

An Iot Based Smart Manifold Attendance System

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ABSTRACT:- Attendance has been an age old procedure employed in different disciplines of educational institutions. While attendance systems have witnessed growth right from manual techniques to biometrics, plight of taking attendance is undeniable. In fingerprint based attendance monitoring, if fingers get roughed / scratched, it leads to misreading. Also for face recognition, students will have to make a queue and each one will have to wait until their face gets recognised. Our proposed system is employing “manifold attendance” that means employing passive attendance, where at a time, the attendance of multiple people can get captured. We have eliminated the need of queue system / paper-pen system of attendance, and just with a single click the attendance is not only captured, but monitored as well, that too without any human intervention. In the proposed system, creation of database and face detection is done by using the concepts of bounding box, whereas for face recognition we employ histogram equalization and matching technique.

Keywords:- Bounding box, Face detection, Face recognition, Histogram, Manifold (passive)

I. INTRODUCTION

The traditional attendance technique involves human to human interaction (attendance slip being passed from teacher to peon) and human to computer interaction (teacher updates the attendance in the system). While a normal working day comprises of 7 to 8 hours of class, even if a minimal of 10 minutes each is devoted for attendance, it sums up to approximately 80 minutes per day. This is truly increasing the plight of the teacher. Advancements in attendance included techniques like retinal scanning, fingerprint scanning, face recognition. Smart Manifold Attendance using Real Time Face Recognition is a real world solution to the existing issues in traditional methods. This system consists of four phases - face database, face detection, face recognition and marking attendance. Image acquisition is accomplished using a camera fitted in the classroom. The system first stores the faces in the database. The faces of students are detected / located from the image captured in real time. The detected faces are then compared with those stored in the database during face recognition. If the system recognizes faces, the attendance gets marked immediately in the excel sheets. Also, we send hourly text messages to parents, of wards that are absent. Teachers’ attendance is monitored as well. As per VTU, 52 hours need to be completed per subject and this purpose is also served in the proposed system on a MATLAB platform.

II. METHODOLOGY

This section discusses starting from the creation of database, face detection, recognition of faces from the captured image and performing appropriate attendance updating and monitoring without any human intrusion.

The step by step procedure for implementation is as follows:

Step 1: Creation of database

Step 2: Capturing a classroom image in real time from a web camera

Step 3: Detecting/Locating faces in the captured image

Step 4: Recognising faces i.e comparing the detected faces with those present in the database.

Step 5: Updating Excel sheets

Step 6: Sending text messages using GSM module

Step 7: Sending mail containing summary of the attendance

Step 8: Updating ThingSpeak page

Fig 1 shows the architecture of the manifold attendance system . An image of the classroom is captured from the camera, in our prototype the images are already fed into the system and the image is given to

the MATLAB environment for further processing in order to extract faces from the group picture. Face recognition is performed to determine if the student is present or absent. After which, the corresponding details are given to the GSM module where text messages are sent and attendance summary is mailed to the HOD. IOT concepts are employed to provide ease in attendance tracking.

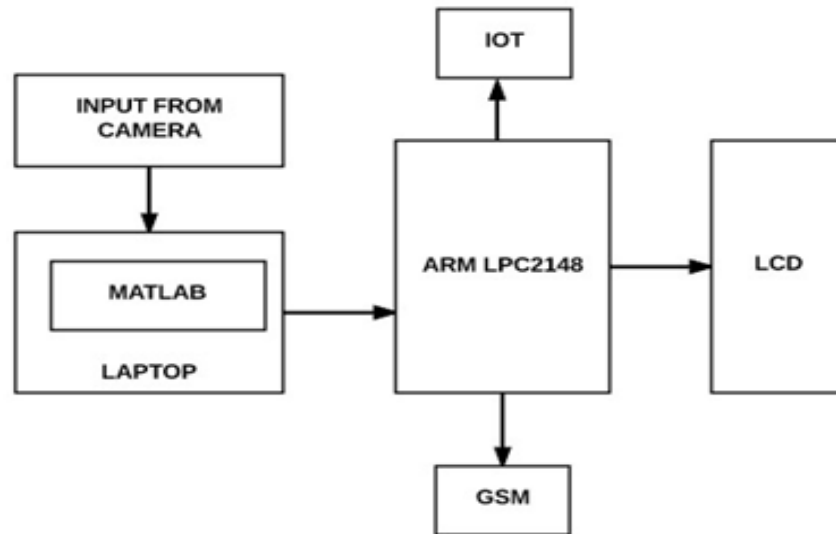


Fig 1: Proposed architecture for manifold attendance system

A. Creating Database: Acquisition from Live Streaming Video

It is necessary to store the images of all the students in an organization. To facilitate ease in doing so, live video acquisition is done so that snapshots are taken from a live video. The user will be first asked to enter the USN of the student like so:

