International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 05 Issue: 07 | July - 2021 ISSN: 2582-3930

Smart Classroom Using Raspberry Pi 3 Model B+

Samina Pathan, Pranali Zende, Sneha Nimbalkar, Pratiksha Jadhav, Mayukh Chakravarthy

Electronic & Telecommunication Department & Phaltan Education Society's college of engineering Phaltan
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Abstract - Smart classroom is the representative of the modern teaching. With the advent of modern technology it becomes easier for the students as well as teachers to perform their task more efficiently. With the aid of modern technology it has become easier for the students and teachers across the world to get a good grasp of the theoretical as well as practical knowledge. In recent times, the traditional time consuming chalk and board class room teaching methodology are transformed into smart classroom teaching which involves digital devices such as laptops, projectors, speakers and more. These de- vices improve the interaction between teachers and students, but the cost is a major factor that still restricts most of the institutions to adopt digital technology. Also, the con- ventional attendance taking system requires involvement of teachers and be present at the laptop to navigate through the slides for which a significant amount of time is lost from the allotted time slot. The main objective of this paper is to design and implements a cost-effective technology-aided system which enhances the quality of service teaching by effectively utilizes the teaching time. The proposed system consists of two modules: 1. Face detection using raspberry pi. 2. Light controlling module.

Key Words: Raspberry Pi 3 Model b+, Raspberry Pi Camera, LED ,Power Supply, Connecting Wires, SD Card

1.INTRODUCTION *(Size 11, Times New roman)*

Smart classroom" refers to the automatic and electronic control of college features, activities, and appliances. The utilities and features of our class can be easily controlled via Internet. There are three main elements of a Smart classroom system: sensors, controllers, and actuators. The present day attendance system is manual. It wastes a considerable amount of time both for teachers and students. The waiting time of the students is increased if attendance is taken manually. There are still chances for proxies in the class when attendance is taken manually. Manual attendance always a have a cost of human error. Face is the essential recognizable proof for any human. So automating the attendance process will increase the productivity of the class. To make it available for every platform we have chosen the Raspberry pi 3 for face recognition. A Webcam is associated with the Raspberry Pi module. Face identification separates faces from non-faces and those countenances that can be perceived. This module can be utilized for different applications where face acknowledgment can be utilized for validation. In this proposed system we take the attendance using face recognition which recognizes the face of each student during the class hours.

Even though the technology is developing in our day to day life, there is no help coming into existence for the people who are physically not good on the basis of technology. As the speech enabled, smart classroom system deploys the use of voice to control the devices. It mainly targets the physically disabled and elderly persons. The home automation will not work if the speech recognition is poor. The speech given by the user will be given as input to the Microphone. Microphone recognizes the speech given by the person and sends it to the recognizing module. It searches for the nearest word even if there are any disturbances in it. If the command (ON/OFF) is given, the action is done.

2. Block Diagram

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Fig.1 shows the block diagram of whole system.The whole system is divided into two modules . 1.Face detection attendance using raspberry pi and 2.Light control system using google assistant. In below fig. it shows the camera module ,led is connected to raspberry pi. Pins of led is connected to vcc and GND of raspberry pi and the camera module is connected to the camera slot to the Raspberry pi . We connect all the interfaces like mouse, keyboard, monitor to the raspberry pi. When we gives command through google assistant the led turned ON/OFF. We creates applets from IFTTT to give command to raspberry pi using adafruit . And in face detection system there are several models like check camera, capture images, detect and recognize image .The captured data are compare with previous stored data and gives attendance in excel shit.

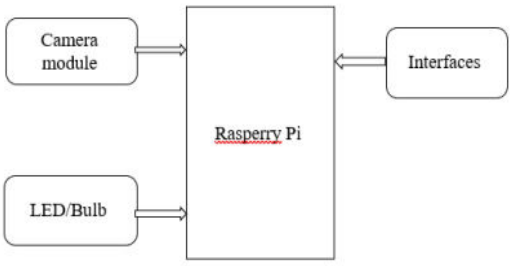

Fig1: Block Diagram

3. Hardware

A. Raspberry Pi 3 Model B+

Fig -3.1 Raspberry pi

RASPBERRY PI 3 is a development board in PI series. It can be considered as a single board computer that works on LINUX operating system. The board not only has tons of features it also has terrific processing speed making it suitable for advanced applications. PI board is specifically designed for hobbyist and engineers who are interested in LINUX systems and IOT (Internet of Things).

