Smart Bus Management System

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***Abstract*—In today's fast-paced world, time management is of utmost importance. Public transport is the most widely used service and a major source of revenue for the government. In order to have a proper ticket collection system and to save time from the traditional bus ticket collection system, a smart ticket collection system is proposed. RFID tags are used to speed up the ticket fair process and also to determine the availability of seats. The schedule of the upcoming bus and the availability of seats are updated to the passengers. Therefore, the passengers can choose their alternative mode of transportation and save time. Our system aims to have an effective fair collecting system with continuous updates to the passengers at the bus stop.**

***Keywords*— RFID Reader, Ticket collection, Smart Payment, RFID tags.**

I. INTRODUCTION

Bus services for public transportation typically consist of a published public transportation schedule that guides the regular running of transit buses along a route, stopping at prearranged bus stops. People waste time waiting for the bus at the bus stop because they are not aware of the bus's timetables. Another is that passengers may experience cash flow issues and a conductor is needed to handle fare collection. The existing system is beset with several issues. Using an RFID card, the Smart Bus Fare Collection System is built. This device is easy to use; it will recognize the passenger automatically and subtract the charge based on the distance traveled. Passenger and transaction identification is made extremely accurate with the use of Radio Frequency Identification (RFID)cards. RFID tickets are more convenient and reusable than those obtained using paper-based ticketing systems. The whole public is given RFID cards. By gathering the personnel information, an account will be made and each individual will receive a unique ID card using RFID technology. As a result, it is feasible to verify his account and deduct the fare by accessing this database. The proposed system integrates all of these subsystems into a single, physically deployable solution for public bus systems, thereby simplifying the process for all parties involved. We'll examine these fields' literature and how it connects to one another in the sections that follow.[13][15]

II. LITERATURE SURVEY

Swapnil Bhosale, Abhishek Aru,Tushar Jashav, Vikas Kalokhe,Santosh Sambare focuses on " RFID Based Bus Tracking System." The proposed bus monitoring and management system utilizes RFID technology and GSM communication for real-time tracking and data exchange. A black box in each bus contains an RFID reader, GSM modem, and emergency button, interfaced with a microcontroller. As the bus approaches a tagged bus stop, RFID devices interact, and data is sent to the Superstation via GSM, updating the central database. Bus modules transmit location information, and in emergencies, the driver can use an emergency button to inform the Superstation. The Superstation processes data, sends location information to Bus-Stop modules, and monitors emergencies. Bus-Stop modules display bus locations and expected arrival times, improving passenger convenience. The system aims to reduce bus un-utilization and waiting times, benefiting both administrators and passengers.[1]

In the recent work by Ms. Supriya K. Adak, Ms. Akshata M. Annadate, Ms. Swarupa A, Deshmukh Mrs. Snehal Bhosale the focus is on the development of a Smart Bus Tracking System Using RFID The system involves three terminals: the device on the bus, device on the bus stop, and the master device on the bus stand. The device on the bus sends wireless data, including its ID, to the device on the bus stop. The bus stop device transmits the received data through RS 485 to a PC with a map displaying bus locations. The master device at the bus stand receives SMS updates on bus status, conveyed by the device on the bus. An Android app allows users to inquire about bus status remotely. The RFID tag used is the EM18 with Wiegand protocol, connected to a microcontroller. The RFID reader continuously transmits an electromagnetic field, and when an RFID card enters its 10cm range, it powers up and provides a 26-bit ID to the reader. The Weigand protocol is interrupt-based, requiring the microcontroller to interpret data from interrupts on data lines connected to its external interrupt pins.[2]

Sudhir Divekar, Sagar R. Patil, Satish Shelke have introduced an innovative Smart Bus System. The project involves two sections: a transmitter placed in a bus and a receiver system at a bus stand. The transmitter comprises a PIC microcontroller, GPS module, GSM modem, voice recording/playback unit, RF transmitter, door switch, relay unit, and an LCD display. The GPS module receives signals from satellites to determine bus locations based on latitude, longitude, and altitude. The microcontroller stores and

compares these coordinates, displaying the location name on the LCD and announcing the stop name via a speaker IC when a match occurs. The microcontroller also checks door status, preventing bus departure if the door is open to avoid accidents. Information about the bus, including bus number, route, and vacant passenger seats, is transmitted via RF transmitter to the bus stand as the bus approaches. The receiver system at the bus stand detects this information, displays details on a display, and makes automatic announcements. The system utilizes GPS technology and microcontrollers for an efficient bus location announcement system.[3]

