A Review Paper on 'Smart Attendance Management System'

Bharath N Parashar[1], Alex Abraham Mathews[2], Ashwin SA[2]

[1]Student – Bachelors of Computer Applications focused in Internet of Things and Services,
Jain (Deemed-to-be-University), School of Computer Science and Information Technology, Bengaluru, India.
[2]Student – Bachelors of Computer Applications focused in Information Security & Mobile Applications,
Jain (Deemed-to-be-University), School of Computer Science and Information Technology, Bengaluru, India.
[3]Student – Bachelors of Computer Applications focused in Information Security & Mobile Applications,
Jain (Deemed-to-be-University), School of Computer Science and Information Technology, Bengaluru, India.

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Abstract - *Uniqueness or individuality of an individual face is the representation of one's identity. In this project face of an individual is used for the purpose of attendance making automatically. Attendance of the student is very important for every college, universities and school. Conventional methodology for taking attendance is by calling the name or roll number of the student and the attendance is recorded. Time consumption for this purpose is an important point of concern. Assume that the duration for one subject is around 60 minutes or 1 hour & to record attendance takes 5 to 10 minutes. For every tutor this is consumption of time. We are all familiar with the pandemic that has turned all of our lives around. Life on earth just became a whole lot complicated than it already was. Time has come for all of us to step out of our misery and move forward in life. It has become a mandatory situation where students have to go outside to get an education and in a situation like this we need to take up all precautions that ensure we are safe. That is when our team came up with the idea of an temperature based attendance automation system. To stay away from these losses, an automatic process is used in this project which is based on image processing and body temperature detection. In this project face detection, face recognition and temperature detection is used. Face detection is used to locate the position of face region and face recognition is used for marking the understudy's attendance. The database of all the students in the class is stored and when the face of the individual student matches with one of the faces stored in the database then the body temperature of the Individual is scanned and if his/her body temperature is normal, then his/her attendance is recorded.*

Key Words: OpenCV, Raspberry Pi, Temperature Detection, Python, Face Recognition

1.INTRODUCTION

Attendance is prime important for both the teacher and student of an educational organization. So it is very important to keep record of the attendance. The problem arises when we think about the traditional process of taking attendance in class room. Calling name or roll number of the student for attendance is not only a problem of time consumption but also it needs energy. So an automatic attendance system can solve all above problems. There are some automatic attendances making system which are currently used by much institution. One of such system is biometric technique and RFID system. Although it is automatic and a step ahead of traditional method it fails to meet the time constraint. The student has to wait in queue for giving attendance, which is time taking. This project introduces an involuntary attendance marking system along with taking safety into consideration during or after this pandemic by also checking the student's body temperature which ensures safety of the student, his peers as well as the staff present in the school or university, devoid of any kind of interference with the normal teaching procedure. The system can be also implemented during exam sessions or in other teaching activities where attendance is highly essential. This system eliminates classical student identification such as calling name of the student, or checking respective identification cards of the student, which can not only interfere with the ongoing teaching process, but also can be stressful for students during examination sessions. In addition, the students have to register in the database to be recognized. The enrolment can be done on the spot through the user-friendly interface.

2. LITERATURE REVIEW

Face recognition is crucial in daily life in order to identify family, friends or someone we are familiar with. We might not perceive that several steps have actually taken in order to identify human faces. Human intelligence allows us to receive information and interpret the information in the recognition process.

We receive information through the image projected into our eyes, by specifically retina in the form of light. Light is a form of electromagnetic waves which are radiated from a source onto an object and projected to human vision. Robinson-Riegler, G., & Robinson-Riegler, B. (2008) mentioned that after visual processing done by the human visual system, we actually classify shape, size, contour and the texture of the object in order to analyze the information. The analyzed information will be compared

to other representations of objects or face that exist in our memory to recognize. In fact, it is a hard challenge to build an automated system to have the same capability as a human to recognize faces. However, we need large memory to recognize different faces, for example, in the Universities, there are a lot of students with different race and gender, it is impossible to remember every face of the individual without making mistakes. In order to overcome human limitations, computers with almost limitless memory, high processing speed and power are used in face recognition systems. The human face is a unique representation of individual identity. Thus, face recognition is defined as a biometric method in which identification of an individual is performed by comparing real-time capture image with stored images in the database of that person (Margaret Rouse, 2012).

