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Design and Implementation of an Rfid Based Automated Students Attendance System R BASAS

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ABSTRACT

Most educational institutions' administrators are concerned about student irregular attendance. Truancies can affect student overall academic performance. The conventional method of taking attendance by calling names or signing on paper is very time consuming and insecure, hence inefficient. Therefore, RFID-based student attendance system is required to assist the faculty and the lecturer for this time-consuming process. The R-BASAS device is designed to collect and manage student's attendance records from RFID devices installed in a class rooms. Based on the verification of student identification at the entrances system, the RFID tag can be embedded in the ID card of the individual. First to activate a new session (hour) the teacher swipes her RFID tag this marks a new attendance session during which the students can swipe once to increment their attendance. This study was conducted for sixteen (16) students, and reveals that the average execution time for the RFID based attendance system reduced to 3.85secs as against the manual system which takes and average of 17.26secs. The RFID module operate in 125Khz range, when a tag passes through its vicinity, the module senses its presence and extracts its unique serial number and passes this code into microcontroller which matches the code to the correct person and increments the attendance of the particular person.

Keyword: RFID, Attendance, microcontroller, Reader, RFID Tags, MAX232

INTRODUCTION

In many institutions, and academic organizations, attendance is a very important criterion which is used for various purposes. These purposes include record keeping, assessment of students, and promotion of optimal and consistent attendance in class. In developing countries, a minimum percentage of class attendance is required in most institutions and this policy has not been adhered to, because of the various challenges the present method of taking attendance presents. This traditional method involves the use of sheets of paper or books in taking student attendance. This method could easily allow for impersonation and the attendance sheet could be stolen or lost. Taking of attendance is time consuming and it is difficult to ascertain the number of students that have made the minimum percentage and thus eligible for exam. Thus, there is a need for a system that would eliminate all of these trouble spots.

This study is going to solve the above problems by using RFID technology. Radio Frequency Identification (RFID) is an automatic identification method, relying on storing and remotely retrieving data using devices called RFID tags or transponders. So the RFID is a wireless identification. Normally the RFID system comprises of two main parts which are RFID Reader and RFID Tag.

Rather than signing an attendance sheet, individuals will swipe their tags on the RFID reader, the reader capture the information in the card. The information is transmitted wirelessly to the microcontroller

A number of related works exist on the application of different methods and principles to effectively monitor the attendance of students. In [1], an embedded computer based lecture attendance management system was proposed. The system provides an improvised electronic card and card reader serially interfaced to the digital computer system.

Authors in [2], used a wireless attendance management system that authenticates using the iris of the individual. The system uses an off-line iris recognition management system that can finish all the process including capturing the image of iris recognition, extracting minutiae, storing and matching.

Attendance Management has also been carried out using attendance software that uses passwords for authentication. The authors in [3] designed and implemented a system that authenticates the user based on passwords, this type of system allows for impersonation since the password can be shared or tampered with. Passwords could also be forgotten at times thereby preventing the user from accessing the system. [4]

Other attendance solutions [5] are Barcode Attendance system, Magnetic Stripe Attendance System, Fingerprint Identification and GSM-GPRS based student attendance system. These are all device-based solutions. While GSM-GPRS based systems use position of class for attendance marking which is not dynamic and if schedule or location of the class changes, wrong attendance might be marked.

This system, however, is a cost effective simplified system that uses RFID tags for identification. The RFID tags contain unique serial number that carries individual data and cannot be shared. It allows students to register for lectures with ease and eliminate errors that are associated with attendance reports because the system generates reports at the end of each lecture.

SYSTEM OVERVIEW

The proposed system mainly consists of RFID tag and RFID reader and the overall process is controlled by the microcontroller. RFID reader is used to detects the tag. These tags have provided to students with particular ID. As soon as the student with valid RFID card comes near to the RFID detector, detector will sense the card and collect the necessary information present in the card. The information is transmitted wirelessly using GPRS. The received information is then updated in the respective student's profile on the WEB. Microcontroller is used for controlling the events.

In PCB (Printed Circuit Board) design, power supply requires zener diode which generates dc supply. This supply is sends to entire device. The major part of this system is LCD, RFID reader, Tag and microcontroller. Microcontroller is the heart of this system.

