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BUS TRACK USING IOT AND PREDICTION LOGIC

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ABSTRACT

Metro cities in India are expanding very rapidly and so are the public transport corporations to connect various parts of the city to cater the growing demand. The market has an inclination towards saving time and expects convenience at cheaper cost. The project aims to address the above needs using the existing resources, the MTC buses with a minor upgrade. The Bus Track system provides solution for tracking the buses on smart phones, fetches current occupancy and prediction of occupancy at upcoming stops to make wiser decisions, regulated flow of buses to maintain frequency of the buses on the route. Real time bus location tracker and occupancy details is provided by an IoT device that gives location data using GPS and updates the occupancy details through internet using mobile network. The bus conductor's handheld ticketing machine sends data about the number of people who are traveling in the bus based on their boarding point and destination. Bus arrival and crowd prediction is done by fetching location and occupancy data from the IoT device to the user interface. Prediction of seat occupancy at upcoming stops to make commuter take wiser decisions is also done additionally. Alternate bus connections are suggested based on bus location and occupancy. A website or an application interface is implemented to map the buses plying in differ-ent routes. It displays bus details, current occupancy, and predicted occupancy for upcoming stops, estimated time of arrival and duration of journey. Alternate bus connections to the destination with their journey duration and occupancy details are given through rerouting. The resultant of the project would a system comprising of IoT device and cloud to perform

predictions and fetch data to smart phones which would help the time bound working class of the city to plan efficiently without compromising on their choices and opt for public transport, which in turn would reduce pollution levels and traffic on roads.

Key words: IoT, Prediction Logic, Smart phones, Tracking System.

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1. INTRODUCTION

Metro cities in India are expanding very rapidly and so are the public transport corporations to connect various parts of the city to cater the growing demand. The market has an inclination towards saving time and expects convenience at cheaper cost. The project aims to address the above needs using the existing resources, the MTC buses with a minor upgrade. The Bus Track system provides solution for tracking the buses on smartphones, fetches current occupancy and prediction of occupancy at upcoming stops to make wiser decisions, regulated flow of buses to maintain frequency of the buses on the route. Real time bus location tracker and occupancy details is provided by an IoT device that gives location data using GPS and up-dates the occupancy details through internet using mobile network. The bus conductor's handheld ticketing machine sends data about the number of people who are traveling in the bus based on their boarding point and destination. Bus arrival and crowd prediction is done by fetching location and occupancy data from the IoT device to the user interface.

Prediction of seat occupancy at upcoming stops to make commuter take wiser decisions is also done additionally. Al-ternate bus connections are suggested based on bus location and occupancy. A website or an application interface is implemented to map the buses plying in different routes. It dis-plays bus details, current occupancy, and predicted occupancy for upcoming stops, estimated time of arrival and duration of journey. Alternate bus connections to the destination with their journey duration and occupancy details are given through rerouting. The resultant of the project would a sys-tem comprising of IoT device and cloud to perform predictions and fetch data to smartphones which would help the time bound working class of the city to plan efficiently with-out compromising on their choices and opt for public transport, which in turn would reduce pollution levels and traffic on roads.

2. PROBLEM STATEMENT

The common problems faced by commuters of public transport in metro cities are that the bus-es are overcrowded during the peak hours and have uneven arrival intervals. The occupancy of the upcoming bus is also unknown which amounts to added stress. Post stressful day at office which is situated in Industrial areas and IT hubs which house similar other companies a lot of employees rush towards the bus stop to catch their bus.

When a bus arrives the possible chances are:

The bus has seats available

The bus doesn't have seats but has standing space.

The bus is crowded and one would have to squeeze in to board.

If the seats are available he may board the buses as it offers good comfort. But the bus may have long route to the destination and might not be suitable for people with time constraints. For someone with commitment post work with time constraints, one might not bother about standing or squeezing into a crowded bus.

