FINAL REPORT- A

INNOVATIVE PUBLIC TRANSPORT INFORMATION SYSTEMS
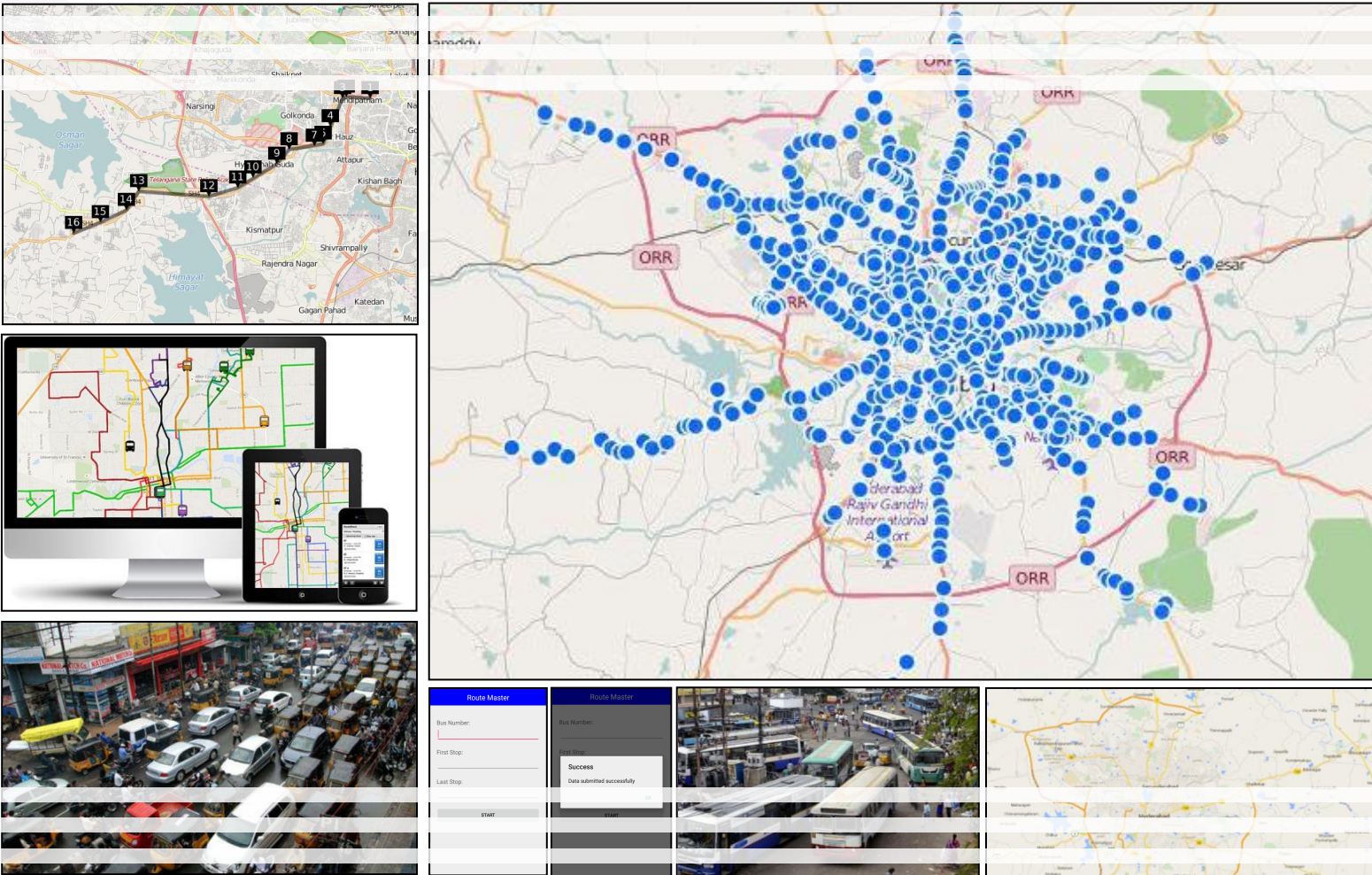
SHAKTI *Sustainable Energy Foundation* was established in 2009 to support India's developmental and energy security objectives and works to facilitate India's transition to a sustainable energy future by promoting policies that encourage renewable energy, energy efficiency and sustainable urban transport.

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LIST OF ABBREVIATIONS

ADAPT	Adapt Technologies & Consultancy Services India Pvt. Ltd
App	Application
GHMC	Greater Hyderabad Municipal Corporation
GIS	Geographic Information System
GPS	Global Positioning System
GTFS	General Transit Feed Specification
HMRL	Hyderabad Metro Rail
HUL	Hyderabad Urban Lab
IPTIS	Innovative Public Transport Information System
MMTS	Multi-Modal Transport System
MoM	Minutes of Meeting
NGO	Non-Governmental Organization
RTC	Road Transport Corporation
SETWIN	Society for Employment Promotion & Training in Twin Cities
SHAKTI/SSEF	SHAKTI Sustainable Energy Foundation
TSRTC	Telangana State Road Transport Corporation
UMTA	Unified Metropolitan Transit Authority

** All supporting databases, Maps, Interview sheets, & MoM of the project has been submitted along with this report separately as report of 'FINAL REPORT-ANNEXURE-B' of project- 'INNOVATIVE PUBLIC TRANSPORT INFORMATION SYSTEMS'.

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EXECUTIVE SUMMARY

The urbanization story of India is throwing up numerous challenges for city planners, managers and administrators. The burgeoning population, concentrated in the urban agglomerations is constantly engaged in an urban life which includes long & tiring commutes to work and back home. Average trip distances for various activities have increased steadily and people are spending much more time and energy on roads than ever before.

The growing city economy has provided people with steadily growing incomes which in turn impacts the way it is spent. Buying cars and houses has become the mandatory norm for people aspiring for a better urban life. The resultant increase in personalized vehicles is adding to the congestion. Due to the lack of efficient and widespread public transport in most cities, traffic volumes have increased while speed flows have decreased resulting in huge losses in terms of time and energy. This has increased pollution and stress levels causing severe health woes of the citizens.

Cities with good public transport are better than those where private modes hugely outnumber any other mode of transport. Huge capital investments in road infrastructure and metro rails will no doubt bring relief in parts and in corridors where the transport facilities function. However the importance of bus based public transport remains evidently the best option available. While governance reforms have started putting pressure on government agencies to improve the quality of civic services which show only slow but steady indicators of progress as far as the road transport corporations remain. Rapid change and reform is required for public transportation systems as due to lack of public transit options coupled with increasing spending capacity, people will keep buying private modes to travel to their destinations.

On one hand the growing population in cities and the resultant growth in private vehicles in roads makes the case difficult for the RTCs, on the other, also provide the perfect reasons to provide better services and re capture the intra city travel market.

Some cities are making good progress while others lag behind. Most of these RTCs are plagued by various internal constraints. Most RTCs have inadequate fleets, outdates vehicles, no real time system of data collection, monitoring, analysis, no public interface, no outreach, inefficient routes, over stressed corridors, human resource problems, lack of physical infrastructure support like quality road geometrics, road space, street furniture. The list of woes is endless.

The paradox is that the harried Indian commuter would opt for a better, affordable, comfortable public transport only if given a chance. This is evident in the fact that despite difficulties, on popular routes people cling on to footboards, get crushed in packed buses to travel to their destinations. This clearly shows the preference for the mode of travel.

Deficiencies in the quality of service of public transport is already making it difficult for administrators as well as the users. Compounding this problem is the fact that there are no organized public transport information systems. In few words data is not open for general use. This project aims to bring to focus the important dimension regarding lack of comprehensive, detailed, accurate and update information systems regarding public transport information.

Despite tremendous leap in ICT (Information & Communication Technologies) in the last two decades the applications related to public transport remain inadequate.

The advent of smart phone based technologies related to location based services transit related apps, direction finders is now an immensely useful tool being used by the large population in everyday life. While there are a few tools available, there is not much focused solutions as far as the public transport facilities are concerned.

This projects aims to develop a replicable model for developing such systems using smart phone apps. Creating a public transport information system requires a combination of human effort and technological use and the effective use of the smart phone. Since the quantum of data to be collected would be huge one of the easier ways to do this would be flock-sourcing of data (a guided 'Crowd-Sourcing' technique). Using a smart phone, the data generated can be validated and converted into a GTFS feed. The end product can be uploaded on the internet with an easy to use interface and also reconverted into an app for hand held devices/smart phone from the user point of view. Once the information is standardised and structured the offline uses can also be specifically applied. To ensure real time data collection, updation and use it is imperative to develop a comprehensive IT enabled system which would include tracking, infrastructural, operational, administrative and financial aspects with the full cooperation and ownership of the respective transport organization. This calls for Innovation.

To realise the objectives of the Innovative Public Transport Information Systems and develop a pilot case, the city of Hyderabad was chosen. As a starting point and to test the methodology SSEF appointed ADAPT to undertake this project. ADAPT created a project team of multidisciplinary expertise and also utilised the volunteers and interacted with other local organisations like Hyderabad Urban Lab involved in similar innovative works.

Hyderabad is one of the largest cities in India with one of the fastest vehicle population growth rates. As per studies and estimates the total vehicle population is in excess of 3.5 million and the share of public transport trips is less than 40%. The population of the Greater Hyderabad is more than 7 million as per latest estimates and that of the urban agglomeration is around 10 million.

The intra city bus operations are managed by TSRTC. While the TSRTC is making all efforts to sustain and improve the public transportation systems, the city continues to remain under tremendous pressure, facing traffic jams, congestion, reduction in traffic flow speeds, loss of energy fuel and time in traffic. The metro rail is project is still under construction and is a capital intensive project and may take time to get fully functional and also may not be able to spread far and wide into the densely population city.

In this scenario bus systems remain the most popular and affordable mode of transportation for a large part of the commuters.

This established the need for developing a model Innovative Public Transport Information Systems project with Hyderabad as a pilot case.

It was decided to develop a methodology for collection and dissemination of public transport information through open data using innovative mechanisms like apps, smart phone and involving the citizens/common public/volunteers of Hyderabad.

The Innovative Public Transport Information Systems (IPTIS) aims to develop a methodology for collection and dissemination of public transport information through open data to catalyse innovation in transportation planning, decision making and various research fields. This model methodology has been tested as a pilot study on Hyderabad and the process and results have been explained in Section 4 onwards in the report.

Based on the general methodology developed (see fig below) and the results of the tested model for Hyderabad /TSRTC Bus transit system it would be easier to replicate the same for other cities also.
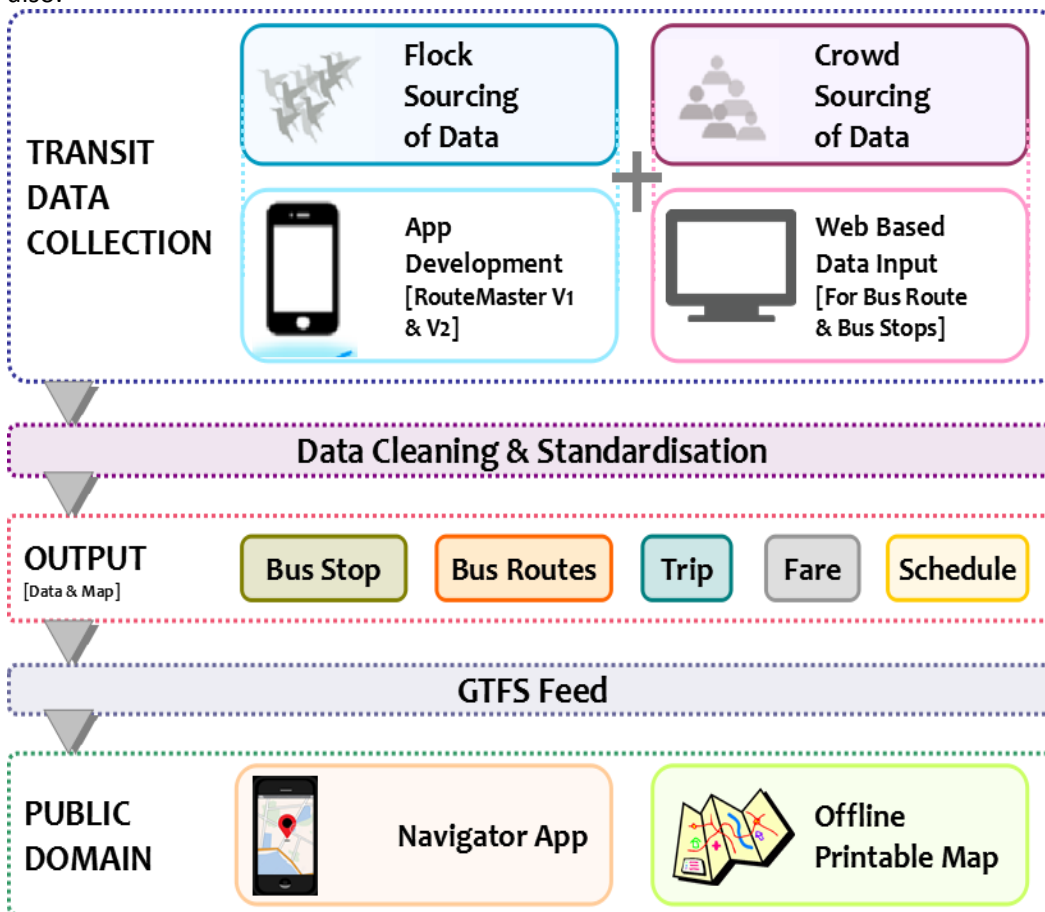
The key stakeholders in this project are the Telangana State Road Transport Corporation (TSRTC), the Greater Hyderabad Municipal Corporation (GHMC) and the Unified Metropolitan Transit Authority (UMTA) for Hyderabad. Hyderabad Metro Rail (HMRL) could also be a major stakeholder for the project. Starting with the bus based transportation system, the respective Road Transport Corporation can maintain the respective database and the multimodal database can be managed by a joint mechanism. Apart from these agencies, the Information and Technology Ministry of the Telangana State government is a key decision maker in all matters related to digitization and use of digital data.

