

Optimal Route and Transport Finder for Dhaka City



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Abstract

In this thesis, we are going to present an application regarding public transport information and optimal route planning for Dhaka city public transport in this thesis paper. We have developed this application on Web Based System which needs permanent internet connection in order to get the services.

In our country transportation information is unavailable in online and searching their information and optimal route outside is not continually feasible, or necessitate too much attempt. We find solutions of this burning problem are the raw datasets using Google API that will trace the Dhaka city public transport information and optimal route systems.

We have created a database structure from using of MYSQL database management system which is easier to control, faster and smaller to process, used Google Map API for map interface and used algorithm to find shortest path.

This web application lists the name of transport (Bus). It also displays the shortest path route on map interface. It will be also displays the stops nearby and available name of the transports on the map interface. Any user can select multiple stops and view details about stops and transports.

Optimal route planning is the main purpose of our application. It arranges leastways one optimal route from a source point to a destination. Before a optimal route planning and information the user will need to set on parameters of starting and destination point.

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Chapter 1

Introduction

Nowadays, huge amount of people uses internet in their devices, it raises its demand of using of web applications running through their device. In times of need of information system people use web application which makes their life easy. To check public transport time-lines, name and optimal route between two points, showing routes on the map etc, lots of well-known applications can be found on web. If an example is considered like www.bing.com/maps which is used widely in Singapore that gives information through plans routes, with the current positions of user and transport name [1, 2]. Another example is Google Maps in India [3], which help peoples of that country to let them know about their current position and find the optimal routes for travelling by foot, on car and in many cases by public transportation available in there. Another well-known path planner for public transportation which is used in Hong Kong is the route planner of Citymapper [4].

Users from those countries can have the access these applications and get services using their web browsers. But in our country there are no online web applications that can provide this kind of information of transport.

In this paper, we have presented a public transport route planning application for urban public. The main aim of our web application is to give a better and well-known services which are listed above like optimal route and transportation name in our country using the Google API, raw data sets and algorithm. Since there is no deposited data on the transport of our country, so that giant web developers did not work on public transport of our country.

1.1 Problem Statement

One of the world's leading research topics is the communication system. We are constantly trying to make our communication system easy, cost-effective and how to save peoples precious time in our country.

In our country there are no such a well organized transport data available for user or developer. For this reason tourist, new comer from other city or country in Dhaka city for business purpose or seeking job or get admission in educational organization have to face a lot of problems to transit their destination and they face a lot of harassments. If we ignore this problem; businessman and student are will be discourage to come in Dhaka City and we may lost our tourist business which could result in lost revenue, lost business, and further damage to our quality reputation. One of the main reasons behind that our tourist businesses are not growing properly day by day. First we have collect raw data of transport information from field of Dhaka city. We will use our application to solve this problem behind the help of Google Map API and Dijkstra's algorithm.

1.2 Research Aims

Our main aim to research is make our communication system easy, cost-effective and user friendly. Any user of our application we hope that should not be faced any harassment for any kind of optimal route and transport information like bus service. We want this sector user friendly.

1. To critically assess the collection of transports data from real world, which contribute to performance and technical efficiency.
2. To classify and evaluate the transportation system schemes nationally.
3. To critically motivate to build the data system and application by local authorities, including routes/transport costs.

1.3 Thesis Organization

The chronological order of matter distributed in our report is as follows, Chapter 2 has the assessment of the background and literature review on optimal route and transport

technology and requirement analysis. In Chapter 3 a comprehensive study of optimal route and transport technology is conferred, along with its property, mechanism, API. In Chapter 4, demonstration of our application and user manual.. Finally, Chapter 6 contains the conclusion about our report and discussion about the limitations and future plan.

Chapter 2

Background and Literature Review

In this chapter we provide the necessary background and literature review of this work.

2.1 Related Work

In 2011 Huan Li of Portland State University work in Assessment of an Optimal Bus Stop Spacing Model Using High Resolution Archived Stop-Level Data [5], In 2017 February a group of BUET work in Assessment of an Optimal Bus Stop Spacing Model Using high resolution Archived Stop-Level Data, In 2017 September a thesis paper of Shortest Route Optimization for Emergency Service Case Study in Kumasi, Ghana these have inspired us a lot for writing this thesis Paper.

Many referenced public transportation and route planning systems are seen around. OneBusAway [6] is the first example which works on smart mobile devices in some limited country. The users can use this application which helps them providing them with static route maps and timetables and this application has an extra benefit of having a real environment tracer and number of route trip planner functions. Its have a multi-tier architecture the route planning happens on the online server which also provides transport information about some of the region in USA.

Another very good trip planner is Google Map. Here all information of public transports is provided. The problem of Google Map is that it possess the information of

some developed cities like Budapest but not have any information about the developing cities like Dhaka, Bangladesh.

