Pollution Base Navigation System for Metro Pollution Cities

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Abstract— Air pollution is responsible for many health problems in the urban areas. Of late, the air pollution status in Delhi has undergone many changes in terms of the levels of pollutants and the control measures taken to reduce them. The urban air database released by the World Health Organization in September 2017 reported that Delhi has exceeded the maximum PM10. Vehicular emissions and industrial activities were found to be associated with indoor as well as outdoor air pollution in Delhi. The increasing vehicular traffic in urban sectors leads to emission of toxic gases thereby increasing air pollution levels which includes Nitrogen Dioxide (NO2), Sulphur Dioxide (SO2), Carbon Monoxide(CO), Ozone (O3), Particulate Matter (PM2:5). The need for a solution to travel healthily for daily activities becomes a place of importance. This project proposes a model where ambivalent Air Quality Index is monitored and thus suggesting path having the least pollution to travel. It concurrently decreases the harmful effect of air pollution on vulnerable people. Dijkstra algorithm is used to defend the shortest path from source to destination and simultaneously evaluating the air quality index and guiding optimal path as result. This model can be used by ambulances and cabs. This model can be considered as a step forward towards healthy lifestyle.

Keywords: Air Pollution; World Health Organization; Dijkstra Algorithm; Guiding Optimal Path; Ambulance and Cabs

I. Introduction

Pollution refers to the contamination of the earth's environment with materials that interfere with human health, quality of life or the natural functioning of the ecosystems. The major forms of pollution include water pollution, air pollution, noise pollution and soil contamination. Other less-recognized forms include thermal pollution and radioactive hazards. It is difficult to hold any one particular form responsible for maximum risk to health; however, air and water pollution appear to be responsible for a large proportion of pollution related health problems.

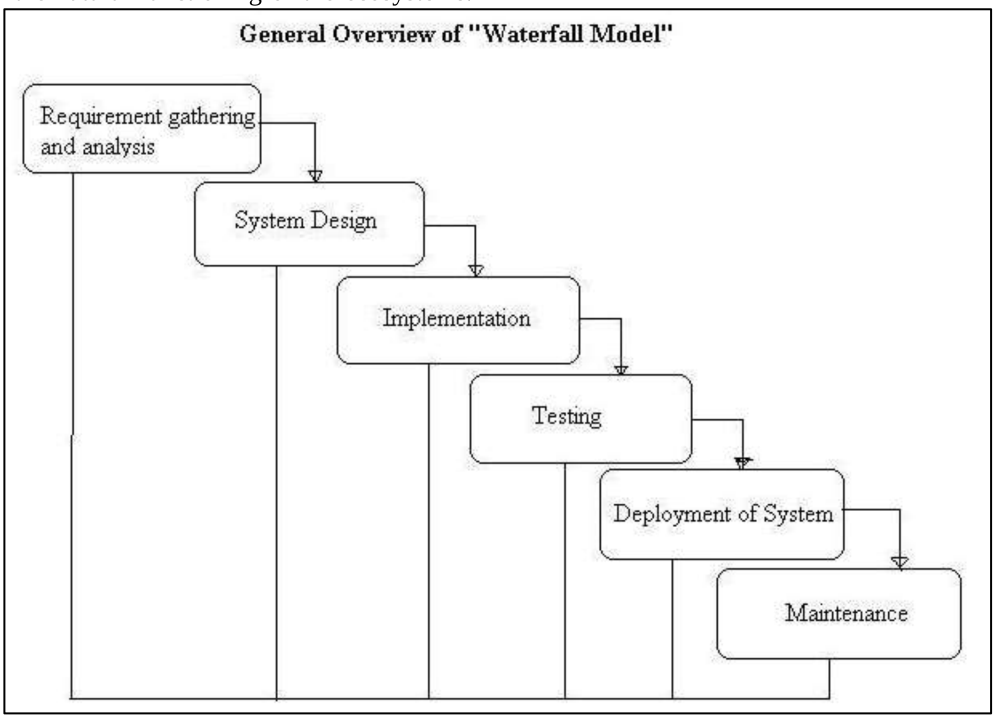
Over the past years the development and urbanization in India has led to increase in air pollution. Rapid Urbanization has resulted in sustained degradation of environmental quality parameters. It is important to keep track of various environmental pollution indices so that the realistic models can be developed and relevant public policies can be created. Therefore, here we present a model that returns an optimal route considering acceptable air pollution index limits. Propose system provide such a path which will have the least air pollution at that point of time. It concurrently decreases the harmful effect of air pollution on vulnerable people. An idea of on-road air quality monitoring and control approach by proposing an agent based system for modeling the urban road network infrastructure, establishing the real time and predicted air pollution indexes in different road segments and generating recommendations and regulation proposals for road users. That network was represented by a weighted graph in which the edges weights evolve according to pollution indexes.

