RFID Based Exam Hall Maintenance System

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ABSTRACT
Seating Arrangement of students during examinations is distributed. Students face difficulties as they have to scrounge for their examination hall numbers and seating arrangement while they are wits end. An innovation which could aid the students in finding their exam halls and seats would be welcoming and very rewarding. This paper "RFID BASED EXAM HALL MAINTENANCE SYSTEM", presents a modernized method of examination hall management. It is possible for a student to identify the particular exam hall from any other hall, when they swipe RFID card in a card reader located there. This helps them to identify the floor or get directions to their respective halls without delays. The card reader is provided at the entrance of the building, if the students enters wrongly a buzzer alarm sets off, otherwise the room number is displayed on the LCD, connected to controller.

Keywords
RFID, AT89S52 Microcontroller.

1. INTRODUCTION
RFID (Radio Frequency Identification) technology is an emerging technology[10,11, 13], used in a wide range of applications, is a member in the family of Automatic Identification and Data Capture (AIDC) technologies which is fast and reliable means for identification of objects. The RFID is composed of two main components: The Interrogator (RFID Reader) which transmits and receives the signal and the Transponder (tag) that is attached to the object. In an RFID [16] system, RFID tags are "interrogated" by an RFID reader. The tag reader generates a radio frequency "interrogation" communicates with the tags. The reader also has a receiver that captures a reply signal from the tags, and decodes that signal. The reply signal from the tags reflects, the tag's data content. The reply signal is created as passive "backscatter"

An RFID tag is composed of a miniscule microchip and antenna. The RFID alone has numerous application but when is spliced with microcontroller the boundaries expands further.

RFID is of three types. They are:

- Passive (using no battery)[2]
- Active (with an on-board battery)
- Battery assisted passive "BAP" (with a small battery on board that is activated when in the presence of an RFID reader)

Passive RFID tags are used in our paper as they are economical with an appreciable range.

The Principal areas of application for RFID that can be currently identified include [18]:

- Transportation and logistics
- Manufacturing and Processing
- Security
- Product security:
  - Tamper evidence
  - Product authentication
  - Anti-counterfeiting

A range of miscellaneous applications may also be distinguished, some of which are steadily growing in terms of application numbers. They are included as follows[14]:

- Animal tagging
- Waste management
- Time and attendance
- Postal tracking
- Airline baggage reconciliation
- Road toll management

As standards emerge, technology develops still further, and costs reduce considerable growth in terms of application numbers and new areas of application may be expected. Some of the more prominent specific applications include[17,18]:

- Electronic article surveillance - clothing retail outlets being typical.
- Protection of valuable equipment against theft, unauthorised removal or asset management.
- Controlled access to vehicles, parking areas and fuel facilities - depot facilities being typical.
- Automated toll collection for roads and bridges - since the 1980s, electronic Road-Pricing (ERP) systems have been used in Hong Kong.
- Controlled access of personnel to secure or hazardous locations.
- Time and attendance - to replace conventional "slot card" time keeping systems.
- Animal husbandry - for identification in support of individualised feeding programmes.

- Automatic identification of tools in numerically controlled machines - to facilitate condition monitoring of tools, for use in managing tool usage and minimising waste due to excessive machine tool wear.
- Identification of product variants and process control in flexible manufacture systems.
- Sport time recording
- Electronic monitoring of offenders at home
- Vehicle anti-theft systems and car immobiliser

A number of factors influence the suitability of RFID for given applications. The application needs must be carefully determined and examined with respect to the attributes that RFID and other data collection technologies can offer. Where RFID is identified as a contender further considerations have to be made in respect of application environment, from an electromagnetic standpoint, standards, and legislation concerning use of frequencies and power levels. But none of the systems never tried to develop a system aiding exam hall seating arrangement.