The Citymapper application is a transit application for Bangkok which includes transport stops information, arrivals schedules, a map, customer care of advisories and a trip guide. One can get a trip with it if he or she stays in the Bangkok Area.

Bing is a online transit application. It provides trip planner, transport scheduled and optimal route only for some selected cities. But the problem is this application didnt take any step for Dhaka city.

2.2 Requirement Analysis

This section provides the benchmark analysis for our work compared to the existing works.

2.2.1 Benchmarks

We have studied various existing web systems and applications blandish our requirement goals to gain detailed information about required features before we proceed to our own web application work. From those benchmark applications we got some idea and knowledge how to handle the optimal route and transport information. But those applications are not open source project for this reason we didnt get full access to get resource. Out of the existing web systems, based on their popularity we have followed systems we've chosen as our benchmark:

1. Google Map (www.google.com/maps/)
2. Bing Map (www.bing.com/maps/)
3. OneBusAway (www.onebusaway.org)
4. City Mapper (www.citymapper.com)

2.2.1.1 Google Map

One of the giant mapping service is Google Maps which developed by Google. It provides satellite aerial , imagery photography, 360 panoramic views of streets, street maps, real-environment traffic conditions, and path planning for traveling on foot, bicycle ,car

2.2 Requirement Analysis

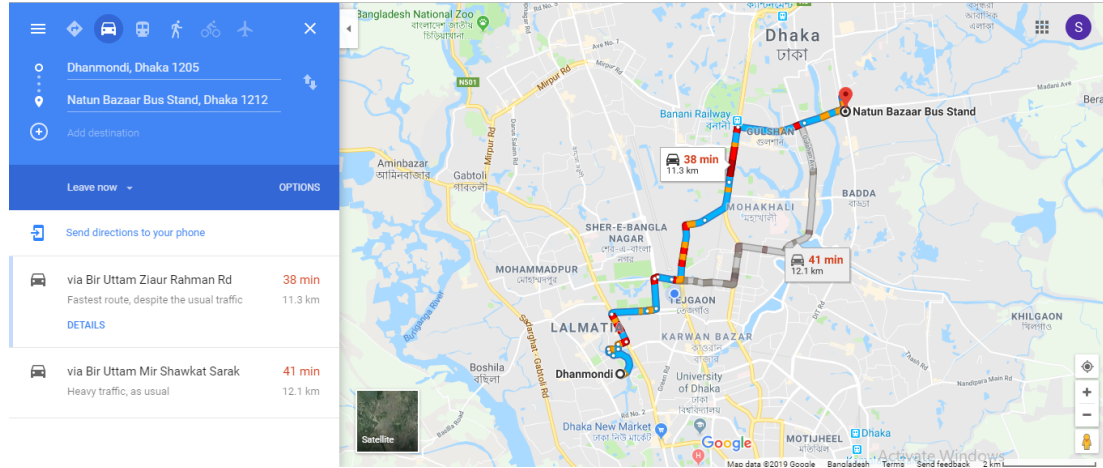


Figure 2.1: Screenshot of Google Map.

and air, or public transport. After those excessive acquisitions of a real environment traffic analyst and a geospatial data thought company, Google Maps application was founded in February 2005. It provides all the features only some selected country. In Dhaka city all the features are not available right now. But they are working on Dhaka city for gathering resources. Figure 2.2 shows a screen shot of Google Map.

2.2.2 Bing Map

Bing Maps is a popular web mapping system provider as a sister concern of Microsoft's Bing suite parts of search engines and powered by the Bing Maps association for Enterprise framework. Bing Maps was mainly founded as MSN Virtual Earth, which was launched for beta testing online in July 24, 2005. This application provides Street maps, driving, walking, and transit directions and Traffic information and ClearFlow in some selected country. Figure ?? shows a screen shot of Bing Map.

2.2.2.1 OneBusAway

OneBusAway is an open-source software system for real-time transit information that grew out of research at the University of Washington in August 1, 2012. MTA in New York is using OneBusAway software as the foundation of their Bus Time system in August 1, 2012. They provide optimal path and transit schedule. Figure 2.3 shows a screen shot of OneBusAway.