What if the bus arrives crowded and is bound to get empty in just two stops, the uninformed waiting individual who wouldn't mind the lack of comfort for 2 stops if he could travel with comfort for the rest of the journey, misses the bus and waits for the next bus? He had just missed a good chance that matched his preferences just because he was uninformed or couldn't predict.

For an average individual, considerable amount of convenience and time taken would be preferred.

There is a need for a system that helps commuters make in-formed choices based on their preferences and priorities.

3. LITERATURE SURVEY

3.1. Chennai MTC's Bus tracking System

The MTC had introduced GPS tracking on a pilot basis and within few months of trial it had gone back to the old method of tearing and issuing paper tickets as the hand held Electronic Ticket Machines became dysfunctional as the new ones fitted with GPS didn't work properly. GPS fitted with ETM machines were used in over 200 buses on a trial basis, but were a fail-ure as it took too much time in dispensing ticket. The conductor punches the codes for the boarding and destination

The drawbacks were severely felt as the old ETMs took 4 seconds while the new ones took close to 8 seconds to dispense a ticket, which is almost twice the time taken. The charge in ETM's battery lasted only for three hours. The conductor had to carry two machines and the ticket book while it only took a maximum of two seconds to provide tickets manually. Maintenance of these machines was a daunting task and machines were convenient only if they were maintained properly. Battery in the ETM could not supply the required power for both GPS and existing ticket printing module simultaneously which was found to be a failure in this initiative. To tackle the above problem a constantly powered module within the bus would have served better. A constantly pow-ered IoT device equipped with GPS and GPRS would have made the initiative a success. The Govt. had procured the on board units at a cost of Rs.13,000 per unit was costly for a state run public transport corporation which has strict budget constraints and is bound to offer service at affordable cost despite increase in the operational cost.

3.2. BEST Buses, Mumbai

The Brihanmumbai Electric Supply and Transport, a state owned and operated service in Mumbai has planned to introduce bus tracking system which would locate the buses and fetch them on the user's app. Initially in 2012 a different system was proposed wherein the stops were marked with codes. User had to SMS source stop code and destination stop code to a number which returned with a reply message containing the upcoming bus and its estimated time of arrival at the source stop. Online ticketing was also introduced on a separate website where users had to visit the website which was mobile friendly and had to enter their trip details followed by online payment. Upon completion of the process an e-pass would be given which should be shown to the bus conductor in order to avoid ticket on board the bus. The

system was widely criticized for poor execution and the system wasn't user friendly either. This led to a look-out for a new system

high cost. It had already incurred 700Cr loss in last two years and the newly proposed system doesn't seem flexible to the future's needs and hence is being widely debated. It plans to include CCTV surveillance system on its buses but economic viability is to be still assessed.

3.3. Online Cab Aggregators

Prior to online cab aggregators like OLA and UBER the market was dominated by radio call tax-is. The booking was made through phone calls and also through online booking, which didn't have a wide reach though. The taxis were equipped with GPS+GPRS for trans-mission of location coordinates and radio communication sys-tem to communicate about new rides by providing the details of the customer through radio. It was very costly to implement and wasn't effective either. Human intervention was always needed to relay the customer information on radio and GPS+GPRS module were used to locate the cab for the control station and was later made available to be viewed online on their website. New cab aggregators like OLA followed by UBER came up in India who marked an end to the reign of radio call taxis. But instead of equipping their cabs with conventional IoT modules they chose Smart phones instead as they offered same utility as that of an IoT module. Chinese smartphones were starting to get dirt cheap and smartphones offered better flexibility as the changes can be made through over the air updates and hence the system could be modified using the existing hardware at lower cost depending on the changing business needs. Ola and Uber introduced a new sys-tem where assignment of cabs to customers was automated using a distance logic, payment wallets were integrated for easy billing and log maintenance. Soon share and pooling ser-vices were introduced which accommodated customers seeking to travel on the same route and the cost was up to 70% lower than the usual fares. Every driver is provided a smart phone with an app that provides the coordinates through the phone's GPS. Notifications about new customers are also pro-vided through the smart phone. Low cost of deployment and maintenance, good ride allotment algorithms and efficient technical team has led to the success of these ventures. The above case study shows how ventures have dumped conventional IoT systems and have the leveraged the availability of the low cost of smart phones. They have indeed made an approach in a different dimension and have clearly succeeded.

