RFID Based Campus Management System: Access Control System

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Abstract: In today's world controlling the access to a particular area, premises or campus is a big matter of concern. Currently there are no specific systems installed at access points or there are traditional pen paper based gate pass systems which is a slow and tedious process. We developed a system with aim to provide a cost efficient, faster and reliable solution for the same problem. We designed an access channel for the same. These access channels would also be the nodes of a local network with a central server that would facilitate two-way communication between the central server and each of the gates. In our system every individual will be assigned a RFID tag (ID card), details of the individual will be saved in the database. When the individual arrives at the access terminal he or she has to present the tag at the gate reader, reader will send the tag details to server via Ethernet module. When the server receives this data it compares it in the database, if the person is authorised to pass through that access terminal, it drives the access controlling gate (opens and closes after some time).

Keywords — Automatic access control, Access control, campus management, RFID, RFID applications, RFID based access control system.

I. INTRODUCTION

Access control to various campuses, buildings, premises etc is very important thing to eliminate the security issues faced by different organizations in world these days. By installing our system at the entrances we can eliminate security issues by only allowing authorized person to pass through the access channel. We can also monitor the movement of the authorized persons inside the campus by installing this system at various points. In this system no unauthorized person will be granted entrance through the access channel hence increasing security.

The RFID technology consists of mainly two parts first is tag or transponder and second is reader or interrogator. RFID reader and tags are classified briefly as per their operating frequency. Tags are also classified based on presence of internal power supply of tag. Classification of tags and readers based on frequency is as follows.

- LOW FREQUENCY: 125-134 KHz
- HIGH FREQUENCY: 13.56 MHz
- ULTRA HIGH FREQUENCY: 902-928 MHz
- MICROWAVE: 2.4 GHz

Further classification of RFID tags based on presence of internal power supply is active tags and passive tags. Comparison of both is given below.

Attribute	Active tag	Passive tag
Source of Power	Built-in Battery	Electromagnetic Induction
Reading Distance	High (20 to 100 m)	Low (Up to 3m)
Required Signal Strength	Low	High
Tag Cost	High ($15 to $100)	Low ($0.15 to $5)
Data Storage	Large read/write data (128kb)	Small read/write(128b)
Size	Large	Small
Weight	Large	Less

II. LITERATURE SURVEY

Radio frequency identification (RFID) is a wireless technology which can be used to develop the access control system. The literature has revealed the use of this technology to automate various systems ranging from industrial sector to home control [1]. Bo Yan has reported the use of RFID technology to automate on sight spot ticket management system. The system hardware includes RFID electronic tickets, RFID readers, computer terminals, optical networks, computer servers and on site controllers. Electronic tickets has the S-DES encrypted form of data which includes scenic region number, scenic spot number, type of ticket, ticket date, site number, serial number and check bit. The RFID reader on the site reads the data inside the e-ticket and sends it to the computer terminal and servers through the network. The data is decrypted at the terminal and its authenticity is tested. The onsite controller then allows the authenticated tourist to enter the spot. This system identification and authentication process is carried out at three sub-levels namely the sale sub- system, with each other through database information [2]. G. Ostojic has developed an automated vehicle parking control system based on RFID technology in the city of Novi Sad, Republic of Serbia. The hardware of the system consists of RFID tag and reader which operates at a frequency of 13.56MHz for authentication, inductive loop for metal detection, a capacity sensor for vehicle counting, Siemens MC 39i GPRS modem to communicate between entrance and exit gates and FEC FC440 programmable logic controller (PLC) which is the heart of the system. When the car stops on the inductive loop at the entrance, reader reads the RFID tag. The data on the tag includes the unique identification number (UID), validity period and check bit for checking the parking status. This data is operated by PLC and access is granted for parking the vehicle if tagged information contains correct UID, validity period and parking status. After the vehicle has entered the parking lot, its parking status will be changed by the RFID reader/writer to prevent the entry of another vehicle on the same card. The same procedure is repeated when the vehicle is leaving the parking lot [3]. Nova Ahmed has described RFID based indoor guidance and monitoring system known as Guardian Angel in pervasive environment. The feature of the system is that it can generate dynamic enquiry in real time through user interface. The environment in the system is equipped with RFID tags and is divided into various cells. The middle-ware of the system is partitioned into two layers namely guidance layer and monitoring layer. The guidance layer is provided with hand-held RFID reader to provide locality information to the monitoring layer in timely manner. Thus monitoring layer contains the information of the entire environment. Experimental results have shown that system is nearly 100 percent accurate in providing the zonal information thereby allowing the construction of very robust guidance and monitoring applications [4].

III. SYSTEM COMPONENTS

A. RFID tag

In our system we are using passive LF tags with operating frequency ranging from 125-134 KHz.

B. RFID reader

We are using EM-18 reader module for the same. The EM-18 RFID Reader module operating at 125 kHz is a low cost solution for any RFID based system. The Reader module has an on-chip antenna and is powered up with a 5V power supply. After Powering up the module and make connection of the transmit pin of the reader module to receive pin of your microcontroller. When you show your card within the reading distance and the card number is sent at the output. The function of the Reader is to activate and power up the tag, demodulate the response, and condition the signal for the microcontroller. The various components of this reader are: the signal generator, peak detector, and low pass filter,

antenna and voltage comparator. When the reader reads the tag it will transmit the unique identification number of the tag to microcontroller. We are using LF tags for which we will have to use LF reader.

