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INTELLIGENT NAVIGATION SYSTEM USING AIR QUALITY INDEX

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Abstract - *With increasing industrialization and large scale urbanization air pollution has become a greater threat to mankind. The increasing vehicular traffic in urban sectors leads to emission of toxic gases thereby increasing air pollution levels which includes Oxides of Nitrogen, Carbon Monoxide (CO), Ozone (O_3), Particulate Matter ($PM_{2.5}$) and Particulate Matter (PM_{10}). 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 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 find the shortest path from source to destination and guiding 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 can be saved and looked up later. This model can be used by ambulances and cabs. This model can be considered as a step forward towards healthy lifestyle.*

Key Words: Air pollution, Air Quality Index, Dijkstra's Algorithm, Central Pollution Control Board

1. INTRODUCTION

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 concentration limits of pollutant gases. To find 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.

2. LITERATURE SURVEY

Abdelaziz El Fazziki, Djamal Benslimane, Abderrahmane Sadq, Jamal Ouarzazi ad Mohamed Sadgal presented 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. In this work they proposed the combined benefits of agent technology with both machine learning and Big Data tools. An Artificial Neural Network model and Dijkstra Algorithm are used for air quality prediction and least polluted path finding in the road network. [1]

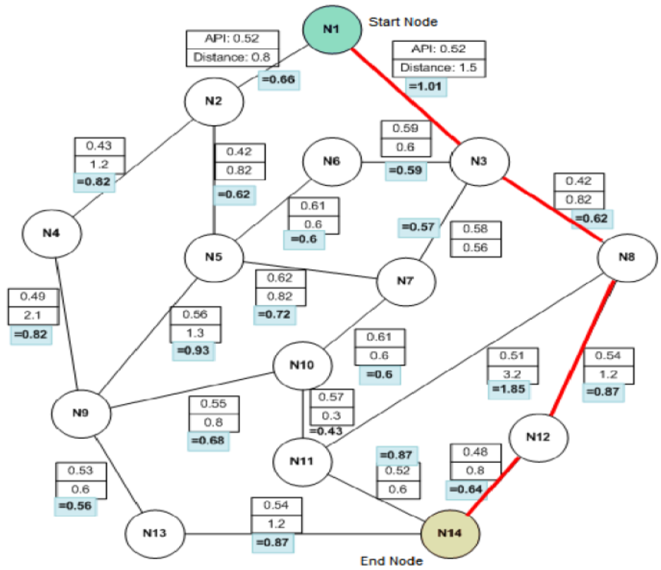

Fig – 1: Weighted road Graph

Komathy Karuppanan, Adhirai Manickam, Elakya Karthikeyan and Monica Narayanan presented an idea about increasing vehicular traffic which emits toxic gases thereby increasing air pollution level. They thought ambient air quality can be monitored dynamically using Vehicular Network called VANET, which sense the AQI and store it in GIS database server. This system was giving the safest route when inquired for the route between source and destination considering acceptable pollution level limits reroute. They used BRTS algorithm that supports bidirectional as well as unidirectional routes between source and destination. They also proposed some searching and optimization techniques. [2]

