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Biometric Fingerprint based Attendance Monitoring System

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ABSTRACT: This project purposes to aim at designing a student attendance system which could effectively manage attendance of students at institutes. Attendance is marked after student identification. Biometric system is essentially a pattern recognition system which recognizes a user by determining the authenticity of a specific physiological or behavioral characteristics possessed by the user. For students identification, a fingerprint recognition based system is used. Fingerprints are considered to be the best and fastest method for biometric identification. They are secure to use, unique for every person and do not change in one's lifetime. 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.

KEYWORDS: Arduino uno, Biometric fingerprint sensor, LCD, Power supply, GUI.

I. INTRODUCTION

Traditional student attendance methods such as Roll calling, paper based attendance, or card punches are outdated and often led to unnecessary time spent by teachers and administrators to track and compensate their limitations. Additionally, with large group of students manual supervision is also very tough to execute and in such cases these traditional student tracking methods have loopholes which cannot prevent proxy attendance, ID card theft, and attendance tracking errors. These are all serious problems that have direct effect on education quality. Biometric attendance systems are automated and provide a convenient way to quickly record student check-in and check-out times. Biometric Technology uses human physical and biometric characteristics (which are unique for every individual) to ensure identification accuracy. It prevents errors, and eliminate proxy attendance even from identical twins. Thus it is very safe and useful to use Biometric technology. Biometric technology also protects students from identity theft because it uses sophisticated encryption to secure and protect user identity privacy. Here, we have designed and implemented such an attendance system. A Fingerprint Sensor takes the input fingerprint from the user. This input is fed to the Arduino microcontroller. The system can work in two modes which are enrollment and

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detection. In Enrollment mode, each individual has to register his/her fingerprint with their details like Class, Roll number, etc. Their information will be fed in the Database. In Detection mode, if the input fingerprint matches with the one in stored Database, Attendance of that individual is marked or else he is asked to try again. During the class, fingerprint module will be passed among the students to mark the attendance. In section II problem definitions and gap analysis are discussed. Furthermore in section III, IV, V, VI and VII problem solution and methodology, results and discussion, future scope and conclusions are discussed. Acknowledgement and references are mentioned at last.

II. PROBLEM DEFINITION AND GAP ANALYSIS

To design a student attendance management system based on fingerprint recognition and identification that manages records for attendance in institutes. Previous projects store information of the attendance of the students in an institute. The attendance in them is through a fingerprint sensor. The output of the sensor is then fed to the microcontroller. The microcontroller is programmed to verify the received fingerprint image to one of the templates stored in its database. If the two images match the attendance of the student is marked. But these projects did not have any provision to select Enrollment or the Detection mode, hence causing confusion and inconvenience to the user. In this project, the mode can be easily changed with the help of a GUI designed using Python. The user can select Enrollment Mode or Detection Mode and use the device efficiently. This makes it an User-Friendly device.

III. PROPOSED SOLUTION AND DISCUSSION

Manual attendance taking and report generation has its limitations. It is well enough for 30-60 students but when it comes to taking attendance of students large in number, it is difficult. For taking attendance for a lecture, a conference, etc. roll calling and manual attendance system is a failure. Time waste over responses of students, waste of paper, chaos, etc. is the disadvantages of manual attendance system. Moreover, the attendance report is also not generated on time.

3.1 USE OF PORTABLE DEVICE

In this section, we suggest the working of portable device and the method of using it for marking attendance. Software which is specially designed for the device will be running on it. The students will be given device for their fingerprint identification and attendance marking. In the continuation, teacher will start his/her lecture. Students will hand over the device to other students whose attendance is not marked. After the class is over, teacher will take device and will end the lecture. The main function of software running on the device will be fingerprint identification of students will automatically save data in memory card.

3.2 FINGERPRINT RECOGNITION

Fingerprint images that are found or scanned are not of optimum quality. So we remove noises and enhance their quality. We extract features like minutiae and others for matching. If the sets of minutiae are matched with those in the database, we call it an identified fingerprint. After matching, we perform post-matching steps which may include showing details of identified candidate, marking attendance etc.

3.3 FINGERPRINT VERIFICATION

Fingerprint verification is the process of matching two fingerprints against each other to verify whether they belong to same person or not. When a fingerprint matches with the fingerprint of same individual, we call it true accept or if it doesn't, we call it false reject. In the same way if the fingerprint of different individuals matches, we call it a false accept or if it rejects them, it is true reject. False Accept Rate (FAR) and False Reject Rate (FRR) are the error rates which are used to express matching trustability.

3.4 GUI

It has been designed using Python. It contains a table viz. "LOGIN" which stores username and password. Whenever user changes password or username, entries of table LOGIN are updated automatically through our python script.

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3.5 LCD JHD 162A

The JHD162A LCD module has 16 pins and can be operated in 4-bit mode or 8-bit mode. Here we are using the LCD module in 4-bit mode.