The proposed block diagram of RFID based Automated Student Attendance system is as shown in fig. 1. It has shown the main blocks that are being used in the system

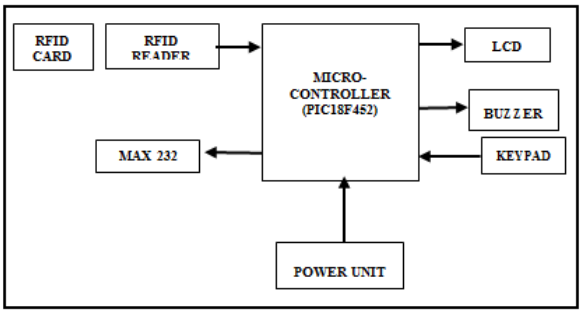


Figure 1.0: Block Diagram of an RFID Based Automated Student Attendance System.

SYSTEM DESIGN

RFID based Automated Student Attendance system is a highly specialized system that automate the whole system of students' attendance registration using RFID.

The major factors in designing a RFID attendance system include: choosing the hardware and software components and integrating both to work together, defining the system working mode (verification or identification) and defining administration and optimization policy [5],[9].

Student attendance system framework is divided into three parts: Hardware design, Software design, Attendance Management Approach and Report Generation. Each of these is explained below.

HARDWARE DESIGN

MICROCONTROLLER PIC18F452

The controller used in this project is a 40 pin wide DIP (Dual In Line) package chip named PIC18F452; This chip was selected because it is robust, and the DIP package interfaces with prototyping. Supplies like solder less bread boards and solder-type per-boards. This same microcontroller is available in a surface mount package, about the size of a dime. Surface mount devices are more useful for circuit boards built for mass production. Figure 2 below shows the 'pin-out' diagram of the PIC18F452. This diagram is very useful, because it tells you where power and ground should be connected, which pins tie to which functional hardware, etc.

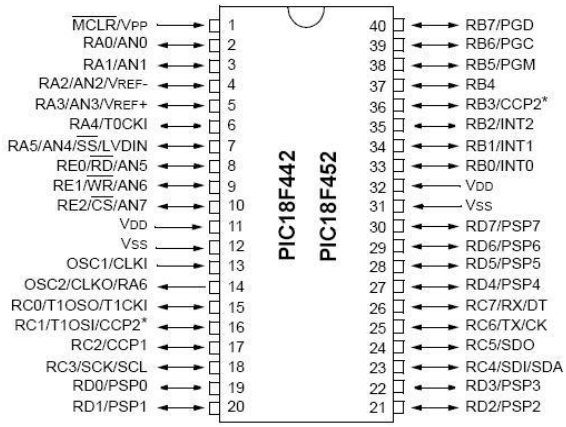


Figure 2: Pin Diagram of PIC18F452

Special Microcontroller Features:

Table 1: PIC18F452 Features

Features	PIC18F452
Operating Frequency	DC-40MHZ
Program Memory (Bytes)	32K
Program Memory (Instructions)	16384
Data Memory (Bytes)	1536
Data EEPROM Memory (Bytes)	256
Interrupt Sources	18
I/O Ports	Ports A, B, C, D, E
Timers	4
Capture/Compare/PWM Modules	2
Serial Communications	MSSP, Addressable USART
Parallel Communications	PSP
10-bit Analog-to-Digital Module	8 input channels
RESETS (and Delays)	POR, BOR,RESET Instruction, Stack Full, Stack Underflow (PWRT, OST)
Programmable Low Voltage Detect	Yes
Programmable Brown-out Reset	Yes
Instruction Set	75 Instruction
Packages	40-pin DIP, 44-pin PLCC, 44-pin TQFP

LCD DISPLAY

The display support 4X20 characters, which means, the LCD can support 4 lines on the display and each line can display up to 20 characters which is relevant as the only essential output to be displayed is the student's name, metric no., gender and ID. Besides LCD Display, the output is displayed on LCD. The diagram of LCD display is shown in Figure 3 below

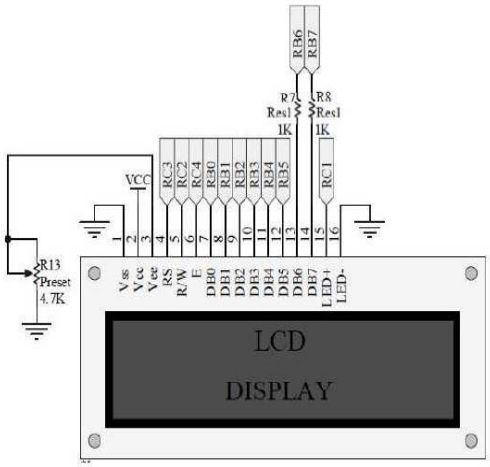


Fig 3: Circuit Diagram of LCD Display

MAX232

The MAX232 is an integrated circuit that converts signals from an RS-232 serial port to signals suitable for use in TTL compatible digital logic circuits. The MAX232 is a dual driver/receiver and typically converts the RX, TX, CTS and RTS signals.

