

RFID Based Ticket Verification Machine

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1. ABSTRACT

In this project, a ticket-verification system is developed using the Arduino Mini microcontroller, an RFID reader module and a 16×2 (or similar) LCD display. When a user presents an RFID tag, the reader reads the unique ID, which the Arduino checks against a stored list of valid tickets. If the ticket is valid, the LCD displays a confirmation and the system marks the ticket as used; if invalid or duplicate, the system displays a rejection. This automated system replaces manual ticket checking, improves speed and accuracy, and reduces human error in access control scenarios. The system hardware uses the RFID reader connected at Arduino Mini digital pins 6 and 7, while the LCD is interfaced via I²C (SDA/SCL) to minimize wiring. The firmware handles tag reading, validation, and display output. The practical application can be in ticketed events, public transport boarding, stadium access or other entry-control scenarios. The result is a low-cost, efficient, and scalable ticket verification system that can be extended to logging, networking, and remote monitoring.

2. INTRODUCTION

Access control and ticket verification are critical functions in many public-facing systems for example at transportation hubs, sports venues, exhibitions, and events. Traditional approaches often rely on manual inspection of printed tickets or barcodes, which is labor-intensive, error-prone, and subject to fraud or duplicate use. In the last few years, automatic identification technologies such as Radio-Frequency Identification (RFID) have matured, bringing the advantages of rapid tag reading, contact-less operation, and large scale deployment. Using RFID for ticket verification allows each ticket to carry a unique identifier stored in an RFID tag (passive or active). When the tag is brought into proximity of the reader, the system reads the identifier, checks it against a back-end or local database, and takes action (grant or deny access). The use of a microcontroller such as Arduino Mini means that this processing can be done on-site, with minimal human intervention. Usually, an LCD display gives real-time feedback to the user. e.g. —Ticket Valid – Welcome! or —Invalid Ticket – Please Check!. The connectivity via SDA/SCL (I²C) simplifies wiring and leaves many digital pins free for future expansions (e.g., buzzer, LED indicator, network module).

In this report, we describe the design, literature background, block diagram, working principle, advantages, applications, and results of an RFID based ticket verification project tailored for a small hardware build using Arduino Mini, RFID reader and LCD display. The aim is to deliver an affordable, reliable, and extendable system for ticket-based access control.[1]

3. LITERATURE REVIEW

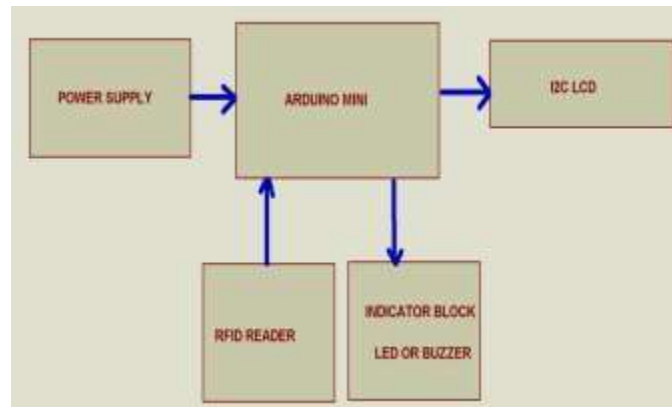
Several research works and practical implementations have explored RFID based systems for access control, attendance tracking, ticketing and more. In one study, an automatic access control system using Arduino and RFID was developed: when a tag is detected, its UID is compared against stored IDs; matched IDs grant access, otherwise access is denied. The authors highlighted the system's low cost and reliability for secure environments. In another project, RFID-based attendance systems using Arduino were implemented in educational institutions. The system lessened manual entries, improved speed, and lowered chances of proxies and errors inherent in paper-based systems.

A work specifically on a smart ticketing system describes the design and construction of an RFID based ticketing system using Arduino, targeting public transport applications: passengers with RFID tags tap on reader; records are

updated automatically; this mitigates fare disputes and human errors.

