this function three other functions are called:

* directionsSetup(), which sets up the search bar and places it in the UI
* googleApiClientSetup(), which creates an instance of the googleApiClient
* gpsServiceStartup(), which creates a new GPSService class that will run in the background for the duration of the journey.

**Flora Program**

The Flora’s on board code is split into two parts. One part contains functionality for the tethered element of the system and the other provides the functionality for the system when it is untethered from the phone.

The first section in cycLED.ino is the setup section. This is where the neopixels, GPS and Bluetooth are initialized.