Wireless Sensor Network based Automatic Fare Collection for Public Transport System

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ABSTRACT: With the rising population and congestion in vehicular traffic, public transport would be a fitting solution. Buses, both public and private are the most common and easy form of shared transport. The ticketing system of bus transport system in India is manual, which is labor intensive, expensive and prone to errors with large crowd of passengers. Traversing through a crowded bus in peak hours of travel is stressful for a ticket collector and to the commuter as well. Incidence of travelling without a ticket in a crowded bus is more. In order to overcome these difficulties a smart card based ticketing system is proposed. The automatic fare collection system in bus is an intelligent ticket collection system using prepaid card to be swiped at the bus entrance. The commuter's smart card is scanned at the entrance, the bus fare is deducted from the card and the trip details is messaged to the registered mobile number. This technique would be hassle free ticketing system.

KEYWORDS: Automatic fare, WSN, Public transport, Smart card.

I.INTRODUCTION

Public and private buses are the most common and efficient mode of transport. The increase in traffic causes stagnation in vehicular movement in peak hours and contributes to a large amount of air and noise pollution as well. Use of substandard vehicles in suburban and rural areas is a threat to the individual safety. Using a shared transport medium will be an efficient solution to all these vulnerability. The conventional system of public transport is based on paper based bus tickets that ultimately lead to argument between people, corruption and time consuming as well. Presenting a user friendly method of ticketing system will be a value addition.

II.EXISTING AND PROPOSED SYSTEM

A good amount of work has been contributed towards automating the ticketing technique in public transport system. There are existing models where the passenger with an RFID card will enter the destination desired on boarding the bus, the trip fare will be calculated and deducted. The fare details will be displayed and printed as well. The count of the total passengers travelling in the bus can also be calculated. The proposed design is to develop a low cost Transport management system based on the integration of RFID and GSM. The system has GSM modems based SMS service which is cost effective. The microcontroller based in-BUS hardware module consists of a Global System for Mobile Communications modem and RFID Readers on the entrance and exit. The proposed system is built up of different units which are wirelessly linked and data transfer enabled with GSM modems. SMS service through GSM network is not only cost effective but also an initiative to save paper. The implementation of wireless sensor network provides highly reliable and stable intelligent public transportation system supported at low cost. Before boarding a bus, the smart card is swiped at the entrance of the bus, RFID reader verifies the swiped card details with predefined commuter prepaid card database automatically, with the availability of minimum required balance the door opens, or if balance is less than minimum required a buzzer sounds indicating low balance. The boarding point details are entered using a keypad inside the bus. On reaching the destination the smart card is swiped again at the exit of the bus, the destination point is chosen using a keypad. Based on the distance travelled and the tariff the trip fare is calculated and deducted from the prepaid
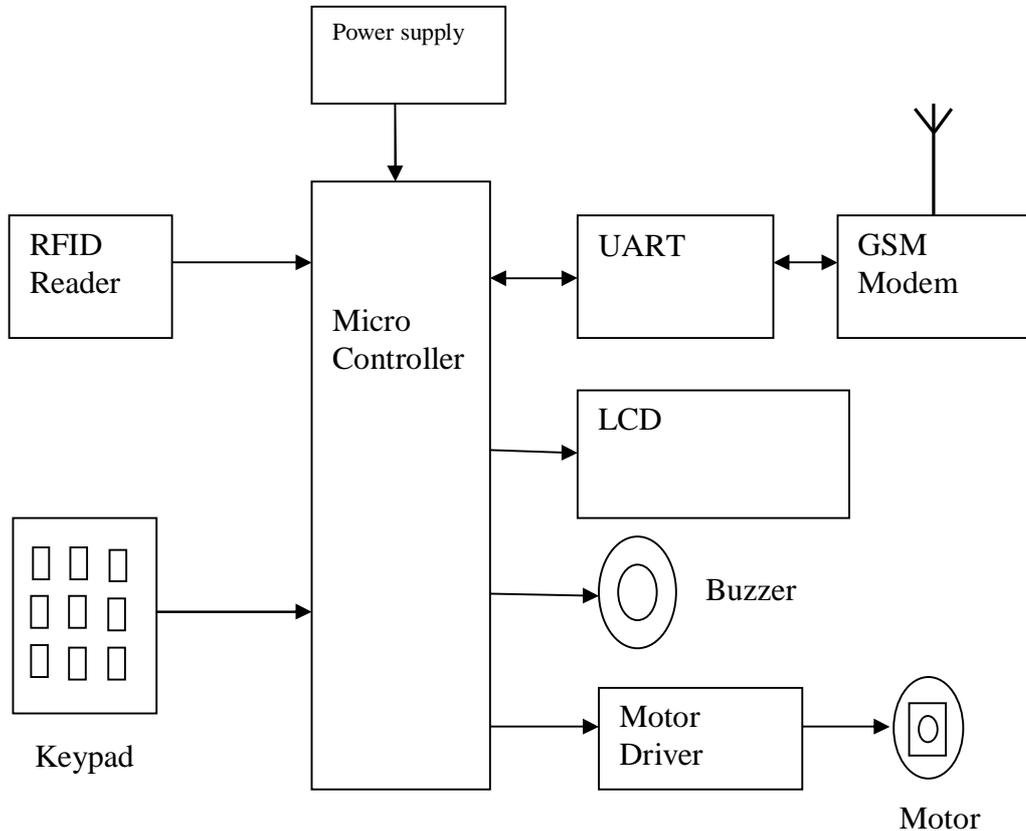
Fig 1: Block diagram of the proposed system