Effort has been made to interact with all these stakeholders at different stages of the Project. It was felt that interaction with government agencies was a challenge in itself - either the data was not available and if available, there was hesitation in sharing the same. However all stakeholders who were contacted gave a positive response to support this project.

- The **general methodology** developed to undertake this exercise has been structured in a generic manner and can be **replicated** for any other city in India. Survey methodology included '**Flock Sourcing'** and types of data collected included Bus Stop Data, Bus route data and Schedule data. Around data for 82 routes (including 31 core corridors and other branches) has been collected.

- For **data collectio**n specialized **smart phone based tools/app (RouteMaster)** was developed.
- A web based version was also created which would be more useful in analyzing the overall data with respect to the spatial issues. The **web based version** would be the foundation for creating the final app for users. Existing bus stops and schedules were mapped and visuals generated. Using the data collected from the app changed routes were also identified.
- **GTFS** feed was created accordingly.
- An important part of the exercise was to **engage with the TSRTC**. Discussions were held with the senior management like the Executive Director and Dy. Chief Traffic Manager regarding issues related to operations, data collection, technology use and willingness to test innovative Public Transport Information Systems (APP based). Interviews were conducted with the Union and the crew to understand the wide ranging issues affecting the functioning of the TSRTC and for a balanced view. Establishing relationships with the TSRTC on the use of data was an important achievement under this head. Another finding of this project is the need to develop relationships between various players in the society for knowledge sharing.
- The other thrust areas identified in this project which need to the focused on in the future are   bringing in data efficiency with a focus on open transit data, developing an app for real time data, creation of authenticated static maps, creating infrastructure for real time tracking, developing multimodal public transit information systems. An important result is the achievement **replicability** of the app and dashboard.

The methodologies developed and tested in this project *are easily portable to other cities. Only specific adjustments would need to be done for similar work to be undertaken anywhere else in India.*

The initiation of this project was based on the premise that **open transit data is critical** to developing sustainable urban transit options in Indian cities. Therefore, creating such a data intervention was selected as the strategic initiative in Hyderabad an as a model for other cities as well. During the course of the project, a number of innovative practices were developed to facilitate opening up of data. Doing this as a part of the development of an overall Public Transport Information system would require a thorough understanding of overall challenges. Interactions with transit providers and experiences on the field uncovered the fact that the *challenges to open data are as much technological as they are institutional.*

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MAIN REPORT

1.BACKGROUND & CONTEXT

One of the major challenges Indian cities are facing is the deficiencies in the public transport systems.

On one hand the vehicle population is growing by leaps and bounds and on the other the growth patterns and resulting spatial structure of the urban sprawl is putting immense pressure on the functioning of the public transport.

The state owned road transport corporations are trying their best to cope up despite severe internal and external constraints. These organisations are plagued by administrative, bureaucratic, human resource, management and technological issues when it comes to coping up with the increasing pressure of urbanisation and mobility related issues in all major cities in India. These woes are added by the lack of proper hierarchical road network, road widths to run buses, road geometrics, street infrastructure like bus bays, and improper location of bus stops or no bus stops at all.
In such a complicated urban mobility scenario alternative solutions are created and used by the citizens. This has led to the advent of para transit, app based cab services, vehicle pooling initiative, private sector transportation companies (like licensed bus services ion various cities).

In the last decade or so there has been a boom in the e-governance and e-commerce world. The information availability and usage has shifted drastically from web based to phone and app based systems. While the advent of new apps related to private road based transportation (like taxi/cab services) systems and to a certain extent with respect to intercity rail based systems are available commonly, there is a dearth of information on public transport especially the bus based systems.

It is felt that ease of availability of higher accuracy information regarding the public transportation system will help us leapfrog from a deficient to an efficient status of operations and service provision.

In this context it needs to be understood that one of the critical requirements is to promote concepts and models of innovative Public Transport information systems, open data etc.

The Public Transport Information System is an integral part now a days for enhancing public transport performance and enabling passengers to get transit information, schedule & trip planning.

Such a system will also be in tune with the recently launched smart city initiatives and help in integrating multiple information and communication technology (ICT) solutions in an efficient & sustainable fashion to manage a city's assets.
Innovative public transport information systems aims to outline a broad framework & model methodology of the system for strengthening the backbone of the system. This project has been focused at creating open access data and applications for collecting data on transit options (model for Bus) in Hyderabad to catalyse innovation in transportation planning and management as well as decision making for the local transit agencies and obviously for the user. It also opens up possibilities for academic institutions and research/development organisations that can use

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open data for researching and analysing transportation networks, suggesting improvements for the greater good of the urban society and creating more reliable future travel models.

This project will also enable better understanding of how these systems can be replicated in other cities to make a nationwide impact.

The project was initiated to build a model methodology for Public Transport Information System and to create the openly accessible and clean datasets on modes of transit specifically relating to-

1)   Data collection methods (using Application)
2)   Service Planning Data (which consists of bus stops, stations, alignments, timetables and fare charts)
3)   Operational and Statistical Data

It was decided that to develop a methodology for collection and dissemination of public transport information through open data using innovative mechanisms like apps, smart phone and involving the citizens/common public of that city.

2.GENERAL METHODOLOGY

Given below is the general methodology developed which can be applied and replicated for any other city. Some modification and improvements can be done based on the lessons learnt from each case which will need to be documented and carried forward.

2.1 METHODOLOGY

The project is mainly focusing to build a standardised methodology framework for the public transportation system. From Data collection to GTFS feed creation, the whole methodology will need to be performed with an expert team & in coordination with the Government organisation handling the transportation system.

Figure 1: Methodology Chart
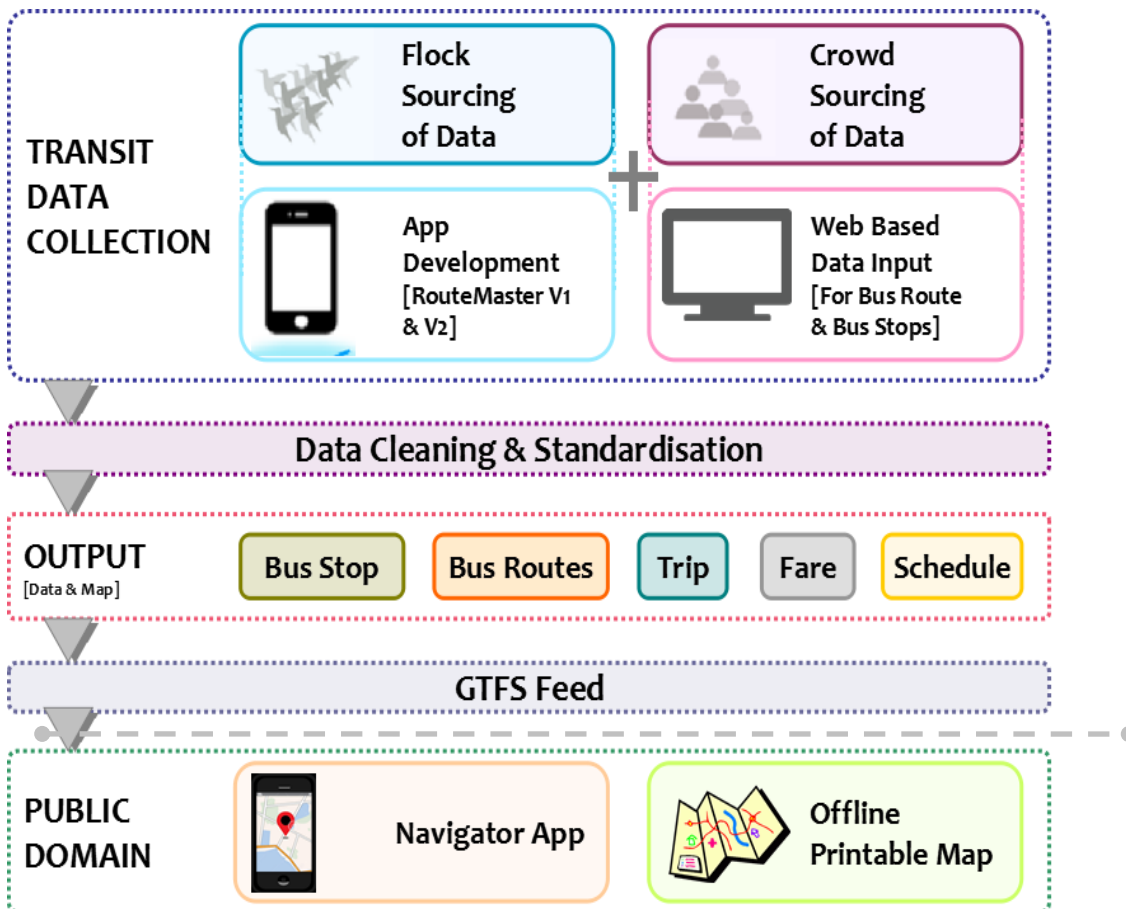
2.1.1 Transit Data collection

One of efficient ways of collecting point data or route data/travel data is by utilising the smart phone based technologies. Since most smart phones have location tracking and map support

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applications which are already popular among all users it is best to utilise this potential for data collection for this type of project.

Knowing fully well that the specific organisations/road transportation corporations in their current state of affairs may not have the wherewithal, technology, manpower and finances to undertake such a huge amount of data collection it is also best to utilise the crowd sourcing mechanism for the same.

The primary technique for collection of data is based on a modification of conventional crowd-sourcing techniques which depend on the general public to be motivated enough to contribute data. In reality, crowd-sourcing efforts are the most successful when there is a crisis or emergency. Under ordinary conditions, there are no immediate incentives to individuals to contribute data. Thus, in order to motivate people to contribute data, a system has been followed:
1. Incentives for individuals to contribute data
2. Quality assurance mechanism.
3. Development of systems for Data standardisation, management, updating and sustainability.
4. Institutional mechanisms

It is intended to build on a technique that is sometimes referred to as flock-sourcing of data - a guided crowd-sourcing technique where a somewhat homogenous group of individuals is trained to gather data. The incentives for the volunteers e.g. learning new skills, honoraria, or recognition of their contribution, has been discussed explicitly at the outset. The data gathering exercise has been discussed and planned in consultation with them and the data gathered has been immediately processed for quality assurance.

2.1.2 Data Cleaning
The data that is collected from field through the Application(APP) using conventional methods or crowd sourcing needs to be processed for cleaning and based on the cleaned data set a GTFS feed can be prepared according to the end use. Since large amounts of data generated requires not only cleaning but also validation, archiving and retrieval mechanisms.

2.1.3 Output & GTFS Feed
All output based on the collected data that that is related Bus Stops, Bus Routes, schedules and also supporting data regarding Trips, Fare chart etc. Based on the required output and final use the GTFS feed has to be prepared.

2.1.4 Availability of relevant/useful information in Public Domain
Once data on bus transit system has been accumulated, for testing the datasets of Bus routes & Bus stops, it has to be updated into public domain using a separate Public Navigator App or through web based systems and the available datasets can be utilised for correlating access to public transport. It can also be used for creating future projections for transit needs in the city. To ensure real time data collection, updation and use it is imperative to develop a comprehensive IT enabled system which would include tracking, infrastructural, operational, administrative and financial aspects with the full cooperation and ownership of the respective transport organization.

4.3. PILOT STUDY- HYDERABAD

To realise the objectives of the Innovative Public Transport Information Systems and develop a pilot case, the city of Hyderabad was chosen.
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5.4.DEVELOPING INNOVATIVE PUBLIC TRANSPORTATION INFORMATION SYTEMS FOR HYDERABAD

5.14.1   PUBLIC TRANSIT OPTIONS IN HYDERABAD

Public transit needs in Hyderabad are met by Buses, local trains and Autos and Cabs. Buses operated by the Greater Hyderabad Zone of TSRTC cover the transit needs of the majority in Hyderabad. The city has around 3800 buses[1] that serve about 3.5 million people per day. These buses cover 70 percent of the road network in GHMC limits and travel for about 9.5 lakh kilometers. Mini buses supported by SETWIN (Society for Employment Promotion & Training in Twin Cities) supplement the services operated by TSRTC. There are also about 150 train[2] services that are operated by south central railway that ferry people from one end to another. While autorickshaws/shared autos or taxis/shared taxis offer alternatives to the commuters, they are expensive and out of reach for a larger section of people. None of these modes offer the comfort and safety of a public bus. The city bus and the train have been an affordable, reliable and efficient way of getting around. However there is no reliable dynamic information about bus routes, bus stops or bus schedules. The only way to know if a bus is going somewhere is to ask - through word of mouth.

For the city of Hyderabad, several smart phone applications with data on transportation options are available some of which are related to bus information also. However, the back-end data of these apps is neither accurate, nor updated. The data has not been validated by the Road Transport Corporation (RTC) in the case of buses (The MMTS Services timetables are available freely). But most importantly, the service datasets are not open to the public.

5.24.2   APPROACH & METHODOLOGY

As discussed in the general methodology in Section 2 above the framework was detailed out and applied for the case of Hyderabad and TSRTC. With a step by step a[approach transit data was collected, cleaned, outputs were generated and GTFS feed created.

Significant effort was made for viewing/using relevant information in public domain either through smart phone based app (primarily for data collection and described in section 4.4 below) or web based interfaces for multipurpose use either by commuters of transport corporations were developed and tested.

The project team also leveraged the precedents in crowd-sourcing data, coding and visualization and transit research to produce open data platform for mobility options in Hyderabad. The project team included experts from urban planning, transportation systems, GIS experts and technology experts.

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[1] *Source: Telangana State Road Transport Corporation (TSRTC)*

[2] *Sourced from secondary data.*

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In Hyderabad, a city based non-profit organisation, Hyderabad Urban Lab made initial forays in this area with the creation of a bus frequency map for Hyderabad to analyse the level of services along the city's network of routes. This mapping exercise revealed a patchwork of under-served or unserved areas of the city indicating a serious spatial inequality. But more importantly, it was observed that the services are sub-optimally organized both in time and space possibly resulting in inefficiencies. Following this, the team began to crowd-source data on shared auto-rickshaw routes and other semi-organized systems of transit that appear to serve the public very well in locations that are under-served by public transit. Over the recent times, Hyderabad Urban Lab discovered that crowd-sourcing data using carefully trained volunteers is an effective and reliable technique to gather transit data.