II. Methodology of Problem Solving

PROJECT PLAN

PROJECT ESTIMATES

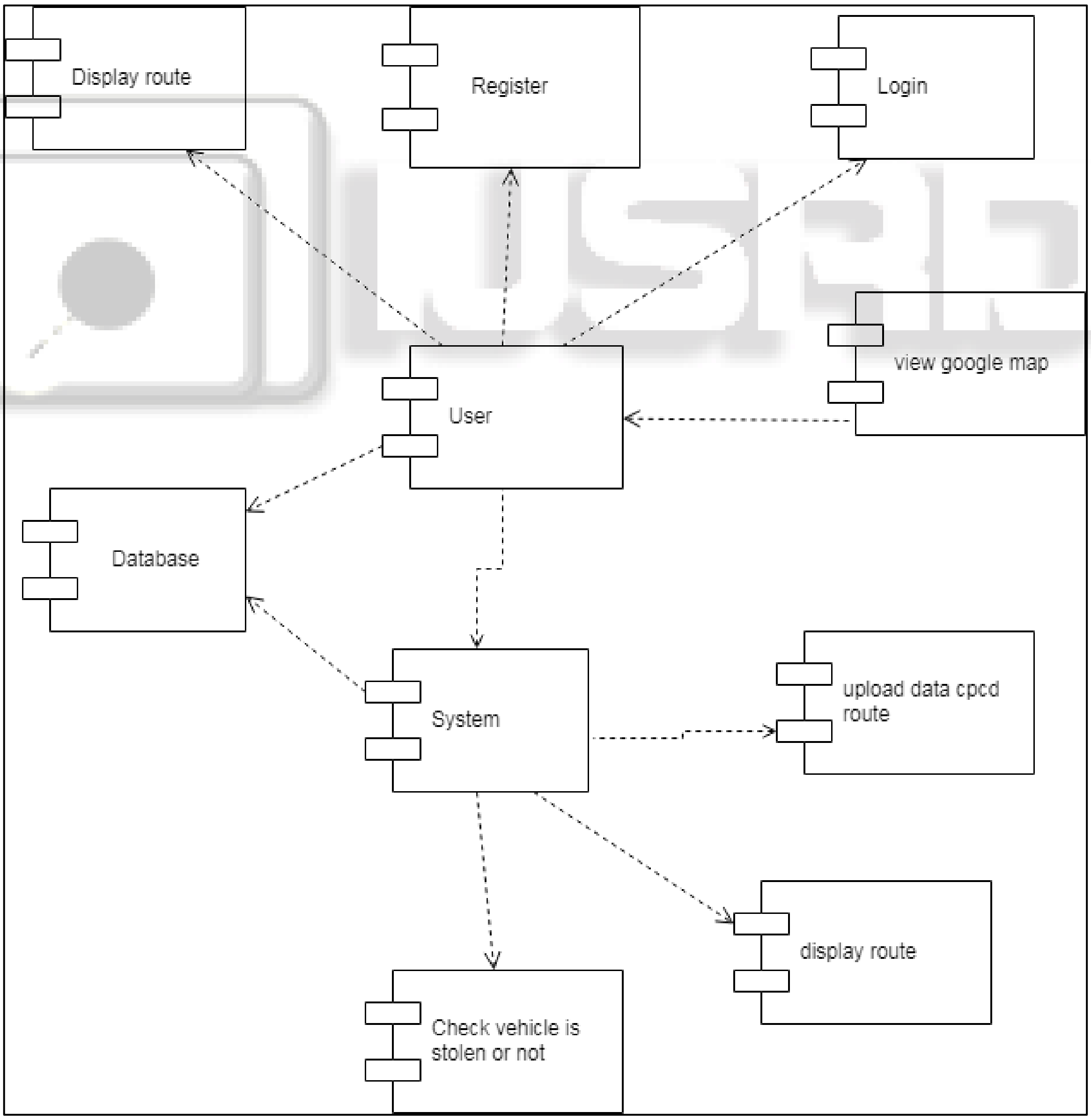
We are using waterfall model for our project estimation.



