

## An Intra-city Route Management System - Sanchari Mitra

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**Abstract**—Bus transportation system is one of India's most effective network which keeps the social, economical, political and cultural labyrinth of the country together. Individual states have their state run buses that help people commute. These buses connect major cities and towns. After the trains, buses are the next choice for travelers. Buses carry more than 90 percent of public transport in Indian cities. In spite of having numerous applications pertaining to the bus transportation, the information available is not being used to its full potential. Also, the real time information is not provided to the user. This project is aiming to implement an application on Web and platforms of Google Android, Apple iOS and Microsoft Windows that can provide relevant bus information to the users. The users will be provided with all the possible direct or indirect routes between the source and the destination. In completing the project, different technologies like GPS, location detection and route finding will be examined.

**Keywords**-City-bus, Global Positioning System, Public Transportation, Routing Algorithms

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### I. INTRODUCTION

With the fast changing world, people are more likely to spend lesser time to complete more jobs. Therefore, people in a city prefer not wasting their time waiting for the buses. Moreover, many people may come across the time when they miss a bus and spend a long time queuing at the bus stop. Sometimes the first choice route is missed by the people and they keep on waiting for the first choice, then the second choice arrives at the bus stop far away across few streets, they would miss the second choice.

If there is a mobile device that can provide the updated bus route information with bus arrival time based on the current location and suggest bus route alternatives to the same destination, it will definitely help us to manage our time efficiently and we can plan out our time in a better way. People can decide whether they have to keep waiting for the first choice or go across few streets to wait for the second choice instead. In addition, people can determine whether they have to run or walk to the bus stops when they are near to the potential bus stop.

The purpose of this project, Sanchari Mitra, is to implement an application on cross platform that can provide relevant bus routes information with bus arrival time to the users. User's current position is collected and together with the up-to-date bus schedule, the bus arrival time is calculated on the server and an alternate bus route is given as a second suggestion.

For improving the city public transportation, it's a certain selection to construct Sanchari Mitra, which can make the public transportation more secure and highly efficient. It also

increases the city public transportation level, improves economic benefit and social benefit.

In this paper, we begin by introducing the preliminaries of this study. The literature survey proposed in section II describes about the related existing systems. The design procedures and methodology of the system is described in section III. We discuss about the advantages and concluding remarks in section IV and V respectively, which is followed by the future enhancement in section VI.

### II. REVIEW

#### A. *m-Indicator*[1]

*m-Indicator* is a digital information post for public transportation (mostly). The main screen shows a series of icons that lead to time table screens wherein you can check specific trains or routes. They concern the local railway, metro, mono-rail and express train along with the bus system. Rickshaw, taxi and ferry rates are also available. There are other icons also.

In the Local screen you can check the rail map, station codes and more importantly departure times relative to any platform. This is very helpful if you are looking to link two or more trains in your voyage plan. You can also create shortcuts for up to six train routes, for future reference.

The Mono and Metro screens are a bit simpler but use the same interface and also gives access to the transportation map.

The Taxi and Auto screens display fee approximations for different distances and contain the phone numbers for the local cab companies. The Ferry screen shows all the available ferries

with opening and closing hours along with fares and time approximations.

The Bus screen shows which bus numbers are linked to which stations and vice-versa. It allows you to consult an online source for time tables and can also suggest routes for an A to B travel scenario. Remember that you must switch between the providers to see all of the information.

Finally, Express deals with the express trains. It lists outgoing and incoming trains along with checking for ticket confirmation, news and updating the database to keep up to speed.



Figure 1: m-Indicator User Interface

Advantages:

- Supports multiple platforms (Symbian, android, Windows)
- User friendly application
- Contains information about all forms of transport including Ferry and taxi

Disadvantages:

- Requires network access
- Does not support indirect locations

#### B. Bangalore Transportation System [2]

Bus route search made simpler. Currently bmtcroutes.in provides the bus routes for BMTC Volvo, Vajra and Big 10 buses.

Some of its features include –

- Intuitive UI - auto complete feature in the search box.
- Easy to use interface - no need to set any options.
- Shows indirect routes - Uses advanced algorithms to present shortest possible indirect routes even if no direct route (bus) exists from Place A to Place B.