2.2 Requirement Analysis

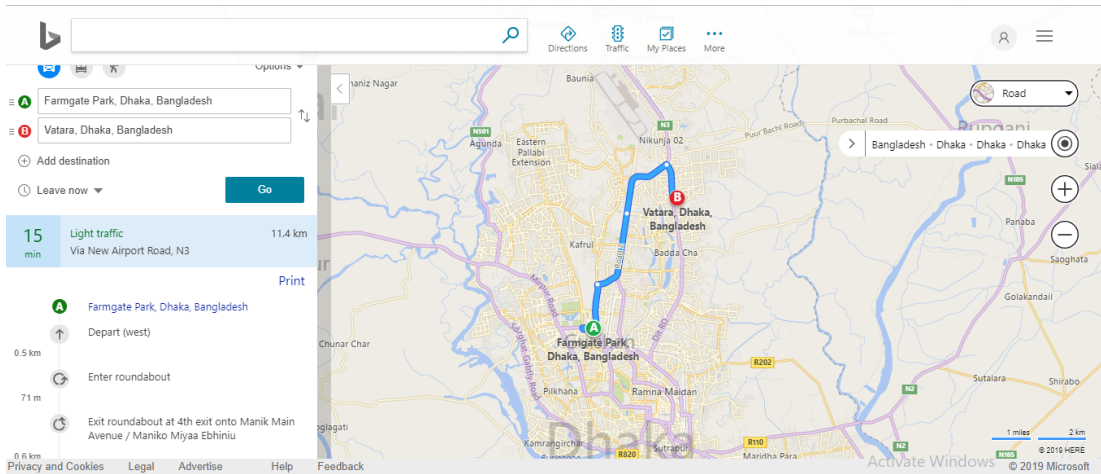


Figure 2.2: Screenshot of Bing Map.

OneBusAway

Where Is Your Bus?

[Clear this search](#)
[44 - Ballard - Montlake](#)
Operated by [Metro Transit](#)

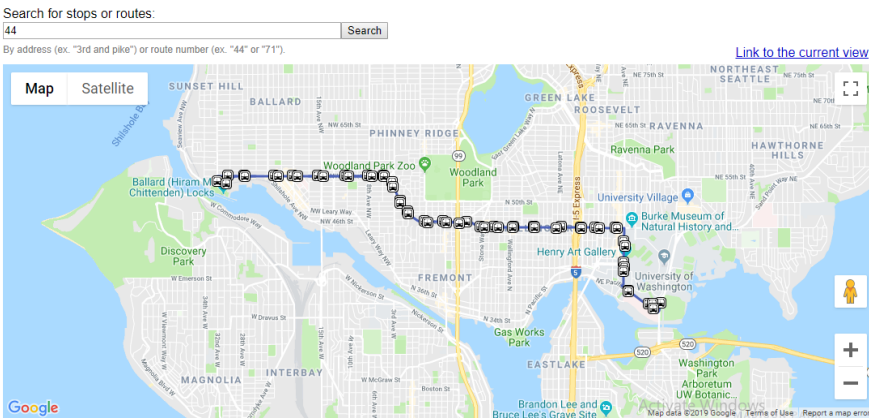


Figure 2.3: Screenshot of OneBusAway.

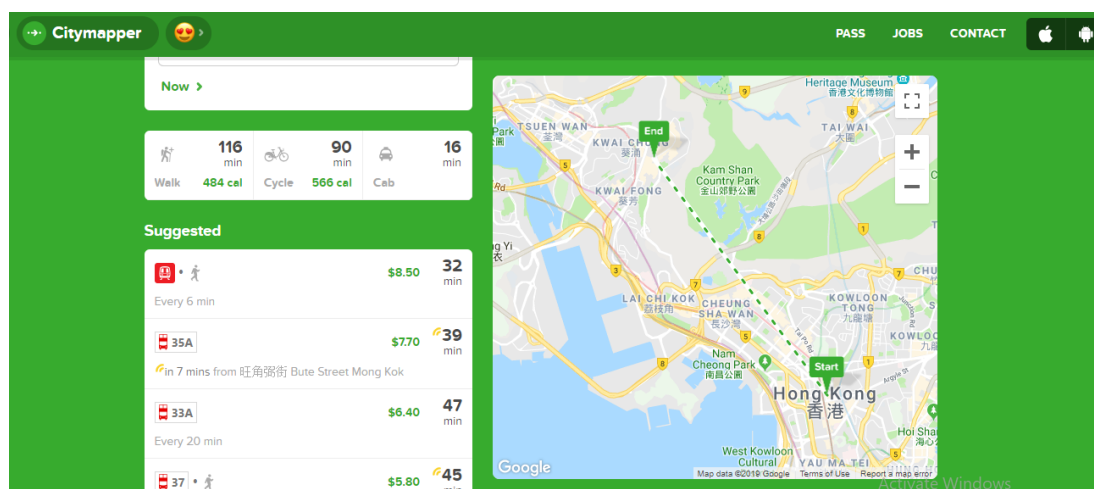


Figure 2.4: Screenshot of CityMapper.

2.2.2.2 CityMapper

In public transport system application Citymapper is one of best application on based in popularity and features and mapping interface service. This application integrates datasets for all townish modes of transport, from walking, cycling to driving to the route, with a feature on public transport in August 7, 2018. It conducts by free version of mobile application and a desktop website; it is in the stack of competition with Google Maps. Citymapper first started their services in London, which all called that "the worlds most historic and iconic public transport city". After some time It started their journey in New York city, and now they are trying to cover all over the world among cities except Africa. But in this time they dont any work in Dhaka city. Figure 2.3 shows a screen shot of CityMapper.