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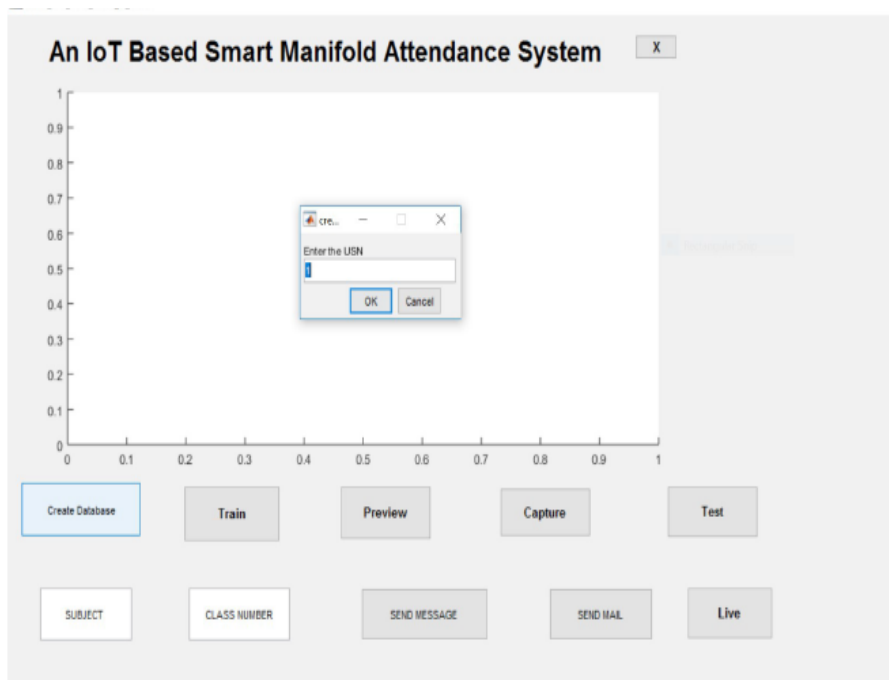


Fig 2:Interface for entering USN

After which, the video player gets enabled .Face Detect function helps to locate the face and returns the row-column where the face begins and the face ends. Using this, a bounding box is drawn. Point Tracker stabilizes the video and provides camera motion estimation.

