A Project Report
on
“Hostel Safety Measurement Using RFID And Image Processing Technique”

Submitted in partial fulfillment of the requirements for the

award of the degree of

Bachelor of Technology in Computer Science and Engineering

Under The Supervision of

Dr. Shrddha Sagar

(Assistant Professor)

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SCHOOL OF COMPUTING SCIENCE AND ENGINEERING
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING / GALGOTIAS UNIVERSITY, GREATER NOIDA
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SCHOOL OF COMPUTING SCIENCE AND ENGINEERING
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CANDIDATE'S DECLARATION

I/We hereby certify that the work which is being presented in the project, entitled **"Hostel Safety Measurement Using RFID And Image Processing Technique" LEARNING"** in partial fulfillment of the requirements for the award of the **BACHELOR OF TECHNOLOGY IN COMPUTER SCIENCE AND ENGINEERING.**

Submitted in the **School of Computing Science and Engineering** of Galgotias University, Greater Noida, is an original work carried out during the period of **SEPTEMBER-2022 to DECEMBER-2022**, under the supervision of **Dr. Shrddha Sagar, Assistant Professor**, **Department of Computer Science and Engineering** of School of Computing Science and Engineering, Golgotha's University, Greater Noida

The matter presented in the project has not been submitted by me/us for the award of any other degree of this or any other places.

19SCSE1010223 – Surya Pratap Singh

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This is to certify that the above statement made by the candidates is correct to the best of my knowledge.

Supervisor

(Dr.ShrddhaSagar)

CERTIFICATE

The Final Thesis/Project/ Dissertation Viva-Voce examination of 19scse1010223- Surya Pratap Singh, 20SCSE1010089 – Nitish has been held on_____and his/her work is recommended for the award of Bachelor of Technology in Computer Science and Engineering.

Signature of Examiner(s) **Signature of Supervisor(s)**

Signature of Project Coordinator **Signature of Dean**

Date: 20-12-2022

Place: Greater Noida

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We would like to express special thanks & gratitude to our guide, Dr.Shrddha Sagar who gave us this golden opportunity to work on this scalable project on the topic of “Sentiment Analysis from Text Feedback”, which led us into doing a lot of Research which diversified our knowledge to a huge extent for which we are thankful.

Surya Pratap Singh (19scse1010223)

Nitish (20SCSE1010089)

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ABSTRACT

This paper describes the design of RFID based security and access control system for use in hostels inside the Punjab University premises. The system combines RFID technology and biometrics to accomplish the required task. When the RFID reader installed at the entrance of the hostel detects a number, the system captures the user image and scans the database for a match. If both the card and captured image belong to a registered user, access is granted; otherwise, the system turns on the alarm and makes an emergency call to the security van through the GSM modem. In this way, the suspicious persons can be caught.

Index Terms—Security and access control, RFID, face recognition.

Introduction

Automatic identification and access control system has become necessary to overcome the security threats faced by many organizations in Pakistan these days. Installing the system at the entrance will only allow the authorized persons to enter the organization. The system can also be installed atvarious points inside the organization to track the person's movement and to restrict their access to sensitive areas in theorganization. In such a way, suspicious persons can be caughtwhich will surely improve the security level in theorganization. Radiofrequency identification (RFID) is a wireless technology that can be used to develop an access control system. The literature has revealed the use of this technologyto automate various processes ranging from the industrial sectorto home control. has reported the use of RFIDtechnology to automate the sight spot ticket management system.The system hardware consists of RFID electronic tickets, RFID readers, computer terminals, optical networks, computer servers, and site controllers. An electronic ticket contains the S-DES encrypted form of data including scenic region number, scenic spot number, ticket type, ticket date, site number, serial number, and check bit. The RFID reader atthe site reads the data inside the e-ticket and transmits it to thecomputer terminal and servers through the network. The data is decrypted at the terminal and its authenticity is verified. The site controller then allows the right tourist to enter the spot. This system identification and authentication process iscarried out at three sub-levels namely the sale sub-system, the decision sub-system, and the management sub-system. All these processes communicate with each other through database information. G. Ostojic [3] has developed an automatic vehicle parking control system based on RFID technology in the city of Novi Sad, Republic of Serbia. The hardware of the system consists of an RFID tag and reader operating at a frequency of 13.56MHz for authentication, an inductive loop for metal detection, a capacity sensor for counting vehicles, Siemens MC 39i GPRS modem for communication 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 loopat the entrance, the RFID tag is read by the reader. The data on thetag includes the unique identification number (UID), validityperiod, and check bit for checking the parking status. This datais manipulated by PLC and access is granted for parking the vehicle if tagged information contains the 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. Nova Ahmed has described RFID based indoor guidance and monitoring system known as Guardian Angel in a pervasive environment. The beauty of the system is that it can generate dynamic queries in real-time through the user interface. The environment in the system is equipped with RFID tags and is divided into various zones. The middleware of the system is divided into two layers namely the guidance layer and the monitoring layer. The guidance layer is provided with a handheld RFID reader to provide locality information to the monitoring layer periodically. Thus, the monitoring layer has information about the entire environment. Experimental results have shown that system is nearly 100% accurate in providing the zonal information thereby allowing the construction of very robust guidance and monitoring applications. Kuo-shien Huang [5] has described business model-based approach for utilizing RFID technology in automating the process according to the enteenterprise'sategic vision and goals. The author has built a business model an r bike rentingsys systems that used RFID technology to implement the system. The conventional way of getting the bikforon rent which includes the recording of customer data bypen and then inputting the dainty to the computer is replaced byproviding a nRFIDard to the customer and fixing an RFID tagon the bike. The bike is tagged to keep track of its location from the renting store to returned store. The information is shared amongst the stostorthrough t the web interface. This was an ay,successful RFID strategy built and deployed. The transponder coil then varies this currentby changing the load on its antenna. This variation is the modulated signal (the scheme known as load modulation) which is received by the interrogator coil through mutual induction between the coils. The interrogator coil decodes this signal and pait sses to the computer for further processing.

