



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 13, Issue 3, March 2024

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 8.423

9940 572 462

6381 907 438

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Implementing Smart and Secured Travelling Management System using RFID

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Abstract: This paper describes a comprehensive surveillance framework designed to monitor individuals traversing from any origin point to any destination. The system aims to bolster the safety and security of travelers throughout their journey. Utilizing Radio Frequency Identification (RFID) technology, both individuals and their accompanying belongings can be seamlessly tracked.

The primary objective of this system is to mitigate various risks such as misinformation dissemination, exorbitant pricing schemes, and potential security threats like abductions. Consisting of RFID readers and tags, the system operates by registering tag signals within the RFID reader's range. Each traveler is assigned a unique RFID tag, while transportation vehicles, including auto rickshaws and taxis, are equipped with their own designated tags. Strategically positioned RFID readers capture pertinent information about passengers' embarkation points, as well as details regarding the corresponding transportation vehicles. All captured data is then stored within a centralized database, enabling efficient retrieval and analysis for passenger tracking purposes.

KEYWORDS: RFID, passenger safety, woman & children security, safe transportation, RFID reader, RFID tag, object tracking

I. INTRODUCTION

In the current transportation landscape, the world is rapidly shrinking, with global destinations becoming increasingly accessible. As a result, individuals frequently traverse between various locations. Unfortunately, these journeys often lead to negative experiences, fostering a sense of aversion towards tourist destinations.

In light of this, the Government of India has launched the 'Athiti Devo Bhava' campaign to bolster travel and tourism development. However, both foreign and domestic travelers encounter challenges upon arriving at new destinations, including:

- i. Excessive overcharging of passengers upon arrival.
- ii. Adverse effects on the reputation of cities and countries.
- iii. Serious concerns regarding the safety of children and women.
- iv. Occurrence of unforeseen incidents such as kidnapping and robbery.

Addressing these issues is crucial for fostering a positive and secure travel environment, aligning with the goals of tourism promotion initiatives. The system targets at addressing the issues mentioned above by using RFID. The rest of the paper is organized as follows; Section II presents the system design. Section III presents mathematical model, Section IV, V presents the architecture of the system. Finally, section VI presents result with section VII concluding the paper.

II. SYSTEM DESIGN

The implementation of the system will leverage the pervasive and adaptable Radio Frequency Identification (RFID) technology. RFID technology comprises RFID tags, also known as transponders, and RFID readers, alternatively referred to as transceivers. Tags possess the capability to transmit and respond to signals emitted by RFID readers, while readers are proficient in both transmitting and receiving signals. [1].

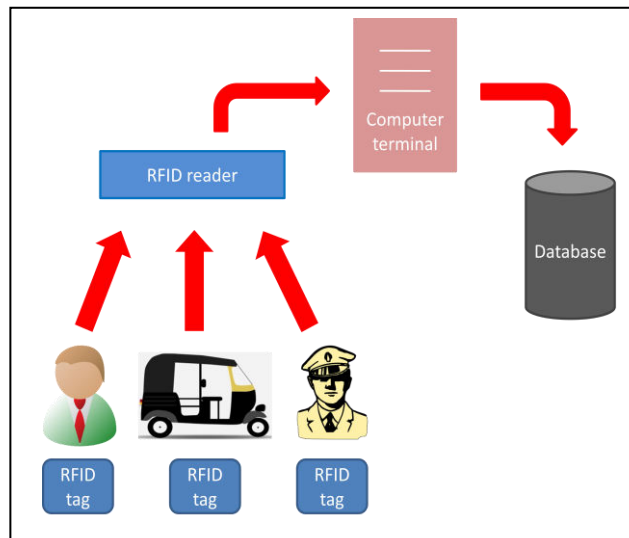


Fig. 1. Communication between RFID and Computer

RFID reader emits electromagnetic waves around itself. Whenever an RFID tag is detected by a reader, it sends back unique id which is present within the tag. This is a unique code, which acts like an identification number to the tag. The reader can only read tag, but it is not able to manipulate the information sent by tags. It needs some support of an intelligent device, which is nothing but a computer. Computer processes the information sent by reader and stores the information into a database. In order to transmit data, the reader can connect with the computer network through a standard interface, and transmits the read data to the computer through the network to analysis and process [2]. The middleware, application which lies between reader and the computer hardware system, fetches the records from the database. Radio frequency identification (RFID) employs wireless communications between electronic tags and readers that reads/writes information from/to the tag [3]. RFID readers are available as single tag reader or multitag reader. Single tag reader can read only one tag at a time, unlike multitag reader which can simultaneously read many tags. There are also variations available such as wired or wireless reader, which could be preferred as per the need of the application.



