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SMART ATTENDANCE SYSTEM

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***Abstract*—This paper aims at automating the entire procedure of taking attendance by the use of biometrics. This system uses a fingerprint scanner for marking attendance and these records are stored in the internal memory of the microcontroller. Then these records are retrieved and converted into Microsoft Excel sheets by connecting the controller to a personal computer.**

I. INTRODUCTION

Attendance is one of the most important tasks that is to be performed in an organization as it indicates how dedicated the people connected to that organization are. It is very crucial because for a student it depicts how many lectures the student has attended and for every subject, certain marks are assigned for attendance by the curriculum and for an employee it is an important parameter for calculation of his salary.

There are several attendance systems currently being used from roll number calling to use of signatures and from face detection to finger print scanning. All of them have their own advantages and disadvantages. But a good attendance system should be easy to use, must have unique identification, should be highly secure and relatively cheap.

Keeping all this in mind this project has been made using biometrics for attendance. Biometrics involves the use of physical characteristics and biological traits like fingerprints, iris, retina, palm veins recognition which are unique to every individual and hence are full proof methods for authentication. This project has been made using a fingerprint scanner to curtail the cost of the module. It is also essential that the project is durable, which is ensured by the use of fingerprint scanner which has a very good sensor life, reliability, accuracy and quick response.

II. PROBLEM DEFINITION

- Accurate marking of attendance with no proxy marking using biometrics(fingerprints)
- Elimination of incorrect marking due to human error
- Storing as many records as possible without the need to clear the memory for repeated use
- Saving of records on the computer in the form of spreadsheets for easy management of records
- Only authorized people should be able to clear the records

A. Existing System

The current system prevailing in colleges has attendance sheets with names of all the students in the class. The professors pass the sheet in the class and the students present in the classroom sign next to their name and in this way their attendance is marked. The professors have to manage the sheets and according to the data in the sheet have to update the database either on the computer or the online server of the college.

The professors have to maintain and manage all the sheets of paper for further reference even after updating records in case of any error in marking. Also, they face a problem of proxies, where students sign for an absent student taking undue advantage of the flaws in the system. To avoid the problem of proxies, the professors have to do a roll call in every lecture, which is also time consuming. Hence paper wastage, errors, efforts and time consumption are the problems faced with the existing system.

B. Proposed System

The proposed system uses biometrics(fingerprints) to mark attendance which eliminates the problems of proxy and human error altogether. It also uses data acquisition by which the attendance stored in the memory is extracted into a database which is easier to manage and maintain compared to sheets of papers. Copies of these databases can be made to assure that even though the database gets corrupted or deleted by human error there is still back up available. Since it uses fingerprints there it also eliminates the necessity to take roll calls and thus saves time as well.

Every professor's fingerprint is also stored so that it automatically comes to know which lecture is going on and the memory is divided in such a way that a professor can mark attendance and pass the module to another professor and still have the attendance of his lecture saved as the attendance of the next professor is saved in a different memory slot. Also the option to clear the memory is protected by a password therefore only a professor can clear the data recorded after extracting it to a computer.

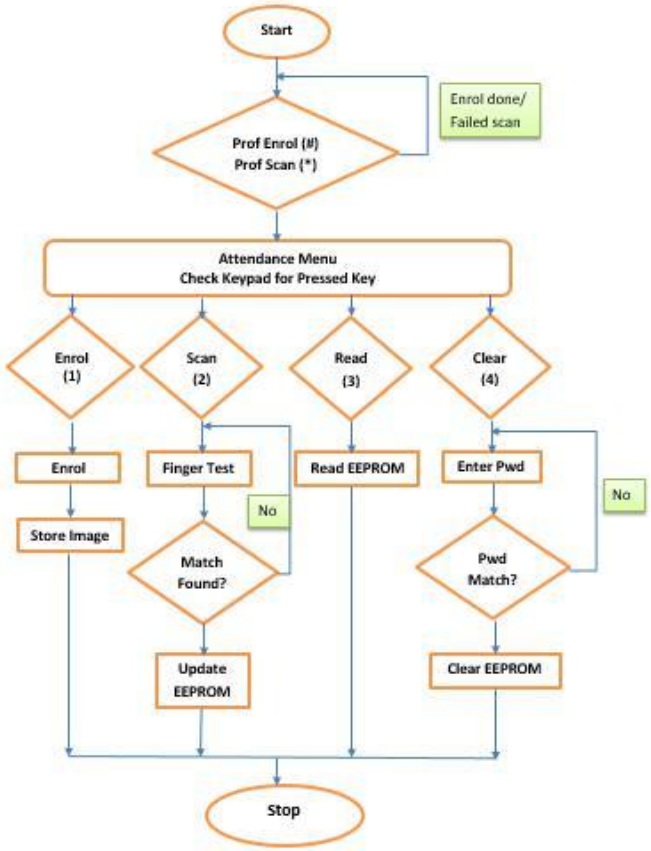

Fig. 1. *Flowchart*

III. HARDWARE COMPONENTS

This system requires a fingerprint module, a keypad, an LCD display and a microcontroller.