Nowadays, face recognition system is prevalent due to its simplicity and awesome performance. For instance, airport protection systems and FBI use face recognition for criminal investigations by tracking suspects, missing children and drug activities (Robert Silk, 2017). Apart from that, Facebook which is a popular social networking website implement face recognition to allow the users to tag their friends in the photo for entertainment purposes (Sidney Fussell, 2018). Furthermore, Intel Company allows the users to use face recognition to get access to their online account (Reichert, C., 2017). Apple allows the users to unlock their mobile phone, iPhone X by using face recognition (deAgonia, M., 2017).   The work on face recognition began in 1960. Woody Bledsoe, Helen Chan Wolf and Charles Bisson had introduced a system which required the administrator to locate eyes, ears, nose and mouth from images. The distance and ratios between the located features and the common reference points are then calculated and compared. The studies are further enhanced by Goldstein, Harmon, and Lesk in 1970 by using other features such as hair colour and lip thickness to automate the recognition. In 1988, Kirby and Sirovich first suggested principle component analysis (PCA) to solve face recognition problem. Many studies on face recognition were then conducted continuously until today (Ashley DuVal, 2012) The paper proposed by Zhao, W et al. (2003) has listed the difficulties of facial identification.

One of the difficulties of facial identification is the identification between known and unknown images.

In addition, paper proposed by Pooja G.R et al. (2010) found out that the training process for face recognition student attendance system is slow and time-consuming. In addition, the paper proposed by Priyanka Wagh et al. (2015) mentioned that different lighting and head poses are often the problems that could degrade the performance of face recognition based student attendance system. Gonçalo Marques et al. (2019) proposed laboratory and teaching activities with reliable data quality should be provided and guaranteed. The thermal comfort of the students must be ensured in teaching activities. During the laboratory activities, several parameters must be ensured and monitored, and data collection must be stored to ensure the stability of the environment when the test is conducted and at the data collection moment as they influence the quality of the results. Oftentimes, there is the requirement of tracking object temperatures with noncontact but also to measure the ambient temperature for comparison. Infrared temperature sensors provide a non-contact measurement in a quickly and accurately process. This paper presents an Internet of Things (IoT) solution for real-time temperature supervision named iRT.

The solution is composed of a hardware prototype for temperature data collection and Web compatibility for data access. The iRT uses an infrared thermometer sensor module which incorporates an MLX90614 and provides object and ambient temperature supervision in real-time. The Web application can be used to access the collected data but also provides the history of the temperature evolution. The results obtained are promising, representing a significant contribution to infrared temperature monitoring systems based on IOT.

Arun Katara et al. (2017) mentioned disadvantages of RFID (Radio Frequency Identification) card system, fingerprint system and iris recognition system. RFID card system is implemented due to its simplicity. However, the user tends to help their friends to check in as long as they have their friend's ID card. The fingerprint system is indeed effective but not efficient because it takes time for the verification process so the user has to line up and perform the verification one by one. However for face recognition, the human face is always exposed and contain less information compared to iris. Iris recognition system which contains more detail might invade the privacy of the user. Voice recognition is available, but it is less accurate compared to other methods. Hence, face recognition system is suggested to be implemented in the student attendance system.

System Type	Advantage	Disadvantage
RFID Card System	Simple	Fraudlent Usage
Fingerprint System	Accurate	Time Consuming
Voice Recognition System		Less Accurate
Iris Recognition System	Accurate	Privacy Invasion

Table -1: Other Recognition Systems

3. DESIGN METHODOLOGY

The objective of this project is to develop face recognition and temperature detecting attendance system. Expected achievements in order to fulfil the objectives are:
To detect the face segment from the video frame.
• To extract the useful features from the face detected.
• To classify the features in order to recognize the face detected.
• Detect body temperature for the student detected.
• To record the attendance of the identified student.
Conditions:
• Train Images when new faces are added to the database
• Adequate amount of lighting must be available
• Continuous supply of power for Raspberry Pi (3.3-5V & 1.5-2A)
• Mark attendance if and only if face match is at least 61% and temperature is between 30° C and 35° C.

3.1. MODEL

We are using Waterfall process model. In a Waterfall model, each phase must be completed before the next phase can begin and there is no overlapping in the phases. The waterfall model is the earliest SDLC approach that was used for software development. In Waterfall approach, the whole process of software development is divided into separate phases. The outcome of one phase acts as the input for the next phase sequentially. This means that any phase in the development process begins only if the previous phase is complete. The waterfall model is a sequential design process in which progress is seen as flowing steadily downwards (like a waterfall) through the phases of Conception, Initiation, Analysis, Design, Construction, Testing, Production/Implementation, and Maintenance.

As the Waterfall Model illustrates the software development process in a linear sequential flow; hence it is also referred to as a Linear-Sequential Life Cycle Model.

