IOT Based Authentication for Online Examination, Using Raspberry Pi

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ABSTRACT

To increase theft and impersonating the main candidate is the dilemma in online examination, and the reason for that is the absence of authentication in the identification of the student, as is the authentication of the commonly used methods in the world of technology, especially the Internet of Things. It is through student interaction to benefit from the recognition on his face and that is discernible personal physical characteristics of humans which impossibility stolen will be approved, and will be recognized on the face by taking a capture image of a student by a Web camera and compare it with the images stored on a server database through an algorithm Haar cascade by OpenCv then allow access page exams directly. In order to reduce the cost and the complete interaction with the student will be used raspberry Pi3 if it has been compared with other devices. This paper presents a novel development of online exam system through student interaction (humans) with the raspberry (thing), this one connection patterns in Internet of things.

Keywords: Internet of Things, Authentication, Online examination, Raspberry Pi, Haar cascade algorithm, OpenCv

1. Introduction

The online exam systems are an electronic application. The framework online exam helps educational institutions to the reduction of time and effort, these institutions can be directed online exams and provides results in real time, either as part of the traditional exams usually work is a recurring and physically exhausting work in addition to the increase in expenses. The general structure of the architectural online exams the internet operates on the principle of client/server, since the Internet is a main element of this structure and where the network of Internet development in the present era a turning point primarily in the field of information by connecting computers and computer networks and devices and portable devices smart scattered in various around the world, among them the possibility to participate and provide data and resources available to the network, such as printers, scanners , applied programs of any kind, as well as allow for transmission of information and direct communication between users quickly and flexibly. With the development of networks that rely on wireless technology and wireless communication it has possible to connect the things that we use in our daily lives to networks, especially access to the Internet to facilitate the completion of tasks in an interactive and intelligent in order to establish the reality of a better life for humans. And there appeared a new generation of the Internet, which is called Internet of Things network or shorten the term (IOT) which allows you to connect the various

things connected to the Internet. It is considered to architectural Internet of Things network through patterns linked to things it, either thing with thing without human intervention or interaction with thing, but the purpose of preventing identity theft students and replace them with others to take the exam is increased reliability using human interaction with thing pattern through face detection for the student and recognition by an algorithm Haar cascade through computer chips as Raspberry Pi. The facial recognition is the face matching process, whether for the same person or not, which is different from face detection methods. Facial recognition can be the first in two ways by comparing the capture from a Web camera with an image of one person and the second comparing one image with multiple images already stored in the database, after saving the images can be converted into numerical values as an xml file, if the same person (the student) authentication has been achieved will open your browser to the server directly, and finally will be generate random questions stored in a database within a server for the purpose of conducting the exam, and finally the result will be displayed in real time after the completion of the exam.

The aim of the paper

I. The development of novel online examination system relying on student interaction to detection his face and recognition it with raspberry pi by a web camera to achieve authentication.

II. Reduce your cost through the use of raspberry pi and electrical energy consumed in addition to speed and accuracy.

2.   Literature survey

Yuan Zhenming, Zhang Liang, Zhan Guohua Proposed a Novel Web-Based Online Examination System for Computer Science Education to prove Web-based Examination System is an effective solution for mass education evaluation. We have developed a novel online examination system based on a Browser/Server framework which carries out the examination and auto-grading for objective questions and operating questions, such as programming, operating Microsoft Windows, editing Microsoft Word , Excel and PowerPoint, etc. It has been successfully applied to the distance evaluation

of basic operating skills of computer science, such as the course of computer skills in Universities and the nationwide examination for the high school graduates in Zhejiang Province, China.

Mohamad M. Al-Laham proposed Reducing Security Concerns When Using Cloud Computing in Online Exams to discusses the current use the cloud computing in many life aspects and then concentrates on online exams aspect; also, this research clarifies the tangible and intangible risks associated with cloud computing adoption. Then, the research examined a specific case study related to the subject matter. Finally, this research explores the level of understanding risks and methods may be used to reduce it and help in protecting data from unauthorized persons.

