Moving Towards an Intelligent Transportation System

IOT driven buses in Ahmedabad

CASE STUDY 5 | JULY 2019

POWERED BY TATA TRUSTS
ABOUT TATA TRUSTS

Tata Trusts are amongst India’s oldest, non-sectarian philanthropic organisations. Since its inception, Tata Trusts have played a pioneering role in transforming traditional ideas of charity and introducing the concept of philanthropy to make a real difference to communities. Through grant-making, direct implementation and co-partnership strategies, the Trusts support and drive innovation in the areas of healthcare and nutrition; water and sanitation; energy; education; rural livelihoods; natural resource management; urban poverty alleviation; enhancing civil society and governance; media, arts, crafts and culture; and diversified employment. The Trusts engage with competent individuals and government bodies, international agencies and like-minded private sector organisations to nurture a self-sustaining eco-system that collectively works across all these areas.

ABOUT DATA DRIVEN GOVERNANCE

The Data Driven Governance (DDG) Initiative of the Tata Trusts works with rural and urban decision making systems to enable inculcation of data as a way of life in the planning and delivery of government schemes – thereby creating significant impact for underserved and marginalized communities. This has been demonstrated through deployment of inclusive data and technology processes at district and city levels, through large scale partnerships with governments, central planning entities, foundations and philanthropies such as the Niti Aayog, Ministry of Housing and Urban Affairs and Tata Steel Rural Development Society.

The Urban Engagements under the DDG Initiative of the Tata Trusts provides directed technology and capacity building support to urban administrations at central and city levels through effective fore-grounding of city data policies, data standardization models, implementation of inclusive open data portals, improved civic engagement and skill building of municipal officials in data and technology practices.
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Data Driven Governance at Tata Trusts seeks to provide directed technology, strategic and capacity building support to strengthen rural and urban decision making systems. The objective is to improve government planning and delivery for inclusive development. Employing data centric tools, technology and planning provides insights into quantitative and qualitative development indicators, makes room for informed policy making, measurable performance indicators, facilitates meaningful collaborations and improves overall governance.

With the specific motive to create a ‘culture of data’ in cities across India, Tata Trusts launched the City Data for India Initiative in partnership with Canada-based World Council for City Data (WCCD). The initiative seeks to empower Urban Local Bodies to make data-informed decisions to improve city planning, infrastructure investment and operational performance management using International Organization of Standardization’s (ISO) standardized, comparable city data.

ISO 37120 includes 100 indicators (46 core and 54 supporting), structured around 17 themes, including economy, governance, education, health, shelter, transportation, environment etc. This exercise is currently being implemented in 8 cities, including the city of Ahmedabad.

As a part of the urban engagements within the Data Driven Governance realm of work, the Trusts are putting together a series of caselets illustrating the meaningful use of data in various city functions.

The objective of this series is to showcase best performing data initiatives in Indian cities, while promoting cross learning and sharing of best practices across cities.

This case study brings out how the city of Ahmedabad, an identified Phase 1 Smart City in the state of Gujarat has successfully deployed big data analysis and applied the Internet of Things (IoT) approach to build a smart bus system (Intelligent Transport Management System) which is easy to plan, merge and grow along with the expanding population of the city.
The Challenge

As one of India’s fastest growing scientific and industrial hubs, the city of Ahmedabad was among the first 20 cities selected for government’s Smart City Mission. The thriving economic environment of the city attracts many individuals to the city, leading to an increased pace of migration to the city and urbanization. In order to ensure that all citizens of the city have equal access to services - education, employment and safe environment and to avoid spatial discrimination, it becomes essential to have an efficient transportation system at affordable prices.

Ahmedabad’s two major bus services Bus Rapid Transit (BRT) and city bus Ahmedabad Municipal Transport Service (AMTS) transport 0.8 million passengers daily across the city\(^1\). Despite affordable ticket prices, the bus services were underutilized due to customer concerns over quality.

The previously manually operated system suffered from poor route planning, lack of advertised bus schedules, bus-bunching, excessive waiting time, rough driving, stop skipping, and inconvenient or inconsistent cash collection.

