Smart E-Ticketing and Payment Systemusing Wi-Fi for Public Transport Bus

Mr. Shivaprakash H V, Systems Engineer, Infosys Limited.

Abstract:

This report document presents the solution for the e-ticketing in the public transit bus. Today, in the era of Digital India and cashless economy, public transport needs to adapt the technological advancement. The public transport buses are providing the most satisfactory services; there is a need to switch the system into smarter. The major problems experienced by the commuter and the conductor are the change issues and network issues while making a cashless payment while traveling on the public transport buses. The proposed smart application that helps the commuter to track the complete information of bus, seat number, remaining distance of his destination, the total number of passengers traveling, and easy payment mode, thereby promoting digitalization and smart cities initiatives. The e-ticket generated that can be verified by the bus conductor. For better convenience and understanding, the application will be available in multiple languages. The introduction of contactless payments alongside the success of e-ticketing is pivotal as we continue to make bus travel a convenient, simple, and attractive experience, encouraging more people to travel by bus. The combination of journey planning, free Wi-Fi, real-time information, contactless, and e-ticketing ensures travel by bus is an attractive option for many customers and their journey needs.

Keywords: *Digital India, Technological Advancement, Cashless payment, Wi-Fi, Contactless*

INTRODUCTION

Buses are the most popular and convenient mode of transportation in India. More than 1.6 million buses are registered in India, and the public bus sector operates 170,000 buses carrying roughly 70 million people per day. As per the details of expenditure on transport, buses are the most preferred mode of public transport in both rural and urban India, followed by auto rickshaws. To serve these many commuters daily, the ticketing facilities available in the existing system of public bus transport are manual i.e., purchasing the ticket from the conductor. However, bus transportation has not been able to meet the needs of the growing travel demand. The problem with bus services is that they are not reliable. Several problems exist in the public bus transport sector which includes wastage of too much paper, use of cash for purchasing tickets, etc. Some other common problems faced by commuters in bus transport are an inadequate time for getting tickets, non-refund of balances, etc.

To overcome all the above-mentioned problems, we have proposed a more advanced system which provides e-ticketing and other necessary information facilities for the civilians. The problem of paper wastage can be overcome by the use of E-tickets whereas the use of cash can be reduced by using a Digital wallet.

E-TICKETING

E-Ticket abbreviated as electronic ticket is the digital form of paper ticket. An e- ticket system is a more efficient and reliable method of ticket entry, processing and marketing and used for companies in the airline, railways and other transport and entertainment industries. E-Ticket is usually referred as a travel card or a transit card. In our proposed system E-Ticketing is used for public transport bus. E-ticketing systems have achieved worldwide renown and public transport can surely benefit from these technological advances [1]. E- Ticket will contain the following information like ticket number, bus number, departure location, destination location, fare, number of tickets, total number of commuters, etc. E-Ticket will be generated in smart phones or as an SMS in feature phones.

Need for E-ticketing.

An e-ticket offers many advantages for commuters, including security, flexibility, cost and convenience. At the same time, it also provides the standard assurances of the traditional paper ticket. There's also less risk of stolen or lost tickets for the ticket buyers.

The following are the features that describe the need of e-tickets :

- Commuters can buy the e-ticket online, without intervention of conductor [2].
- Commuters can pay for the e-ticket using no cash but by digital wallet [3].
- If you buy a physical ticket, there's a risk of this getting lost. The great thing about e-tickets is youhave 100% access to it.
- The e-ticket is securely maintained in the electronic form [4].
- The commuter does not need to carry the tickets in hand.
- To maintain transparency between public transport bus company and conductor.
- Tickets can be bought and used immediately.
- Easier and faster communication between the customers and the company.
- Company saves resources and speeds up the management process.
- Last but not least, buying an e-ticket online reduces your carbon footprint and it's the little steps thatmake a difference in a sustainable future.

These prove two important facts:

i. There is a progressive introduction of electronic tickets in different kinds of services.
ii. Mobile phones are the main platform for e-tickets.

LITERATURE REVIEW

In this section, we will survey in brief on the various literatures which are based on the Information and Communication Technology (ICT) usage in public transport towards tracking of bus. In the research papers, we have observed that GPS technology is been employed for tracking of bus location and scheduling. This has been achieved in some states in India (e.g.: Maharashtra) where the government has developed a GPS enabled Bus Rapid Transit System to meet the transportation needs for increasing the security and reliability of the system. BRTS aims to combine the capacity and speed of a metro with the flexibility, lower cost and simplicity of a bus system [5].