2.2.3 Functional Requirements

Following are the functional requirements of our system:

1. Any user can find optimal route and transports information
2. Any user can see optimal route visually in map
3. ny user can search more than one routes from our application
4. Any user can built communication with our admin any time

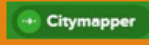
Topic					Our Proposed Application
Optimal Route	✓	✓	✗	✗	✓
Transport name	✗	✗	✗	✗	✓
Alternative Transport	✓	✗	✗	✗	✗

Figure 2.5: Benchmarks systems VS our propose system for Dhaka City.

2.2.4 Nonfunctional Requirements

Following are the non-functional requirements of the proposed system.

1. **Security measures:** We hope that we are solving inherent complexity of our source code, which increases the likelihood of unattended vulnerabilities and malicious code manipulation.
2. **Performance:** We have given a lot of importance in time complexity for our application to get better performance and use limited resource from the user.
3. **Flexibility:** We also analysis in flexibility for our application that help the user device to get services from our application.
4. **Accessibility:** Any one can access our service from anywhere and they can search more than one route for their daily purpose.
5. **User friendly:** We develop our application software interface that should be easy to use. For user friendly we have used Google map interface because this interface is popular in Dhaka city.

2.2.5 Benchmark Comparison for Dhaka City

In Figure 2.5, we have tried to show the comparison of the key features of our benchmark systems and our proposed systems in Dhaka City.

Chapter 3

Proposed Method

In this chapter, we describe our proposed method.

3.1 The Scheme

Our web application provides the optimal route and transports information like transport name, stops. It can show the optimal route in our map interface. It display the bus stops nearby to the user with the optimal route go with. A user of our application can select any stops and can check out the details, route go through the stops. Based on B TREE structure we have built our data structure for our application.

The principal purpose of our system is the optimal path arranger. Our proposed system arranges at the least one optimal route from the starting-point to the expected destination. User need to set parameters of source and destination before the route planning. Then our application provides the optimal route and map interface to the user like as the result. In the next sections we are going to describe the logical data structure broadly with figure which was used by our application. After that we present the conversation among the shortest path algorithm and our build data structure. At last in this paper we have given a short note of designation about the optimal route planning, algorithm and API.

3.2 Logical Data Structure

Figure 3.1 shows the structure shows the principal sections of our logical data. It is built in the base of using our plain collected data, which is signify our using of C primitive