Deepankar vishwas kotwal, et al., proposed that Online Examination System is a software solution, which allows any industry or institute to arrange, conduct and manage examinations via an online environment. It can be done through the Internet/Intranet and/ Local Area Network environments. Some of the problems faced during manual examination systems are the delays occured in result processing, filing poses a problem, filtering of records is difficult. The chance of loss of records is high also record searching is difficult. Maintenance of the system is also very difficult and takes lot of time and effort. Online examination is one of the crucial parts for online education system. It is efficient, fast enough and reduces the large amount of material resource. An examination system is developed based on the web. This paper describes the principle of the system, presents the main functions of the system, analyzes the auto-generating test paper algorithm, and discusses the security of the system.

3.   Proposed system

The purpose of this project is that there is a real interaction between humans and the thing through the use of physical personal characteristics of human beings such as the face, which the impossibility of stolen or forged, and the purpose of this interaction is to hold real apply for connecting pattern (human - to - machine) so is this project is to develop a novel online exam by the authentication personal physical characteristics of the student.
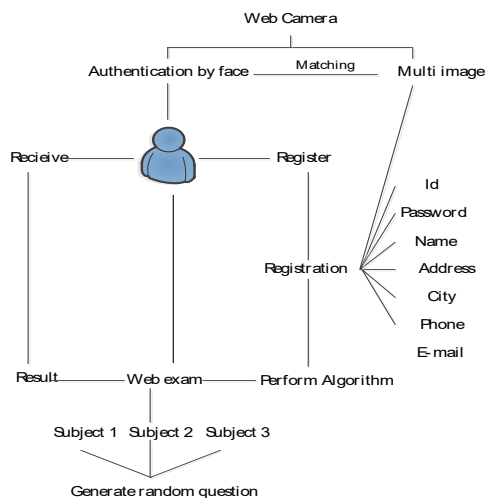
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Figure 3.1: Online exam by authentication face

3.1 Relationship

The five design tables inside the database for the purpose of the project work as follows (Face recognizes, Login, Main information, Subject):-

a.   Face recognize table: - It is consist of the multi-image of the student.

b.   Login table: - It is consist of ID student.

c.   Main information table: - It is consisting of general information.

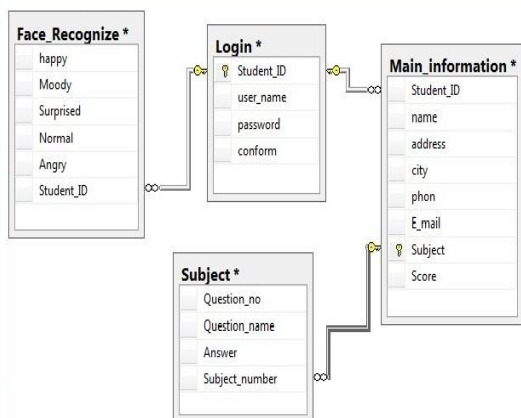d.   Subject table: - It is consist of subjects and question with answer.

Figure 3.2: Relationship table

3.2 Architecture

In this project has been to rely on the principle of connection is known (human - to - Machine). In this pattern of connection types are connected, and the interaction of humans with thing on the network and this is what is called in the name of (human - to - machine) and to shorten the term (H2M).

This divides the connection pattern (H2M) into three domains:

a.   **H2M domain :** This domain is considered the most complicated in terms of connectivity hybrid of things and turns electronic devices simple to smart devices by connecting electronic boards of thing from the connecting boards computer chips programmed in advance to perform its function. In this domain will be all the data that will be collected or calculated directed to work with users in the domain of (i.e. applications you will need to enter the user and not taken action to do so except by order of the user).

It also are connected computer chips boards way wired or wireless device with a gate (H2M), which includes a total of hardware and software that connects between networks that use different protocols.