1) Requirement gathering and analysis: In this step of waterfall we identify what are various requirements are need for our project such are software and hardware required, database, and interfaces.
2) System Design: In this system design phase we design the system which is easily understood for end user i.e. user friendly. We design some UML diagrams and data flow diagram to understand the system flow and system module and sequence of execution.
3) Implementation: In implementation phase of our project we have implemented various module required of successfully getting expected outcome at the different module levels.
4) With inputs from system design, the system is first developed in small programs called units, which are integrated in the next phase. Each unit is developed and tested for its functionality which is referred to as Unit Testing.
5) Testing: The different test cases are performed to test whether the project module are giving expected outcome in assumed time. All the units developed in the implementation phase are integrated into a system after testing of each unit. Post integration the entire system is tested for any faults and failures.
6) Deployment of System: Once the functional and nonfunctional testing is done, the product is deployed in the customer environment or released into the market.
7) Maintenance: There are some issues which come up in the client environment. To fix those issues patches are released. Also to enhance the product some better versions are released. Maintenance is done to deliver these changes in the customer environment.

All these phases are cascaded to each other in which progress is seen as flowing steadily downwards like a waterfall through the phases. The next phase is started only after the defined set of goals are achieved for previous phase and it is signed off, so the name "Waterfall Model". In this model phases do not overlap.

III. COMPONENT DESIGN



OUTCOME
O = f O1, O2g
1) O1: Login Successful
2) O2: Optimal path between source and destination
Success
Success = f S1, S2 g
1) S1 = Air Quality Index Calculated
2) S2 = Optimal path generated
3) 2.9 Failure
Failure = f Fl1, Fl2 g
1) Fl1 = To retrieve data from pollution monitoring station website.
2) Fl2 = Disconnection of platforms.

IV. LITERATURE SURVEY

A. Paper Name: Scalable Measurement of Air Pollution using COTS IoT Devices

Author Name: Varun Jain, Mansi Goel, Mukulika Maity, Vinayak Naik, Ramachandran
Ramjee

Air pollution levels have been rising at an alarming rate for the past ten years. The situation is considerably worse in developing nations, such as India. The average concentration of PM10 in Delhi has increased by over 66and 2010 and continues to increase further. Rising air pollution has been shown to have a detrimental effect on human health. The first line of action is to sensitize people about the problem by informing them about the quality of air that they are breathing in their immediate vicinity. Unfortunately, India still lacks the infrastructure required to measure pollution at a granular scale. Most of the pollution monitoring stations are placed in regions of low population density, and hence, it is difficult to calculate the personal exposure to air pollution for most of the population. It is also not economically viable to add pollution monitoring devices at such a scale in a short period of time. We propose a framework to estimate air pollution for a given locality by leveraging the existing infrastructure of monitoring stations and looking at factors, such as traffic conditions and greenery. We evaluate our framework by estimating the pollution exposure for long trips undertaken by users, given the seed pol- lution values at a few spots. Our framework incurs a reasonable accuracy. We find that greenery has more impact on pollution than traffic conditions.

B. Paper Name: A fuzzy interface system for determining Air Quality Index

Author: Archit Aggarwal, Tanupriya Choudhary, Praveen Kumar

Delhi was declared the most polluted city in the world in 2014 by the world health organisation. There are three major sources of pollution in Delhi namely road dust, industry and vehicles. Majority of the pollution is caused by road dust and industries. The Air Quality Index(AQI) is the standardised way of describing the level of pollutants and overall air quality. AQI is dependent on the measurement of eight pollutants. The traditional method used is linear interpolation where only one pollutant is considered to calculate AQI. This paper proposes a fuzzy interface system for the calculation of AQI using two pollutants with each having six linguistic variables. The system gives satisfactory results and can provide many solutions for industrial air pollution