On the security front, a recent paper addresses the risks and vulnerabilities in RFID based IoT systems showing that tags can be cloned or emulated in some cases, and emphasizing the need for secure protocols. From these works we draw key lessons: RFID + Arduino is a well- established method for identification and access control; practical projects often adopt similar pin outs and interfaces; yet security, data logging and duplicate ticket prevention remain important design considerations. For our ticket verification project, these studies support the feasibility and point toward enhancements (e.g., logging to SD card, linking to network, using unique tag lists, anti-duplication logic).[3]

4. BLOCK DIAGRAM



Block Description

Fig 1.1 Block diagram

The RFID-based ticket verification system consists of several interconnected functional blocks, each performing a specific role in the overall operation. At the heart of the system lies the Arduino Mini microcontroller, which acts as the central processing unit. It is responsible for receiving input data from the RFID reader, processing the tag information, verifying it against stored records, and generating the appropriate output responses to the display and indicators. The RFID Reader Module, connected to digital pins 6 and 7 of the Arduino Mini, serves as the primary input device. It continuously scans for nearby RFID tags and reads the unique identification (UID) code stored within each tag. When a tag is detected, this code is sent digitally to the Arduino through serial communication.

Once the UID data reaches the Arduino Mini, it moves to the processing block, where the microcontroller compares the scanned code with a list of pre-stored valid UIDs saved either in the Arduino's memory or in an external EEPROM module. If a match is found, the Arduino recognizes the tag as an authorized ticket; otherwise, it is deemed invalid. The LCD Display Module which is connected through the I²C interface (SDA and SCL pins), acts as the output device for real-time user interaction. It displays messages such as —Ticket Valid – Welcome|| or —Invalid Ticket – Access Denied.|| This immediate feedback helps the operator and the user understand the status of the scanned ticket without delay.

➤ **RFID Tag & Reader Module:** Passive RFID tags carry a unique identifier (UID). The RFID reader module (e.g., MFRC522 or similar) continuously scans for tags in its range. When a tag is detected, the reader forwards the UID via SPI or serial interface to the microcontroller.

➤ **Microcontroller (Arduino Mini):** The Arduino Mini is the central processing unit. It receives the UID from the RFID reader, compares it with a stored list of valid UIDs (either in Arduino's EEPROM or external memory). If the UID is matched, the Arduino marks the ticket as valid (and optionally flags the UID as used), then sends a signal to drive outputs (LCD, LED, buzzer). If no match or if duplicate use is detected, it signals invalid.

- **LCD Display (I²C via SDA/SCL):** The LCD (typically 16×2) connected via the I²C interface uses two lines (SDA and SCL) to communicate with the Arduino, thereby simplifying wiring. The display shows messages like —Ticket Valid‖ —Welcome‖
—Ticket Invalid‖, —Try Again‖, and can also show ticket number, date/time if desired.
- **Power Supply & Interface Modules:** The system requires a regulated 5 V supply (or 3.3 V depending on modules). The RFID reader may operate at 3.3 V. Proper interfacing and level-shifting may be required. Additional interface blocks may include LEDs (green/red) and a buzzer for visual/audible feedback.
- **Storage / Logging (optional):** To track ticket usage, an SD card module or EEPROM may be incorporated to log each scan event with timestamp, ticket ID and result. This block is optional in the minimal system but recommended for event-audit capability.[2]

