

# Fingerprint Based Classroom Attendance Recording Device

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**Abstract**--A portable, compact and handheld fingerprint based classroom attendance recording device has been developed. The device is completely fool-proof and works independently without the need of a computer or a wireless network. It has a user-friendly and convenient user interface making it easily operable. The device can be passed around the classroom and it records the attendance by verifying the fingerprints of the students who are present, when they place their fingers on the fingerprint sensor and automatically updates an excel worksheet with the attendance data of each session/lecture in a Micro-SD memory card present in the device, which helps in maintaining attendance records.

**Keywords**--Classroom attendance, fingerprint based, handheld attendance recording device

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## 1. Introduction:

In many schools and colleges, even these days, classroom attendance is recorded manually by lecturers/teachers by calling out the names or roll numbers of the students and the students, in turn are required to respond to the call, to register their attendance. This process, apart from being time consuming, is also open to the possibility of students indulging in malpractices like feigning one's attendance using a proxy. This becomes a big concern in institutions where minimum attendance is prescribed. In addition, the recording and management of student attendance data for the whole year (or semester) is a tedious process. In this context, the use of modern biometric sensors and electronic devices to uniquely identify individuals enable the classroom attendance to be recorded independently and efficiently, while the teaching remains uninterrupted.

There have been a few such systems proposed for classroom attendance using fingerprint sensors. Li Jianpo et al.,<sup>[1]</sup> proposed a fingerprint based attendance system using the Zigbee wireless technology which uses an attendance management module installed in a remote computer while an independent fingerprint acquisition module that transmits the attendance data. This system however, cannot be used without a remote computer and can only work within the Zigbee wireless range, which is 10-100m in range from the remote computer. Another design, proposed by Mohammed Basheer et al.,<sup>[2]</sup> is a portable fingerprint attendance system which uses a bulky remote module for recording attendance that can communicate with a host computer via USB interface for processing. The host computer has an

application installed to facilitate the management of attendance data, to transfer data such as names of students for enrollment, etc. This device cannot work without this computer application during enrollment and employs an inconvenient user interface making it difficult to work with and remains susceptible to malpractices like resetting the attendance data.

Hence, there is a need for an independent, hand-held classroom attendance recording device with a convenient, easily operated user interface which is fool-proof and works reliably without the need for a computer or any kind of wireless network. A computer may be needed only for the management and processing of attendance data.

Here, we report the development of such a device. It is compact, handheld and can be passed around independently in the classroom for fingerprint recognition. The device automatically records the attendance data (current and cumulative) within a Micro SD memory card, which is present inside the device. The data in this card can later be transferred to a computer for data management, at the convenience of the lecturer/teacher.

## 2. Design and fabrication:

The device consists of a microcontroller (ATmega2560), a fingerprint scanner module, an LCD display, a Micro SD card, a real time clock, and 3 push buttons.

The ATmega2560, which is an 8-bit microcontroller, is the central part of the device and controls other peripheral devices and supports different serial communication protocols like UART, SPI, and

I<sup>2</sup>C. The fingerprint sensor used is an R305 fingerprint module manufactured by Zhejiang SFG Technology Co., Ltd. This is used, to enroll new fingerprints by placing the finger on the sensor and also to verify existing fingerprints by doing the same. The module is interfaced with the controller through the UART protocol. The communication between the microcontroller and the fingerprint module takes place at a baud rate of 57600bps (bits per second). The LCD display device (HD44780) is a 2-line 16 character display module which is used to display messages to the user.

A Micro SD breakout board is used to provide a slot for the Micro SD card. The Micro SD card is interfaced with the microcontroller via the SPI protocol. The device records the classroom attendance for each session and this requires the date and time of the session to be a part of the attendance record. Hence, a real time clock IC is used. The one used here is the DS1307, manufactured by Maxim Integrated Products Inc. This is interfaced with the microcontroller using the I<sup>2</sup>C protocol. The device consists of 3 push buttons -UP, DOWN and SELECT.

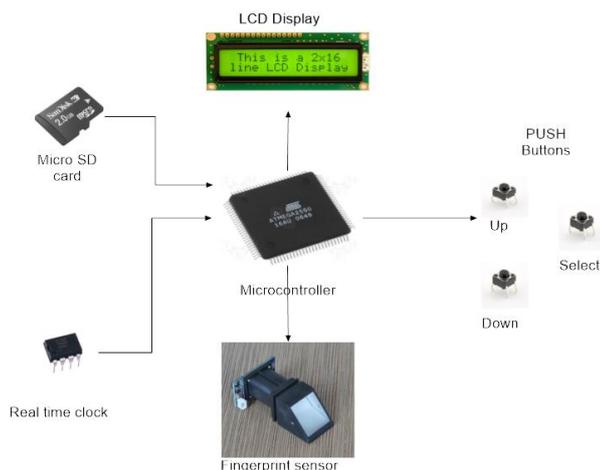


Fig 1: Block diagram of the hardware



Fig 2: Wired PCB (printed circuit board) of the prototype

### 3. User interface:

When the device is switched on, it asks the user to place an ADMIN finger. An ADMIN fingerprint belongs to the administrator(s) of the device, usually the teacher/lecturer. Only when an ADMIN finger is placed it moves ahead and asks the user to select one of the 6 modes available from the MAIN MENU - 1) Enroll, 2) Verify, 3) Show attendance, 4) Write to SD, 5) Restart, 6) Delete all prints. The user can move through these modes (options) using the UP and DOWN keys and choose the required mode (option) by pressing the SELECT key. The different modes are:

#### 3.1 Enroll:

The 'Enroll' mode is selected when new fingerprints need to be enrolled. Once this mode is selected, the user is further provided with two options: 1) Enroll a student, 2) Enroll an ADMIN. After selecting the appropriate option, the device enters the 'Enroll' mode.

Now, the device asks for the finger to be enrolled to be placed on the sensor. Once the fingerprint is captured, the user needs to place the same finger for confirmation. If the fingerprints match, then that fingerprint gets stored along with a device generated ID number, which is subsequently displayed. In case the fingerprints do not match, or in case the finger is not properly placed, then the fingerprint does not get stored and an error message is displayed to the user. When the device is used for the first time, or after all the fingerprints have been deleted from the memory, the device automatically starts from the 'Enroll' mode for two fingerprint enrollments and those two fingerprints are taken to be ADMIN fingerprints by default.

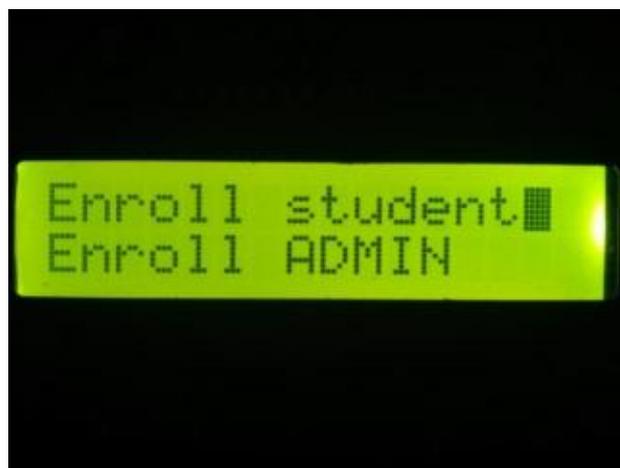


Fig 3: The device displaying the enrollment options

### 3.2 Verify:

The 'Verify' mode is used to verify the fingerprints of the students present in the class. Once this mode is selected, the user is asked to select the class (batch). The device supports attendance keeping of up to 5 classes. Selecting the class allows the attendance data to be recorded separately for each class/batch. Once the class is selected, the device enters the 'Verify' mode.

The device can now be passed around the classroom for students to verify their fingerprints and therefore mark their attendance. When a student places his/her enrolled finger on the fingerprint sensor, the ID number of that particular fingerprint is displayed to convey that that student's attendance has been marked for that session.

A student, in the case of any a doubt can verify if his/her attendance has been marked by placing his/her finger again on the sensor. If the student's attendance has been marked then the ID number of that student followed by the message "Already entered", is displayed.

Also, the students can be seated in any order. The seating arrangement or the numbers of verify checks made by the students do not affect the attendance data.

To go back to the MAIN MENU, an ADMIN finger needs to be placed on the fingerprint sensor.

### 3.3 Show attendance:

The 'show attendance' option shows the total attendance of that particular session (i.e. the total number of students whose attendance has been marked by the device for that particular session). In the case of any discrepancy between the head count and the total attendance count, or any other confusion, the ADMIN can restart the attendance process using the 'Restart' option.

### 3.4 Write to SD:

The user can select this option to record the attendance data on to the Micro SD card (memory card). The attendance of the session gets appended to the existing data on an excel worksheet. This worksheet is a part of an excel workbook which has in built templates to help in keeping records. It includes all the information about the students' attendance like the attendance percentage etc. The workbook gets updated every time attendance data is written to the micro SD card.

When the data is successfully written in to the Micro SD card, the message "Written to SD!" is displayed.

### 3.5 Restart:

This option allows the ADMIN to delete the attendance data of the session before the data is written to the Micro SD card and reset/refresh the attendance count. This feature can be used by ADMIN to restart the attendance process (for that session) in case there is any confusion or discrepancy regarding the attendance marking or total count. After this, the 'Verify' mode is selected to restart the attendance verification process.

### 3.6 Delete all prints:

This option allows the user (ADMIN) to delete all the fingerprints from the device memory. This option is used at the end of the academic year/semester when the fingerprints of a new set of students need to be enrolled. When this option is selected, the device asks for a confirmation. To proceed with the deletion, the 'yes' option is selected and to cancel the deletion and go back to the MAIN MENU, the 'no' option is selected. When the device is switched on for the first time after deleting all the fingerprints, the device enters the 'Enroll' mode for two fingerprint enrollments, which are taken to be ADMIN fingerprints by default.