Formulation of Problem

As we all see that with the rise in colleges, Students have to move from their homes to live and a dormitory is the safest and most secure place for a student to live in. But when students move to a new place, it's harder to accommodate the place. From personal experiences and after listening to many people around me, I concluded that with most of the hostels in our country, it's really hard to make a proper connection between students and hostel staff. The hostel is a new home for the student and if one student feels uneasy or can't connect with the people in the place he's supposed to live, then it's a major problem. Our project HOSTEL CONNECT as the name suggests tries to bind the students and staff.

This project is based on

Response -> Validation -> Response

technique and will make residents of the dorm and staff connect smoothly and more efficiently.

Tool and Technology Used

The whole project is divided into two parts the front end and the back end.

Frontend: -

The front end is designed using Php/HTML, CSS, and Python.

HTML

Hypertext Markup Language.HTML elements form the building blocks of all

websites, allow images and objects to be embedded and can be used to create interactive forms. It provides a means to create structured documents by denoting structural semantics for text such as heading, paragraphs, lists, links, quotes, and so on. It can also embed scripts written in languages such as JavaScript which affect the behavior of HTML web pages. HTML consists of several key components, including tags and their attributes, character-based data types, character references, and entity references. An important component is the document type declaration, which triggers standards mode rendering.

PHP

PHP is a server-side scripting language designed for web development but also used as a general-purpose programming language. PHP is now installed on more than 244 million websites and 2.1 million web servers. Created by Rasmus Leadoff in 1995, the reference implementation of PHP is now produced by The PHP Group. While PHP originally stood for Personal Home Page, it now stands for PHP: Hypertext Preprocessor, a recursive backronym, and PHP code is interpreted by a web server with a PHP processor module, which generates the resulting web page: PHP commands can be embedded directly into an HTML source document rather than calling an external file to process data. It has also evolved to include a command-line interface capability and can be used in standalone graphical applications. PHP is free software released under the PHP License. PHP can be deployed on most web servers and also as a standalone shell on almost every operating system and platform, free of charge.

CSS

CSS Stands for "Cascading Style Sheet." Cascading style sheets are used to format the layout of Web pages. They can be used to define text styles, table sizes, and other aspects of Web pages that previously could only be defined in a page's HTML. The basic purpose of CSS is to separate the content of a web document (written in any markup language) from its presentation (that is written

using Cascading Style Sheets). There are lots of benefits that one can extract through CSS like improved content accessibility, and better flexibility moreover, CSS gives a level of control over various presentation characteristics of the document. It also helps in reducing the complexity and helps in saving overall presentation time. CSS gives the option of selecting various style schemes and rules according to the requirements and it also allows the same HTML document to be presented in more than one varying style.

Python

Python is an interpreted, object-oriented, high-level programming language with dynamic semantics. Its high-level built-in data structures, combined with dynamic typing and dynamic binding, make it very attractive for Rapid Application Development, as well as for use as a scripting or glue language to connect existing components. Python's simple, easy-to-learn syntax emphasizes readability and therefore reduces the cost of program maintenance. Python supports modules and packages, which encourages program modularity and code reuse. The Python interpreter and the extensive standard library are available in source or binary form without charge for all major platforms and can be freely distributed.

BACK END- The back end is designed using MySQL which is used to design the databases.

DJANGO

Django in its 'out-of-the-box' state is set up to communicate with SQLite -- a lightweight relational database included with the Python distribution. So, by default, Django automatically creates an SQLite database for your project.

