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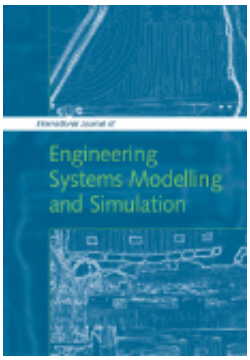

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Artificial intelligence-based conference automation system involving image recognition

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Abstract: Conference hall automation system is very useful in the modern world primarily to reduce manpower required for monitoring the conference. From the security point of view, the entry of only the authorised persons to the conference hall is of prime importance. Therefore, artificial intelligence-based image recognition plays a vital role in the proposed automation system. Face is the essential part of the human physique that uniquely identifies a person. Utilising the face traits as biometric, the face recognition-based participants' entry to the conference hall is implemented. Attendance database will be automatically updated whenever the participants enter and leave the conference hall. An attendance confirmation message will be sent to the participants registered e-mail ID once the participant enters the conference hall. The proposed conference hall automation system is superior to the conventional conference hall system in terms of man power requirement, automation, energy efficiency and security.

Keywords: image processing; Python OpenCV; automation; artificial intelligence; Raspberry Pi.

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1 Introduction

The automation system is a technology developed to do tasks smartly according to minimal to zero human intervention. It reduces the manual effort to control and operate in any situation (Ani et al., 2018). The introduction of an automation system (Guan et al., 2017) is to alert the person about the events going to happen in the conference hall, save energy, labour and materials for improving quality, accuracy and precision. When all is said in done, people are more inclined to mistakes. Notwithstanding, a mechanised framework can work with consideration, flexibility, and right around zero blunder, in this way preferring manual techniques (Gupta et al., 2015).

Image processing is the process of analysing images through an algorithm. It allows the possibility of applying a wide range of algorithms to the input data to avoid modifications and alterations during processing. Each algorithm performs distinct analysis over fixed sequences of operations performed at each pixel of an image. Such procedures are executed in parallel using a pipeline of processors, each acting on the leading one's output. The processor executes the operation on the image, pixel by pixel. As soon as the first processor executes the first

operation on the first pixel and its neighbours, the following processor begins to perform the subsequent process, and so on. Considering each processor has the output value of its operation at every pixel, it can also figure out these values if desired. The benefit of including face recognition using image processing is to relieve the most demanding process, attendance marking (Lim et al., 2017).

The paramount necessity of connecting image processing and automation is to reduce the human resources simultaneously getting the work done without compromising the attendees' comfortability. There is an absence of automation or an artificial technique to monitor and guide the attendees for an event in the currently existing system. There is a lot of human intervention required to coordinate the conference attendees and control the electronic devices. Considering the current COVID-19 situation, it is practically difficult to have a large number in a closed space. Thereby reducing the human intervention required for coordinating both safety and the comfortability of the attendees are met.

In this paper, the person's face is detected by the Raspberry PI camera module, and the alert about the events is given by voice message before 10 minutes of the event beginning. This project also offers an intelligent door locking system when the event begins. Once the conference started, the topic's content to be discussed is displayed by replacing the old content. Electricity is one of the most important means, which plays a vital role in our everyday life. It is primary to conserve electricity being it gets dissipated due to the negligence of people. This project automates this process by sensing the people's presence inside the room and turning OFF and ON the lights and fan.

2 Related works

AI-based attendance monitoring system by Reddy et al. (2019), uses the technique of using face detection and recognition to constantly recognise students who are going to class or not and mark their attendance by comparing their faces with the database to match and mark their attendance. This biometric facial image takes a photo of a person using the camera and contrasts that image and compares the image with the image it is stored with at the time of registration and if it matches, it marks frequency and monitors student performance continuously We can use the concept of artificial intelligence to monitor student attendance, for example by capturing moving images of the student when present in the classroom to analyse student data for how long the student is in class.

In AI-based techniques for real-time face recognition (Pattnaik and Mohanty, 2020), two approaches for auto attendance system are discussed. Real-time presence monitoring uses a web application that can be managed remotely using a local server and the Amazon Web Service cloud recognition application programming interface. The Five sections present in the first approach are face detection, preprocessing, training and facial recognition through which the presence will be recorded and sent to the respective teacher. The second approach relies on the AWS Acknowledgement API which processes data in the cloud.

Rajamanogaran et al. (2020) proposed a contactless attendance management system using artificial intelligence in which a database was built containing images of students' faces in a particular class. The knowledge obtained by using the convolutional neural network (CNN) is perfectly reused using transfer learning. The system is designed to increase students' engagement time in class, to communicate frequently with parents, to avoid proxies' attendance, and to generate detailed reports for future reference.