Fig. 2. *Smart Attendance Prototype*

A. Arduino UNO

Arduino UNO is a microcontroller based on ATmega328P. It has 14 digital input/output pins, 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; it only requires to be connected to a computer.

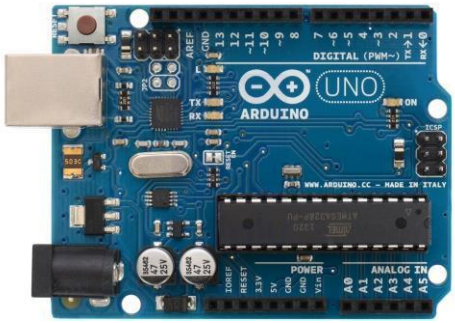

Fig. 3. *Arduino Uno*

This arduino is the heart of the project, it performs all the required functions from storing and scanning fingerprints to reading input from the keypad and displaying messages on the LCD display. This board also has 1KB of EEPROM memory which is used to save the attendance and retrieve it later since even after power off the data is maintained in the EEPROM memory.

B. Fingerprint module(R305)

This is a finger print sensor module with TTL UART interface. The user can store the finger print data in the module and can configure it in 1:1 or 1: N mode for identifying the person. The finger print module can directly interface with 3v3 or 5v Microcontroller.

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Fig. 4. *Fingerprint Sensor R305*

For 1:1 matching, system will compare the live finger with specific template designated in the Module; for 1:N matching, or searching, system will search the whole finger library for the matching finger. In both circumstances, system will return the matching result, success or failure.

This module has the capacity to store 256 fingerprints. In this system the fingerprint module stores fingerprints of the students in the initial slots while the ending few slots are for professors to store their fingerprints.

C. LCD display 16x2

An LCD is required to display messages according to which the user has to input data using the keypad. A 16x2 LCD display is a very basic module and is commonly used in various devices and circuits.

Fig. 5. *LCD*

A basic LCD requires 8 digital pins for sending data and a 3 more for ground, supply and enable connections. Therefore, an I2C LCD is used which reduces the need for so many pins and only 4 pins suffice the requirement, leaving many digital pins free to be used for interfacing other devices. It consists of four pins: Vcc, ground, serial data(SDA) and serial clock(SCL). By using simple I2C and SPI input/output expanders we have reduced the number of pins while still making it easy to interface with the LCD. There are just two wires, called SCL and SDA. SCL is the clock line. It is used to synchronize all data transfers over the I2C bus. SDA is the data line. The SCL and SDA lines are connected to all devices on the I2C bus. There needs to be a third wire which is just the ground or 0 volts. There is also a 5volt wire for power to be distributed to the devices. Both SCL and SDA lines are "open drain" drivers. What this means is that the chip can drive its output low, but it cannot drive it high. For the line to be able to go high you must provide pull-up resistors to the 5v supply. There should be a resistor from the SCL line to the 5v line and another from the SDA line to the 5v line. You only need one set of pull-up resistors for the whole I2C bus.

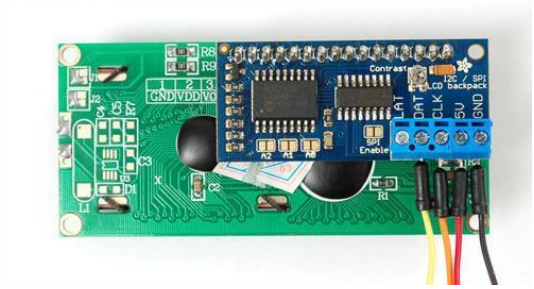


Fig. 6. *I2C LCD Connections*

D. Keypad 4x4

The Keypad 4x4 Board features 16 push buttons arranged in 4x4 matrix to form standard alphanumeric keypad. Matrix keypad offers more input to the microcontroller with lesser I/O pins required as compared to buttons. A 4×4 matrix keypad consists of 4 rows and 4 columns. This is roughly how the keypad looks like:

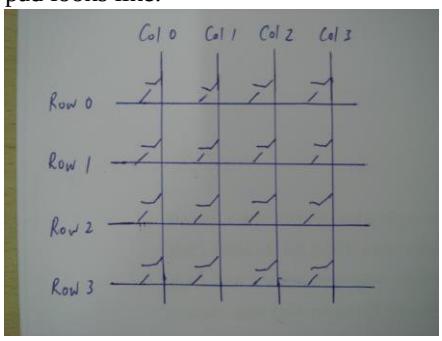


Fig. 7. *Switching Connections*

There is a switch connecting each row and column. So the combination of rows and columns makes up the 16 inputs. Now there is a connection between the row and column. Initially all the switch are open (not connected). When you pressed either one buttons, the switch is closed (connected).