3.4. Inference

From the above case studies we infer that:

For a reliable tracking system the module on board should be constantly powered.

It shouldn't hinder the functionality of other core processes such as ticket vending, power systems in the bus and electrically operated hydraulics (If any).

Cost should be low and modules used in the system should be reusable.

It should accommodate developments for changing business needs at low cost and effort.

The system should be user friendly to operate for both drivers and the passengers.

Technologies used in the system should stay relevant for the near future, for at least 5 years.

SoC driven Smart phones on the whole, with decreasing cost are outperforming conventional microcontroller driv-en IoT devices.

Business logic and feasibility matter more than technological advancement when solving real world problems.

4. HARDWARE AND SOFTWARE SPECIFICATIONS:

Hardware Requirements

Android and GPS enabled smartphone Storage space of 30MB is suggested Minimum of 50MB of free RAM Internet connectivity

Software Requirements:

Android 4.0 or above

5. PROPOSED ARCHITECTURE

Bus Application**:** This application uploads data to the database located in a server. The data contains details of location of the bus, number of available seats and ticketing details.

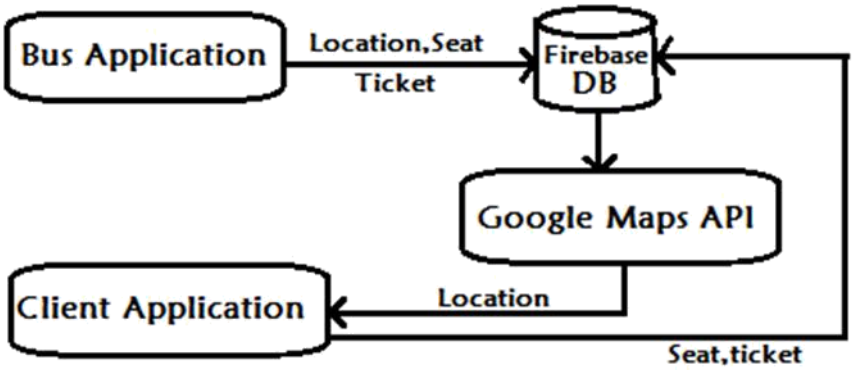

Figure 1

This may also be known as the server application because it creates and transmits data. This application plays a significant role as the backbone of the whole tracking system. The importance is because of the data that it delivers, it is very sensitive with respect to the environment.

Client Application: The client application displays the Bus location by retrieving data from the database through the Google Maps API. The client application also has additional features like getting to know seat availability details and purchasing of a travel ticket through the interface itself. This is the end user's interface, people who wish to use the BusTrack system's service must install the client application to their smartphones.

Google Maps API: The API provided by Google to integrate maps into the system plays a major role in displaying the location of the bus to the client. There is a necessity that we rely on APIs like this because it is a reliable service provider.

There are tools which help us integrate the map into our system in Google Maps API. The API will facilitate as a gateway between Google maps and the Application software that is developed.

Firebase DB: This is a real-time database that is used to store and retrieve all the information that we use in our system which includes location data, seat occupancy and ticketing details. The main advantage of using Firebase is that it is well implemented Real-time database. Integration of Firebase with Google Maps and Android applications are very convenient and developer friendly. Updating details from one app to another app is facilitated by this amazing real-time database. **Interactions in the Architecture:** The Bus application interacts only with the Firebase DB to update the data. The Google Maps API is connected to both the Client application and Firebase DB. It gets location data from Firebase DB and plots it in the Map in the client app. The client app is additionally connected to the Firebase DB to obtain the details of seat availability and ticketing purpose.

