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DESIGN, DEVELOPMENT AND TESTING OF ELECTRONIC CLASS ATTENDANCE USING FINGERPRINT

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ABSTRACT: *Electronic Class Attendance System (e-CAS) is an easy way to keep track of attendance of students and lecturers in School. It will cover the requirements of the personnel department in terms of day-to-day monitoring of students' and lecturers activities. Hence, students' attendance is an important issue every institution must take into consideration to be productive. Hence, this research aims to design, develop and test using fingerprints. The methodologies used were miniature techniques and image processing techniques for design and development. This target was mainly decomposed into image pre-processing, feature extraction and feature match. For each sub-task, some classical and up-to-date methods in literature were analysed. Based on the analysis, an integrated solution for electronic class attendance was developed for demonstration. However, Poison probability process, Biometrics as well as NP-chart of Quality control were adopted for classical statistical analysis of quality and functionality of the e-Class Attendance System (e-CAS). The project on electronic class attendance system was coded by PHP and the hardware was developed with ATMEGA series of microcontrollers. The result when experimented achieved the objective of improving the performance and consistency of the electronic class attendance system based on template matching techniques as well as class attendance for both students and lecturers.*

KEYWORDS: e-CAS, Fingerprints, Atmega, Microcontroller, Template-Matching.

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INTRODUCTION

Attendance management of students in institutions can be rigorous using the conventional method of paper sheets and the old file system method. Every academic institution poses some standards concerning how attendance is to be confirmed for students in classes, laboratory sessions, and examination halls (Jain et al., 2023). That is why keeping an accurate record of attendance is very important. The approach of using paper sheets and the old file system to confirm students has been in use for years. Tracking and monitoring students' time of attendance could be a tedious task, time-consuming, and as well prone to errors. As an alternative to the traditional manual clocking process by students Attendance management of students in institutions can be rigorous using the conventional method of paper sheets and the old file system method. Every academic institution poses some standards concerning how attendance is to be confirmed for students in classes, laboratory sessions, and examination halls. That is why keeping an accurate record of attendance is very important (Jain et al., 2022). The approach of using paper sheets and the old file system to confirm students has been in use for years. Tracking and monitoring students' time of attendance could be a tedious task, time-consuming and as well prone to errors. As an alternative to the traditional manual clocking process by students in classes or during examinations, biometrics characteristics can be used for authenticating students. This research will focus on developing Fingerprint based Biometric Student Attendance Monitoring System. The fingerprint biometrics is adopted in this research work for the fact it is one of the most successful applications of biometric technology. In the manual signing processes, where lecturer give a sheet of paper to student to write their names and signature as a form of confirming their presence for a particular class session, falsification in student attendance mostly occur a situation where by a student can sign on behalf of his or her colleague as being present in the class when not true can be so difficult to prevent from happening especially for large classes where row count can takes longer time (Hong, 2024).

The radical need to improve the students' and lecturers' class attendance is therefore, necessitated this research work so as to address some pertinent problems associated with class attendance using E-CAS vis-à-vis accurate attendance where educational institutions can centrally and accurately monitor student attendance to prevent proxy attendance and errors which are common problems when using traditional check-in and check-out methods (Kuosmanen. 2019).

Time wasting and inconveniences associated with manual attendance taking would be cut down. Technical knowledge by the students and lecturers to check in and out is not required. These systems can track student attendance in mere seconds which saves lecturers a lot of time rectifying attendance data errors from traditional methods (Adegoke et al., 2013).

Also, the problems associated with inefficiency, security and privacy will be addressed. In the enrolment process, biometric systems convert scanned biometric templates to computer code and store the information in a database for matching and verification, making it virtually impossible to duplicate the original image for spoofing or fraud purposes (Obaje, 2019). Electronic Class Attendance systems use strong encryption methods to protect a database from being compromised helping to increase security and protect student privacy.