It is treated in the domain with real-time data, and usually has a limited volume of data in real time and is easy handled by computer chips boards.

b.   **Network domain :** In this domain is relying on networks to complete the connecting where you can rely on the local network or WAN or the Internet to connect the previous domain (H2M) and subsequent domain (applications domain).

c.   **Application domain :** In this domain is complete connecting with servers that provide storage, analysis, and service delivery service devices
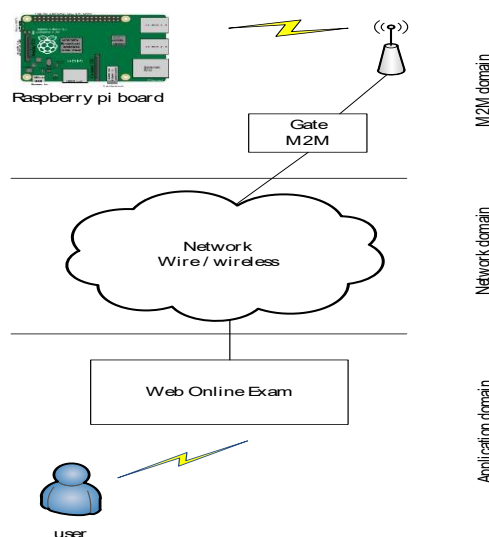

Figure 3.3: IoT based online exam "H2M"

4.   Implementation

Implementation is shows the stages of the project work, where the student first start up the exam online through the Web-in page designed language examinations (PHP) where they will be entering ((Id, Password, Address, City, Phone number, E-mail, as well as the introduction of Multiple images using the student Web camera as if to be (happy, moody, normal ... etc.).) the stage of registration is very important, where will be implemented through raspberry pi3 pre-programmed Python language , then will be sent to all of these information for the student to the server for store inside a database designed using (My sql Server) for this purpose . After that date will be set for the examination, and then the student will sit in front of monitor exam from anywhere where we will be connected to the monitor raspberry pi3 board, which in turn is connected to the Web Camera.

Here the student will be directly interacting with raspberry pi3 using web camera by taking a capture to him, then it will be sent this image to a server and match them using function OpenCv with the images stored in the database. If the image is matching by Haar cascade algorithm will be directly open online exam page. Where the raspberry Pi3 board and a server equipped with a Wi-Fi network in advance.

Finally, the student will choose the subject and after the exam will generate random questions from a number of questions stored in the database, and when completed will be informed student result directly from the same page online exam.

4.1 Student interaction

4.4.1 Capture and read multi images: It will capture images of the group of students and read them as in the following:
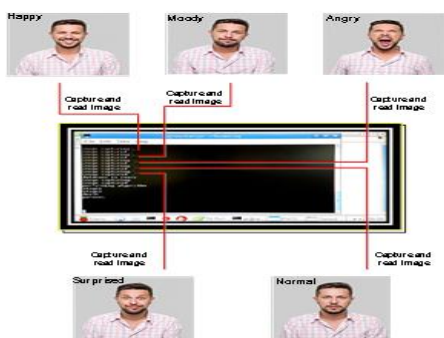

Figure 4.1: IoT based online exam "H2M"

4.4.2 Store multi images in database

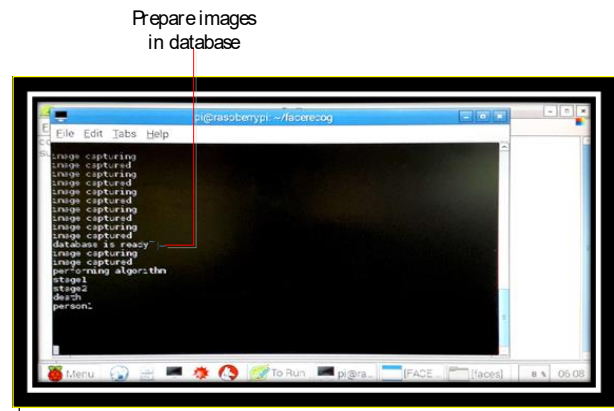All images will be stored within inside the database following figure

