

## FYP Project Proposal Form 2019/2020



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<b>Programme Code: DT228</b>	
<b>Project Title: Extraction and Visualization of Air Quality Parameters from Copernicus Satellites</b>	
<b>Summary (approximately 200 words)</b>  The Goal of this project is to visualize the air quality data provided by Copernicus Satellites in an easy to understand format and perform analysis based on this.  Air Quality is a uniquely 21st century issue which is becoming more and more prevalent in built up area's around the globe, the aim of the app is to visualize air quality, provided appropriate easy to understand metrics so users can understand the data and give warnings when high pollution is detected in their location.  This will be accomplished through a web app and a mobile application to ensure the maximum reach for potential users and to increase awareness.  Extracting the data will be one of the difficult parts of the project as the data provided by the satellites is in formats such as grib which are unique to meteorological uses and I will need to write a library to interface with existing decoding tools.  There is also potential scope for incorporating other data provided by the Copernicus Satellites such as UV Index tracking, Sea Temperature tracking and Wildfire tracking. Other Air quality sources such as the EPA's Irish Network could also be incorporated if access could be obtained.	

## Background (and References)

As of late, I've become more and more concerned with environmental issues, our world is being choked to death by our actions and we need to raise awareness of the effect it's having on us. That's why I chose this project.

In my research I have found similar applications using different datasources such as <http://www.londonair.org.uk> which provides a very impressive down to the postcode indication of air quality. This is produced using the local air monitoring stations.

Edzer J Pebesma (2005)

This paper looks specifically at methods for visualizing spatial data eg Air Quality data in a uniform method. These methods are illustrated through modelling No2 data for the EU from the year of 2001

J Wood (1996)

This paper though old looks specifically at data visualization over the web, at its application to environmental data specifically. It looks at the scenario of air quality data which is published raw by the provider and then visualized by the user/client.

Tolga Eblbir (2004)

This paper details a decision support system which was developed for Authorities, it visualizes data from local sources and uses this to estimate overall air quality and help officials identify patterns and make management decisions.

### References:

London Air <http://www.londonair.org.uk> Date Accessed: 30th September 2019

Edzer J. Pebesma, Kor De Jong & David Briggs. (2005) Interactive visualization of uncertain spatial and spatio-temporal data under different scenarios: an air quality example: International Journal of Geographical Information Science: Vol 21, No 5. Retrieved October 04, 2019, from <https://www.tandfonline.com/doi/abs/10.1080/13658810601064009>

J. Wood ; K. Brodlie ; H. Wright . (1996) Visualization over the World Wide Web and its application to environmental data - IEEE Conference Publication. Retrieved October 04, 2019, from <https://ieeexplore.ieee.org/abstract/document/567610>

Tolga Elbir. (2004) A GIS based decision support system for estimation, visualization and analysis of air pollution for large Turkish cities. Retrieved October 04, 2019, from [http://www.academia.edu/download/44813399/A\\_GIS\\_based\\_decision\\_support\\_system\\_for\\_20160417-7568-mbj7yr.pdf&hl=en&sa=X&scisig=AAGBfm12K7m1nP4Zlie-ckgaN4T0nTtvkQ&nossl=1&oi=scholar](http://www.academia.edu/download/44813399/A_GIS_based_decision_support_system_for_20160417-7568-mbj7yr.pdf&hl=en&sa=X&scisig=AAGBfm12K7m1nP4Zlie-ckgaN4T0nTtvkQ&nossl=1&oi=scholar)

## Proposed Approach

### Design & Research:

- I will need to do a lot of research into Air Quality in general, what the acceptable parameters are and how it's measured.
- I will also need to research how it's encoded within grib files and the like.
- There will need to be a lot of planning put into the architecture of the applications, so that it's capable of scaling up and down without trouble. This will involve significant research into the front end frameworks and techniques so that I can maximize the processing being done by the client not the server.

### Implementation:

- The first step of implementation will be either implementing my own library or using the older existing ones to decode the data and normalize it into a format that can be stored within a database and read easily.
- Second step will be writing a backend API which will serve the data out to the applications, this will need to be scalable. I may right this in Django with Django Rest Framework but it may be necessary to use GO to achieve scalability. Authentication and Rate Limiting may also be needed.
- The Next Step will be writing the Web frontend, this will be written in either React, Angular or Vue depending on architecture constraints.
- Following this I will build the mobile applications with a cross platform javascript framework such as Ionic, potentially this could be combined with the web app for a write once deploy everywhere approach.

### Testing and Deployment:

- Ensuring the data is accurate is a key aim, warnings about pollution and its effect on our health and environment should be accurate.
- To ensure the application scales it will probably need to be deployed on AWS Container service with a Orchestration tool such as Docker Swarm, Cloud Foundry or Kubernetes to auto scale.
- Continuous Integration and Deployment will also need to take place with tools such as Jenkins, Travis CI, or Circle CI. Deployment and scaling will provide significant complexity.

## Deliverables

A Web Application that Visualizes the data and provides appropriate context.  
A Mobile Application that Visualizes the data and provides appropriate context.  
A reusable library or improvements to existing ones for interfacing with grib files in python.  
A dissertation, interim report and other required documentation.

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<b>Technical Requirements</b> Laptop A Postgres Database with Spatia Lite Web Hosting Mobile Devices for testing (Android & IOS)

**Project Reviews – Please include reviews of two of LAST 2 years projects from either DT228, DT282 or DT211C.**

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## **Project 1**

**Title:** CrimViz: Irish Crime Data Visualization

**Student:** Max Curtis

### **Description (brief):**

The goal of the project was to visualize crime data and statistics on a map, this would allow potential home buyers, garda and other interested parties to find out about crime in area's and discover crime trends and types.

### **What Is Complicated:**

Data had to be collated from multiple static sources and combined together and normalized. There was no easy source of the Locations of Garda stations so it had to be ripped off the Garda website then combined with the crime data.

### **What Technical Architecture:**

Django, Bootstrap, Digital Ocean, Docker, Nginx, OpenStreetMaps, Leaflet JS, Python

### **Strengths/Weaknesses:**

- Data was Visualized Well, good metrics were used and thought was put into the type of visualizations provided and giving meaningful context.
- Deployment architecture was well thought out and somewhat scalable.
- Overall UI could use some work with better styling
- Data was mostly static without updates, this means it needs to be manually updated and potentially need rewrites due to the one of nature of the data.

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## Project 2

**Title:** Training Pal

**Student:** Daniel Tilly

### Description (brief):

The goal of the project was to provide athletes and coaches with a common way of sharing training data. Human interaction was key too, so it included features such as video calling for sharing.

Common tasks included creation of training log entries, searching for users, managing training targets, one to one video consultations and also graphical representation of data.

### What is Complicated:

Features such as video conferencing are quite complicated to implement, especially on a cross platform basis. UI is also key to getting people to engage with and the UX had a lot of research put in to make it engaging.

### What Technical Architecture:

Python, Flask, Digital Ocean, Angular, Android, MySQL

### Strengths/Weaknesses:

- UI is strong, there is nice graphics and the screens presented seem logical and easy to use.
- Architecture is simple but scalable.
- Having only partial functionality on Mobile is a downside as this is the best medium to engage people with.

### Proposal Sign off:

**Student Signature:**

**Date:**

**Lecturer Signature:**

**Date:**