1.1 RFID:

RFID[1-8,9-14], its application, standardization, and innovation are constantly changing. Its adoption is still relatively new and hence there are many features of the technology that are not well understood by the general populace. Developments in RFID technology continue to yield larger memory capacities, wider reading ranges, and faster processing. It's highly unlikely that the technology will ultimately replace bar code - even with the inevitable reduction in raw materials coupled with economies of scale, the integrated circuit in an RF tag will never be as cost-effective as a bar code label. However, RFID will continue to grow in its established niches where bar code or other optical technologies aren't effective. If some standards commonality is achieved, whereby RFID equipment from different manufacturers can be used interchangeably, the market will very likely grow exponentially.

A moment's thought about radio broadcasts or mobile telephones and one can readily appreciate the benefits of wireless communication. Extend those benefits to communication of data, to and from portable low cost data carriers, and one is close to appreciating the nature and potential of radio frequency identification (RFID). RFID is an area of automatic identification that has quietly been gaining momentum in recent years and is now being seen as a radical means of enhancing data handling processes, complimentary in many ways to other data capture technologies such bar coding.

A range of devices and associated systems are available to satisfy an even broader range of applications. Despite this diversity, the principles upon which they are based are quite straight forward, even though the technology and technicalities concerning the way in which they operate can be quite sophisticated. Just as one need not know the technicalities of a mobile phone or personal computer to use it, it is not necessary to know the technicalities to understand the principles, considerations and potential for using RFID. However, a little technical appreciation can provide advantage in determining system requirements and in talking to consultants and suppliers.

The range that can be achieved in an RFID system is essentially determined by[14]:

- The power available at the reader/interrogator to communicate with the tag(s)
- The power available within the tag to respond
- The environmental conditions and structures, the former being more significant at higher frequencies including signal to noise ratio

RFID System Components

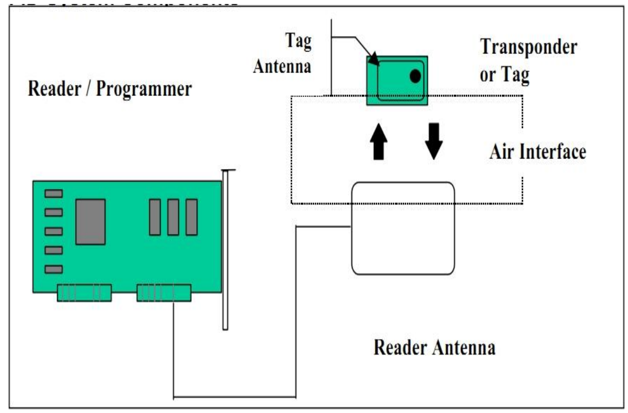

Figure 1 RFID System Components

Transponders/Tags

The word transponder, derived from TRANSMITTER / RESPONDER, reveals the function of the device. The tag responds to a transmitted or communicated request for the data it carries, the mode of communication between the reader and the tag being by wireless means across the space or air interface between the two. The term also suggests the essential components that form an RFID system – tags and a reader or interrogator. Where interrogator is often used as an alternative to that of reader, a difference is sometime drawn on the basis of a reader together with a decoder and interface forming the interrogator. The basic components of a transponder may be represented as shown below. Generally speaking they are fabricated as low power integrated circuits suitable for interfacing to external coils, or utilizing "coil-on-chip" technology, for data transfer and power generation (passive mode).

Antenna:

The transponder antenna is the means by which the device senses the interrogating field and, where appropriate, the programming field and also serves as the means of transmitting the transponder response to interrogation. A number of features, in addition to carrier frequency, characterize RFID transponders and form the basis of device specifications, including:

Means by which a transponder is powered

- Data carrying options
- Data read rates
- Programming options
- Physical form
- Costs

The frequency Band, characteristics and its typical applications are given in Table 1 as follows[18]

Frequency band	Description	Operating range	Applications
100kHz to 500 kHz	Low Frequency	<0.5m or 1.5ft	Access Control • Animal Tracking • Vehicle immobilizers • Product Authentication • POS applications
13.56MHz	High Frequency	< 1m or 3ft.	.Smart Cards • Smart shelve tags for item level tracking •Library Books •Airline Baggage • Maintenance data logging
860 MHz to930MHz 2.4GHz to 5.8 GHz	Ultrahigh Frequency (UHF)	3m or 9ft	•Pallet tracking •Cartontracking • Electronic toll collection • Parking lot access