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This project is related to embedded system technology. The main objective of this project is to provide good security in offices/rooms by using a unique module called fingerprint module. In which a person's fingerprint is stored and identified .If a person has to enter a room ,he need to scan his fingerprint in the fingerprint scanner, then after verification further he need to enter the desired password ,thus using fingerprint, password we are avoiding the usage of keys and providing good security for the office.

LITERATURE REVIEW

Fingerprint

Fingerprint identification is based upon unique and invariant features of fingerprints. Fingerprints are graphical flow like ridges present in human fingers which are formed during embryonic development, caused by ridges underneath the skin. According to the Federal Bureau of Investigation the odds of two people sharing the same fingerprints are one in 64,000,000,000. Fingerprints differ even for ten fingers of the same person. Some of the advantages of fingerprint identification are: high distinctiveness, high permanence, low potential for fraud and high performance with medium collectively and acceptability (Lee, 2020).

Historical Background

The science of fingerprint identification stands out among all other forensic sciences for many reasons, including the following (Maio et al., 2020):

i. It has served governments worldwide for over 100 years to provide accurate identification of criminals. No two fingerprints have ever been found alike in many billions of human and automated computer comparisons. Fingerprints are the very basis for criminal history foundation at every police agency on earth. Established the first.

ii. It established the first professional certification program for forensic scientists, the IAI's Certified Latent Print Examiner program (in 1977), issuing certification to those meeting stringent criteria and revoking certification for serious errors such as erroneous identifications.

Review of Related Works

In earlier civilizations, branding and even maiming were used to mark the criminal for what he or she was. The thief was deprived of the hand which committed the thievery. Ancient Romans employed the tattoo needle to identify and prevent desertion of mercenary soldiers from their ranks (Ratha et al., 2019). Before the mid-1800s, law enforcement officers with extraordinary visual memories, so-called "camera eyes," identified previously arrested offenders by sight. Photography lessened the burden on memory but was not the answer to the criminal identification problem. Personal appearances change. Around 1870, French Anthropologist Alphonse Bertillon devised a system to measure and records the dimensions of certain bony parts

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of the body. These measurements were reduced to a formula which, theoretically, would apply only to one person and would not change during his/her adult life.

The Bertillon system was generally accepted for thirty years. But it never recovered from the events of 1903, when a man named Will West was sentenced to the U.S. Penitentiary at Leavenworth, Kansas. It was discovered that there was already a prisoner at the penitentiary at the time, whose Bertillon measurements were nearly the same, and his name was William West.

Upon investigation, there were indeed two men who looked exactly alike. Their names were Will and William West respectively. Their Bertillon measurements were close enough to identify them as the same person. However, a fingerprint comparison quickly and correctly identified them as two different people. Per prison records discovered later, the West men were apparently identical twin brothers and each had a record of correspondence with the same immediate family relatives.

The traditional system is still mostly used in lecture rooms or laboratory sessions in most institutions today. Lecturer or instructor will give out a sheet of paper containing a list of student's names to sign or in some cases, the student will be the ones to write their names, student id and matriculation number to indicate their presence for a particular class. Falsification in student attendance does occur rampantly in the traditional method. For example, another student can easily sign an attendance on behalf of another student. In order to prevent this problem, it is necessary to develop an Authentication System for Students using fingerprint biometric recognition that will be employed to track and keep the attendance of every student in a particular class. Fingerprint is a unique feature for everyone compared to using barcodes in smart cards (Zhang & Liu, 2022). Therefore, this system designed in this research work is not based on the existing barcode system. Tracking and monitoring student time of attendance could be tedious, time consuming and more susceptible to errors. The security of the existing attendance system that is now used in the classroom (signature system) can be easily compromised. Some students can master other student's signatures (Younhee, 2023). Thereby, helping their colleagues who are absent for a particular class to sign the attendance sheet using the duplicated signature. The Fingerprint Attendance monitoring system designed in this research work for students is a more secure platform where students mark their attendance with their fingerprint (Thomas, 2021).