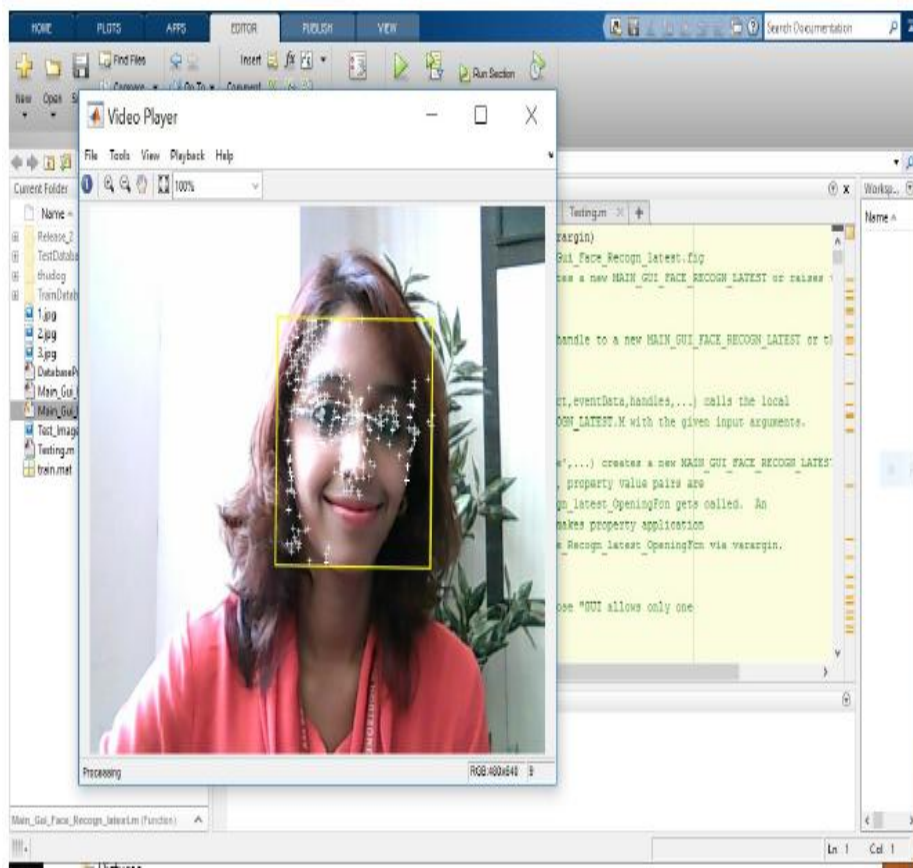


Fig 3: Live stream



Fig 4: Snapshots and cropped faces

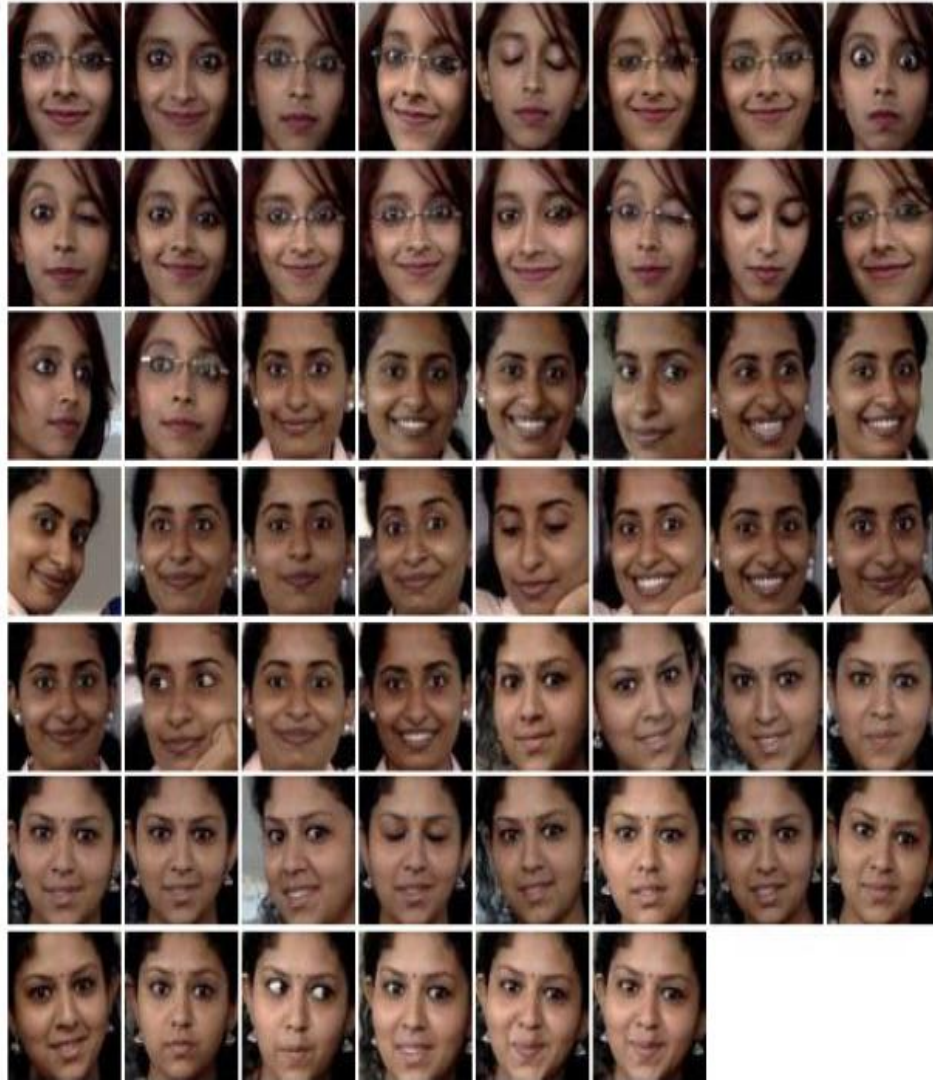


Fig 5: Database created

B. Image Acquisition

Image acquisition in general involves the capturing or getting an image from a source. In real time implementation of smart attendance monitoring system, a webcam or a HD camera is fixed at a suitable position, create a webcam object and then use the snapshot function to acquire images from a webcam. We can acquire a single image or set up a loop to acquire multiple images and use the preview function to test the camera stream. The MATLAB GUI (Graphical User Interface) is implemented using the GUIDE option available in MATLAB.