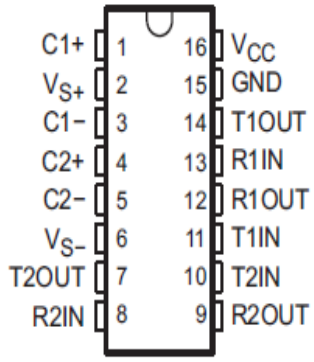


Fig4: Pin configuration of MAX232

Table 2: Pin description of MAX232

PIN NUMBER	USE
1 & 3	C1+ & C1-: External capacitance of Positive voltage multiplier unit.
2 & 6	Vs+ & Vs-: Output of positive and negative voltage of multiplier unit Respectively.
4 & 5	C2+ & C2-: External capacitance of Negative voltage multiplier unit.
7 & 14	T2OUT & T1OUT: Output of transmitter data (levels RS – 232).
8 & 13	R2In & R1IN: Input of receiver data (Levels RS – 232).
9 & 12	R2OUT & R1OUT: Output of receiver data (levels TTL/CMOS).
10 & 11	T2IN & T1IN: Input of transmitter data (levels TTL/CMOS).
15	GND: Ground.
16	Vcc: Supply voltage

RFID READER

A reader (now more typically referred to as an RFID interrogator) is basically a radio frequency (RF) transmitter and receiver, controlled by a microprocessor or digital signal processor. The reader, using an attached antenna, captures data from tags, then passes the data to the controller for processing. The reader decodes the data encoded in the tags integrated circuit (silicon chip) and the data is passed to the microcontroller for process.

FEATURES OF RFID READER

a. Low cost solution for reading passive RFID transponder tags.
b. Industrial grade casing for better outlook and protection.
c. Integrated RFID reader, antenna, LED, power cable and data cable.
d. Every reader has been tested before is being shipped.
e. 9600 baud RS232 serial interface (output only) to PC.
f. Fully operation with 5VDC power supply.
g. Buzzer as sound indication of activity.
h. Bi-colour LED for visual indication of activity.
i. Standard RS232 serial cable (female) ready to plug to desktop PC or Laptop.
j. 2m reading range.
k. 0.1s response time.
l. Operating frequency: 125KHz

POWER SUPPLY

Power supply is used to supply required power to the system. Electronic device requires wide variety of voltage level to operate correctly, for this system, a +5V dc power supply is required.

SOFTWARE ARCHITECTURE

RFID TAG SERIAL NO.	RFID TAG STATUS	STUDENT STATUS	ALARM
0006754533	VALID	PRESENT	SHORT BEEP
0008904456	VALID	PRESENT	SHORT BEEP
0006884352	VALID	PRESENT	SHORT BEEP
0006829102	VALID	PRESENT	SHORT BEEP
0006763881	VALID	PRESENT	SHORT BEEP
0006999886	VALID	PRESENT	SHORT BEEP
0006784479	VALID	PRESENT	SHORT BEEP
0000674314	VALID	PRESENT	SHORT BEEP
0000714022	VALID	PRESENT	SHORT BEEP
0000681445	VALID	PRESENT	SHORT BEEP
0000703686	VALID	PRESENT	SHORT BEEP
0000672823	VALID	PRESENT	SHORT BEEP
0000674918	VALID	PRESENT	SHORT BEEP
0000708902	VALID	PRESENT	SHORT BEEP
0000683104	VALID	PRESENT	SHORT BEEP
0006813276	VALID	PRESENT	SHORT BEEP
0008913950	INVALID	REJECTED	LONG BEEP
0006757137	INVALID	REJECTED	LONG BEEP
0000716325	INVALID	REJECTED	LONG BEEP

The software architecture consists of: the database and the Microcontroller software.

Database: this is a device that holds all data, here data can be retrieved and transmitted. In this project, PIC18F452 Microcontroller serves as our Database.

Microcontroller Software: The microcontroller is programmed using the C procedural language. The environment in which the program was written is the MPLAB which is a design tool for PIC

microcontrollers. The software is that it assisted in utilizing the management of the RFID tag, RFID reader and also to control the output on the LCD Flowchart for controls, inputs, outputs and a user interface were created before the coding began. After the codes were written, it was then debugged, compiled and the hex files produced by the compiler were burnt into the microcontrollers flash memory (called the code memory) using pickit2 microchip programmer.