In addition to SQLite, Django officially supports (i.e., included in Django itself) three other popular relational databases that include: PostgreSQL, MySQL, and Oracle. And unofficially (i.e., with third party packages) Django supports connectivity to other relational databases that include: SAP (Sybase) SQL Anywhere, IBM DB2, and Firebird, as well as the ADO (ActiveX Data Objects) and ODBC (Open Database Connectivity) interfaces, the last two of which are standard for connecting to Microsoft SQL Server and the latter, is supported by most relational database brands.

Literature Survey

E-registration seeks to simplify the students' affairs/porters' operation. The stages involved in the registration process must be reduced to t h e nearest minimum if it is to be faster and more convenient. Paper-based processes of registration are time-consuming and expensive. The student usually has gone through several layers of authorization, generating many documents along the way. An increase in the number of students will mean more paperwork and less efficiency in the traditional registration system, hence, many Universities are finding e- registration a better and more effective way of catering to the inconvenience. Security in the organization is one of the most persistent problems that an organization needs to address. Nowadays security is a prime concern in every human being's life. In today's fast life parents do not have time to visit the college hostel to know the student in/out time in a hostel. Today students' attendance becomes a more important part of any organization. Recording and monitoring hostel attendance is an area of administration that can require significant amounts of time and effort in a hostile environment. The system has student name, roll no., branch, year, photo, figure print, and parents' mobile number stored in the hostel database. The system is especially proposed for hostel management and monitoring. The system is based on the ARM 11 microcontroller, fingerprint scanner, Face recognition system, GSM module, RFID reader, and passive RFID tag. The system automatically takes attendance of students present in the hostel which is helpful for hostel management. In the proposed system the in/out monitoring of students is done by using a fingerprint scanner, RFID card, and Face recognition system and sending alert SMS to parents of students with the help of the GSM module.