smart card. The IN-Bus module sends the bus number and passenger details to the transport corporation and to the passenger as well.

III. WORKFLOW OF INTELLIGENT TRANSPORT MANAGEMENT SYSTEM

The smart card employed here is used for information storage, management and authentication. A smart card is a synthetic card, small in size resembling a credit card (without the magnetic strip) with an inbuilt microchip consisting of embedded microprocessor chip, electronic memory, and a battery. The memory can be loaded with data used for e-cash payments and any other supporting applications, which can be periodically refreshed for additional use. Smart cards can be designed to be inserted into a slot and read by a special(RFID) reader. RFID -Radio frequency Identification and Detection is a tracking technology that makes use of radio waves to identify and authenticate tags that are applied to any product. Powered by its internal battery, the microchip embedded inside the smart card is read by the RFID reader as and when the card is swiped against it. The tag when activated sends radio waves, on receiving these waves the reader identifies the frequency to generate a unique ID. The data stored in the integrated circuit of tag is in decoded form, the processing of reading is to encode this data and transmit it to the computers for use. A GSM system manages communication between a mobile telephones(passenger's mobile), base stations (public transport

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           ┌────────────────────────────┐
           │  Swipe the card at entrance │
           └────────────────────────────┘
                        │
                        ▼
           ┌────────────────────────────┐
           │  RFID Reader               │
           │      Card balance > Min    │
           └────────────────────────────┘
                        │
                        ▼
           ┌────────────────────────────┐
