Smart Covid Screening and Access Control System

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Abstract **- one of the criteria to measure the student performance is checking his regularity. Normally in schools and colleges attendance is marked by calling their names or register numbers and marking the attendance in register book. In laboratories logbook is maintained to track the students and utilization of laboratory components. In both the cases it is time consuming and requires more paperwork. Therefore, institutes started using student attendance marking systems based on wireless technologies or biometric information such as fingerprint reading, face recognition along with RFID tags. In the present situation created by Covid-19 pandemic, the thermal screening is also very important to allow the student to attend the class. We propose an idea where along with face recognition temperature screening is also added to the attendance marking system. This system is designed using ultrasonic sensors, IR temperature sensor, camera module which is interfaced with Arduino. In this way attendance can be marked automatically and at the same time system can scan individual student to identify potential patients of Covid-19.**

Index Terms **- Arduino; computer vision; coronavirus; COVID-19.**

INTRODUCTION

Attendance plays more important role in student's academic performance. This shows student's commitment towards studies. Almost all the universities and educational institutions pose strict rule based on attendance. Student has to maintain said percentage of attendance to take end exam. So, in each class the faculty or lecturer has to mark attendance. In most of the educational institutions manual attendance marking is still in use. Calling individual student's name and marking his/her presence is common. The problem with this method is it takes time to call each and every student. Another problem is authentication, where a student can answer for his friend's roll call. Alternate method usually practiced in classroom or a laboratory is passing student's name list on which they have to sign. As stated above, here also the same authentication problem arises. Many smart attendance marking systems were developed. Few of them require mobile applications and other based on biometric information. Even though we have different choices as mentioned above, still new requirements are arising. Along with attendance tracking or marking, outbreak of Covid 19 imposed another concern of temperature screening on these systems. The Universities made it compulsory to scan everyone before entering the school or college. Hence, smart attendance marking system need to be implemented in place of traditional attendance marking. The objective of this paper is to propose a biometric based attendance marking system with temperature screening for schools or colleges.

The system of intelligent attendance is generally implemented with biometrics help. Recognition of face is one of the Biometric ways of improving this system. Face recognition proved to be a productive method for taking attendance. The normative face recognition techniques and methodologies fail to tackle challenges like scaling, pose, illumination, variations, rotation, and occlusions. The framework proposed is designed to solve the drawbacks of current systems. there has been a lot of advancement in face recognition, but the vital steps are face detection, feature extraction, and face recognition. firstly, two or more cameras depend on the need, and the size of the classroom has to be installed on the ceiling of the classroom from where it covers the entire area. image captured from these cameras will be considered as an input to the system. There may be a possibility of getting image blurred due to movements of students, for better efficacy image can be upgraded using Generative Adversarial Networks. A newly generated ameliorated image will be passed to the system for face detection. process of face detection is

accompanied by feature extraction and face recognition these process makes the use of Gabor filters. face recognition is done using the K-nearest neighbor algorithm, Convolutional neural networks, and SVM algorithm with their comparative studies. post-completion of face recognition, the system generates the name and identification number of the students who are present and identified in the image. then attendance is marked in front of the student names in the excel format with respective date and subject of a lecture in an institution. It requires very few hardware resources hence it is a cost-friendly system.

Within the UN Sustainable Development Goals (SDG), Goal 3, Good Health and Well-Being, several areas of human health have been recognized as having been part of progress, but still requiring acceleration [1]. Maternal Health and Child Health are among the stated areas [2]. Research indicates that maternal health and child health may be linked, with maternal health issues, consequently affecting fetal and child health [3] [4] [5]. The urgency for improvements in maternal health and reduction in mortality has been demonstrated [6]. While the specific effects of COVID-19 on pregnant women are not well understood currently, cautious approaches are recommended in preventive and post-diagnostic care [7]. The focus of the current work is on the demonstration of the feasibility of a low-cost open-source solution for self-care and monitoring for a specific cohort. The solution may be expanded to include other cohorts and additionally allow for the design of population health intervention using machine learning techniques. Medically underserved populations [8] would be better served by the availability of innovative, cost effective diagnostic and monitoring devices [9] with at least an acceptable level of performance enhanced by technological advances in sensing. Maternal temperature measurement and monitoring have been studied and reported in clinical studies [10]. Temperature, a basic vital sign recommended for monitoring during pregnancy [11] is also indicated for pregnant women diagnosed with COVID-19 infection [7].

