IOT Based Automated Attendance with Face Recognition System

D. Narendar Singh,M. Kusuma Sri, K. Mounika

Abstract—Our Paper involves the student attendance and faculty attendance. The student attendance is marked by face recognition. For face detection and face recognition the raspberry pi. If the camera is connected to Raspberry pi USB port then only images will capture of the students who are available in the class for face detection. The captured images recognises with stored images then in that images we will recognize the faces of every student and according to thatattendance will be given to that subject class. This process is carried out for every class and students are given attendance accordingly. Faculty attendance is monitored with this project. A unique RFID card is given to the faculty, when faculty enters the classroom swipes the RFID card attendance will be marked with date and time. ESP8266 is used along with OLED to display the faculty attendance. We can mark the attendance at any time without any human Intervention.

Keywords— Student Attendance, Raspberry Pi, Camera, Face Detection, Face Recognition, Image Processing, Open CV, Python, Faculty Attendance, ESP8266, OLED.

1. INTRODUCTION:

This is developed to mark the attendance for students and faculty without any person interference that makes very useful for institutions and schools to mark the attendance easily. This system helps for the people by saving time they can know the attendance academic performance anywhere by registering in student/faculty registration in web page which has been developed in this paper.

2. SYSTEM ARCHITECTURE:

From fig.1 the USB Camera is connected to the raspberry pi camera slot. Live video stream of students is captured in the class with USB1 camera, Raspberry pi takes those images as input images and uploaded to the AWS cloud platform and we make use of face recognition service to compare the input images with the existing image.Matched images are detected and attendance is marked with date and time for students present in class in the local data base using MYSQL. This process is carried out for every period and students are given attendance accordingly. This happens due to importing the open CV packages at the initial stage of the development of the system.

Faculty attendance is monitored with this project. A unique RFID card is given to the faculty, when faculty enters the classroom swipes the RFID card attendance will be marked with date and time and is displayed on OLED.

The web application is designed for the output purpose to see the list of students/faculty, present and absent for every hour in the class. Admin tracks the attendance of the students periodically or whenever required by the administration and finds the result. The result is displayed on the monitor screen. Student/Faculty attendance will be monitored and if the student/faculty is absent for that class then the notification will send to the HOD and parents.

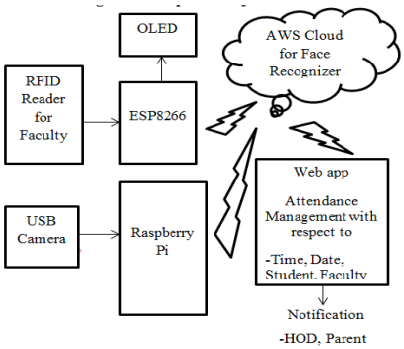

Figure1: Block Diagram.

3. HARDWARE DESCRIPTION:

A. Raspberry Pi 3Model B:

Raspberry Pi 3Model B is an controller Built-on the latest Broadcom2837 chipset, 1.2GHz, 64-bitquard-core processor, 40 pin extended GPIO, 802.11bgn wireless LAN, WIFI, Bluetooth 4.1 connectivity, 1GB RAM, 4USB Ports, CSI camera port, Micro SD port, full size HDMI, and Micro USB Power source. In our project Keyboard, Mouse, Camera cables are connected to the 3 USB ports. HDMI cable is connected to the HDMI output, 1GB micro SD card with installed NOOBS.

B. USB Camera:

USB camera is used to capture the images for marking the student attendance.In this the Logitech C110 camera is used. The USB camera is connected to the Raspberry Pi USB port.

C. ESP8266:

Esp8266 (espressif) is an controller and has 32pins inbuilt Wi-Fi module with 32-bit processor, one core, CPU frequency of 80mhz, RAM of 160kb, flash of 16mb, one ADC pin, 4 busses (SPI, I2C, UART, I2S), GPIO pins of 17. Esp8266 setup is placed at the entry of the class were OLED are integrated with esp8266 and connected to cloud.