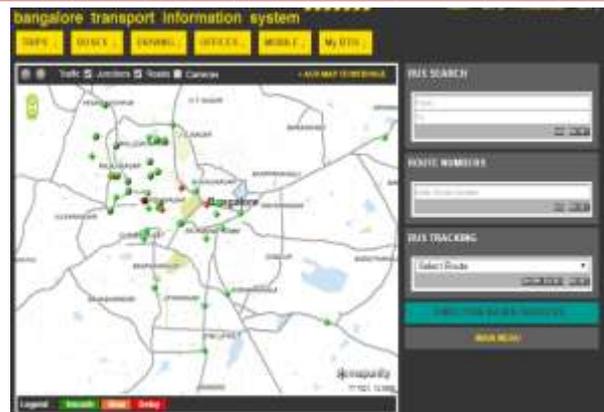


Figure 2: Bangalore Transport Information System User Interface

Advantages –

- User friendly application
- Supports indirect routes
- Simple handy interface

Disadvantages –

- Requires network access
- Localized to Bangalore public transport (busses).

#### C. Google Maps [3]

Google Maps provides city wise public transit information only in selected cities like Ahmadabad, Bangalore, Chennai, Hyderabad, Kolkata, Mumbai, New Delhi, Pune and Thane.

Provides Bus/taxi/walk/subway information (if exists) under several options such as "best route", "lesser walking" and "fewer transfers".

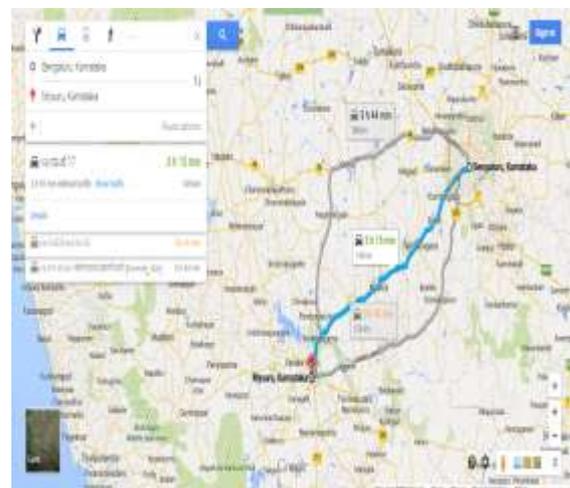


Figure 3: Google Maps User Interface

Advantages:

- High performance as it is built and maintained by Google Inc
- Cross platform as it works on the web and on mobiles.
- Uses GPS to track your location automatically

Disadvantages –

- Requires network access
- Outdated information
- Not present in current city (Mysore)

#### D. Mysore Intelligent TRAnsport (MITRA) System [4]

The Intelligent Transport System implemented at Mysore addresses the critical issue of road congestion by offering state-of-art technologies and attractive, convenient, comfortable,

value added services to encourage the usage of bus services against individual personal vehicles.

Building intelligence into the transport system brings in the convergence of technologies providing a synergetic transformation in the commuter experience. ITS provides benefits in terms of reduce waiting time and uncertainty, Increase the accessibility of the system, Increase the safety of users, reduce the fuel consumption and emissions, reduce the operational costs, Improve traffic efficiency, reduce traffic congestion, Improve environmental quality, energy efficiency and improve economic productivity.



Figure 4: MITRA User Interface

**Advantages:**

- Using SMS to query real-time bus information
- Can track bus location using GPS present on busses

**Disadvantages:**

- Not user friendly
- Requires network access
- Does not support indirect routes
- Not cross platform i.e. has only web interface

**III. DESIGN PROCEDURES AND METHODOLOGY**

**A. Architecture and General Approach**

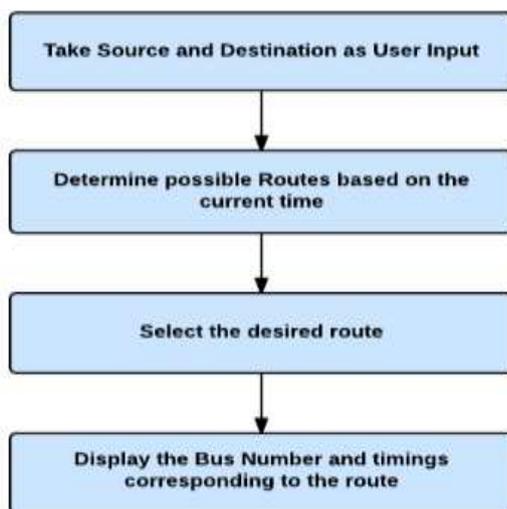


Figure 5 : General approach for finding the bus number.