Keeping in view the challenges mentioned earlier, effort was made to identify the various sources of data and knowledge which can be utilised for the Innovative Public Transport Information Systems.

5.2.14.2.1 SURVEY METHODOLOGY- The Flock Training

With clarity on how to gather bus route information and the app developed, the project team required volunteers who were willing to be a part of the data collection team. For this, 'Engineers Without Borders', India was approached, which is a non-profit organisation whose motive is to involve engineers, and other professionals with special or general skills, in a movement of constructive change. It is inspired by an urgent concern for accelerating sustainable rural development, assisting in capacity building in backward rural and urban communities of India, protecting the country's natural resource base, and working across national boundaries for social and economic justice and responsible use of technology.

The EWB India - Muffakham Jah College of Engineering and Technology (MJCET) Chapter had fifteen volunteers available for the process of gathering data on bus routes over a period of four weeks. The volunteers were told about the intent of the research and be trained to use the app to gather data. Each of these volunteers was allocated a set of bus routes to collect and submit the GPS tracks.

The first workshop with the volunteers was conducted on the 15th of March - The volunteers were oriented regarding the research purpose of the project. Harsha Devulapalli (Team Leader) and Sai Ratna Chaitanya (Technical Coordinator) explained to the volunteers the work flow of the data collection process and had sent them out for a test run. The test run by the volunteers was to check the possible challenges of collecting data in the field. Training was imparted to the volunteers for data collection in this workshop.

Photograph- 1: Training program for data collection

5.34.3　　　FINDINGS

5.3.14.3.1　TYPES OF DATA COLLECTED

Bus Stop Data

With the corridors identified - the bus stop locations on these routes has been captured by the App developed [RouteMaster].

Bus route data

After the bus stop locations were approved, Schedule data from TSRTC was needed to create the GTFS feed. Data was sourced from TSRTC after a series of meetings. The possibilities of sourcing/updating data through flock sourcing and importance of creating a GTFS feed for the city bus operations were explained to the Executive Director and Deputy Manager, schedules of the greater Hyderabad Zone of TSRTC. The list of bus routes has been attached in the Annexure Report B.

Schedule data

TSRTC stores data regarding its operations in separate packages. The schedule data is stored in excel workbooks which are called "MTD 141" internally. Any changes to the schedules are updated on these workbooks and uploaded to an internal data sharing website "TSRTC-WAN". "MTD 141" contains depot code, service number, trip number, timings at starting and terminal points and the route code. These workbooks while being formulated, also contain the route course, route length, running time, vehicle utilization, fare rules, trip timing and frequency. This helps TSRTC formulate schedules efficiently.

The data received from TSRTC was not in a desired format. There were inefficiencies in the data with respect to the stop names and route numbers. Using the network analysis done for collecting bus route data, the "MTD 141" cards were cleaned up to be used for GTFS feed.
For GTFS feed to be complete, it is essential that the information is exhaustive with the arrival and departure times for the bus route at all of the bus stops enroute.This data was missing in the "MTD 141" cards. Data from routemaster website contains the route id, route length and the approximate distance between each bus stop. An algorithm was written to merge the route master data with the "MTD 141" cards. This completed the process of creating a true dataset with schedule data.
Samples of MTD 141 Cards can be accessed **here**.[3]

5.3.24.3.2　BUS ROUTE NETWORK & CORE CORRIDORS IDENTIFIED

The bus routes in Hyderabad are mostly either extensions, diversions or short terminations of a much bigger route. Hence, identification of the core routes and the different variations of it has been made a clear picture of the routes. This study revealed a very interesting pattern of how the bus routes has assigned a numbers. The route No. 1 to 200 are urban routes, 201-300 are suburban routes and anything beyond that is reserved for mofussil routes. Unlike the random numbering of a few new routes like 649 , 602 and 333 , the core routes form a systematic grid around the city and it also explains how the city grew over years. To demonstrate this,

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[3]　*Link: https://drive.google.com/file/d/0B8Jii7EpecooZTUwSlhWRnBzVFU/view?pref=2&pli=1*

218,219,225 and 226 originate from Patancheru, 218 and 225 head to Koti whereas 219 and 226 head to Secunderabad, 218 and 219 head to Patancheru from Lingampally via Ashok Nagar. Whereas, 225 and 226 take a detour via BHEL Township. Many such pat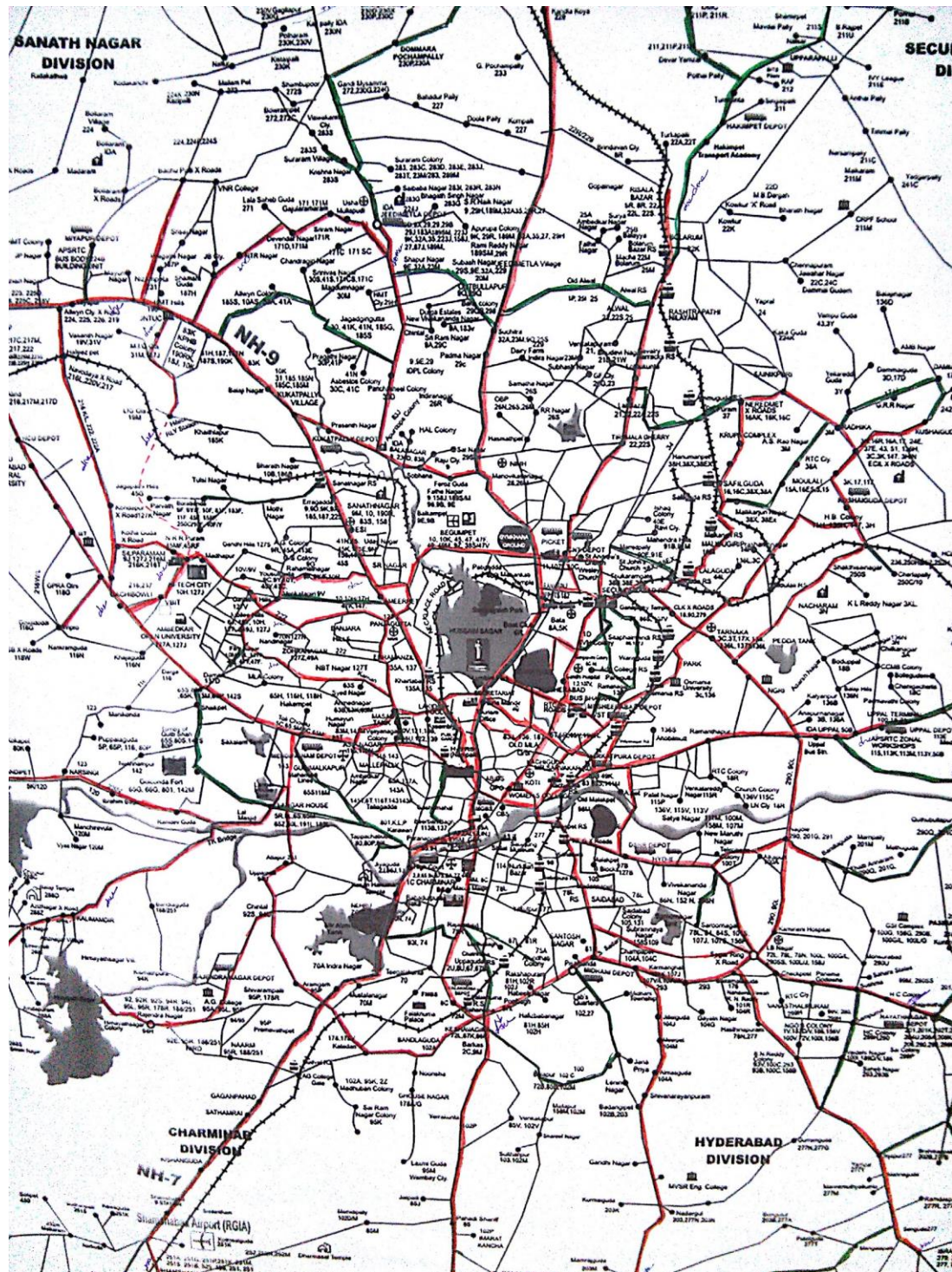terns has been found across the city. The naming of the different variations of a route too had an interesting pattern. The extensions, diversions and short terminations got an alphabet as a suffix. The alphabet in some cases was obviously signifying the place the route was terminating at, and there were instances where it wasn't so obvious. For example, all bus terminating in NGOs colony have V as suffix. Where V means Vanasthalipuram, of which NGOs colony is a part. The additions are obvious to understand. 156/299 is one such example where it is just a combined route formed by adding two core routes 156 and 299. On the other hand all depots outside inner ring road have some home routes. As an example, most of the routes served by Hayatnagar depot are some kind of a variation of 299. Hence, the huge network is actually a simple overlap of different variations of a set of important routes.

As an operator that has been present for the last seven decades in the city, TSRTC often engages in small scale changes in the route network based on multiple parameters - such as ridership analysis, revenue and feedback of passengers. As is the case with several other entities that run buses, the TSRTC often relies on a network principle of direct connections with no transfer. For example, NGOs Colony in Vanasthalipuram (east of Hyderabad) gets direct buses to several places in the city. This destination-oriented model often means that suburbs such as NGOs Colony are served by multiple distinct routes that branch off a core transport corridor to serve riders. Such demands over decades has led to the network of TSRTC buses to look like the image below (See Map1). There exists a main network of bus corridors (which have been termed as **Core Corridors**) that have multiple tiny branches off the nodes. After close examination and study, finally data for 82 routes (including 31 core corridors and other branches) has been collected (Annexure Report B- 1.1 & 1.2).

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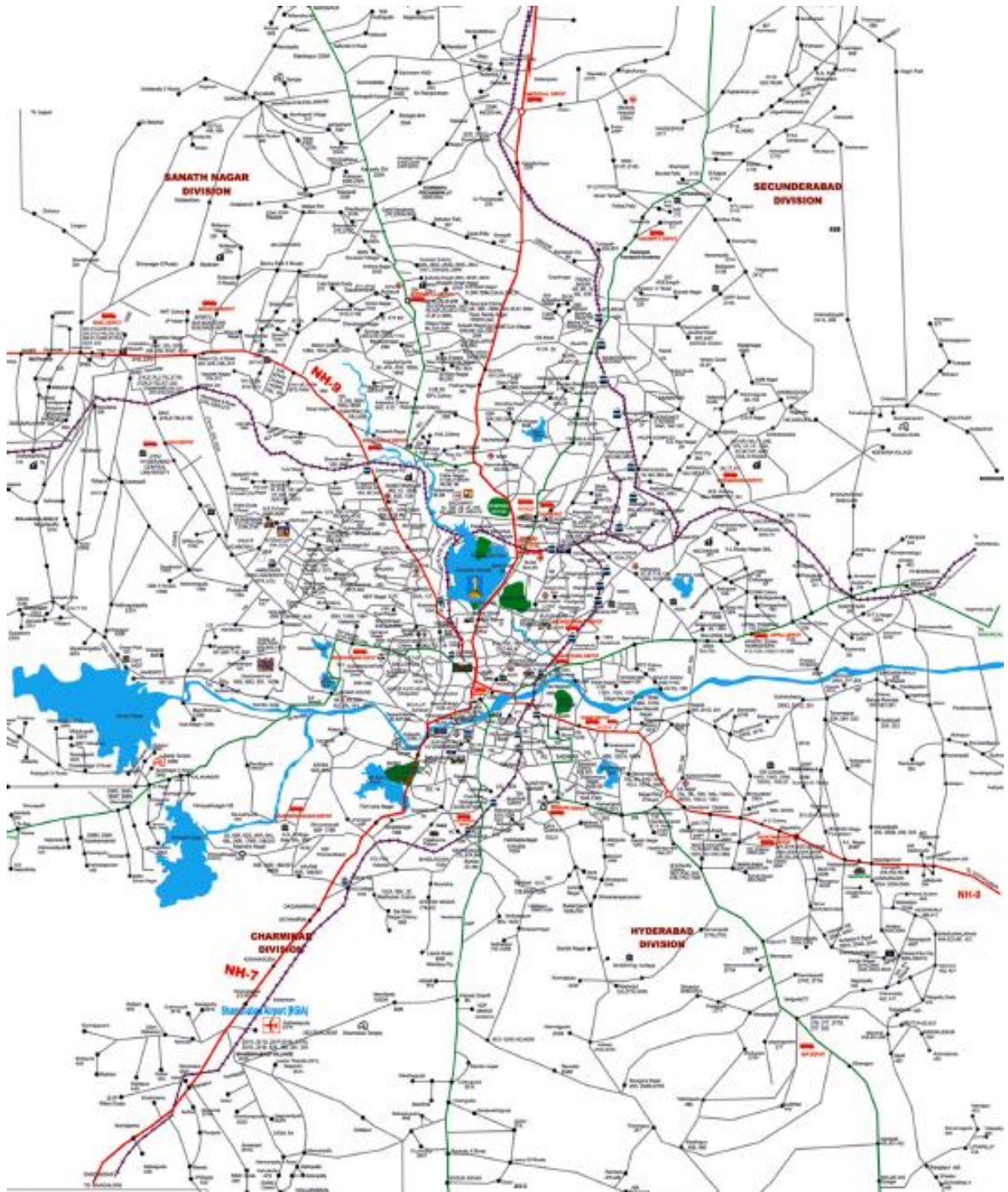
Map- 1: A visual representation of the Hyderabad City Bus Network on the TSRTC Website

Map- 2: Showing identified core corridors in the city - colored in red.

An important task was to identify these core corridors of the city bus network. The network can be visualised as a grid of corridors spread across the urban area. Most bus routes would therefore be a part of this grid - entirely or partially with branches off the grid. Our knowledge of the system as it exists enabled us to identify the core corridors. (See Map 2).

