

CLASSROOM AUTOMATION AND ATTENDANCE TRACKING SYSTEM

Submitted in partial fulfillment of the
requirements for the award of
Bachelor of Engineering degree in Electronics and Communication Engineering

By

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APRIL - 2023



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BONAFIDE CERTIFICATE

This is to certify that this Final Year Project Report is the bonafide work of K SRI VENKATESWARARAO (REG NO: 39130197) AND K INDRASENAREDDY (REG NO: 39130203) who have done the project work entitled “CLASSROOM AUTOMATION AND ATTENDANCE TRACKING SYSTEM” under my supervision from October 2022 to April 2023.

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DECLARATION

We **K SRI VENKATESWARARAO (Reg.No:39130197)**, **K INDRA SENA REDDY (Reg.No:39130203)** hereby declare that the Project Report entitled “**Classroom Automation And Attendance Tracking System**” done by us under the guidance of **Dr. E. ANNA DEVI.,M.E.,Ph.D.**, at Sathyabama Institute of Science and technology is submitted in partial fulfilment of the requirements for the award of Bachelor of Engineering degree in **Electronics and Communication Engineering**.

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ACKNOWLEDGEMENT

We are pleased to acknowledge our sincere thanks to the Board of Management of SATHYABAMA for their kind encouragement in doing this project and for completing it successfully. I am grateful to them.

We convey our thanks to **Dr. N.M. NANDHITHA M.E., Ph.D.**, Dean, School of Electrical and Electronics and **Dr. T. RAVI M.E., Ph.D.**, Head of the Department, Department of Electronics and Communication Engineering for providing me necessary support and details at the right time during the progressive reviews.

We would like to express our sincere and deep sense of gratitude to our Project Guide **Dr. E. ANNA DEVI, M.E., Ph.D.**, for her valuable guidance, suggestions, and constant encouragement paved way for the successful completion of my project work.

We wish to express our thanks to all Teaching and Non-teaching staff members of the Department of Electronics and Communication Engineering who were helpful in many ways for the completion of the project.

ABSTRACT

Classroom Automation and Attendance Tracking System is focused on developing a new hardware system for human face detection that is based on the Raspberry Pi, a versatile computer that is commonly used in electronic devices. The system utilizes the Raspberry Pi Camera to capture images and display them in a monitoring system. The integration of the Internet of Things (IoT) technology has made this process even more streamlined and efficient.

By implementing automation and IoT based monitoring, this project's main objective is to improve security and classroom interactions. The system is made to enable users to control room automation, keep an eye on students entering the classroom, and take pictures of students for use in digital monitoring. The system is able to capture and send images of students to a digital monitoring system by utilizing the IoT to automate room functions like turning on the lights and fans.

The overall goal of this project is to develop a user-friendly and effective system that makes it possible to better manage and keep an eye on classroom activities through the use of cutting-edge technology. The system has the potential to significantly improve classroom interactions and enhance security by utilizing the latest advancements in hardware and IoT technology.

LIST OF FIGURES

FIGURE NUMBER	FIGURE TITLE	PAGE NUMBER
3.1	PROCESS OF ATTENDANCE MARKING	13
3.2	PROCESS INVOLVED IN ATTENDANCE TRACKING	14
3.3	BLOCK DIAGRAM	15
4.1	RASPBERRY PI	18
4.2	PORT SPECIFICATION	20
4.3	IR SENSOR	26
4.4	IR SENSOR CIRCUIT DIAGRAM	27
4.5	IR IMAGING DEVICES	29
4.6	WEB CAM	31
4.7	PIEZO SENSOR	32
4.8	RELAY MODULE	34
4.9	RELAY SWITCH	35
4.10	DATA ENTRY	40
5.1	PROJECT OUTVIEW	45
5.2	AUTOMATION OF LIGHTS AND FANS	46
5.3	CAMERA MODULE AND PIEZO SENSOR	46
5.4	STUDENT DETECTION	47
5.5	STUDENTS ATTENDANCE	48

TABLE OF CONTENTS

CHAPTER NUMBER	TITLE	PAGE NUMBER
	ABSTRACT	v
	LIST OF FIGURES	vi
1	INTRODUCTION	1
	1.1 MOTIVE OF THE PROJECT	1
	1.2 PROJECT OBJECTIVE	2
	1.3 METHODS FOR ATTENDANCE TRACKING	3
2	LITERATURE SURVEY	6
	2.1 IMPLEMENTATION OF SMART CLASSROOM USING WAGOPLC	6
	2.2 LEARNING THE CLASSROOM AUTOMATION PREFERENCES	6
	2.3 TOWARDS BUILDING AN IOT BASED SMART CLASSROOM	4
	2.4 ATTENDANCE BASED ON FACIAL RECOGNITION-RASPBERRY PI	7
	2.5 ATTENDANCE MANAGEMENT SYSTEM USING RFID	8
	2.6 ATTENDANCE SYSTEM USING FACERECOGNITION	8
	2.7 SMART ATTENDANCE SYSTEM USING IoT	9
	2.8 ATTENDANCE SYSTEM USING FINGERPRINT RECOGNITION	10
	2.9 COMBINATION OF FACE-RECOGNITION AND RFID	10
3	SYSTEM DESIGN	12
	3.1 EXISTING SYSTEM	12
	3.2 PROPOSED SYSTEM	12
	3.3 PROJECT IMPLEMENTATION	13
	3.4 BLOCK DIAGRAM	15
	3.5 HARDWARE REQUIREMENTS	16
4	HARDWARE EXPLANATION	17
	4.1 RASPBERRY PI	17
	4.2 RASPBERRY PI ADVANCED SETUP	22
	4.3 CLASSIFICATION OF RASPBERRY PI'S	24
	4.4 USAGE OF RASPBERRY PI IN AUTOMATION SYSTEM	25

	4.5 IR SENSOR	26
	4.6 WEB CAM	30
	4.7 PIEZO SENSOR	32
	4.8 RELAY MODULE	34
	4.9 SOFTWARE ENVIRONMENT	35
5	RESULTS AND DISCUSSION	45
6	CONCLUSION AND FUTURE WORK	49
	6.1 FUTURE SCOPE	50
7	REFERENCES	51

CHAPTER-1

INTRODUCTION

1.1 Motive of the project

Organizations of all sizes use attendance systems to record when student or employees start and stop work and the department where the work is performed. Some organizations also keep detailed records of attendance issues such as who calls in sick and who comes in late. An attendance system provides many benefits to organizations. Traditional approach for attendance is professor calls student name & record attendance. It takes some time to record attendance. Suppose duration of class of one subject is about 50minutes & to record attendance takes 5 to 10 minutes. For each lecture this is wastage of time. To avoid these losses, we are about to use automatic process which is based on raspberry pi. In this novel approach, we are using face detection & face recognition system. This face detection differentiates faces from non-faces and is therefore essential for accurate attendance. The other strategy involves face recognition for marking the student's attendance. The Raspberry pi module is used for face detection & recognition. The camera will be connected to the Raspberry pi module. The database is collected. The database includes name of the person, their images. One of the unique features of our brain is that it can think only in images not inwards. Once you may forget to keep your Car's key but you will never forget to bring a face with you.

While capturing an images from a webcam we have to come across some problems like pose (position of camera), presence of structural components (spectacles and beard), facial expression, occlusion (obstructed by someone), image orientation (variation in rotation), imaging condition (lightning and camera characteristics) etc. Face Detection and Face recognition System is a system which automatically identifies and/or verifies the identity of a person from digital images or a video frame from a video source. A general statement of the face recognition problem (in computer vision) can be formulated as follows: Given still or video images of ascend, identify or verify one or more persons in the scene using a stored database of faces. And also designing an advanced classroom automation system using normal web server and Wi-Fi technology. The devices can be switched ON/OFF and sensors can be read using a controller through Wi-Fi. We also able to ON/OF our projector in the classroom. Automation is the

most frequently spelled term in the field of electronics. The hunger for automation brought many revolutions in the existing technologies. These had greater importance than any other technologies due to its user-friendly nature. These can be used as a replacement of the existing switches in home which produces sparks and also results in fire accidents in few situations. Considering the advantages of Wi-Fi an advanced automation system was developed to control the appliances in the classroom.

It's frequently done by hand, such as calling by name or rolls number. The main goal of this project is to create a Face Recognition-based attendance system that will automate an otherwise manual process. The requirements for upgrading the way attendance is handled, as well as the time management standards, are met by this project. This device is placed in the classroom and stores student information such as their name, roll number, class, sec, and photographs. The pictures were extracted using Open CV.A Logitech C270 webcam and processing board were used in this project. The student must wait in line to get his or her attendance. As a result, the procedure for recording attendance takes a lengthy time. This project features an involuntary attendance mechanism that does not interfere with traditional teaching methods in any way. The device can also be used in the classroom for test sessions or other occasions that require punctuality. Traditional student recognition procedures, such as calling students' names or validating their identity cards, might disrupt the teaching process and annoy pupils during review sessions. In order to be remembered, students must also register in the database. Because of the user-friendly interface, on-the-spot enrolment is feasible. Face recognition is necessary for recognising relatives, friends, and acquaintances in everyday life. It's possible that we don't realise that recognising human faces involves numerous steps. During the recognition process, human intelligence assists us in receiving and perceiving information. The image sent into our eyes, specifically the retina in the form of light, provides details. Light is an electromagnetic wave that is released from a source and projected onto an object for human perception.

1.2 Project Objective

Attendances of every student are being maintained by every school, college and university. Empirical evidences have shown that there is a significant correlation between students' attendances and their academic performances. There was also a claim stated that students who have poor attendance records will generally link to poor

retention. Therefore, faculty has to maintain proper record for the attendance. Manual attendance record system is not efficient and requires more time to arrange record and maintain the attendance of every student. Hence there is a requirement of a system that will solve the problem of student record arrangement.

In many colleges the process of taking attendance is done by the faculty members by asking them to respond according to their roll numbers which was the time taken process. So for time saving purpose we can adopt methods like biometrics such as fingerprint scanning, face recognition. But when it comes to a class with a greater number of students fingerprint scanning won't be a suitable method. So another way of identify the student's presence is by face recognition by considering this we got an idea that we can use this method for purpose of marking attendance without wasting time for the faculty by writing a code for face recognition and compare with the database of the class and mark the attendance according to the time table.

The main objective of this project is to develop face recognition based automated student attendance system. In order to achieve better performance, the test images and training images of this proposed approach are limited to frontal and upright facial images that consist of a single face only. The test images and training images have to be captured by using the same device to ensure no quality difference. In addition, the students have to register in the database to be recognized. The enrolment can be done on the spot through the user-friendly interface.

