

Energy Auditing and Attendance Monitoring System



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Abstract: Classrooms are learning spaces that are found in educational institutions of all kinds, from preschools to universities. The refining classroom-based activities like real time-based attendance monitoring and creation of a Knowledgebase are very important. Taking the accurate attendance of students at each classroom and keeping it on record is an uphill battle. Today, all teachers are taking the presence of students manually and marks it on paper. And finally, they enter data in the computer. So, this paper deals with a smart real-time human detection based attendance monitoring system. In this project-based course, a cloud-based weather classroom monitoring system that streams attendance and power consumption over the internet to the user at a remote location. The system is designed in a way that whenever the temperature exceeds a certain limit and when the brightness level decreases, the device automatically sends an email notification. This project is a cloud-based automation system which automatically switches ON and OFF the light, fan based on the presence of human.

I. INTRODUCTION

Internet of Things (IoT) is the idea of connecting physical devices, buildings and other gadgets embedded with electronics, software, sensors and actuators to the community which allows these items to gather, alternate and analyze the statistics. An entire IoT framework involves data collecting, information analysis, sensors setup and this framework has to be easily work on real global issues like surveillance system, clever home or smart town implementation, smart transportation and better health care. In the work of arts, it has been rationale to look at the utility of IoT inside the training place. Teaching and mastering systems may be considered because of the most vital activity in an educational institute. In maintaining the attendance of students IoT as a dynamic management plays a complicated and time-consuming task. This is necessary because the attendance record directly affects the academic performance of students which in turn also impacts the career. Routinely, attendance has been

handled through registers where teachers mark the student's attendance based on their presence in the classroom. The best way to avoid this problem is to replace the attendance record from manual entries to biometric-based attendance automation system.

Image Processing

Image processing is processing of pictures and fixing it with mathematical operations by any style of signal processing which loads a picture or a video, then the output will be provided either as an image or a parameters related to the image after image processing. Most image-processing techniques involve handling the image as a two-dimensional signal and applying customary signal-processing techniques to it. The images are refined as three-dimensional signals wherever the third-dimension being time or the coordinate axis. Image processing usually refers to the digital image process, but both optical and analog image processing is carried out. The procurement of pictures (producing the input image within the first place) is remarked as imaging.

Nearly associated with image process square measure special effects and pc vision. In special effects, pictures square measure manually made up of physical models of objects, lights and environment rather than being non-inheritable (via imaging devices like cameras) from natural scenes, as in most animated movies. Computer vision on the opposite hand commonly thought about high-level image process out of that, a computer/software intends to decipher the physical contents of a picture or a series of pictures (e.g., videos or 3D full-body resonance scans).

In emerging trends, science and technologies gains pictures conjointly for lot of broader scopes to the developing importance of scientific visualization (of usually large-scale advanced scientific/experimental data). Examples period multi-asset portfolio mercantilism in finance or embrace micro-array information in genetic analysis.

II. LITERATURE SURVEY

Srivish Pss^[9] uses RFID and face certification for identifying small and reliable classrooms. The RFID card is used to identification of each student uniquely using RFID card and for further verification face recognition is carried out. The system is trained using FEI face database for testing each student's face with six different poses with seven different head poses. The system is used for testing face verification and proxy attendance detection also the identification may be 98% correctly detected on two attempts. AniR^[1] makes daily routine to be made easily by the person's using IoT in many fields like medicine, automobile, space and technology etc.

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The main focus is automating classroom with the electrical equipment's like light and fan present in classroom for overutilization of electrical energy. Initially, a camera is fixed in classroom for recognizing the presence of students in classroom once the entry of person is carried out, it recognizes with the seating position and automatically switches ON the electrical equipment's.

Anisha Gupta^[2] designed and implemented an intelligent automated system using Ethernet for conserving electrical energy using an INTEL GALILEO development board. This idea is used for large universities and organizations to avoid human intervention and conserve resources. A development board can be placed as a server in the control room, it is made to connect with all the electrical equipment's in the every classroom to minimize the cost. And, a surveillance camera is fixed in each rooms so with the help of camera the server comes to know where the energy must be saved and used.

The Energy Preserving System for Smart Rooms(EPSSR) also proposes a concept of energy saving but in an very real way where every person can use, it includes ESP8266 chip a Wi-Fi chip and MCU capability to control lights in rooms. The concept is calculating number of person's entering the rooms using infrared sensors and chip, when each person enters the count gets incremented and light gets glow when the count is more than zero. And, when the person leaves the class one by one the count gets decreased when it reaches zero the light automatically gets switched OFF.