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METHODOLOGY

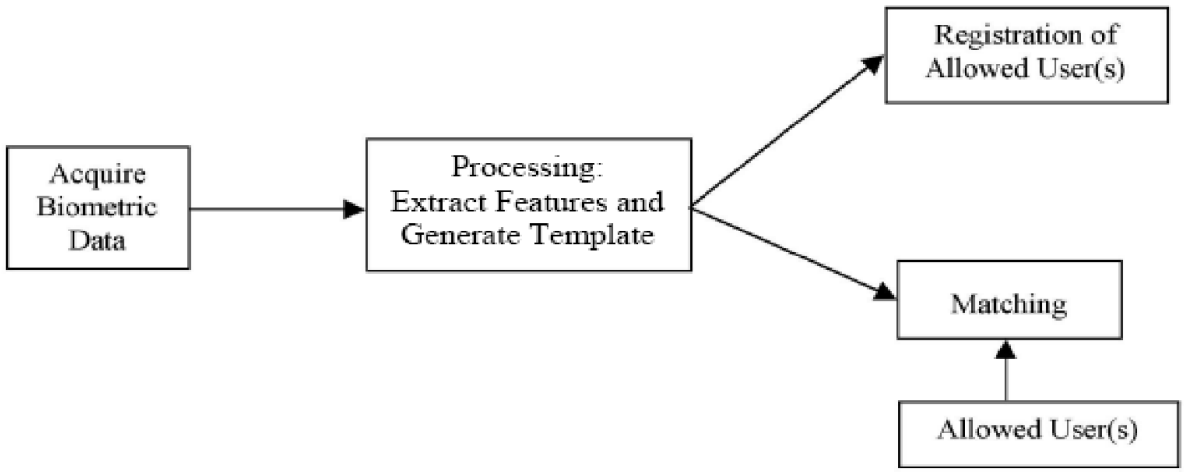

Figure 1: Biometric System Process Flow

Figure 1 shows the biometric system flow of the fingerprint attendance system. Biometric data is captured and processed.

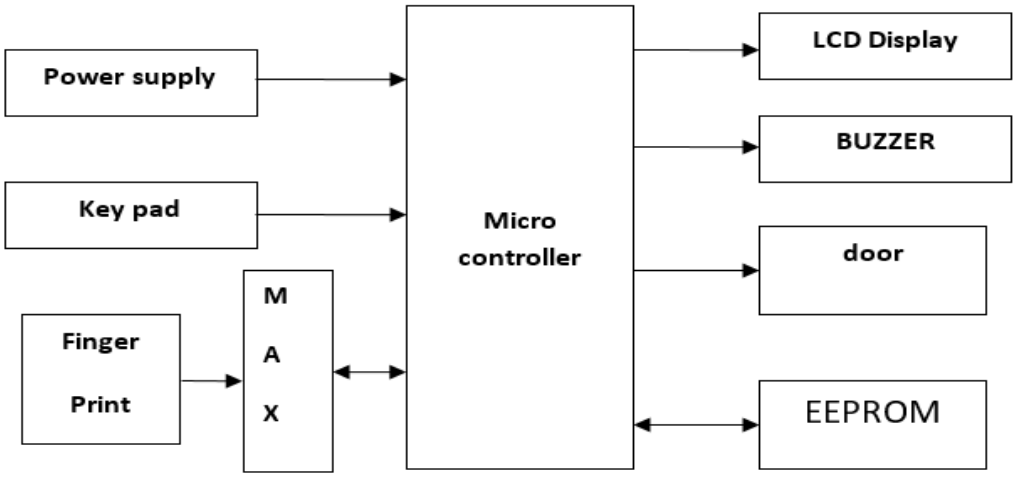

Figure 2: Block Diagram of the Power Supply

Figure 2 shows the block diagram of the power supply. According to figure 2, a variable regulated power supply, also called a variable bench power supply, is one where you can