1.3 Method for attendance tracking

Traditional student attendance marking technique is often facing a lot of trouble. The face recognition student attendance system emphasizes its simplicity by eliminating classical student attendance marking technique such as calling student names or checking respective identification cards. There are not only disturbing the teaching process but also causes distraction for students during exam sessions. Apart from calling names, attendance sheet is passed around the classroom during the lecture sessions. The lecture class especially the class with a large number of students might find it difficult to have the attendance sheet being passed around the class. Thus, face recognition student attendance system is proposed in order to replace the manual signing of the presence of students which are burdensome and causes students get

distracted in order to sign for their attendance. Furthermore, the face recognition based automated student attendance system able to overcome the problem of fraudulent approach and lecturers does not have to count the number of students several times to ensure the presence of the students.

There is a need to develop a real time operating student attendance system which means the identification process must be done within defined time constraints to prevent omission. The extracted features from facial images which represent the identity of the students have to be consistent towards a change in background, illumination, pose and expression. High accuracy and fast computation time will be the evaluation points of the performance. The objective of this project is to develop face recognition based automated student attendance system. Expected achievements in order to fulfil the objectives are

- To detect the face segment from the video frame.
- To extract the useful features from the face detected.
- To classify the features in order to recognize the face detected.
- To record the attendance of the identified student.

As the science & technology is growing or changing quickly, everything is getting automated, so the attendance of a student can be taken automatically by capturing the individual or group image from the sophisticated camera and then compared with the stored or trained images. The attendance of a student in classroom or laboratory During lecture is attached to the video streaming service; it is possible to present the timing video when the student was absent. It is necessary to take the attendance of students in the classroom automatically, by manually lecturer taking the attendance is not sufficient because it is waste of time for both students and lecturer and also it is traditional and

normal approach. Even though one of the daily using concepts is biometric attendance system is available but it is also need extra time that will affect for student and teachers, it is also very difficult to take the attendance again and again for all the classes in the room. A survey and near investigation of human posture estimation and movement acknowledgment late improvements utilizing multi-view data. Likewise there is a overview of past and current advancements in the demonstrating and acknowledgment

of human movement. The diverse sorts of human body modelling range from body Coarse portrayal, for example, 3D super ellipsoids, bounding.

The decision of a proper body model relies upon the application. Face recognition or face identification concept compares an input image (probe) against a database (gallery) and reports a match, if any. The purpose of face authentication and identification is to verify the claim of the identity of an individual face of the student in an input image, while face tracking and estimation methods continuously identify the location and possibly the orientation of the student face in an image sequence in real time. Face Detection in the Coloured Images is one of the techniques for automatically detecting human faces in digital colour images.

CHAPTER-2

LITERATURE SURVEY

2.1 Implementation of Smart Classroom Using WAGO PLC

Vibhuti, Shimi S.L., Said that With the increase in room energy demand both energy management and sustainable energy systems are used in smart rooms, which provides automatic control and monitoring of various room appliances. Smart room is a room that enables user to have high-level comfort with efficient use of electricity. This paper proposes a class room automation by considering human comfort and use of solar power as a renewable source of power. WAGO programmable logic controller (PLC) is used to provide solution for automatic control and monitoring of class room appliances such as lights, fan, air conditioning (AC) and projector. Arduino uno is also used as data acquisition device which is programmed to acquire sensor data and generate output signal in accordance to input of WAGO PLC. Real time status of various input sensors, and electrical appliances can also be monitored through PLC Ethernet gateway on PC as well as wirelessly on smart phone through Wi-Fi. Class room appliances will turn ON to provide workable environment only when occupancy is detected by PIR sensors. The room automation system consist of sensors (PIR sensor, Temperature sensor, and lux sensor), Wago PLC, arduino uno, Wi-Fi router, photovoltaic panels and solar charge controller.

2.2 Learning the Classroom Automation Preferences with Low User Intervention

Feng-Cheng Chang, Hsiang-Cheh Huang, Liou Chu., Said that With the affordable Internet of Things (IoT) devices, the number of smart classrooms are increasing. There are researches on how to incorporate the IoT technology into the pedagogy. We put the emphasis on classroom automation which enables the teacher to flexibly configure the smart devices without coding. It is achieved by a framework on top of the physical IoT network. In the framework, the automation process is modeled as a state transition engine. The teacher only needs to signal the engine to take a few system state snapshots as the preferences. Once the preference model is derived by the learning process, an event would trigger the engine to compute the suggested

system states from this model. Then the automation process invokes the predefined actions to reach the target system states. The framework allows the engineer to provide the basic functions to configure the system, while keeping the user intervention low at providing the training data. In addition to describing the example applications of the framework, a simple use case is also simulated to demonstrate how to design a learning mechanism for this framework.

2.3 An Approach Towards Building an IoT Based Smart Classroom

Ani R, Krishna S, Akhil H, Arun U Said that IoT (Internet of Things) is a dynamic innovation with a powerful impact on today's world which can make human life simple and effortless. The scope of this field is limitless and has emerged as a winner in various areas ranging from Medicine, Engineering, Computer Science, Space and Technology, Automobiles and so on. The centre of purpose is utilizing IoT based technology in accomplishing automation for classrooms. In this paper, we propose an approach to control and manage electrical equipment's such as fans and lights based on human presence. Our focus is towards building a solution which could help in reducing overutilization of energy resources. A camera is used for recognizing the presence of people in the classroom and for analyzing their seating position. Here a classroom is divided into two segments. Whenever a human presence is detected in a particular segment then the light and fan will be switched ON. The reasonable objective of this paper is how to build up a smart classroom where we can automate the electrical equipment's with a focus towards energy conservation.

2.4 Smart Attendance System Based on Facial Recognition using Raspberry Pi

Vijayakumar M., et al.(2021) Said that smart attendance system that utilizes facial recognition technology to automate the process of taking attendance. The proposed system is designed using Raspberry Pi, a low-cost, credit-card sized computer that can be used to develop various embedded applications. The system consists of a Raspberry Pi camera module, which captures the images of students, and a facial recognition algorithm, which recognizes the faces of the students in the images. The algorithm compares the faces in the images with a pre-existing database of faces to identify the students and record their attendance. The proposed system is designed

to be easy to use and can be set up in any classroom. It eliminates the need for manual attendance taking, which can be time-consuming and error-prone. Additionally, the system is designed to be secure and reliable, with features such as password protection and backup storage. The authors conducted experiments to evaluate the performance of the proposed system, and the results showed that the system was able to accurately recognize faces and record attendance. The system was also found to be fast and efficient, with attendance records being updated in real-time. Overall, the paper presents an innovative and practical solution for automating the attendance process in classrooms using facial recognition technology and Raspberry Pi.

2.5 Development of an Attendance Management System Using RFID Technology

Bhavya S., et al.(2020) Said that attendance management system based on RFID (Radio Frequency Identification) technology. The system is designed to automate the attendance process in educational institutions, eliminating the need for manual attendance taking. The proposed system consists of an RFID reader, which is used to read the unique ID of RFID tags attached to students' ID cards. The system also includes a database management system that stores the attendance records and generates reports for further analysis. The authors conducted experiments to evaluate the performance of the proposed system, and the results showed that the system was able to accurately record attendance with minimal errors. The system was also found to be fast and efficient, with attendance records being updated in real-time. The paper also discusses the advantages of using RFID technology for attendance management, including improved accuracy, speed, and security. Additionally, the authors highlight the scalability and cost-effectiveness of the proposed system, making it a viable solution for educational institutions of all sizes. Overall, the paper presents a practical solution for automating the attendance process in educational institutions using RFID technology. The proposed system is reliable, efficient, and cost-effective, making it an attractive option for institutions looking to streamline their attendance management process.

2.6 Classroom Attendance Management System Using Face Recognition

Dafedar S., et al.(2019) Said that classroom attendance management system based on face recognition technology. The system is designed to automate the

attendance process in educational institutions, eliminating the need for manual attendance taking. The proposed system consists of a camera module that captures the images of students, and a facial recognition algorithm that recognizes the faces of the students in the images. The algorithm compares the faces in the images with a pre-existing database of faces to identify the students and record their attendance. The authors conducted experiments to evaluate the performance of the proposed system, and the results showed that the system was able to accurately recognize faces and record attendance. The system was also found to be fast and efficient, with attendance records being updated in real-time. The paper also discusses the advantages of using face recognition technology for attendance management, including improved accuracy, speed, and security. Additionally, the authors highlight the scalability and cost-effectiveness of the proposed system, making it a viable solution for educational institutions of all sizes. Overall, the paper presents a practical solution for automating the attendance process in educational institutions using face recognition technology. The proposed system is reliable, efficient, and cost-effective, making it an attractive option for institutions looking to streamline their attendance management process.

2.7 Smart Attendance System using Internet of Things (IoT)

Rajesh K., et al.(2018) Said that smart attendance system that utilizes Internet of Things (IoT) technology to automate the process of taking attendance. The proposed system is designed to be used in educational institutions and is capable of monitoring attendance in real-time. The proposed system consists of an RFID reader, which is used to read the unique ID of RFID tags attached to students' ID cards. The system also includes a Wi-Fi module, which is used to connect the system to the internet and transmit the attendance data to a cloud server. The attendance data is then analyzed and processed to generate reports. The authors conducted experiments to evaluate the performance of the proposed system, and the results showed that the system was able to accurately record attendance with minimal errors. The system was also found to be fast and efficient, with attendance records being updated in real-time. The paper also discusses the advantages of using IoT technology for attendance management, including improved accuracy, speed, and scalability. Additionally, the authors highlight the cost-effectiveness of the proposed system, making it a viable solution for educational institutions of all sizes. Overall, the paper presents an innovative and

practical solution for automating the attendance process in educational institutions using IoT technology. The proposed system is reliable, efficient, and cost-effective, making it an attractive option for institutions looking to streamline their attendance management process.

2.8 Automated Attendance Monitoring System using Fingerprint Recognition

Elsawah., et al.(2020) said that a literature review of various automated attendance monitoring systems. The authors discuss the advantages and disadvantages of different systems based on barcode, RFID, facial recognition, and fingerprint recognition technologies. The authors argue that fingerprint recognition-based attendance systems have several advantages, including high accuracy, reliability, and security. They highlight that fingerprint recognition technology has been widely used in various applications such as financial transactions, access control, and healthcare. The authors also discuss the challenges of using fingerprint recognition technology in attendance systems, such as the need for good quality fingerprints, and the possibility of spoofing or forging fingerprints. The literature review section of the paper includes several references to previous research in the area of automated attendance systems, providing a comprehensive overview of the state-of-the-art in this field. The authors conclude that fingerprint recognition-based attendance systems are effective and practical solutions for monitoring attendance, particularly in academic and industrial settings.