CORE BUS NETWORK IN THE HYDERABAD URBAN AREA
in the form of a node diagram

● MAJOR JUNCTION

Dundigal
Medchal
Shamirpet
Patancheru
Allwyn Colony
KPHB
Trimulgherry
Neredmet
Keesara
Lingampally
Balanagar
Bowenpally
JBS
HITEC City
Kukatpally
Sangeet
Paradise
Patny
Punjagutta
Boats Club
Mettuguda
ECIL
Secunderabad
Secretariat
Tarnaka
Rethi-bowli
Liberty
Nanal Nagar
Masab Tank
Lakdi-ka-pul
Abids
Narayan-guda
6 No
Uppal
Ghatkesar
Fever Hospital
Kothi
MJ Market
Chaderghat
Chevella
Afzalgunj
Malakpet
LB Nagar
CBS
Moosarambagh
Chandrayangutta
DRDO
Sagar Ring Road
Choutuppal
Aramgarh
Ibrahimpatnam
Kothur
Kadtal
Nadargul

Map- 3: Schematic map of Core Bus Network with Bus Stops in Hyderabad Urban Area

Adapt
Technologies & Consultancy Services India Pvt Ltd

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SUSTAINABLE ENERGY
FOUNDATION

5.44.4   TOOLS DEVELOPED FOR DATA COLLECTION

The parameters to develop the app are that it should be light-weight, i.e. small in terms of file size, capable of running on Android phones, and not use data or internet for most of its operations.

The app has been given the name RouteMaster - a reference to London's famous doubledecker buses. The app in its current version is extremely stable, accurate and less battery draining.
This app has been developed with inspiration from the work that Urban Launchpad has been doing in Dhaka and Mexico City, around an idea called flock-tracking that can make the process of collecting data faster and hassle free. Flock-tracking involves the process of training a group of volunteers in a way that they are trained to look out for the information being sougth and use the app to collect.

5.4.14.4.1   APP BASED - RouteMaster

Version One

The app in its initial form is very basic and is intended to collect location coordinates of the bus stops alone. The app can be downloaded <u>here</u>.[4]

The first screenshot shows the homepage of the app. It consists of three fields to be filled. The first one being the bus route number that is being tracked, the second and the third fields are for storing the first and last bus stops in the trip. This has been done to ensure legibility of data being collected - on the up and down trips. For example, the bus stop Masab Tank is actually in two different locations - on two different sides of the road.
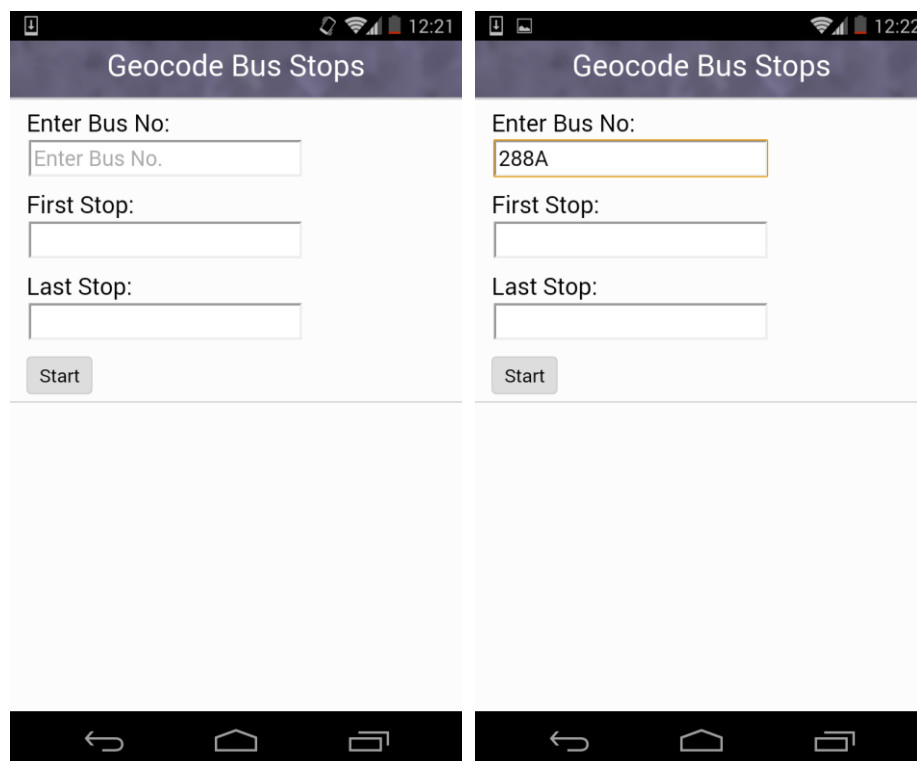

Screenshot- 1: Left : Home Page of the App.

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[4] *Link: http://routemaster.hydlab.in/assets/hul_routing.apk*

Screenshot- 2: Right : Data can be entered by typing in through the keyboard.

As soon as the user fills up the first three fields, the screen transforms into the one shown below. Every time the user passes by a bus stop - including the one they start at - they ought to press the Geocode Location button. Using the GPS in the phone, the data of the location of the phone is sent to our server. After the location has been confirmed, the user is expected to enter the name of the stop. The earlier versions of the app would report an error in geocoding. The error has been resolved currently and the app in most cases has been able to geocode locations even in the furthest corners of the urban area.

The process is repeated for every bus stop till the last bus stop on the route.
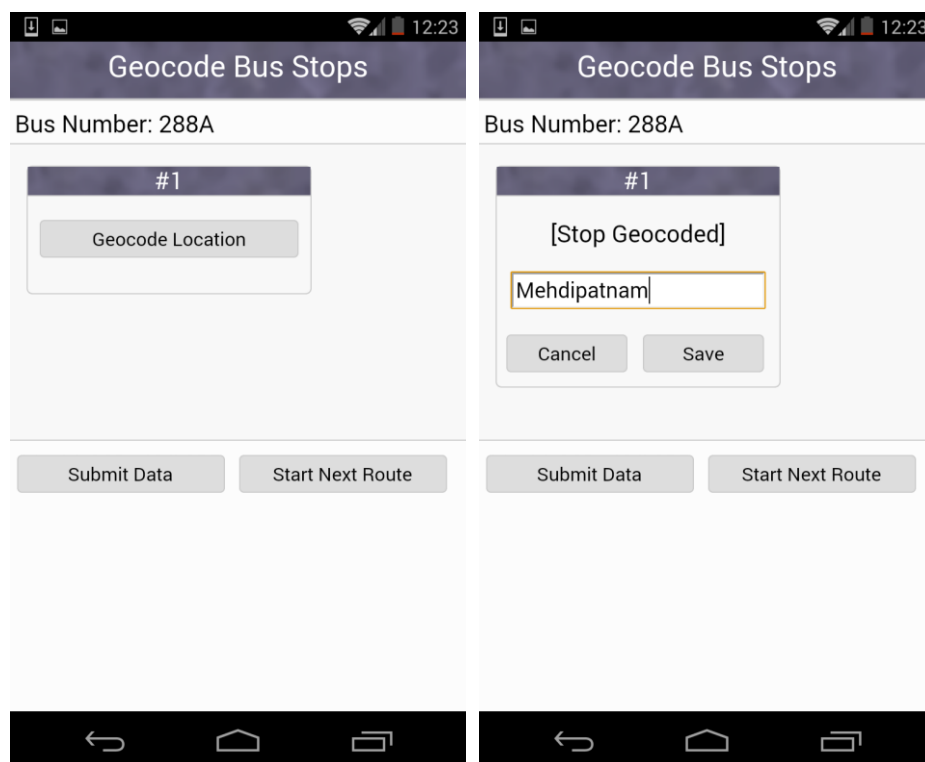
Screenshot- 3: Left : When the user has to geocode the location of bus stop that has just passed.

Screenshot- 4: Right : Once the location has been received by the server, the user can enter the name of the bus stop in this case.
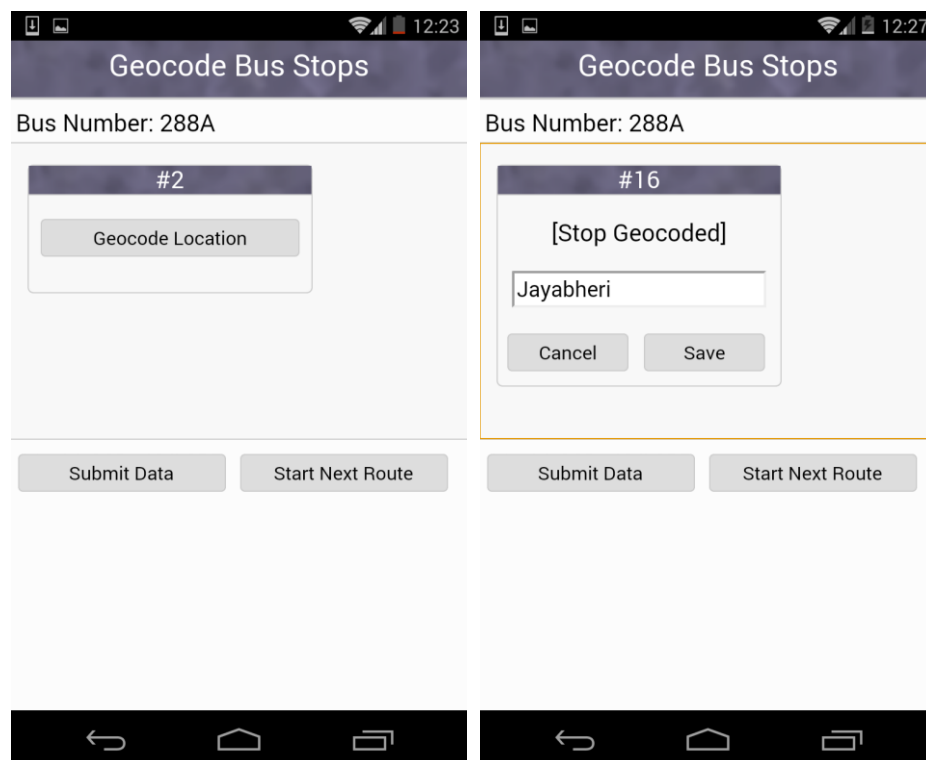
Screenshot- 5: Left : Once the first location has been geocoded and named, the user can proceed to geocode the location of the next bus stop.

Screenshot- 6: Right : Data can be gathered in similar fashion for all bus stops in a given route. Once the route ends, the user can submit the data.

Once the user is done collecting the data for a particular bus route - that is, after the last bus stop has been geocoded, the user can submit the GPS track by clicking on the Submit Data button. For the GPS track to be sent to the server, internet access/data pack is necessary. So while users can send the data of every bus route as a separate GPS track - it is not always possible to have access to data. Therefore, the 'submit new route' button was introduced. The user after gathering data on one route - need not submit the data. They can go on gathering data about other bus routes and can submit the data once they have access to internet.

Version Two

The app in its current form is stable and is intended to collect location coordinates of the bus stops alone. The app can be downloaded here.[5]

Volunteers faced difficulty with poor stability of the earlier version of the app. It was also not clear for the user to know if the data was submitted properly. To address these issues, a new app was built on java platform with material design guidelines. Functionality of the app in its second version is similar to the earlier version. This was to make sure there was no need for a second round of flock training as the group was already well versed with the app. A progress bar was added to the app to make sure the volunteers know the data is submitted properly.

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[5] *Link: http://routemaster.hydlab.in/assets/hul_routing_android.apk*
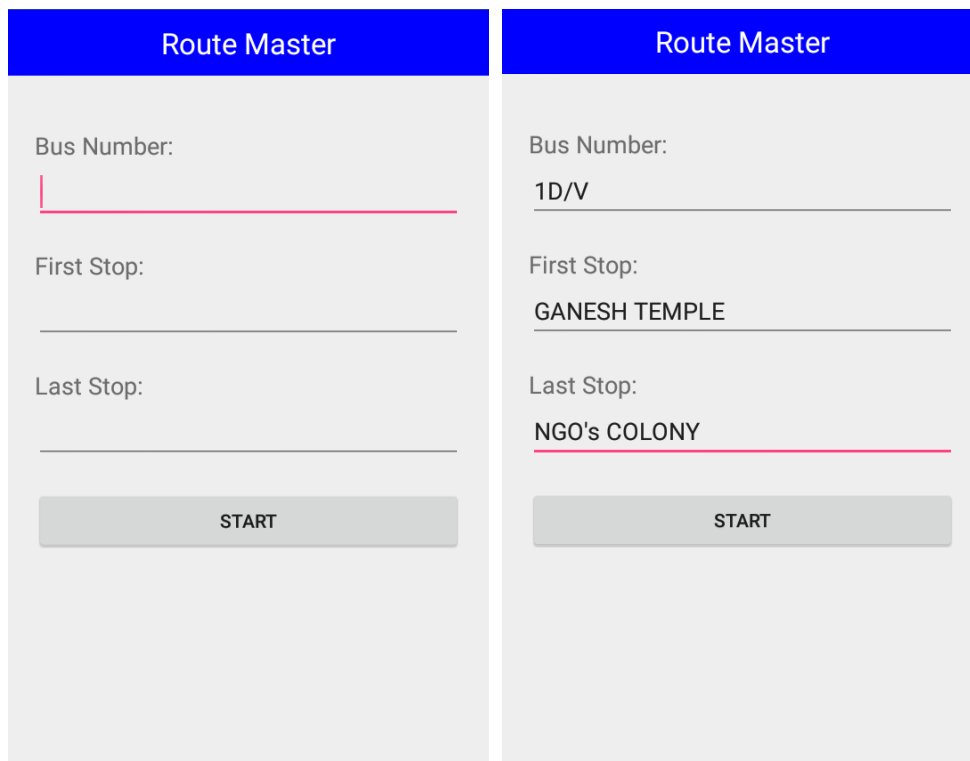
Screenshot- 7: Left : 1st interface of the Routemaster version two.