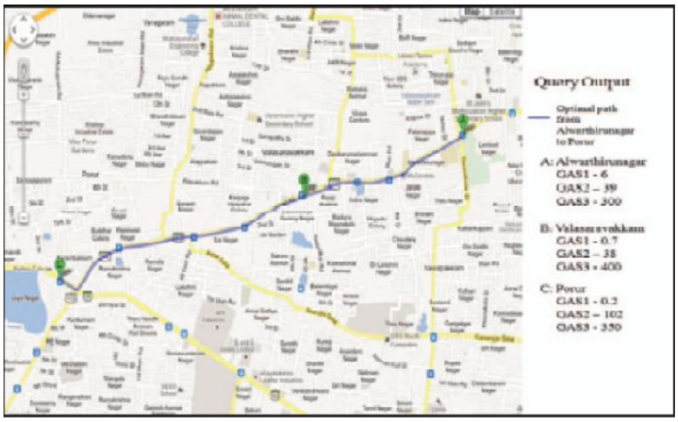

Fig – 2: Bidirectional Optimal path from Alwarthirunagar to Porur

Homayon Zahmatkesh, Mohsen Saber and Majid Malekpour presented an idea about city of Tehran. It is considered as one of most polluted cities in the world. So by considering air pollution as an important issue in urban management route planning based AQI in Tehran. They drew three different possible plans which gave appropriate path. First plan was only considered the distance and minimize length without considering any parameter. Next one was based on AQI. The final one gave path which was sensible to specific values. [3]

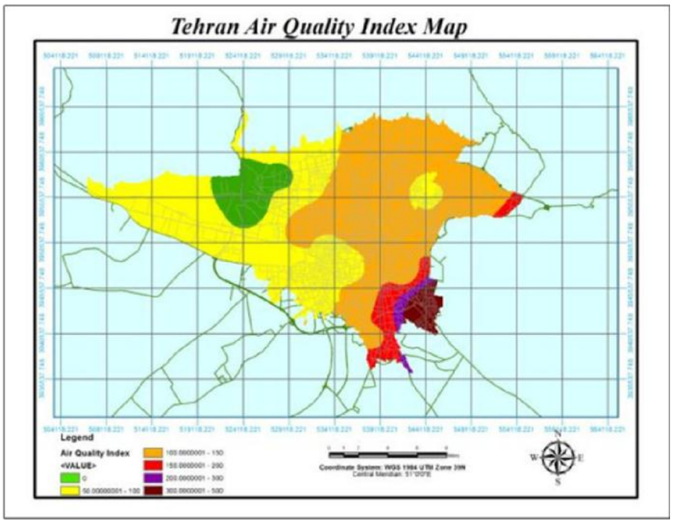

Fig – 3: The map of Air Quality Index of Tehran

3. SYSTEM OVERVIEW

This system consists of Android mobile app, Tomcat Server and XAMPP Server.

We need to start run XAMPP server and Tomcat Server. As we start Tomcat server we will be redirected to Air Quality Index monitoring Station. It is dummy website where we upload the data set into MySQL table. We have to upload data set of all 15 location of Delhi.

After this new user needs to fill registration form with all basic details. Then he has to login. After that he has to select source, destination and gas parameter. This selected information will send to XAMPP server where Dijkstra Algorithm is executed and shortest path is send to Android App. Google Map API show shortest path between source and destination using blue line and nodes using Green pin points. After this next page is showing distance between consecutive nodes in kilometer.