Figure 4.2: Store image in database

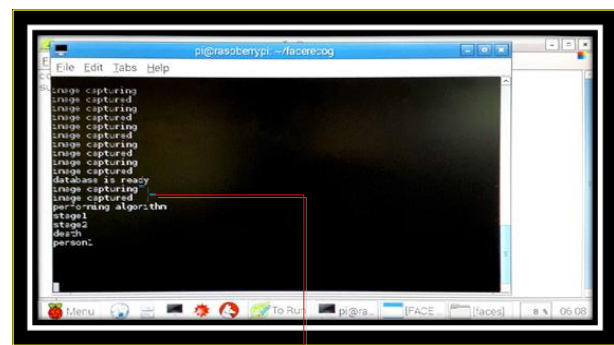### 4.4.3 Capture new image for same student

Figure 4.3: New image for matching

4.5 Haar Cascade algorithm

For the purpose of understanding the algorithm Haar cascade, where computers and embedded devices to understand what is the face, so will describe Haar cascade brightness signature. The main principle of the work of the algorithm is that the face has a pair of eyes surrounded by the skin, and that the area around the eye represents a different intensity to the eye the same, so will provide Haar cascade manner face detection. So need to import the various libraries I shall going to

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use and set some sensible defaults for the Haar detector. These defaults provide a trade-off between speed and accuracy. First, I set minSize to limit the smallest detectable face to a 20-pixel square. imageScale scales the image before feed it into the detector; smaller images mean faster detect times, but less accuracy. minNeighbors tells the detector that a match must be made up of a minimum number. Finally, haarFlags are special flags telling the detector what bits to ignore.

Summed area table is a data structure and algorithm for fast and efficiently generating the sum of values in a rectangular subset of a grid. In computer vision it was popularized and then given the name "integral image" and prominently used object detection framework. This principle is well known in the study of multi-dimensional probability distribution functions, namely in computing 2D or ND probabilities (region under the probability distribution) from the respective cumulative distribution functions.

$$I\Sigma(x,y) = \sum_{\substack{x' \leq x \\ y' \leq y}} i(x', y')$$

Then the summed area table can be calculating efficiently in a single pass over the image, using the truth that the value in the summed area table at (x, y) is perfectly.

$$I(x,y) = i(x,y) - I(x-1, y-1) + I(x, y-1) + I(x-1, y)$$

The moment that the summed area table has been calculated, the task of evaluating the intensity over any rectangular area need only four array references? This let for a constant calculation time that is independent of the size of the rectangular area. This is clear in the following figure
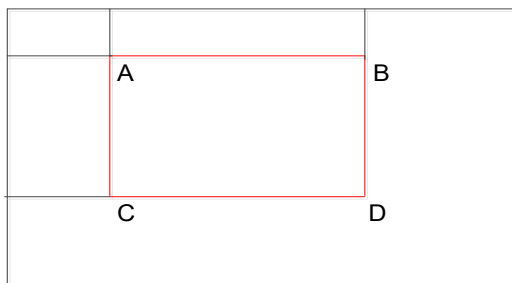

Figure 4.4: sum=D-B-C+A

Where, A=(x0, y0), B=(x1, y0), C=(x0, y1) and D=(x1, y1), the sum of i(x,y) over the rectangle be extended by A, B,C and D is:

$$\sum_{\substack{x0 < x \leq x1 \\ y0 < y \leq y1}} i(x,y) = I(D) + I(A) - I(B) - I(C)$$

This manner can be also extended to high-dimensional images. If the corners of the rectangle are x^p with p in $\{0,1\}^d$, then the sum of image values contained in the rectangle are computed with the formula

$$\sum_{p \in \{0,1\}^d} (-1)^{d-\|p\|1} I(x^p)$$

Where, $I(x)$ is the integral at x and i the image dimension.