Terminal Software

Terminal is software which can be used in the windows environment to communicate with the serial port. Serial port is used to communicate with the microcontroller; the terminal software is used to get the attendance status of the students in the system from the serial port.

METHODOLOGY

The paper in question is an attendance system that monitors student attendance and stored their data on a microcontroller. The mode of communication is wireless using a radio frequency module. The primary purpose of an RFID system in this application area is to detect the presence and absence of the student data to be transmitted wirelessly by mobile device, called a tag, which is read by an RFID reader and processed according to the programmed instructions on the Microcontroller.

TESTING AND DISCUSSION

Upon Completion of project, several test was carried out on the system and the following results were obtained by swiping of the Student's RFID Tag against the Reader. The table below shows the summary of the results obtained;

Fig.5a:Displaying name matric. No.depart.and RFID tag

Fig 5b: Displaying attendance taken

Fig 5a & b: Test result upon flashing a valid tag (0000683104) on the Reader

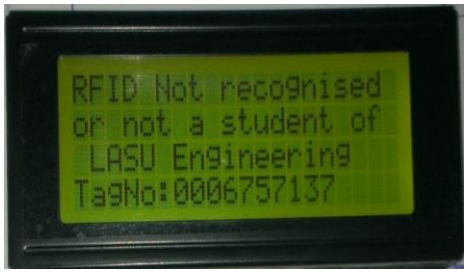


Fig. 6a

Fig. 6b

Fig. 6c

Fig6a,b&c:Test result upon viewing the ATTENDEES

COMPARISON OF DATA

The table below, shows the execution time by (16) students to mark their attendance both manually and electronically (RFID

STUDENT	RFID ATTENDANCE SYSTEM	MANUAL ATTENDANCE SYSTEM
1	3.81	20.78
2	3.43	13.82
3	4.12	13.65
4	3.63	22.38
5	2.53	15.65
6	2.49	15.24
7	3.35	19.66
8	4.01	27.23
9	4.21	14.97
10	4.31	14.87
11	3.85	19.16
12	4.32	14.78
13	4.78	21.01
14	4.23	12.96
15	3.55	14.78
16	5.00	15.23
	$\sum x = 61.62$	$\sum y = 276.17$

Average execution time by the RFID base attendance system is thus

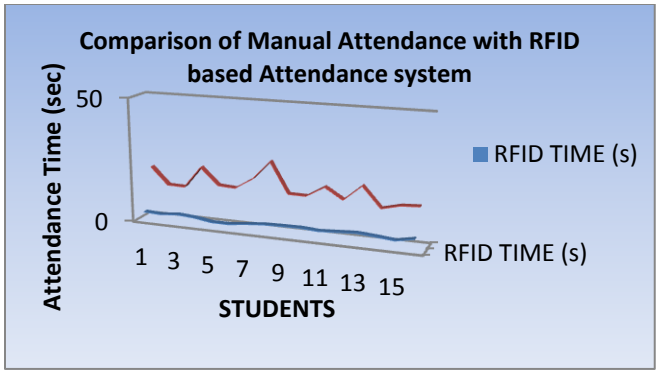
$\sum x = \frac{\sum x}{n} = \frac{61.62}{16} = 3.85$sec

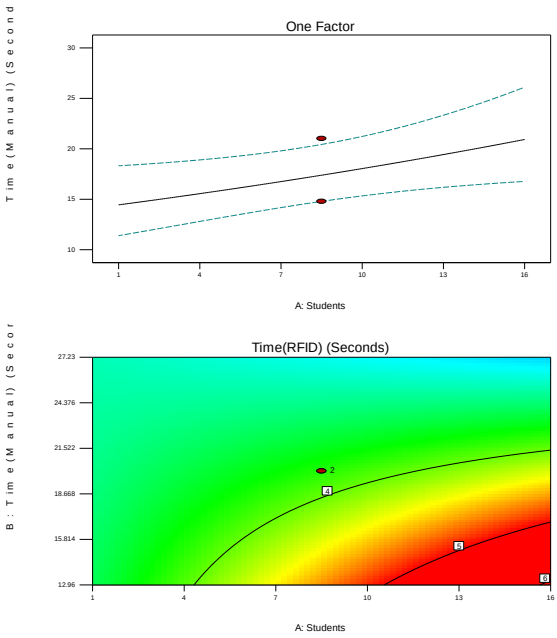
Average execution time by manual attendance system is thus,