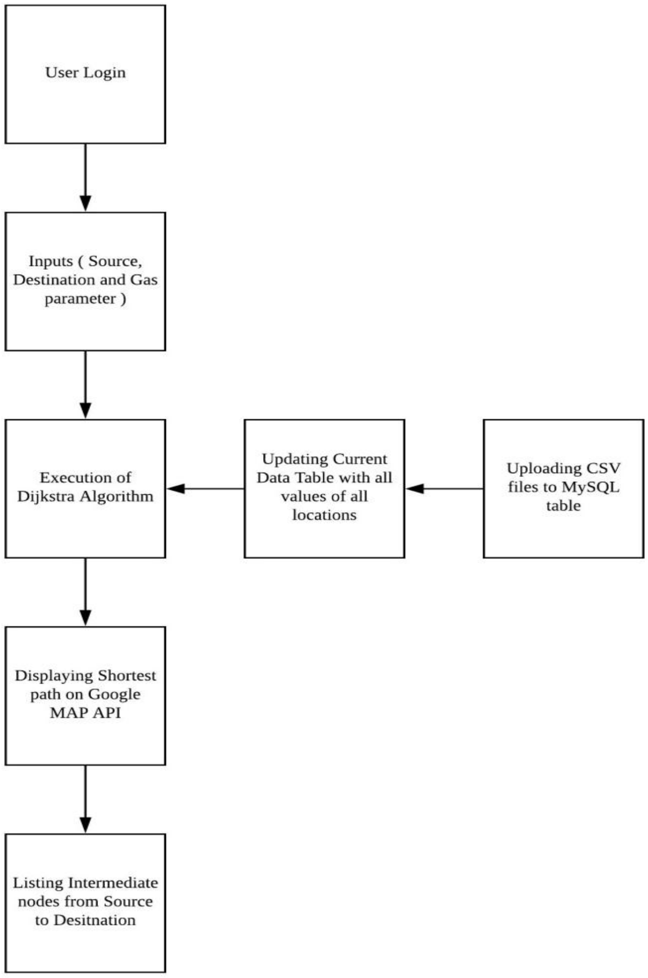

Fig – 4: Architecture Diagram

3.1 FUNCTIONAL REQUIREMENTS

1. **Selecting Input:** As user login he has to select source, destination and gas parameter as input from drop downlist. This accepted data is sent to XAMPP server for processing.

2. **Creating current data table:** We are having dataset of one month with interval of every 15 minutes. This is to be uploaded to MySQL table. When all the files are uploaded of all locations then we will find recent concentrations of gases of all location and feed it into current data table.

3. **Dijkstra Algorithm Implementation:** After accepting input from user this data is sent to XAMPP server where Dijkstra Algorithm is executed using values of current data table and given input. Then shortest path is sent to Android App.

4. **Output on Google MAP API:** As soon as shortest path is received. It is displayed using Google Map API. Nodes which are included in path are shown in green pin points and in blue line. In route details the journey is shown from source and destination.

3.2 NON FUNCTIONAL REQUIREMENTS

1. **Speed:** The result of the optimal path should be provided to the user within fraction of seconds.

2. **Accuracy:** The accuracy of this system is based on the analysis of source, destination and air quality given as an input to the system.

3. **Reliability:** The application will be installed on an Android smartphone. Scalability of application allows it to easily get adopted in other android systems. As user interface is a mobile app, it can be easily accessible by client through an android device and internet connection.

4. **Usability:** The application will be installed on an Android smart phone. Scalability of application allows it to easily get adopted in other android systems. As user interface is a mobile app, it can be easily accessible by client through an android device and internet

3.2 ALGORITHM FOR ROUTE DETAILS

function Dijkstra(Graph, source):

create vertex set Q

for each 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[]

3. RESULTS

The Figure 5 displays the Registration/Login page. As soon as user opens the App he has to enter mobile no. and password to login. If he is new user he has to fill basic registration form by clicking on Sign Up.

Fig – 5: Login page

The Figure 6 Select source, destination and gas parameter. This is second page appear after successful login. Here user has to enter source, destination and gas parameter which will used as starting point, ending point and gas selection for Dijkstra Algorithm.

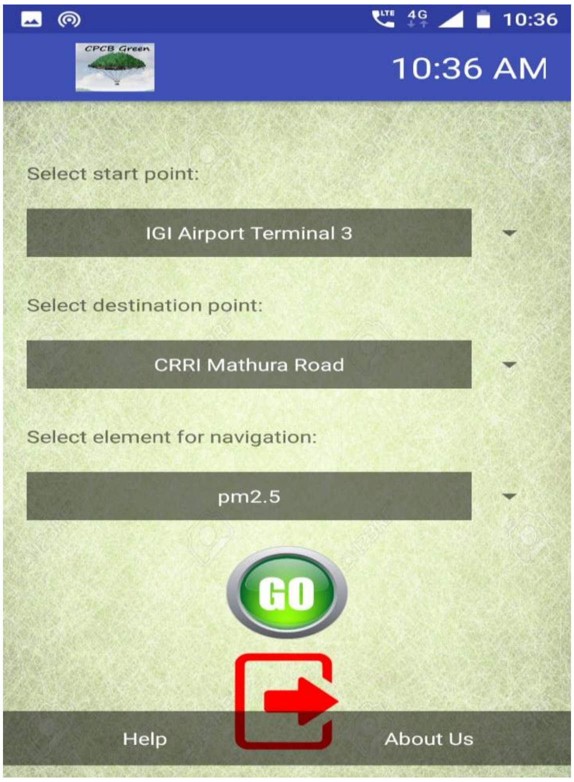

Fig – 6: Select source, destination and gas parameter

The Figure 7 shows optimal path on map. This page shows optimal path with blue line and green pin points as intermediate node. Google Map API is used for the same.

