Design and Implementation of Student Registration Attendance Management System Using Biometric (A Case Study Computer Science Department) Enugu State University of Science and Technology (ESUT)

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Abstract

In Nigerian academic institutions, managing attendance has been a significant concern over the years. Quality attendance management has been a challenge across the board, from universities to polytechnics, institutions of education, and secondary schools. Manually authenticating attendance in logbooks has become a difficult and time-consuming operation.This research project aims to build fingerprint-based attendance management systems that accurately and automatically keep track of students' attendance. The Enugu State University of Science and Technology (ESUT) has not used fingerprints as a method of identification until recently, which has resulted in persons appearing for exams for others who then collect the results at the end. The gadget is a useful module that includes a fingerprint sensor for keeping track of students' attendance records at all levels of an academic institution.This goal can be broken down into three sections: picture pre-processing, feature extraction, and feature matching. Some classic and up-to-date methodologies in literatures are analyzed for each sub-task. For demonstration purposes, an integrated solution for fingerprint identification is constructed based on the study. This example application is written in the Visual Studio.net programming language, and several coding and algorithm optimizations are offered to increase the speed of this fingerprint recognition systemExperiments on a range of fingerprint photos suggest that these speed improvements are possible. Furthermore, the studies demonstrate the key challenges of fingerprint recognition in a way that is compatible with the literature. The main goal is to eliminate any type of impersonation during attendance/examination by using a more secure fingerprint biometric system.

Keywords-Attendance , fingerprint, students, system.

INTRODUCTION

In the context of information systems, a biometric system is defined as "a pattern recognition system that recognizes a person by determining the authenticity of a certain physiological and/or behavioral attribute possessed by that individual" (Davide et al 2003). Pattern recognition is a sort of data analysis that employs machine learning techniques to discover patterns and regularities in data automatically. Text, photos, audio, and other specific qualities can be included in this data. Pattern recognition systems are capable of swiftly and reliably identifying known patterns. (Arm,2022). The first use of systematic biometric measures to distinguish one person from another was documented in China in the 14th century. Chinese merchants were known to imprint their inked palms and footprints on paper to differentiate children (Julian 2004). In this sense, biometrics bridges the gap between biological, behavioral, social, legal, statistical, mathematical, and computer sciences, as well as sensor physics and philosophy. It's no surprise that biometrics, a sophisticated combination of technologies, has piqued the interest of both the government and the general people for decades (National , 2010). Biometric identification techniques evolved as a way to formalize and organize subjects into graphs and tables during the creation of early modern nation states in Europe. As Galton's forceful statement emphasizes, fingerprinting set out to become the main type of identification in the second half of the twentieth century (Ariana, 2019).Despite its shortcomings, Bertillon's work helped to establish biometrics as a respectable topic of study, and other pioneers like Sir Francis Galton and Edward Henry helped to enhance the understanding of fingerprint morphology (Davide et al 2003). Automatic Fingerprint Identification Systems (AFIS) were developed as a result of advances in forensic science during the course of the twentieth century, and they became critical to law enforcement organizations all over the world. Today, in addition to continuing to develop AFIS applications, a range of alternative biometric 2 systems have arisen, with the potential for widespread usage in both government and commercial IT security, thanks to the tremendous expansion of information technology. Biometrics, a science that uses people's physical or biological traits to identify them, includes fingerprinting. Arches, loops, and whorls are the three most common fingerprint patterns. Each fingerprint is distinct due to the shape, size, number, and arrangement of microscopic minutiae in these patterns (Interpol, 2021).

Biometric Attendance System

A biometric is a device that uses fingerprints to track employees' daily attendance. The biometric technology enables the company to keep track of its employees' attendance in a systematic manner. It utilizes each employee's biometric in order to keep track of their in and out time throughout working hours (Keka, 2021).The solution will make it easier for institutions and organizations to track individual attendance as well as data information, according to Imran Anwar Ujan 2021.

Time & Attendance Systems using Fingerprint clocking devices

Biometrics is by far the most accurate and cost-effective method for tracking your employees' time and attendance.

For time and attendance, fingerprint devices are currently the most prevalent biometric devices.

Figure 1. 1 Fingerprint (Idency, 2021)

Fingerprint Time and Attendance Devices Have a lot of advantages.
Employees cannot misplace or leave their finger at home
Employees cannot have a colleague clock in or out on their behalf
There are no further charges once the system is implemented.
The system functions as follows: In factory and office environments, using an individual's fingerprint in a biometric attendance system has allowed for unobtrusive tracking of worker timings. To get a biometric attendance system up and running, each individual employee's fingerprint is scanned and then mapped out to specific coordinates established by the system. The coordinates of each fingerprint are also plotted on a graph and saved in the system. The coordinates are then checked against the mapped and stored coordinates every time the same person touches their fingertip on the scanner.Only if the most recent photograph matches the one stored is the individual's entry timed. Because scanning a single finger in the biometric attendance system causes numerous coordinates to be mapped and saved, the fingertip of one person cannot be replicated by another. It's difficult to match up all of the coordinates that have been generated. Furthermore, any single fingerprint's coordinates are unique and cannot be replicated. This is the most distinct advantage, and it is for this reason that the fingerprint reader biometric method is the most widely used today.