2.9 An Intelligent Classroom Attendance System that combines Face Recognition and Radio Frequency Identification (RFID) Technologies

Huang., et al.(2016) said that to accurately and efficiently track student attendance in a classroom setting. The system consists of a face recognition module and an RFID reader module, which are integrated into a single system. The face recognition module uses a camera to capture images of students' faces and compares them with the images stored in a database to identify each student. The RFID reader module reads the unique ID numbers of the RFID tags attached to the students' ID cards to further confirm their attendance. The system then generates a report of attendance records, which can be accessed by teachers and administrators in real-time. The

authors conducted experiments to evaluate the performance of the system using a dataset of 200 students. The results showed that the system achieved an accuracy rate of 98.5% in identifying students using face recognition and an accuracy rate of 100% in detecting the presence of RFID tags. The system also proved to be efficient in terms of speed and ease of use. Overall, the system proposed by Huang et al. provides an effective and efficient solution for classroom attendance tracking, which can help improve the accuracy of attendance records and reduce the workload of teachers and administrators.

CHAPTER-3

SYSTEM DESIGN

3.1 EXISTING SYSTEM

Ever since IOT has been introduced, most classroom spaces are increasingly made up of highly smart and logical devices that imprints in the minds of its occupants, the aura of technological advancement today. Smart classrooms may include cameras with image signal processing to take attendance, smart interactive boards and wireless projectors that helps to enhance the quality of learning. In , a very creative application of AI in classrooms are made which involves the assessment of the quality of teaching using complex face detection algorithms. In , they have proposed a mobile application that is used to control and monitor the usage of a student's mobile during class hours, while also taking attendance automatically. For the cause of saving power, a lighting control system using light sensors can be designed to turn on electrical tube-lights only when day light is insufficient.

Disadvantages

As a consequence, performance and productivity can be affected. The manual process of collecting attendance data for all your employees will also take time. You might also end up spending a lot of time maintaining scorecards, rectifying errors in time entry, and so on.

3.2 PROPOSED SYSTEM

In proposed system face detection-based attendance system by image processing using raspberry-pi. We have used image processing concept to detect each and every student is present or not. Face recognition system is widely used for human identification due to its capability to measure and subsequently identifies human identification. Camera module is WEB camera interfacing to the raspberry pi module. It issued for capturing an image and send captured image to the Raspberry pi module. And also at a time student is going to on his place automatically Fan and light will be with the help of the Piezo Sensor. Here we have to use the relay for on and off the appliances also by using IR sensor to detect the motion of a object(man) and automatically fan and light will be on/off, once the motion of object finded by IR Sensor.

Images of the attendance area, such as classrooms, are captured using cameras the acquired images are pre-processed to enhance their quality and prepare them for future analysis. They may involve techniques such as image resizing.

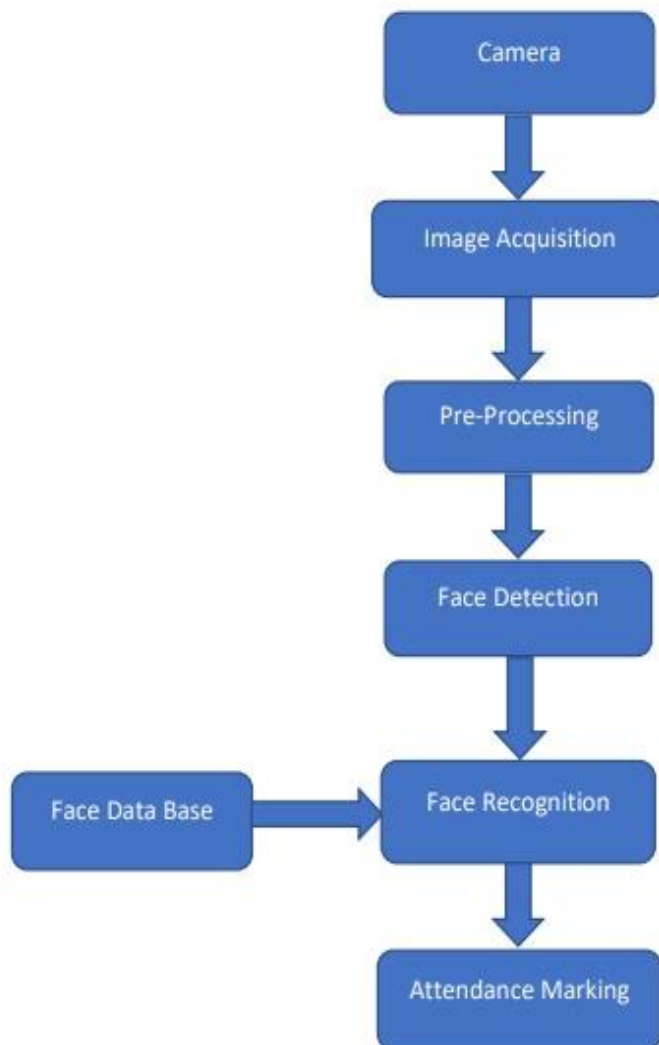


Fig.3.1:Process of Attendance Marking

3.3 PROJECT IMPLEMENTATION

- We will be using the sensors such as piezo sensor, relay module, ir sensor, usb camera and a monitor in the proposed module.
- Here by using relay module we can turn on and off other devices such as fans and lights without any human involvement. The main purpose of the device is to control a high powered circuit using a low power signal.

- Here piezo sensors are used to capture the movement of the human being. Piezo sensors are used in thermal sensing applications such as security and motion detection.

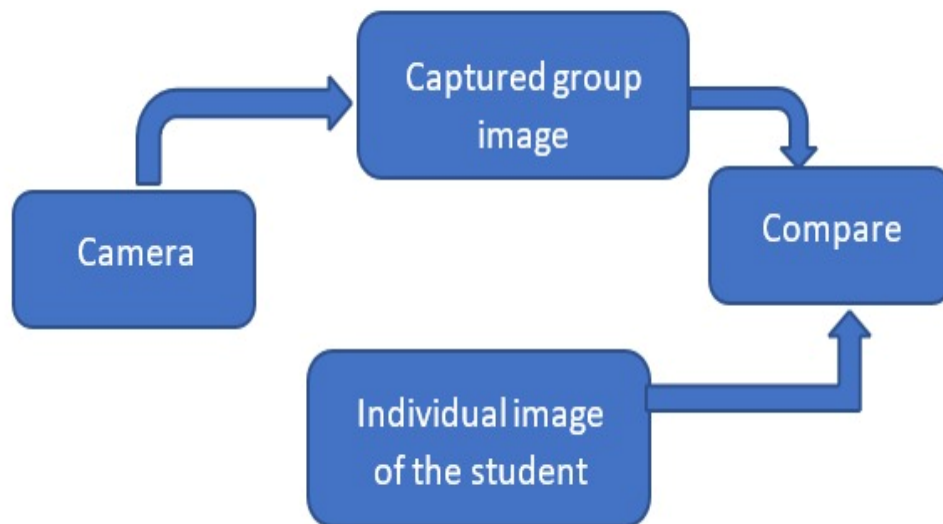


Fig.3.2:Process Involved in Attendance Tracking

- Each student or employee would have their face registered in a facial recognition system. This involves capturing an image of their face and creating a template that can be used for comparison. When the person arrives at the class or workplace, they stand in front of a camera that is connected to the facial recognition system.
- The camera captures an image of their face, which is then compared to the registered template using a complex algorithm. If there is a match between the two images, attendance is recorded in real-time.
- Digital Image Processing can be used for attendance tracking in a few different ways. One way is to use facial recognition technology to identify individuals as they enter a room or building. This can be done by comparing the faces of people entering the space to a database of known faces. If a match is found, then the individual can be marked as present.
- Another way to use digital image processing for attendance tracking is to use object detection algorithms to detect when people enter or exit a room. This can be done by placing cameras near entrances or exits and analyzing the video

footage in real-time. The algorithm can then determine when people are entering or leaving the space, and mark them as present or absent accordingly.

Advantages

These systems can help reduce the time and effort required to record attendance, minimize errors, and provide more accurate and timely attendance data. They can also help improve security and prevent fraud by verifying the identity of the person present.

PROJECT DESIGN

3.4 BLOCK DIAGRAM

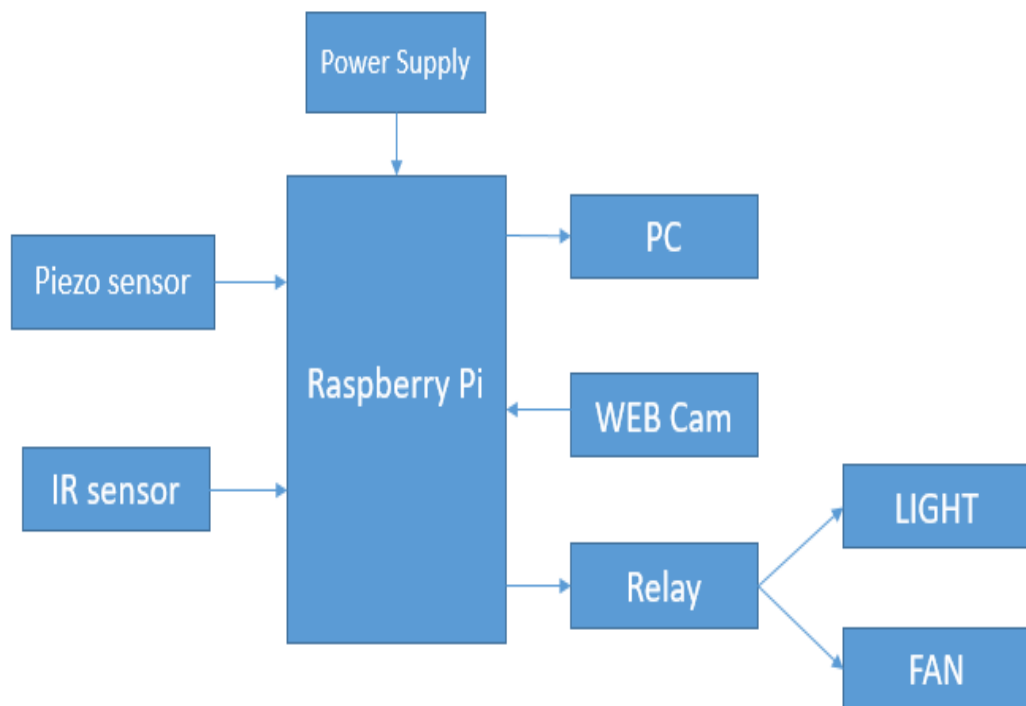


Fig.3.3:Block Diagram

The Figure 3.3 says that IR sensor are used to detect the presence of students in the classroom. These sensors are placed at the entrance of the classroom and can detect the movement of people passing by. If there is no movement detected for a certain amount of time, it means that the classroom is empty and the automation system

can turn off the lights and fans. The fans in the classroom can be controlled by the automation system based on the temperature and the number of students in the classroom. The automation system can turn on or off the fans based on the temperature sensors installed in the classroom. The automation system can also control the lights in the classroom. The IR sensors can detect the presence of students in the classroom, and if the students are not present, the system can turn off the lights to save energy. The system can also adjust the brightness of the lights based on the natural light coming into the classroom. The Raspberry Pi is the brain of the automation system. It receives input from the IR sensors and temperature sensors, and then it sends output signals to control the fans and lights in the classroom.