6. INTERACTION SCENARIO

The Administrator overlooks the system and its operations. The Bus application has control over all the data related to the particular bus. The client app gathers information from all the bus applications to show which bus to select. The route of that specific bus is also shown to the user and therefore it lets him decide which bus to choose. This will increase the chances of the person to use the app next time before planning a bus journey. Although Admin has permission to access all the data, he limits himself to sensible data. The admin wants to keep the data of location and seat capacity as his primary log for research purpose. Admin can block the usage of specific users who try to corrupt or modify the system for illegal or irrational purposes. There is a necessity to keep all the data in secure database which is to be maintained in such a way that data can mined to obtain useful results in future.

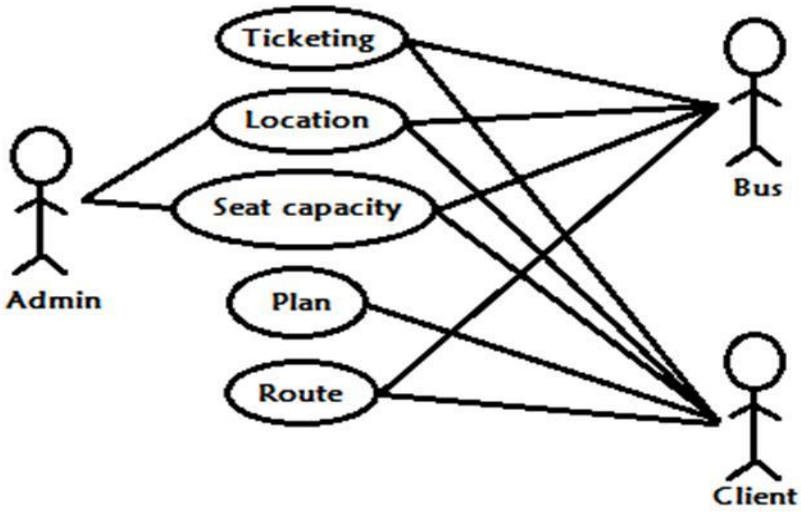

Figure 2

The main purpose of appointing the Admin is to maintain discipline in the system. If he were not present it would form a P2P network system which not reliable and is prone to a lot of major issues.

7. METHODOLOGY AND APPROACH

Basic Methodology: Each bus is equipped with a smartphone. We create an application which transmits data about the location of the bus. It also includes the occupancy details and seat availability of the bus. The data about the occupancy is collected in many ways.

Ticket count and seat occupancy: The ticket count is up-dated whenever a ticket is issued and at every bus stop. This helps us to maintain a precise count. People inside the bus can also

contribute to this. Adding on to this, we also have the data of occupancy on similar days, we show up a predicted value as seat probability in the bus.

The Client Application: The client application shows various details about the bus. The real-time bus location, route, seat availability and much more. We get the information about the bus arrival timings and the time it will take to reach the destination.

Data Availability: All the data is stored in the cloud, making it completely accessible to every user. We also share the ticketing database of the bus. This facilitates the user and bus operators because there is auto accounting for the tickets. The extension of this application could be limitless, we can integrate almost all the tasks in the bus into this system.

Modern Approach: Right now, we live in a world where we are using smartphone applications for everything. The approach of putting our idea of tracking buses into an application makes it possible to reach the public at a faster pace. A major part of the Indian population is equipped with a smartphone. Hence a lot of people can use this BusTrack as a service to make their commutation easier and better.

The approach that is followed in the project is up to date. It has been developed with the current trends into valuable consideration. This system is designed in such a way that the interface is intuitive to use. The consumer need not take much effort to use the application. It occurs quite naturally that the interface is easy to use for almost all sorts of people. The whole point of putting this system into an application is to make it widely available to a variety of people to make their travel better.