C. Face Detection

Face detection is the computer technology that identifies the human faces in digital images. A human can do this easily, but a computer requires precise instructions and constraints. MATLAB provides an inbuilt function called Cascade Object Detector to locate the faces in the captured image. This inbuilt function make use of the Viola Jones algorithm that detects the eyes, nose, face in the upper portion of the body. To make the task more manageable, Viola Jones requires full view frontal upright faces. Thus, in order to be detected, the entire face must point towards the camera and should not be tilted to either side. The goal is to distinguish between faces and non-faces. Skin color varies with many facts such as race, health, degree of sun tan etc. Consider an example of a captured image in which two faces are detected. The pixels that are closely related to skin pixels appear white. The pixels that have a drastic change in the pixel value compared to the previous pixels collectively appear as black. A pixel value is classified as skin pixel if its value falls within the threshold.

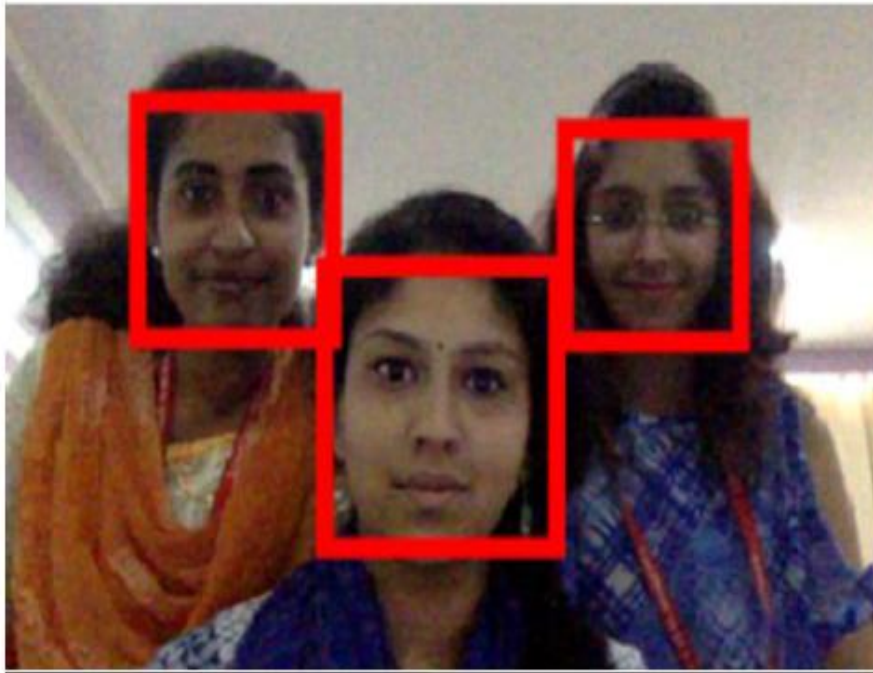


Fig 6 : Creation of Bounding Box on detected faces.

Once the faces are identified in the captured image, they need to be demarcated which is employed by using the concept of bounding box. A bounding box represents the co-ordinates of the rectangular border that encloses a digital image, It uses the co-ordinates at the initial and the final point where it recognizes the skin pixels to form diagonal and thereby draw the rectangle.

Each row in the matrix of the bounding box represents a face been detected. Thus, the number of rows gives the number of faces that are located in the captured image and thereby the number of students present in each class. The faces that are pointed by bounding box (Fig 5) are cropped and fed as input for further processing. This concept is used when there is a single student in case of data base creation or multiple students in case of real time attendance monitoring.

D. Face Recognition

For face recognition, we employ the technique of histogram equalization.