           │  Motor Driver activated    │
           │      Door open control     │
           └────────────────────────────┘
                        │
                        ▼
   ┌──────────────────────┐      ┌──────────────────────┐
   │  Keypad input        │────▶ │  LCD                 │
   │   Boarding point     │      │   Boarding point     │
   │   entry              │      │   choice             │
   └──────────────────────┘      └──────────────────────┘
                        │
                        ▼
           ┌────────────────────────────┐
           │  Swipe card for exit-      │
           │          RFID Reader       │
           └────────────────────────────┘
                        │
                        ▼
   ┌──────────────────────┐      ┌──────────────────────┐
   │  Keypad input        │────▶ │  LCD                 │
   │   Destination point  │      │   Destination point  │
   │   entry              │      │   choice             │
   │                      │      │   Ticket fare        │
   │                      │      └──────────────────────┘
   │                      │      ┌──────────────────────┐
   │                      │────▶ │  SMS of Ticket Fare  │
   │                      │      │  to registered mobile│
   │                      │      │  and Transport       │
   └──────────────────────┘      └──────────────────────┘
                        │
                        ▼
           ┌────────────────────────────┐
           │  Motor Driver activated    │
           │      Door open control     │
           └────────────────────────────┘
                        │
                        ▼
           ┌────────────────────────────┐
           │  Smart card                │
           │   balance updated          │
           └────────────────────────────┘
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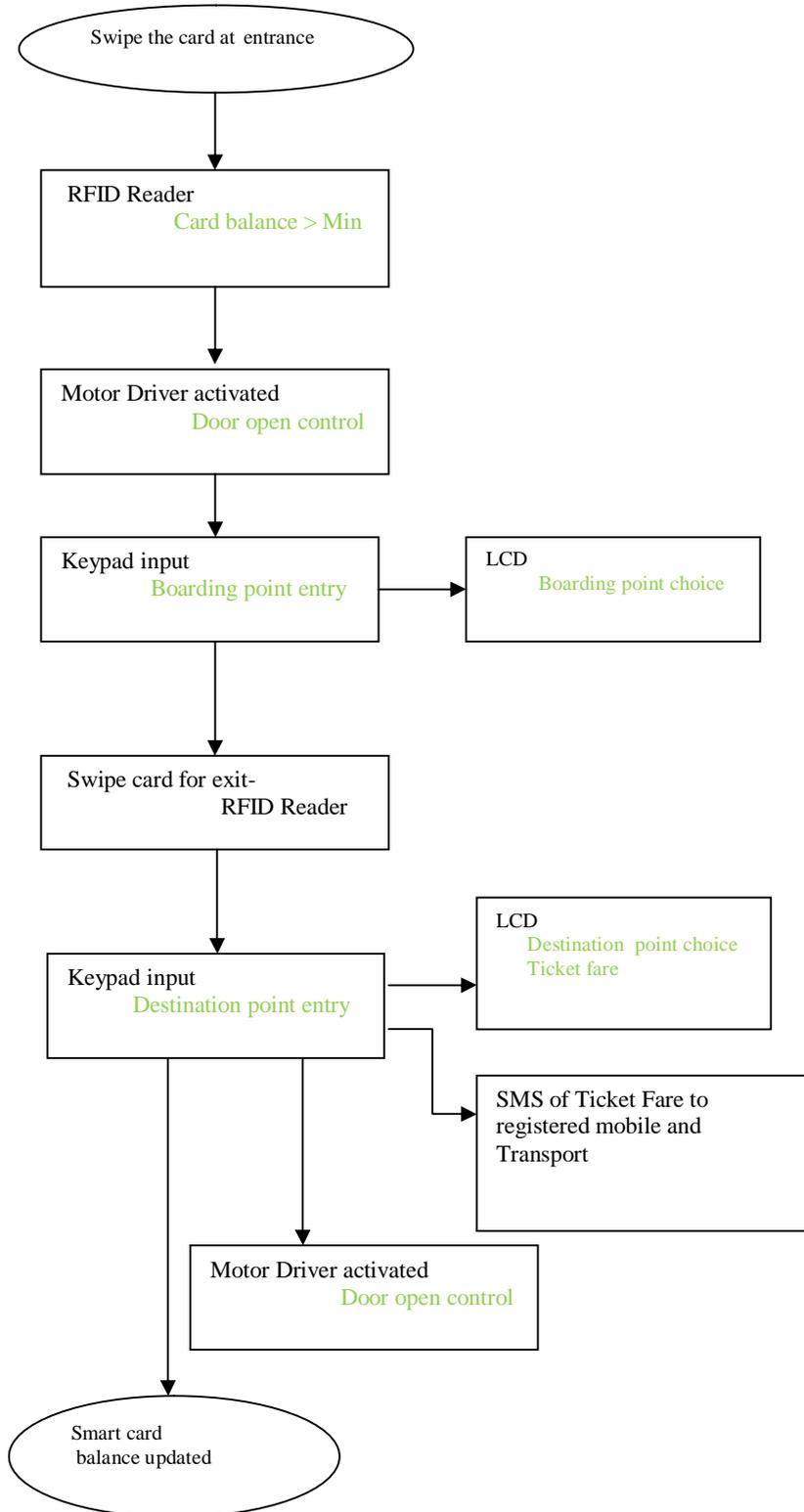
Fig 2: Workflow of intelligent transport management system