RELATED WORK

Several attendance marking systems have been developed and are in use. These systems are designed either using wireless technology standards such as blue tooth low energy (BLE), Wi-Fi and Radio frequency identification (RFID) or technologies like fingerprint matching, face recognition, speech recognition. In Bluetooth based attendance marking systems mobile applications were implemented. The Mac Ids of student's device was mapped to fetch their identity. [1] A lecturer can take attendance by clicking the application installed in his mobile. Before starting the lecture, the web service will be initiated, and the session will remain active till lecture ends. Hence, lecturer can take attendance multiple times during the lecture hour and find the proxy attendance.

Using Bluetooth low energy beacons a smart attendance marking was proposed. [2] Beacons are small, low power transmitters which periodically broadcasts signals. These signals are universally unique identifiers recorded by mobile applications and then delivered to the web services. In each lecture student acquires a unique token upon login and mobile application sends the request for the scheduled lecture. From the beginning to end of the lecture, mobile application tracks student and device id as well as timestamp, later it is delivered to the web service. The problem with these Bluetooth based systems is students must carry Bluetooth enabled devices. If student does not have device, then again, we have to go back to manual attendance marking for such students. Even though some security measures were taken into consideration but still by sharing the mobile device student can give proxy. The attendance system with fingerprint matching has been proposed [3]. This system had two modules: enrolment and verification. A biometric fingerprint reader was interfaced with Arduino UNO. At very first-time student has to enroll his fingerprint to store biometric information in database. In the later time fingerprint of the student was verified. A web application was used to store and access the attendance. To transmit the data to the attendance system Ethernet shield was used between Arduino and database. In this system main concern was reducing power consumption and storage as well as to provide reliable attendance marking system.

Another attendance marking system was proposed based on event tracking [4]. Two passive infrared sensors were used to identify the entry and exit of the student. On recognizing an event webcam is activated and captures the picture. Attendance records are

updated in the cloud and email notification will be sent to the faculty. In RFID based systems, RFID tag is integrated with the student ID card. Whenever students enter into the classroom, they are asked to swipe their id card. RFID reader will fetch the information and verifies their identity by comparing it with college database. The disadvantage of this system is identifying the misuse of RFID tags. To address this issue another attendance system was proposed where face recognition was added to the existing system. When student swipes his id card and it matches with the stored data then camera will be activated and it captures the image and identifies. To enhance security, fingerprint sensor is also used after face recognition [5][6].

METHODOLOGY

In the present scenario contactless attendance marking is gaining more popularity because of covid-19 pandemic. As much as possible human contact must be avoided. In the previous section we have discussed about Bluetooth based attendance marking system. This system imposes using mobile devices and applications to be installed in their device. In majority of the universities a strict rule is followed which does not allow carrying mobile phones. If we use RFID based system, there one can steal their id card and enter the classroom. There arises authentication problem in both Bluetooth based and RFID based systems. The next choice is biometric authentication with fingerprint scanning. Here either the fingerprint reader is passed to each student or one by one student will come to the place where device is mounted and provide their information. The main objective "contactless" is not achieved in this method. To overcome from these aforementioned problems, we propose contactless attendance marking system which applies face recognition for authentication and to check the temperature of student thermal sensors are added. Contactless attendance marking and thermal screening system is designed using the concepts of IoT, Machine Learning and Artificial Intelligence. The entire system is divided into four major modules: Object's proximity module, face recognition module, temperature screening module, and alert module as shown in Fig.1.