D. RFID Reader & Tag:

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RFID stands forradio frequency identification. RFID Reader has 6pins all are connected to ESP8266. 1st pin (Data) connected to D4, 2nd pin (Clock) to D5, 3rd pin (MISO) connected to D6, 4th pin connected to D7, GND to GND and VCC to VCC of esp8266 (3.3v).

E. OLED:

OLED is defined as organic light-emitting diode the purpose of OLED is to display information. It has 4 pins all are connected to esp8266. 1st pin (clock) connected to D1, 2nd pin (data) to D2, GND to GND and VCC to VCC of esp8266 (3.3v).

4. SOFTWARE DESCRIPTION:

A. Python IDLE:

IDLE is integrated development environment for editing and running python2.x or python 3 programs. Where we can see or check the output.

B. Raspbian O.S:

Raspbian is a free operating system which is used run the applications. To run our applications install the Raspbian OS. Raspbian OSis bestfor Ras-pi 3 controller for developing our system.

C. NOOBS:

NOOBS -New Out Of Box Software is aninstallation manager for the Raspberry Pi. We install this manager in SD card of Raspberry pi.

D. Python:

Python is a programming language. Which has easy syntaxes to read that allows fewer lines of code to the programmers. This language is also suitable for other customized applications.

E. Arduino IDE:

Arduino IDE is an open source software were we can write, execute and upload to the board. It can be installed in any PC's like windows, Linux etc. In Arduino IDE we can write different languages like C, C++, embedded C. I have written the program in embedded C and uploaded to hardware board by connecting USB.

F. Embedded C:

Embedded c ispreferred languagecompare to other because it is an efficient code used for microcontroller based applications. The embedded c programs were small and efficient they must be optimized for for size and speed.

G. PHP:

PHP (Hypertext Preprocessor), It is backend language used for the development of Web Application.

H. HTML:

HTML stands for Hypertext Markup Language. HTML is used for creating web applications With Cascading Style Sheets and Java Script.

I. AWS Cloud:

In the Amazon Web Service Cloud "S3"(simple storage service) is used to store thecaptured images ,those captured images are analysed and comparedusing AWS"Rekognition" service and results are send back to web application.

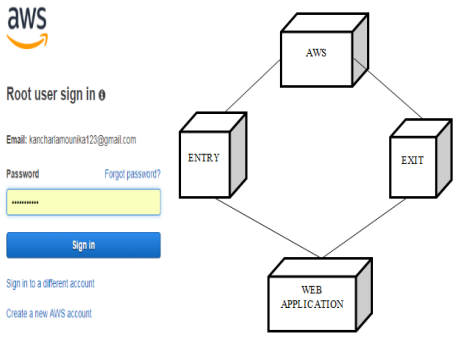

Figure2: Deployment Diagram

5. PROPOSED SYSTEM:

In our proposed system the student attendance is marked by face recognition. For face detection and face recognition the raspberry pi is used. If the camera is connected to Raspberry pi USB port then only images will capture of the students who are available in the class for face detection. The captured images recognises with stored images then in that images we will recognize the faces of every student and according to thatattendance will be given to that subject class. This process is carried out for every class and students are given attendance accordingly.Faculty attendance is monitored with this project. A unique RFID card is given to the faculty, when faculty enters the classroom swipes the RFID card attendance will be marked with date and time. ESP8266 is used along with OLED to display the faculty attendance. The student database includes the stored images which will be compared by captured images to mark the attendance and faculty database includes their registered numbers which will be compared by RFID tag number then attendance for the faculty is marked.

5.1. Proposed System Flowchart:

From the Fig3 Camera captures the images in the video streaming, while the face detection resizes the captured image up to certain point. The segmented image is compared with the present data sets and faces are recognized. Admin records the attendance if the particular student and generates the report. The result is displayed in the monitor.