RFID Tag / Reader Schematic

Figure 2 RFID Reader/Tag Schematic

The Schematic View of Inside RFID Reader is given in Fig 3

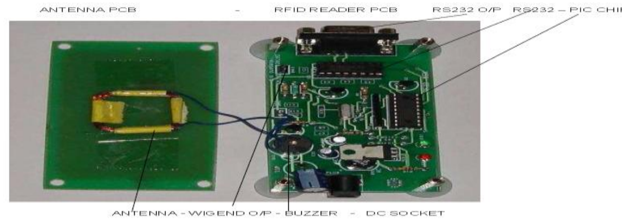

Figure 3 Inside RFID Reader

1.2 Working of RFID READER: 125kHz/LF

The RFID Proximity Reader Module has a built-in antenna in minimized form factor. It is designed to work with standard carrier frequency of 125 kHz. This LF reader module with an internal or an external antenna facilitates communication with Read-Only transponders—type UNIQUE or TK5530 via the air interface. The tag data is sent to the host systems via the wired communication interface with a protocol selected from the module Both RS232 and Wiegend Protocol. The LF module is best suited for applications in Access Control, Time and Attendance, Asset Management, Handheld Readers, Immobilizers, and other RFID enabled applications.

Features:

- Selectable UART or Wigand26
- Plug-and-Play, needs +12V to become a reader
- No repeat reads
- LED indicates tag reading operation
- Excellent read performance without an external circuit
- Compact size and cost-effective.

The RFID reader continuously transmits a 125 kHz carrier signal using its antenna. The passive RFID tag, embedded in an id card for example, powers on from the carrier signal. Once powered on, the tag transmits, back to the reader, an FSK encoded signal containing the data stored on the card. The FSK signal is a 125 kHz carrier, with 12.5 kHz as the mark frequency, and a 15.625 kHz as the space frequency. The encoded signal is picked up by the reader's antenna, filtered, and processed on the embedded microcontroller to extract the tag's unique identity. At this point the identity can be matched against the records stored on the reader.

The clock generator serves a single purpose. It generates a low level 125 kHz square wave for use by the transmitting circuit within the antenna module. The antenna module takes a 125 kHz square wave input, buffers it, using three shunted inverting gates, and converts it into a 125 kHz sinusoidal wave using the RLC circuit immediately following the buffers. The resulting wave is amplified, using a push pull amplifier, forming the carrier signal, and fed into an antenna that transmits the carrier continuously toward any RFID tag position above it.

The same antenna is used to capture the FSK encoded waveform returning from the tag. This resulting waveform, or simply the 125 kHz carrier, if no tag is present, is available as an output from the antenna module. The filtering module's main purpose is to filter out the carrier signal and any noise that was picked up by the antenna. To get rid of any high frequency interference and the 125 kHz carrier, which contains no data, we apply an envelope detector. From the previous stage we still have some low frequency and traces of high frequency interference in our signal. To get rid of both we pass the signal through two active band pass filters, one at our mark frequency of 12.5 kHz, and one at our space frequency of 15.625 kHz. At this point we have a fairly clear signal at either the mark or the space frequency and minimal noise.

We use a PIC 16F628A chip as the microcontroller [9] in the reader. The chip does not need an external clock source as it is using one of the internal oscillator to generate its clock. The resistors are used to set the reference level for an internal comparator used to process the output of the filtering stage. The comparator is formed by the reference voltage at RA2 and the output of the filtering module at RA1. The microcontroller processes the signal coming from the filtering module to extract the bits and decode them into usable data and sent to MAX232 IC embedded on the kit.

Hence in this paper we propose a simple but an effective system design using the spliced microcontroller and RFID technology for the convenience of students without having to scrounge for their examination halls in an alien building. A prototype of this idea has been developed to prove the feasibility and to demonstrate its features. The design offers a great amount of feasibility and project opportunities, which may in future begin to define new pinnacles of innovation.