III. PROPOSED SYSTEM

Smart classroom energy auditing and attendance system is a critical task but with the fusion of IoT devices and computational algorithms like machine learning, computer vision techniques and data analysis, the monitoring task and scrutiny of student's performance in the class is maintained. The raspberry pi 3 processor is used to perform the functions of the smart classroom, the python programming language is used. To predict the names of all persons which is stored as a folder in the datasets, a machine learning algorithm is used. Initially, the images of students and staff are made to store in the datasets with the label of names. So, when analyzing the facial image for attendance the data gets entered as an entry for attendance with both the date and time the student entered and exit from the classroom. The face detection using Haarcascade filter is registering the video images which have been taken through mobile webcam and stores as a dataset named with the label of student's identification and face reorganization using LBP algorithm are the algorithms used for recognizing the face which is stored in the dataset it compares and chooses the face correctly and makes the entry.

With the help of camera and pressure gauge the availability of the person can be identified (i.e.), a student entering inside the class and goes to a side and makes the seating at that time it is not necessary to switch ON all the fans inside a classroom. It is sufficient when a single fan in that area gets ON by viewing with the camera and sense that a person made a seating in that place using pressure sensor it switches ON. In the case of light when the brightness level decreases, the LDR sensor senses the brightness level and makes the light switched ON and OFF when necessary.

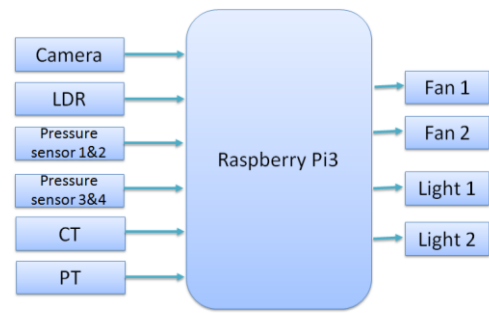


Fig 1. System Architecture

A. Collecting Datasets

The raspberry pi 3 uses a python programming language to run face recognition using the Internet of Things and Image processing. A VNC viewer is an interface platform that connects the raspberry pi with the monitor to ensure with coding and view the list of entered attendance based on date and time. In 'create_dataset' python programming dataset is being created using the IP webcam in the mobile device. The IP webcam in the mobile is used for scanning the video images of the person and store less than 30 images of each person in each dataset. The image capturing can be visualized to the user by the rectangular blue box, where the image inside the blue box will be stored in the dataset. The image keeps on capturing all the features by extending the count not more than 30 captured images are stored with an extension of 'png' format in a folder, the folder will be the student's name to register in the log when attendance is monitored.

The images are stored in the datasets taken via mobile it uses OpenCV to scan the facial images in all views and store it. Initially, when an image is captured in mobile the OpenCV shows to the user in the monitor with the blue rectangular box instructing that this image is captured. To use these different colors and thickness of the box it has been coded in the backend also numpy is used in image recognition for storing data in array format.

Face Reorganization using LBP algorithm

- The LBP is Local Binary Pattern which is a simple operator but very efficient one which can label the pixels of an image by each pixel of the neighbor which results as a binary number.
- As its discerning power and computational simplicity become more popular with its LBP texture operator in various applications. It can be seen as a consolidated approach to the structural models of texture analysis and also traditionally divergent statistics.
- One of the important property of the LBP operator in real-world applications with its robustness to monotonic gray-scale.
- The other important property is computational simplicity, to take out the challenge to undergo real-time objects for analyzing images.

B. Face Recognition

The FISHERFACE algorithm is used to detect the registered face from the dataset, the face must be recognized using the mobile webcam where the facial data gets checked with all the entries in the dataset. This system uses image processing, the images stored are extended with an extension of .png format. Once after the data are stored 'face_recognizer' is made to run, also IP webcam is used to recognize the face. When a single entry gets matched with the image it will mark with the thicker green box extended with the person name, it is made possible with the entries of each person storing as a folder. That folder will be named after the name of the student or the staff so, when face recognized properly using the algorithm it will be shown with the marking and the label named with the person.

Also, when each entry is made for the attendance it is made to store in the notepad as the entries with the date and time by including the import for handling with date and time. Each time the person enters and exit the classroom will be registered in the log for maintaining the attendance of students also to reduce the proxy attendance, this face recognition is used.

