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OPTIMAL ROUTE BASED ON AIR QUALITY INDEX

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Abstract

Over the past years, the development and urbanization in India have led to an increase in air pollution. Rapid Urbanization has resulted in sustained degradation of environmental quality parameters. The increasing vehicular traffic in urban sectors leads to the emission of toxic gases thereby increasing air pollution levels which include Oxides of Nitrogen, Carbon Monoxide (CO), Ozone (O3), Particulate Matter (PM2.5), and Particulate Matter (PM10). The concentration of pollutants in Delhi, the capital of India, usually exceeds international standards. This city could be considered as one of the most polluted cities in the world. The main reason for this pollution is the large number of cars commuting through the transportation network of Delhi. This paper proposes a model where ambivalent Air Quality is monitored and thus suggesting a path having the least pollution to travel in Delhi. It decreases the harmful effect of air pollution on people. Dijkstra's algorithm is used to find the shortest path from source to destination and guiding the optimal path as result. The Algorithm will run until all vertices in the graph have been visited. This means that the shortest path between any 2 nodes. In this project, a solution is proposed to provide the best route for citizens by considering their priorities. It is possible to calculate the optimum path based on the user-defined constraints and weights. the main purpose of the system to develop a system that searches for an optimum path using air quality index: PM 2.5, Nitric oxide, Oxides of carbon, Nitrogen dioxide into consideration.

Index Terms **- Air pollution, Air Quality Index, Dijkstra's Algorithm, Central Pollution Control, Global Positioning System.**

1. INTRODUCTION

With increasing industrialization and over-scale urbanization, air pollution is the presence of a substance in the air that is harmful to living beings. So we have to find the solution to this problem. The capital of India, Delhi the concentration of harmful pollutant exceed day-by-day so, it is important to keep track of various environmental pollution indices. Therefore, here we present a model that gives us an optimal route considering acceptable air pollution index. By applying the information about the air quality of the city, people could find the better routes for daily travels to find such a path which will have the least air pollution at that point of time. In this project, a solution is proposed to provide the best route for citizens by considering their priorities by checking the air quality index and suggest a path having the least pollution to travel. In this paper, we develop an application that gives the least polluted route to travel safely by entering a starting point and destination point within Delhi the application directly opens in Google map which gives us a minimum pollution route with minimum distance considering their priorities. This project is limited only to Delhi. It is accepting the concentration of gases from 14 nodes only. The data is captured after every 15-20 minutes. Data is being obtained from the pollution monitoring station website only. Gases that are taken into consideration are Nitrogen Dioxide (NO2), Sulphur Dioxide (SO2), Carbon Monoxide (CO), Ozone (O3), Particulate matter (PM2.5). The motivation of this paper is to India's poor air quality causes 1.1M per mature deaths every year. Delhi is among the worst polluted cities in the world. We are on the

urge of destruction due to air pollution. Therefore a system must be developed which considers parameters of air quality index in navigation.

2. LITERATURE SURVEY

[1]ABDERRAHMANE SADIQ[1], DJAMAL BENSLIMANE[2] Proposed a idea on An artificial neural networks model and the Dijkstra algorithm are used for air quality prediction and the least polluted path finding in the road network. All data processing tasks are performed over a Hadoop-based framework: HBase and MapReduce. This paper presented the implementation of an air quality system for recommendation and traffic regulation over distributed data gathered from different air quality sensors, users' devices and other external databases, that are managed using Hadoop to ensure fast data.

Fig. 1 Road segment details and an example of road paths with different data

[2]Zahmatkesh H, Saber M, Malekpour M. Proposed a idea on A New Method for Urban Travel Rout Planning Based on Air Pollution Sensor Data presented an idea about city of Tehran..In this research Dijkstra algorithm is used to find the optimum path which is efficient in both aspects of shortness and air quality condition. Here the sensor are attached to the point and data are collected with that sensor and detect a path having least pollution. Three different weights are assigned for network dataset to evaluate the sensitivity of calculated path in various conditions.

[3]Ritik Jain, Ishan Agrawal Proposed a system on Navigation System Using Air Quality Index using A* algorithm to find the optimum path. It used to minimize the harmful effect of air pollution. The model is validated on data set for two different routes. The used road distance between the cities as a basic cost function and aerial distance between the cities as a heuristic function . But in the previously done work, they have to traverse more cities as compared to the no. of cities traversed in the A* algorithm for the same source and destination.