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continuously adjust the output voltage to your requirements. Varying the output of the power supply is the recommended way to test a project after having double checked parts placement against circuit drawings and the parts placement guide. This type of regulation is ideal for having a simple variable bench power supply

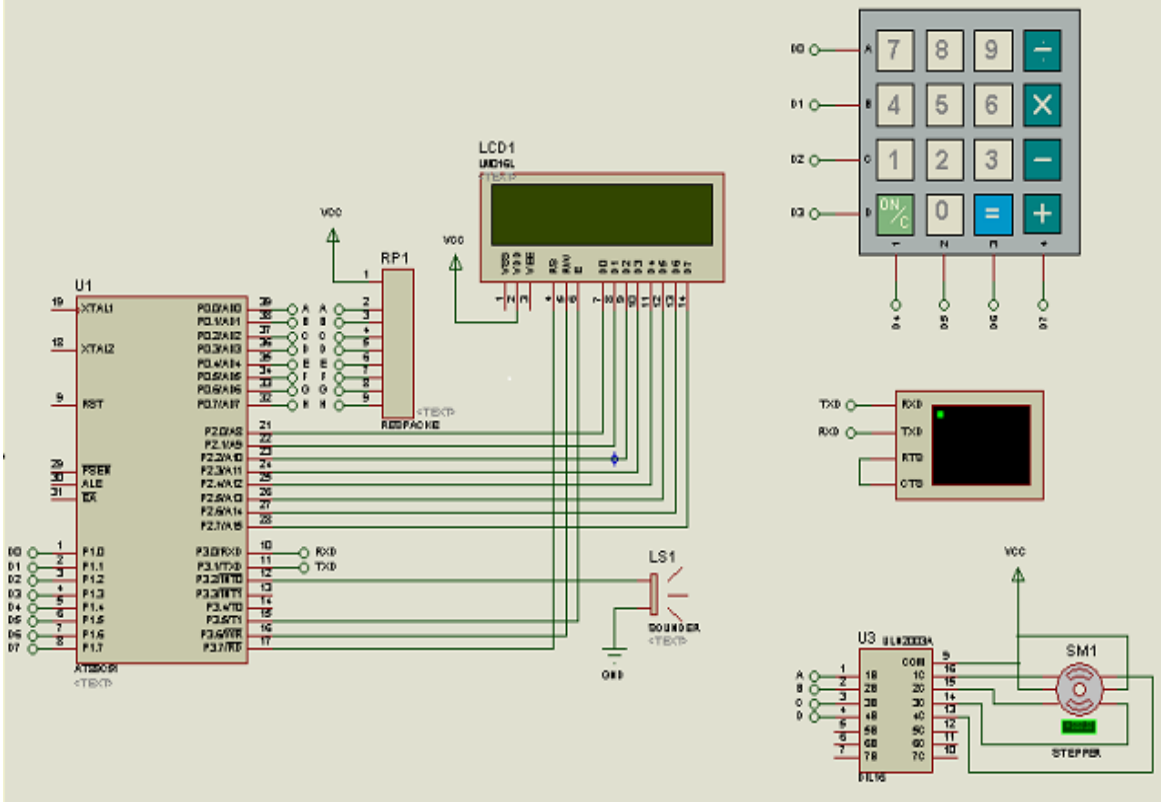

Figure 3: Schematics Diagram for the Design

The simulation of the design was done according to figure 3 using proteus software. According to the design, all the design was tested and functioned properly.