Project Design

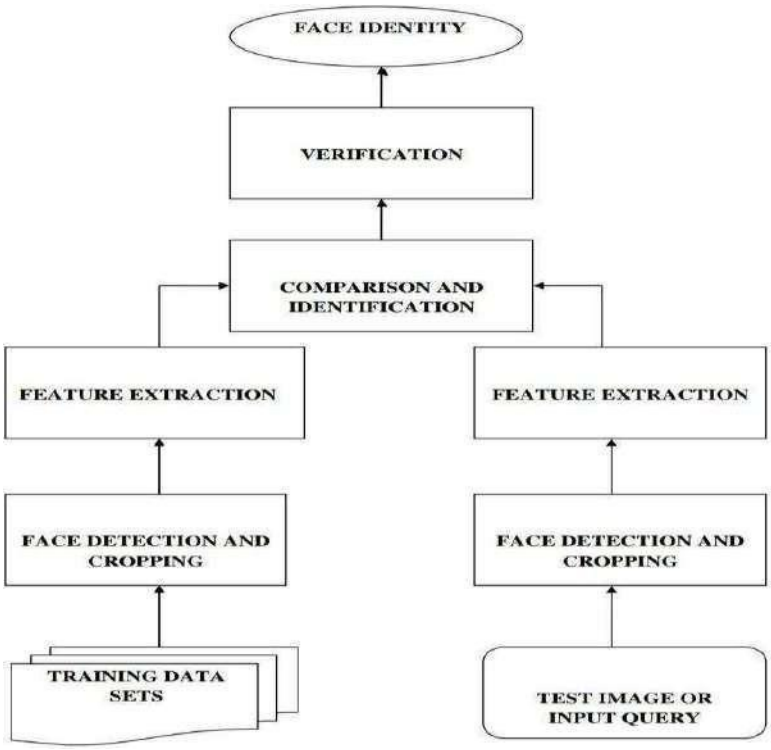


Fig . Architecture Diagram for Proposed Method

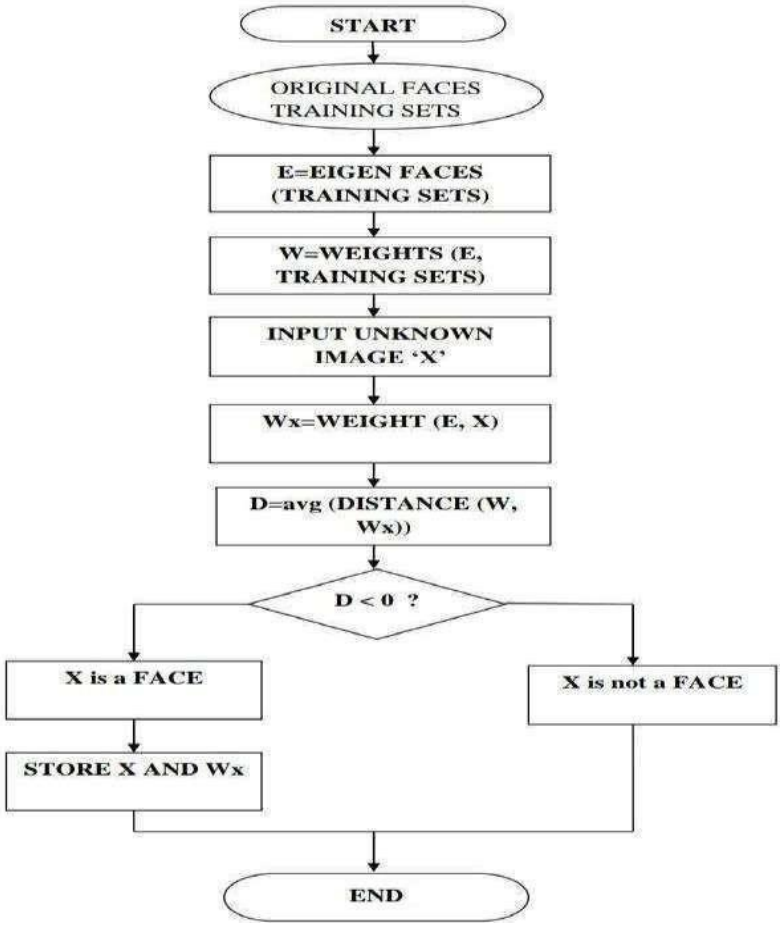


Fig. Eigen Face Based Algorithm Flow Chart

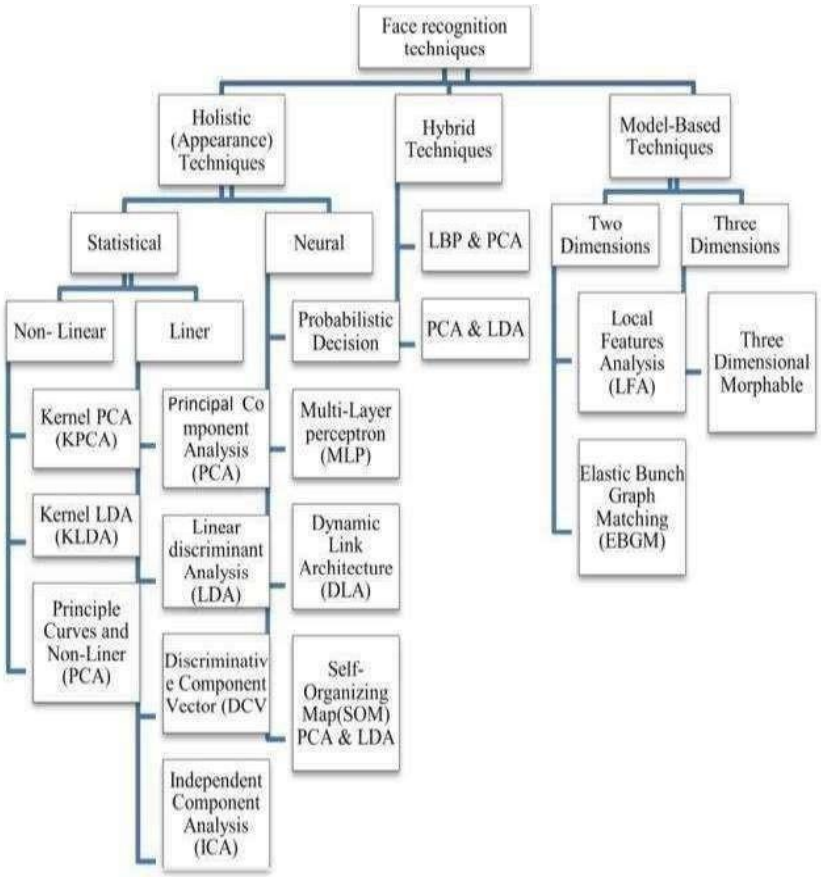


Fig. Face Recognition approaches

II. OVERVIEW OF RFID TECHNOLOGY

An RFID system consists of three components namely transponder (tag), interrogator (read, er,) and computer containing the database, as shown in Fig. 1. The interrogator reads the tag data and transmits it to the computer for authentication. The information is processed and upon verification, access is granted. The system offers diverse frequency bands ranging from low frequencies to microwave frequencies [5]:

- Low Frequency: 125-134 kHz
- High Frequency: 13.56 MHz
- Ultra-High Frequency: 902-928 MHz
- Microwave Frequency: 2.4 GHz