Fig.2 Red pin points node represents the path using A* algorithm

3. SYSTEM OBJECTIVE

1. To create a learner algorithm that will be able to predict the hourly pollutant concentration.
2. To develop an Android application that will provide the users with the real-time pollution concentration PM2.5 along with the hourly forecasted value of the pollutant concentration from the learner algorithm.
3. To suggesting the formation of the less polluted navigation route between source and destination supported the Google navigation in Android application.

4. SYSTEM OVERVIEW

This System consists of a mobile-based application which we require the android studio to develop an application XAMPP server is used to apply the Dijkstra algorithm. As we enter to input the data processing is done in XAMPP server it gets redirected to the pollution monitoring website i.e. CPCB website which being updated in every 15 min. we have to upload the data set of 15 locations in Delhi. After processing is done in the XAMPP server it calculates the shortest path Dijkstra's algorithm gets executed and the shortest path is sent to the mobile application. The result open in google Maps gives the shortest distance between source and destination further on the click it gives a kilometer between source and destination .To deal with the problem of pollution, a system architecture is developed in Fig. 3 to find the optimal route by avoiding pollutants. This diagram consists of the following steps

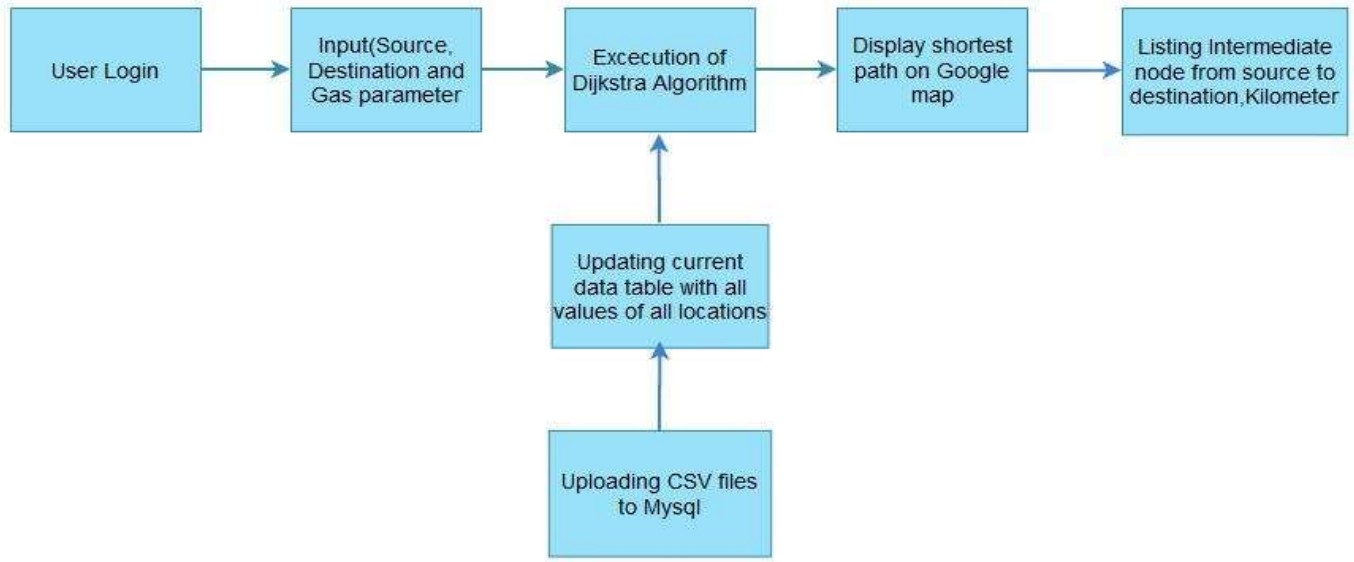

Fig. 3 Architecture Diagram of system

1. **Selecting Input:** The user has to first log in to the application further has to select the source, destination, and gas parameter. For processing, this data goes to the XAMMP server

2. **Data processing**: Form a central pollution control board the concentration of pollutant data obtained This data is to be uploaded to MySQL table. When all the files are uploaded to all desired locations then we will find recent concentrations of gases of all locations. Here we are taking AQ from the dummy website CPCB where the concentration of different gases is present which is being updated after every 15 minutes.