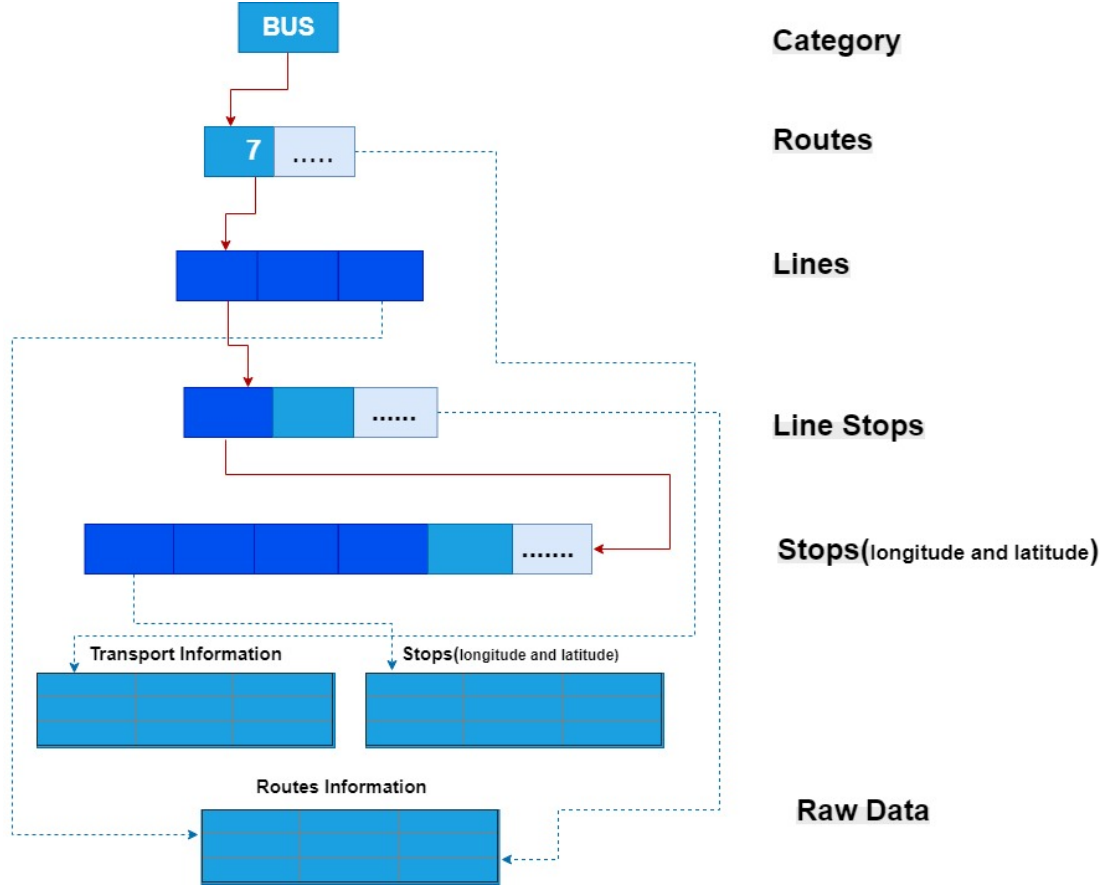


Figure 3.1: Logical Data Structure.

types, arrays and structures. Optimal routes are planned into one category like bus, that work for aspires of grouping analogous routes simultaneously. An example likes bus number 8 route in Dhaka city. A route always has at least one way, but usually it has at least two. For example like bus number 7 has 4 ways: 1. from Gabtoli Stop to Sciencelab Stop, 2. return on this way, 3. from SadarGhat Stop to Shabag Stop, and 4. back on this way.

All paths are shown to using Google Map API.

For each route we have stored the stops that way or line goes through and for every stop we store the bus informations.

3.2.1 Corporal Representation

Since the logical structure of our application is built using plain collected data (POD) category, it is frank to present the data in the system memory using these facile develops. While identical entities (for example routes, stops, etc.) have some identifiers, so they are obtained by pointers. For the reason of a lot of delicacy in data (like, the name of a stop could be arrive multiple times), almost all numeric data and strings are stored in classified table full of raw transport data and they are continuously stored each once. Transport related all of our data to our application is stored in a continual field in the system memory of database, and all the pointers provide locations of the fields inside this memory. Because of this reason, we can load and save our whole database by inscription this field.

3.3 Implementation of Optimal Route planning

Our optimal route planner works on online database system, so that it was significant step to take the less time and utilize resources to utilize user devices for consideration of choosing during to develop of the algorithm. We are going to describe the different cycle of development in our application step by step.

3.3.1 Preprocessing Cycle

We have used Dijkstras algorithm to find the optimal route. In preprocessing phase the algorithm starts. During this period, it enumerates the distance for every stop form each stops and save the data in database. We have indexed the stops by their longitudes and latitude coordinates to get information of finding for nearby stops from user position or source.

3.3.2 Planning Cycle

The main target of this planning phase is to provide the shortest path to the destination and transportation information. This is gained by the Dijkstras algorithm functions. The heuristic function in algorithm provides the shortest possible optimal path to user destination; such a direct link would always want to be present (optimistic estimation).

3.3 Implementation of Optimal Route planning

There does exist a one-to-one relation between user recent position and destination stops.

The user needs to specify any two points as a source and destination to find a path. First, the algorithm finds the nearest N number of stops to the starting position, and calculates the amount of path and stops that user needed to the destination are found, and they will be the target positions. In this phase the Dijkstra's algorithm uses only one operator to retire an amount of new positions. Using those given distance to the current stop those operator searches for other stops. After that step, for each way that goes through that stop it searches the nearby vehicle list we can reach destination. The operator provide a number of new positions using all the next stops of that vehicle, which will be included using this process, until the target is found or there are no more unvisited stops. We have utilize a most important optimization: a new position is only be created if it has a option to get better or cost efficiency results than any of the existing positions for the reason of reduce the number of states. To acquire this, the algorithm uses in the application a second heuristic function. The algorithm always keeps track of the recent minimum or less value of this function continuously for the whole process. In the next process, if we select a stop for the reason of first heuristic value is bigger than the recent minimum of our application is the second heuristic values that process stop are simply skipped.

If the algorithm in its procedure does not end in a goal state (because of public transport cannot reach the destination), which state will stop is the closest to the destination will be selected.

3.3.3 Fine tuning cycle

In this step the Dijkstra's algorithm always tries to simplify the optimal route by getting the subsequent synthesis like optimizing the position of transfers to reduce the amount distance of traveling; providing bus stops informations, and contrarily; substituting collateral route with each to increase the amount of chances. This application also gathers to display the transports name on that route constantly.

In this step briefly presented to the user of our application that user can get the best route for their daily purposes.

3.4 Google Map API

In this platform we have used Google Map API. Because we need a platform to show the shortest path giving coordinate and we believed that for developer Google Map API is the best selection. HTTP interface are available in the Google Map platform web services to Google services providing geographic data for our map application. We have used the distance matrix API that provide coordinate distance for a womb of origins and destinations, based on the consulted route between start and end point. This API gives us a free developer option to gain knowledge and practice this API on our application. It was very helpful for us. Also the Google map interface is also user friendly because of this giant company continuously doing research on user friendly and collect resources.