- Quad Core 1.2GHz Broadcom BCM2837 64bit CPU
- 1GB RAM
- BCM43438 wireless LAN and Bluetooth Low Energy
- 100 Base Ethernet
- 40-pin extended GPIO
- 4 USB 2 ports
- 4 Pole stereo output and composite video port
- Full size HDMI

B. Raspberyy Pi Camera

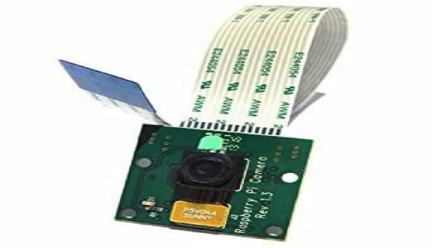

Fig.3.2: Raspberry pi Camera

The Raspberry Pi Camera Board plugs directly into the CSI connector on the Raspberry Pi. It's able to deliver a crystal clear 5MP resolution image, or 1080p HD video recording at 30fps! Latest Version 1.3! Custom designed and manufactured

- Frequency range: 0.2 to 2500Hz
- Operating temperature: -50° and +85°c
- Fully Compatible with Both the Model A and Model B Raspberry Pi
- 5MP Omnivision 5647 Camera Module
- Still Picture Resolution: 2592 x 1944
- Video: Supports 1080p @ 30fps, 720p @ 60fps and 640x480p 60/90 Recording
- 15-pin MIPI Camera Serial Interface - Plugs Directly into the Raspberry Pi Board
- Size: 20 x 25 x 9mm
- Weight 3g
- Fully Compatible with many Raspberry Pi cases

C. LED

Fig -3.3 LED

A light-emitting diode (LED) is a semiconductor device that emits light when an electric current is passed through it. Light is produced when the particles that carry the current (known as electrons and holes) combine together within the semiconductor material. Since light is generated within the solid semiconductor material, LEDs are described as solid-state devices. The term solid-state lighting, which also encompasses organic LEDs (OLEDs), distinguishes this lighting technology from other sources that use heated filaments (incandescent and tungsten halogen lamps) or gas discharge (fluorescent lamps).

D. GPIO Pins General-

Purpose input/output (GPIO) is a generic pin on an integrated circuit or computer board whose behavior including whether it is an input or output pin is controllable by the user at run time.

.E. Power Supply

The Power Supply is a Primary requirement for the project work. The required DC power supply for the base unit as well as for the recharging unit is derived from the mains line. For this purpose center tapped secondary of 12V012V transformer is used. From this transformer we getting 5V power supply.

F.SD Card

The OS required for raspberry pi is raspbian and the minimum recommended card size is 8 GB.

4. SOFTWARE

A. Python IDE

Python is an easy to learn, powerful programming language. It has efficient high-level data structures and a simple but effective approach to object-oriented programming. Python's elegant syntax and dynamic typing, together with its interpreted nature, make it an ideal language for scripting and rapid application development in many areas on most platforms. The Python interpreter is easily extended with new functions and data types implemented in C or C++ (or other languages callable from C). Python is also suitable as an extension language for customizable applications.

B. OpenCV

OpenCV is a library of programming functions mainly aimed at real-time computer vision. It has a modular structure, which means that the package includes several shared or static libraries. We are using image processing module that includes linear and non-linear image filtering, geometrical image transformations (resize, affine and perspective warping, and generic table-based remapping), color space conversion, histograms, and so on. Our project includes libraries such as Viola-Jones or Haar classifier, LBPH (Lower Binary Pattern histogram) face recognizer, Histogram of oriented gradients (HOG).

C. IFTTT

IFTTT derives its name from the programming conditional statement "if this, then that." What the company provides is a software platform that connects apps, devices and services from different developers in order to trigger one or more automations involving those apps, devices and services.

D.Adafruit

Adafruit IO is a platform designed (by us!) to display, respond, and interact with your project's data. We also keep your data private (data feeds are private by default) and secure (we will never sell or give this data away to another company) for you. It's the internet of things - for everyone

5. PROPOSED APPROACH

A.Face Detection Attendance

The total system is divided into 3 modules-
Database creation, Training the dataset, Testing, sending alert messages as an extension.

1. Database creation
a) Initialize the camera and set an alert message to grab the attention of the students.
b) Get user id as input
c) convert the image into gray scale, detect the face and
d) Store it in database by using given input as label up to 20 frames.

2. Training
a) Initialize LBPH face recognizer.
b) Get faces and Id's from database folder to train the LBPH face recognizer.
c) Save the trained data as xml or yml file.