Screenshot- 8: Right : Data can be gathered in similar fashion for all bus stops in a given route. Once the route ends, the user can submit the data.
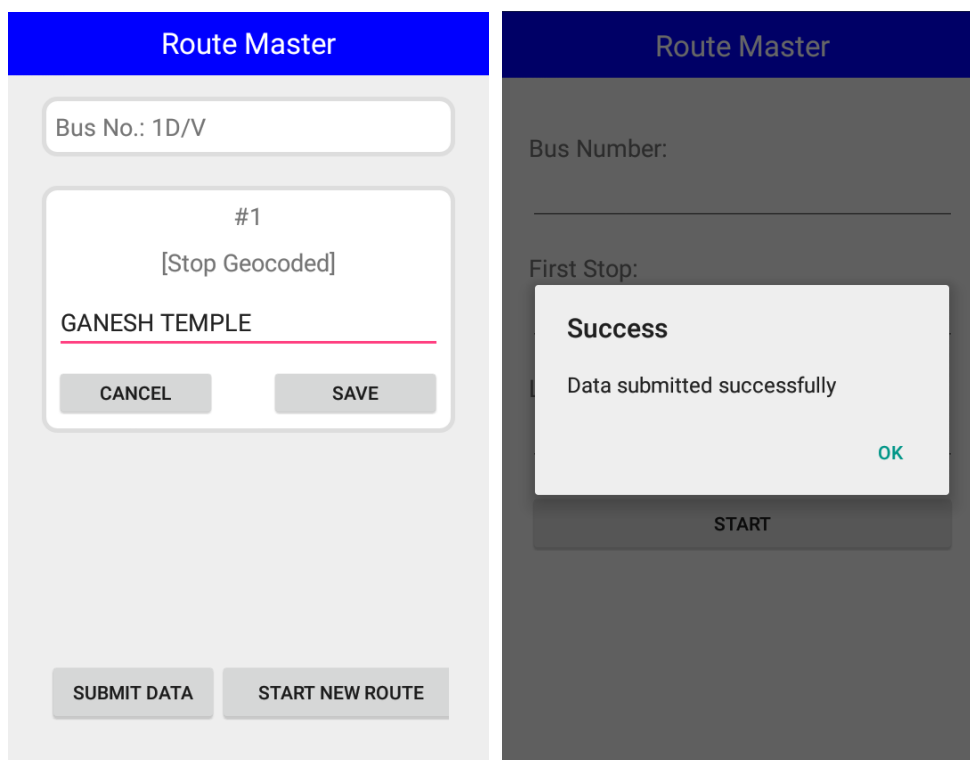
Screenshot- 9: Data collection through Routemaster version two

Technical specifications of the App and Dashboard

"<u>routemaster.hydlab.in</u>" [6], As explained earlier has a Dashboard which can be accessed by administrators to accept/reject submissions once they are recieved. The data on website primarily comes from three database tables.

➔ **Bus_stop**
Stores the name, lat-lng pairs of the stops.
➔ **Bus_routes**
Contains an entry for each stop of a route.
Contains the bus-no, stop-name, stop-id as in bus_stops table etc.
➔ **Bus_routes_with_stop**
This contains the bus_no, first-stop, last-stop, polyline (geometry) of all stops.

The following Technology stack are used for the "Routemaster" website and its dashboard

➔ **postgres database (with postgis extension)**
➔ **php**
➔ **cartodb.**
➔ **html, js and css for the web pages.**

The server side is written in php language. It fetches the data from these tables as needed.On the web pages,leaflet library is used for rendering the maps, routes etc. Cartodb is used for rendering the stops layer and also for displaying the list of buses at a stop etc.

This "Routemaster" apps, both version one and two are written in Java. Latitude and longitude recorded through geocoding are sometimes not accurate owing to the limitations of the phone hardware. The url to which the data will be submitted is hard coded into the application. Since raw data is submitted in batches, to arrive at the proper route information, data has to be cleaned and arranged in proper order. During this phase inconsistencies of the data submitted, particularly the lat/lng pairs can be corrected.


[6] *http://routemaster.hydlab.in/*

5.4.24.4.2   WEB BASED- RouteMaster

While the APP based system allows the organisation like TSRTC to analyse the existing systems and their efficiency there is another option to take feedback and suggestions from the citizens/commuters to be a part of a dynamic system to interact with TSRTC so that the system can be improved based on the requirements of the people based on critical mass requirements to run the services efficiently and optimally.

Any types of suggestions regarding Bus Routes & Stops can be done through the web based data input system also. The user can suggest new bus stops or bus routes which the administrator can analyse and accordingly modify the system after due protocols. Screenshots 10, 11 and 12 highlight the options available on the website. The website and servers are currently privately owned and utilised for this project for testing purpose only. Once the stakeholders/final owners are finalised appropriate measures can be taken to develop and manage the servers etc.

Screenshot- 10: Home page of Web based Data collection
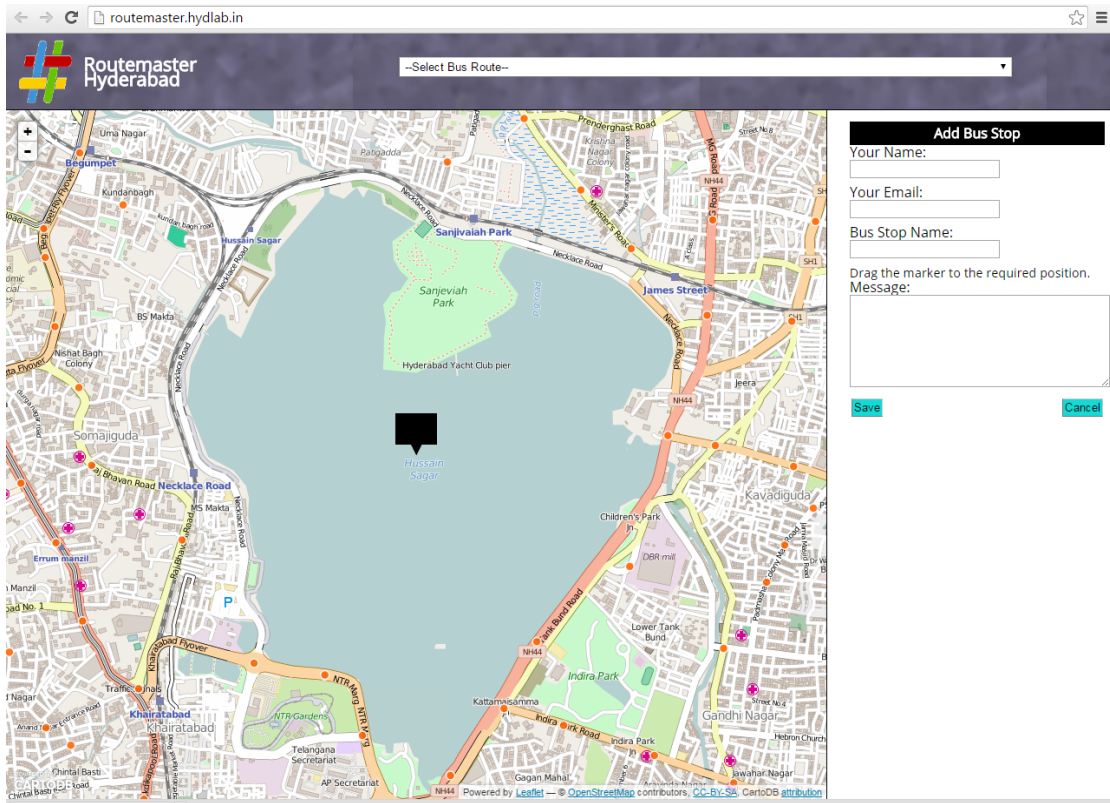
Screenshot- 11: Suggest New Bus Stop input option in Web based Data collection
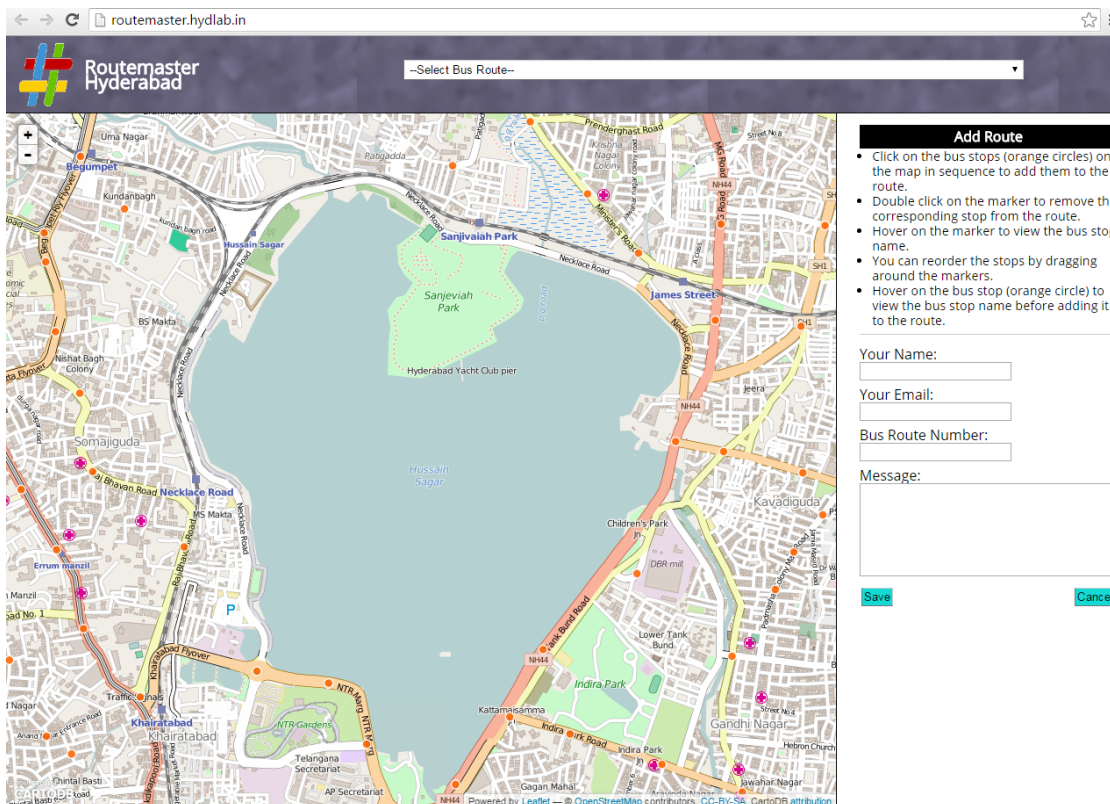
Screenshot- 12: Suggest New Route input option in Web based Data collection

5.54.5   DATA CLEANING AND STANDARDISATION

The data has been collected and stored visually in the form of a set of points joined by a line in our base server. On the Crowd submissions page of the Routemaster website, it is possible to see all the multiple submissions made by multiple users. Below is the screenshot of some of the user submissions made. On the top of the page are four links - Stops Map, Pending, Approved and Rejected. The Stops Map - shows all the locations of the stops collected so far. The remaining three tabs are the status of the user's GPS submissions. It is possible to approve, reject or keep the user submissions pending. The quality checking has been done to refine the dataset. In case of badly done tracks, it is possible to reject the track altogether.

Screenshot- 13: Example of visual representation of a User's GPS track

5.64.6   OUTPUTS GENERATED

5.6.14.6.1 MAPPING OF TABULATED ROUTES

The data collection APP itself is the output of this project and the information collected, viewed and analysed is web based which can be viewed and printed out as per requirement.

The following screenshot is a visual representation of a User's GPS track. It is possible to see the route in its entirety on the map portion on the left side of the webpage. The right panel has all the locations geocoded presented in the form of a series. It is possible to edit the names of the bus stops in case of wrong spellings. It is also possible to approve only select bus stops. Once it is seen there are no haywire GPS locations, it becomes possible to approve of this track and the locations are added to the Bus Stops map.
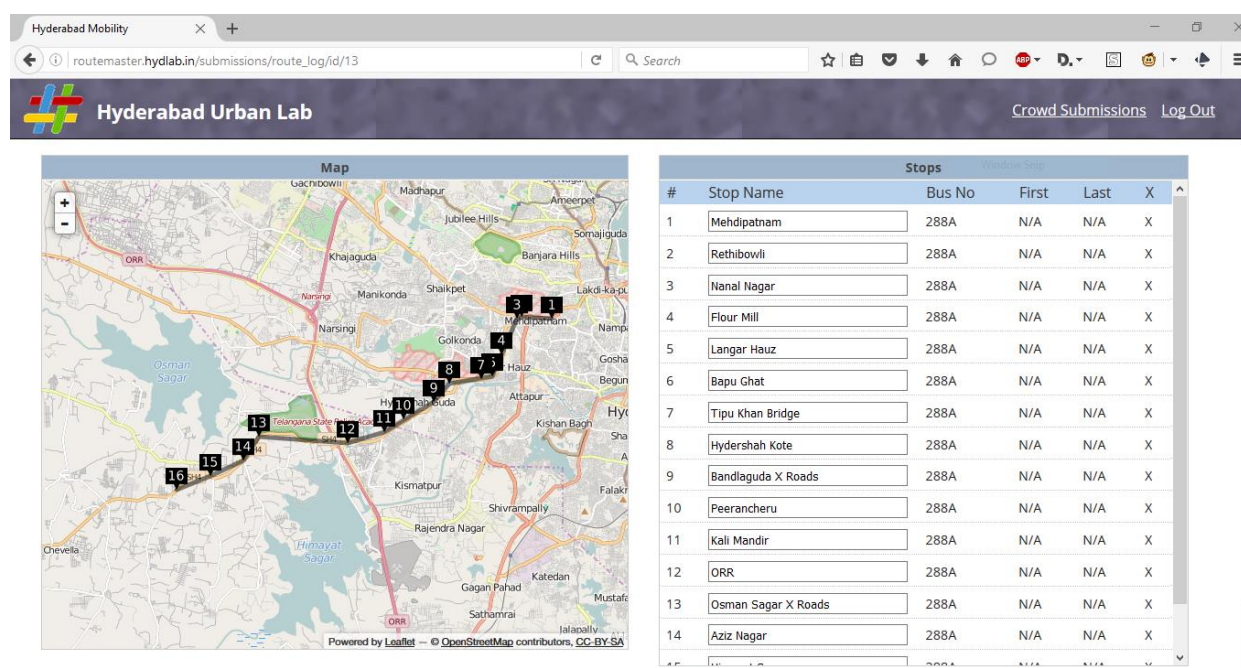
Screenshot- 14: Example of the Route 288A with all bus stops in webpages

5.6.24.6.2 IDENTIFICATION AND MAPPING OF CHANGED ROUTES

The route data collected was mapped and is shown in above & Annexure Report B-1.2. However after discussions with the TSRTC personnel it was found that in some cases the routes had changed on ground. Using the flock sourcing method these routes were mapped using the APP and have been presented in Annexure Report B-1.3.