corporation office), and the required switching systems. The card when inserted at the exit will help calculate the cost of the ticket. To override paper tickets, the swipe of the card at the exit initiates the GSM technology to trigger a message of the travel cost to the passenger and the transport office as well.
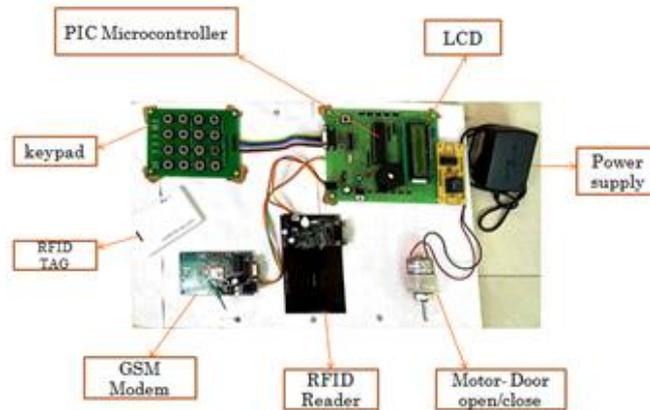

Fig 3: Hardware of the In-Bus module

Fig 4: RFID Reader

Fig 5: RFID tag(smart card)

IV. RESULT AND DISCUSSION

Carrying a wallet with less money is a safer way to travel in a crowded bus, thus the use of a smart card to access and pay for transport services is now a budding option. The RFID tag reader is activated with a tag which switches on the motor for door open/close. Enter the boarding point by using the keypad. If passenger wants to get off from the bus, show the RFID tag on the RFID reader and enter the destination point using keypad. After entering destination point the motor switches on (door open). Then a message will be sent to the passenger and transport office by GSM modem. The use wireless communication provides all passenger information to public transport corporation. Human intervention is not required. This system is User friendly, enhances security, efficiency and comfort of the transport system.

The MTS (Mobile ticketing system) is an effective application of Mobile transportation operations. Commercially available application servers/IMSI Scanners and Industry standard hardware components have been used with extremely user-friendly software. The man machine interface is menu driven and Fault Tolerant Hardware & Software with Hot standby arrangement ensures 100% reliability as well as to reduce mean time to recovery.
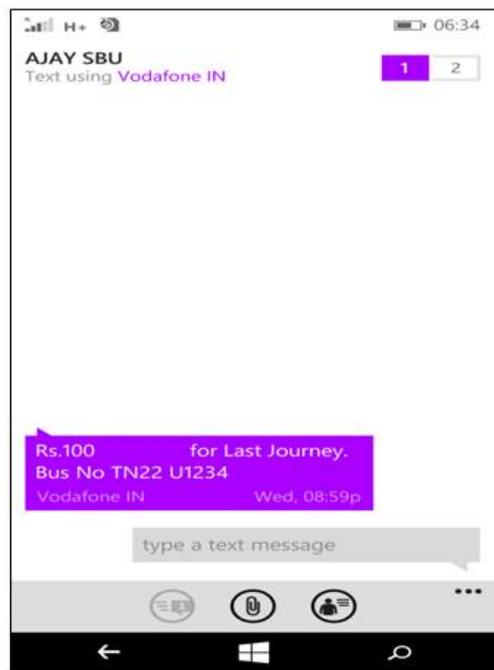
In the fig 2, it shows the graph of throughput of received bits Vs Maximal end to end delay. End to end delay is the time taken by a packet to travel from source to reach destination.

V.FUTURE SCOPE

The conventional ticketing system may be upgraded for the present day large volume of traffic being handled by using MTS will not only streamline the ticketing process but also prevent revenue leakage and thus prove to be financially beneficial. Initially, commuters may experience some inconvenience, but in the long run, it will be for their own benefit. In future mobile service providers can also earn customers by offering benefits over billing for using this service. This shall also enable to enhance the customer relationship management and boost the brand image of a public transport system.

This concept can be used for other public transport system like airlines & India railways or other already existing public and privates transport system and coming up in future.

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