The piezo sensor is used to detect when a student enters the classroom. The sensor can detect the vibrations while entering and send a signal to the Raspberry Pi to register attendance. The camera module is used to capture images of the students as they tap their ID cards on the desk. The camera module is connected to the Raspberry Pi, which processes the images to identify the students and mark their attendance. The Raspberry Pi is the central processing unit of the attendance tracking system. It receives input signals from the piezo sensor and captures images from the camera module. The Raspberry Pi processes the signals and images to identify the students and mark their attendance

3.5 HARDWARE REQUIREMENTS

- Raspberry Pi
- WEB Cam
- IR sensor
- Piezo sensor
- Relay
- Power Supply

CHAPTER-4

HARDWARE EXPLANATION

4.1 RASPBERRY PI

Raspberry Pi Basic Hardware Setup

Extra Hardware

You Will Need the Raspberry Pi board contains a processor and graphics chip, program memory (RAM) and various interfaces and connectors for external devices. Some of these devices are essential, others are optional. RPi operates in the same way as a standard PC, requiring a keyboard for command entry, a display unit and a power supply. It also requires 'mass-storage', but a hard disk drive of the type found in a typical PC is not really in keeping with the miniature size of RPi. Instead we will use an SD Flash memory card normally used in digital cameras, configured in such a way to 'look like' a hard drive to RPi's processor. RPi will 'boot' (load the Operating System into RAM) from this card in the same way as a PC 'boots up' into Windows from its hard disk.

The following are essential to get started:

- SD card containing Linux Operating system
- USB keyboard
- TV or monitor (with HDMI, DVI, Composite or SCART input)
- Power supply (see Section 1.6 below)
- Video cable to suit the TV or monitor used recommended optional extras include:
- USB mouse
- Internet connection, Model A or B: USB Wi-Fi adaptor
- Internet connection, Model B only: LAN (Ethernet) cable
- Powered USB hub

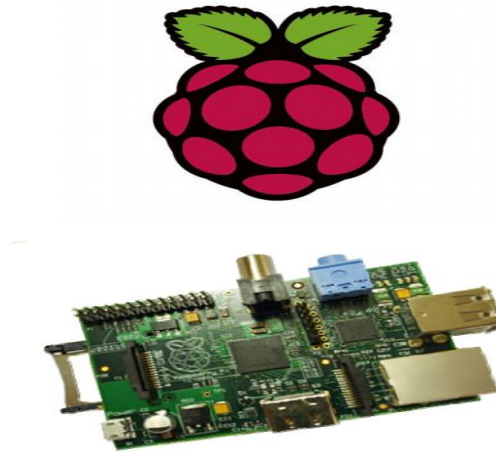


Fig.4.1:Raspberry Pi

Connecting Everything Together

1. Plug the preloaded SD Card into the RPi.
2. Plug the USB keyboard and mouse into the RPi, perhaps via a USB hub. Connect the Hub to power, if necessary.
3. Plug a video cable into the screen (TV or monitor) and into the RPi.
4. Plug your extras into the RPi (USB WiFi, Ethernet cable, external hard drive etc.). This is where you may really need a USB hub.
5. Ensure that your USB hub (if any) and screen are working.
6. Plug the power supply into the mains socket.
7. With your screen on, plug the power supply into the RPi microUSB socket.
8. The RPi should boot up and display messages on the screen. It is always recommended to connect the MicroUSB power to the unit last (while most connections can be made live, it is best practice to connect items such as displays with the power turned off). The RPi may take a long time to boot when powered-on for the first time, so be patient!

Operating System SD Card:

As the RPi has no internal mass storage or built-in operating system it requires an SD card preloaded with a version of the Linux Operating System.

- You can create your own preloaded card using any suitable SD card (4GBytes or above) you have to hand. We suggest you use a new blank card to avoid arguments over lost pictures.
- Preloaded SD cards will be available from the RPi Shop.

Keyboard & Mouse:

Most standard USB keyboards and mice will work with the RPi. Wireless keyboard/mice should also function, and only require a single USB port for an RF dongle. In order to use a Bluetooth keyboard or mouse you will need a Bluetooth USB dongle, which again uses a single port. Remember that the Model A has a single USB port and the Model B has two (typically a keyboard and mouse will use a USB port each).

Display:

There are two main connection options for the RPi display, HDMI (High Definition) and Composite (Standard Definition).

- HD TVs and many LCD monitors can be connected using a full-size 'male' HDMI cable, and with an inexpensive adaptor if DVI is used. HDMI versions 1.3 and 1.4 are supported and a version 1.4 cable is recommended. The RPi outputs audio and video via HDMI, but does not support HDMI input.
- Older TVs can be connected using Composite video (a yellow-to-yellow RCA cable) or via SCART (using a Composite video to SCART adaptor). Both PAL and NTSC format TVs are supported. When using a composite video connection, audio is available from the 3.5mm jack socket, and can be sent to your TV, headphones or an amplifier. To send audio to your TV, you will need a cable which adapts from 3.5mm to double (red and white) RCA connectors. Note: There is no analogue VGA output available. This is the connection required by many computer monitors, apart from the latest ones. If you have a monitor with only a D-shaped plug containing 15 pins, then it is unsuitable.

Raspberry pi Port specification:

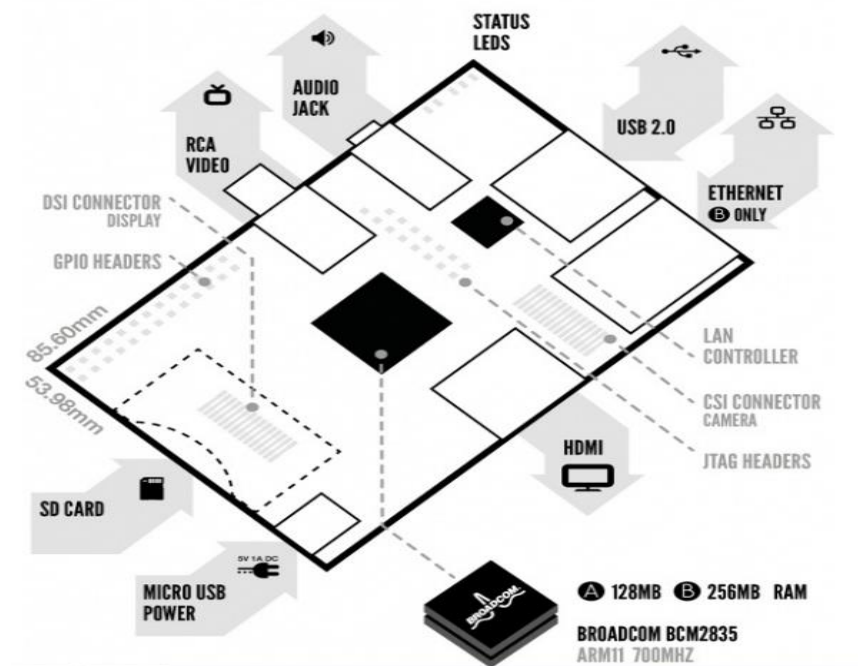


Fig.4.2:Raspberry Pi Port specification

Power Supply:

The unit is powered via the microUSB connector (only the power pins are connected, so it will not transfer data over this connection). A standard modern phone charger with a microUSB connector will do, providing it can supply at least 700mA at +5Vdc. Check your power supply's ratings carefully. Suitable mains adaptors will be available from the RPi Shop and are recommended if you are unsure what to use.

Note: The individual USB ports on a powered hub or a PC are usually rated to provide 500mA maximum. If you wish to use either of these as a power source then you will need a special cable which plugs into two ports providing a combined current capability of 1000mA.

Cables:

You will need one or more cables to connect up your RPi system.

- Video cable alternatives: o HDMI-A cable o HDMI-A cable + DVI adapter o Composite video cable o Composite video cable + SCART adaptor
- Audio cable (not needed if you use the HDMI video connection to a TV)
- Ethernet/LAN cable (Model B only).

Additional Peripherals:

You may decide you want to use various other devices with your RPi, such as Flash Drives/Portable Hard Drives, Speakers etc.

Internet Connectivity:

This may be via an Ethernet/LAN cable (standard RJ45 connector) or a USB WiFi adaptor. The RPi Model B Ethernet port is auto-sensing which means that it may be connected to a router or directly to another computer (without the need for a crossover cable).

USB hub:

In order to connect additional devices to the RPi, you may want to obtain a USB hub, which will allow multiple devices to be used. It is recommended that a powered hub is used - this will provide any additional power to the devices without affecting the RPi itself. A USB 2.0 model is recommended. USB 1.1 is fine for keyboards and mice, but may not be fast enough for other accessories.

Case:

Since the RPi is supplied without a case, it will be important to ensure that you do not use it in places where it will come into contact with conductive metal or liquids, unless suitably protected.

Expansion & Low-Level Peripherals:

If you plan on making use of the low-level interfaces available on the RPi, then ensure you have a suitable plug for the GPIO header pins. Also if you have a particular low-level project in mind, then ensure you design-in suitable protection circuits to keep your RPi safe.

4.2 Raspberry Pi Advanced Setup (Geeks only)

Finding hardware and setting up:

You'll need a preloaded SD card, USB keyboard, TV/Monitor (with HDMI/ DVI/ Composite/SCART input), and power supply (USB charger or a USB port from a powered USB Hub or another computer). You'll likely also want a USB mouse, a case, and a USB hub (a necessity for Model A). A powered USB hub will reduce the demand on the RPi. To connect to the Internet, you'll need either an Ethernet/LAN cable (Model B) or a USB WiFi adaptor (either model). When setting up, it is advisable to connect the power after everything else is ready.

Serial connection:

The Serial Port is a simple and uncomplicated method to connect to the RPi. The communication depends on byte wise data transmission, is easy to setup and is generally available even before boot time.

First interaction with the board:

Connect the serial cable to the COM port in the RPi, and connect the other end to the COM port or USB Serial Adapter in the computer.

Serial Parameters:

The following parameters are needed to connect to the RPi. All parameters except Port_Name and Speed are default values and may not need to be set. Port_Name: Linux automatically assigns different names for different types of serial connectors.