Fig. 2. RFID Reader (single tag)

RFID tags are also available in various types like, active tags and passive tags. Active tags make use of battery which increases their range for tracking. However, passive tags completely rely on RFID reader's waves to communicate. As far as standards go, the protocols that the tags and readers use to communicate can be described as the *air interface protocol*[5]. These tags charge themselves by the waves transmitted by RFID reader.



Fig. 3. RFID Tag (standard clamshell passive tag)

RFID provides a strong alternative to present Barcode technology. The challenges faced by barcode are given below:

1. Barcodes are essentially printed on paper, rendering them susceptible to damage.
2. Duplication of barcodes can be achieved through simple photocopying methods.
3. Line of sight is necessary for accurate barcode scanning.
4. Information on barcodes can be erased or washed away.
5. Barcode technology is increasingly perceived as unreliable.

III. MATHEMATICAL MODEL

The system uses a model to calculate fare. The fare could be predefined for a route or else the fare could be calculated from the following set of steps:

$$F(r) = D(s,d) \times R \text{ where,}$$

- F = Amount of Fare ... { $F > 0$ }
- r = route travelled ... { $r_1, r_2, r_3 \dots r_n$ }
- D = Distance travelled
- s = Source terminal
- d = destination terminal
- R = Rate per kilometer ... { $R > 0$ }

Post calculating the total amount (fare), the amount will be deducted from the previous balance of passenger's account.

$$B_u = B_p - F(r) \text{ where,}$$

- B_u = Updated balance after travelling ... { $B_u > 0$ }
- B_p = Previous balance (before travelling) ... { $B_p > 0$ }
- $F(r)$ = Fare calculated for the route 'r'

The updated balance (after deduction of the balance) cannot be greater than previous balance, however must be greater than 0.

$$0 < B_u < B_p$$

IV. ALGORITHM

Shown below is algorithmic model to read data from RFID tag, which uses serial communication as a mode of interface.

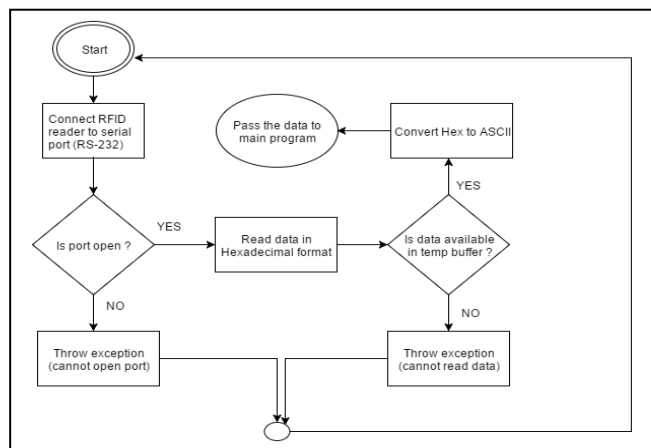


Fig. 4. Algorithmic steps to read data from tag

V. SYSTEM ARCHITECTURE

The system architecture incorporates RFID reader, tags and voice based response system to facilitate the working. RFID readers will be placed strategically at pre-identified locations to track passenger, driver details. These details will be encoded in tags allotted to passengers and vehicles which are used for transportation.