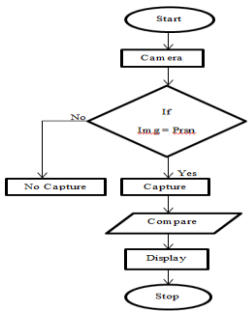

Figure3: Flowchart

5.2. Proposed System Algorithm:

The Algorithm of proposed system is as follows.

1. Write Raspbian OS in to the SD card and fix the card into the SD slot
2. Install all the open CV libraries into the raspberry pi
3. Fix the entire hardware setup.
4. Take the video data in that images of individual student from classroom camera
5. With the viola Jones Algorithm Face Detection is done.
6. Take the detected faces of students.
7. Crop the faces of the students.
8. In Exit folder the detected images of students will be stored.
9. The features of stored images and detected images will be compared
10. Marks the Student's Attendance based on recognised faces.

5.3. Face Detection Algorithm:

In this viola jones algorithm is used in this 160,000 features are there.

For face detection in viola jones we have 4 steps for implementing they are:

a) Selection of Haar features
b) Integral images
c) Adaboost
d) Cascade Classifier

a) Selection of Haar features:

Haar features are similar to these convolution kernels which are used to detect the presence of that feature in the given image. Each feature results in a single value which is calculated by subtracting the sum of pixels under white rectangle from the sum of pixels under black rectangle.

$$Val=\Sigma(\text{pixels in black region}) - \Sigma(\text{pixels in white region}) \quad (1)$$

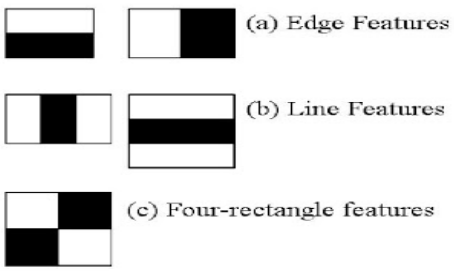

Figure4: Types of Haar Features

b) Integral images:

For generating the sum of values in a rectangular subset of a grid in the image processing domain it is known as integral image. In an integral image the value at pixel (x,y) is the sum of pixels above and to the left (x, y) inclusive.

$$ii(x, y)= \Sigma\, i(x', y') \quad (2)$$

$x' \leq x, y' \leq y$

Eqn.2 combines neighbour pixel values for easy of calculation.

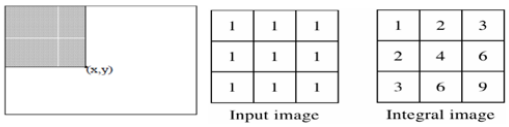

Fig.5: Integral image.

c) Adaboost:

As declared in viola jones algorithm have 160,000 features in that only few set of features will be useful among all these features to identify a face. In adaboost we have two classifiers they are strong and weak classifiers. The adaboost constructs a strong classifier has a linear combination of the weak classifier.

$$F(x) = \alpha_1 f_1(x) + \alpha_2 f_2(x) + \alpha_3 f_3(x) +$$

F(x) = Strong classifier
αf(x) = Weak classifier

d) Cascade Classifier:

The cascade classifier is used for composed of stages each stage contains a strong classifier when all the features are combined into different stages where each stage as number of features. That each stage is used to determine whether it's a face or not a face.

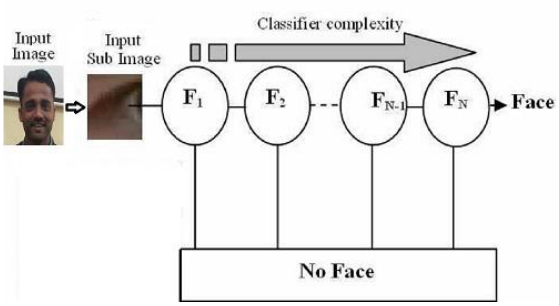

Fig.4: Cascading Classifier

6. RESULTS AND DISCUSSION:

Student Registration:

The following are the login credentials provided to the student to login into the registration portal. Then student needs to login with username and password provided to them.