Choose your option:

- Standard Serial Port: ttyS0 ... ttySn
- USB Serial Port Adapter: ttyUSB0 ... ttyUSBn
- Speed: 115200

- Bits: 8
- Parity: None
- Stop Bits: 1
- Flow Control: None The Serial Port is generally usable by the users in the group dialout. To add oneself to the group dialout the the following command needs to be executed with root privileges.

Super Easy Way using GNU Screen:

Enter the command below into a terminal window screen Port_Name 115200

Super Easy Way using Minicom Run minicom with the following parameters:

```
minicom -b 115200 -o -D Port_Name
```

GUI method with GtkTerm:

Start GtkTerm,

select Configuration->Port and enter the values above in the labelled fields.

Windows Users:

Windows 7 or Vista users must download putty or a comparable terminal program. Users of XP and below can choose between using putty and HyperTerminal.

First Dialog:

If you get the prompt below, you are connected to the Raspberry Pi shell!

```
prompt> #
```

First command you might want try is "help":

prompt> # help

If you get some output, you are correctly connected to the Raspberry Pi! Congratulations!

SD card setup:

Now we want to install a GNU/Linux distro on an SD card and make space for our stuff. You can use either an SD or SDHC card. In the latter case of course take care that your PC card reader also supports SDHC. Be aware that you are not dealing with an x86 processor, but instead a completely different architecture called ARM, so don't forget to install the ARM port for the distro you are planning to use.

Formatting the SD card via the mkcard.txt script:

1. Download mkcard.txt .
2. \$ chmod +x mkcard.txt
3. \$./mkcard.txt /dev/sdx, where x is the letter of the card.

You can find this by inserting your card and then running `dmesg | tail`. You should see the messages about the device being mounted in the log. Mine mounts as sdc. Once run, your card should be formatted.

4.3 Classification of Raspberry Pi's

There are several types of Raspberry Pi, each with its own unique features and specifications. Here are some of the most popular types of Raspberry Pi:

- Raspberry Pi 4 Model B: This is the latest and most powerful Raspberry Pi board available, featuring a 64-bit quad-core ARM Cortex-A72 processor, up to 8GB of RAM, USB 3.0 and Gigabit Ethernet ports, and support for dual 4K displays.
- Raspberry Pi 3 Model B+: This board features a 64-bit quad-core ARM Cortex-A53 processor, up to 1GB of RAM, Wi-Fi, Bluetooth 4.2, and Gigabit Ethernet.

- Raspberry Pi Zero W: This is a low-cost, ultra-compact board that features a 1GHz single-core ARM11 processor, 512MB of RAM, Wi-Fi, and Bluetooth 4.1.
- Raspberry Pi Compute Module 4: This is a more industrial-focused board, featuring a quad-core ARM Cortex-A72 processor, up to 8GB of RAM, and support for PCIe, multiple displays, and dual cameras.
- Raspberry Pi Pico: This is not a traditional Raspberry Pi board but is a microcontroller board featuring the Raspberry Pi RP2040 microcontroller. It includes 2MB of flash memory, 26 GPIO pins, and can be programmed in C++ or MicroPython.

Overall, each Raspberry Pi board has its own strengths and weaknesses and is suitable for different types of projects and applications.

4.4 Usage of Raspberry Pi in Automation System

Raspberry Pi is a small, affordable, and versatile computer that can be used in various automation systems. It can run various operating systems, including Linux-based ones, and supports a wide range of programming languages such as Python, C++, and Java. In an automation system, Raspberry Pi can be used to collect data from sensors and other devices, process and analyze the data in real-time, control various automation devices, and communicate with other devices in the system. It can also be used as an HMI to interact with the system, display real-time data, alarms, and trends.

Raspberry Pi can be a cost-effective and flexible solution for automation systems, especially for small-scale and medium-scale applications. It can be easily integrated with other devices and systems using various communication protocols such as Modbus, MQTT, and OPC-UA. It can also be used for edge computing, which involves processing data at the edge of the network, reducing network latency and improving system response time.

4.5 IR Sensor

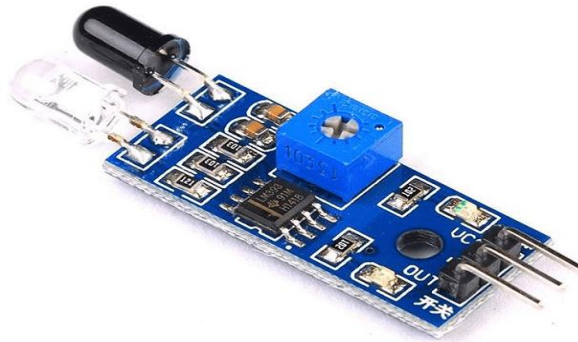


Fig.4.3:IR Sensor

An infrared sensor is an electronic device that emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. These types of sensors measures only infrared radiation, rather than emitting it that is called as a passive IR sensor. Usually in the infrared spectrum, all the objects radiate some form of thermal radiations. These types of radiations are invisible to our eyes that can be detected by an infrared sensor. The emitter is simply an IR LED (Light Emitting Diode) and the detector is simply an IR photodiode which is sensitive to IR light of the same wavelength as that emitted by the IR LED. When IR light falls on the photodiode, the resistances and these output voltages, change in proportion to the magnitude of the IR light received.

IR Sensor Circuit Diagram and Working Principle

An infrared sensor circuit is one of the basic and popular sensor module in an electronic device. This sensor is analogous to human's visionary senses, which can be used to detect obstacles and it is one of the common applications in real time. This circuit comprises of the following components

LM358 IC 2 IR transmitter and receiver pair

Resistors of the range of kilo ohms.

Variable resistors.

LED (Light Emitting Diode).

In this project, the transmitter section includes an IR sensor, which transmits continuous IR rays to be received by an IR receiver module. An IR output terminal of the receiver varies depending upon its receiving of IR rays. Since this variation cannot be analyzed as such, therefore this output can be fed to a comparator circuit. Here an operational amplifier (op-amp) of LM 339 is used as comparator circuit. When the IR receiver does not receive a signal, the potential at the inverting input goes higher than that non-inverting input of the comparator IC (LM339). Thus the output of the comparator goes low, but the LED does not glow. When the IR receiver module receives signal to the potential at the inverting input goes low. Thus the output of the comparator (LM 339) goes high and the LED starts glowing.

IR Sensor circuit

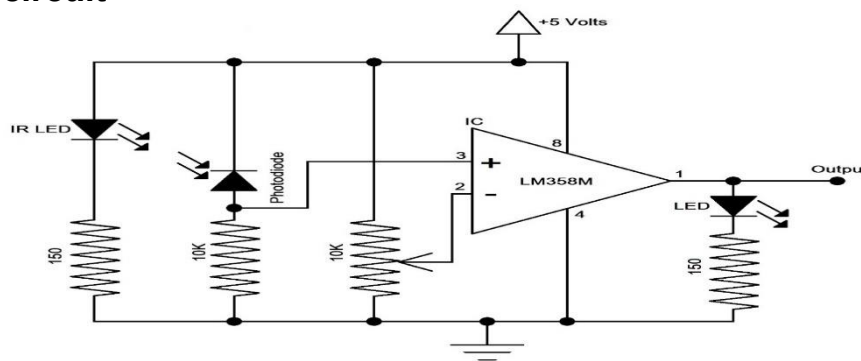


Fig.4.4:IR Sensor circuit diagram

Resistor R1 (100), R2 (10k) and R3 (330) are used to ensure that minimum 10 mA current passes through the IR LED Devices like Photodiode and normal LEDs respectively. Resistor VR2 (preset=5k) is used to adjust the output terminals. Resistor VR1 (preset=10k) is used to set the sensitivity of the circuit Diagram. Read more about IR sensors.

Different Types of IR Sensors and Their Applications

IR sensors are classified into different types depending on the applications. The speed sensor is used for synchronizing the speed of multiple motors. The temperature sensor is used for industrial temperature control. PIR sensor is used for automatic door opening system and Ultrasonic sensor are used for distance measurement.

IR Sensor Applications

Infrared (IR) sensors are devices that can detect infrared radiation emitted by objects and convert it into an electrical signal. Here are some brief explanations of the applications of IR sensors:

- IR sensors can be used for proximity sensing, such as recognizing an object or person, by detecting their presence. They can be found in touchless faucets, hand dryers, and automatic door openers.
- IR sensors can be employed for object detection, such as when looking for objects on a conveyor belt. When objects are detected in the incorrect location, they can be used in manufacturing and industrial applications to start processes or sound alarms.
- IR sensors can detect motion by observing variations in IR radiation. They can be incorporated into automatic doors, lighting systems, and security systems.
- IR sensors can detect the amount of IR radiation an object emits and use that information to calculate the temperature of the object. They can be utilized in HVAC systems, industrial processes, and medical equipment.
- Flame detection: By detecting the IR radiation that flames emit, IR sensors can identify the presence of flames. They can be utilized in industrial furnaces, fire suppression systems, and fire alarms.

In general, IR sensors can be used for a variety of sensing and detection tasks and have a wide range of applications in numerous industries. IR sensors are used in various Sensor based projects and also in various electronic devices which measures the temperature that are discussed in the below.

Radiation Thermometers

IR sensors are used in radiation thermometers to measure the temperature depend upon the temperature and the material of the object and these thermometers have some of the following features

- Measurement without direct contact with the object.
- Faster response.
- Easy pattern measurements.

Flame Monitors

These types of devices are used for detecting the light emitted from the flames and to monitor how the flames are burning. The Light emitted from flames extend from UV to IR region types. PbS, PbSe, Two-color detector, pyro electric detector are some of the commonly employed detector used in flame monitors.

Moisture Analyzers

Moisture analyzers use wavelengths which are absorbed by the moisture in the IR region. Objects are irradiated with light having these wavelengths (1.1 μm , 1.4 μm , 1.9 μm , and 2.7 μm) and also with reference wavelengths. The Lights reflected from the objects depend upon the moisture content and is detected by analyzer to measure moisture (ratio of reflected light at these wavelengths to the reflected light at reference wavelength). In GaAs PIN photodiodes, Pbs photoconductive detectors are employed in moisture analyzer circuits.

IR Imaging Devices

IR image device is one of the major applications of IR waves, primarily by virtue of its property that is not visible. It is used for thermal imagers, night vision devices, etc.



Fig.4.5:IR Imaging devices

For examples Water, rocks, soil, vegetation, an atmosphere, and human tissue all features emit IR radiation. The Thermal infrared detectors measure these radiations in IR range and map the spatial temperature distributions of the object/area on an image. Thermal imagers usually composed of a Sb (indium antimonite), Gd Hg (mercury-doped germanium), Hg Cd Te (mercury-cadmium-telluride) sensors.

