**Problem:**

The problem I am addressing is that cycling in London is unsafe and unhealthy. With the huge amount of investment put into encouraging more cyclist's to take onto the roads, there is a conundrum that remains - cycling in the capital is still hazardous. There is a high amount of pollution in London's capital, which by far exceeds regulatory limits. It has been published that in 2015, 9416 people died prematurely due to PM2.5 (Particulate matter) and NO2 in London alone (Kings College London). A Kings College London study published has put the figure for deaths annually for the two pollutants at (80,000). Nearing deaths from smoking (100,000) (The Guardian, Environment, 2015). In addition to this, a heavily used infrastructure such as London's will have hazards or "irregularities" bound to appear. Be it construction on a cycleway, obscured potholes, blocked paths, dangerous manhole covers on corners etc.

Statistics of incidents are startling and there is a lack of awareness about the severity of the issue. There are many vulnerable people (cyclist's in particular) being so close to exhaust fumes with the dangers caused by particulate matter entering the body. The impact of pollution extends further than just death, it causes short term and long terms illnesses such as cancer.

In addition to this problem, safety for cyclists is a huge concern. London is a rapidly growing city and its infrastructure is massively strained. Even with improvements being put in place, there is lack of knowledge about what the safest routes to take are and which are statistically dangerous. In 2014, the national statistic for cyclists killed and injured was 21,287, 75% of those incidents occurred at or near road junctions. (RoSPA, pedal-cyclists, facts & figures).

**Solution:**

My idea is to provide an interface that combines current data infrastructures to provide cyclists an opportunity to travel clean and safe. This would be in the form of a Pathfinder that offers the cleanest path based on an hourly pollution data model of London, combined with statistics of dangerous roads/intersections. There will also be hierarchising of roads which best suit cyclists (cycleways, segregated lanes, residential roads) etc. This Pathfinder will be dynamic and will be able to make a calculated decision on taking particular roads. Through the power of many, users can report irregularities on roads that will flag up to the Pathfinder when enough reports are made to confirm the issue and its severity. This will change the dynamic of the Pathfinder to tailor for the circumstances, whether it be the need to divert or just to warn the user of a dangerous pothole. Once the issue is solved it would then be reported back as fixed by the users. This is a similar concept which has proven to work by Waze - recently acquired by Google. Knowing that the cycling community has a strong bond in London, this could go very well.

**Originality:**

The idea is a comprehensive tool that assembles individual tools to provide something tailored for the London cyclist. It doesn't seek to solve the "shortest path" problem as Google Maps does. It takes the path which is the cleanest and safest for the cyclist. Furthermore, Google Maps doesn't hierarchise roads appropriately for cyclists, even when the "cyclist" option is chosen.

Example of Google Maps poor fit:

When a Start location from: 10 Adam St, London WC2R 0DE is chosen, with the destination of: Big Ben, Westminster, London SW1A 0AA. The Google Map routing decides against using the dedicated cycle lane along Victoria Embankment and instead chooses to go through the infamous Charing Cross Junction/roundabout and use Whitehall road which has no cycle lane or markings. This is at the "cost/benefit" of 0.4miles, which is calculated as 3mins journey time. Ironically, a free flowing segregated cycle lane down the embankment is much more likely to be quicker, even when combined with the additional zig-zagging at the start of the route. This is proof that Google Maps does not properly utilise cycling route information and does not weight junctions/roundabouts as hazardous for cyclists.

Google's Cyclist Suggested route: https://www.google.co.uk/maps/dir/51.509873,-0.1223656/Big+Ben,+Westminster,+London+SW1A+0AA/@51.5071264,-0.129427,17z/data=!4m9!4m8!1m0!1m5!1m1!1s0x487604c38c8cd1d9:0xb78f2474b9a45aa9!2m2!1d-0.1246254!2d51.5007292!3e1

My drawn route (Goes along segregated Embankment Cycle Lane) - Much cleaner and safer:

https://www.google.co.uk/maps/sdir/51.509873,-0.1223656/Big+Ben,+Westminster,+London+SW1A+0AA/@51.5083083,-0.124921,16z/data=!4m14!4m13!1m5!3m4!1m2!1d-0.1225444!2d51.5061209!3s0x487604c8c5659059:0xd07094affef03d3b!1m5!1m1!1s0x487604c38c8cd1d9:0xb78f2474b9a45aa9!2m2!1d-0.1246254!2d51.5007292!3e1

The second implemented concept is from London Air's pollution model. London Air, powered by Kings College's Environmental Research department provides predicted data about pollution at any point in the capital. This type of information is very useful when making decisions about what roads are best to take, which is likely to change depending on the time of day.