***Username*:** kancharlamounika42@gmail.com
Password: 123456

Fig.7Face detection and capturing:

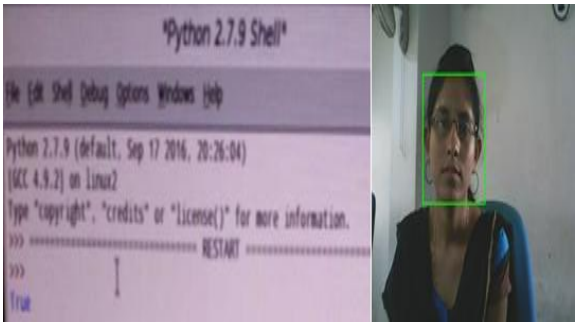

Fig.8: To mark the attendance of a student first it captures the image in the form of rectangular box.

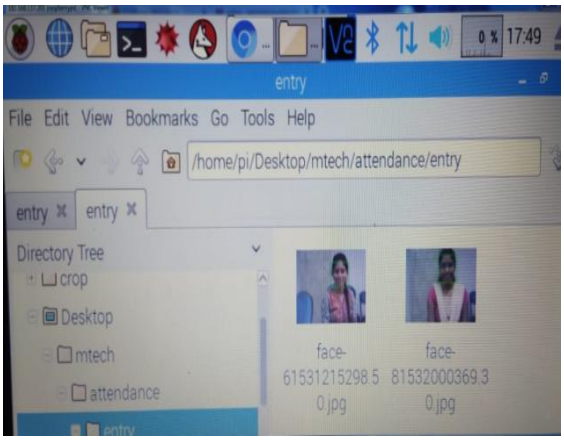

Fig.9: The detected face in the rectangular box will be cropped. Then Finally that cropped images will be stored in exit folder.

Face Recognition:

To get the Face recognition first detect the face.First the image is cropped the region of interest and comparing them to enrolled images in the face database. For the face recognition, the faces are verified one by one using the AWS face recognition service.

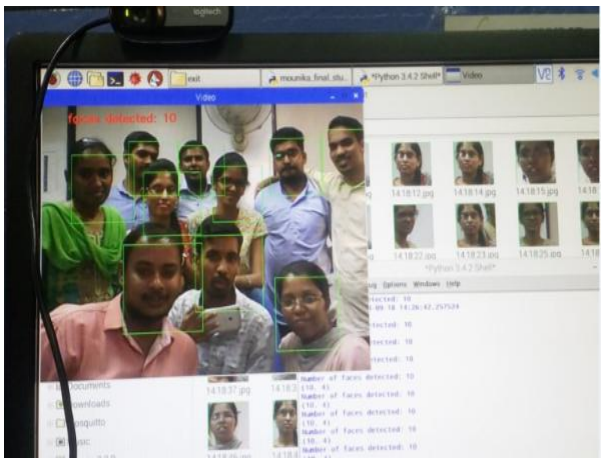

Fig.10: Faces which are exposed during video streaming for multiple face recognising. Display the registered number of the specified students.

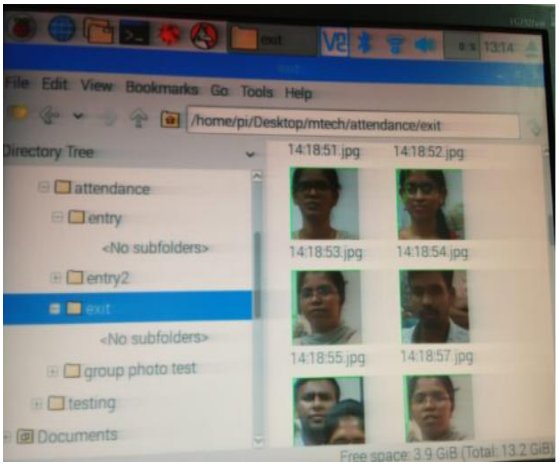

Fig.11: Faces acquired during face recognizing process. Store the cropped images in the specified folder.