The steps involved are:

1. Consider an image as shown below, whose pixel values are represented using 3-bit data. There are 8 possible grey levels ranging from 0-7

1	2	3
0	1	4
5	6	0

2. Determine Pixel frequency and their respective pixel probability $P(i)$.

3. Calculate CDF, P(c) using $\sum P(i)$ for $0 \leq i \leq L-1$.

Levels	0	1	2	3	4	5	6	7
No. of pixels	2	2	1	1	1	1	1	0
P (i)	0.222	0.222	0.111	0.111	0.111	0.111	0.111	0
P (c)	0.222	0.444	0.555	0.666	0.777	0.888	0.999	0.999
h	4.4	8.8	11.1	13.32	15.54	17.76	19.98	19.98
H	4	9	11	13	16	18	20	20

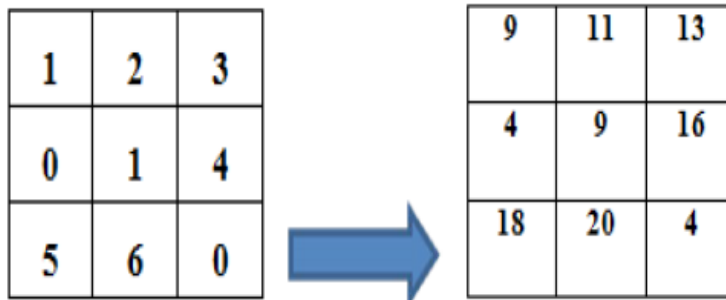


Fig 7: Results of steps in histogram equalization and enhanced image matrix.

E. Face Matching

- First value of the test_processed_bin (histogram values of the detected face) is then compared with all the values of train_processed_bin (histogram values of image in the database) to determine a certain distance given by EU =
- {a -b} ; where a= test_processed_bin, and b= train_processed_bin The EU values corresponding to each of the images are stored as img_bin_hist_sum which is a single columned matrix.
- By using the function min, we can determine the minimum value ‘M’, as well as the corresponding index ‘temp’ of that value ‘M’ present in a matrix. This function is used to determine the minimum EU and is stored as M. [temp M] = min (img_bin_hist_sum);
- The bin value is used to differentiate histograms of different people. i.e. The obtained M value is divided by this bin value and rounded off to nearest positive infinity and updated. The value hence gives the folder number where the image histogram match was found.
- Depending on the folder found, the first image present is selected by default and displayed as
- “STUDENT NAME FACE FOUND”.

F. Updating Excel Sheets

Some key features of the excel sheets include:

- Column A is dedicated for the list of students.
- Column B is dedicated for the USN numbers of respective students.
- A total of 10 classes will be taken for each of the 4 subjects from column C to L
- Percentage calculation is done using the formula :

(Number of classes attended / Total number of classes taken)

Attendance for BE 8th semester Students - 2017 (SUBJECT 1)												
Name	Registered Number	CLASS 1	CLASS 2	CLASS 3	CLASS 4	CLASS 5	CLASS 6	CLASS 7	CLASS 8	CLASS 9	CLASS 10	Percentage
student 1	17BEC13001	0	0	0	0	0	0	0	0	0	0	0
student 2	17BEC13002	0	0	0	0	0	0	0	0	0	0	0
student 3	17BEC13003	0	0	0	0	0	0	0	0	0	0	0
student 4	17BEC13004	0	0	0	0	0	0	0	0	0	0	0
student 5	17BEC13005	0	0	0	0	0	0	0	0	0	0	0
student 6	17BEC13006	0	0	0	0	0	0	0	0	0	0	0
student 7	17BEC13007	0	0	0	0	0	0	0	0	0	0	0
student 8	17BEC13008	0	0	0	0	0	0	0	0	0	0	0
student 9	17BEC13009	0	0	0	0	0	0	0	0	0	0	0
student 10	17BEC13010	0	0	0	0	0	0	0	0	0	0	0
Number of students present		0										
Date												

Fig 8: Excel sheet corresponding to 10 students and 10 classes

G. Sending Messages

Serial communication is used and appropriate port name must be included to activate it. Character ‘A’ is sent to the controller which then uses Send SMS function to send the message employing the GSM module. Likewise, a unique character will be assigned for each student like ‘B’, ‘C’ and so on and in case of student’s absence, that particular character is considered, from which the students name is decoded and this will be sent to LCD for displaying.