C. Microcontroller

We are using two microcontrollers' viz. PIC18f452, PIC 16f628. One connecting Ethernet shield and the reader and other to receive signals and drive the mechanical system and alerting system.

PIC 16f628 is a powerful yet easily programmable CMOS FLASH-based 8-bit microcontroller which packages microchip's powerful PIC architecture into an 18-pin package. The PIC16F628A has 4MHz internal oscillator, 128 bytes of EEPROM data memory, also a capture/compare/PWM, along with USART, 2 Comparators and a programmable voltage reference that make it ideal for analog/integrated level applications in field of automotive, industrial, appliances and consumer applications.

PIC 18f452 is also a powerful microcontroller with 40 pin package. It has four 8 bit ports which are bit and byte wise addressable

D. Ethernet shield

We are using Ethernet protocol to send the tag data from microcontroller to the server where the data base is stored. We are using USR-TCP232 Ethernet shield.

USR-TCP232-T is a smart module to send data from Ethernet port to serial port or serial to Ethernet port (duplex transmission).Transparent transmission will be achieved from TCP/UDP data to RS232 via the module. It is multi functional module which is integrated with TCP/IP protocol stack. It is easy for user to complete the network function of the embedded equipment easily, and select TCP Sever/TCP Client/UDP work mode by software.

E. Database and GUI

We are using PHP based web page as GUI. We have prepared database in MYSQL

F. Mechanical system

Mechanical system is nothing but an access granting or denying system or gate which will be operated by the microcontroller.
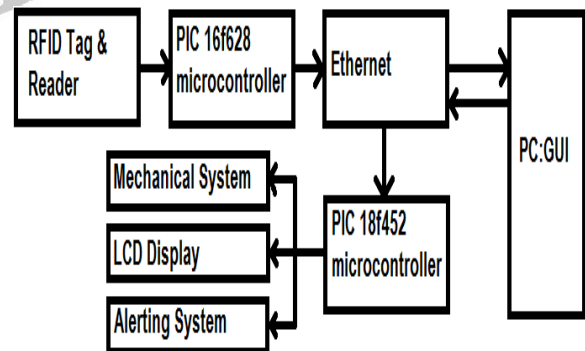
IV. SYSTEM OPERATION

Fig.1 Block Diagram

Block diagram and the flow chart of our system are shown above. Whenever an individual wants to enter a building, campus or any premises he has to provide his or her ID card (RFID tag) at the reader. When Reader reads the tag it sends its tag number to microcontroller (PIC 16f628). On reception

of this data Microcontroller transmits this data to TX pin (pin no 8). TX pin of PIC 16f628 is connected to serial data Rx pin of USR-TCP232 Ethernet shield. This data is transmitted to the server through the TX line of Ethernet cable. At server the received data (tag number) is compared with the database. If the person is authorized to pass through the particular access channel then server sends 'Y' through Ethernet cable. If the person is not authorized to pass through that access channel, then server sends 'N'.
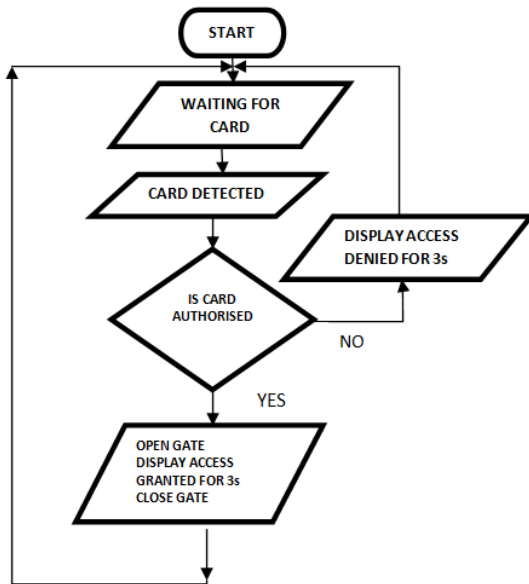

Fig.2 Flowchart

This Data ('Y' or 'N') is sent to PIC 18f452 microcontroller's Rx pin (pin no 26). On reception of 'Y' the microcontroller opens the gate for three sec and closes it. And also displays access granted on the LCD. On reception of 'N' the microcontroller displays access denied on the LCD.

We are using PHP based web page as GUI using which we can add new user, delete a saved user or can generate a temporary ID for the visitors.

V. RESULT ANALYSIS

We have successfully designed prototype of our system in which we are able to add or remove user from database, assign a temporary card for visitors. We can allow or restrict the entry through particular access channel using our software.

VI. CONCLUSION

The system uses radio frequency identification to differentiate between valid and invalid users. The system achieves the security and access control task by processing information from sub-controllers. These controllers include

Entrance monitoring controller, exit monitoring controller installed at entrance gate, exit gate. These controllers read RFID tag issued to the user and search in the database if match is found then the access is granted else not. The current system in use is a manual system which involves a paper gate pass system our system will reduce expenditure of campuses in stationary required for the same.

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