Depending upon the source of electrical energy, RFID tags are classified as either active or passive. The active tags use abattery for powering the circuit on the tag and transmitting the taginformation upon the reader's request. However, these tags arevery expensive and seldom used. On the other hand, passivetags get energy from the reader to power their circuit. These tags are very cost-effective and hence most applications use them. A comparison of these tags highlights important features. In the present work, passive RFID tags have been used. Apassive RFID tag transmits information to the reader when it comes to the vicinity of the electromagnetic field generated by the reader. The phenomenon is based on Faraday's law of electromagnetic induction. The current flowing through the coil of the interrogator produces a magnetic fithathlinkedinks to the transponder coil thereby producing a current in the system is tested by installing RFID kits with antennas covering a range of 10cm and is satisfactory results are obtained. Xiang-Lei Meng [9] has described an RFID-based embeddedsecurity authentication system with a novel face recognition structure. The system comprises two phases namely registration and recognition. In Treg, the situation phase, ten pictures ofuuser'sr'sr face with different emotions are collected and eigen information is obtained with an extraction algorithm. This information along with a UIDwrittenenan o The FID tag. Intherecognition phase, a camera tracks the face

and an extraction algorithm returns eigen information of the face in the picture. This information is then matched with the information already stored on the tag for authentication. The entire processing is done on an embedded ARM11 processor, S3C6410 instead a of computer terminal/server which has resulted in an n faster response time, about 57ms with authentication accuracy up to 86.5%. The performance of the system is compared with the existing database systems and is found to have far better respotimestime with the same authentication accuracy. Dong-Liang Wu [10] has described an access control system based on RFID in conjunction with face recognition based on neurnetworksork. The system recognizes the face of a person holding ng RFID card and denies the access ss if a person is found to bauthhA radial. A radial basis function neural network (RBFNN) has been used for learning the face of authorized persons. Principal component analysis (PCA) has been used for extracting the features from the image and linear discriminant analysis (LDA) for refining these features. The network is trained with la localized generalization error model (L-GEM) for enhancing its generalization capabilities. Experimental results have shown that the proposed system canimprove the security of RFID access control.

SYSTEM COMPONENTS

RFID Tag

IPC80 passive RFID tag operating at a frequency of 125KHz is issued to the user. The tag transmits information tothe reader in ASK format [11].

A. RFID Reader

IP10 proximity card reader with an operating frequency of 125KHz and reading distance up to 4 inches is used. The reader can be easily installed on metal doors, provides the taginformation serially in RS232 for, mat and is suitable forindoor as well as outdoor operations [11]. Three such readersare installed for hostel security: hostel entrance gate, hostel exit gat, e, and mess entrance gate.

B. Camera

Logitech C500 webcam is used to capture images. The camera has 1.3-megapixel sensors and can capture video up to 1280x1024 pixels. Two such cameras are installed for hostel security: one at the entrance and the threat at the exit. No camera is used to enter the mess hall to reduce the overall complexity.

C. GSM Modem

The Nokia 12i GSM modem is used to man Ake emergencallsall tothe security van. Nokia 12i offers advanced GSM connectivity and supports EDGE/GPRS and HSCSD with automated GSM connection establishment it is equipped to provide reliable remote connections and offers application-level watchdogs, inbuilt self-check mechanisms, and a reliable Virtual Machine(VM) for JAVA™. Nokia 12i also supports reliable inbuilt internet protocols: TCP/IP for reliable data transfer, UDP/IP for audio and video streaming, and HTTP for accessing web pages. The module can also be connected to an external GPSdevice that supports National Marine Electronics Association(NMEA) standard. The inbuilt NMEA parser can parse the location data from the output that it receives from the GPS device. External microcontrollers can use AT commands to communicate with Nokia 12i and simple remote I/O applications can easily be controlled via text messages.

D. Microcontroller

AT89C52 microcontroller is selected because it is a powerful microcomputer that has low power consumptionand provides a highly flexible and cost-effective solution to many embedded control applications. It has 8K bytes of in-system programmable flash memory, 256 bytes of internalRAM, 32 programmable I/O lines, three 16-bit timers/counters, eight interrupt sources, and a programmable

serial channel [11].

E. Nonvolatile RAM

256K Nonvolatile RAM (NV-Ram) DS1230Y-85 is used for storing passwords against registered RFID numbers. NV-RAM is selected because it combines the best of RAM and ROM: the read and writing ability of RAM and the non-volatility of ROM. The DS1230 Nonvolatile SRAM is 262,144-bit, fully static, nonvolatile SRAM organized as32,768 words by 8 bits. Each NV SRAM has a self-containedlithium energy source and control circuitry which constantlymonitors V_{CC} for an out-of-tolerance condition. When such a condition occurs, the lithium energy source is automatically switched, and down, and write protection is unconditionally enabled to prevent data corruption.

F. Door Locks

Solenoid-operated door locks are used in the entrance, exit, andmess gates of hostels. A relay is used to energize the solenoidto open the gate.

G. Alarms

Two alarms are installed; one at the entrance and the other at the exit gate. These alarms are turned on if an illegal person tries to enter the hostel premises.

