



Advanced Online Examination using Raspberry Pi

M.Joshua John¹, S.Hari Ramakrishnan², M.A.Mohamed Sirajudeen³, S. Suthagar⁴

Dept of Electronics and Communication Engineering, Kings Engineering College,
Sriperumbudur, India

1jojohnmano@gmail.com, 2sharkrishnan1@gmail.com, 3siraj6121996@gmail.com,
4susjou@gmail.com

Abstract—Nowadays online exam has been used by most institutions, organizations, schools and colleges for conducting exams. The most commonly used online examination system is conducted by giving user id and password for candidates and then logging into the current web page and answering the questions. It has lot of bugs and anyone can misuse the password and anyone can malpractice in the exam. Thus a need of secure system is required. In this project we use an enhanced model raspberry pi 3. Also we use webcam for capturing the image which captures the image when it detects any motion by using the Passive Infrared Sensor (PIR) and the captured image is sent to the raspberry pi for face detection with the help of openCV. Then, the face detected is compared with the database, to check whether face detected is applied candidate or not, if it matches then webpage on which the questions are available is opened and the candidate can continue with the exam. Thus, it provides a secured online examination system.

Keywords—Raspberry Pi 3, PIR sensor, openCV, Face detection, Haar Cascade classifier.

I. INTRODUCTION

Nowadays, the online examination has become a growing trend in education assessment. It has been adopted by various institutions, colleges and schools to be effectively conduct exam. An online examination without any authentication is like unto a programmer without any knowledge about the coding. There are various techniques used for authentication. Even though there are different constraints of online platform and surrounding environment, but they cannot be entirely relied upon. The traditional username-password is one such mean as this. But the traditional system has many loopholes as the student can share his or her's passwords with other and can do malpractices. Hence to prevent such things we go for a more sophisticated method of authentication by using face detection.

In our project we have done both face detection and face recognition using raspberry pi 3 model which is a minicomputer of a credit card size and also by using webcam.

For the real time image processing we have used Open Source computer vision (Open CV) which is a widely available and advantageous image processing software tool. In the Advanced Online Examination using Raspberry Pi we have used a PIR sensor to detect the motion of a person turns on the webcam and we have also used a system which can detect as well as recognize a person. If the person has been recognized the webpage of the exam is opened and he can attend the exam.

II. LITERATURE REVIEW

Previously there are many of the projects which are related to online examination to improve the security. Following are the previous projects.

A. Secure Online exams using students' devices

The Secure Online exams using students devices makes use of the Learning Management System (LMS) such as the Moodle to perform exams. The examination is performed on student's laptops. This paper also involves the use of Secure Exam Environment (SEE) for exams to be held without access to local files or the Internet[1]. However the student authentication is not done by using this system.

B. Secure Online Exams on thin client

The secure online exams on thin client uses the Moodle to manage the quiz activity. This paper mainly involves Ubuntu for operating system and the LTSP and LXDE desktop manager to provide the thin client infrastructure. Ubuntu OS is fast, free and incredibly easy to use. The LTSP adds thin client support to Linux servers. LXDE (Lightweight X11



Desktop Environment) is an extremely fast-performing and energy-saving desktop environment[2]. This system provides the thin client which reduces the total cost of ownership.

C) Online automatic examination system for digital circuits

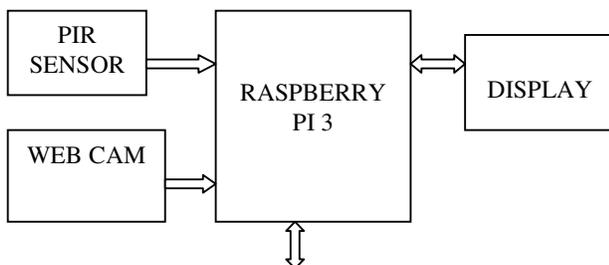
The Online automatic examination system for digital circuits is designed to conduct online exam in an efficient way. In this paper, open source software was used to construct a dynamic website for automated student examination in order to support asynchronous e-learning, supported by an RDBMS database. The application development language is the dynamic programming language for web applications PHP, while we use the PDO extension for a safe and secure connection to the database. The exams are accessible either by authenticated students or by students who have received a personal identification number (token) or by free users with limited privileges. This system provides the authentication phase in which the student username and password can be used to login. This causes the system to be advantageous than the previous systems.

III. ADVANCED ONLINE EXAM USING RASPBERRY PI

In this system we are providing an integrated system which provides both face detection as well as face detection of the person who appears for the examination. The proposed system uses provides the security for writing the examination. The system uses the PIR sensor to detect the motion of a person and makes the webcam to be switched ON. The webcam is connected to the cam port of the Raspberry Pi 3 model. The Raspberry Pi 3 is an advanced model compared to other Raspberry Pi models with 1.2 GHz quad core and with 1GB RAM. The image is captured and with the use of haar cascade classifier the face is detected and is compared with the database to recognize it. If the face is recognized then the webpage of the exam is opened and the questions are displayed.