An electronic detector is cooled to low temperatures using liquid helium or liquid nitrogen's. Then the Cooling the detectors ensures that the radiant energy (photons) recorded by the detectors comes from the terrain and not from the ambient temperature of objects within the scanner itself an IR imaging electronic devices.

Thus, this is all about IR sensor circuit with working and applications. These sensors are used in many sensor based electronics projects.

4.6 Web Cam

A **webcam** is a video camera which feeds its images in real time to a computer or computer network, often via USB, Ethernet or Wi-Fi. Their most popular use is the establishment of video links, permitting computers to act as videophones or videoconference stations. This common use as a video camera for the World Wide Web gave the webcam its name. Other popular uses include security surveillance and computer vision. Webcams are known for their low manufacturing cost and flexibility, making them the lowest cost form of video telephony. They have also become a source of security and privacy issues, as some built-in webcams can be remotely activated via spyware.

LENS

Webcams typically include a lens, an image sensor, support electronics, and may also include a microphone for sound. Various lenses are available, the most common in consumer-grade webcams being a plastic lens that can be screwed in and out to focus the camera. Fixed focus lenses, which have no provision for adjustment, are also available. As a camera system's depth of field is greater for small image formats and is greater for lenses with a large f-number (small aperture), the systems used in webcams

have a sufficiently large depth of field that the use of a fixed focus lens does not impact image sharpness to a great extent.

Image sensors can be CMOS or CCD, the former being dominant for low-cost cameras, but CCD cameras do not necessarily outperform CMOS-based cameras in the low cost price range. Most consumer webcams are capable of providing VGA resolution video at a frame rate of 30 frames per second. Many newer devices can produce video in multi-megapixel resolutions, and a few can run at high frame rates such as the PlayStation Eye, which can produce 320×240 video at 120 frames per second.

Support electronics read the image from the sensor and transmit it to the host computer. The camera pictured to the right, for example, uses a Sonix SN9C101 to transmit its image over USB. Typically, each frame is transmitted uncompressed in RGB or YUV or compressed as JPEG. Some cameras, such as mobile phone cameras, use a CMOS sensor with supporting electronics "on die", i.e. the sensor and the support electronics are built on a single silicochip to save space and manufacturing costs.



Fig.4.6:Web Cam

PORTABILITY:

Most webcams feature built-in microphones to make video calling and videoconferencing more convenient. The USB video device class (UVC) specification allows for interconnectivity of webcams to computers without the need for proprietary device drivers. Microsoft Windows XP SP2, Linux and Mac OS X (since October 2005) have UVC support built in and do not require extra device drivers, although they are often installed to add additional features.

FEATURES (LOGITECH WEBCAM C100):-

Plug-and-play setup (UVC)

Video capture: Up to 640 x 480 pixels

Photos: Up to 1.3 megapixels (software enhanced)

Frame rate: Up to 30 frames per second (with recommended system)

Hi-Speed USB 2.0 certified

Fixed focus

Universal clip fits notebooks, LCD or CRT monitor

4.7 Piezo Sensor



Fig.4.7:Piezo sensor

Piezoelectric sensors are electronic components that are able to convert a mechanical or thermal input into an electrical signal. It works by the principle of electromechanical coupling. Piezoelectricity is the phenomenon that some materials will produce an electrical voltage when subjected to mechanical stress and vice versa.

They use the piezoelectric effect to measure the electrical potential caused by applying mechanical force to a piezoelectric material. They are based on the principle of electromechanical energy conversion and primarily measure force, as well as other quantities such as pressure, acceleration, temperature, and strain by converting the acquired data to an electrical charge.

Flex motions, touch, vibrations, and shock measurement all use piezoelectric sensors. They are used in sectors such as healthcare, aerospace, consumer electronics, and nuclear instrumentation. They are important as vibration and shock shorten the life of electronic and electromechanical systems so delicate leads and bond

wires tend to be stressed. Due to impact and impulse shock, an intermittent failure may occur as a result of system failure.

How Do Piezoelectric Sensors Work?

Piezoelectric sensors work on the principle of the piezoelectric effect. Piezoelectric originates from the Greek word piezein, which literally means to squeeze or press. As the latter suggests, we are squeezing quartz crystals to make an electric voltage. Hence, piezoelectric sensors work by applying mechanical energy to a crystal in the following steps:

1. A piezoelectric crystal is placed between two metal plates that are in a perfect balance (even if they're not symmetrically arranged) and does not conduct an electric current.
2. Metal plates apply Mechanical force or stress to the material. Electric charges forced within the crystal are out of balance. Excess negative and positive charges appear on opposite sides of the crystal face.
3. The metal plate collects these charges and produces a voltage that sends an electrical current through a circuit. This transforms to piezoelectricity.

It is important to understand the behaviour of the piezoelectric crystals when determining the piezoelectric effect. Piezoelectric Sensors based on the piezoelectric effect can operate from transverse, longitudinal, or shear forces, and are insensitive to electric fields and electromagnetic radiation. The response is also very linear over wide temperature ranges, making it an ideal sensor for rugged environments.

Benefits of Piezoelectric Sensors

The benefits of these sensors are great and include:

- They offer very high-frequency **responses** to rapidly sense parameter changes.
- High **transient response** as they are able to detect the events of microseconds and also give the linear output.
- They offer a high **output** to measure the electronic circuit.

- They have **small dimensions** and have rugged construction which means they are easy to handle.

Piezoelectric

As the name suggests, the piezoelectric type uses the piezoelectric ceramic's piezoelectric effect & pulse current to make the metal plate vibrate & generate sound. This kind of buzzer is made with a resonance box, multi resonator, piezoelectric plate, housing, impedance matcher, etc. Some of the buzzers are also designed with LEDs.

The multi resonator of this mainly includes ICs and transistors. Once the supply is given to this resonator, it will oscillate and generates an audio signal with 1.5 to 2.kHz. The impedance matcher will force the piezoelectric plate to produce sound.

4.8 Relay Module

A relay is an electrically operated switch. Current flowing through the coil of the relay creates a magnetic field which attracts a lever and changes the switch contacts. The coil current can be on or off so relays have two switch positions and they are double throw (changeover) switches. Relays allow one circuit to switch a second circuit which can be completely separate from the first. For example a low voltage battery circuit can use a relay to switch a 230V AC mains circuit. There is no electrical connection inside the relay between the two circuits; the link is magnetic and mechanical.

The coil of a relay passes a relatively large current, typically 30mA for a 12V relay, but it can be as much as 100mA for relays designed to operate from lower voltages. Most ICs (chips) cannot provide this current and a transistor is usually used to amplify the small IC current to the larger value required for the relay coil. The maximum output current for the popular 555 timer IC is 200mA so these devices can supply relay coils directly without amplification.



Fig.4.8:Relay module

Relays are usually SPDT or DPDT but they can have many more sets of switch contacts, for example relays with 4 sets of changeover contacts are readily available. Most relays are designed for PCB mounting but you can solder wires directly to the pins providing you take care to avoid melting the plastic case of the relay. The animated picture shows a working relay with its coil and switch contacts. You can see a lever on the left being attracted by magnetism when the coil is switched on. This lever moves the switch contacts. There is one set of contacts (SPDT) in the foreground and another behind them, making the relay DPDT.

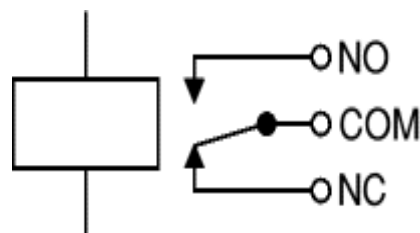


Fig.4.9:Relay Switch

The relay's switch connections are usually labeled COM, NC and NO:

- **COM** = Common, always connect to this, it is the moving part of the switch.
- **NC** = Normally Closed, COM is connected to this when the relay coil is **off**.
- **NO** = Normally Open, COM is connected to this when the relay coil is **on**.

4.9 Software Environment

Python:

Python is a high-level, interpreted, interactive and object-oriented scripting language. Python is designed to be highly readable. It uses English keywords frequently where as other languages use punctuation, and it has fewer syntactical constructions than other languages.

- **Python is Interpreted** – Python is processed at runtime by the interpreter. You do not need to compile your program before executing it. This is similar to PERL and PHP.
- **Python is Interactive** – You can actually sit at a Python prompt and interact with the interpreter directly to write your programs.

- **Python is Object-Oriented** – Python supports Object-Oriented style or technique of programming that encapsulates code within objects.
- **Python is a Beginner's Language** – Python is a great language for the beginner-level programmers and supports the development of a wide range of applications from simple text processing to WWW browsers to games.

Python Features

Python's features include –

- **Easy-to-learn** – Python has few keywords, simple structure, and a clearly defined syntax. This allows the student to pick up the language quickly.
- **Easy-to-read** – Python code is more clearly defined and visible to the eyes.
- **Easy-to-maintain** – Python's source code is fairly easy-to-maintain.
- **A broad standard library** – Python's bulk of the library is very portable and cross-platform compatible on UNIX, Windows, and Macintosh.
- **Interactive Mode** – Python has support for an interactive mode which allows interactive testing and debugging of snippets of code.
- **Portable** – Python can run on a wide variety of hardware platforms and has the same interface on all platforms.
- **Extendable** – You can add low-level modules to the Python interpreter. These modules enable programmers to add to or customize their tools to be more efficient.
- **Databases** – Python provides interfaces to all major commercial databases.
- **GUI Programming** – Python supports GUI applications that can be created and ported to many system calls, libraries and windows systems, such as Windows MFC, Macintosh, and the X Window system of Unix.
- **Scalable** – Python provides a better structure and support for large programs than shell scripting.

Apart from the above-mentioned features, Python has a big list of good features, few are listed below –

- It supports functional and structured programming methods as well as OOP.
- It can be used as a scripting language or can be compiled to byte-code for building large applications.
- It provides very high-level dynamic data types and supports dynamic type checking.
- It supports automatic garbage collection.
- It can be easily integrated with C, C++, COM, ActiveX, CORBA, and Java.

Python is available on a wide variety of platforms including Linux and Mac OS X. Let's understand how to set up our Python environment.

Getting Python

The most up-to-date and current source code, binaries, documentation, news, etc., is available on the official website of Python <https://www.python.org>.

Windows Installation

Here are the steps to install Python on Windows machine.

- Open a Web browser and go to <https://www.python.org/downloads/>.
- Follow the link for the Windows installer python-XYZ.msi where XYZ is the version you need to install.
- To use this installer python-XYZ.msi, the Windows system must support Microsoft Installer 2.0. Save the installer file to your local machine and then run it to find out if your machine supports MSI.
- Run the downloaded file. This brings up the Python install wizard, which is really easy to use. Just accept the default settings, wait until the install is finished, and you are done.