H. Sending Mail

Function sendmail (recipient, subject, message, attachments) is used to mail the updated sheet to the email-id specified. We use JAVA concepts to initialize the mail sending process, SMTP and setting preferences.

I. Implementation of IOT

The Internet of Things (IOT) is a system of ‘connected things’. The things generally comprise of an embedded operating system and an ability to communicate with the internet or with the neighbouring things. One of the key elements of a generic IOT system that bridges the various ‘things’ is an IOT service. An interesting implication from the ‘things’ comprising the IOT systems is that the things by themselves cannot do anything. At a bare minimum, they should have an ability to connect to other ‘things’. But the real power of IOT is harnessed when the things connect to a ‘service’ either directly or via other ‘things’. In such systems, the service plays the role of an invisible manager by providing capabilities ranging from simple data collection and monitoring to complex data analytics. The below diagram illustrates where an IOT service fits in an IOT ecosystem. One such IOT application platform that offers a wide variety of analysis, monitoring and counteraction capabilities is ‘ThingSpeak’. The channel page settings and display of attendance on ThingSpeak is shown in Fig 12.

III. RESULTS

All This section mainly shows the experimented results of the implemented algorithm. Each steps of the algorithm is executed in the MATLAB and all the expected results are discussed below. Fig 9 shows the overview of the GUI model, the algorithm is developed in MATLAB using graphical user interface (GUI), the platform of MATLAB which enables to develop a devise without any hardware requirement. Let us consider a test case where only two students are present. The teacher enters the subject name and the class number as well, where the corresponding excel sheet is selected. By clicking on the 'capture' ushbutton an image of classroom is captured. Fig 10 shows how the faces are detected and cropped. These faces are temporarily stored which is then compared with the faces present in the database on clicking the 'Test' pushbutton. Here the technique of histogram matching is employed as discussed earlier where the best face is matched. The face under test, the matched face is then displayed as shown in Fig 11. Based on the faces recognised excel sheets are updated and on clicking the 'Send Message' and 'Send Mail' pushbuttons text messages and mail is sent respectively as shown in Fig 12. All the above discussed steps can be carried out at one stretch without any intervention with LIVE pushbutton, where each step will be executed one after another with a mentioned time span.