3.5 Dijkstras Algorithm

Dijkstra's algorithm find the shortest path, it picks the unvisited vertex with the minimum distance from the database of map, calculates the distance through its procedure to each unvisited neighbor, and updates all the neighbor's distance if smaller. Mark visited neighbors when done with neighbors. Continuously doing this procedure this application provides the shortest path and user get their desired shortest path and a frame of path in map. Advantages of Dijkstras Algorithm for our application are given below:

- It does a blind search on our bus stops network. The node are directional or non directional that not matter for this algorithm.
- We can use in Google Map API platform.
- It calculates distance between the location refers to edges of bus stops.

Chapter 4

Web Demonstration

4.1 User Manual and working process of our Application

First User has to browse our application site. Then user sees a home page which contains two users input from. One is source and other is Destination. Beside this box user can show the Google map interface of Dhaka.

Second step is to put users source and destination in the blank from and press the button of Go Result. User responsibility is over here.

Getting the source and destination data our application run the algorithm in our data base and find the optimal route and transport(Bus) name list and show the optimal route in the map and under the Go Result Button show the transport(Bus) list accordingly.

User can zoom in the map to see the stations, directions and roads that contain in the optimal route. If user needs to find some other routes he/she have to refresh the page and have to give the information again.

In the next section given some screenshot of user every steps like homepage, data insertion, search result and the result of optimal route in map and transport list using our application.