5. CIRCUIT DIAGRAM

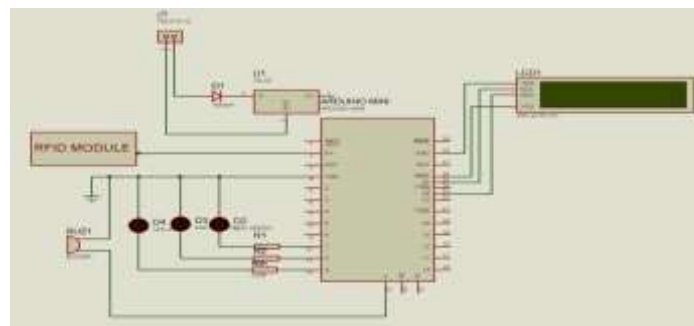


Fig 1.2 Circuit Diagram

6. WORKING

The working of the RFID-based ticket verification system revolves around the interaction between the RFID reader, Arduino Mini microcontroller, and LCD display. When the system is powered on, the Arduino initializes all connected modules setting up serial communication with the RFID reader through pins 6 and 7 and establishing I²C communication with the LCD display via the SDA and SCL pins. Once initialization is complete, the LCD screen displays a message such as —System Ready Please Tap Ticket,‖ indicating that the system is operational and waiting for an RFID tag. The RFID reader module continuously emits a radio frequency signal within its detection range. When an RFID tag or card is brought near the reader, it induces a small current in the tag's coil, enabling the tag to transmit its unique identification number (UID) back to the reader.

This UID data is then sent to the Arduino Mini for processing. The Arduino acts as the control center of the circuit it receives the tag ID and compares it with a list of pre-stored valid ticket IDs saved in its memory or EEPROM. If the incoming UID matches one of the authorized IDs, the Arduino confirms that the ticket is valid. It then sends a command to the LCD display to show a confirmation message like —Ticket Valid – Welcome,‖ and optionally activates a green LED to signal access approval. If a buzzer is included, it remains silent to indicate successful verification. In case the scanned UID does not match any stored ID, or if the tag has already been used earlier, the Arduino identifies it as invalid or duplicate. In this case, the LCD displays —Invalid Ticket – Access Denied,‖ while a red LED lights up and the buzzer produces a short alert sound to inform the user or operator of the rejection.

The system is designed to handle continuous scanning efficiently. After each verification process, whether successful or not, the Arduino clears the display after a few seconds and returns to its idle state, ready to read the next RFID tag. The entire process—from tag detection to message display takes less than a second, providing fast and seamless ticket verification. The regulated power supply ensures stable voltage to all modules: 5 V for the Arduino and LCD, and 3.3 V for the RFID reader if required. In advanced versions, each scan event can also be stored in an external memory or SD card module with the ticket ID, time, and result, enabling event organizers to maintain digital attendance or entry logs.[4]

7. LCD 16 x 2 DISPLAY

LCD (LiquidCrystal Display) screen is an electronic display module and has a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segment and other multi segment LCDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on. A **16x2 LCD** means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data. The command register stores the command instructions provided to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD. Click to learn more about internal structure of a LCD.[3]

Pin Diagram: [1]

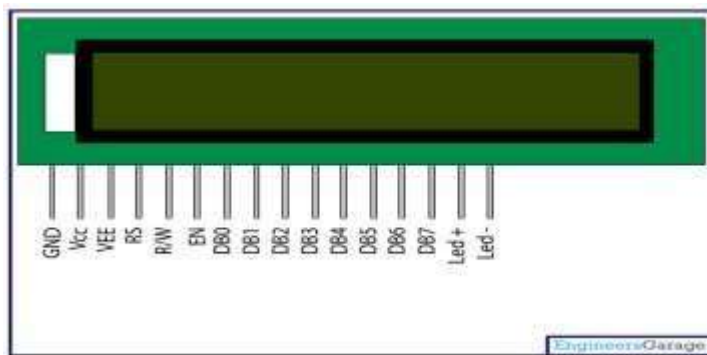


Fig 1.3 Pin Diagram

8. WHAT IS ARDUINO

Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board. The Arduino platform has become very popular with people just starting with electronics, and for good reason. Unlike most previous programmable circuit boards, the Arduino does not need a separate piece of hardware (called a programmer) in order to load new code onto the board – you can simply use a USB cable. Additionally, the Arduino IDE uses a simplified version of C++, making it easier to learn to program. Finally, Arduino provides a standard form factor that breaks out the functions of the micro-controller into a more accessible package.

