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Multifunctional Train Ticket Service Terminal: Integration of Train Ticket Trading System with ATM for Enhanced Efficiency and Convenience

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Abstract:

This paper presents a novel approach to improve train ticket purchase services by integrating a train ticket trading system with an Automated Teller Machine (ATM) in an embedded mode. By combining an IC card recognition module and the ATM, the system achieves real-name system information checking, ensuring a secure and reliable user experience. Furthermore, the integration of a payment module with the ATM enables various payment modes, including cash and Unionpay transfer. The ATM mainframe is connected to a host processor via a private network or telephone wire, facilitating the transmission of client operation information. This research explores how the embedded technology facilitates seamless integration with existing ATMs, expanding the purchase channels for train tickets and effectively reducing ticket purchase pressure at train stations. The integration of payment modes and identity recognition enhances the efficiency and speed of train ticket purchases, while the consolidation of printing modes in a single printer reduces device investments and space occupancy.

Keywords: Multifunctional train ticket service terminal, embedded technology, ATM integration, train ticket trading system, real-name system information checking, payment modes, identity recognition, printing modes.

ISSN PRINT 2319 1775 Online 2320 7876
Research paper Volume 11, Iss 8, 202

Introduction:

The process of purchasing train tickets can often be cumbersome and time-consuming, particularly during peak travel seasons. Traditional ticket counters often experience long queues, leading to customer dissatisfaction and increased pressure on train station staff.[1] To address these challenges, this study proposes a multifunctional train ticket service terminal that integrates a train ticket trading system with an ATM. By leveraging embedded technology, this solution aims to expand the purchase channels for train tickets, alleviate ticket purchase pressure, enhance ticket purchasing efficiency, and reduce device investments and occupied space.

Related work:

Trains are the most commonly used mode of transportation for people going on a journey. However, the process of buying train tickets has long been plagued by challenges, leading to the prevalent issue of long queues at railway stations.[2] This phenomenon has become a significant inconvenience for travelers, and finding a solution to alleviate the pressure and reduce waiting times has become essential for both clients and railway stations.[2]

Currently, train tickets are primarily sold through three different modes. The first mode is manual ticketing, where tickets are purchased through human-operated ticket counters.[3] While this method offers the advantage of quick transaction times, it suffers from several drawbacks.[4] Firstly, the working hours of ticket counters are limited, which means that tickets can only be purchased during specific times. Secondly, this method requires individuals to physically visit the railway station and wait in line to buy tickets, leading to wasted time and energy.[5,6]

The second mode of ticket purchase involves ordering tickets over the telephone. This mode provides convenience and saves labor as customers can book their tickets without visiting the railway station.[7] However, it also has limitations. Clients are still required to either collect their tickets from the railway station within a specified time frame or rely on authorized agents to obtain their tickets. This dependency on limited collection options restricts flexibility for travelers.

The third mode of ticket sales is through the internet. Online ticket sales have addressed some of the drawbacks of the previous two modes. It offers convenience, allowing customers to purchase tickets from the comfort of their own homes or using mobile devices. However, this mode also has its own set of shortcomings.[8] Firstly, individuals who do not have access to the internet or are in areas with no internet

ISSN PRINT 2319 1775 Online 2320 7876
Research paper Volume 11, Iss 8, 202

connectivity are unable to utilize this mode. Additionally, even for those who can access online ticketing, there can still be significant waiting times at the train station to collect the tickets due to the high number of customers. Moreover, during peak periods, the network load often becomes excessive, leading to system failures and disruptions in the ticketing process.[9]

Given the challenges faced by traditional ticketing methods, there is a pressing need for an innovative solution that can improve the efficiency and convenience of train ticket purchases. The integration of a train ticket trading system with an Automated Teller Machine (ATM) in an embedded mode presents a promising approach. By leveraging the advantages of embedded technology, this solution aims to overcome the limitations of existing ticketing methods. It offers the potential to expand ticket purchase channels, relieve ticket purchase pressure at railway stations, enhance transaction efficiency, and reduce the investment costs and space requirements associated with multiple devices.

Developing a multifunctional train ticket service terminal that combines an ATM with a train ticket trading system would revolutionize the ticketing experience, offering a seamless and user-friendly solution for travelers.

Research Objective:

The primary objective of this research is to develop a multifunctional train ticket service terminal by integrating a train ticket trading system with an ATM. The specific goals include:

Combining an IC card recognition module with the ATM to achieve real-name system information checking, ensuring secure and reliable ticket transactions.

Integrating a payment module with the ATM to facilitate various payment modes, including cash and Unionpay transfer, providing convenience and flexibility to users.

Connecting the ATM mainframe with a host processor through a private network or telephone wire to enable seamless transmission of client operation information, enhancing system reliability and responsiveness.