Other countries like Canada use refillable smart cards, provide one-week passes, or offer electronic systems for payment. In the city of Calgary, the users would download an app in their smart phones and create an account that would allow them to purchase a fare that would activate upon boarding a bus. When required to show their ticket, mobile users would simply show the officers a virtual ticket on their Smartphone [6].

Also in other research papers, the security of the system and its database is another important aspect. Software problems that occur in distributed database systems may involve data management, transaction management, and database recovery [7]. The proposed architecture incorporates the needs of the metropolitan transportation system with persevering the security requirements of the user and enhancing the privacy of commuters. The research was also done on the privacy concerns for collecting the personal information of the user and then aggregating and centralizing information. User account used in public transportation enables the tracking of the user with data tracking which is stored on the central server [8].

Karnataka State Road Transport Undertakings (SRTUS) are going big on Wi-Fi enabled on-board infotainment services. While KSRTC (Karnataka State Road Transport Corporation) has installed the facility in 1,800 buses, including premium and non-AC ones, BMTC (Bangalore Metropolitan Transport Corporation) is providing the service in about 150 Volvo buses so far. Passengers can access movies, television shows, and music through their smart phones. Stickers bearing instructions have been pasted on seats to guide passengers. "Users can browse the internet at 4G speed." The move is expected to encourage more people to switch topublic transport [9].

So far from the literature review, GPS, Wi-Fi, and other technologies are deployed towards the cashless public transportation system. So, with the consideration of these technologies, we have proposed a novel system, in which the GPS and Wi-Fi enabled device is within the bus and this device would help us to know the bus-id and the route information and to each GPS enabled device, id is given for tracking the location and bus-id.

PROBLEMS IN EXISTING SYSTEM

Transport problems are not common for all the places, but they exist everywhere. Further, transport problems are mainly due to non-availability of alternative modes and inadequate transport services. Even though the public sector transport buses have been providing satisfactory services, there is a feeling that these services

are unreliable. Following are some of the most common problems in the existing system faced by thecommuters:

A. *Inadequate time for getting tickets:*
Sometimes, the buses are so crowded, and the travel distance is so small that getting a ticket result into chaos.Finding the conductor and getting a ticket in crowded buses is the biggest problem in peak hours.

B. *Conductors cheating the bus companies:*
Many conductors have been caught pocketing the fare money by not issuing tickets to passengers.

C. *Excessive waste of paper:*
The amount of paper required to generate bus tickets is far too high as almost all the passengers take tickets except those having passes. This results in excessive paper waste which can be stopped by generating e-tickets.

D. *Non-refund of balance:*
In some cases, it is possible that both the commuter and conductor do not have change. In these cases, the conductor may not refund the balance to the commuter. Moreover, most of the commuters do not co-operate with the conductor by tendering the exact amount of fare. For instance, giving a hundred Rupees currency note for a twenty-six- twenty-eight Rupee ticket may irritate the conductor, especially when the bus is overcrowded.

E. *Use of cash:*
Passengers buy tickets using cash which contradicts the system of cashless economy. There is no other way to buy tickets from the conductor except of cash. This opposes the initiative of the Indian government to go cashless.

PROPOSED SYSTEM

By considering the problems from the existing system, a more advanced system has been proposed. In the new system, the user will be asked to register once at the start. The application proposed will allow users to get a bus ticket, remaining destination, and intermediate stops update.

The user must connect their Smartphone with bus Wi-Fi. The range of the Wi-Fi would be only within the bus limits. Once, the user device is connected to the Wi-Fi the window pops up on the user phone without any installation or they can download it too. The user must scan the QR code (unique for each bus) pasted on seats, will be asked the user to provide the destination while the source will be auto filled by taking into consideration of GPS location. The user's auto-filled source location will be verified automatically by using the current location of the bus (Bus with installed GPS/ GPS enabled device with the bus conductor).

Our application will calculate the fare. The appropriate amount for the ticket will be deducted directly from the user's account which will be provided by the user at the time of registering or using an existing e- wallet like Pay Pal, Google Pay, Phone Pe, Paytm, etc. to support the cashless system. The amount deducted is directly credited to the bus company's account. On successful completion of payment, an acknowledgment will be generated, which would contain information such as ticket number, source and destination of the route, date& time of ticket generated, seat number, bus number, and bus depot, etc.