4. IMPLEMENTATION

The main components used in the implementation approach are open source computer vision library (OpenCV). One of OpenCV's goals is to provide a simple-to-use computer vision infrastructure that helps people build fairly sophisticated vision applications quickly. OpenCV library contains over 500 functions that span many areas in vision. The primary technology behind Face recognition is OpenCV. The user stands in front of the camera keeping a minimum distance of 50cm and his image is taken as an input. The frontal face is extracted from the image then converted to gray scale and stored. The Principal component Analysis (PCA) algorithm is performed on the images and the eigen values are stored in an xml file. When a user requests for recognition the frontal face is extracted from the captured video frame through the camera. The eigen value is re-calculated for the test face and it is matched with the stored data for the closest neighbor.

OpenCV: We used OpenCV 3 dependency for python 3. OpenCV is library where there are lots of image processing functions are available. This is very useful library for image processing. Even one can get expected outcome without writing a single code. The library is cross-platform and free for use under the open-source BSD license.

PyMLX90614: We used this module to import functions to connect to the Infrared Contactless Temperature Sensor which can be included in the code to get the object temperature.

Python-csv: We used the CSV module to upload the attendance details to a sheet in .csv format.
The PiCamera ribbon is connected to the camera port available on the Raspberry Pi and the connections required to implement the MLX90614 Infrared Contactless temperature Sensor is as shown in the below figure.
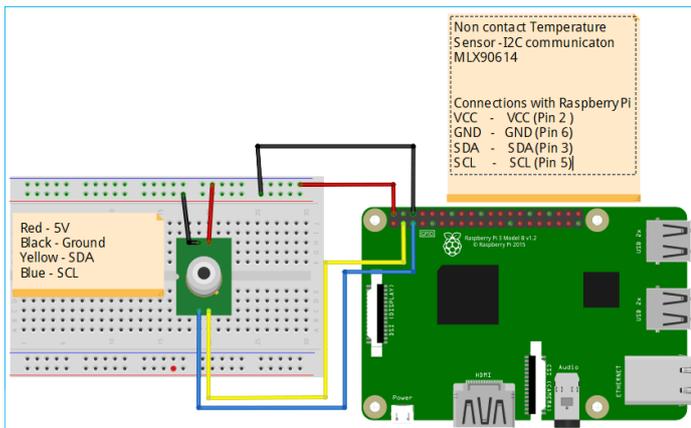
Figure 1. Circuit Diagram

5. RESULT

When we run the main program, the following outputs are shown

• The main menu pops up to choose our option
• If selected option is 1 – Camera tab opens, if camera is not available then we can see an error
• If selected option is 2 – The program asks for Student ID and Name which is supposed to be registered and after the user enters details, camera tab is opened to capture face
• If selected option is 3 – Image training takes place.
• If selected option is 4 – Camera tab is opened for face recognition and if the face is matched with any of the student in database with a minimum match of 61%, the body temperature of the student is scanned and if the body temperature is normal, then the attendance of the students is marked in csv format.
• A sample Attendance sheet is shown below.

ID	Name	Date	Time Stamp	Body Temperature
1	Bharath	26-04-2021	10:01:32	31.16
2	Alex	27-04-2021	10:02:46	30.93
3	Ashwin	28-04-2021	10:05:08	31.44

Table 2: Sample Attendance Marking

6. CONCLUSION

Capturing the images from camera or cc camera and applying techniques face detection and recognition can decrease the manual work from human and increase the security safety, taking the decision from this recognition result. Based on this face detection and recognition can used in implement so many application like automatic attendance systems based on face recognition, worker attendances, security, safety, police application like finding thief in image that help to catching thief. In this system we have implemented an attendance system for a lecture, section or laboratory by which lecturer or teaching assistant a record student's attendance. It saves time and effort, especially if it is a lecture with huge number of students. This attendance system shows the use of facial recognition techniques for the purpose of student attendance and for the further process this record of student can be used in exam related issues. The temperature is measured using the infrared thermometer is a sensor that consists of a lens to focus the infrared (IR) energy on to a detector, which converts the energy to an electrical signal that can be displayed in units of temperature after being compensated for ambient temperature variation.

From initiation through conclusion of developing this system the following results has been achieved. They are as follows:

• The system can be administered by a non-IT technician.
• The system is market ready for commercial use.
• The system has the capacity to carry up to a thousand faces to recognize.
• The system can serve as much people as they want within an organization

6.1. LIMITATIONS

If the bearded person removes the beard or vice versa it will not be recognized. Also if the face gets highly injured it will not get recognized.

7. FUTURE SCOPE

In the future, this project can be improvised by implementing the following:

• Can improve security.
• Can use Neural Network for high accuracy.
• Can used in big factory or employee attendance.
• Can build on fully web base system.
• Can build an UI for ease of operations
• Can Integrate multiple attendance sheets to calculate a student's overall attendance

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