3. Testing Load Haar classifier, LBPH face recognizer and trained data from xml or yml file.
a) Capture the image from camera,
b) Convert it into gray scale,
c) Detect the face in it and
d) Predict the face using the above recognizer. This proposed system uses Viola Jones algorithm for face detection which uses modified Haar Cascades for detection

B. Light control system

The proposed system eliminates the complication of wiring in case of wired automation. Considerable amount of power supply is also possible. Operating range is more than the Bluetooth. The existing system does not allow remote monitoring and controlling of appliances. But where as in the proposed system the system using the Wi-Fi based home automation system it allows to monitor and control the appliances. The home automation of the existing system in 1990's, the people in every home has electronic devices which are controlled manually but in our proposed system we are controlling all electronic appliances through remotely. The IOT application have become this popular in this 21st century is due to dominant use of the internet, evolution of smart phone technology and raised standard of mobile communication

6.RESULT

A. Face Detection Attendance

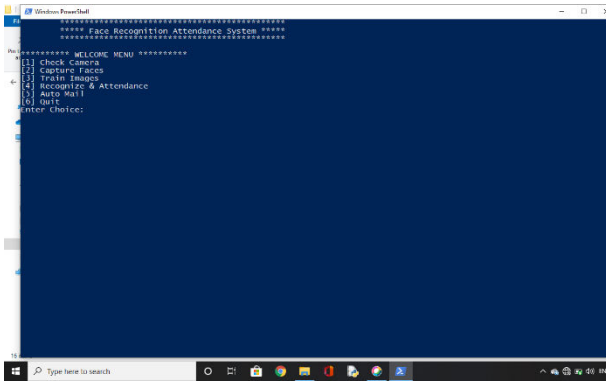

Fig.6.1 OUTPUT window asking for choice

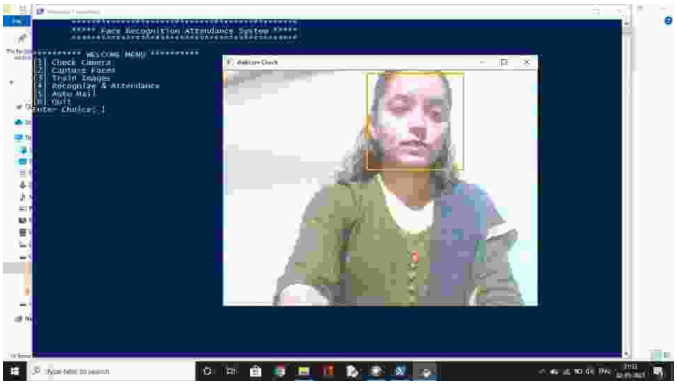

Fig.6.2. Checking Camera

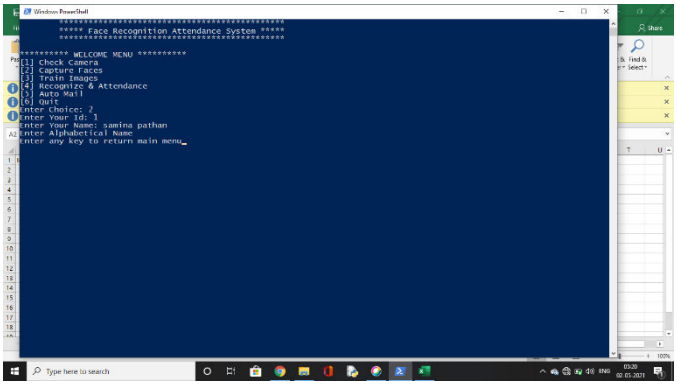