$\sum y = \frac{\sum y}{n} = \frac{276.17}{16} = 17.26$sec

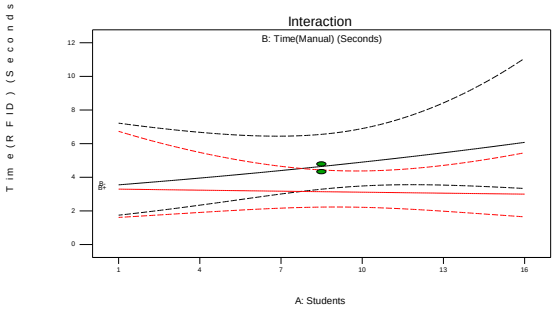
COMPARISON WITH MANUAL ATTENDANCE

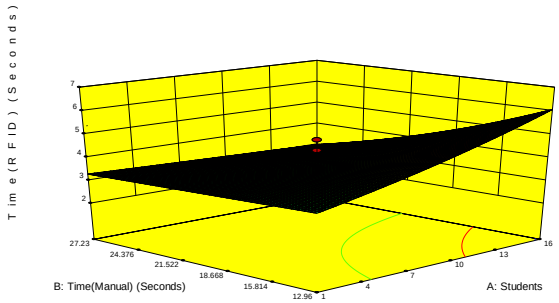
The manual attendance system average execution time for sixteen (16) students is approximately 17.26 seconds as against 3.85 seconds for the RFID based Attendance system. Reports generation for the attendance system takes approximately 30s. The test conducted in Table 5.0 consists of sixteen (16) . It can be shown in the graph below and thus, it can be seen that the RFID based Attendance system is better and faster than the use of sheets of paper.

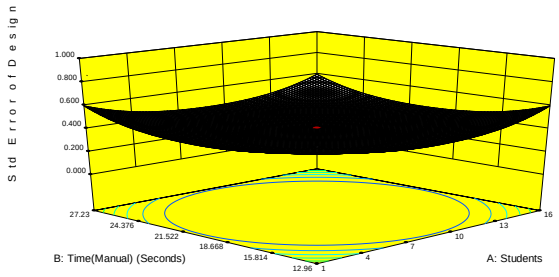




The lack of fit sum of squares for the linear model. The F-value compares the variation of the differences in the average responses at the design points, and the corresponding estimated responses using the linear model, with the expected experimental variation as estimated from replicated design points (Pure Error). It is the mean square for the linear model lack-of-fit divided by the mean square for pure error. The lack-of-fit tests compare the residual error to the pure error from replicated design points. A lack-of-fit error significantly larger than the pure error indicates that something remains in the residuals that can be removed by a more appropriate model. Fraction of Design Space (FDS) calculates the volume of the design space having a prediction variance less than or equal to a specified value.







DISCUSSION OF RESULTS

RFID Based Automated Student Attendance System which is able to identify Student tag, monitor and take their attendance wirelessly was successfully developed. The major contribution of this work is managing to write a functional code for the Microcontroller to communicate with other components. This system should be able to minimize the technical human error and time wastage while taking attendance of students.

RECOMMENDATION

This system is not without limitation as a data collection technology with accurate and timely data entry. Hence, the limitation of this design would be improved upon in future by considering the following salient recommendations:

- By incorporating a facial recognition application that would serve to further increase the biometric security of the system against impersonation by erring students.
- Usage of High Frequency (HF) active RFID tags against passive Low frequency (LF) RFID tags for better performance and flexibility of users
- By adding more storage capacity by interfacing Flash memory devices to microcontroller and interfacing networking modules (like GSM module, GPRS module, etc.) to send attendance status to mobile phones via SMS.

CONCLUSION

As the RFID technology evolves, more sophisticated applications will use the capability of RFID to receive, store and forward data to a remote sink source. RFID has many applications as can be imagined. In this project, we have utilized the versatility of RFID in implementing functional and automatic student attendance recording system that allows students to simply fill their attendance just by swiping or moving their RFID cards over the RFID reader which are located at the entrance of lecture halls with a considerable degree of success and acceptability of usage in our faculty. We hope that this system can shift the paradigm of students' lecture attendance monitoring in face-face classroom and provide a new, accurate, and less cumbersome way of taking student attendance in Nigerian Higher Institutions.

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