Exploring the ease of integration with existing ATMs through embedded technology, expanding the purchase channels for train tickets and effectively dispersing clients in train stations.

Enhancing the efficiency and speed of train ticket purchases by integrating multiple payment modes and identity recognition methods, streamlining the overall ticketing process.

ISSN PRINT 2319 1775 Online 2320 7876
Research paper Volume 11, Iss 8, 202

Consolidating various printing modes into a single printer, reducing device investments and occupied space while maintaining ticket printing capabilities.

Research:

The train ticket of the embedded type multifunctional based on ATM service terminal is a system that combines various functions related to train ticket transactions and is integrated into an ATM machine. This innovative system offers several distinct characteristics: (FIG. 1)

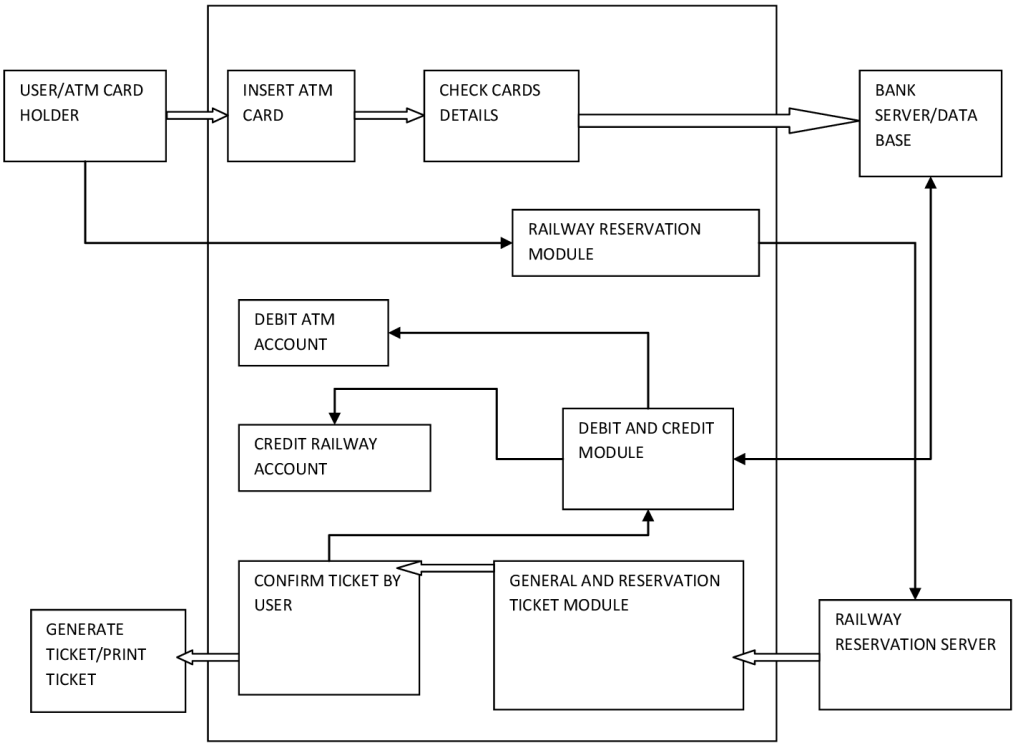

FIG. 1. Architecture

Connection and Communication: The ATM main frame is connected to a master processor through a dedicated network or telephone wire. The master processor selects the appropriate bank server based on the client's needs and connects it to the server of the train ticket Ticketing Centre via a router. This connection allows the transmission of client-operated information between the ATM main frame, the bank server, and the train ticket system.

LED Display: The ATM main frame is equipped with an LED display, which is connected through communication serial ports. The LED display serves as a visual interface for demonstrating information related to the train ticket transactions and other relevant details.

ISSN PRINT 2319 1775 Online 2320 7876
Research paper Volume 11, Iss 8, 202

Loudspeaker: A loudspeaker is connected to the ATM main frame through communication serial ports. It provides auditory cues to guide and assist clients in their operations. The loudspeaker plays an important role in providing instructions and warnings to the clients during their interaction with the ATM system.

Input and Output: The client interacts with the system through keyboard input. The client's input information is transmitted to the ATM main frame via communication serial ports. This enables the system to receive and process the client's input effectively.

Card Reader: The system includes a card reader that reads the client's interchanger information. The card reader communicates with the ATM main frame through communication serial ports, transmitting the obtained information for further processing.

IC-Card Identification: An IC-card identification module is employed to identify the client's identity information. Once the identification is completed, the IC-card information is transmitted to the ATM main frame through communication serial ports, enabling the system to verify the client's identity.

Payment Module: A payment module is connected to the ATM main frame through communication serial ports. This module facilitates train ticket payment transactions as well as ATM bank card functions such as depositing and withdrawing funds.