Face Detection using HAARCASCADE Filter

The work of HAARCASCADE filter is to find out where a face is located in the image. The face detection performs detection by scanning an image with different angles and looking for some simple patterns which denotes its presence. It scans up and appears in the center to present at a uniform size. Face detection determines where a face is located in an image. The face detection works by scanning up an image at different angles and searching for similar patterns that identify the presence of a face. The overall algorithm for face detector is detected with the flow detection of the face detection algorithm.

FISHERFACE Algorithm

The Eigenface is the initial method which become a successful technique for face recognition. The FISHERFACE algorithm is an enrichment of the Eigenface method that is when Fisher's Linear Discriminant Analysis (FLDA or LDA) is used for the dimensionality reduction. Eigenface is a label given to a group of eigenvectors for human face recognition when they are used in computer vision problem.

The FISHERFACE algorithm is used for face recognition where the images of face's are scanned as an training images with 100% efficiency. The trained images are tested and results will be provided with 93% of accuracy. Face recognition with FISHERFACE method not only performs an introduction to test face images with different color components yet also a copy of the original image.

C. Automating Electrical Equipment

The electrical equipment like light and fan are connected to the sensors like temperature sensor, LDR, current and voltage sensor through raspberry pi 3. The concept is when a student enters the classroom the light and fan have to be switched ON based on the number of places the students occupy. If a student entering the classroom is on the same side it is enough to switch ON the fan and light on that side to consume power

it can be identified when a student taking a seating the pressure sensor will be attached to every seat so that the persons can be identified.

When the person entering on one side it automatically switches ON the fan and light but by checking with the cloud-based weather conditions of the classroom. The temperature sensor senses the classroom temperature and switches ON the fan only if the temperature exceeds a certain limit. Also, in the case of an ambient light emitting sensor it analyzes the brightness level of the class once the student enters the classroom and if the level of brightness is less the light will be made to ON. Once after the student enters the classroom it checks with the side the student arriving and then checks with the weather conditions of the room like temperature level and brightness level and the process of switching the types of equipment ON/OFF will be automated.

D. Registering the Attendance

The student's face which are captured through the IP webcam in the mobile device is shown through the label in color image, it is stored as the database for attendance monitoring system. When the student enters the classroom the face of a person is recorded and made to store as the attendance recording system from where the eligibility to attend the examination will be automatically detected. It will be recorded that only the students attended the specific number of classes can appear for examination, by checking with the records the dataset gets processed.

IV. IMPLEMENTATION

A. VNC viewer

The VNC is a Virtual Network Computing which shares desktop by graphical system which utilizes the Remote Frame Buffer protocol (RFB) to manage other systems remotely. It performs actions of both the keyboard and mouse from one laptop to other one, relaying the graphical-screen renews back within the different direction over a network. VNC and RFB are certified emblems of RealVNC Ltd. within the United States and a few different countries.

RealVNC purchaser's victimization VNCviewer will play in full-screen mode they use the function-key F8, because of the default key for observing a choices menu. The server part of RealVNC permits a laptop to be remotely guarded by another system.

B. OpenCV

OpenCV is an open-source computer vision library available from internet sources. This library functions are written in C and C++ and runs beneath UNIX operating system and Windows OS. There is an effective improvement on interfaces for developing languages like Ruby, Python, Matlab etc. It was designed for machine potency and with a robust concentrate on a period of time applications. OpenCV is written in optimized C and might make the most of multicore processors.

The additional automatic optimization on Intel architectures [Intel] can buy Intel's Integrated Performance Primitives (IPP) libraries (IPP) which consist of low-level optimized routines in many distinct algorithmic areas. OpenCV automatically uses the acceptable IPP library at runtime if that library is put in it. The main goal OpenCV is to produce a simple usage of PC vision infrastructure which helps the individuals to build adequately refined vision applications faster. The library consists of more than five hundred activities in several areas like manufacturing plant product scrutiny, security, robotics medical imaging and also in camera calibration. Because PC vision and machine learning oftentimes linear unit go side by side, OpenCV collectively contains a general Machine Learning Library (MLL). The library is highly practical for the visual task which is core of OpenCV's mission and is used for any machine learning problem.

OpenCV (Open supply laptop vision) is a library functions predominantly prepared towards time period laptop vision. Basically, developed by Intel and was supported by more people, it supports deep learning frameworks like TensorFlow, Torch/PyTorch and Caffe.