The notation x^p correspond in the equation to d = 2, A = $x^{(0,0)}$, B = $x^{(1,0)}$, C = $x^{(1,1)}$ and D = $x^{(0,1)}$

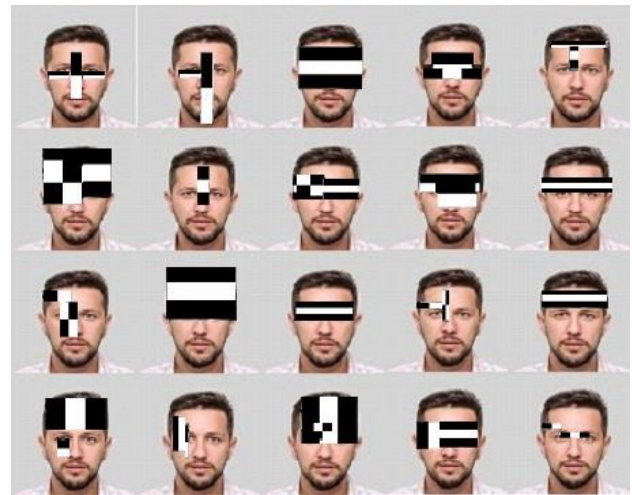After training the classifier, it will show in the following figure

Figure 4.5: Training the classifier

5.   Results

5.1 Registration information on the website

Figure 5.1(a): Home page

Figure 5.1(b): Student information page

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Figure 5.1(c): Fill in the necessary information

Figure 5.1(d): Great id 1

5.2 Registration images

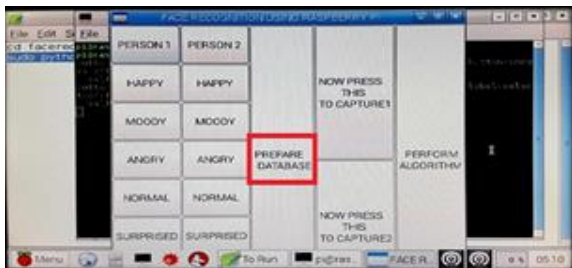Figure 5.2(a): Five image of the student by web camera

Figure 5.2(b): Store five images in the database server

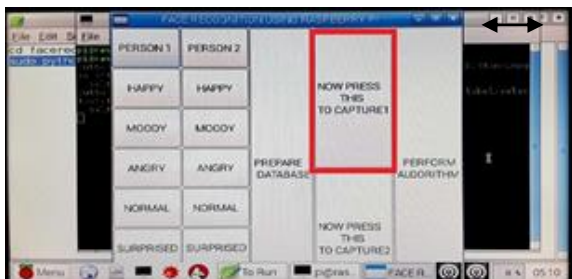## 5.3 Authentication of the student to enter the online exam by web camera

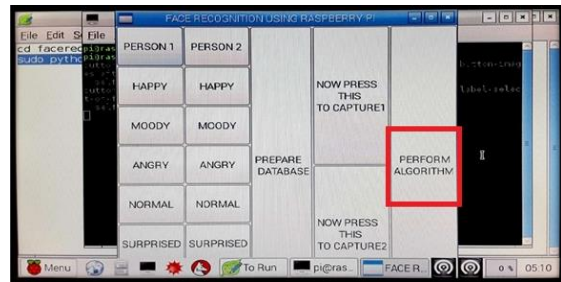Figure 5.3(a): Capture image of student (id = 1)

Figure 5.3(b): Execution of the algorithm

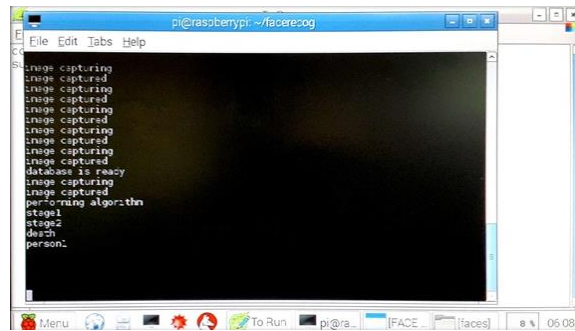Figure 5.3(c): Matching image of a student with stored images in the database