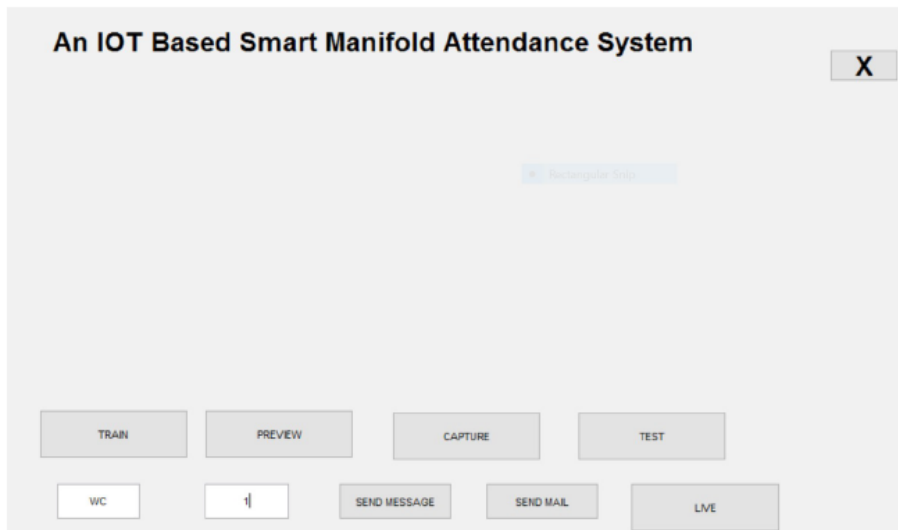


Fig 9: Overview of GUI

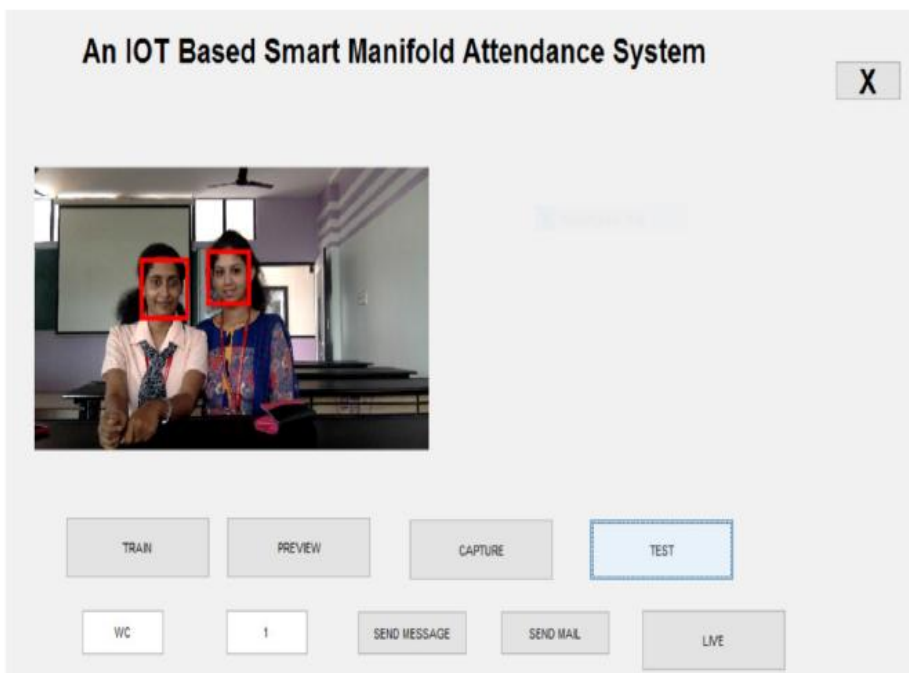


Fig 10: Test case considered

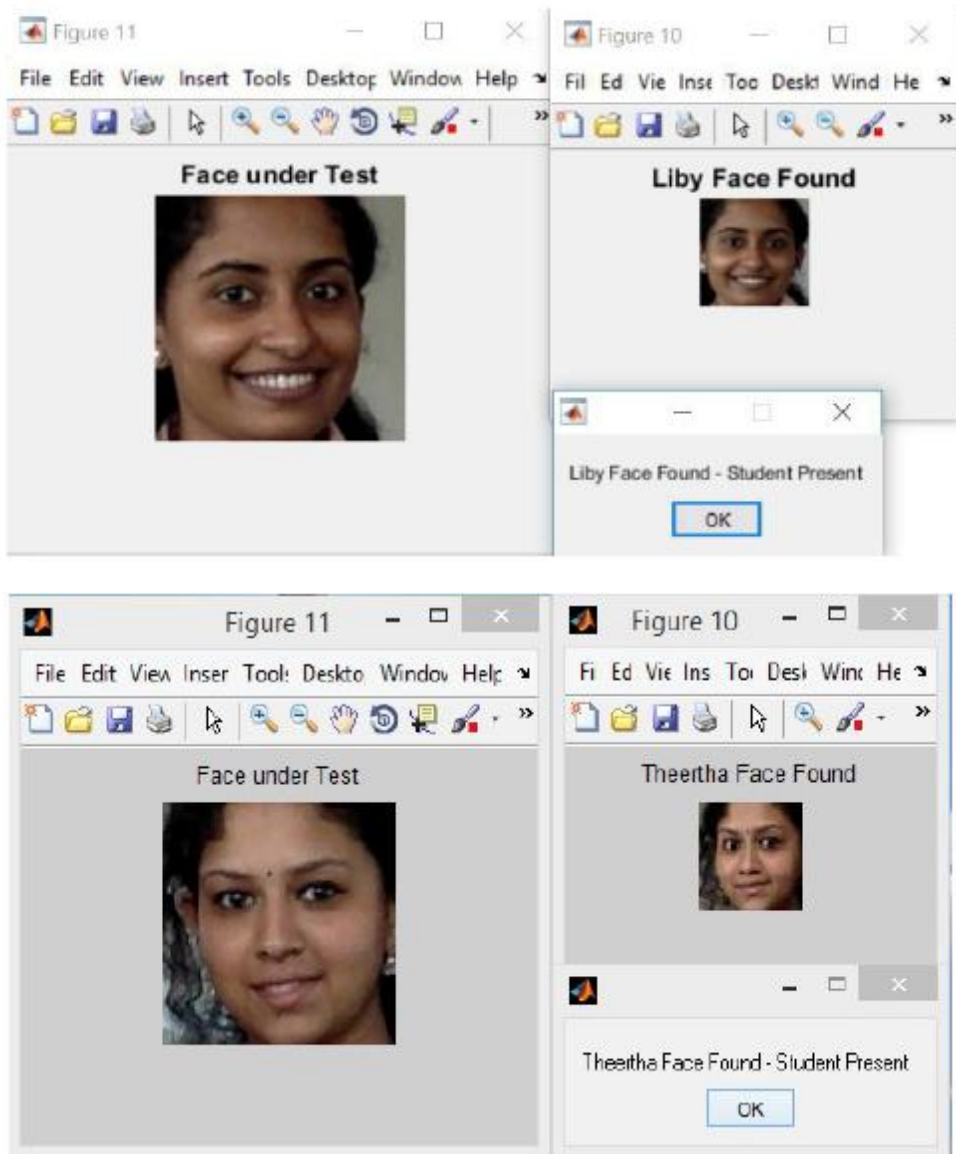


Fig 11: Dialogue box display for detected faces

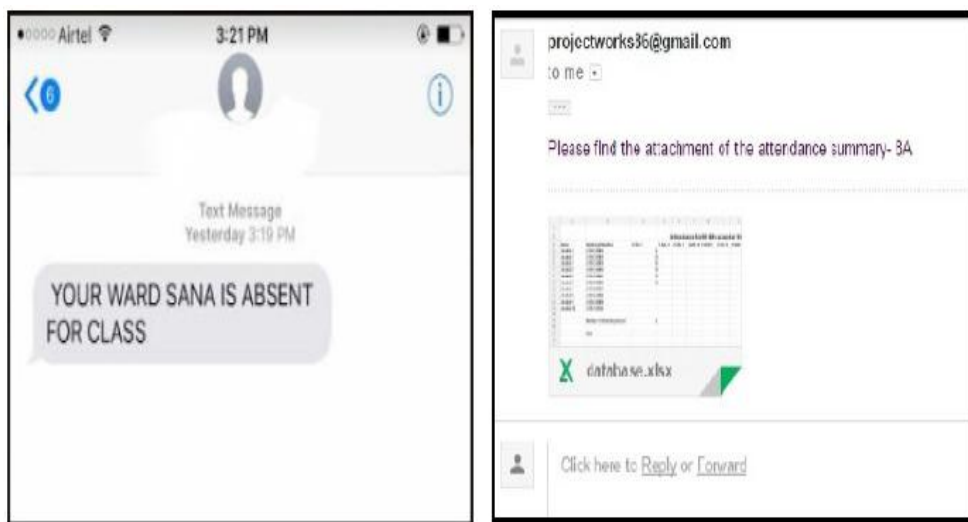


Fig 11: Screenshots of how text messages and mail is received

The screenshot shows the ThingSpeak website interface. At the top is a navigation bar with the ThingSpeak logo and links for Channels, Apps, Community, Support, How to Buy, Account, and Sign Out. The main content area is divided into two columns. The left column, titled 'My Channels', features a 'New Channel' button and a table listing three channels: Sana, Libby, and Theertha. Each channel entry includes a name, a 'Created' date (all are 2017-05-06), and a row of buttons for 'Private', 'Public', 'Settings', 'API Keys', and 'Data Import / Export'. The right column, titled 'Help', contains text about creating channels, a link to learn more, and an 'Examples' section listing Arduino, Arduino MKR1000, ESP8266, Raspberry Pi, and Netduino Plus. Below the examples is an 'Upgrade' section with text about sending more data faster and using ThingSpeak for commercial projects, followed by an 'Upgrade' button.

Channel Stats

Created: about a month ago
 Updated: about 5 hours ago
 Last entry: about 5 hours ago
 Entries: 47



Fig 12: Details of channels created and display of student attendance on ThingSpeak

IV. CONCLUSIONS

A study of image processing techniques and the existing attendance techniques was done and the MATLAB program for the manifold recognition of students in a captured classroom picture was successfully accomplished. The attendance sheets were created using MS-Excel. The interface of LPC2148 with LCD, GSM module was done. IOT assistance was successfully provided using ThingSpeak. The program corresponding to hardware flow was written in Kiel u4, dumped on the controller using Flash magic and was successfully tested.

ACKNOWLEDGMENT

All work done, images shown in this paper are for educational purpose only and not for commercial purpose.

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