Data Uploading:

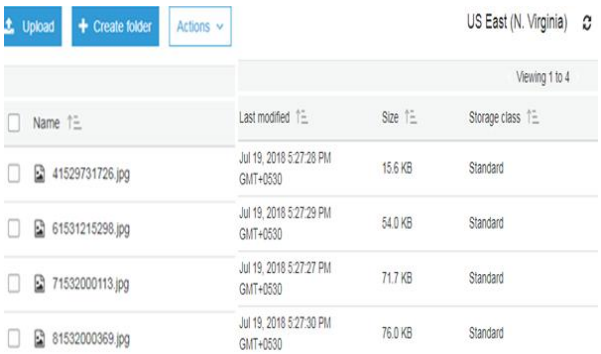

Fig.12: The collected data from both the ends are uploaded to the data base which is cloud, the data is stored in the buckets and frontal faces uploaded are compared from both ends which are entry and exit. Cloud provides the security for each and every uploaded real time photo.

Facial Comparison:

Frontal faces captured and uploaded are compared in the data base which is AWS. AWS provide the best service for recognition and comparing the captured pictures. It compares the faces from both the ends each and every picture is compared and the compared picture is deleted from the cloud.

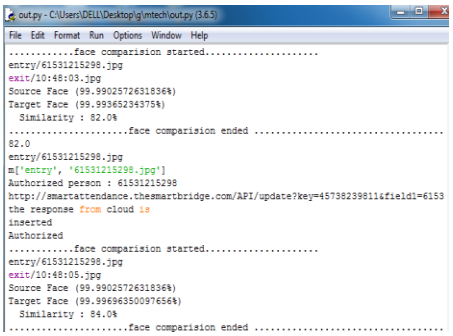

Fig.13: Faces which are exposed during video streaming. If the face has been matched then attendance will be inserted.

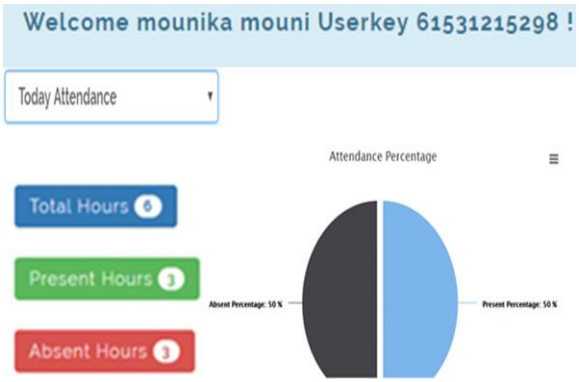

Fig.14: The data can be collected from web server with proper authentication only. We can see the student daily hour wise attendance percentage.

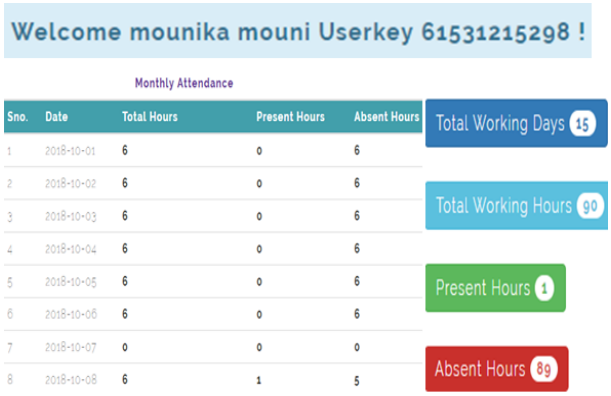

Fig.15: We can see the monthly attendance for students who are present and absent for every hour in the class.