A. BLOCK DIAGRAM

The block diagram of the proposed system is quite simple with limited number of components.



DATABASE

Fig 1. Block diagram of the system

The inputs to the system are Webcam and PIR sensor. The PIR sensor is used to detect the motion of the human and turns the Webcam to be made ON if any motion detected. The captured image is sent to the Raspberry Pi3 processor and is checked with the database to see whether to see whether the person detected is authorized one. If the face is recognized correctly the processor leads to the webpage of the exam and the questions are displayed from the database.

1) Raspberry Pi 3

The Raspberry Pi 3 is a processor which is like unto a credit card sized 1.2 GHz 64 bit quad core ARMv8 CPU. It has Bluetooth Low Energy (BLE) 1 GB RAM. In this model we have 4 USB ports and 40 GPIO (General Purpose Input Output) pins. A HDMI port is provided to connect to the display and the Ethernet port to connect to the Laptop. The Raspberry Pi 3 has both Camera interface (CSI) as well as Display Interface (DSI). Along with 1GB RAM we also can provide additional memory by inserting a SD card. Compared to Raspberry Pi 2 it has Bluetooth 4.1 and 802.11n Wireless LAN.



Fig 2. Raspberry Pi 3 model

2) PIR Sensor

A passive infrared sensor (PIR) sensor is an electronic sensor that measures infrared light radiating from objects in its field of view mostly used in motion detectors. It is used to sense the movement of the people. The sensor converts the incoming radiation temperature into a change in output voltage and thus it triggers the detection. The PIR sensor has a supply voltage of over 5 to 12 V and 110° x 70° detection range. The sensitivity range is of about 20 feet (6 meters). It produces digital pulse high when triggered (motion detected) digital low idle (no motion detected).



Fig 3. PIR Sensor

3) Webcam

In this system we use a USB 2.0 Webcam of 25MP (interpolated). It provides a frame rate of upto 30 fps.



Fig 4. Webcam

B. SOFTWARE

1) OPENCV

The OPEN Source Computer Vision(OPENCV) is a library of programming functions mainly aimed at real time computer vision. It has C,C++,Python and Java interfaces. In our system, we use Open CV for the face detection as well as for face recognition. [3] discussed about a system, GSM based AMR has low infrastructure cost and it reduces man power. The system is fully automatic, hence the probability of error is reduced. The data is highly secured and it not only solve the problem of traditional meter reading system but also provides additional features such as power disconnection, reconnection and the concept of power management. The database stores the current month and also all the previous month data for the future use. Hence the system saves a lot amount of time and energy. WORKING PRINCIPLE

The working of the system can be determined by means of sing a flow diagram. The image is first stored in the database. The webcam is switched ON by means of the motion detected by the PIR sensor the image is captured. The captured image is then sent forward for face detection system, which then checks for the frames for the faces with the help of Haar feature like cascade classifier. The detected face is then compared with the database for recognition of the face. The Local Binary Pattern Histogram is used for face recognition.

- If the detected face matches with that in the database then the webpage of the examination is automatically opened and the examinee can start the exam.
- If the face is not matched with the database then the examinee is not an authorized one and so the webpage of the exam does not open and he cannot attend the

START

exam.

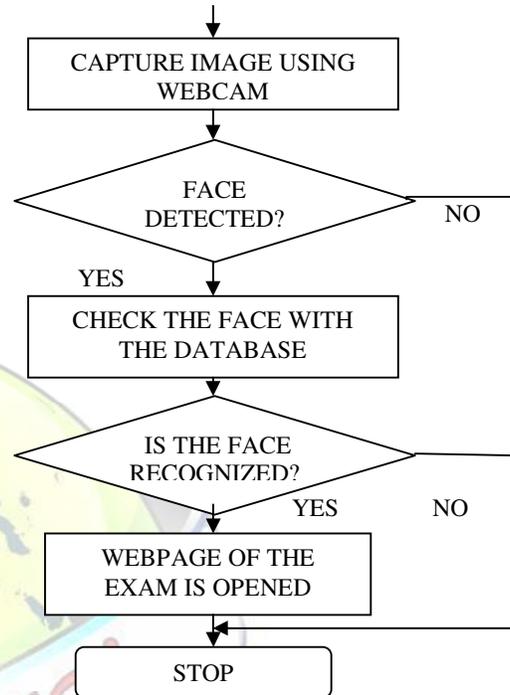


Fig 5. Flow diagram of the system

C. FACE DETECTION

The face detection can be done by using the Haar cascade classifier as the image is sent from the webcam is sent to the face detection module. The Haar features are used for this purpose.