Figure 5.3(d): Screen execution in sequence

5.4 Access to the online exam after facial recognition authentication
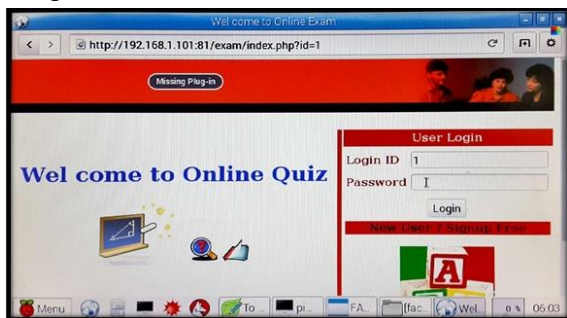
Figure 5.4(a): Get id = 1 directly

Figure 5.4(b): Inter password

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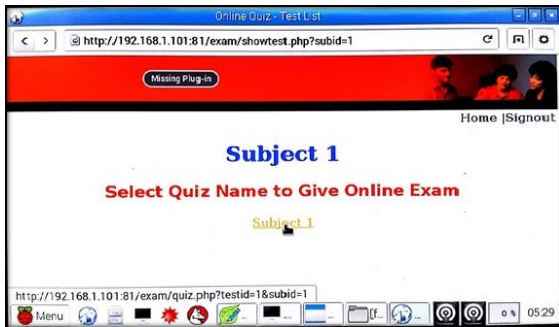
Figure 5.4(c): Choose the first subject

Figure 5.4(d): The first question

Figure 5.4(e): The second question
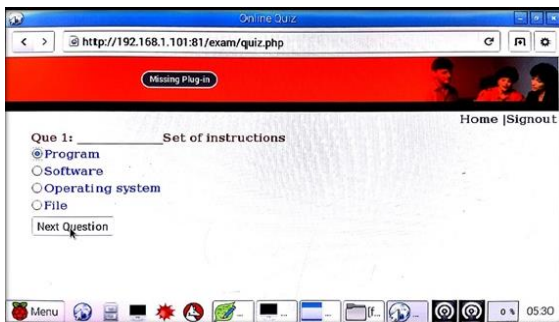

Figure 5.4(f): The third question

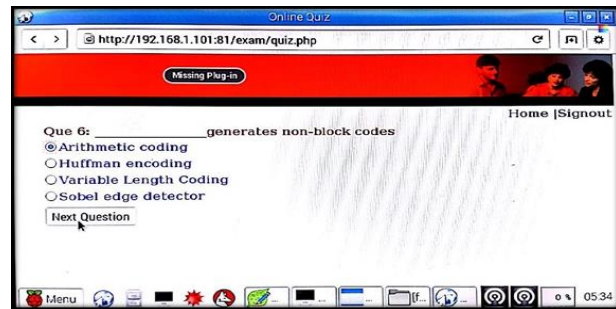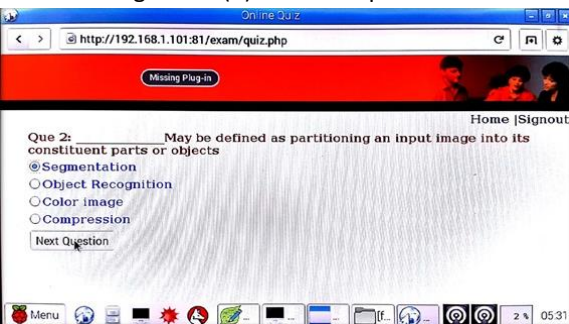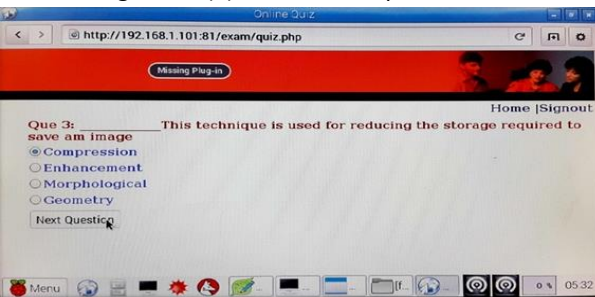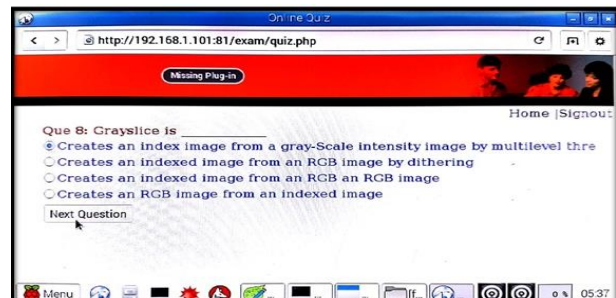Figure 5.4(g): The fourth question