C. Paper Name: Air quality monitoring system based on IoT using Raspberry Pi

Author Name: Somansh Kumar; Ashish Jasuja

Air pollution is the largest environmental and public health challenge in the world today. Air pollution leads to adverse effects on Human health, climate and ecosystem. Air is getting polluted because of release of Toxic gases by industries, vehicular emissions and increased concentration of harmful gases and particulate matter in the atmosphere. Particulate matter is one of the most important parameter having the significant contribution to the increase in air pollution. This creates a need for measurement and analysis of real-time air quality monitoring so that appropriate decisions can be taken in a timely period. This paper presents a real-time standalone air quality monitoring system which includes various parameters: PM 2.5, carbon monoxide, carbon dioxide, temperature, humidity and air pressure. Internet of Things is nowadays finding profound use in each and every sector, plays a key role in our air quality monitoring system too. Internet of Things converging with cloud computing offers a novel technique for better management of data coming from different sensors, collected and transmitted by low power, low cost ARM based minicomputer Raspberry pi. The system is tested in Delhi and the measurements are compared with the data provided by the local environment control authority and are presented in a tabular form. The values of the parameters measured are shown in IBM Bluemix Cloud.

D. Paper Name: Extracting Patterns and Variations in Air Quality of Four Tier I Cities in India

Author Name: Alka Yadav; Durga Toshniwal

The cities in India are classified into Tier I, II and III based on population. Air pollution is an issue of major concern as it has adverse impact on human health and ecosystem. Tier I cities in India have high levels of pollutants due to increased vehicles, industrial units etc. In the present work, the air quality data from New Delhi, Mumbai, Chennai and Bengaluru has been used. Initially, dimension reduction has been performed on the data. After that, the data has been de-seasonalized. Finally, a modified ARIMA model has been proposed which is applicable to numeric data streams. This is denoted as SDA (Streaming Data ARIMA). Principal Component Analysis (PCA) has been used for dimensionality reduction. The results of SDA and ARIMA are compared with each other and also with GARCH Model and have been found to be very promising.

E. Paper Name: Time series and predictability analysis of air pollutants in Delhi

Author Name: Rashmi Bhardwaj; Dimple Pruthi

Air pollution is a challenging problem globally and the complete globe is facing the hazards caused by it. In the recent years, it draws an attention of all as it is directly related with the health concern of an individual. Air pollution is a big concern for Delhi. More than 15 million people are exposed to severely high pollutant concentrations. Air pollution have a high impact on the environment also. Government of Delhi performed a litmus test of vehicular emissions in the form of Odd-Even Scheme (15April 2016-30 April 2016). This paper deals with the estimation of regression coefficient, Hurst exponent, Fractal Dimension and Predictability Index of air pollutants NO, NO 2, NO x, SO 2, PM2.5 and the weather conditions relative humidity and temperature during (15April 2016-30 April 2016), pre (30 March 2016 -14 April 2016) and post Odd-Even Scheme (1 May 2016-16 May 2016) in the Dwarka area adjoining Indira Gandhi International Airport, Delhi. The Hurst exponent is defined as the index of long-range dependence. It measures a relative tendency of a time series either regress strongly to the mean or to cluster in a direction. It is related to fractal dimension which gives measure for roughness of surface. The Predictability Index describes the behaviour of time series. The data for the above period is taken from Central Pollution Control Board, Government of India. It is observed that carbon mono oxide (CO) behavior is unpredictable with Relative Humidity and sulphur-di-oxide (SO 2) as they follows a Brownian motion for pre and post the Odd-Even Scheme simultaneously. During the period of Odd- Even Scheme, the behaviour of temperature with respect to PM2.5 is unpredictable. It is concluded that CO with PM2.5 follows a Brownian time series and hence the trend is unpredictable and SO 2 for pre and post Odd-Even Scheme follows a Brownian time series. Thus it is difficult to predict the behavior and trend of the pollutants

V. Future Works

System also develop for other cities.
System will include other gases for more accurate result.

VI. Conclusion

In previous research we addressed the problem of achieved to find out shortest path with minimum pollution using Dijkstra Algorithm. To full fill the user requirement for the searching path. In this way we have achieved to find out shortest path with minimum pollution using Dijkstra Algorithm. Here we are taking AQI index from CPCB website which is being updated after every 15-20 minutes. We are taking inputs from user through mobile app. Computing shortest path using Dijkstra Algorithm and results are send back to user on mobile app and those results are displayed using Google maps with the accurate result.

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