The Python language has many similarities to Perl, C, and Java. However, there are some definite differences between the languages.

Script Mode Programming

Invoking the interpreter with a script parameter begins execution of the script and continues until the script is finished. When the script is finished, the interpreter is no longer active.

Let us write a simple Python program in a script. Python files have extension **.py**. Type the following source code in a test.py file –

```
print"Hello, Python!"
```

We assume that you have Python interpreter set in PATH variable. Now, try to run this program as follows –

```
$ python test.py
```

This produces the following result –

```
Hello, Python!
```

Flask Framework:

Flask is a web application framework written in Python. Armin Ronacher, who leads an international group of Python enthusiasts named Pocco, develops it. Flask is based on Werkzeug WSGI toolkit and Jinja2 template engine. Both are Pocco projects.

Http protocol is the foundation of data communication in world wide web. Different methods of data retrieval from specified URL are defined in this protocol.

The following summarizes different http methods –

Sr.No	Methods & Description
1	GET Sends data in unencrypted form to the server. Most common method.

2	HEAD Same as GET, but without response body
3	POST Used to send HTML form data to server. Data received by POST method is not cached by server.
4	PUT Replaces all current representations of the target resource with the uploaded content.
5	DELETE Removes all current representations of the target resource given by a URL

By default, the Flask route responds to the **GET** requests. However, this preference can be altered by providing methods argument to **route()** decorator.

In order to demonstrate the use of **POST** method in URL routing, first let us create an HTML form and use the **POST** method to send form data to a URL.

Save the following script as login.html

```
<html>
<body>
<form action="http://localhost:5000/login" method="post">
<p>Enter Name:</p>
<p><input type="text" name="nm"/></p>
<p><input type="submit" value="submit"/></p>
</form>
</body>
```

</html>

Now enter the following script in Python shell.

```
from flask import Flask, redirect, url_for, request
app=Flask(__name__)
@app.route('/success/<name>')
def success(name):
    return'welcome %s'% name
@app.route('/login',methods=['POST','GET'])
def login():
    if request.method=='POST':
        user=request.form['nm']
        return redirect(url_for('success',name= user))
    else:
        user=request.args.get('nm')
        return redirect(url_for('success',name= user))
if __name__ == '__main__':
    app.run(debug =True)
```

After the development server starts running, open **login.html** in the browser, enter name in the text field and click **Submit**.

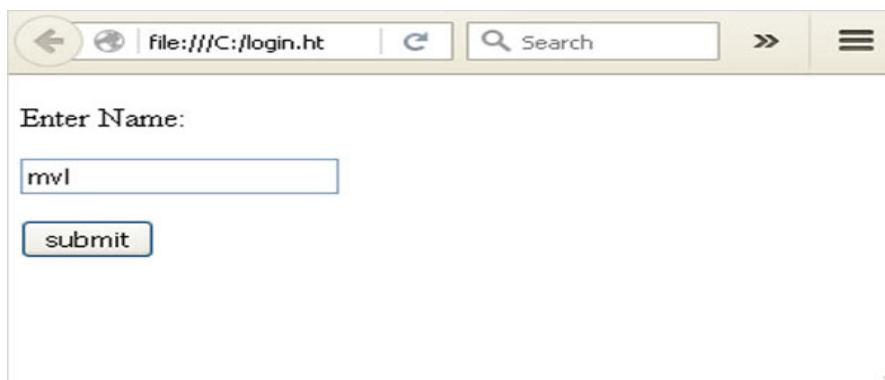
A screenshot of a web browser window. The address bar shows the file path 'file:///C:/login.ht'. The main content area displays a simple login form. It starts with the text 'Enter Name:' followed by a text input field. The input field contains the text 'mvl'. Below the input field is a button labeled 'submit'.

Fig.4.10:Data entry

Form data is POSTed to the URL in action clause of form tag.

http://localhost/login is mapped to the **login()** function. Since the server has received data by **POST** method, value of 'nm' parameter obtained from the form data is obtained by –

```
user = request.form['nm']
```

It is passed to **'/success'** URL as variable part. The browser displays a **welcome** message in the window.

Change the method parameter to **'GET'** in **login.html** and open it again in the browser. The data received on server is by the **GET** method. The value of 'nm' parameter is now obtained by –

```
User = request.args.get('nm')
```

Here, **args** is dictionary object containing a list of pairs of form parameter and its corresponding value. The value corresponding to 'nm' parameter is passed on to **'/success'** URL as before.

What is Python?

Python is a popular programming language. It was created in 1991 by Guido van Rossum.

It is used for:

- web development (server-side),
- software development,
- mathematics,
- system scripting.

What can Python do?

- Python can be used on a server to create web applications.
- Python can be used alongside software to create workflows.
- Python can connect to database systems. It can also read and modify files.
- Python can be used to handle big data and perform complex mathematics.
- Python can be used for rapid prototyping, or for production-ready software development.

Why Python?

- Python works on different platforms (Windows, Mac, Linux, Raspberry Pi, etc).
- Python has a simple syntax similar to the English language.
- Python has syntax that allows developers to write programs with fewer lines than some other programming languages.
- Python runs on an interpreter system, meaning that code can be executed as soon as it is written. This means that prototyping can be very quick.
- Python can be treated in a procedural way, an object-orientated way or a functional way.
- The most recent major version of Python is Python 3, which we shall be using in this tutorial. However, Python 2, although not being updated with anything other than security updates, is still quite popular.
- In this tutorial Python will be written in a text editor. It is possible to write Python in an Integrated Development Environment, such as Thonny, Pycharm, Netbeans or Eclipse which are particularly useful when managing larger collections of Python files.

Python Syntax compared to other programming languages

- Python was designed to for readability, and has some similarities to the English language with influence from mathematics.
- Python uses new lines to complete a command, as opposed to other programming languages which often use semicolons or parentheses.
- Python relies on indentation, using whitespace, to define scope; such as the scope of loops, functions and classes. Other programming languages often use curly-brackets for this purpose.

Python Install

Many PCs and Macs will have python already installed.

To check if you have python installed on a Windows PC, search in the start bar for Python or run the following on the Command Line (cmd.exe):

```
C:\Users\Your Name>python --version
```

To check if you have python installed on a Linux or Mac, then on linux open the command line or on Mac open the Terminal and type:

```
python --version
```

If you find that you do not have python installed on your computer, then you can download it for free from the following website: <https://www.python.org/>

Python Quickstart

Python is an interpreted programming language, this means that as a developer you write Python (.py) files in a text editor and then put those files into the python interpreter to be executed.

The way to run a python file is like this on the command line:

```
C:\Users\Your Name>python helloworld.py
```

Where "helloworld.py" is the name of your python file.

Let's write our first Python file, called helloworld.py, which can be done in any text editor.

```
helloworld.py  
print("Hello, World!")
```

Simple as that. Save your file. Open your command line, navigate to the directory where you saved your file, and run:

```
C:\Users\Your Name>python helloworld.py
```

The output should read:

```
Hello, World!
```

Congratulations, you have written and executed your first Python program.

OpenCV

OpenCV (Open Source Computer Vision) is a library of programming functions mainly aimed at real-time computer vision. Originally developed by Intel, it was later supported by Willow Garage and is now maintained by Itseez. The library is cross-platform and free for use under the open-source BSD license History Officially launched in 1999, the OpenCV project was initially an Intel Research initiative to advance CPU intensive applications, part of a series of projects including real-time ray tracing and 3D display walls. The main contributors to the project included a number of optimization experts in Intel Russia, as well as Intel's Performance Library Team. In the early days of OpenCV, the goals of the project were described as: Advance vision research by providing not only open but also optimized code for basic vision infrastructure. No more reinventing the wheel. Disseminate vision knowledge by providing a common infrastructure that developers could build on, so that code would be more readily readable and transferable. Advance vision-based commercial applications by making portable, performance-optimized code available for free—with a license that did not require code to be open or free itself.

The first alpha version of OpenCV was released to the public at the IEEE Conference on Computer Vision and Pattern Recognition in 2000, and five betas were released between 2001 and 2005. The first 1.0 version was released in 2006. In mid-2008, OpenCV obtained corporate support from Willow Garage.

CHAPTER-5

RESULTS

In our project, the raspberry pi is the most and important component. Because it stores the students data base of our project and the entire project program was stored in it. With the help of ir sensors we track the students in the class room. Within the field of view the ir sensors will detect the object movements and sense students presence by measuring the radiation of the moving objects.



Fig.5.1:Project Overview

Figure 5.1 says that we have divided the classroom into different sectors and we have placed the IR sensors in each sector. And when the person enters into the range of the ir sensor the fans and lights will automatically switch on and off using relay module. When the person move from one sector into another sector in the classroom the ir sensors will activate and find the student in which sector he was present and in that sector only the automation of fans and lights will switched on and the remaining sectors will be switched off.

And by using the piezo sensors and webcam module we will able to track the attendance of the student in the classroom. With the help of that the teacher can take the attendance through the mail. The attendance taken by the camera module will send the attendance to the registered mail id. So, with that teacher can take the attendance of the student without wasting any time in the classroom and the

attendance of the students will automatically go to the registered mail id in the raspberry pi.

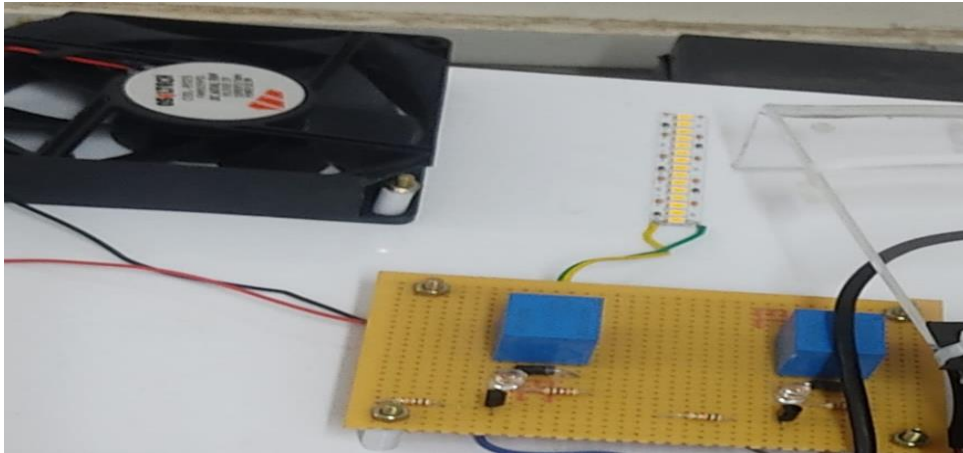


Fig.5.2:Automation of Light and Fan

Figure 5.2 says that it connect the light and fan switches to the relay module. Typically, there will be three pins on the relay module that correspond to the three pins on the switch. The common pin on the switch should be connected to the NO (normally open) pin on the relay module. Connect the wires to the relay module. There should be four pins on the relay module: VCC, GND, IN1, and COM. Connect the VCC pin to the positive power supply terminal, and the GND pin to the negative power supply terminal.