Fig 4: The device displaying the unique ID of a student when he/she places his/her finger on the fingerprint sensor

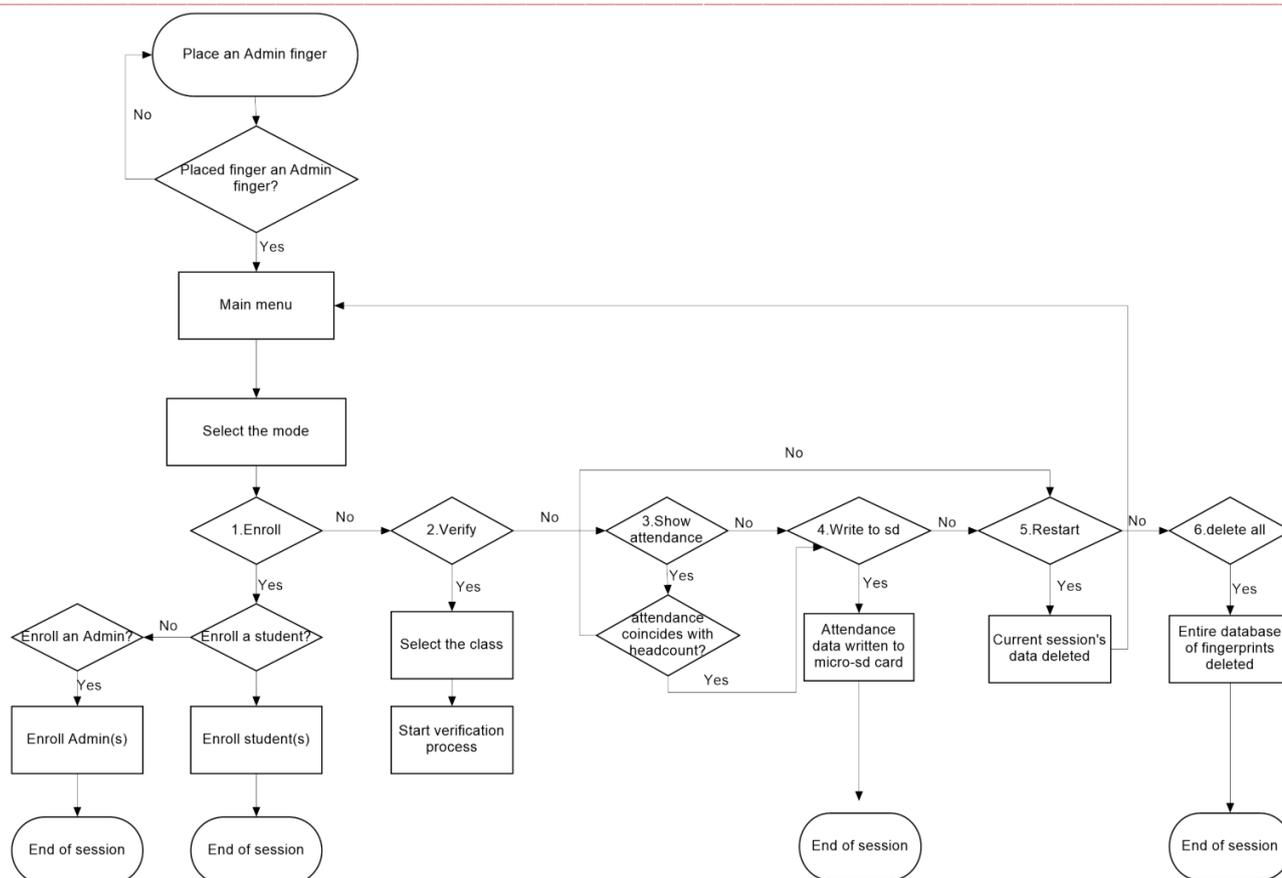


Fig 5: Flowchart of the device operation

**Conclusion:**

The device presented here is a compact, hand-held device that enables attendance recording in a classroom by passing the device around the class. It provides a reliable and time saving alternative to manual roll calling performed by teachers. It functions independently using a convenient user interface and requires a computer only for data management.

**Authors:**

Mr. Varun Chandrasekar is a budding engineer doing his Bachelors in Instrumentation and Control engineering at National Institute of Technology, Tiruchirappalli, India. He is interested in developing innovative solutions for different applications and real life problems. The present work that is published here is one such an attempt to address the problems in the classroom attendance system. He proposes to pursue his Master’s degree in some good universities in USA.

Dr. T.S.Natarajan is a senior professor of Physics at the Indian Institute of Technology (IIT) Madras, in Chennai, India having nearly four decades of experience in teaching

and research. His YouTube videos (40 videos, each of one hour duration) on basic electronics has been received very well by teachers and students all over the globe. He has guided many PhD and Master’s students in IIT on several innovative projects. He has developed an Electrospinning apparatus for preparing nano fibers of polymers and more than 60 machines have been sold by the company in Chennai, India to whom its technology was transferred. Prof. Natarajan has nearly 100 publications in journals and conference proceedings. He has also developed many teachings/demonstration aids in electronics and physics.

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