Karthikeyan G, Jawahar M L have introduced a Smart Bus Management System. The proposed system involves a GPS module fixed inside each bus, continuously fetching latitude and longitude data, processed by NodeMcu, and sent to a cloud server connected to Google Maps for real-time bus tracking. Users can monitor the bus's location through the mobile application. The system also includes monitoring bus stand entries, activating a timer upon entry, and triggering a buzzer if the bus exceeds the designated time. Violations trigger notifications and details sent to the bus stand in-charge, who may impose penalties. Monthly reports, including rule violations and fines, are forwarded to the bus owner. An emergency OFF switch is available for the bus stand in-charge to shut down the system in emergencies. The GPS data is sent to the cloud server, checked against bus stand locations, and triggers alerts and notifications as needed. The entire process updates in real-time on the mobile application, providing a comprehensive solution for bus monitoring, compliance, and accountability.[4]

M. Malleswari, M.Koteswara Rao, K.V.Supriya, K.Pavan Krishna, B.Ravi Teja have introduced a RFID Based College Bus Management System. The proposed system comprises two modules: the in-bus module and the base station module. The in-bus module is fixed in buses to track passengers' entry and exit. Passengers swipe identity cards, and the RFID reader sends the tag number to the microcontroller. The microcontroller checks if the person belongs to the bus, and if so, it sends the tag number, along with GPS-derived location and time, to the base station module via a GSM modem. In case of an unauthorized person, an error is displayed on the in-bus module's LCD. The base station module, equipped with a GSM receiver, microcontroller, and computer, receives the information, searches for the tag number-related data, and stores it for further use. The system aims to efficiently track passenger movement and provide real-time data to the base station for monitoring and record-keeping.[5]

Priyanka Godge, Kalyani Gore, Apurva Gore, Aishwarya Jadhav, Anuradha Nawathe on Smart Bus Management and Tracking System automation processes present a paradigm shift, enabling remote monitoring and control that the proposed framework comprises two sections: Admin login and Station master login. The admin module allows for adding bus details, stationmaster details, and viewing bus details. The Stationmaster module enables the viewing of bus information at a specific bus stop. The workflow involves authentication for both station masters and admins at the application start. Admin operations include adding buses and station masters, as well as viewing bus and station master details. In the Station master module, information such as bus type, bus number, arrival/departure times, current bus location, and stops between the source and destination are accessible. When a bus arrives at a station, its RFID tag is scanned by the RFID reader, which, in conjunction with GPS, tracks the bus's location. This data is then communicated to the server, updating the database entries. The RFID system functions as a reader that can retrieve unique IDs and other information from tags, with passive RFID systems utilizing transmitted signals for tag activation and data reflection back to the reader.[6]

Surendranath.H, Sai Ram.B, Praveen Kumar.N, S.Akshay, Pavan have introduced a Smart Bus Tracking System." The proposed project utilizes an Arduino Mega 2560 microcontroller interfaced with GPS, IR sensors, Wi-Fi module, and LCD for real-time bus tracking. The GPS module communicates with satellites to obtain coordinates, which are then sent to a database via Arduino. The extracted GPS data is uploaded to Firebase and displayed on an LCD. The system also detects the number of students entering and leaving the bus. Push button switches update the bus's current position remotely to Firebase and the LCD. A mobile app allows students to track bus information based on GPS coordinates. The Bus Stop Module retrieves data from the database, displaying the current bus status. The system architecture involves Arduino Uno and Arduino Mega 2560, powered through USB or a power supply. The Mega 2560 offers 54 digital I/O pins, 16 analog inputs, and 4 UARTs for complex projects. The LCD module provides a user interface, while the Wi-Fi module enables connectivity to networks. GPS offers global position information, and IR sensors cater to sensing and remote controls in the infrared spectrum. The project aims to enhance bus tracking efficiency and student awareness at respective stops.[7]

Nagavel, Jeyakkannan & Chandran, Karthik & Lukose, Vivek on IoT Based Smart Bus System using wireless sensor networks. The project makes the use of an Arduino Uno controller with an ATmega328 microcontroller, integrating an alcohol sensor, GPS module, GSM module, and RFID module. In the morning mode, the system checks for alcohol content using the alcohol sensor before allowing the bus to start. If alcohol is detected, the relay is cut, preventing the bus from starting, and a warning message is sent to authorities. The bus can only be started by another driver after passing an alcohol test. The system sends messages to parents through GSM about the bus's location, which is also displayed on the LCD. At each stop, RFID cards are swiped for entry, and the RFID module verifies the code, and then opens the door for students. Evening mode involves a similar alcohol check, and the RFID card reader is used to identify the students entering the bus. The GPRS-enabled GSM module allows higher data rates, and the project aims to enhance safety and communication in school bus transportation.[8]