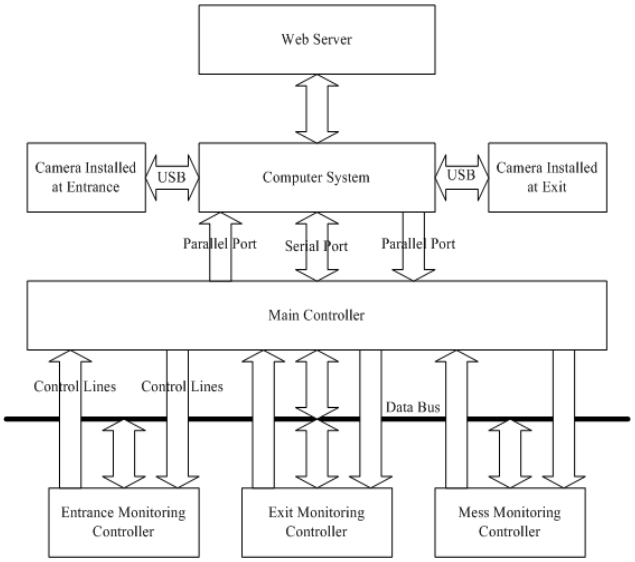
v. SYSTEM OPERATION

The security and access control system is comprised of twophases: the registration phase and the recognition phase. In the registration phase, ten images of the hostel user are captured while issuing an RFID tag. These images are used to train a feed-forward neural network with backpropagation on the training algorithm and the converged weights are stored corresponding to a particular user. The recognition phase comes when the user wants to enter the hostel. At this point, after getting The FID user number, the image of the user is captured and passed to the neural network for recognition. If a match is found, access is granted to the user. The user authenticity is checked at three places: hostel entrance, hostel exit, and messentrance. The entrance and exit modules use RFID and face recognition for identification while the mess modules use RFID with a password to grant permission. These modules communicate with the computer system through the main controller. The main controller transmits module information to thecomputer system. The computer system after processing these interrupts issues commands to the modules through the aim controller. The data exchange between the main controller and computer system is through a serial port while parallel port data and control

lines are used for handshaking purposes. The block diagram of the system is shown in Fig. 2.

A. Entrance Monitoring Controller

The entrance monitoring controller comprises an RFID reader, a GSM modem, a Nan RAM, door lock, alarm, scroll keys, and 16x4 LCD; all interfaced to the AT89C52microcontroller as shown in Fig. 3. After detecting and receiving RFID tag data through a serial interrupt routine, the microcontroller searches the NV-RAM for this number. If nomatch is found, the microcontroller makes an emergency callto the security van through the GSM modem. At the same time, itsends a request to the computer system through the main controller to capture the user image and turns on the alarm signal. On the other hand, if a match is found, the microcontroller checks the entrance status of the user by scanning NV-RAM. If the user has not entered the hostel yet, the controller sends a request to the computer system to capture and process the user image. The computer system performs two functions. First, it verifies the user against the received RFID number using a face recognition algorithm and then checks whether the user is a defaulter or not. After processing, the computer system generates one of the three messages: „access granted" corresponding to the registered and clear user, „access denied" corresponding to a non-registered user, and „user is a defaulter" corresponding to a registered and defaulter user. In the case of a non-registered user, a heavy fine is included in user hostel dues on an account of using the RFIDtag of another user. The entrance controller receives the message from the computer system and displays it on a 16×4 LCD.The details on LCD can be read with the help of scroll keys. If the message „access granted" is received by the controller, itopens the entrance gate by switching the relay. At the same time, the entrance status of the user is updated in the nonvolatileRAM. The entrance monitoring module thus ensures the entryof registered and clear users in the hostel and also helps in catching suspicious persons that are not authorized to enter. The flow chart describing the operation of the



entrance monitoring module is shown in Fig. 4.

Fig. 2. Block diagram showing modules interconnection with the computer system.

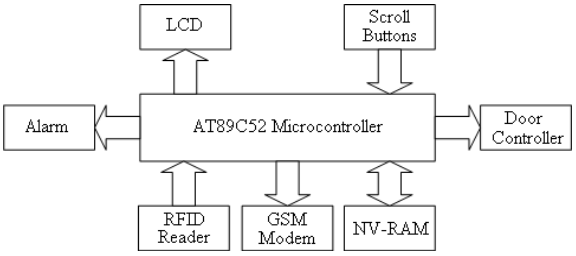


Fig. 3. Block diagram of entrance monitoring controller.

A. *Exit Monitoring Controller*

The exit monitoring module comprises an RFID reader, analarm, and a door lock; all interfaced to the AT89C52 microcontroller as shown in Fig. 5. After receiving RFID taginformation through a reader, the microcontroller sends a request to the entrance monitoring controller to search the user and its entrance status in NV-RAM. Upon receiving a „no‟ signal from the entrance controller, the exit controller blocks the RFID tag and sends a request to the computer system to capture the userimage. At the same time, it makes an emergency call through aGSM modem interfaced with the entrance controller, and turns on the alarm signal. On the other hand, if a „yes‟ signal is received, the exit controller sends a request to a computer system to capture and process the user image. The computer system uses a face recognition algorithm to verify the user. If a match is found, the computer system asks the exit controller to grantpermission to the user to leave the hostel. After the user has left the hostel, the exit controller sends a request to the entrance controller through the main controller to update the user's entrancestatus. In the case of a non-registered user, a heavy fine is included in thehostel dues of the user for using the card of another person. The exit monitoring controller thus enables the system to allow the valid person to leave the hostel. The flow chart describing theoperation of the exit monitoring controller is shown in Fig. 6.