Facial Recognition System

A face recognition system is a technique which experiences characteristic or collateral an individual from a digital image or video frame. The image is square measured in multiple ways, the biometric identification of systems work, normally it works by comparing hand-picked countenance from the listed images of faces among information. It is additionally represented as a Biometric AI primarily based application that will unconditionally determine an individual by analyzing patterns that supported the person's facial consistency and shape. The initio is a variety of PC applications, it is seen wider and is used on mobile operating system in alternative styles of technology like artificial intelligence in recent times. It is usually used to access security in management systems and also compared to alternative life science like a fingerprint or eye iris recognition systems. The certainty of a biometric identification system as biometric technology is not up to iris recognition and fingerprint recognition. Recently, its additional fashion has become an advertisement identification and selling tool. The other applications embrace advanced human-computer interaction, video police investigation, automatic compartmentalization of pictures, and video information, among others.

FISHERFACE is one in every favored algorithms utilized in facial recognition and is stronger believed to be greater alternative techniques, like EIGENFACE owing to the hassle to extend the partition between classes in the training process.

C. RASPBERRY PI 3

The Raspberry Pi is a set of mini single board CPU which is developed in United Kingdom by the Raspberry Pi Foundation to market the teaching of technology for faculties and also for developing countries. The actual picture became much more in style than expected, achieving more than the desired target in marketplace for users like artificial intelligence. It doesn't embody components or cases however

some accessories are enclosed in many formal and informal bundles.

The foundation of Raspberry Pi organization consists of two main ideas, initially two models were developed by the Raspberry Pi Foundation. Then, the Pi developed a Model B the muse, which came upon Raspberry Pi commercialism with Eben. The executive officer developed the third model, the B+. Raspberry Pi commercialism is answerable for developing the technology whereas the muse is an academic charity to market the teaching of basic technology for faculties and developing countries.

D. IP WEBCAM

IP Webcam is an Android application that converts the mobile device into a network camera which will remotely view videos that are watched real-time. The captured video can be viewed via a browser or stream it over the mobile device.

After installing the application on the mobile device configuration setup includes login and password, resolution, frames per second, image quality and TCP port. When the process is set, press 'Start Server' on the application, it displays the URL of video where it can viewed remotely. Then, knowing that the system needs a Java browser plug-in to view the video in the browser. In addition, it may also take snapshots using the 'Take Immediate Photo' feature.

V. RESULT ANALYSIS

<i>DESCRIPTION</i>	<i>ACTION</i>	<i>OUTPUT</i>
A room filled with person's (detects using PIR sensor)	Temperature is high	Fan switches ON automatically
	Brightness level is low	Light switches ON automatically
A room not filled with person's (detects using PIR sensor)	Temperature is high	No process
	Brightness level is low	No process
A person enters the room	Camera reads each person's face	Updates attendance (one person once in a hour)

In energy auditing and attendance monitoring system the classroom can be monitored thoroughly through a camera placed in a room. It monitors each entries inside the room and updates the attendance for each hour. And, with the help of sensors the system detects room temperature and brightness level of room and automatically ON's the light and fan in the room, if the persons are available in classroom. In case, when the temperature gets higher and number of persons present in classroom is zero, then it does not gets ON.

The same is followed for light in case on lighter brightness.

Campus Internet of Things Framework.” 978-1-5386-1104-3/17/\$31.00
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VI. CONCLUSION

Smart classroom energy auditing and attendance system is a critical task but with the inclusion of IoT devices and computational algorithms like face detection using Haarcascade filter, face reorganization using LBP algorithm, computer vision techniques, data analysis and machine learning, the supervision task and analysis of student's performance in the class is maintained. The raspberry pi 3 processor is used to perform the functions of smart classrooms to store images as a folder in the datasets machine learning algorithm is used. Initially, the images of students and staff are made to store in the datasets with the label of names. So, when analyzing the facial image for attendance the data gets entered as an entry for attendance with both the date and time the student entered and exit from the classroom. Then, the smart energy auditing of the classroom can be made by a student entry inside the class and occupying aside and makes the seating at that time it is not necessary to switch ON all the fans inside a classroom. It is sufficient when a single fan in that area gets ON by viewing with the camera and sense that a person made a seating in that place using pressure sensor it switches ON. In case of light when the brightness level decreases, the LDR sensor senses the level and makes the light switched ON and OFF when necessary. This makes the classroom smart by auditing the weather conditioning and attendance of the classroom by consuming energy.

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