Table 1. CPCB Data of AQI

SN.	STATE	Station Name	AQI
1	Delhi	DTU, Delhi	175.00
2	Delhi	Sirifort,Delhi	149.00
3	Delhi	ITO, Delhi	188.00
4	Delhi	Lodhi Road,Delhi	121.00

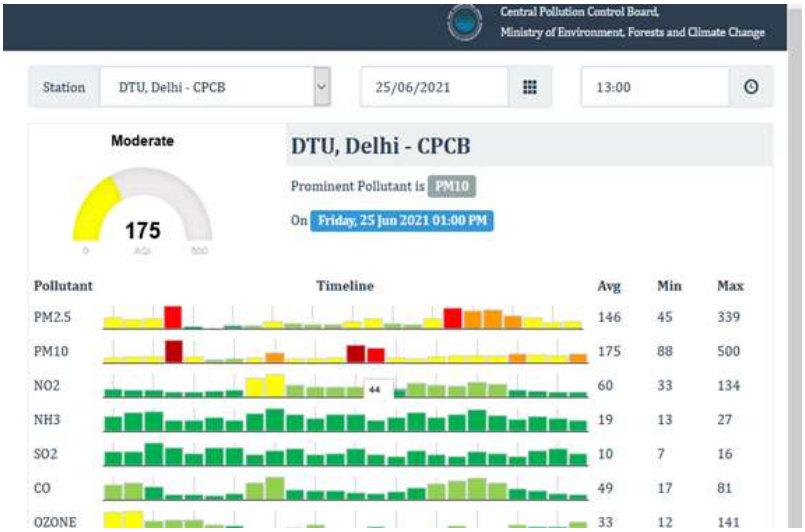

Fig. 4 CPCB data DTU, Delhi

3. Display Shortest path: After accepting login information from the XAMPP server Dijkstra Algorithm is executed and shorted path display in the android app.

4.Output on Google MAP: As the shortest path is received. It is displayed using Google Map .with green nodes this route is the best route to travel with the minimum distance it also gives us how many kilometers it away from our source point.

5. PROPOSED METHODOLOGY

Dijkstra algorithm is used to find the shortest distance between the two nodes where the distance between all nodes is calculated and gives us as a result minimum distance within nodes. In this fig. YELLOW edges give us minimum distance by applied the Dijkstra algorithm.

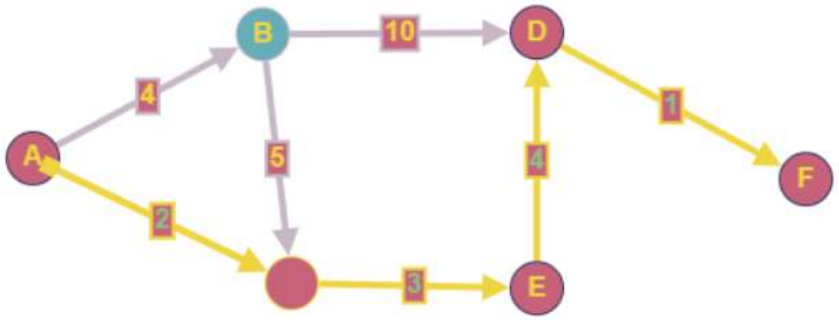

Fig. 5: Dijkstra's algorithm weighted graph

```
function Dijkstra(Graph, source):
    create vertex set Q for every vertex v in Graph:
        dist[v] ← INFINITY
        prev[v] ← UNDEFINED
    add v to Q
        dist[source] ← 0
   while Q is not empty:
     u ← vertex in Q with min dist[u]
        remove u from Q
```

```
    for each neighbor v of u:
      alt ← dist[u] + length(u, v)
    if alt < dist[v]:
       dist[v] ← alt  prev[v] ← u
return dist[], prev[]
```

6. SCOPE OF STUDY

1. This application is being developed for Delhi state.
2. 14 Nodes are taken into consideration.
3. Data is being obtained from Central Pollution Control Board (pollution monitoring station website.
4. Gases under consideration are Nitric Oxide, Sulfur Dioxide, Carbon monoxide, Ozone, and Particulate matter.
5. Vulnerable people with specific allergies are also being considered.