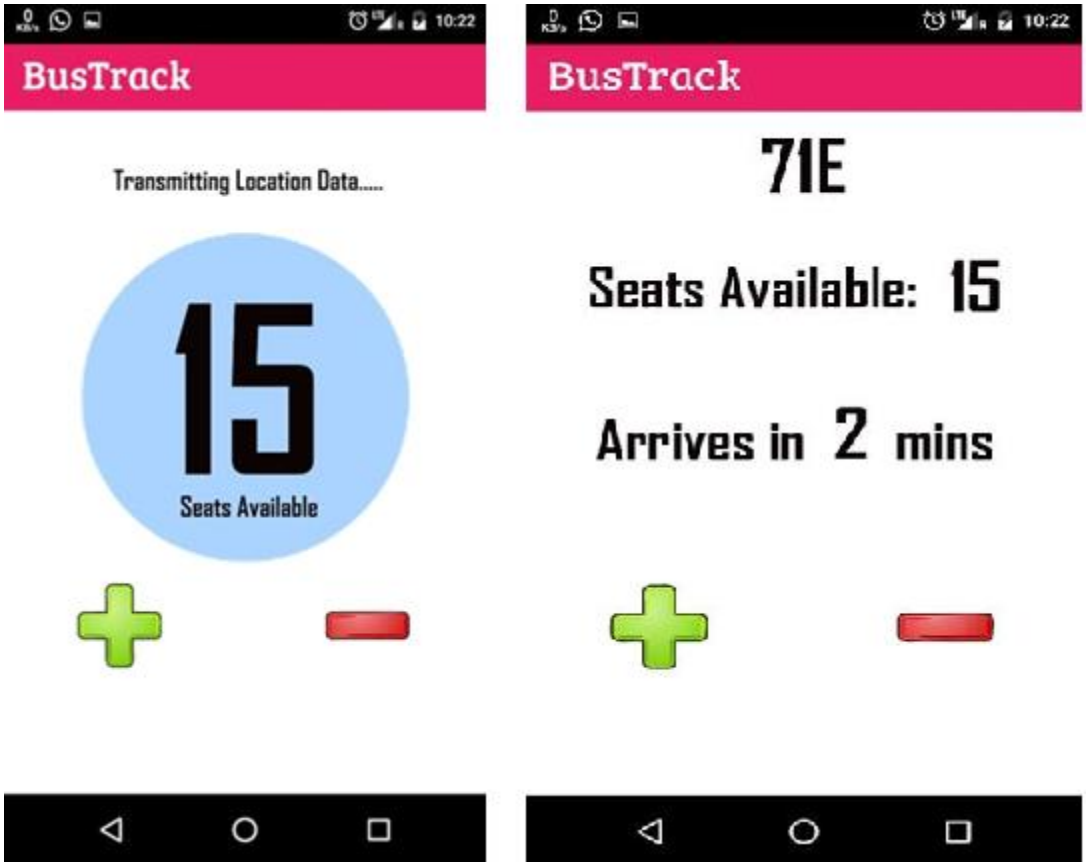

Figure 3

8. OUTPUT AND RESULT

The result is an amazing application based bus tracking system which is easy to use and highly appreciated. The application enhances the user's travel experience and makes him a smarter person. There is real-time data collection involved, this creates a good base for huge chunks of valuable data to analyze bus and traffic related purposes. A common man can plan his day which will include the bus journey and therefore his day stays planned according to his necessity. This is an intelligent system which in future will have integrations with Google Now and therefore be an more accurate and easily accessible to people at the touch of their smartphone. The resultant system aims to create a digital environment foe people in India. This system would help digitalize the ticketing system of metropolitan buses thereby solving accounting and ticket printing issues. The system as such, is a useful necessity which will facilitate and add comfort to the travellers.

9. CONCLUSIONS

The main purpose of development of this system is to solve the problem that people face while trying to board a commuting bus in a metropolitan city. This has been intelligently solved by using methods that are easy to use and of appreciable quality. The system on reaching out to the public will create an impact by saving their time, money and effort. The primary aim of the application will get fulfilled when such a situation occurs.. The problem was taken into consideration to solve because of the significance of the issue and hence been given a solution which is flexible to changes and updates in future to make it a crowd sourced initiative.

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