Fig.6.3 OUTPUT window asking for students data

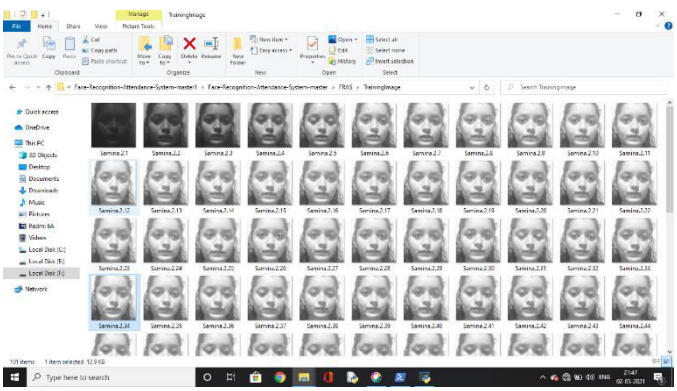

Fig.6.4 Train Image

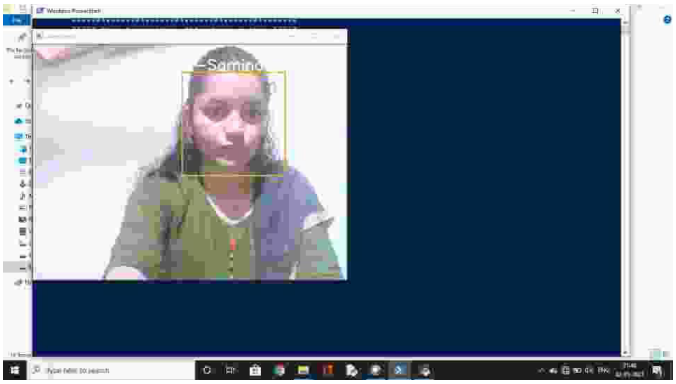

Fig.6.5 Recognize Student

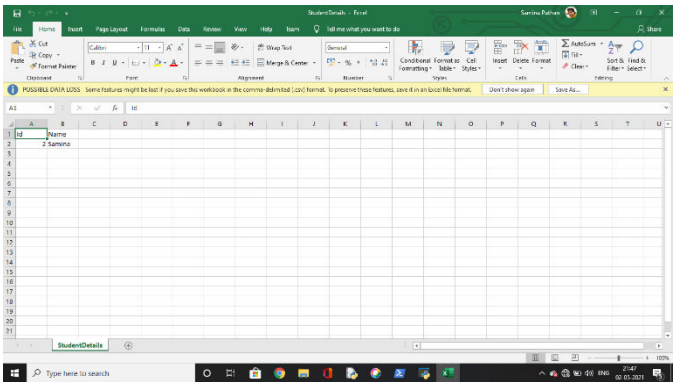

Fig.6.6 Attendance mark in excel sheet

B.Light Control System

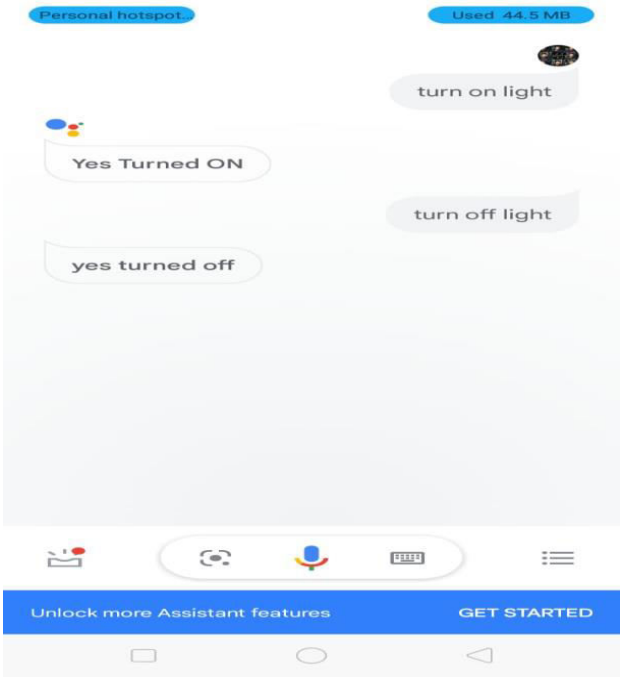

Fig 6.7 Giving command to google assistant

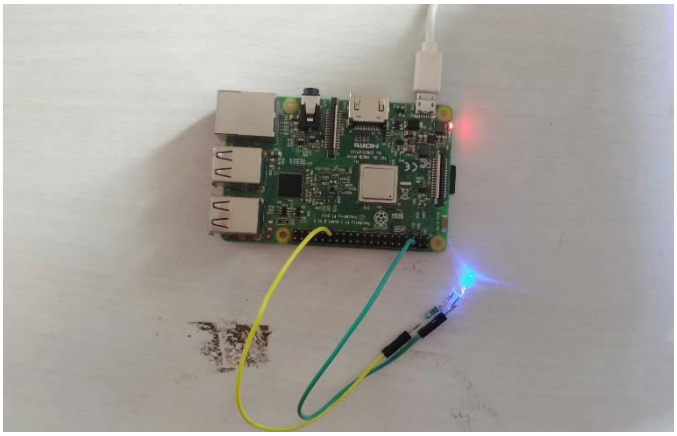

Fig 6.8. OUTPUT of light control module

7. CONCLUSIONS

In this smart classroom system, user have given commands to the Google assistant. classroom appliances like Bulb, Fan and Motor etc., are controlled according to the given commands. The commands given through the Google assistant are decoded and then sent to the microcontroller and it control the relays. The device connected to the respective relay turned On or OFF as per the users request to the Google Assistant.

And We came to realize that there are extensive variety of methods, for example, biometric, RFID based and so on which are tedious and non-productive. So to defeat this above framework is the better and solid arrangement from each keen of time and security. Hence we have accomplished to build up a solid and productive participation framework to actualize an image handling algorithm to identify faces in classroom and to perceive the confronts precisely to check the attendance

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