The way that this idea differentiates itself from City Air (Implemented by Kings College London) is that from what I understand, City Air bases its decision making based on pollution and appropriate cycle paths. Even though pollution is positively correlated with vehicle congestion, it is not always enough to make an accurate decision. Being able to know which intersections are notoriously dangerous, tricky to maneuver, particularly for beginners or tourists is important, even when that particular intersection may not be heavily congested; the risk is still present. It is important to reiterate that in the 2014 RoSPA report, 75% of incidents occurred at or near junctions.

Furthermore, this idea implements a community report feature which allows its users to report irregularities on paths. A similar concept which has been successfully implemented by Waze. This feature will warn users or divert appropriately depending on the severity of the issue. This further enhances the dynamic ability of the app and works synonymously with a fast paced City.

**Practicality:**

///////////////////////////////////////// Data Implementation/////////////////////////////////////////

Firstly, access to the statistical data and pollution data will be required. Much of which is held by TFL and developed by Kings College London as part of its service to TFL. Part of the data is already made openly available via APIs and is currently what I am using to work on my final year project at university (2017).

- The statistical data will need to be collated on a map of London. This data will need weights placed on junctions/roads which are statically infamous for being dangerous. This will allow the Pathfinder to make a calculation on whether diverting around a hazardous junction/roundabout is less costly than traversing over it. (This is what is meant by adding weights to hazardous intersections)

- The same concept is applied with hourly pollution data fed from London's Pollution sensors (Currently processed by Kings College London's Environmental Research Department). Roads will have weights added to them depending on pollution level. The Pathfinder will need to make a calculated decision as to what is the best route to take. The length of a journey is also calculated in the overall cost of a journey, therefore the Pathfinder will not overextend itself when it comes to choosing the least polluted route.

//////////////////////////////////////////////Wider Picture///////////////////////////////////////////

In order to get the idea off the ground, I will need co-operation from Kings College London's Environmental Research group, whom of which have been very resourceful and helpful towards my inquiries thus far. I will also need access to accident data held by TFL which should be available, however more recent information will be more difficult to access which is where the competition could help. Further to that, it would be much better for the Application to have frequently updated accident data throughout the year in order to adapt to road changes. Currently it would appear that statistics are released annually.

Much of the core concepts I have already begun implementing in my Final year project in Computer Science. However some other complicated aspects will require a dedicated team of skilled individuals. This will either come in the form of inspired volunteers who believe in the cause or a few contracted people. Either way, it would need money and expertise to get a hold of the right people and connections for it to take off.

/////////////////////////////////////////////////End Game////////////////////////////////////////////

The Pathfinder will initially be implemented as a mobile App which would be the quickest way to roll it out, followed by a web implementation which would enable cyclists to plan their routes. As technology develops, it would be an ideal application for a wearable technology piece.

**Clarity:**

We are providing cyclists with an accessible, easy to use Pathfinder which identifies the healthiest and safest way to traverse the capital. Whilst enabling them to flag up hazards on roads as a way to warn other users and autonomously send reports to the local authorities.

**Carbon Emissions Reduction:**

This idea will path the way to more people taking up cycling, as they’re given a tool which allows them to take a healthier and safer route. As well as being given the opportunity to make cycling better for others. Addressing the current biggest barriers to cycling in highly populated cities.

A more efficient use of infrastructure will reduce congestion and improve the flow of traffic, which in turn reduces emissions.

This idea will help reduce the strain put on the NHS due to health dangers/incidents caused by pollution/safety.

**Longevity:**

I see this idea being rolled out to other cities in the UK. Allowing us to make a stronger shift to a healthier nation not just for cyclists to live in, but everyone else too by reducing the number of people in emission producing vehicles.

This idea addresses the main barriers to cycling in highly populated cities by making road information widely available in a way that utilises modern technology. This promotes efficient use of our infrastructure. Along with the co-operation of local authorities and the adequate availability of pollution sensors. This idea will give power to the cyclist and not leave them vulnerable as they currently are.

With the prospective prominence of cycling along with the use of the app. Data analysts of the App would be able to closely co-operate with TFL and other local authorities to map out plans for future planning in accordance with route usage data. The data held by millions of cycling journeys will give a first time access to such a vivid picture.

Pot holes are a common issue for cyclists, they can cause punctures and even serious accidents. In the future I would see the app as a convenient way for users to flag up potholes which would be fed to the local authority. The frequency of road usage by cyclists would also give local authorities a method of hierarchy when it comes to mending roads.

It would also be of benefit to have the app advertised on hire bikes (Santander Bikes) to its users as a positive tool to get around with. Google maps is a powerful tool, however it is not specialised enough. This app could be the London Cyclist's powerful tool to getting around. Giving tourists, visitors and beginners a safe and healthy way to get around.

If we want to make the transition to a less polluting capital, we need a higher transfer rate to cycling. This can only be done if the right environment is available for the cyclist to feel safe in. This application gives the cyclists the tools they need as well as giving them the opportunity to look out for each other.