5.6.34.6.3 MAPPING OF BUS STOPS

The following screenshot- 15 is a visual representation of the bus stops for which the locations were collected. This part of the dashboard contains two layers, one contains approximate locations of the bus stops and the other has exact locations of bus stops. It is possible to switch on and off the two layers to monitor the progress. The list of Bus stops has been attached in Annexure Report B-1.4.
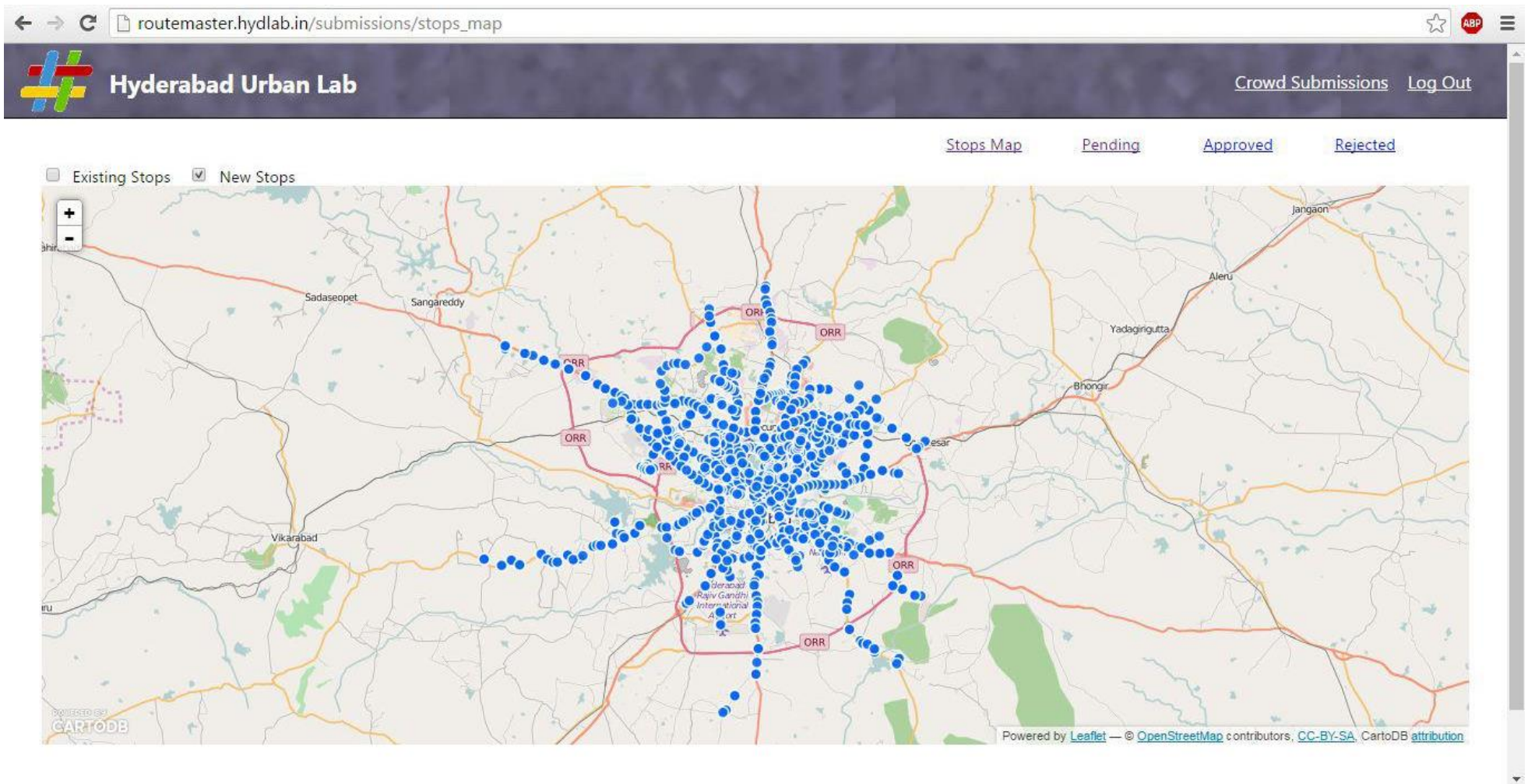
Screenshot- 15: Example of visual representation of a User's Bus Stops

5.6.4~~4.6.4~~ GTFS FEED

The General Transit Feed Specification (GTFS) defines a common format for public transportation schedules and associated geographic information. GTFS "feeds" allow public transit agencies to publish their transit data and developers to write applications that consume that data in an inter-operable way. A GTFS feed is composed of a series of text files collected in a ZIP file. Each file models a particular aspect of transit information: stops, routes, trips, and other schedule data. The standard requirements are explained in detail **here**.[7]

Components of GTFS feed

To prepare GTFS feed for Hyderabad, the data sourced from TSRTC was cleaned and the "*.Zip*" files containing various "*.txt*" files were created. It was decided to create the feed with all of the required fields. The following six files were created for 1000 bus routes in Hyderabad.

➔ **Agency.txt**
  This part of the feed helps uniquely identify the services operated by Greater Hyderabad Zone of TSRTC to avoid ambiguity once the data is made open.
➔ **Stops.txt**
  This forms an essential part of the feed. Stops are uniquely IDed and their lat-long locations are fed in that help transmit location specific data.
➔ **Routes.txt**
  Each route is given a ID and the route code itself is added to this part of the feed. Routes.txt along with Stops.txt form the line on map to refer to bus route on a map.
➔ **Trips.txt**
  This helps in reducing the number of sets of ".Zip" files to be created. Each schedule can have its own "trips.txt" file with the numerous trips.
➔ **Stoptimes.txt**
  Most important part of the feed, this file is fed n with details of expected time of arrival and departure at each stop on any given route.
➔ **Calendar.txt**
  This file helps in identifying routes which are not operated or short terminated on Sundays and public holidays.

Preparing GTFS Feed

The schedule data and route master data sourced from TSRTC were merged as mentioned earlier and sample GTFS feed was created for 5 of the 15 routes rescheduled by TSRTC early this year. Glitches with respect to inconsistency in stop names and route IDs were identified and attended to. This process also opened up opportunities to innovate on the graphic design front. Various service categories like City ordinary, Metro express, Metro deluxe and Metro luxury were given unique color codes. The bus route lines on map would then be given the same colors, which will help the end user differentiate between various service categories. Initially, "Fare rules" attribute was also worked on to see if we can produce fares for any given route between two stops if the end user requests for it. This idea was shelved in later stages owing to unavailability of a clean data set with respect to fare rules. However, we are working on simplifying the fare rules based on stop names and ID s and we are hopeful of adding fare rules to the feed at later stages.

Now that the glitches were identified, GTFS feed was created for the remaining routes. During this process, the schedule data was further cleaned to ensure maximum reliability. Provision was

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[7] *Link: https://developers.google.com/transit/gtfs/reference*

made to edit the schedule data further over time considering TSRTC is rescheduling its operations on a large scale.

The GTFS Feed/data structure developed can be accessed <u>here</u>.[8]

5.74.7 OUTCOMES/KEY ACHIEVEMENTS OF THE PROJECT

In the course of collating data, it was realized that the TSRTC route schedules are currently being updated. However, the procedure for doing this has not been based on the enormous data that is already being captured by the organization on a moment to moment basis. Route rationalization and schedule updation are done on an ad-hoc basis largely relying on the experience of the depot managers. TSRTC's data woes have largely to do with the patchy and ad-hoc implementation of technologies and lack of training of staff. At the same time, the rapid changes in the urban context are too complex for experienced staffers to be able to interpret without the assistance of new technologies. In other words, institutional, contextual and technological challenges feed off each other. Against this backdrop, the key achievements of the project are as follows:

5.7.14.7.1 Development of the Smart Phone APP for data collection
As described in Section 4.4 above the app has been given the name RouteMaster.

The app was tested over a weekday in different circumstances by the team. Also, a small group of users not familiar with the project were asked to use the app for their commute and recreational purposes to test the adaptive capabilities of the app. Feedback was taken from the users and the glitches were attended to by the team. A second version of app was built and tested again thoroughly to ensure there are no more gaps. The app in its current format is light, stable and reliable.

5.7.24.7.2 Piloting a methodology for flock sourcing data

5.7.34.7.3 Large amounts of data collected
Data was collected related to bus stops, bus routes, schedules as on current situation and travel patterns of buses. (Provided in a separate report). Creation of new data and cleaning up existing data. Bus stop data was cleaned up to avoid confusion at locations where there are multiple bus stops.

5.7.44.7.4 Development of the model web based Public Transport Information System
This system which can be converted into another specialised app. The system developed will help users in navigating through the city if they are keen on visiting new places. There are options with respect to transfer if there are no direct routes available. The system can display data with up to two transfers. With all of the bus stops geocoded, a user can search for any bus stop close to them and look for options for travel from those respective bus stops. One can also search for options from any bus stop from any location given the data has already been fed into the temporary servers. A seasoned user can also search a bus route by number. This feature will help people commuting to work every day.

Though enough care was taken in sourcing the data, cleaning it up and converting it to a GTFS feed, there is a need to test the system thoroughly given our experiences with Routemaster app. he highlights of this system are:

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[8] Link: https://drive.google.com/file/d/0B8Jii7EpecooVUNtVGYzUHFzNUE/view?pref=2&pli=1

> ➤ **The** system includes a **Navigator** which has a location-sensitive schematic map of the Bus transit routes which shows all the available Bus routes of the city. This map can also be used by the TSRTC to take stock of their own bus stops and routes, analyse and conversion of bus route data in to GTFS format. Analysis and conversion of bus route data in to GTFS format has been completed. Bus stop location data collected for around 600 bus stops inside outer ring road has been completed.
> ➤ **Uniquely IDed bus stops** that will help prevent the chaos and confusion that persists at larger bus stops such as Secunderabad Railway Station
> ➤ **Online map/Offline printable maps** that shows all available information of Routs & Bus stops
> ➤ **Visualisations using transit data** to relate transport access with respect to other aspects of the city such as access to services, settlement patterns, etc.
> ➤ Working on the vision document

This web based system can be converted into another specialised app for managers/users/commuters.

5.7.54.7.5   Stakeholder participation

Stakeholder participation and entrepreneur workshops carried out supported by interviews with the crew, depot managers concerned. Discussions were held with the senior management like the executive director and dy.chief traffic manager regarding issues related to operations, data collection, technology use and willingness to test innovative public transport information systems (app based). Interviews were undertaken with the crew and depot managers concerned. Establishing relationships with the TSRTC on the use of data was an important achievement under this head.

All of the above outcomes are easily portable to other cities.

5.84.8   RESULTS OF THE INTERVIEWS CONDUCTED

Specific interviews were conducted and interesting and useful feedback and opinions were received. From an institutional improvement point of view these conversations and leads derived from them become extremely critical in designing the overall improvement strategy and also the applicability and sustainability of any information system. Given below are the details.

5.8.14.8.1   INTERVIEW REPORT OF UNION

IN CONVERSATION WITH MR.RAJI REDDY, GENERAL SECRETARY OF EMPLOYEES UNION - RECOGNIZED UNION OF TSRTC ON MARCH 04, 2016.

Schedules and overtime payments

➢ **Are you okay with the current schedules do you want any changes. What would be your suggestions to address the problems regarding schedules and overtime payments?**

Running time for intercity and city schedules was decided based on average speed for each service category. Over time, with improvements in road conditions and vehicles, the average speed was increased without taking into consideration the traffic and bad road conditions in few specific routes.Employees feel let down by these practices of corporation.

➢ **Do you think this problem is more evident in city services? How does traffic affect running time? This is visible to commuters in the way that second shift services are always cancelled or cut down.**

Conditions of drivers in city are beyond imagination. Ongoing construction of metro in three corridors has badly affected the running time in a few routes. The current running time of services was decided two decades earlier. When we initially started serving as drivers, there was clear distinction between city services and sub-urban services. Suburban services had their own stops hence their running time of 2.5 minutes per kilometer was justified. We suspect that officials are using this distinction to exploit the crew by giving unjust running times for a few services by extending them just a kilometer beyond the suburban limits. For example, If uppal-Gachibowli-Hyderabad Central University route were to considered a city service, the running time for up and down trips would have been 180 minutes. The officials, however are citing the suburban limits and reducing the running time to a mere 150 minutes. The drivers are under immense pressure because of this unjust behavior by the corporation. There has to be a review on running times at least in city. The waiting time at signals has increased, number of intermediate stops have increased and this leads to immense pressure on crew which forces them to drive rash and skip bus stops. Driver fatigue is one the main reasons for accidents in city. We have been trying hard to take these issues to the management but they seem to have no interest in addressing the same. They get way by saying road conditions have improved. Whatever they may say, the fact that current running time is not sufficient remains same.

➢ **Drivers skipping bus stops has been a perennial problem. What do you think is the reason for this? Do you think this has to do with the increase in route lengths and the static running times?**

Driving a bus in city requires special skills. The roads are filled with potholes, there is horrible traffic and they won't even maintain bus shelters properly. There are no bus bays at many locations and where there are bus bays they are occupied by Autos and sometimes even shops. GHMC has no clue on how to deal with this mess. Given there is lack of infrastructure, drivers

tend to stop buses before or after the shelter where there is road space. Sometimes when bike riders try to overtake from left, drivers are forced to skip stops given they don't let us shift lanes. At bus stops where there is high frequency, drivers might stop behind four buses and leave. This might make an impression in the mind of passenger that the driver has skipped stop but we also have to remember that drivers have to stick to decades old running times. The government which is going around proclaiming it would make Hyderabad a world city should understand that this city needs bus bays. How can you call Hyderabad a global city if passengers have to wait for buses in sun and drivers have to skip the stop because there is no place to stop the bus.

Ticket Issuing Machines (TIMs)
➢ **How has the experience with TIMs been? Would you support the continuation of TIMs or would you like the old fashioned trays to be back.**

Employees union welcomes the use of Ticket Issue Machines. Having said that we are opposed to the use of TIMs as a way to reducing the staff. Only conductors should be using these machines and driver should not be burdened with additional duty of issuing tickets. There are a lot of technical issues with the TIMs issued to conductors. We suspect there is a scandal in procuring the paper for these machines. The paper is getting stuck or skid while printing. We demand that the management uses only quality paper. Other issue is usage of IMs of different make in the same depot.   We have made multiple representations to the management to make sure TIMs of only one make are used at a particular depot. It would make maintenance a lot easier.   I would reiterate that we are not opposing the use of TIMs we just want to raise the issues with respect using them.