4.2 General View

4.2 General View

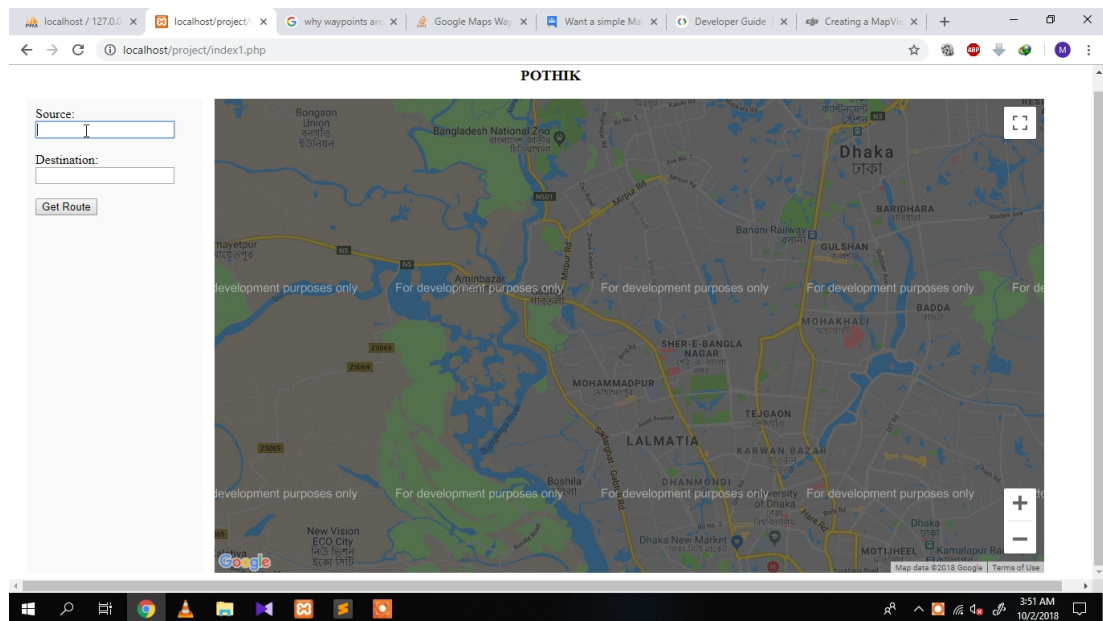


Figure 4.1: Screenshot of the application, Home Screen

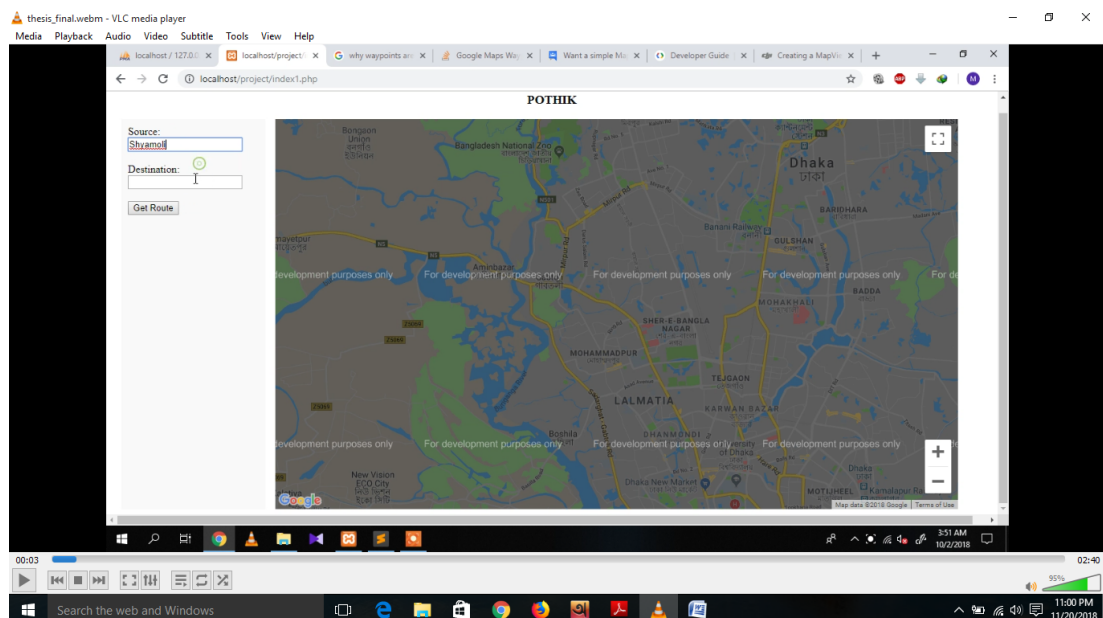


Figure 4.2: Screenshot of the application, Source

4.2 General View

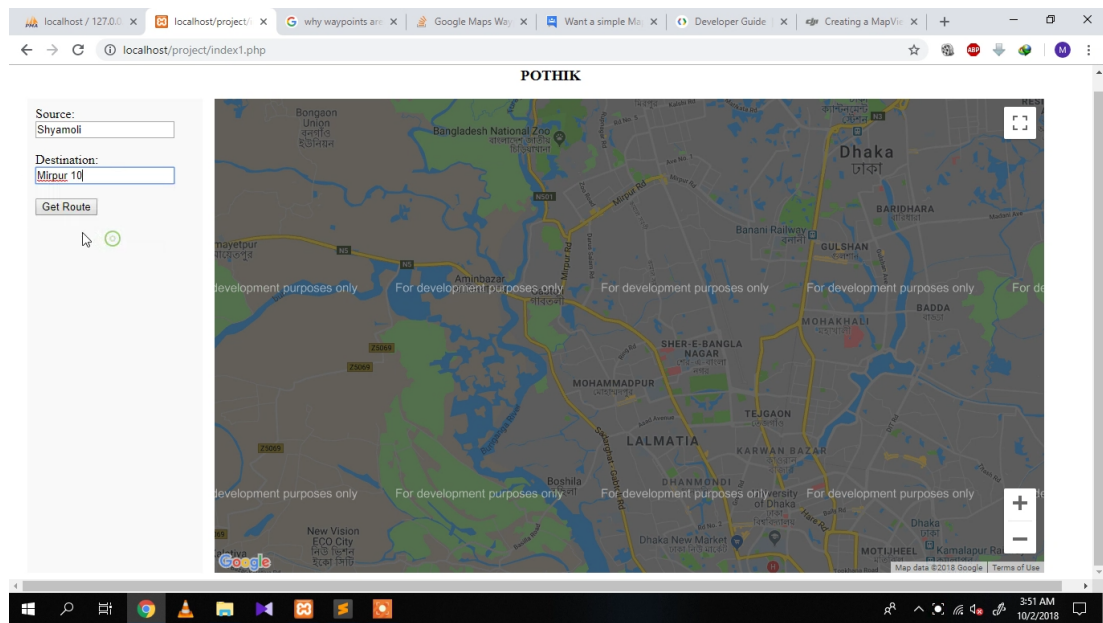


Figure 4.3: Screenshot of the application, Destination

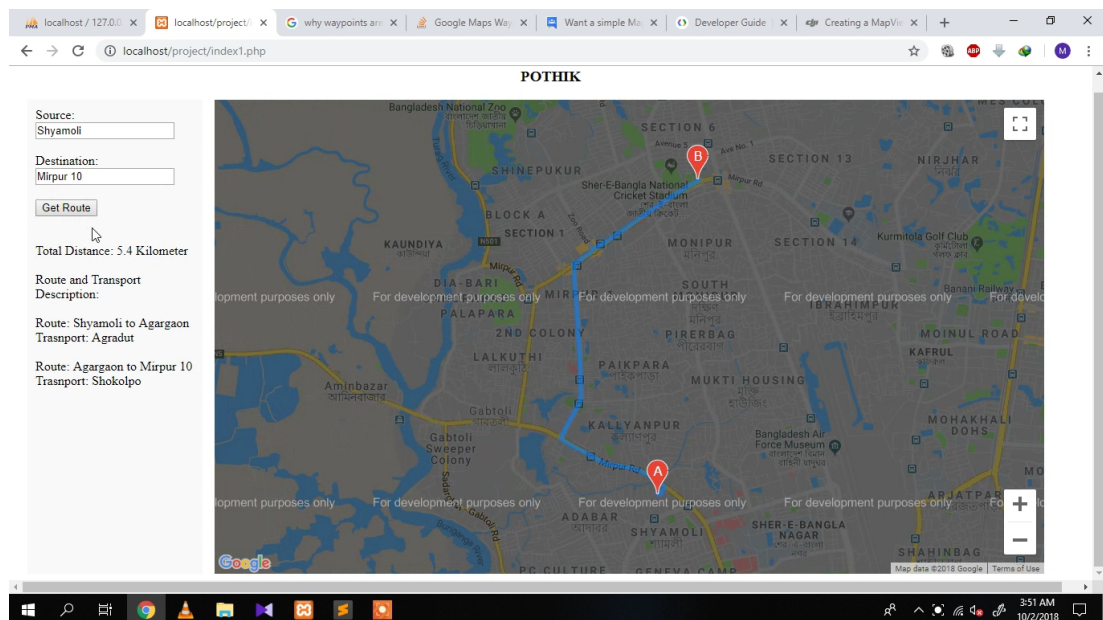


Figure 4.4: Screenshot of the application, Search

Chapter 5

Summary, Conclusions, and Future Work

5.1 Summary

In this thesis, we dealt with the problem of finding most suitable route from possible choices to minimize the distance. We proposed a two-step solution where the first step finds an appropriate optimal route for each user and the second step selects the bus transport information of destination route from the routes selected by all the users . We developed to increase the efficiency of optimal route using the Dijkstra's algorithm in our approach.

Yes in this application there were some lacking and limitations. But we always think about a user friendly and simple solution system and I hope the system is just like that.

5.2 Problems Experienced

Weve experienced several problems in way of our development process of our web application. We have to work hard and it took a long time to complete. Some of the main problems are given below gradually:

1. **Deficiency of Appropriate Data:** Firstly, we unable to find any suitable Data for our web application. Because in our country there are no appropriate database collected before on transport system. It was a big challenge to us to collect the

raw data from practical field. Then we had to spend a lot of time and effort to collect the raw data from live environment for our application.

2. **Implementation of Backend Code using PHP:** Weve faced some difficulties when we started giving structure of our application in the backend using PHP. It was a new platform to apply for our application. First we had to learn how to use PHP in backend of our application, after that we were able to implement PHP in our application. It took more time for us that we expect.
3. **Implement Google Map API for Map Interface:** We havent work using Google Map API before. It was a second most tough challenge to us to provide a map interface using this API. We have to analysis why should to use this API and have to learn how to add this API. We have to buy a key to develop our application because in free development mode the Google API didnt work properly all time.