3.6 INTERFACING ARDUINO WITH FINGERPRINT MODULE

Basically there are two enrollments. First we have to interface arduino with LCD and fingerprint sensor. First we all need to enroll a fingerprint that means the specific ID or the roll no for particular student. Once you have enrolled, your id is made. Working: The fingerprint module basically checks for the thumb impression and if the finger is placed, it converts it into the equivalent hex number. The fingerprint module sends data serially, i.e. only in one direction to the Arduino board. The LCD is made to work in 4-bit mode and it takes up data from the data pins during the first time and then data from the other pins adds them up together and shows them on the screen. The enable pin is given to vcc to ensure that the LCD screen is actually getting the power so as to work. The V0 pin is connected to ground. It can be used to change the intensity of the LCD screen depending upon requirements. When a person places his/her finger on the fingerprint module, the fingerprint will be checked with the fingerprints that have been already stored. If any match is found, the student will be marked present. If the fingerprint doesn't match with the fingerprints already stored then the LCD screen will display an error.

3.7 MICROCONTROLLER

Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button.

IV. RESULTS AND DISCUSSION

4.1 TESTING

Testing can be done by following ways which are testing of the enrollment and detection program separately, testing of a single combined program, testing of the GUI, testing of program for communication between arduino and GUI, testing of the entire project with the GUI as well as combined code.

4.2 TESTING OF ENROLLMENT PROGRAM

This Program is the code which helps enroll new fingerprints to the fingerprint module. Thus any new admissions or any additions in the class can be enrolled using this Program. In this code, the Roll No of the student to be enrolled is taken as an input and the corresponding fingerprint has to be pressed twice on the fingerprint module. The two images are merged to create a final template, which is then stored in the module.

4.3 TESTING OF DETECTION PROGRAM

This Program is the code which helps detect which Roll Numbers are present. Whenever this Program is uploaded in the Arduino, the fingerprint module continuously checks for any finger placed on it. When a finger is placed on the sensor, it captures an image of the finger and matches this image with the templates of all the enrolled fingerprints. In case of a match between the two, the ID of the saved fingerprint i.e. the Roll No of the student present is displayed.

4.4 TESTING OF COMBINED PROGRAM

In this stage of testing, the two separate programs for Enrollment and Detection were combined. Thus the two Modes, viz. Enrollment Mode and Detection Mode were represented by numbers, i.e. (Mode 1 as Enrollment Mode) and (Mode 2 as Detection Mode). In this Program, the Mode number is taken as an input from the user. If Mode 1 is given as input, new fingerprints can be enrolled to the module according to the procedure mentioned in the Enrollment Program. If Mode 2 is given as input, the Roll Numbers which are present can be displayed. If any other value of Mode is given as input, the message 'Invalid Mode' is displayed

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4.5 TESTING OF GUI

In this stage, a GUI (Graphical User Interface) was created for the selection of the Mode, using the Python GUI package. In the GUI, the first window is for selection of the Mode. By default, the Detection Mode is selected. If the Enrollment Mode is selected, another window for Authorization of the access opens. This is the Login Window. If the Username and the Password are correct, access is granted to the user and the Mode is changed to Enrollment Mode. However, in case of an incorrect Username and Password, access is denied and the Mode still remains in Detection Mode.

4.6 TESTING OF PROJECT

This is the final stage in which the Combined Program modified to take input from the GUI is uploaded to the Arduino board, the Program for communication between the Arduino board and the GUI is executed once, and the GUI is run on the PC. As the communication Program is executed, the Python GUI code is linked to the Combined Arduino Program. Thus, once the port on which the Arduino board is connected to the PC is selected on the GUI, the Mode Selection window opens on the GUI. The default Mode is set to Detection Mode. If the Enrollment Mode is selected on the GUI and if the user is authorized, the Mode is changed to Enrollment Mode. Here, the Roll No of the student to be enrolled is taken as an input from the user. Once the Enrollment Procedure is done, the user can exit the Mode to return to the default Detection Mode if he/she wishes to. Also, a PC is required only for the Enrollment purpose. Once all the students have been enrolled, the project can be powered using a 9V battery, so as to make it in form of a portable product.

V. FUTURE SCOPE

To modify the GUI, so that it helps in also extracting data from updated Databases. This attendance system can be extended from marking attendance of more number of students and can be further extended for implementing in the entire institute. The template data obtained from the fingerprint module can be streamed to the PC/Laptop for Local Record Maintenance.

VI. CONCLUSION

In era of rapid technological developments, educational institutions need to have cost-effective and efficient systems in place such as biometric student attendance solutions to streamline operations and increase security. This Wireless fingerprint attendance system is elegant and efficient way to track the presence of students in the class over an entire semester for various courses. The system helps to reduce many issues such as, denying the possibilities of cheating in recording the attendance, helps to ease the lectures to keep data of students' attendance, the encryption technique adds more security so that there will be no anonymous fingerprint which will be able to tamper with the recorded data, and the portability saves time in taking attendance instead of roll calls by professors. Future works will be making this system wireless and using IOT (Internet of Things) concept and designing a GUI for the database.

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