Elevate

Analysing today to provide a greener future

Introduction

The project deals with solving the problem of identification of excessive air pollution in the environment. Pollution of urban and rural areas has never been explored at such a detailed level before. Our aim is to collect and provide high quality data that can be used to analyse the effects of air pollution and use that data to provide a greener footprint to the citizens of the country. By using a drone we have enabled the possibilities of navigating complex city landscapes while also being able to cover large distances in open fields if need be. Being an independently functioning device, the drone can be automated to fly out to certain distances from its base station and gather real time data at any point in time. The drone can also be used as a manual flight surveillance tool for multiple other purposes. An autonomous system that helps detect interest points in the city while also collecting useful data about the low altitude atmosphere can be a useful resource.

Main Features

- USER INDEPENDANT
- CENTRAL DATA ARCHIVE
- MULTIPLE SIMULTANEOUS DRONE DEPLOYMENT
- DATA ANALYZATION & VISUALIZATION
- AUTONOMOUS FLIGHT
- ACCURATE INFORMATION

Problem Definition

The Delhi and NCR region is most affected by the air pollution due to huge population and traffic jams. Though Gurgaon's air quality has been marked 'good' for the first time in seven months, the data on the basis of which the assessment was made may not be entirely reliable.

It turns out that the data on the level of PM 2.5, a key constituent of air pollution, for the last seven days is not available. The daily average reading put out by the Central Pollution Control Board's (CPCB's) air quality index daily average in Gurgaon has only been displaying the city's Ozone (O3) data over the last week. Since July 14, the air quality index hasn't put out data on the extent of major air pollutants that could present a clearer picture on the city's air quality.

While the city is in line to get three ambient air quality monitoring stations, the only one currently in operation has, of late, not been putting the necessary data that not only helps the

HSPCB assess the city's air quality but also adopt measures to bring down the level of pollutants in the atmosphere as mandated by the Supreme Court.

Due to lack of air quality monitoring station MCG don't have sufficient data about the pollution level in Gurgaon. Air quality monitoring stations are very expensive and time consuming with very inaccurate data processing techniques. We want to mobilize air quality monitoring station.

Our goal is to supply MCG a processed and adequate data with detailed information about the pollution levels and the toxicity level of the air. By mobilizing the air quality monitoring system we would be able to collect a huge amount of data in less time and less cost. This might be a revolutionary step by which we can monitor the pollution levels and come up with better solutions to minimize the pollution of the city.

FOCUS S Approach

Financial Viability

Keeping costs at a bare minimum during development has allowed for the project to be completed within ₹20,000. When compared to a product that can be purchased off the shelf or is custom made. We have reduced cost by at least ₹80,000 depending on various configurations that are available. This solution that can be easily adapted to perform many other tasks. A large or medium scale production run can be financially profitable.

Originality

The project aims to establish a system through which data about air quality can be easily extracted. Such systems do not exist in India as of today and can help industries and governing bodies to make changes and control the pollutants that are escaping into the atmosphere. With detailed projections and a human free operating environment we have created a new approach to understanding air quality.

Customer Acceptability

Due to the increasing rate of air pollutants and the interest of the Indian government makes this project highly acceptable. Air quality is not only a national but an international problem that is being looked at as the cause of many diseases. Taking the current scenario into consideration, the project has a high rate of acceptance.

Usefulness to society

With the help of our live data and extracted trends government can research and devise plans to tackle air pollution. We can deploy drones during the implementation of these plans to observe the effects of these strategies. This will help to build a better future for our society.

Sustainability

There are about 174 developing and 33 underdeveloped countries which can't afford to build a pollution substation for every city. Our product provide pollution mapping autonomously at affordable price which can help many countries attain air pollution data for their cities and polluted areas.

Structured

Elevate is an interface of two different technologies to provide an effective pollution mapping solution. One part of it is a pollution sensor mounted drone which maps pollution in a specific area. Other part is a server that collects the data and process it to extract useful trends from it. Both components are well structured and planned to provide seamless experience to the user.