Connect the power supply to the microprocessor, and then connect the IR sensor and relay module to the microprocessor,. Connect the light and fan to the relay module. Written a program for the microprocessor that will read the IR sensor and control the relay module based on the sensor's input. For example, if the sensor detects movement in the classroom, the program should turn on the lights and fans. If there is no movement for a certain period, the program should turn off the lights and fans to save energy.

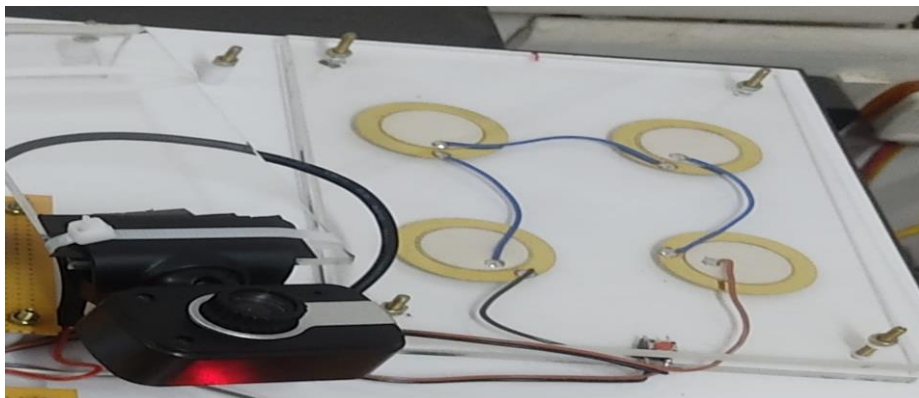


Fig.5.3:Camera Module and Piezo Sensor

Fig 5.3 says that piezo sensors can be used to detect the pressure of a person's footsteps as they enter or exit a room. By installing these sensors at the entrance of a classroom or office, the system can track the time and attendance of people entering and leaving the room.

We have Installed OpenCV and Python libraries on our Raspberry Pi. Connected a camera module to the Raspberry Pi board and ensure that it is working properly. We have Capture an image of the classroom using the camera module and Implemented a computer vision algorithm, such as face detection or object recognition, using OpenCV and Python to identify the students in the image. We have compared the recognized faces with the known faces in a database to determine which students are present in the classroom and record the attendance of the students who are present and store it in a registered mail id mentioned in the raspberry Pi.

STUDENT DETECTED

One attachment • Scanned by Gmail ⓘ



Fig.5.4:Student Detection

Figure 5.4 says that before taking the attendance the camera module will capture the students face and it will run the students face id in the given data base by using digital image processing. The first step is to pre-process the image to enhance its quality and remove any noise. This can be done by applying filters and the next step is to extract the features from the image, this can be done using various algorithms. Once the features are extracted, you can use them to search for similar images in a database.

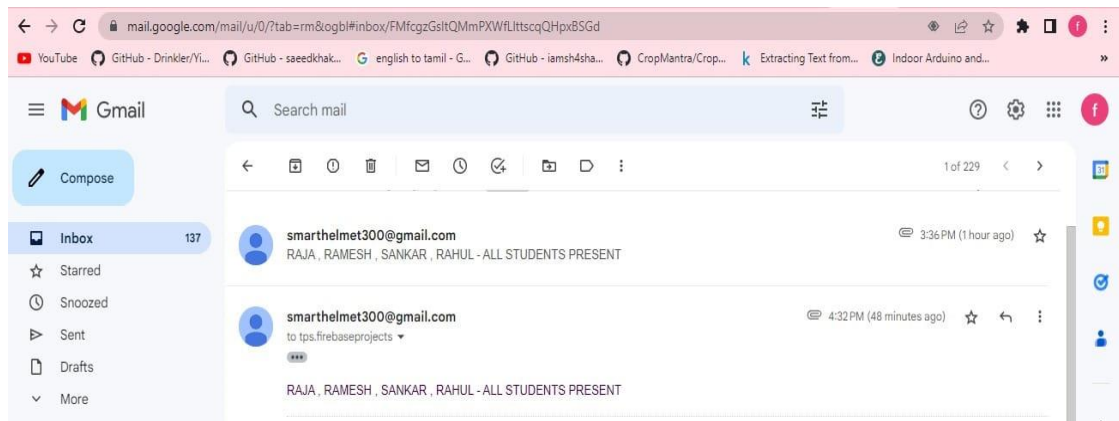


Fig.5.5:Student Attendance

Figure 5.5 says that after the detection of students face id in the data base the raspberry pi will identify the students name using digital image processing and it will send the students names as present to the mail id mentioned in the raspberry pi.

CHAPTER-6

CONCLUSION AND FUTURE WORK

The smart classroom concept described from a completely new perspective i.e. real-time feedback on activity around environment using Internet of Things (IoT). The main contribution of this proposed system is an innovative approach to a smart classroom environment and Attendance tracking system in Digital image processing. This perspective demands an understanding of problem statement so as to define parameters with further aim to create a better prologue for the system implementation. Our Proposed system mainly focuses on use of the monitoring and sensing technology to save the energy and detect the thief in an intelligent environment. The information collected can provide insight into classroom activity level by correlating the movement's existence and intensity.

Using Digital Image Processing (DIP) for classroom automation and attendance tracking has the potential to improve the efficiency and accuracy of the attendance-taking process, as well as reducing the workload for instructors. By automating the attendance tracking process, instructors can focus on teaching and engaging with their students, rather than spending time on manual record-keeping.

Facial recognition technology can be used to identify students as they enter the classroom, and object detection algorithms can be used to track movement and determine attendance. These technologies can be integrated with existing classroom management systems to streamline the process and provide real-time updates on attendance.

However, it is important to note that there are privacy concerns associated with using DIP for attendance tracking, and appropriate measures should be taken to protect students' data and privacy. Additionally, the technology is not foolproof and may encounter issues such as false positives or difficulties in identifying individuals accurately in low light or crowded environments.

6.1 Future Scope

In addition to facial recognition, other biometric modalities such as fingerprint recognition or voice recognition can be integrated into the system. This can help in situations where facial recognition may not be reliable, such as when students wear masks.

Implementation of an alert system: An alert system can be implemented to notify parents or guardians if their child is absent from class. This can help parents take necessary action if their child is missing school.

CHAPTER-7

REFERENCES

- [1]. Bhavya.S,Deepa.P.,&Amitha.G.(2020). Development of an Attendance Management System Using RFID Technology. International Journal of Engineering Research & Technology, 9(4), pp.342-346.
- [2]. Bo Chen; Mingguang Wu; Shuai Yao; Ni Binbin, (2006) "Zigbee Technology and its Application on Wireless Meter-Reading System", Industrial Informatics IEEE International Conference on, vol., no., pp.1257- 1260,16-18 doi:10.1109/INDIN.275820.
- [3].Cheng Pang, Valierry Vyatkin, Yinbai Deng, Majidi Sorouri, "Virtual smart metering in automation and simulation of energy efficient lightning system" IEEE2013.
- [4].Chih-Hung Wu, Etc,(2004) "Design of a Wireless Arm Based Automatic Meter Reading and Control System ", Power Engineering Society General Meeting. IEEE6-10, Vol.1, pp.957-962.
- [5].Dafedar.S, Gawande.N., & Deshpande. P(2019). Classroom Attendance Management System Using Face Recognition. International Journal of Innovative Technology and Exploring Engineering, 8(11), pp.2387-2390.
- [6].Elsawah.W., Al-Saedi, M. A., Al-Haddad, S. A., & Al-Jumeily, D. (2020). Automated Attendance Monitoring System using Fingerprint Recognition. International Journal of Advanced Computer Science and Applications, 11(5), pp.452-457.
- [7].Joga Rao.G, K. Siva Shankar " Smart Solar Charging Meter",International Journal of Scientific Research in Science, Engineering and Technology(IJSRSET), Print ISSN : 2395-1990, Online ISSN : 2394-4099,Volume 4 Issue 4, pp.701-704,March-April2018.
- [8].Himshekhhar Das, L.C.Saikia, "GSM Enabled Smart Energy Meter and Automation of Home Appliances", PP-978-1- 4678-6503-1, 2015 IEEE.
- [9].Huang, X., Liu, J., Zhou, Z., & Tan, T. (2016). An intelligent classroom attendance system based on face recognition and RFID. IEEE Transactions on Education, 59(4), 284-291. doi: 10.1109/TE.2016.2520439

- [10]. Luigi Martirano, Matteo Manganelli, Danilo Sbordone, "Design and classification of smart metering systems for the energy diagnosis of buildings"; IEEE2015.
- [11]. Ofoegbu Osita Edward, "An Energy Meter Reader with Load Control Capacity and Secure Switching Using a Password Based Relay Circuit", PP-978-1-4799-8311-7, "Annual Global Online Conference on Information and Computer Technology"; IEEE 2014
- [12]. Rajesh.K., Saravana Kumar.G., Manoj Prabhakar.N., & Aravind.R. (2018). Smart Attendance System using Internet of Things (IoT). International Journal of Pure and Applied Mathematics, 119(12), 1531-1539.
- [13]. Sahana M N, Anjana S, Ankith S, K Natarajan, K R Shobha, "Home energy management leveraging open IoT protocol stack ", PP- 978-1-4673-6670-0, "Recent Advances in Intelligent Computational Systems (RAICS)"; IEEE2015.
- [14]. Tsang.K.F, H.Y, Tung, K.L. Lam, (2009) "Zigbee: From Basics to Designs and Applications", Prentice Hall. [5] Li, Xiaoguang Hu, (2009) "Design of an Arm-Based Power Meter Having Wifi Communication Module" IEEE.
- [15]. Vijayakumar.M., Jeyaprabha.J., & Ayyanar.P. (2021). Smart Attendance System Based on Facial Recognition using Raspberry Pi. International Journal of Advanced Science and Technology, 30(5), pp.3614-3623.
- [16]. Widmer.J, Landis, "Billing metering using sampled values according IEC 61850-9-2 for substations", IEEE2014.
- [17]. Yingying Cheng, Huaxiao Yang, Ji Xiao, Xingzhe Hou, "Running State Evaluation Of Electric Energy Meter", PP978-1-4799-4565-8, "Workshop on Electronics, Computer and Applications"; IEEE2014.