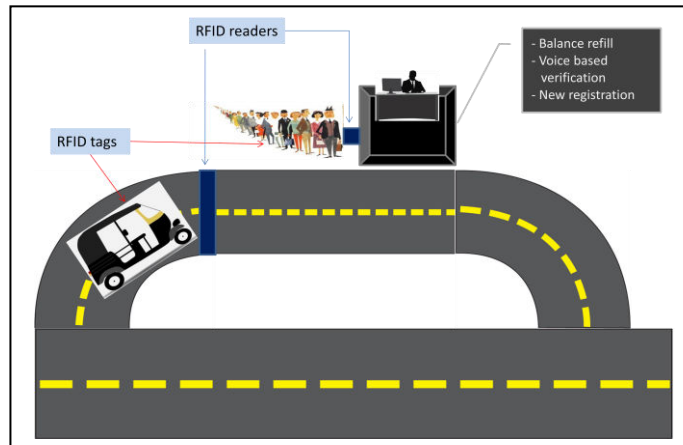


Fig. 5. Architecture of the system

This is how system works to address the concern:

- To enhance passenger security - The system employs smart-card readers to scan auto/taxi driver details, facilitating passenger identification for potential future reference in unforeseen circumstances.
- To avoid cases of kidnapping, theft, malpractices - Detailed records of both driver and vehicle information are logged by the system each time a person travels, serving as a deterrent against criminal activities.
- To facilitate cashless transaction- Through the system, the predetermined fare is automatically deducted from the passenger's account, streamlining cashless transactions.
- To increase women & children safety – The recorded driver and vehicle details contribute significantly to enhancing the safety of women and children, bolstering confidence in the travel experience.

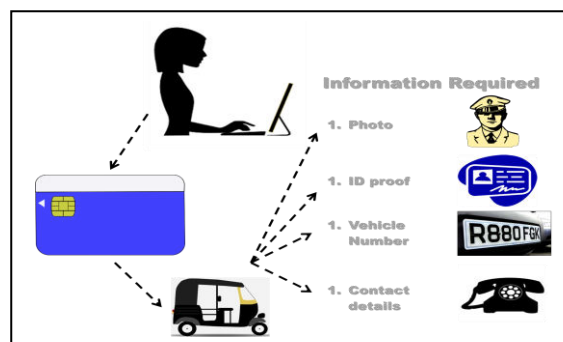
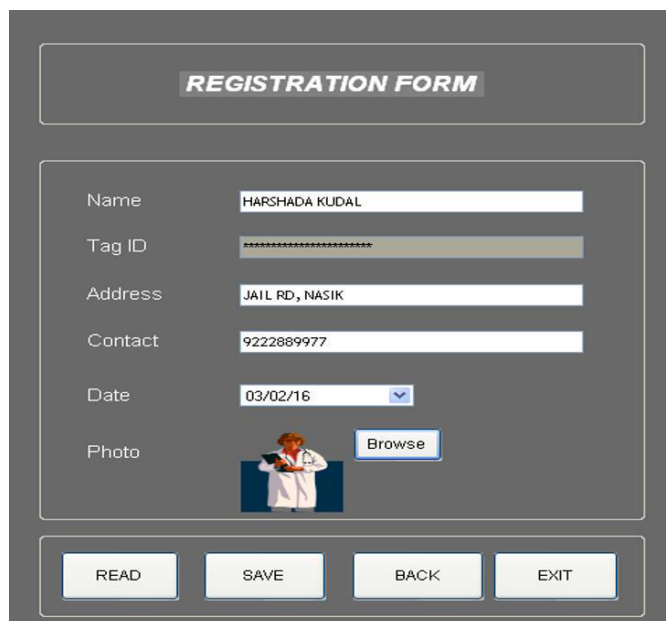


Fig. 6. Details of transport vehicle will be stored in tag

The installation of a RFID infrastructure changes numerous established procedures and therefore makes it necessary to redefine all processes that are affected by the technology [4].

VI. RESULT AND DISCUSSION

The system is able to detect registered passenger, and once the journey from point A to point B is completed the balance is updated as per the fare chart. Voice based confirmation is given to validate updated balance.



VII. CONCLUSION

RFID reader located at the terminals detects the RFID tags carried by the travelers. RFID reader strategically located records the details of vehicle and its driver. It then sends the recorded data to the system database. The system records which passenger boarded from place A (source terminal) and exited at place B (destination terminal). In addition, the system captures the payment made at the destination terminal and updates the database. Voice based response will assist users to identify details like deducted balance, updated balance. Future scope of the system could be designing a surveillance network using CCTV for more effective control.

ACKNOWLEDGMENT

I would like to show my sincere gratitude towards Prof. S. M. Rokade, HOD, Department of Computer Engineering, SVIT, Nashik for his valuable guidance throughout study of my work and to keep me motivated.

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