A lack of transparency also resulted in higher operating costs and poor customer complaint handling. The city authorities were keen to upgrade to a cashless, software-based bus service system backed by advanced information and communication technology to help reduce expenses and problem-response time.

The Solution

A. Intelligent Transport Management System

In recognition of the importance of an efficient public transport, Smart City Ahmedabad Development Limited (SCADL) has partnered with NEC. NEC Corporation is a Japanese multinational provider of information technology (IT) services and products. It provides IT and network solutions to business enterprises, communication service providers and government agencies.
SCADL has partnered with NEC to upgrade the city's manually operated, often erratic bus transit infrastructure with a seamless, safe and reliable intelligent transport management system. Intelligently applied Internet of Things (IoT) and big data analysis technologies can enable the city to build a smart bus system that is easy to plan, merge and grow along with its expanding footfall. Services offered span across 230 BRT buses, 158 BRT stations, 850 AMTS buses, 2500 AMTS bus stations.

B. How was it implemented

The new Intelligent Transport Management System (ITMS) improves the efficiency of BRT and AMTS bus services using a cashless open-loop card system. In addition to automated fare collection, the one-stop, IoT-driven system manages bus resources, bus maintenance, transport information, and personnel. It also collects and analyzes data to help optimize resources, and boost ticket sales. The ITMS incorporates five smart transport sub-systems:

i. Automated Fare Collection Service (AFCS): Quick and secure cashless payment via prepaid RuPay card or smartphone ensures greater convenience, passenger safety and ridership visibility.

ii. Automatic Vehicle Location System (AVLS): Real-time visualization of vehicle location via fitted GPS enables the city to calculate estimated time of arrival and support bus operations from a central command center to adhere to a planned schedule.

iii. Passenger Information System (PIS): Provide real-time bus information via mobile app, website and in-station boards to enable passengers to plan their route and estimate waiting and arrival times. Route and bus stop information is also provided via on-board displays and announcements.


v. Depot Management System (DMS): Allocate and optimize crew and overall bus operations by automating the management of vehicles, fuel, inventory, personnel, and vehicle maintenance.

Incident management systems also enable operators to track incidents such as equipment failure and bus accidents throughout the incident lifecycle. Further, all buses and bus stops have CCTV cameras installed for citizen safety.
“Throughout this project, NEC Technologies India orchestrated a group of 20 vendors and partners scattered worldwide because our primary motivation is to build synergies, and leverage our transportation solutions portfolio and ICT to create advanced social infrastructure, and improve India’s society,” stated Shumpei Fujii, Head of the Transportation Business Unit at NEC Technologies India. The operation and maintenance of the buses are outsourced to a private vendor.

All data collected in the buses through IOT devices gets sent to the back end system on a daily basis. The backend system has been developed in a standard interface format to interpret and understand data from different devices and ensure standardization of all data collected.

If data from any device does not get sent to the backend due to unforeseen technical lapses, then the data gets stored in the device. As soon as connection is restored, data is sent to backend. Every 3 hours, the data gets automatically backed up from all devices and is replicated at disaster recovery site. All of the data collected is owned by Ahmedabad Municipal Corporation.

Data from each service is analyzed at the Integrated Command and Control Center against key performance indicators to create more efficient and dynamic bus service operations, and a smarter, safer travel experience for commuters, across the ticketing, in-station and in-journey stages. The information includes whether the designated travel routes are adhered to, the stops at which the bus stops, how long does the bus stop for, number of passengers on each bus, professionalism of the driver, driving of the driver, bus delays etc.

If the analysis reveals any shortcomings in the operations, then an appropriate action is taken by human personnel at ICC, according to the prescribed statement of purpose. Usually, in case of a minor hindrance, the driver is immediately contacted by ICC. It is a two way communication and the driver too can contact the ICC in case of any hindrances in the operation.

If the issue can’t be resolved immediately then a complaint ticket id is generated through an automatic ticket disclosure management system, and further action is taken by coordinating with concerned Municipal Commission Department.