➢ **In my earlier conversations with the crew, conductors expressed happiness over the use of TIMs especially the elimination of need to write SR.**

Yes, ~~Earlier~~earlier we used to write SR while on service, It used to be extremely difficult to do that in city bus services. Depot staff would question the crew if any alteration was found. With TIMs there is no scope for these errors to happen. Also, there is no scope for passengers to use re issued tickets. This has really helped in reducing the number of cases on conductors because if the passengers' mistake.

IT initiatives
➢ **How has the experience been with LED destination boards? Is any training given to crew on operating them?**

Use of LED destination boards started with JnNURM buses. They were very useful for commuters in the start but overtime they started falling apart. No training was given to drivers and conductors on operating them and depot level maintenance crew had no technical support to repair them. In fact, the problems of drivers and conductors are visible to at least a few people. The working conditions of maintenance crew is pathetic. One cannot expect them to know how to maintain these without any training.

➢ **What are your opinions or concerns on VTPIS (GPS-tracking~~) ?~~)? Do you think this will result in passengers being informed and better and Realistic schedules for the crew.**

As I said earlier, Employees union is never opposed to technological initiatives in the corporation. But, Corporation should not force them on to the crew to increase their duties. We will oppose VT-PIS if it used as a tool for surveillance. We will ask the management to use the data from this project to create realistic schedules. We have already made multiple representations asking the management to conduct fresh route surveys at least in the city.

Cost cutting measures

> ➢ **Does employees union support the management's decision to take hire buses? Do you think this will help corporation given its financial condition.**

We oppose hire buses. They cannot introduce hire buses citing any reasons. They do not make any financial sense to the corporation. It might seem as if the corporation is investing very less amount and earning from it initially but it is worse than paying EMI s for lifetime. TSRTC, after its formation invited tenders for hire buses three times. We opposed this move all the three times. They do not follow any terms given in the tender document. They pay meagre salaries to their drivers and make them work double duties. Depot level officers who have to make sure the hire bus owners do not do such mischievous activities get into shady deals with them instead. If the management thinks there is need for improving connectivity it should ask the government for financial help and buy buses on its own. It ~~make~~makes sense that way. Hire buses are just a step towards privatizing the corporation and we will continue to oppose it.

> ➢ **Does employees union support the management's decision to outsource a few posts? What is your opinion on contract labor?**

Just to inform you, we have been successful in convincing the corporation to do away with the contract labour system. We are proud to say TSRTC is the only place in state where there is no contract labour any more. We went on strike during Telangana agitation and regularizing contract employees was one of our main demands. Contract labour is nothing but bonded labor and we opposed it right from the introduction of it in the corporation. You cannot ask people to work for less salary and no retirement benefits when they are supposed to do the same amount of work as other regular employees.

While we rejoice the regularizing of contract employees, we have made little progress towards questioning the corporation on outsourcing of jobs. As I said earlier, there is a lack of support staff at every other depot in the state. Corporation has literally stopped hiring people under "shramik", "painter" and other support cadres. This is worse than contract labor. With no benefits guaranteed and little salaries, often unskilled labour end up being support staff for mechanics which adversely impacts the condition of buses. We have recently convinced management to hire the kin of deceased drivers and conductors as "shramiks" after proper training at ITI s or Hakimpet transport academy.

We will continue to question the management whenever they come up with such "out of the box" ideas.

Financial condition of corporation
> ➢ **How bad is the financial condition of corporation? How do you think the support from government has been?**

TSRTC being in losses is not a surprise given the policies of government which always look as if they are designed to push the corporation into more and more losses. According to the management TSRTC has accumulated losses of around 2000 crore and we continue to add a burden of 700 crore every year. Even if the corporation is doing well financially in terms of earning it is never seen because of the insane amounts of loans we have to repay. Everyone in the corporation knows we are in losses and as employees union, we keep sensitising our cadres to be responsible and work towards getting the corporation out of this financial mess. But, government seems to undo alll of this collective effort by not re paying its dues. In united corporation, we had to pay the government Rs.400 crore in lieu of MV tax and the government had to pay us Rs.600 crore in lieu of the subsidies we offer different classes of people. The balance of Rs.200 crore is never paid to us. Unless we are given "soft loans". Is this a joke? Adding to this the transport ministers decide to put unreasonable targets. How do you expect corporation to function if you keep extracting unreasonable taxes. TSRTC should not be looked

at as a source of revenue. The government should understand that we are the biggest contributors in terms of the VAT we pay on diesel. Why is it difficult for the government to give us subsidy on this tax? If railways does not pay VAT on diesel, why should we continue to pay? Support from government has been very minimal always be whoever is in power. We expect governments act more responsibly.

> **Do you have any ideas for alternate revenue? Do you understand that corporation cannot survive on ticket revenues alone?**

Yes, we do understand that we cannot sustain on ticket revenues forever. That is the case world over. Even in case of Hyderabad metro rail, they know they cannot sustain the operations with ticket revenues alone hence they are building their own shopping malls. RTC has many properties on highways. We have been demanding the management to make use this for alternate revenues. We are one of the biggest consumer of diesel and over time learn how to manage the procurement and management of fuel on our own. We suggested the management to open petrol bunks at least on highways to monetize our properties. Our zonal workshops and tyre retreading shops have capacity to manage tyres of 11,000 buses. Additional capacity can easily be added and we can collaborate with tyre manufacturers to manufacture tyres. This will reduce cost of consumption for us and increase revenue. We have also been demanding to start cargo services and expand dramatically into freight business. Even railways is earning most of its revenue from freight business. We already have the institutional set up and basic infrastructure ready to start freight business. And who can reach our network. We have depots even in the most remote places like Utnoor in Adilabad. We hope the corporation considers this.

Immediate measures can be taken up by taking over of parcel services from ANL. We suspect there has been a huge amount of revenue leakage here. We caught them at many instances they have weighed the parcels less and made money off the corporation. Can we not manage parcel service by ourselves? Management should start managing parcel services in house and build experience to start freight operations. Government should also support us through this transition.

Proposed changes to MV Act
> **How has the response been among the cadre on the proposed changes to MV act**

We have been opposing the road safety bill 2015 from its inception. It seeks to eliminate the monopoly for STUs and remove all protections given to the employees. We support the government's endeavour for safer roads but this bill is just ridiculous. The proposed fines make no sense for the drivers. Elimination of the distinction between contract carriage and stage carriage will effectively encourage the private bus mafia. De nationalizing of routes will adversely impact the corporation. How can the corporation compete with the big wigs of transport sector? They will end up buying all the profitable routes and we will be left with the loss making village routes. We cannot stop running them owing to social responsibility but where is the money to do so?
We are proud to say we were part of the nationwide strike opposing this anti worker bill. We will continue to fight if the government plans to pass the bill in its current form. We urge the state government to also look into the impending crisis.

Competing modes of transit
> **What do you think will the future of TSRTC be in Hyderabad given the aggressive investment on metro?**

We are sure, TSRTC will continue to thrive even after the completion of metro. One of my colleagues recently was telling me how Delhi metro had very little impact on Delhi's traffic problem. The same will sure happen in Hyderabad. How else will the people commute if buses

are not there? We might lose commuters on metro routes but the crew will surely work with management in identifying alternate routes. We should not feel let down but work towards connecting the distant colonies. But to do this we need the support of government. We have been asking the state government to allot land for new depots in Gachibowli and other parts of HITEC city. There has been little support on this front. As we always say, TSRTC can do wonders if it is given little support. How could the government give away 250 acres to metro? Can they not do the same for TSRTC. We transport 35 lakh people every day we deserve it. Don't we?

Share autos, SETWIN buses and Cabs in City, Do you consider them to be eating in to your revenue.

SETWIN buses were supposed to be operated by unemployed youth in routes where there were no RTC buses or where we could not serve because of the narrow roads. But you know how they operate now. None of them operate in the routes sanctioned to them. They do not have any specific schedules nor do they have any set timing for the drivers and conductors. They act like thugs and eat in to passengers who would otherwise have taken our bus. A customer lost for once is lost forever. They occupy bus bays and often drive rash. We have been asking the management to put pressure on government to make sure they operate properly and don't compete with us. They are definitely not filling the gaps. We are not against people getting alternative source for transport but they should be serving where there is not transit. What is the point in both of us competing? Coming to share autos, we have the same concerns as with SETWIN buses. We are not opposed to them operating where there is no transit but them operating in competition with us is not going to help anyone.

> **What about private operators on long distance routes. Do you oppose their operations?**
The private bus mafia is at it! They operate like they own the roads their drivers are not trained nor their buses are in condition. They take contract carriage permits and operate as stage carriage. We don't understand why RTA does not act on them. It is not that they are operating in secret. They have their booking offices all over the city. They pick up passengers from every other major junction, why is it difficult to control them. Now, the proposed changes to MV act will make all of this legal. They should be controlled at least for the safety of passengers. Previously we had done special drives on our own on behalf of the union and got the RTA to seize private buses operating illegally with contract carriage permits. We will do a special drive very soon.

Challenges that crew face
> **Are there any complaints on behalf of women crew members?**
The decision hire women as conductors was taken in 1993 when 33% reservation in working places for women was implemented. Since then many women have joined the corporation and worked brilliantly for the corporation supporting their families. Sadly, their working conditions have remained the same. There is lack of basic facilities like changing rooms and toilets at depots and change over points. We have been campaigning to improve these conditions. We were successful at least in city when we got the management to enter into an agreement with Sulabh international to waive the fee to use toilets. We were also instrumental in getting the corporation to build toilets at many bus stations which are now being used even by the passengers. We have also been campaigning to stop the corporation from giving women late night duties. This seems to be going in vain as we have observed recently there has been a spike in women being given second shift duties and night out duties. Women being given night out duties is cruel. How can you expect women conductors to sleep in the open in some desolate village in the night? We demand that women are given light duties that end before 9pm.

➢ **Are there any complaints on behalf of garage workers?**

As I said earlier, the condition of workers in depots is just beyond explainable terms. There are no training workshops for skill upgradation, there are no tools nor protective gear for the crew. How can we expect them to work in such inhuman conditions? We demand the management to resolve these issues on priority. You cannot have shiny buses without the garage staff. One should not deliberately ignore them.

➢ **All the complaints seem to be directed at management. Does the crew have any complaints on behavior of passengers?**

Our crew tries to be courteous to passengers whenever possible. But, sometimes the behavior of passengers is not justified. Men harassing women in second shift services is a major problem. Often drunk men get into bus and pick up fights with co passengers. What should the crew be doing then? Should they be concentrating on their duty and target running time or try to get them out? We try to be patient to the extent possible. Passengers should also keep in mind that ticket less travel is an offense. The squad may let you off by imposing a fine of Rs.500 but a case on conductor means him losing his one month's increment. I think we should all act responsible and understand that RTC is just not someone's' property, but it belongs every one. We should all work collectively towards the wellbeing of it. If nurtured well, it will be the backbone for this state.

Thank you.

5.8.24.8.2   INTERVIEW REPORT OF CONDUCTOR

IN CONVERSATION WITH MRS.RADHA, CONDUCTOR WORKING WITH TSRTC ON INTERNATIONAL WOMEN'S DAY - MARCH 08, 2016.

➢ **How is the day in life of a woman conductor?**
➢ **What challenges do you face over the day?**

I am Radha, Conductor working with Kushaiguda depot. First of all wishing all of the women on international women's day.

My life is like any other working woman. Waking up early in the morning running around to finish the cooking and cleaning jobs, Taking care of the medicines for the In Laws and then getting the kids ready for school. After my husband is gone for work, I have to get back to work again at home washing clothes and utensils. Time is already 12 by when I complete all my household chores. I feel I get tired even before I go to work. I have to then quickly run to the depot by 1pm to take over the duty in second shift. I wish I wasn't working in second shift but, can I help it? The work at home is just not manageable. Once I get to the depot, I pray to the god I get a light service. Sometimes I do get a light service but cannot expect for it every day right? Then I wish I get a good bus so I can at least rest on the first trip. Most of the days I do get that too. But again this is not a fixed thing right. I hope I get into a regular service and there is certainty as to which bus I will be serving in today. Once I sign on the duty chart, I have to go search for a reliable TIM. You see they are really helpful but at times they tend to act weird and I want a good TIM. I avoid changing at the depot because there are very few changing rooms here. Thankfully, we have good toilets. I wish there were good changing rooms too. Then, I meet the driver for today, mostly they are helpful and treat me like a family member but there are a few days when the drivers are just frustrated and they don't want to talk to you. Who else do I have then, After all he is my only co-worker for the day! If everything goes well we rush out of the

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depot in twenty minutes and now starts the service. Mostly passengers are courteous but, college students tend to act rowdy. They block our way and not let us move around in the bus. They do not show their passes and I fear for my job thinking what would happen if there was a squad. If i had chance, I would request all of them to be a little bit more responsible. Few trips are just peaceful, there are very few passengers in the bus and I feel that is the only time where I just sit and not do anything. Running time targets in city are just not real. They cannot expect us to complete the trip in the same old thirty minutes while there is unbelievable congestion on roads. I feel frustrated when my duty hours get extended. In rush hours men don't give way and few grope. In my initial days I used to be a bit calm and ignore all these but over time I have learnt how to give it back and remain strong. We often get support from drivers and a few good passengers. Coming back to the depot after a long day, I can't wait to get back home but the waiting time at depots to submit cash and TIM reports annoys me. I Try hard and complete this and rush home to get back to work again. The kids would've been back home from school and the husband back from work. I cook for them and get back to sleep only to get up early next day morning repeat all of the work again. Working with RTC as a conductor has really helped me gain confidence that I can support my family and I'm just not someone else. But, there are times when I feel let down when the in laws and my husband pass on remarks demeaning my job. Having said all of that, I am happy I am part of this wonderful corporation serving this big a crowd.

Thank you.