4. **Built Website Online to User:** Weve tried to trace free web domain hosting website for our web based application. But we were failed to get free domain hosting site which would provides us Google API feedback. So we had forced to buy a domain & a hosting service for our application.

5.2.1 Abridgement Discussion

Some abridgements that have faced by us during implementation of our web application. Most common problem that we have faced is absent of well categorized resources and data of transport system for Dhaka city. Internationally there are no well designed researches happened on Dhaka city transportation system. For this reason there are no suitable databases for us to use get help or use for our application.

So that there are no Optimal Route of transport giving application in our country related open source data and the giant company like Google, Bing,Yahoo are now starting to invest on development on transportation system database for Dhaka city. If we could be able to get those resources, investment and data, then we could built our proposed system wealthier in features and extend its functionalities. In the guise of this is a new concept in Bangladesh, so we havent been able compare with our proposed with the Optimal Route giving application related website in Bangladesh.

5.3 Limitations

We have faced some limitation also during implementation of our system. The most common problem we have faced is lacking of resources and data. International system don't share data. There is no Optimal Route of transport giving application in our country related open source data also. If we could be able to get those resources and data, then we could make our proposed system more features full and expand its functionalities. As this is a new idea in Bangladesh, so we havent been able to find any Bangladeshi Optimal Route giving application related website to compare with our proposed system.

5.4 Future Work

For the reason of limited amount of time and resources we cannot success to implement some resourceful features, we hope that will implement those missing features in near future. Our oncoming works are given bellow:

- Optimal cost of transportation system
- Schedule to move and arriving of the transport
- Provide location of transport in our map.

If we get some investment or sponsor or government help it will helps and motivated us to resolve our abridgements and we will implement our future planning about our system in near future. We hope that this application will help all people to giving information at Dhaka city in Bangladesh.

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