Sanchari Mitra is a software application to assist easy public transportation by providing the accurate and reliable information as required by the user for the journey, thereby, utilizing the public transportation system to its full potential.

The application will present the user with an interface where he/she should enter the source and destination. The source address can be entered manually by the user or it can be automatically retrieved using GPS. Route is estimated using various routing algorithms. The routes along with the available bus numbers are presented to the user. The user can choose his desired route from the list of routes presented.

The application is mainly beneficial for people who transit from one place to another in bus on a daily basis. If we have a mobile device that can provide updated bus route information with bus arrival time based on the current location and suggest bus route alternatives to the same destination, it will definitely help us to manage our time efficiently and we can plan out our time in a better way. People need not wait at the bus stop unnecessarily. It will save a lot of time. Moreover, since this application uses data from the official KSRTC website, so the raw data provided can be entrusted completely.

After the user enters the appropriate source and destination, the system checks whether the destination can be reached directly. If a direct route is available, DirectRoute Algorithm follows; else the route is calculated using IndirectRoute algorithm and the user is presented with multiple bus numbers to reach the destination.

**B. Data Flow Diagram**

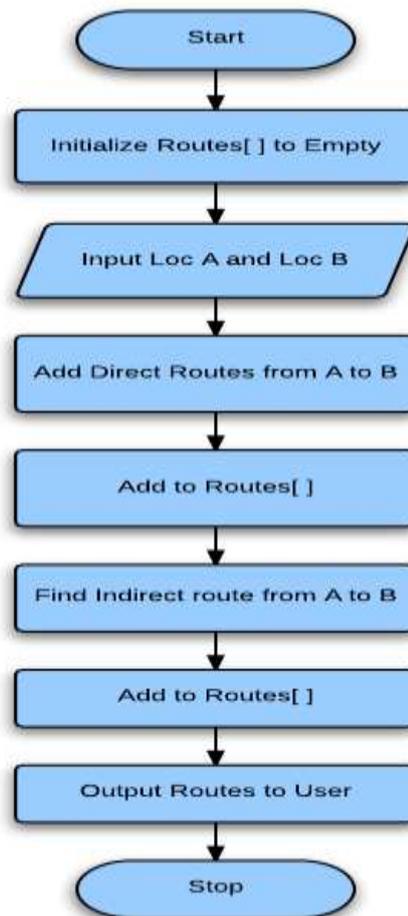


Figure 6: Flowchart illustrating the operations of the application

C. *Direct Route Finder Algorithm (Input: Source, Destination)*

- Initialize DirectRoute [ ] to empty.
- Compute set of bus stops of Loc A (LocAStops) and Loc B (LocBStops).
- Perform intersection operation on LocAStops{ } and LocBStops{ } to a new set PossibleBuses{ }
- For each bus in PossibleBuses { }, find route of bus from RouteOfBusList [PossibleBus] and add it to DirectRoute [ ].
- Return DirectRoute [ ].

D. *Indirect Route Finder Algorithm (Input: Source, Destination)*

- Initialize IntermediateLoc[ ], BusStopsSet[ ]
- IndirectRoute [ ] to empty.
- Compute set of LocAStops and LocBStops from BusStops [ ].
- Compute Cartesian product of LocAStops and LocBStops as ReqBusPairs [ ] = (LocAStops X LocBStops).
- Compute BusStopsSet[ ] as For all bus stops in BusStops[ ],
- BusStopsSet[i] = BusStops[i] X BusStops[i], where 'X' is Cartesian product.
- While BusStopsSet[ ] not empty For all ReqBusPairs in ReqBusPairs[ ]
- If BusStopsSet[i] ==ReqBusPairs, then add BusStops[i] to IntermediateLoc [ ].
- Remove BusStopsSet[i] from BusStopsSet [ ].
- While IntermediateLoc[ ] not empty, For each IntermediateLoc in IntermediateLoc[ ], compute DirectRoute between LocA and IntermediateLoc and add to IndirectRoute [ ].
- Compute DirectRoute between IntermediateLoc and LocB and add to IndirectRoute [ ].
- Return IndirectRoute [ ].