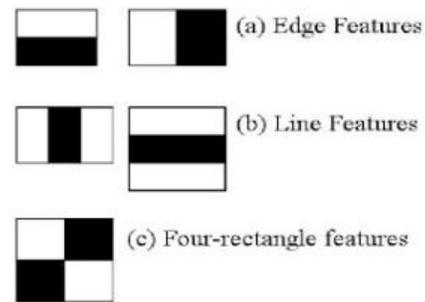


Fig 6. Haar like feature cascade classifier

First training is provided for cascade of classifiers by giving both the positive as well as the negative images. This is done for most of the time so that the face detection can be done accurately for various image samples. [4] Viola and Jones provided the use of the Haar like features. The features



consider the rectangular regions in the window and then sums the pixel in each region and finds the difference between the sums. Thus it has two rectangles that lie above eye and cheek. Thus the rectangle acts in the detection window as box to target the face of the person.

The image is captured and is converted into a multidimensional array called as numpy array which can be supported by OPEN CV. This image or array is converted into gray scale image and with using haar cascade file the features are compared and the face is then detected [5].

D. FACE RECOGNITION

Recognition plays a major part in the authentication of the face. We have to provide a well defined database for the system and it should be trained with various samples to obtain the recognition to be a perfect one.

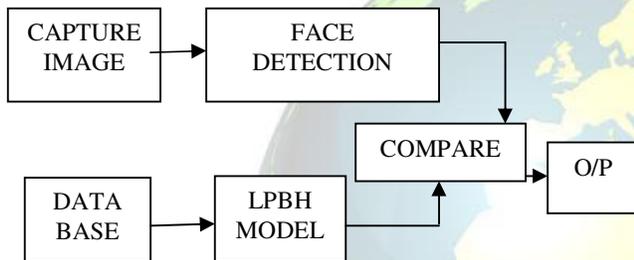


Fig 6. Face recognition model.

In this system the Local Binary Pattern Histogram is used for the face recognition. The given RGB image is converted into gray scale and the image pixels are compared with neighboring pixels both in clockwise as well as in counter clockwise directions. Histogram and its normalization is done and the corresponding vector is generated for the image. These vectors thus can be used to classify images by processing it with algorithms. Thus we have provided a system which does both face detection and recognition to conduct a well authenticated advanced online examination.

IV. RESULT

The advanced online examination system thus provides a secured and an authenticated way to conduct the online examination. The detection of the face of the examinee can be detected by using Haar cascade classifier and then it can be checked whether he is a right candidate or not. It also causes the system to be very efficient and effective one compared to other systems.

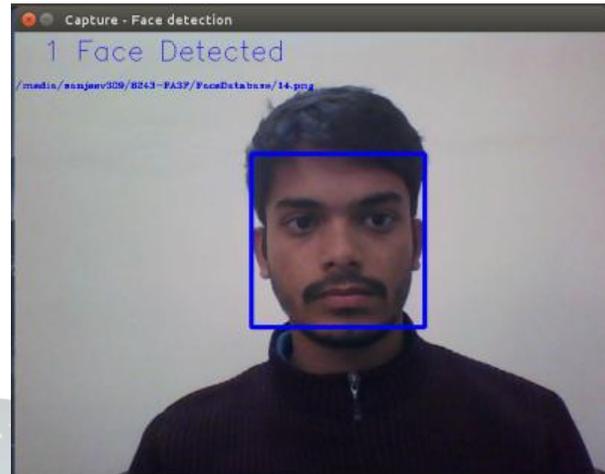


Fig 7. Face detected correctly

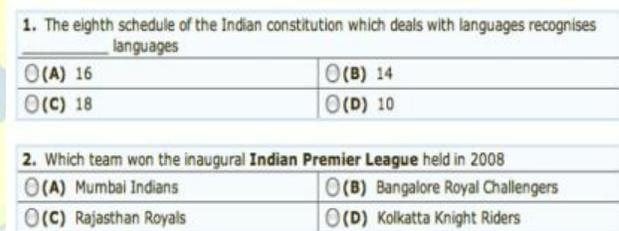


Fig 8. Screenshot of the question

S.NO	Face detection output		
	Total number of samples	Correctly detected	Wrongly detected
1.	54	50	4

Table 1. Face detection analysis of samples

Thus the accuracy of the system can be found out by using the formula

$$\text{Accuracy} = \frac{\text{No of correctly detected faces}}{\text{Total no of faces detected}} \times 100$$

$$= \frac{50}{54} \times 100$$

$$= 92.5\%$$



V. CONCLUSION

This advanced online examination system can thus be created to provide both face detection and face recognition. It is a compact system and also a cost effective system which uses the Haar cascade classifier for face detection with an accuracy of 92.5%. The connection of the system to the laptop can be done by wireless connection whereas in Raspberry Pi 2 does this by an Ethernet connection.

VI. FUTURE SCOPE

The system can also be used for various other applications such as for security in houses, banks, etc. The system can provide a more efficient, compact and a less cost system that can provide both face detection and recognition.

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