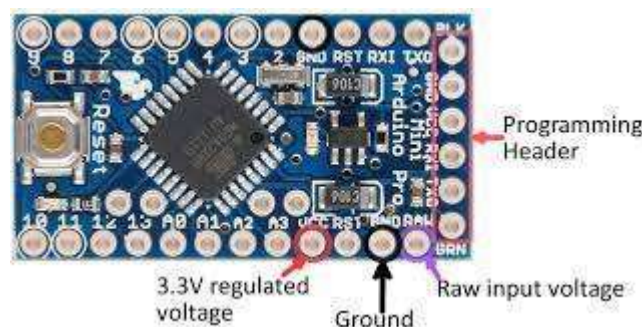


Fig 1.4 Arduino Diagram

The Arduino Mini (specifically the Arduino Pro Mini) is a compact, open-source development board for projects where space is limited, featuring an ATmega328 microcontroller. It comes in versions for both 5V/16MHz and 3.3V/8MHz operation, has no built-in USB port or programmer, and requires an external adapter like an FTDI board for programming. The board is designed for semi-permanent installations and offers 14 digital I/O pins (6 of which are PWM) and 8 analog inputs. [1]

9. ADVANTAGES

Speed & Efficiency: Ticket verification is done in milliseconds, speeding up entry flow compared to manual inspection.

Reduced Human Error / Fraud: Automatic matching of UIDs and optional duplicate-use control reduces unauthorized access, counterfeiting and oversight.

Contactless Operation: RFID tags do not require line-of-sight or physical contact, making scanning convenient and hygienic (especially relevant in public venues).

Low Cost & Scalability: Using Arduino Mini and low-cost RFID modules keeps the system budget-friendly; additional readers and tags can be easily added.

Modularity & Extendibility: The system can be extended to include network connectivity (WiFi/Bluetooth), remote logging, cloud databases, smartphone apps, and multi-reader coordination.

Audit Logging (optional): Logging ticket usage enables after-event analytics, improved security and operational insight.

Visual Feedback for Users: The LCD provides immediate feedback (—Welcome! or —Denied!), reducing confusion and operator workload.[2]

10. APPLICATIONS

Public transport ticket boarding (bus, metro, tram) where each passenger has an RFID-based ticket.

Event access control: concerts, exhibitions, sports stadiums where tickets are issued as RFID cards or tags.

Parking lot entry where vehicles carry RFID tags and are validated before entry.

Library or museum ticket verification systems, allowing quick access for verified visitors. Corporate or institutional entry systems where employees or visitors present RFID badges for access to specific zones.

Temporary or portable setups (e.g., trade shows, pop-up events) where low-cost and rapid deployment is beneficial.[3]

11. RESULT

Thus our group actively coupled with project, and we develop this project named as —RFID- based ticket verification systeml.

The implemented system successfully demonstrated the automatic verification of RFID tickets using Arduino Mini, with the RFID reader and I²C LCD display via SDA/SCL. Upon presenting an authorized RFID tag, the LCD displayed a welcome message and the ticket was marked as used to prevent duplicate entry. Unauthorized or reused tags were rejected with a denial message and visual/audible indicator. The system responded reliably to tag presentations

During testing, multiple tags were scanned in succession without misreads or failures, and the duplicate-use prevention logic worked as intended. The modular hardware allowed for future integration of data logging and remote monitoring. Overall, the project met its objectives: delivering a cost-effective, efficient, and scalable ticket verification system for entry control.[4]

12. CONCLUSION

An RFID-based train ticketing system offers a modern, efficient, and secure solution for public transportation. By replacing traditional methods with an automated, cashless system, it improves the passenger experience while also benefiting the transport authorities through increased efficiency and revenue protection. While there are initial challenges, the long-term benefits make it a worthwhile upgrade for modern transit systems.[4]

13. REFERENCE

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