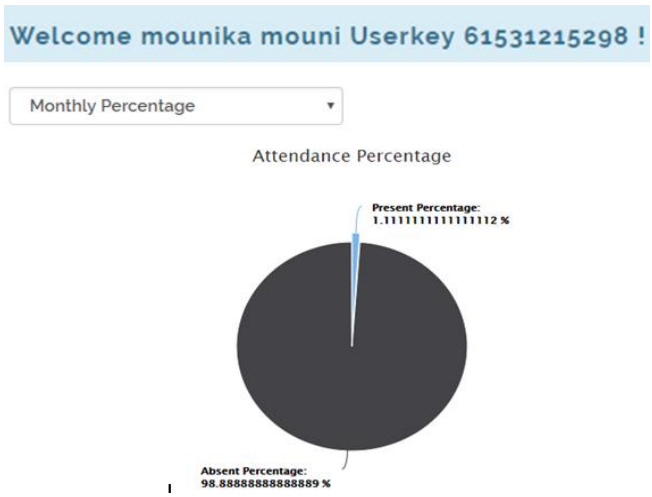

Fig.16: We can see the student monthly attendance percentage.

Faculty Registration:

The following are the login credentials provided to the faculty to login into the registration portal. Then faculty needs to login with username and password provided to them.

***Username*:** kancharlamounika123@gmail.com
Password: 123456

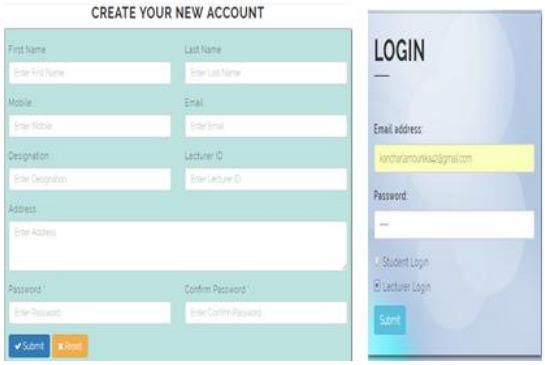

Fig.17Faculty Attendance:

Fig.18: The RFID tag is swiped to the RFID Reader. If the data has been matched with the existing data. Display the name of the specified faculty and the attendance will be marked

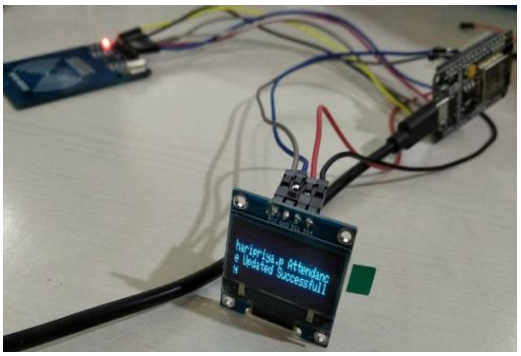

Fig.19: The RFID tag is swiped to the RFID Reader. Display the name of the specified faculty on OLED.

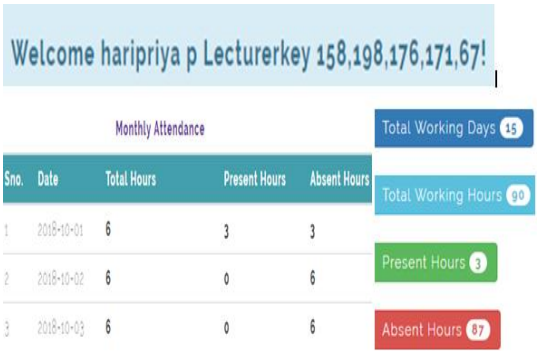

Fig.20: We can see the monthly attendance for faculty who are present and absent for every hour in the class.