“The comprehensive system offers the operator a plan-do-check-action optimization cycle that not only executes specified plans but also evaluates those plans by visualizing operation performance. Real-time visualization of running buses and fare revenue enables operators to easily detect irregularities and swiftly determine countermeasures,” explained Shumpei Fujii.
C. Solution Enablers

The operation and maintenance of the buses are outsourced to private vendors and the remuneration is on a performance basis. In the pre-digitised era, fabrication of reports and leakage of large sums of public money were common practices, as all information presented was manual and there was no mechanism in place to validate the data that was being presented. Since the adoption of IOT devices, every single detail about the movement of the bus - the route followed, duration of stops, no of passengers on it in a day, professionalism of the driver, driving of the driver etc., all of it is recorded and can be validated.

The new highly transparent system was initially resisted by the bus drivers and staff on ground as it hindered any payments for which there was no data available. Often the IOT enabled devices in the buses were hampered with, resulting in breakdown of devices. The support of middle-top agents, especially the leadership of Municipal Commissioner and CEO, Smart City was key to the implementation process. Along with this, engineers were deployed on ground to ensure smooth functioning, random checks were conducted.

i. The introduction of a software based system makes the system more transparent. Eg: Service contractors are now remunerated on the basis of concrete parameters like total kilometers driven, professionalism of the driver, adherence to route and safe driving

ii. Efficient commuter management has reduced ques and waiting time

iii. Innovative Vehicle Scheduling and Dispatch System Software allows to modify transit routes and dispatch vehicles according to need

iv. Geographical Information Management System, by making data available, allows the government to save approx. Rs. 60 Lakh per month

v. Automated cashless payment system keeps in check payment frauds and makes it possible to track payments

vi. Analytical tools supports all levels of decision making

vii. SCADL is now looking at developing multi-modal travel services spanning BRT, metro, railway, monorail, taxis, etc. and offering seamless services supported by integrated operation and ticketing platforms

The Impact

Launched in 2017, the intelligent transport management system is already helping develop efficient and convenient bus transport services.

Lessons Learned

i. The use of real-time data can yield tangible results both in terms of cost savings as well as driving better performance for public services being offered by the municipality.
The bus transit system in Ahmedabad is a case in point, and such use cases can be extended to other cities as well as other services.

i. Bus systems are mostly used by commuters for daily work and also students, and hence reach a sizeable population across the city. Efficient bus services further serve to encourage commuters to utilize public transport and can be an effective way to bring down the carbon footprint as well. While this case does not specifically look at this aspect, the linkages between efficient public transport and better air quality levels have been well documented.

ii. Success of any ITMS implementation depends on the ownership by the top management of the Public Transport Operator (PTO) agency. Unless the top management is involved in the intervention, individuals involved in other levels of management never take it seriously.

iii. PTO, Project Management Consultant (PMC) and vendor have to work as a cohesive team to ensure timely and successful implementation.

iv. Clarity on scope & objectives of ITMS implementation and agreement by all stakeholders is the most critical aspect for successful implementation. The quicker it is achieved, the better it is.

v. As the operations and maintenance of buses is typically outsourced to third party private operators, it is very important that these operators are also taken on board in the early stages by PTO. Since the private operators are the ones who will be using the ITMS/AFCS systems on a daily basis, ownership by them is equally important.

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**Endnotes**

1. The information used in the section was retrieved from NEC’s website
2. The information for this case study has been developed with the support of NEC.
Abbreviations

AFCS  Automated Fare Collection Service
AMTS  Ahmedabad Municipal Transport Service
AVLS  Automatic Vehicle Location System
BRT   Bus Rapid Transit
DMS   Depot Management System
ICCC  Integrated Command and Control Center
IT    Information technology
ITMS  Intelligent transport management system
NUIS  National Urban Innovation Stack
PIS   Passenger Information System
PMC   Project Management Consultant
PTO   Public Transport Operator
SCADL Smart City Ahmedabad Development Limited
VPSD  Vehicle Planning Schedule and Dispatch System
WCCD  World Council for City Data

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