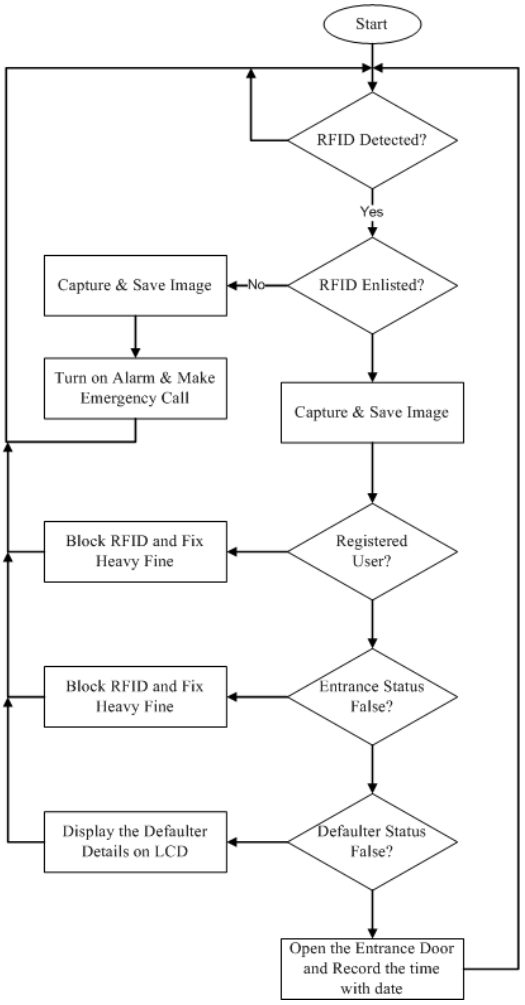


Fig. 4. Flow Chart for entrance monitoring module.

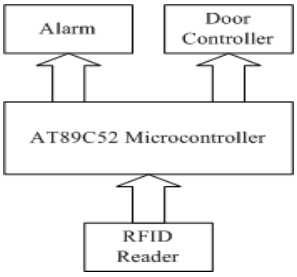


Fig. 5. Block diagram of exit monitoring controller.

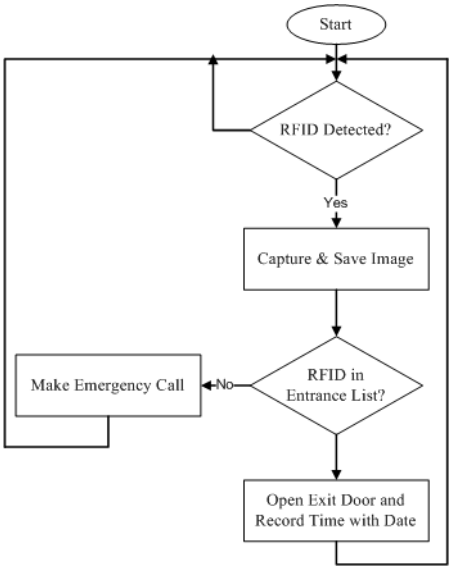


Fig. 6. Flow chart for exit monitoring controller.

B. *Mess Monitoring Controller*

While entrance and exit monitoring controllers help in tracking the users, the mess monitoring controller automates the mess attendance system. The mess monitoring module comprises an RFID reader, 4x3 keypad, 16x4 LCD, an NV-RAM, door lock, and alarm indicator; all interfaced to the AT89C52 microcontroller as shown in Fig. 7. Upon receiving theRFID tag number, the controller searches it in a list ofregistered numbers stored in NV-RAM. If a match is found, the controller asks the user to enter the password. The password list of registered users is also maintained in NV-RAM corresponding to RFID tag numbers. If the entered passwordis correct, the controller grants access to the user for entering themess hall. At the same time, the controller sends the user information along with mess attendance to the computer system through the main controller. The computer system updates the database and sends „attendance recorded“ messages to the mess controller. In this way, the exact mess charges are maintained in an online database. The flow chart describing the operation of the mess monitoring controller is shown in Fig.