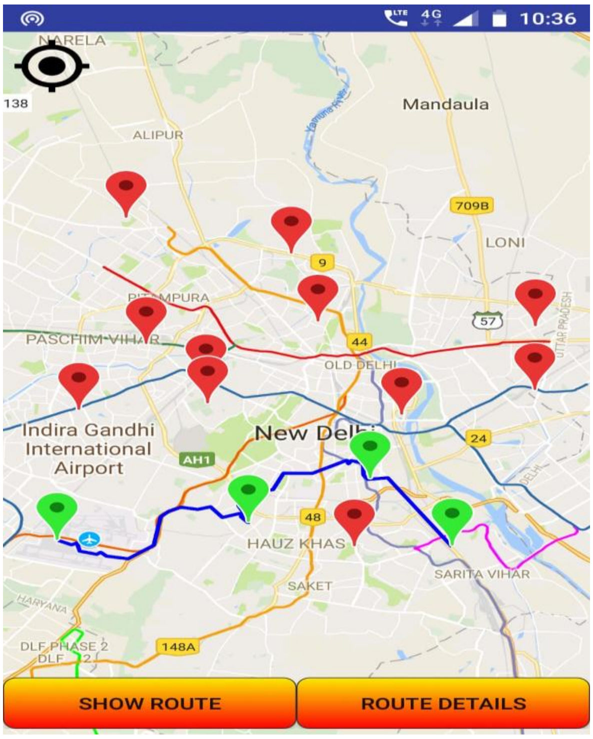

Fig – 7: Map with Optimal path

The Figure 8 displays route details. The detailed path between the source and the destination is displayed. The route is expressed in a sequential manner so that the user can follow it and reach the required destination.

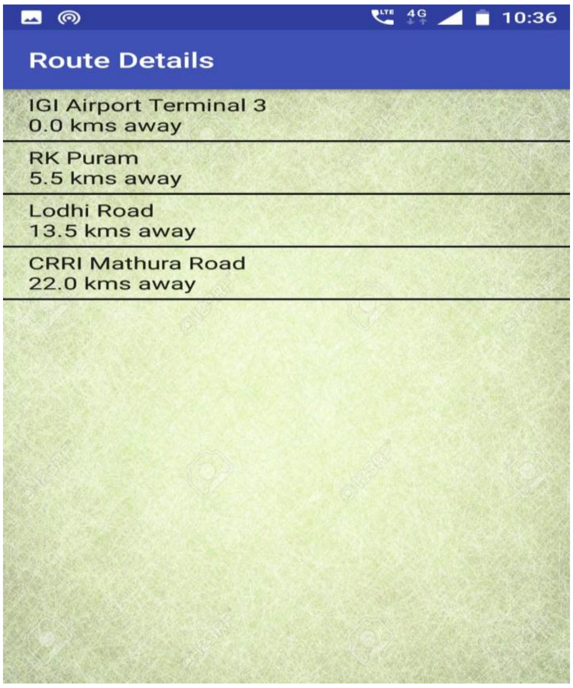

Fig – 8: Route details

6. CONCLUSION

In this way we have achieved to find out shortest path with minimum pollution using Dijkstra Algorithm. Here we are taking AQ from dummy website of which is being updated after every 15 minutes. We are taking inputs from user through mobile app computing shortest path on cloud using Dijkstra Algorithm and results are send back to user on mobile app and those results are displayed using Google maps.

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