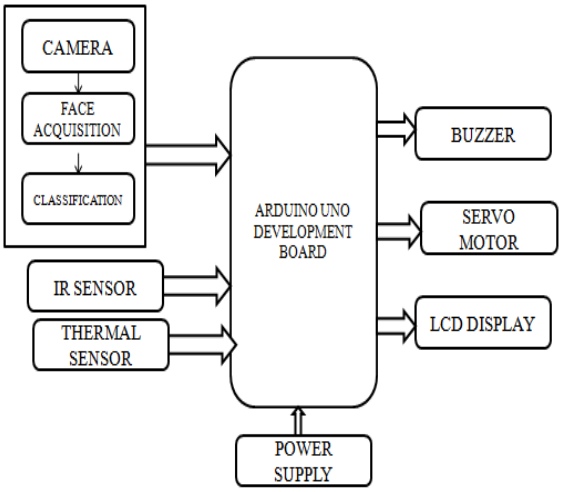

Fig 1: Block Diagram

Hardware Requirements

- Arduino Uno R3
- Ir Sensor
- Mlx90614 IR TEMPERATURE SENSOR
- Buzzer
- Servo Motor
- Power Supply
- Lcd Display

Software Requirement

- ARDUINO IDE
- MATLAB 2014 B
- Embedded C

HARDWARE IMPLEMENTATION

Arduino UNO

The Arduino UNO is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by arduino. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 Digital pins, 6 Analog pins, and programmable with the Arduino IDE (Integrated Development Environment) via a type B USB cable. It can be powered by a USB cable or by an external 9 volt battery, though it accepts voltages between 7 and 20 volts. It is also similar to the Arduino Nano and Leonardo. The hardware reference design is distributed under Common Creative Attribution Share-Alike 2.5 license and is available on the arduino website. Layout and production files for some versions

of the hardware are also available. "UNO" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The UNO board and version 1.0 of arduino Software (IDE) were the reference versions of arduino, now evolved to newer releases. The UNO board is the first in a series of USB arduino boards, and the reference model for the arduino platform. The ATmega328P on the arduino UNO comes preprogrammed with a boot loader that allows uploading new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol. The UNO also differs from all preceding boards in that it does not use the FTDI USB-toserial driver chip. Instead, it uses the Atmega16U (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

Fig -2: Arduino Board

Object's Proximity Module:

This module identifies the student when he comes closer to the device. To find the distance from the attendance marking system ultrasonic sensors are used. An ultrasonic sensor is an instrument that measures the distance to an object using ultrasonic sound waves. An ultrasonic sensor uses a transducer to send and receive ultrasonic pulses that relay back information about an object's proximity. In a single ultrasonic sensor there is a Trigger and Echo, trigger emits the sound waves and echo receives the sound waves which were emitted by trigger, so the data from the ultrasonic which we receive is the time taken for the sound waves emitted from the trigger to the sound waves received back by echo, by this time taken we can calculate the distance between the sensor and the object.

LCD

Liquid Crystal Display (LCD) is used to display the output to the user in the form of GUI (Graphic User Interface) and a mono chromatic display. LCD used in this project is JHD162A series. There are 16 pins in all. They are numbered from left to right 1 to 16 (if you are reading from the backside). Generating custom characters on LCD is not very hard. It requires the knowledge about custom generated random-access memory (CG-RAM) of LCD and the LCD chip controller. Most LCDs contain Hitachi HD4478 controller. CG-RAM is the main component in making custom characters. It stores the custom characters once declared in the code. CG-RAM size is 64 byte providing the option of creating eight characters at a time. Each character is eight byte in size.

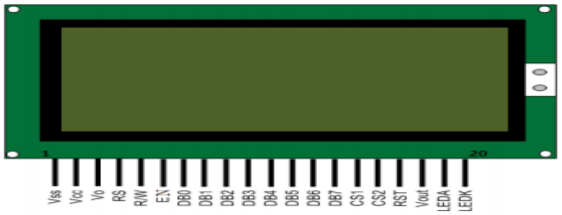

Fig -3: LCD

Face Recognition Module

when the distance between student and the device is within the proximity set by the system, image will be captured. The face of the person is checked and compared with the face of the previously stored images of the authorized person in datasets. If it matches with stored image then it will proceed with temperature screening. Otherwise an image and SMS will be sent to the faculty. Selection: Highlight all author and affiliation lines. For detection of faces 68 landmarks of faces are taken into account. with the help of these landmarks, faces are detected. For face detection, Haar classifiers have been used. It is an approach based on machine learning in which a cascade function is trained from many positive and negative images. This is then used on other images to detect images. These classifiers are simply the subtraction of the sum of pixels under the black area from the sum of pixels under the white area. applying 6000 features on each window frame was found to be difficult. features were grouped into stages which are known as cascades of a classifier.