Aim and Objectives

The aim of the study is to design an Automated Attendance Register for students with the following objectives;
1. A user interface that interact with students
2. Sore student's bio-data to a database
3. Take attendance of day to day students in the class
4. Retrieves the attendance register at when do

The issues' problem statement Lecturers in the computer science department find taking attendance on a piece of paper a boring and tiresome operation due to the large number of students, the ambiguity of data, and the nature of students' handwriting. Following a comprehensive examination, the researcher noticed the following difficulties with the existing method of taking attendance during an interview with the department's lecturers:
• Lecturers are having problems grading attendance due to some students' bad handwriting, and some students are taking attendance for their friends.
• Some professors are less worried about whether or not students show up for class.
• Keeping track of attendance on paper is getting excessively expensive.

RESEARCH METHODOLOGY

Visual Basic Studio 2008 was used to create the study because of its many features, which include many inbuilt functions, easy manipulation, flexibility, high level performance as any other high level programming language, support for network and web applications, cross platform programming, and functions and controls designed to make programming simple. Microsoft Access will be used to manage the student database. The Unified Modeling Language will be used to construct diagrams (UML). Despite the fact that this system was built using object-oriented (OO) design methodologies, it may be useful to do so in order to identify the overall requirements in functional terms. "Object oriented methods only produce functional models within object oriented methods, which is a drawback of object oriented design (Rickman, 2000) points out. The focus of the object-oriented approach is on encapsulating the structure and behavior of information systems into tiny modules that combine both data and logic (Tutorialspoint, 2021). Finally, Requirements Engineering (RE) is sometimes dismissed as a routine task carried out by well-intentioned analysts prior to getting down to business (Inflectra 2021). This project uses a requirements engineering (RE) process to supplement object-oriented modeling with the Unified Modeling Language (UML). At each stage of development, the RE technique, which is supported by the UML, generates ordered layers of textual requirements. The 'Guideline for Rapid Application Engineering,' or GRAPPLE, is the main methodology for applying the UML in a systematic way. In the overall design process, each level of GRAPPLE development (known as segments) is mapped to a generic requirements engineering technique. The key to this general approach is the adoption of a qualification strategy for input requirements at each level of the development lifecycle. (see Figure 3.0 below).
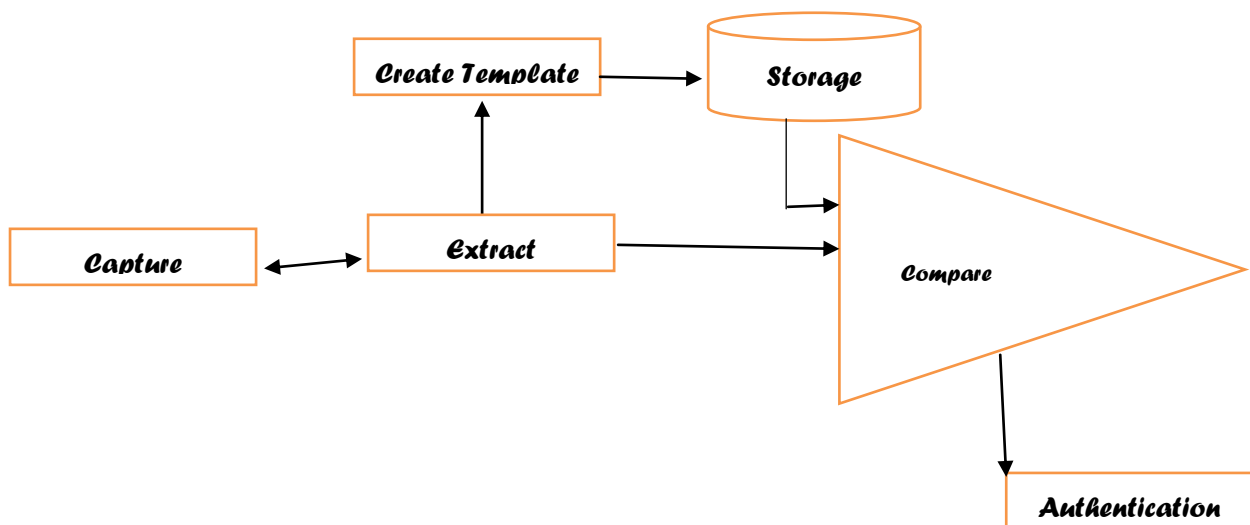

Fig. 1.0. Generic process with qualification strategy recognized.