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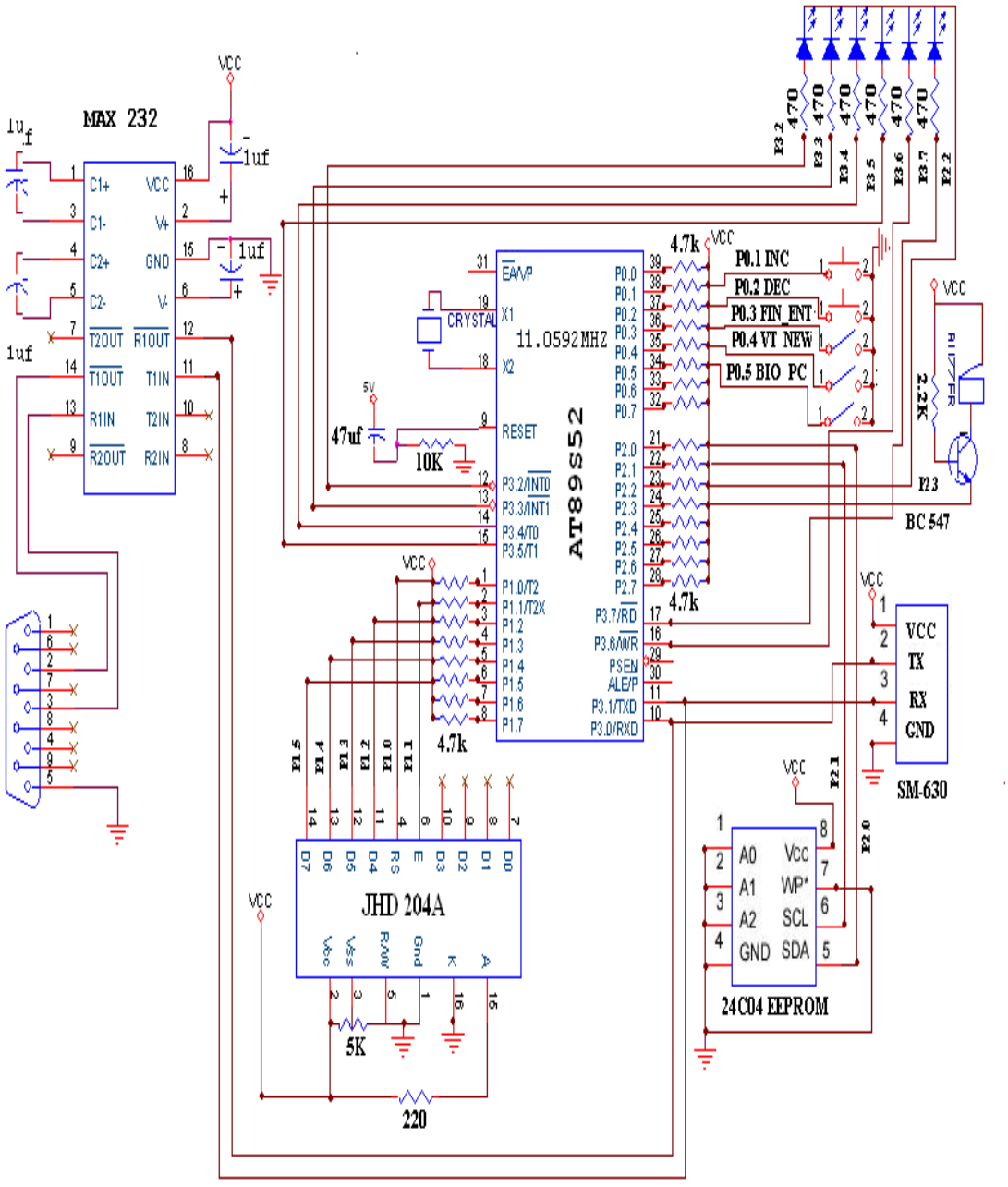

Figure 4: Simulated Diagram for the Design

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The simulated diagram of the design was shown in Figure 4. All the functioning components were tested with laboratory equipment and this was attached to the computer.

RESULT AND DISCUSSION

After selecting the mode of operation, the optical sensor takes the finger print and compares with the previously stored database. If the present fingerprints match with any one of the previously stored data then the controller sends a signal to enable the keypad.

For each key press a low logic value will be present at the concerned pin of the microcontroller and by reading this value the controller will do the further actions as specified in the program. The concerned transaction by the user is loaded in the external memory in this case what we are using is EEPROM of 2K bytes at a particular location in the memory.