Literature Review

Looking at sources of information for pollution data we found that our country has a lower number of Air Pollution Stations as compared to other countries in Asia. Using the data available on AQICN we can easily demonstrate the same. The two pictures below show the number of station in India vs Japan. AQICN works out of Beijing, China and aims to provide open source data that is accurate and live. They have also taken up projects that focus on collecting detailed air quality data of a small area like an industrial area. With 101 countries being a part of their community they have established a great base to collect data and help start the journey to better understand the effects human activities have on the environment and how the changes in air quality affect us humans in turn.
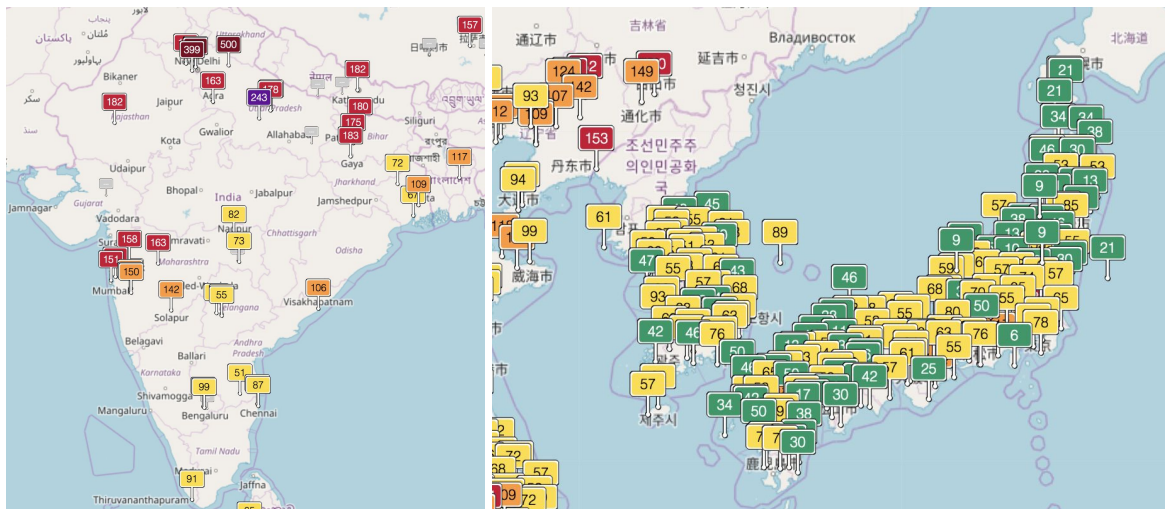
Although drone based pollution monitoring exists it is very expensive and has not been deployed on a large scale basis. With the rapid decrease in air quality index the Indian Government has made efforts to create and implement rules and regulations for the public and private sector. However there is no evaluation that is taking place, our solution provides a cheaper alternative to the commercially available ones and provides similar quality of data.

The cost of a similar solution costs upwards of one and a half lakh rupees. Our goal is to reduce the cost of collecting saturated data of a given area and bring it down to twenty thousand rupees. We hope to provide a sound solution that can be integrated into pre existing systems and help to improve the quality of information that is currently available.

Research & Design
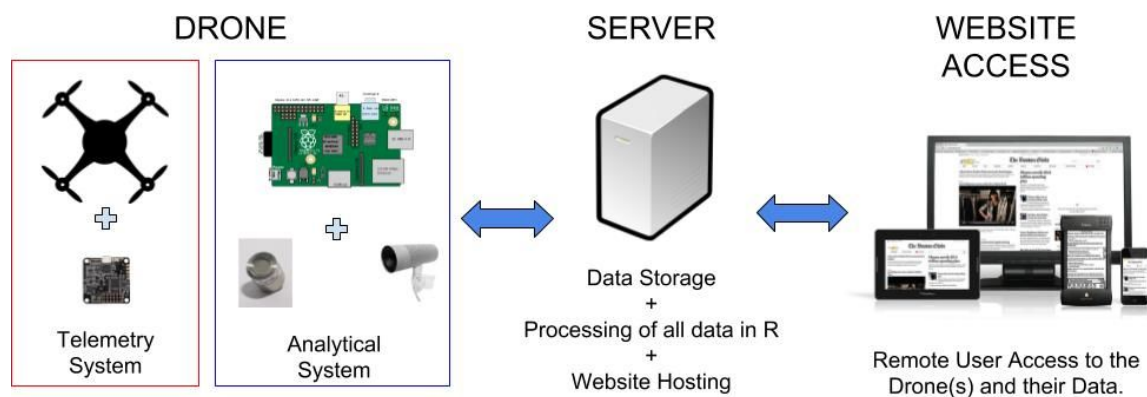
The Diagram above clearly represent the order of operation being carried out. By creating a complete system that can orchestrate multiple drones at any given time allows for a speedy operation when dealing with large areas of land.