Temperature Screening Module

After face recognition is successful temperature screening will be done. Student's identity, time stamp information and the temperature readings will be recorded only if temperature is not more than normal

body temperature. On recognizing temperature higher than the normal temperature, buzzer is activated and generates an alarm.

Alert module

As mentioned in the face recognition module, if capture image does not match with images stored in the database, and if temperature is high then warning message will be sent to the faculty. This Alert module takes advantage of some of the technologies that Mobile devices provide, technologies.

RESULTS AND DISCUSSION

Initially every student's image will be taken and updated in the database. Fig.2 shows the flow diagram of proposed system. Accordingly, whenever student comes to attend class he has go with automatic attendance marking system. The ultrasonic sensor module finds the distance of the student from the device. If it is within the specified range then image will be captured and compared with stored information. Once the student's face is recognized temperature will be read using thermal sensor and student's details like identity, timestamp and temperature will be recorded. It will continue to scan next student. In case some unknown person tries to enter into the class, SMS and email notification will be sent to the concerned faculty or admin. These notifications are also sent when temperature of the student is above the normal body temperature.

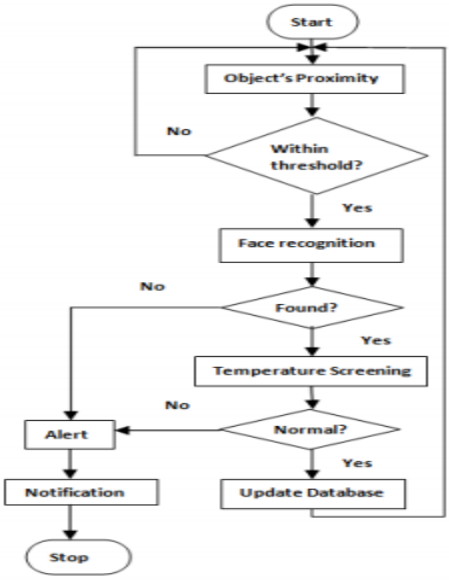

Fig 4: Flowchart of proposed system

As face recognition is used, it acts as first layer of security and hence unauthorized people cannot attend. Students cannot give proxy attendance because the image and date time stamps are recorded. In this system non-contact thermal screening will be done, so the person who is having high body temperature will not be allowed. Thereby spreading of infection to other students will be controlled. When student forget to bring ID card or lost his id card still his identity can be verified with face recognition. The device implemented in low cost, hence a cost-effective system for contact less attendance marking and thermal screening can be developed.

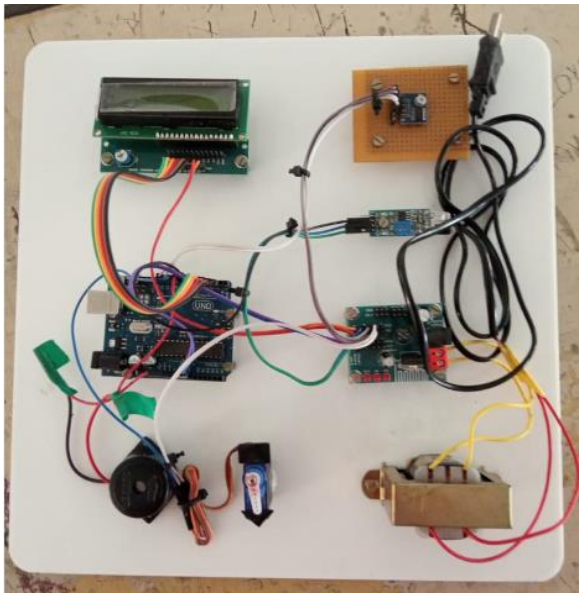

Fig 5: Experimental Setup

CONCLUSION

The above proposed system is designed based on health and multilayer security principle. As we have integrated face recognition and thermal screening technique, and it is implemented by low cost; it can be affordable by all. This system is implemented on keeping security and health as main concerns so alert email and SMS will be sent to admin, the buzzer will ring. It can be used in schools, colleges and offices where security and health are almost important. As the proposed contactless attendance and thermal screening system using Arduino not only be used for attendance and thermal screening but also be used as pre security check. We use this system to check whether the student, staff is authentic or not, and their health care status too. In future it can be enhanced by adding

admin's live voice call interaction to device when unknown person enters.

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