2. Proposed Methodology.

The RFID Reader emits a low-power radio wave field using its antenna to power up the tag so as to pass the information that is contained on the chip. This information on the chip is an FSK encoded signal which is picked up by the reader antenna, filtered and processed on the embedded microcontroller to extract the tag's unique identity. The RFID card reader is connected to the controller through MAX232. The controller will receive TTL logic from a line driver, MAX232 since the RS232 is not compatible with today's microcontrollers. The controller performs a database search for the exam room number of the student and displays it on the LCD screen connected to the controller. It is thus possible for a student to identify the particular exam hall from the various hall after swiping RFID card in a card reader. In addition, readers can be fitted with an additional interface that converts the radio waves returned from the tag into a pattern that can then be passed on to another system, like a computer or any programmable logic controller for further processing or storing of data. RFID card readers are provided at the entrance of the building to enable entry. If any unauthorized person enters a buzzer alarm is set off.

2.1. Block diagram & Type of components

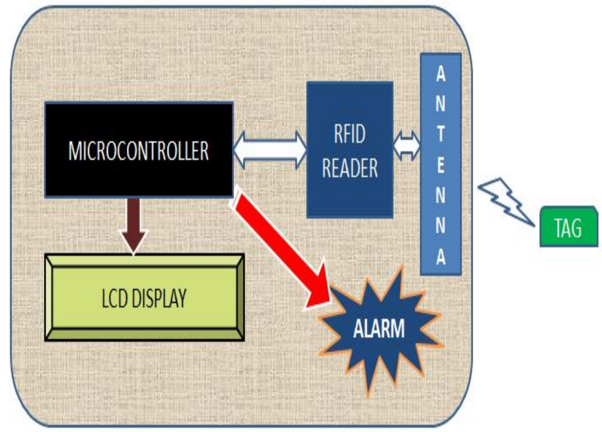

Figure 4 Block Diagram of the proposed system

The system constitutes the following modules:

1. Microcontroller[9]
2. RFID Reader[3]
3. RFID Tag[1]
4. LCD[9]
5. Power Supply

SBUF register[9]:

SBUF is an 8-bit register used for serial communication. For a byte of data to be transferred via the TxD line, it must be placed in SBUF register. Similarly, SBUF holds the byte of data when it is received by the 89S52's RxD line. The moment a byte is written into SBUF, it is framed with the start and stop bits and transferred serially via the TxD pin. Similarly, when the bits are received serially via the RxD, the controller de-frames it by eliminating the start and stop bits, making a bite out of the data received and then placing it in the SBUF.

Baud Rate in AT89S52 [9]

The 89S52 transfers and receives data serially at many different baud rates. The baud rate in the controller is programmable. This is done with the help of Timer1.The controller divides the crystal frequency by 12 to get the machine cycle frequency. In the case of XTAL =11.0592MHz, the machine cycle frequency is 921.6kHz (11.0592MHz/12= 921.6kHz). The serial communication UART divides the machine cycle frequency once again by 32 once more before it is used by Timer1 to set the baud rate. Therefore,921.6 kHz/32= 28,800Hz. This is the number we will use to find the Timer1 value to set the baud rate. When Timer1 is used to set the baud rate it must be programmed in mode 2 i.e, 8-bit auto reload mode.

MAX 232[15]:

Features:

- Meets or Exceeds TIA/EIA-232-F
- Operates from a single 5V power supply with 1µF charge pump capacitors.
- Operates up to 120 kbit/sec.
- Two Drivers and Two Receivers.
- ±30V Input Levels.
- Low supply current typically 8mA.

Applications:

TIA/EIA-232-F, Battery powered systems, Terminals, Modems, and Computers.