The project will consist of creating the complete Telemetry and Analytical platform for the data to be collected. This entails:-

1. The assembly of the components of the drone.
2. Creating an interface between the Raspberry pi and the flight controller and making sure that the area to be monitored is assigned correctly and an automated flight path is generated for the given area.

3. Collecting the data from the sensors locally and then pushing that data to the cloud on the go.
4. Making a server that can start processing the data by cleaning it and displaying it while highlighting key aspects of what has been found.
5. The data as a whole will also be used to analyse long term trends of a given area and due to being Volumetric in nature the data can also be used to study how our environment behaves with variation in pollution metrics.

Flight time of our drone is about 15 minutes and it can fly upto 300 feet high. Two sensors that detects CO_2 and PM2.5 level are interfaced with raspberry pi which is mounted on the drone. As soon as drone boots up it powers raspberry pi which uploads the data on server and starts mapping pollution using the sensors.

Using APM mission planner users can specify a region where he/she wants to map the pollution. Drone will automatically design a flight plan for optimal pollution mapping and then will fly autonomously in that area to collect pollution data. We can pair upto 10 drones to this software which can map pollution in different regions at the same time.

All this data is then processed using R. Website is designed using Shiny. Our website takes the data from our server and then process it using the predefined algorithms and display collected insights from the data.

Until now pollution stations were costly and stationary. Elevate is a mobile autonomous pollution mapping system which costs way less than setting up a pollution substations.

Future Scope

The data collected from the drone can be eventually used to create high scale 3D models of the city and the data can be represented on those models as shown above. We have pitched the project to the MCG and have received a lot of interest from the government. We hope to convert this project into a product and provide some useful insight to anyone who is looking for detailed data about air quality.
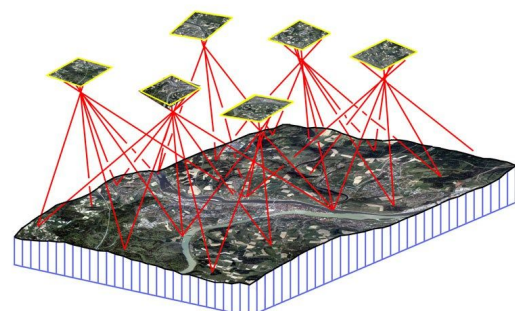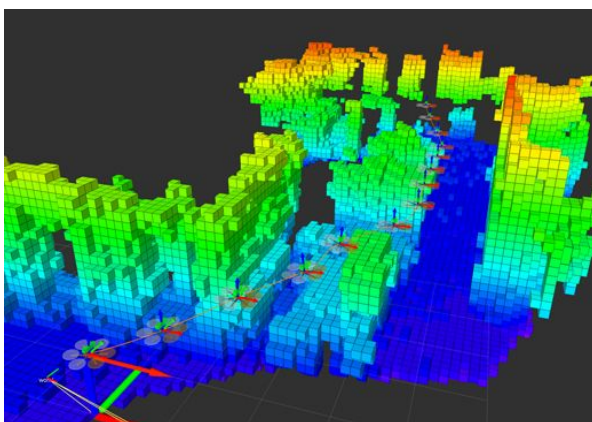
Advantages

Here are some advantages of Elevate over traditional pollution mapping devices:

1. Sensors in traditional pollution mapping stations are stationary and have very limited coverage. Therefore monitoring air pollution using elevate which uses drone to map air pollution may add accurate pollution data to the official repository.
2. Elevate provides accurate pollution mapping at a very low cost than its competitions. Cost of building a pollution mapping substation is 1 crore which is 500% more than elevate cost.
3. Elevate is an autonomous system which only needs a human to specify a certain area for pollution mapping. After further improvements elevate won't even need human intervention to charge the drone batteries.