All these functions which are performed by the user are simultaneously displayed on the LCD. In case any of the finger print is not matched with the data the Locker system is not opened and the Keypad is not enabled at all by giving the indication in the form of buzzer.

The device after the development was subjected to statistical testing and quality assurance, in view of this, Poison probability process was carried out on the functionality and expected half-life/ life-span of the e-CAS. Also the np-chart was employed to monitor its quality performance.

$$P(X = x) = \frac{e^{-\lambda}\lambda^{x}}{X!} \qquad x = 0, 1, 2 \ldots n$$

Where x = number of failure of the machine, and λ = expected value = (np), p=0.0001 and n=100

When x= 0 , the probability that none failed is 0.9999.

The result confirmed that the device works to the expected specification.

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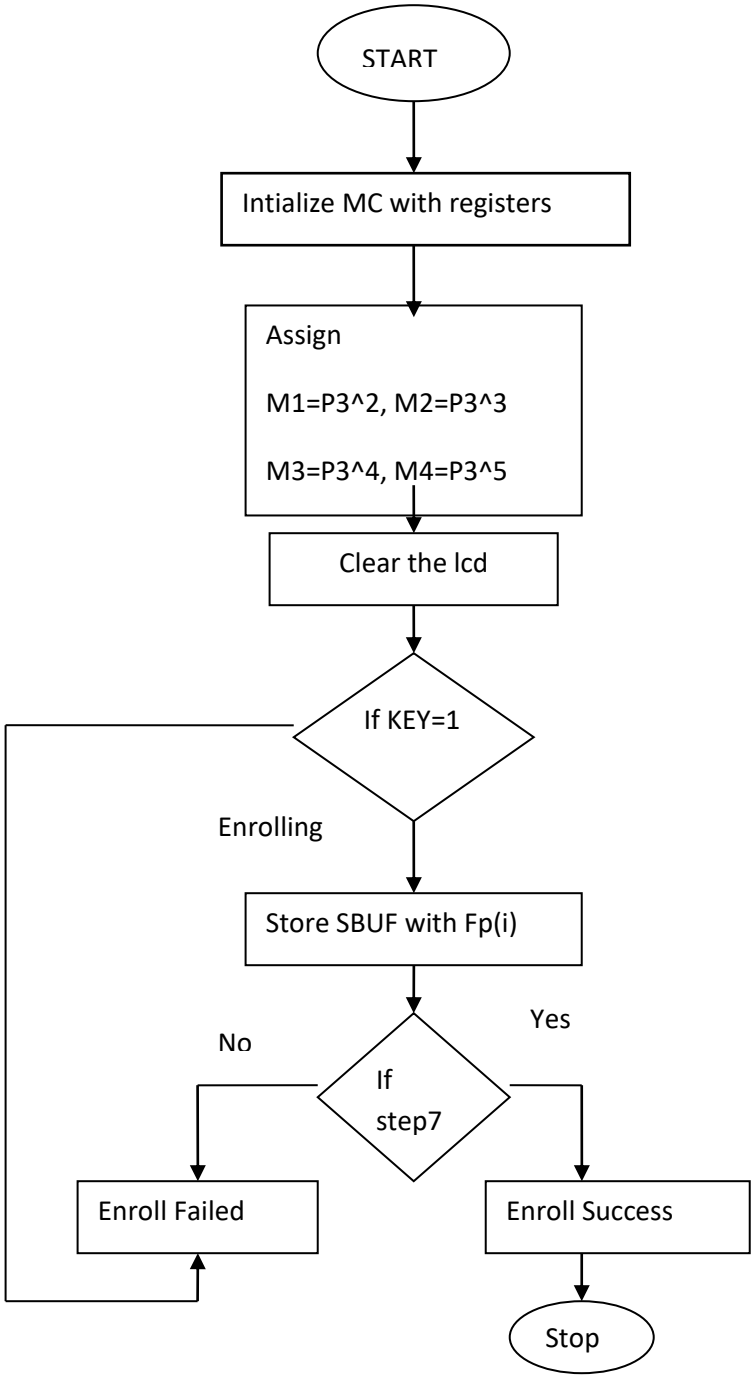

Figure 5: Flowchart to be followed for the development

Figure 5 shows the iteration flowchart process for the entire process starting from capturing to the verification stage.