If a user changes his/her mind, they can leave the bus in any of the stops between the source and destination of the route, can cancel the ticket, the traveled amount is deducted, and the remaining amount will be refunded to the users account as per the return policies of the company.

The bus conductor will now just have to verify the ticket and the seat number.

Considering a case where the commuter does not have a smart phone and illiterate, they can have the ticket from the bus conductor.

Sensors were installed in both the doors of the bus, to get the total count of passengers in the bus, and it is updated to the company's system regularly.

IMPLEMENTATION

For implementation purposes, an application needs to be developed which will have a basic registration page asking for user personal information and a login page. The user must log in every time if they do not install the application, or if the user changes his/her phone or uninstalls the application, the user would be asked to

login otherwise not. Once the user is connected to bus Wi-Fi, automatically the window pops up on the user'sscreen, or they can use the installed application too.

The source of the user is updated by using GPS location. When the user books the ticket by providingthe destination, an appropriate amount and an acknowledgment e-ticket would be sent to the application.

All the above information would be stored in a database which would be real-time. Implementation isexplained using the figure 2.

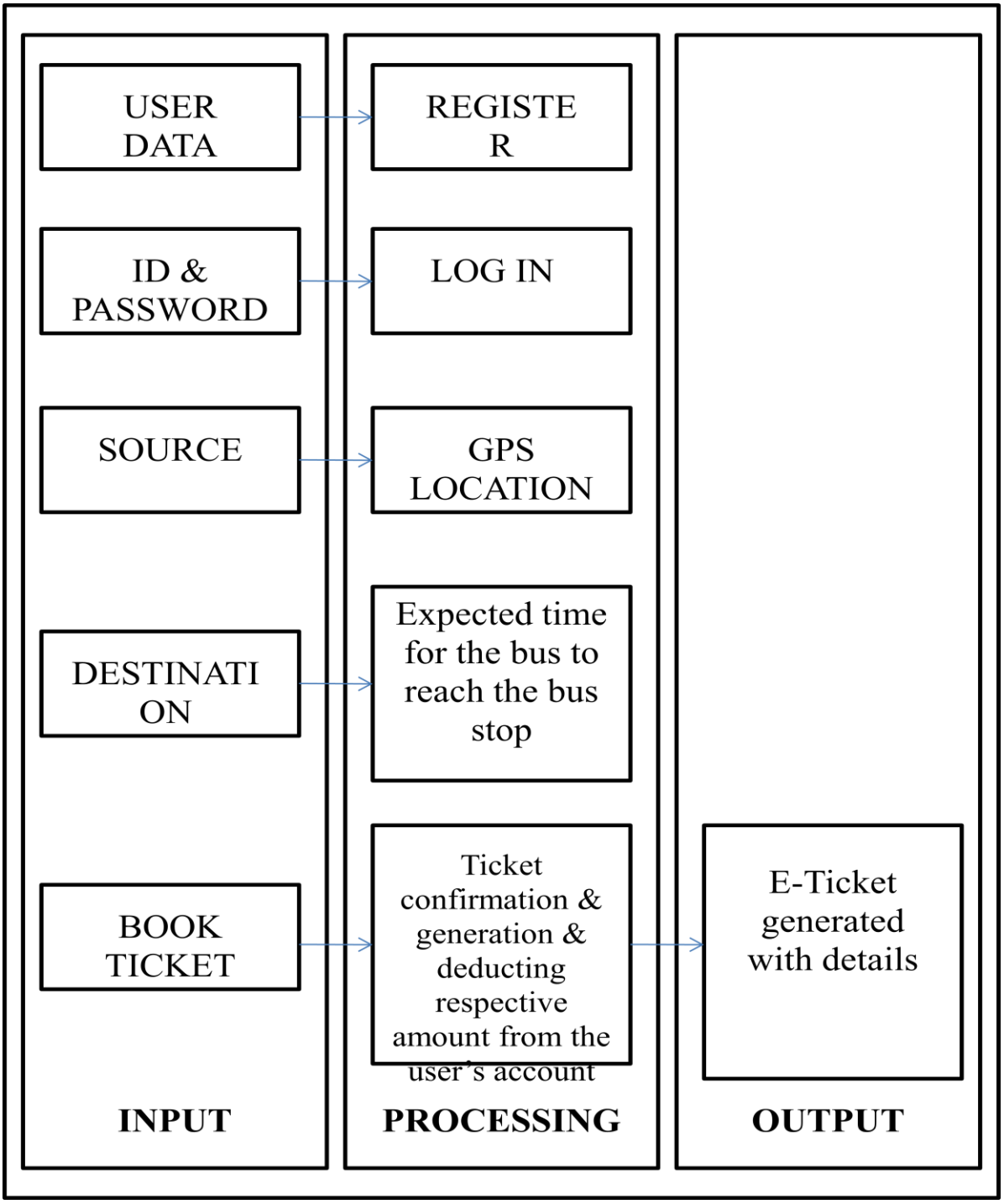

Fig. 1. Block diagram of proposed system

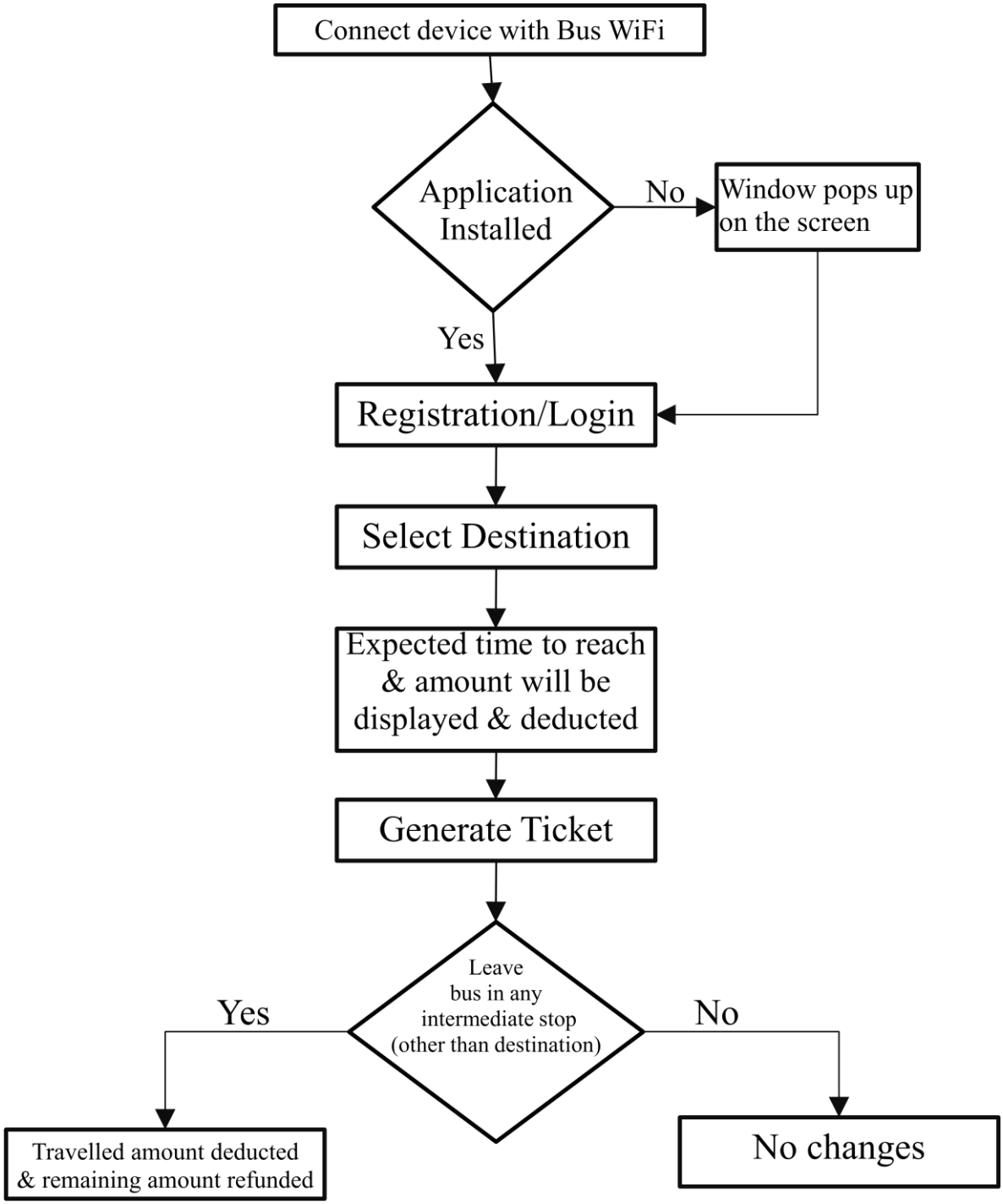

Fig. 2. Flowchart of proposed system

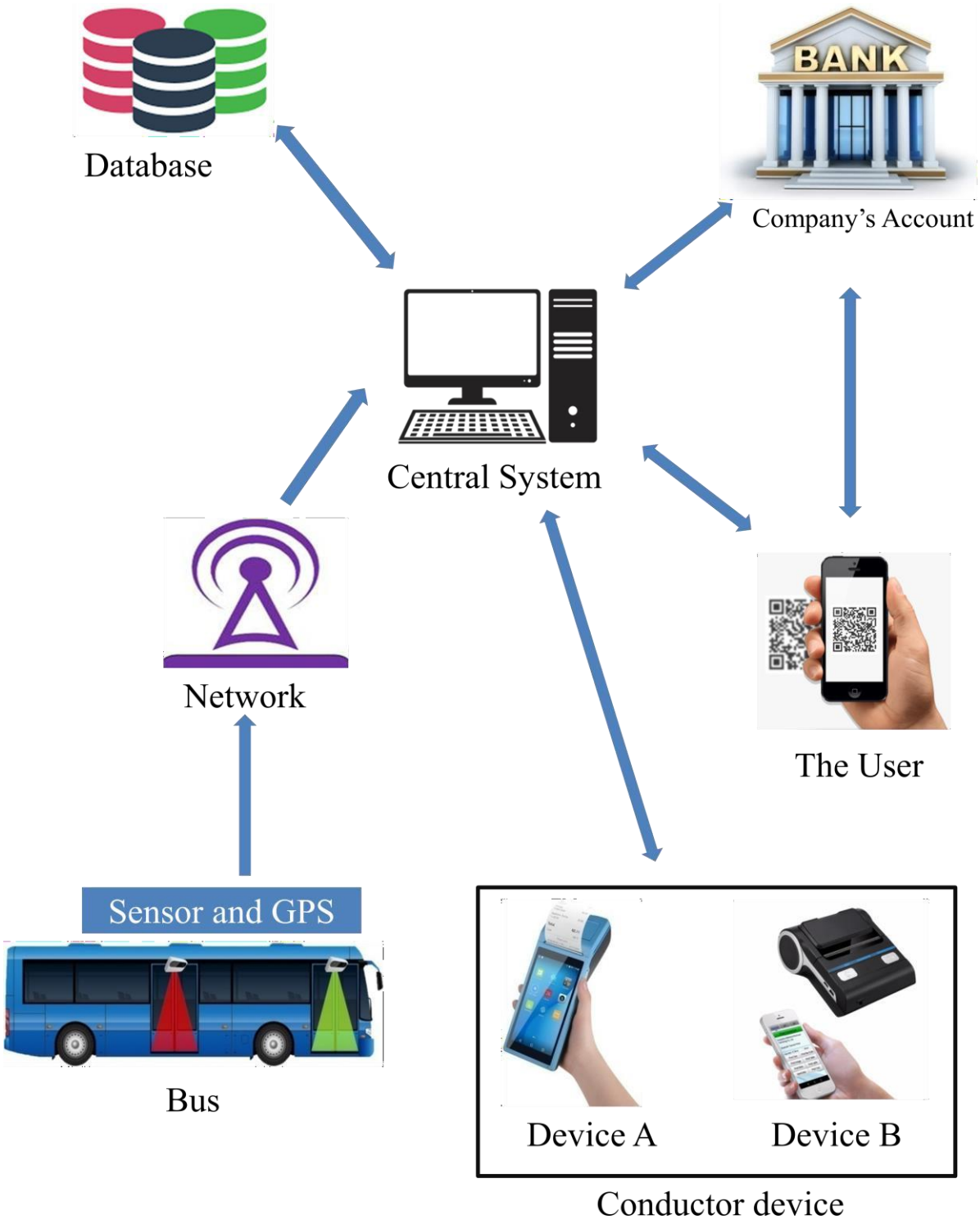

Fig.3. Pictorial Representation of Proposed System

Figure 3 represents the actual working of the proposed system. If the conductor does not have a smart phone, he can use Device A (POS receipt printer with Android/IOS OS, supports 4G, BT, Wi-Fi). If the conductor has a smart phone, he must download the application and connect with Device B (Portable Bluetooth printer).