RE provides textual elaboration on the system model representation, whereas modeling improves design effort by providing a justification for traceability between levels. As a result, a standardized language for both functional and non-functional textual requirements exists, which may be utilized at any stage of the process. Common standards for the representation and structure of requirements are necessary for effective requirements management, as we will see when we look at the requirements management case tool, DOORS (Dynamic Object Oriented Requirements System).

Significance

For students, the fingerprint biometric technology will eliminate the need of paper in manual signing processes, as well as all of the risks that come with it. One of the drawbacks of using a paper for class attendance is that it is easily misplaced, and students cheat by signing for each other while they are absent, defeating the point of taking attendance. It can be difficult, time-consuming, and error-prone to keep track of and monitor a student's attendance. As a result, the System will drastically reduce the time it takes to check attendance data. The technology also allows institution administration to track or investigate student class attendance in a low-attended course, allowing management to address the situation by taking suitable actions. Because of the system's high level of security, imposters and impersonators will be unable to get entrance to examination halls. The fingerprint biometric technology will store historical data, making it easier for professors to access and grade students.

The Fingerprint Based Student Attendance Management System is incredibly beneficial in universities, especially during classes, tutorials, laboratory sessions, and tests, when strict security is typically used to verify students' identities and weed out imposters. The number of security staff will be considerably decreased if an Authentication System is used. The most common misplaced or destroyed handout sheet of paper for class attendance, which creates a lot of stress when it comes to gathering grades for their students, is easily misplaced or damaged. The lecturer can keep track of each student's attendance, detect truants, and take appropriate action using the technology. As a result, all of these flaws are eliminated by the approach. The authentication process assists students as well as institutions and instructors by reducing the stress of queuing, which causes delays and, in some circumstances, damage to the attendance sheet. It also avoids the errors and oddities associated with manual signing in, such as when a student is listed as not present for a class, leading in the loss of the mark allocated to that attendance due to multiple attendance sheets.

This study could benefit the Bachelor of Science in Computer Science program by providing new ideas and insights into the production of more advanced and effective algorithms in the domain of software development.

Thanks to reports generated by the system and disseminated by the school teacher or administration, parents and student guardians can easily learn about their children's school performance. The report includes the student's attendance records, which the school may use as justification for referring the student to the guidance office for counseling in order to avoid any further cause and effect that could harm the student's career and reputation on and off campus..

Summary

The purpose of this research is to design and build a biometric fingerprint recognition application that will allow students to track their lecture attendance. The project's introduction gives some background on biometrics, defines and explains the problems to be solved, and describes the study's overall aims, objectives, scope, and limits. The literature review, which follows the introduction, reviews the research materials that form the study's foundation. This data is derived from a variety of sources, including books, journals, and research papers, as well as additional data gleaned from the internet. Based on the literature, the following subjects are discussed: the history and context of modern biometrics; technological, social, organizational, and environmental implications; current market

technologies; design issues, such as security and performance; and current market technologies. The system's analysis and the approaches that will be utilized to design it. The process adopts a requirements engineering approach to system development, formally describing user demands and allowing continuous requirements assessment throughout the project life-cycle, i.e. the issue representation strategy and technique. The high-level design issues, such as module construction and description; evaluation and selection of programming language to use; project management, implementation strategy, evaluation of user requirements and system testing, database and interface design; project management, implementation strategy, evaluation of user requirements and system testing, database and interface design; and project management, implementation strategy, evaluation of user requirements and system testing.

Conclusion

Biometrics has only recently become a commercially viable technology, and as it advances, it will surely affect our daily lives in fundamental ways. Misconceptions about biometric systems' technical and performance aspects, as well as their societal impact, have resulted in a misrepresentation of the facts, claiming that "there is really no such thing as a biometric system," and that biometric recognition is embedded as part of the system, requiring careful architectural design and implementation. The goal of this work was to create a fingerprint-based student attendance identification system that allows students to be logged into lectures.

<div align="center">Recommendation</div>

1. Given the rapid pace of technological advancement in our society today, any educational institution that wishes to remain at the forefront of today's competitive educational performance must provide a fingerprint authentication application that allows students to log in to lectures in order to ensure that they are attending classes and thus providing dependable knowledge to students and the general public. Developing such an application can help eliminate the consumption of paper, allowing for income to be maintained.

2. The system should not be limited to the Microsoft Operating System (OS) and Visual Studio.net platforms, but should also work on Linux, Mac OS, iOS, and Java programming software.

3. Students should be able to view their attendance in a web browser or via a mobile application accessing the Internet through the system.

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