Cash Handling: The system incorporates a useless paper money case and a deposit cash box, both connected to the ATM main frame via communication serial ports. The useless paper money case stores incomplete coins and counterfeit money, which are identified by the system. The deposit cash box is used to store coins received for train ticket payments or bank card deposits, classified based on their denominations.

Power Supply: To ensure uninterrupted operation, an uninterrupted power supply (UPS) is connected to the ATM main frame. The UPS provides continuous power in case of sudden power supply interruptions, maintaining the system's functionality.

Print Module: A print module is connected to the ATM main frame through two parallel ports. This module is responsible for printing various documents, including ATM daily records, ATM business strips, and train tickets, based on client requirements.

The integration of these features in the embedded type multifunctional train ticket service terminal based on ATM offers convenience, efficiency, and cost-effectiveness. The system reduces development and maintenance costs while providing a comprehensive platform for train ticket transactions.

This research focuses on the development and integration of a train ticket transaction system into an ATM using embedded technology. The aim is to create a comprehensive transaction platform for train ticket

ISSN PRINT 2319 1775 Online 2320 7876
Research paper Volume 11, Iss 8, 202

services within an ATM, reducing development and maintenance costs and enabling scalability. The following steps outline the various components and functionalities of the embedded train ticket system:

Step 1: Connection Setup

The ATM mainframe is connected to a master processor via a dedicated network or telephone wire.

The master processor selects the bank server associated with the client and connects it to the train ticket Ticketing Centre server using a router.

The client's operational information is transmitted from the ATM mainframe to the selected server.

Step 2: Display and Audio Output

An LED display is connected to the ATM mainframe through communication serial ports to showcase information.

A loudspeaker is connected to the ATM mainframe through communication serial ports to provide auditory cues for client operations.

Step 3: Input and Data Transmission

The client inputs information through a keyboard, and the ATM mainframe receives and processes it through communication serial ports.

A card reader reads the client's interchanger information and transmits it to the ATM mainframe via communication serial ports.

An IC-card identification module identifies the client's identity information and transmits it to the ATM mainframe through communication serial ports.

Step 4: Payment and Cash Handling

A payment module is connected to the ATM mainframe through communication serial ports to facilitate train ticket payment transactions, as well as ATM banking functions such as depositing and withdrawing funds.

A coin storage case is connected to the ATM mainframe through communication serial ports to store identified incomplete coins and counterfeit money.

A deposit cash box is connected to the ATM mainframe through communication serial ports to store coins received from clients based on denomination classification.

ISSN PRINT 2319 1775 Online 2320 7876
Research paper Volume 11, Iss 8, 202

An uninterrupted power supply (UPS) ensures the continuous operation of the ATM mainframe in case of sudden power outages.

Step 5: Printing Function

A print module is connected to the ATM mainframe through parallel ports to print ATM daily records, ATM business strips, and train tickets.

Step 6: Integration and Transaction Process

The train ticket system is integrated into the ATM as an embedded module, controlled by the ATM mainframe.

When a train ticket transaction is initiated, the ATM mainframe establishes a connection to the corresponding server (bank or train ticketing service) through the master processor and router, completing the transaction.

- The loudspeaker provides guidance and warnings to clients during their operations.
- The card reader reads interchanger information and passes it to the ATM mainframe.
- The LED display showcases information to the clients.
- The keyboard sends client input messages to the ATM mainframe.
- The UPS ensures uninterrupted power supply, and the coin storage case and deposit cash box handle cash and coin storage.
- The payment module enables various payment methods, such as UnionPay or cash payments.
- The IC-card identification module identifies client information and transmits it to the ATM mainframe.
- The print module prints necessary records, including ATM daily records, ATM business strips, and train tickets.

Overall, this embedded train ticket transaction system within an ATM provides a comprehensive and efficient platform for conducting train ticket transactions. It leverages embedded technology to streamline processes, reduce costs, and facilitate scalability.

Conclusion:

The multifunctional train ticket service terminal developed in this study offers a comprehensive solution to the challenges faced in traditional ticket purchase systems. By integrating a train ticket trading system with an ATM in an embedded mode, the terminal enables real-name system information checking, various

ISSN PRINT 2319 1775 Online 2320 7876
Research paper Volume 11, Iss 8, 202

payment modes, and seamless transmission of operation information. The system effectively expands the purchase channels for train tickets, alleviating ticket purchase pressure and improving overall efficiency. The integration of payment modes and identity recognition methods ensures a faster and more convenient ticket purchasing experience. Furthermore, the consolidation of printing modes in a single printer reduces device investments and occupied space. This research contributes to the advancement of train ticketing services, offering enhanced convenience and improved customer satisfaction.

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ISSN PRINT 2319 1775 Online 2320 7876
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