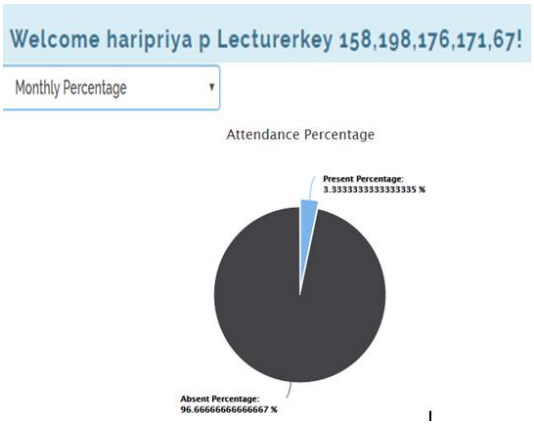

Fig.21:We can see the faculty monthly attendance percentage.

Web Application:

The following are the login credentials provided to the branch coordinator to login into the registration portal. Then coordinator needs to login with username and password provided to him. Then he needs to enter the ID of the student/faculty to enroll the student/faculty

***Username*:** admin1@gmail.com

Password: 123456

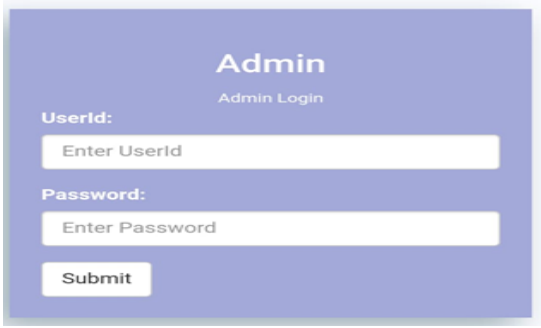

Fig.22

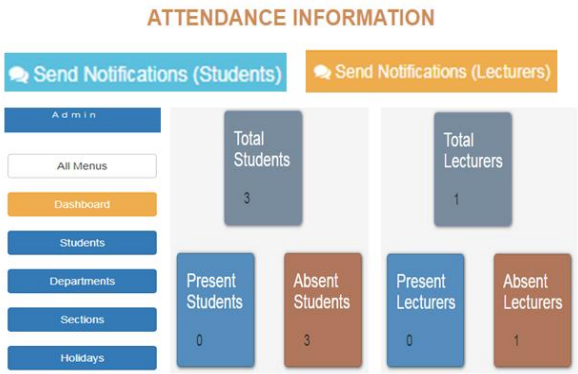

Fig.23: From the figure admin shows the list of students, faculty, sections, departments and holidays.

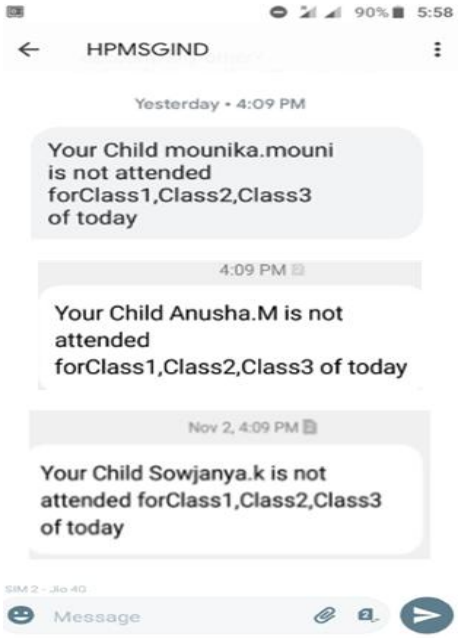

Fig.24: SMS Sent to Corresponding People.

Fig.25: SMS Sent to HOD.

7. CONCLUSION:

In this developed system ten faces were detected and recognised, the attendance was marked hour wise and monthly wise percentage of each Student/Faculty are stored in web app and SMS will be sent to Parents/HOD. Further, Raspberry Pi development board is a cost effective fully functional computational system can be used for many applications, Camera modules are also cost effective and can be used for surveillance systems. Using Python and Open CV in Raspberry Pi made our project flexible and adoptable to any required future changes.

8. ACKNOWLEDGMENT:

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