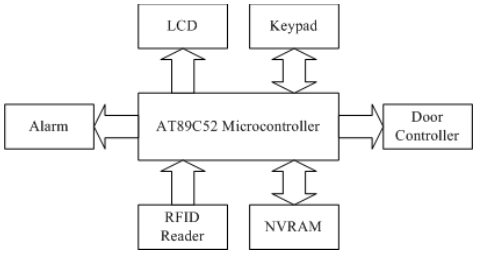
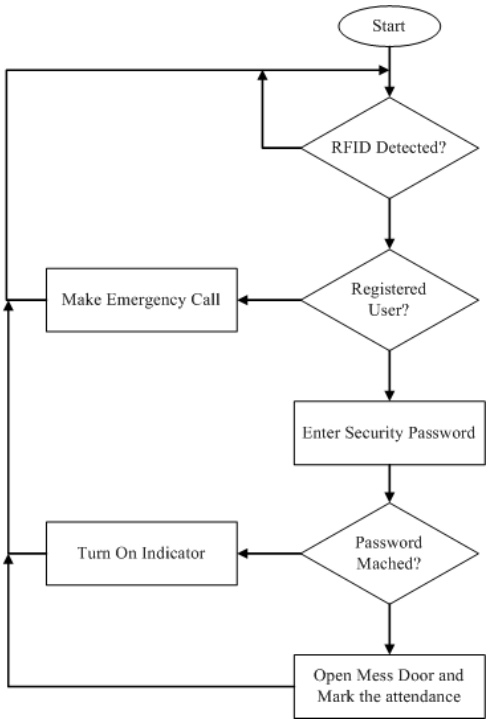


Fig. 7. Block diagram of mess monitoring controller.

c. *Computer System and Web Server*

The information provided by the system modules is maintained in a database inside the computer system. The database keeps a record of user history including check-in timeand date, check-out time and date, electricity, gas and mess charges, fine (penalty) details, RFID card lost details, and user's visitor record. In addition to this, the database also keeps a record of illegal persons trying to enter the hostel premises. Ascreenshot of a user form in the database is shown in Fig. 9. The security and access control system is installed in eighteen hostels and computer systems in these hostels share the information to a web



server which is the central station and can be searched to locate a particular user inside the hostels.

Fig. 8. Flow chart for mess monitoring controller.

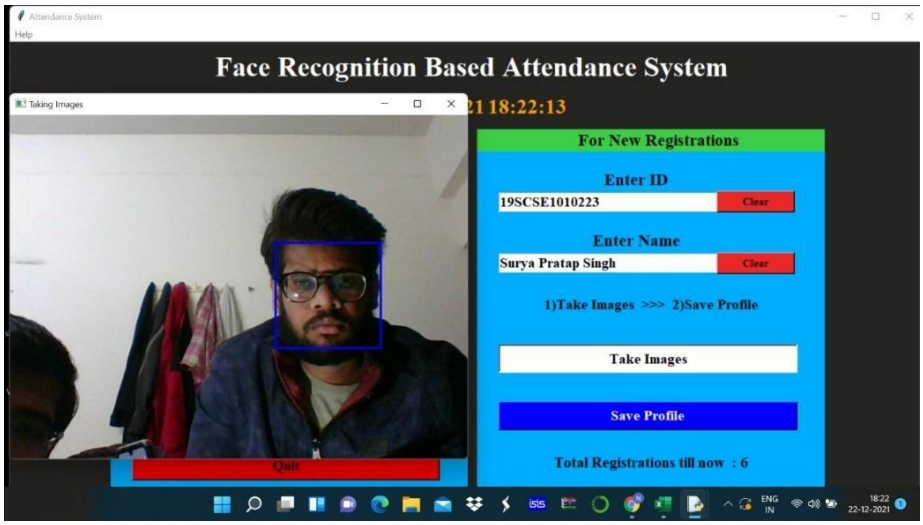


Fig. 9. A screenshot of the user form in the hostel database.

CONCLUSIONS

In this paper, the design of a security and access control system for use in Punjab University hostels is presented. The systemuses radio frequency identification with biometrics technology to differentiate between valid and invalid users. The system accomplishes the security and access control task by processing information from sub-controllers. These controllers include an entrance monitoring controller, exit monitoring controller, and mess monitoring controller installed at the entrance gate, exit gate, and mess gate respectively.These controllers read the RFID tag issued to the user and search this tag number in non-volatile RAM. On a successful match,the controllers request the computer terminal to capture the user image. The computer system uses a neural network-trainedface recognition module to verify the user authenticity and responds to the controllers by sending them „access granted‟ or „access denied‟ messages. The controllers grant the accessto the user or make the emergency call accordingly. This systemis made centralized with the help of a web server. The web server takes information from computer terminals in hostels and keeps track of a particular user. Although the developed system is useful in reducing security threats to the hostels, there is room for improvement in the response time of the system. The response time can be improved by using dedicated processors instead of computer systems capable ofprocessing the images in real-time.

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FUTURE SCOPE

Multiple security applications that require authentication to access each system's permissions frequently utilize the same design. Facial recognition algorithms are frequently enhanced in terms of resource consumption, allowing designs to recognize numerous faces at once, greatly improving the system. These initiatives are frequently created and implemented for a variety of reasons, including home security, personal benefit, and organizational gain. With the use of this technology, we will also be able to easily track a specific pupil within the organization.

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