7. RESULTS

Figure 6 After successful login user goes on the second page here the user has to enter the start point i.e source point, destination point, and gas parameter. This data is sent to the XAMPP server where the Dijkstra Algorithm is executed using values of the current data table and given input. After selecting starting point, ending point, and gas selection just click on the "Go" button.

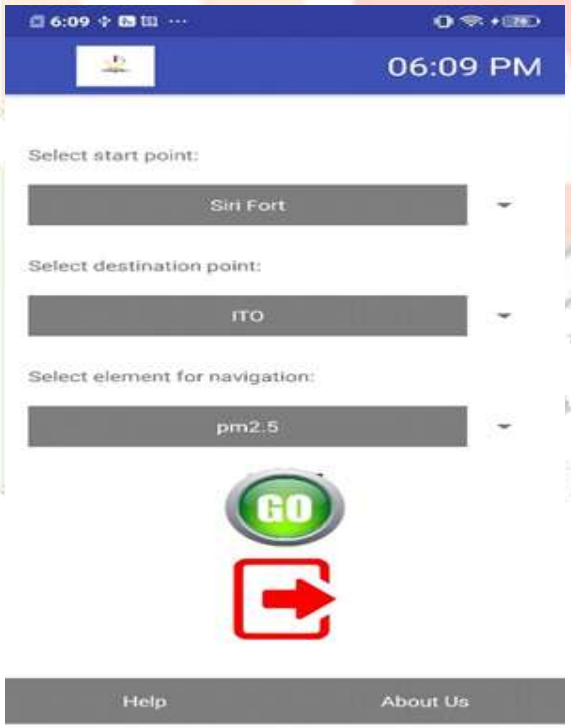

Figure 6: Selection of parameter

Figure 7 After selecting the parameter the page redirected to map as a result showing an optimal path as a green pinpoint. These green points are the result and have to travel within this green point considering the minimum pollution and safest route as a result.

Figure 8 After clicking route details the detailed path between the source and the destination is displayed. The route is expressed successively so that the user can follow it and reach the required destination.

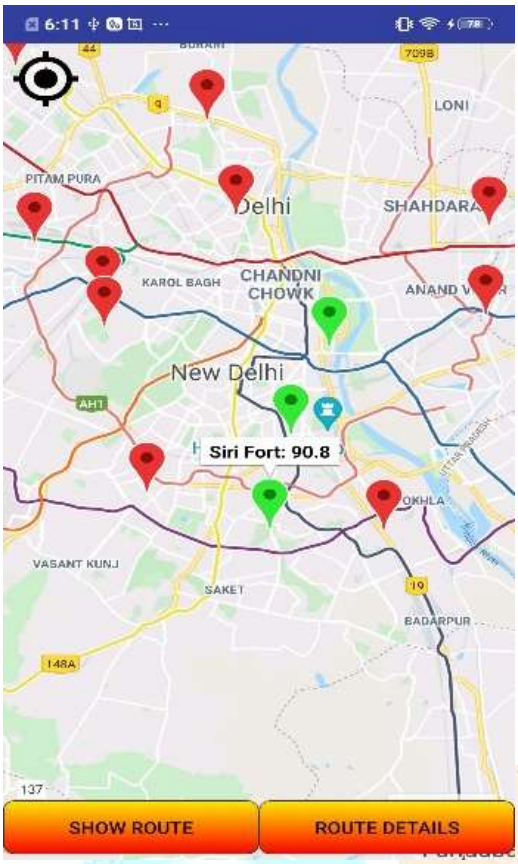

Figure 7: Optimal path as a Result

Figure 8: Route details

8. CONCLUSION

In this way we are taking AQI index from the CPCB website which is being updated after every 15-20 minutes. The user will enter source and destination. Then simultaneously system will obtain concentrations of various gases from the pollution monitoring website after a particular interval of time. Then this data will be given input to the XAMPP where calculation AQI and implementation of Dijkstra algorithm with weights as AQI will take place and results will be available to User on Mobile and those results are displayed using Google maps with the accurate result. The main advantage of this System is that it ensures in providing a better path to move from one place to another.

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