6.5.CONCLUSION & WAY FORWARD

6.15.1   CONCLUSIONS

The initiation of this project was based on the premise that open transit data is critical to developing sustainable urban transit options in Indian cities. Therefore, creating such a data intervention was selected as the strategic initiative in Hyderabad. During the course of the project, a number of innovative practices were developed to facilitate opening up of data. Doing this as a part of the development of an overall Public Transport Information system would require a thorough understanding of challenges. Interactions with transit providers and experiences on the field uncovered the fact that the *challenges to open data are as much technological as they are institutional.*

Figure 2: Sustainable transportation System
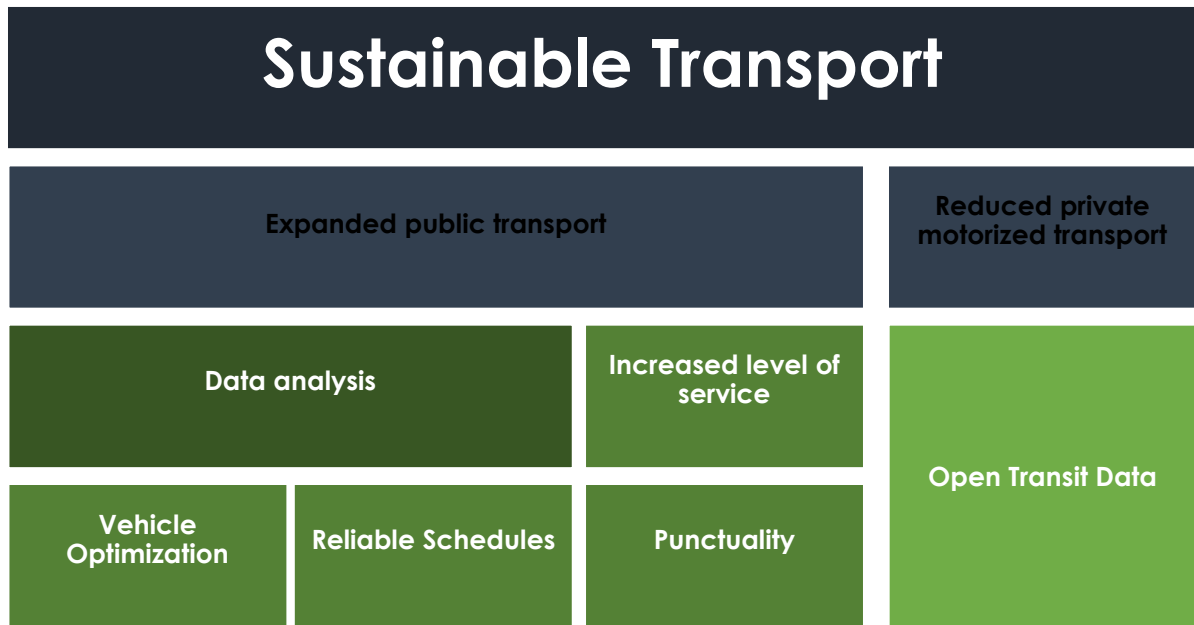
One key learning from the project is that developing new relationships among research organizations, technology providers, state institutions and civil society organizations takes investment of time and resources which do not yield immediate results. As the visual below shows, we need to invest time and resources into building long term relationships in local urban contexts among three key sets of actors – state transport undertakings, civil society and market agents and agencies committed to funding such collaborative work.

Figure 3: Three key sets of actors
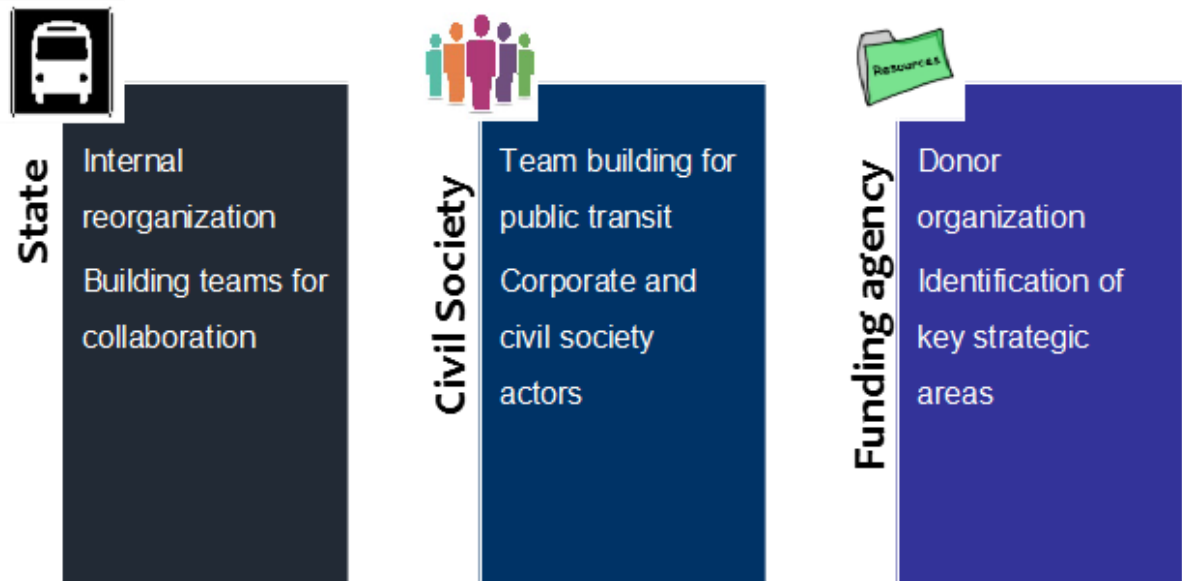
6.1.1 5.1.1 OVERALL INFRASTRUCTURE

It is clear that the TSRTC requires an overall improvement is aspects related to physical infrastructure, provision of street furniture and facilities like bu bays, bus stops with real time display systems on bus stops as well as within buses, training and upgradation of the staff of TSRTC, improving the routing systems, data collection, updation and management systems, transfer of real time database, public interface mechanisms, fleet improvement, operational efficiency, reduction in accident rates and higher compliance of traffic rules and safety records as part of the service improvement.

6.1.2 5.1.2 PASSENGER INFORMATION SYSTEM

The corporation requested the project team to help them on IT initiatives where the private players seem to have been taking advantage of the lack of capacity internally. It was agreed that TSRTC will look into the option of hosting the schedule data cleaned up by the team on its servers so that a web browser version of the Hyderabad Transit app can be created. TSRTC also agreed on working with the team on creating a template for static maps after testing one such map thoroughly at Koti medical college bus terminus.

It is felt that developing a smart public transportation information system can be a quick start for such a comprehensive improvement for the TSRTC.

6.1.3 5.1.3 SERVICE CONDITIONS OF CREW

Interviews revealed the grim working conditions of the crew. Women conductors complained about the lack of toilets and security in case of late night shifts. The union leaders also complained about the financial condition of TSRTC and the lack of support from the government. Though the unions have been effectively campaigning about these issues with the management, they lament the lack of response or opinion in general public. Working around these issues can help the corporation and in turn work in favour of public transport in Hyderabad.

6.25.2   AFTER LIFE OF THE PROJECT-WAY FORWARD

The meetings with Executive Director and Deputy Chief Traffic Manager of Greater Hyderabad Zone-TSRTC and previous interviews with the crew and union leaders opened up a slew of opportunities to work on.

6.2.15.2.1   BRINGING IN DATA EFFICIENCY

Interviews with the crew and union leaders revealed there is lack of understanding at depot level about the basic IT initiatives taken up by the corporation. Easy adaptation of ticket issue machines reveals that given support, the crew can work efficiently no matter what the IT initiative is. Hand holding measures at depot level in training the crew can be an area of interest for civil society organizations.

An interview with Depot Manager, Miyapur 2 depot revealed that there is enough data at depot level that is not being analyzed and put to use. Extensive amount of data is generated and stored as daily/ monthly reports of which only the financial reports are given priority and analyzed. The depot manager conveyed that often the data is not clean and there are several issues in the way it is collected and stored. This conversation and earlier work on understanding the bus route data revealed that there is a need to understand these structural problems with regard to data. Addressing these issues requires working with a network of depot managers.

After further discussions, It was decided that the team will work with the depot manager at Miyapur 2 depot to understand the flow of data and the problems attached to it. The sample interviews presented earlier provide an indicator that further discussions are required for broader understanding. A series of interviews with all of the stakeholder's right from conductors holding ticket issuing machines to the depot manager analyzing the data will give us a better sense of the problems with data.

It is possible to initiate a pilot at one of the depots soon to determine the issues with data.

A report on this can be made and solutions to solve these problems can be worked on in the future which could lead us to build a robust policy dealing with data in TSRTC.

### 6.2.25.2.2 TRAVEL DEMAND PROJECTIONS ALONG METRO CORRIDORS

The project team proposes to identify 25 data points within a transversal distance of 1 km from the metro for each of the routes to conduct a travel pattern survey. The survey will be designed in such a way that it can be carried out by a group of trained surveyors over different days of the week and at different timings of the day to capture a representative sample. The survey form will be shared with the RTC senior officials before finalization. Subsequent to the survey, six focus group discussions will also be held at different locations to gauge commuters preferences through an interactive discussion.

The results will be tabulated and shared with the report with a power point presentation submitted to TSRTC.

6.2.35.2.3   PROSPECTIVE VIEW OF THE COLLABORATION

TSRTC is currently facing severe stress on operational front due to human resource and financial constraints. Depot managers, route managers and key decision makers are doing their best to work within these constraints. Bringing about a shift in the data culture in such a situation requires a consistent medium to long term approach where in support in the form of resource provision and hand holding is provided by civil society and allied corporate actors.

Figure 4: Prospective view of the collaboration
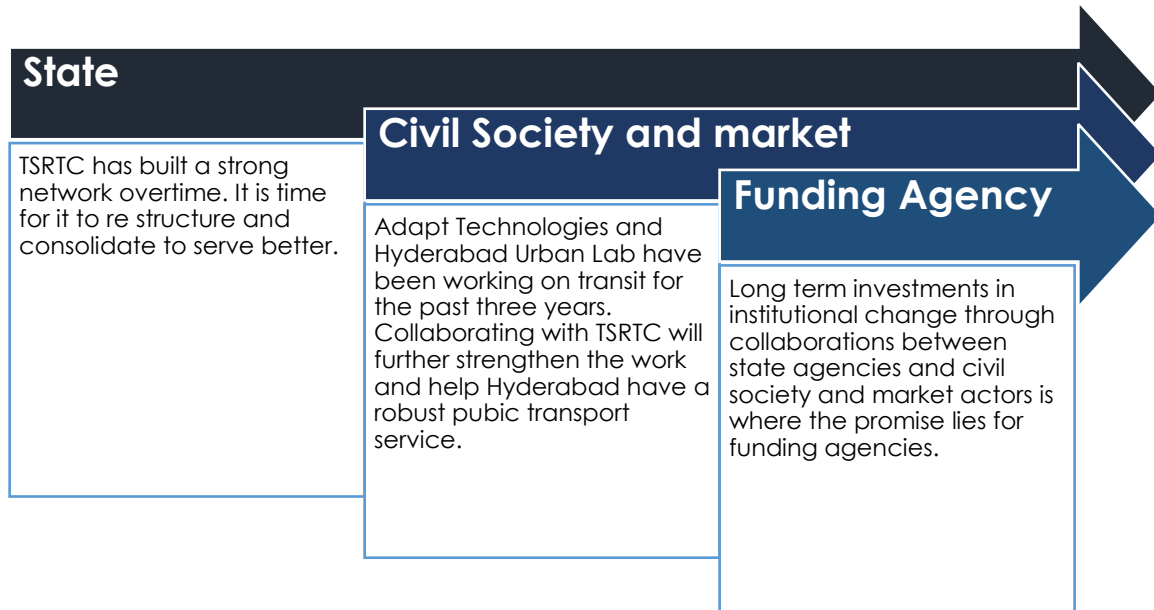
Large scale comprehensive computerized data management and e-governance system is required for TSRTC. Not just for the data capture and updation for also for digital methods to bringing overall efficiency in service provision. ***This can be undertaken in coordination with TSRTC and funding agencies***

~~6.2.4~~5.2.4   APP FOR REAL TIME DATA
Based on the dataset created, separate Public Domain App can be created for enhancing the passengers information system.

~~6.2.5~~5.2.5   CREATION OF AUTHENTICATED STATIC MAPS
The app developed is functional, stable and very useful for data collection. Once the information system is transferred into a specialised app, it is important that the commuters without smartphones should also have access to quality information about bus routes and their schedules. Inspired by the Dhaka Bus Map[9] by urban launchpad, based on the bus route analysis data, maps for major terminals and hubs where more passengers are likely to make transfers can be prepared in future. Also since the routes may change these static maps will require constant updation. In the longer run all information should be on digital display either on Bus Tops or within buses supported by static maps at specific locations.

On further consultation with TSRTC, the map can be tested on one of the new commuter amenity centers and assess the passenger's' reactions to the map so that a template can be designed for designing maps in the future and to be displayed/publicised appropriately .

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[9] Link: http://urbanlaunchpad.github.io/src/pdf/BUS-MAP_basemap_BETA-nov13.pdf

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~~6.2.6~~5.2.6   INFRASTRUCTURE FOR REAL TIME TRACKING

For real time tracking of the public transport it is necessary to build a good suitable infrastructure which includes- GPS enabled fleets, real time tracking system, Good organisational infrastructure of the authority/service provider etc.

~~6.2.7~~5.2.7   MULTIMODAL PUBLIC TRANSIT INFORMATION SYSTEMS

This report has focused on Bus transit system as a case and further support is required to understand the operations of rail based, metro rail systems, para transit, cab services etc.

~~6.2.8~~5.2.8   REPLICABILITY OF THE APP AND DASHBOARD

The website, dashboard and data are currently hosted on Hyderabad Urban Lab's servers. The "Routemaster" app is a general purpose application and can be used in any city in India. Some server side code is needed to gather and store the data submitted through the app. TSRTC has shown interest to host this data on their servers and make it a part of their website. Depending on the needs of other cities, the code can be worked on to include all the features, exclude a few or add new functionalities and be hosted on that particular city's desired/selected server.

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