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Figure 5 is another important diagram in UML used to describe the dynamic aspects of a software system. An activity diagram is a flow chart of an object-oriented system used to represent the flow from one activity to another. The activity can be described as an operation of the system. So the control flow is drawn from one operation to another. This flow can be sequential, branched or concurrent.

The database that will be adopted for this work is MSSQL which is a relational database. It is accessed using the graphical user interface provided by MYSQL. This will be used to create courses, create timetables, register staff, register students and also register a course. All the users and activities details are stored. The tool allows the database to be administered through the desktop application after installation.

CONCLUSION AND RECOMMENDATION

The project report began with the introduction to the basic functioning of the Microcontroller based Identification, Authentication and Setup of Security system. Project deals with Microcontrollers as central controlling units for various other sections like Biometrics SM630 module, LCD etc. Interfacing between all sections required for system and microcontroller 89S52 has been done successfully. For the person who is registered with the system can get access through doors according to their designation. Doors opening and closing have been achieved successfully. It is expected that the outcome of the study can be used by policy makers and stakeholders as a guide to reveal whether students and lecturers attend class.

REFERENCES

Adegoke., B, Omidiora., E, Ojo., J & Falohun., S. (2013). Iris feature extraction: *A Survey. Computer Engineering and Intelligent Systems* 4(.9), pp. 115-123.

Jain, A.K., Hong, L. & Bolle, R. (2021), "On-Line Fingerprint Verification," *IEEE Trans. On Pattern Anal and Machine Intel,* 19(4), pp. 302-314.

Jain, U.Halici, I. Hayashi, S.B. Lee & S.Tsutsui (2019). Intelligent Biometric Techniques in Fingerprint and Face Recognition. The CRC Press.

Hong, Y. Wan & A.K. Jain, (2024.) "Fingerprint Image Enhancement: Algorithms and Performance Evaluation", *IEEE Transactions on PAMI* , 20(8), pp.777-789.

Kuosmanen, H,. & Saarinen, D. (2019). Wavelet domain features for electronic class attendance, *Electronic Lett.,* 37(1), pp.21-22.

Lee, C.J. & Wang, S.D. (2020): Fingerprint feature extraction using Gabor filters, *Electron.* pp. 288-290. Lin Hong ."Automatic Personal Identification Using Fingerprints", Ph.D.Thesis.

Maio, D. & Maltoni, D. (2020): Direct grey-scale minutiae detection in fingerprints. *IEEE Trans. Pattern Anal. And Machine Intell.*, 19(1): 27-40.

Obaje. S. (2019). Automatic Fingerprint and Toe print Recognition for Personal Identification and Forensic Application. PhD Thesis, University Of Ilorin. Nigeria.

Article DOI: 10.52589/AJSTE-ZFTTFQBV
DOI URL: https://doi.org/10.52589/AJSTE-ZFTTFQBV

Ratha, S. C. and Jain, A.K. (2019). "Adaptive Flow Orientation Based Feature Extraction in Fingerprint Images", *Pattern Recognition*, 28(1), pp. 1657-1672.

Thomas, Y., Wee,P.T. & Ying, Y.T. (2021). Image Systems Engineering Program, Stanford University. *Student Project Understanding,* 57(1), pp 652 – 655.

Younhee, G. (2023). Access Control System with high level security using fingerprints IEEE The 32nd Applied Imagery Pattern Recognition Workshop.

Zhang, Y. & Liu J. (2022). The design of wireless fingerprint attendance system, Proceedings of ICCT '06, International Conference on Communication Technology.

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