So we connect the first 4 pins to the column as INPUT. The other 4 pins are connected to the row as OUTPUT. The input is the input to the microcontroller while output is the output from the microcontroller. Note that the input to the microcontroller has to be connected to pull up resistors. The microcontroller now sends LOW pulse to each row one at a time and checks whether there is a LOW pulse detected on the column. If there is no button pressed, the microcontroller will scan the next row and check for LOW pulse. Since the column is pulled up internally, so no button pressed would return 1 to the microcontroller. When you press one of the button, the row and column get connected. The 0 from row would make the column return a 0 to microcontroller.

Embedded systems that require user input in form of numbers (decimal, or hexadecimal) can use this board as a solution.

Fig. 8. *Keypad with push buttons*

IV. SOFTWARE REQUIREMENT

- Arduino IDE

This is used for coding the entire project including enrollment, fingertest,etc.

- CoolTerm (PC application)

This is basically used for Serial communication in which it connects the controller to the PC via USB port and reads the attendance records on the Serial Monitor. It is also used for storing the records in a text file which is further used for transferring it in the Excel sheet. It can also add timestamp if mentioned.

- MS Excel(or similar)

The text file created by CoolTerm is imported in Excel sheet after delimiting according to our requirement.

V. LIMITATIONS

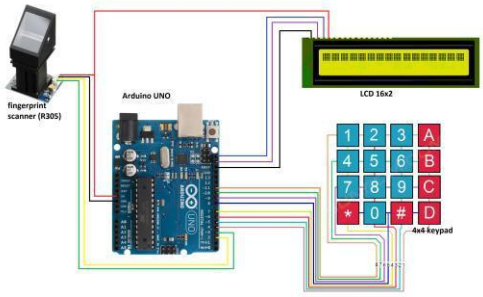
- The fingerprint module can store only 256 templates in its memory. That would be enough for most of the applications but there can be areas where more number of templates need to be saved. This can be done by adding additional memory to the fingerprint module.
- The size of EEPROM is limited and hence there are limitations on the storage of data in it. The size of the EEPROM is 1KB so storing more data will require additional memory. However, we can still use the EEPROM with current size, for which the data has to be transferred to a database and the EEPROM has to be cleared before further use.

VI. WORKING

On powering the device, it displays the menu, stating keys and tasks mapped to them.

Enroll option takes ID and fingerprint, confirms fingerprint by taking again and matching it with the previous one and if matched, stores it. Fingertest checks fingerprint and gets the ID number from the mapping, and then updates the student as present by making the flag 1, as all the flags are 0 by default. EEPROM read option shows the attendance of the entire class on serial monitor. Taking multiple lectures attendance for a whole day is possible as all the professors are given unique ID numbers and the attendance for their lectures are stored with this ID number of the professor. This ensures that the attendance for different lectures is not mixed up and confused.The EEPROM clear option is password protected which ensures that the records are not cleared by unauthorized people. It's only for professors to clear after they update attendance.

Once the attendance is recorded, the professor can update the records by connecting the system to the PC. Opening a Serial Communication Software, CoolTerm, the data from the EEPROM is captured and saved into a text file on the computer. The text file is then imported in Microsoft Excel and analyzed. Date and timestamp are also marked along with the attendance. The data remains on the EEPROM even after the power off, which is one of the most important feature of the system.



a. Sample of a table footnote. *(table footnote)*

Fig. 9. *Interfacing Diagram*

VII. FUTURE SCOPE

Attendance updation would be done directly by connecting controller to ESP8266 Wi-Fi module which searches for access points and connects to the network whose SSID and password is mentioned in the code. This is done by giving proper AT commands. Once connection is established, the controller then sends data on to the server wirelessly, through Wi-Fi. Once the query is submitted, data gets updated in the database by the PHP script. This would ensure maintenance and updation of records without human intervention and thus would be more reliable.

VIII. RESULT

We have successfully been able to extract the data into an Excel sheet from the EEPROM. The Excel sheet updated with records is as follows:

	A	B	C	D	E
1	Date	Time	Roll no	Attendance	
2	25-01-2016	16:24:17	0	0	
3	25-01-2016	16:24:17	1	0	
4	25-01-2016	16:24:17	2	1	
5	25-01-2016	16:24:17	3	0	
6	25-01-2016	16:24:17	4	0	
7	25-01-2016	16:24:17	5	1	
8	25-01-2016	16:24:17	6	0	
9	25-01-2016	16:24:17	7	0	
10	25-01-2016	16:24:17	8	0	
11	25-01-2016	16:24:17	9	0	
12	25-01-2016	16:24:17	10	1	
13	25-01-2016	16:24:17	11	0	
14	25-01-2016	16:24:17	12	0	
15	25-01-2016	16:24:17	13	0	
16	25-01-2016	16:24:17	14	1	
17	25-01-2016	16:24:17	15	0	
18	25-01-2016	16:24:17	16	0	
19	25-01-2016	16:24:17	17	0	
20	25-01-2016	16:24:17	18	1	
21	25-01-2016	16:24:17	19	1	
22	25-01-2016	16:24:17	20	0	
23	25-01-2016	16:24:17	21	0	

Sheet1

Fig 10. *Excel Sheet after attendance is updated*

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