E. *Route Ranking Algorithm (Input: Routes)*

This is a Heuristic Algorithm which will rank the found routes.

$$\text{BusRouteLength [busNumber]} = \text{RouteOfBusList [BusNumber].length}$$

$$\text{ConnectivityIndex [location]} = \text{location [location].length}$$

SynthesizedConnectivityIndex = (formula) rank value returned by algorithm

- Init SortedRoutes to empty.
- Compute busRouteLength [ ] for all buses in Routes [ ]
- Compute ConnectivityIndex (CI) for all locations (source, destination and Intermediate – in case of indirect route) in Route [ ].
- Compute SynthesizedConnectivityIndex (SCI) for each route in Routes [ ] using the formula

$$\text{SCI[route]} = \frac{[\sum_{\text{Source, destination \& intermediate}} \text{CI}] *}{\sum_{\text{bus in Route}} \text{busRouteLength[bus]}}$$

- Assign SCI to the respective route in Routes [ ] and add to SortedRoutes [ ].
- Sort the SortedRoutes [ ] array using insertion sort.
- End.

F. *System Architecture*

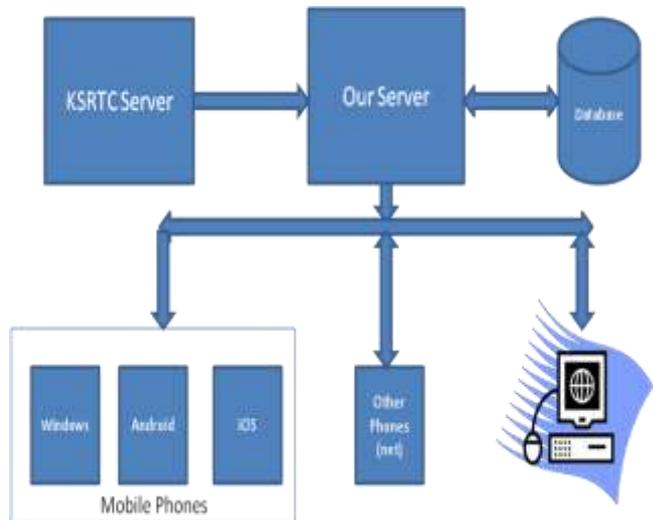


Figure 7: Architecture of the system.

- Central Server: The server which contains our raw data in form of PDF files which is handled by KSRTC (Karnataka State Road Transport Corporation).
- Our Server: The server is used to store the algorithm which works on the formatted data stored in the Database to retrieve the required information.
- Database: It is used to store the formatted data which is obtained from the Mitra website.
- Mobile Phones:-
  - Windows: Windows Phone (WP) is a smartphone operating system developed by Microsoft.
  - Android: Android is a mobile operating system (OS) based on the Linux kernel and currently developed by Google.
  - iOS: iOS (previously iPhone OS) is a mobile operating system developed by Apple Inc. and distributed exclusively for Apple hardware.
  - Other Phones: Phones which do not run on Windows/Android/iOS operating systems can run our application using internet.
- Personal Computers (PCs): Our application can be accessed in a PC using various browsers like Google Chrome, Internet Explorer, and Mozilla Firefox etc.

IV. ADVANTAGE OF THE SYSTEM

With the Web as well as Smart phones, this application can be utilized more thoroughly.

- User-Friendly: Smart phones support finger touch input method. Users can perform multiple task or actions in just a few flips of fingers. Every action on the interface can be performed intuitively without costing extra learning time.
- Adaptable: Whenever there is an update of the application version, users will be informed

immediately and the most updated version is guaranteed to be delivered.

- Accurate: Since the database used is maintain by KSRTC so the information provided by the website can be considered as accurate.
- Accessible: This application can be accessed through Web as well as Smart phones with different operating systems. This application will reach a high availability.

## V. CONCLUSION

The proposed system Sanchari Mitra provides the necessary bus details required for the passengers who travel frequently via bus. Our system provides easy, reliable and enhanced access to the information like bus number, routes and timings which helps people to utilize the public transportation system to its full potential.

## VI. FUTURE ENHANCEMENT

Our system currently focuses on providing the information locally, i.e., for a city. The implementation of our project is due. Since our proposed application is efficient to serve the data even without the internet connection (after installation) efficiently, there is scope for extending our system for more cities.

Our application involves processing of the user request from the data which is already stored in our database. So, the data provided is static data. Instead, there is scope for providing the data dynamically.

Currently, our application provides the user with the Bus number and the Timings corresponding to the selected route. There is scope for providing the Bus fare for the selected route along with the Total distance of the selected route.

Further implementations can be done to provide the user about the Traffic delay for each of the routes available with the help of real-time data. Therefore, the user can select the route with less traffic and get to know via which route he/she can reach the destination quicker.

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