RESULT ANALYSIS

Fig.4. Scan QR code

Fig.5. Destination Entry

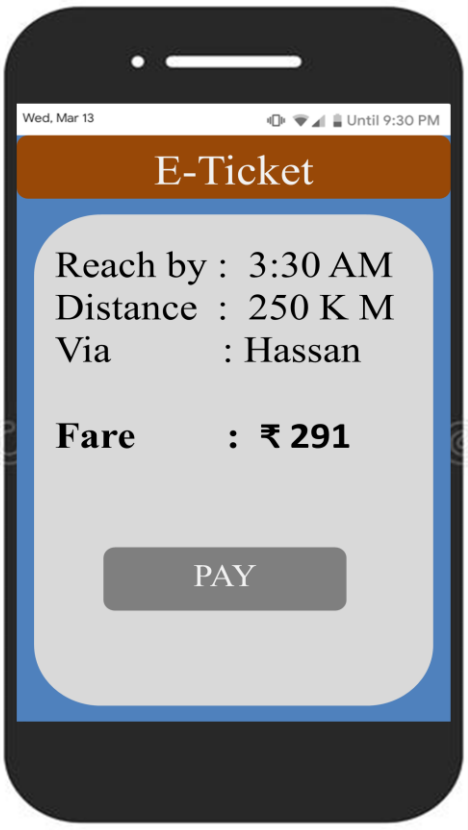

Fig.6. Pay amount

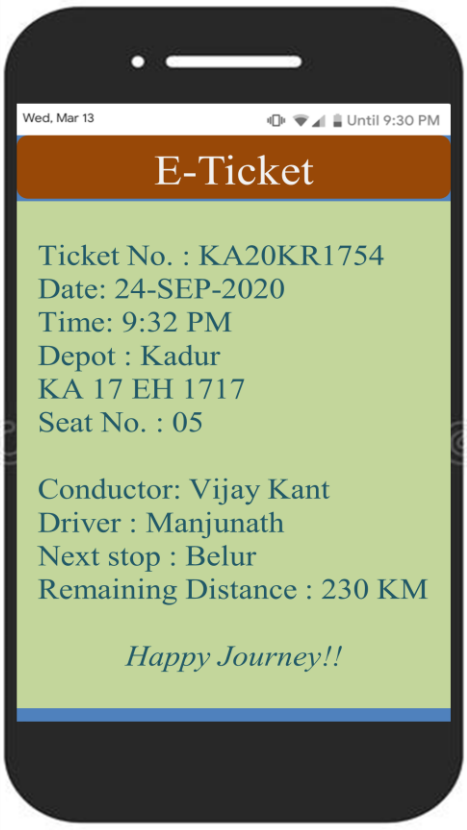

Fig.7. Generated Ticket

By implementing this project, many disadvantages in current ticketing systems is rectified and thereby supporting the cashless economy. Amount is debited directly from the user's bank account to overcome the change issue as shown in figure 6.

CONCLUSION

In summary, this project aims to give an agile and smooth ticketing experience to the commuters. If implemented, it will give a new ticketing experience to commuters as well as contribute a part of cashless economy. With the growing popularity of smart-phones and mobile wallets this is the right time to adapt this technology so that people will become familiar with it, and this will improve the overall services provided to passengers.

LIST OF ABBREVIATIONS

Abbreviation	Meaning
4G	Fourth Generation
BMTC	Bangalore Metropolitan Transport Corporation
BRTS	Bus Rapid Transit System
BT	Bluetooth
GPS	Global Positioning System
ICT	Information and Communication Technology
KSRTC	Karnataka State Road Transport Corporation
Non-AC	Non-Air Conditioned
OS	Operating System
POS	Point Of Sale
QR Code	Quick Response code
SMS	Short Message Service
SRTUS	State Road Transport Undertakings
Wi-Fi	Wireless Fidelity

DECLARATIONS

Availability of data and material

All the data and material used in this paper is mentioned in the "REFERENCES" part.

Competing interests

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Authors' contributions

Shivaprakash H V conceived and designed the study and wrote this paper.

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