Description:

In order to make RS232 compatible with today's microcontrollers, we need a line driver (voltage converter) to convert the RS232's signals to TTL voltage levels that will be acceptable to the TxD and RxD pins. The MAX232 converts from RS232 voltages levels to TTL voltage levels, and vice versa. One advantage of the MAX 232 is that it uses +5V power source which is same source for the 89S52. In other words, with a single +5V power supply we can power both the 89S52 and MAX 232.

The MAX232 has two sets of line drivers for transferring and receiving data. The line drivers used for TxD are called T1 and T2, while the line drivers for RxD are called as R1 and R2. In many applications only one is used. For example, T1 and R1 are used together for TxD and RxD of 89S52 and the second set is left unused. In MAX232 the T1 line driver has a designation T1in and T1out on pin numbers 11 and 14 respectively. The T1in pin is the TTL side and is connected to TxD of the microcontroller, while T1out is the RS232 side that is connected to the RxD pin of the RS232 DB connector. The R1 line driver has a designation of R1in and R1out on pin numbers 13 and 12, respectively. The R1in(pin13) is the RS232 side that is connected to the TxD pin of RS232 DB connector, and R1out(pin12) is the TTL side that is connected to the RxD pin of the microcontroller. MAX232 requires four capacitors ranging from 1 to 22µF. The mostly used value for these capacitors is 22µF. The MAX232 is a dual driver/receiver that includes a capacitive voltage generator to supply TIA/EIA-232-F voltage levels from a single 5-V supply. Each receiver converts TIA/EIA-232-F inputs to 5-V TTL/CMOS levels. These receivers have a typical threshold of 1.3 V, a typical hysteresis of 0.5 V, and can accept ±30-V inputs. Each driver converts TTL/CMOS input levels into TIA/EIA-232-F levels.

LCD:

LCD (Liquid Crystal Display) screen is an electronic display module and find 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 segments and other multi segment LEDs. 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 given 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.

3. Result & Discussion

The developed unit and its responses at various stages are shown in figure 5,6,7 and 8 is as follows, where figure 6 shows the Initially without any Tag output on the LCD.

Figure 5 Photo of Kit assemblies

Figure 6 Initially without any Tag output on the LCD

Initially we store the tag id's in the microcontroller. When the student swipes the tag in the rfid reader; the corresponding id is fetched from the database of the microcontroller. If the student is an Authorisied person the exam hall room number is displayed on the lcd. If the student is an unauthorized person a buzzer alarm is produced and also it displays the reason why the student is an Unauthorisied person.

Case1: The tag id shown is 10813759. The tag's corresponding id is checked from the database of the microcontroller. Here the student is Authorisied person so the hall number is displayed on the lcd.

Output: Authorized

ROOM NO VV201

Figure 7 The Tag ID shown is 10813759

Case2: The other successful case is shown in figure 8

The Tag ID shown is 10813772

Output: Authorized

ROOM NO VV214

Figure 8 gives the Tag ID is 17128183

Case 3:If the student is an Unauthorisied person a buzzer alarm is produced and displays the reason on the lcd why the student is an Unauthorisied. The tag id shown is 10813759. The tag's corresponding id is checked from the database of the microcontroller. Here the student is an unauthorised person hence a buzzer alarm is produced.

Figure 9 The Tag ID is 17128183

Output: Unauthorized

Pay Exam Fee

Figure 10: Output on the lcd

4. CONCLUSION & FUTURE SCOPE

RFID technology is emergent technology which can be used in wide range of applications. By integrating both RFID and microcontroller generates a project with wider boundaries and effective solutions. Here a simple but effective system has been designed for the convenience of students using the spliced technology and a prototype to prove the feasibility and demonstrate the features has been developed. This idea can be improved upon by adding more features like - maintaining student's details like fee due, library transactions, attendance etc... The idea is beneficial to both the student and the corporate society depending upon its effective implementation as it sow in the seeds to develop various veritable projects..

5. ACKNOWLEDGMENTS

The author wants to thank Rengarajan Amirtharajan Assistant Professor & Project Coordinator / ECE School of Electrical & Electronics Engineering SASTRA University for his valuable guidance and moral support without which this paper would not be possible.

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