Figure 5.4(h): The fifth question

Figure 5.4(i): The sixth question

Figure 5.4(j): The seventh question

Figure 5.4(k): The eighth question

Figure 5.4(l): The ninth question
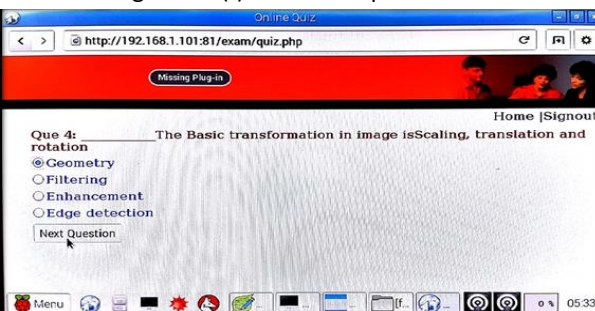
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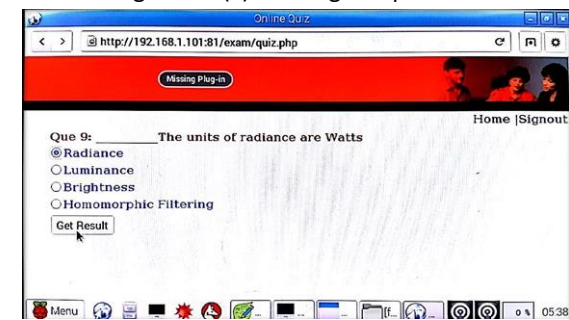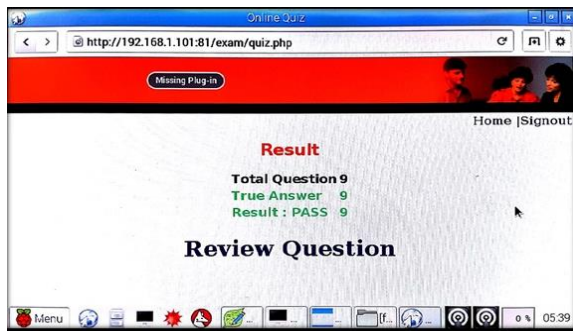
Figure 5.4(m): Online exam result

6.   Conclusion and Future work

i. Face recognition, which is one of personal physical characteristics of human beings, where is the best means to authenticate, so it is impossible to steal.

ii. The algorithm used proven accuracy and speed, especially in the face twin recognition.

iii. Raspberry pi3 proved its ability to implement the action and this is what assures exploited of the cost of low-lying.

iv. IoT allows the possibility of connecting the things miscellaneous to the internet and to enable people to communicate and interact with things used by and deal with it in his daily life without the need for a presence in a specific.

v. Add confirmation to authenticate using hand geometry.

vi. We must understand the IoT well because we still find some blur, because IoT is coming battle technological Home paved things of revolution.

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