U. L. Kokate, Shravani Sanjay Bagade, Purva Balasaheb Biradar, Pranali Ramesh Dhumal, Saniya Imtiyaj Shiragave have focused on IOT BASED SMART PUBLIC TRANSPORT BUS" The system, implemented in every bus using Arduino Nano, incorporates GPS for obtaining latitude and longitude, GSM for wireless internet access, and IR sensors at entry and exit doors to count passengers. When the ignition is on, Arduino continuously reads GPS coordinates and sends them, along with passenger count, to a webpage. If the ignition is off, the IR sensors track passenger entries and exits, updating the count accordingly. The webpage displays bus details manually uploaded by authorities, such as bus number, route, and timings. Public access to bus information is facilitated by QR codes at each bus stop, allowing users to

scan and view details on the webpage. The connectivity between the GSM module and the webpage is established through internet commands, enabling data transmission. The proposed system enhances public access to real-time bus information and passenger counts, providing a user-friendly interface via QR codes. The system design involves developing individual program units for reading GPS data, establishing GSM connectivity, and sending data to the webpage, which are then integrated for overall functionality.[9]

Parveez Shariff1, Abhishek S, Ashwini R G, Sneha G, Shradha have proposed A Proposed System on Smart Bus Ticketing System. The proposed municipal transportation system integrates RFID readers and GPS modules on buses for efficient tracking and management. Each traveler receives a smart card linked to their service provider account. An Android mobile app allows travelers to check bus locations and occupancy estimates. When boarding, passengers use the RFID reader, deducting the tariff from their account based on the trip's start and end points. The GPS module transmits real-time bus locations to the server, enabling seat availability estimates. The mobile app displays a map view of operating buses, and passengers can choose based on estimated occupancy. Only passengers with a minimum balance and validated identification are allowed to board, ensuring security. The system updates the database after each trip, enhancing monitoring, transparency, and corruption prevention.[10]

III. GAP ANALYSIS

Reference Number	Description
1	The effectiveness of the QR code system depends on the availability and functionality of smart phones or devices with QR code scanning capabilities among the public, potentially limiting accessibility for some users.
2	If a significant portion of the population does not have access to smart phones or chooses not to use the application, they might be excluded from accessing real-time bus information and occupancy estimates.
3	In areas with a high density of bus stops in close proximity, the system might face challenges in providing precise location announcements, especially if the bus stop locations are very close together.
4	The reliance on the cloud server and Google Maps for location comparison introduces dependencies on external services. Changes or disruptions in these services may affect the system's functionality.
5	If there are signal interruptions or communication failures, it may lead to inaccurate or delayed bus location updates in the database and mobile application.

IV. PROPOSED SYSTEM

- The proposed smart bus project utilizes RFID technology for efficient ticket collection based on the distance traveled by the bus.
- RFID scanners and tags are employed at the entry and exit points for passengers.
- This system aims to streamline the ticketing process and enhance tracking based on the distance covered during the bus journey.
- This system will update the status of bus arrival to the people at bus stand.

V. BLOCK DIAGRAM

Given below is the proposed block diagram

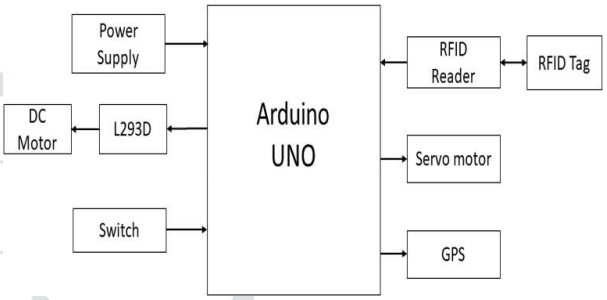

Fig:1 BUS MODULE

VI. APPLICATIONS

- This smart management system replace traditional paper tickets, significantly reducing paper consumption and the associated environmental impact by promoting an eco-friendlier and resource-efficient public transport system.
- Enables simple tap or wave of their RFID cards. This reduces boarding time, minimizes queues, and enhances the overall efficiency of public transport services.
- Applicable for private school or Institution buses.

VII. CONCLUSION

The integration of smart ticketing using RFID tags in public transportation heralds a transformative era for urban mobility. The adoption of RFID technology in ticketing systems brings forth a myriad of benefits, revolutionizing the way passengers' access and experience public transport.[12]

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