Teoh et al. (2020) describe the concept of how to design and develop facial recognition systems through deep learning using OpenCV in Python. The database was created by incorporating image samples taken at different lighting conditions, with different facial expressions and at different postures.

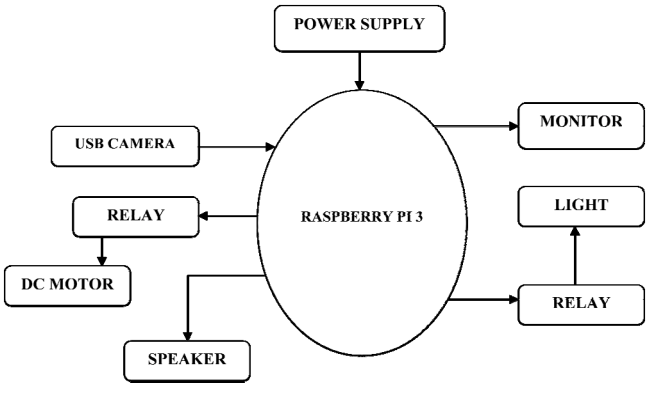
Bah and Ming (2020) presented a new method that uses the local binary pattern (LBP) algorithm in combination with advanced image processing techniques such as contrast adjustment, bilateral filters, histogram equalisation, and image blending to address some of the problems that hinder facial recognition accuracy and to improve the LBP code, thereby increasing the accuracy of the overall facial recognition system (Bah and Ming, 2020; Ayarpadi et al., 2012).

3 Methodology

3.1 Conference hall automation

The proposed conference hall automation system consists of two parts. The first section is face recognition using image processing and the second section is automation. Conference hall automation is shown in Figure 1.

Figure 1 Conference hall automation

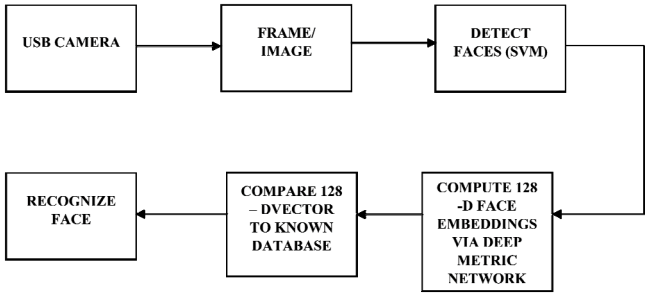


3.1.1 Face recognition using image processing

Image processing is transforming an image into a digital form while operating on it to get an improved image or extract information from it. The most crucial step face detection is a primary system for which the input is an image from a USB camera connected to the raspberry pi. The output of this primary system serves as the input for

face detection. The image acquired through the camera is processed with CNN, and the datasets are obtained. These datasets are matched with the pre-processed data in the database and correspondence, the attendee is identified. At the conference hall entrance, the attendee needs to click the switch that turns on the USB camera, following which the face detection process takes place. On successful facial detection and matching, the attendance database is updated, and the automation is initiated. Steps involved in face recognition are shown in Figure 2.

Figure 2 Face recognition via image processing



3.1.2 Automation

Conference room automation is the technology that can enable managing multiple collaboration tasks through a manageable and intuitive user interface. As the primary step of the project, face recognition is completed, and with the updated database, the automation is initiated. Upon successful attendance, record the doors open for a fixed period for the candidate to enter and close automatically. The lights are automatically switched ON as soon as the first attendee enters. A voice prompt intimates the participants by alerting the remaining time until the start of the event. Precisely at the beginning of the event, the same voice prompts the participants that the conference is about to start and the lights are either dimmed or switched OFF. The contents on the projector change to the conference presentation as soon as the lights are turned OFF. Just as the conference is over, the projector is turned OFF, the lights are turned ON, and the doors are opened.

4 Results and discussion

With the prospect of connecting image processing and automation, the artificial intelligence-based, mostly automated system is developed. The system utilises Raspberry Pi for detecting face and acknowledging the attendees' face, which is already saved in a database. The CNN is carried out for the analysis of the datasets due to its high precision. The raspberry pi also serves as the core for the automation of the conference hall. The attendee is alerted through an e-mail about the event. Upon the candidate's presence, the AI scheme will mechanically acknowledge the face of the person and update the database. The doors will automatically open for a determined period allowing the candidate to enter the hall and then close through the command from the raspberry pi. Before the commencement of the event, a voice intimates regularly the time prevailing to the event's start. Once the event has started, the screen will automatically change to the content of the event. Also, upon the command from the raspberry pi, the AI system will turn ON/OFF the lights considering the people's convenience. Here the face recognition and the entire automation system will be done by using our machine learning algorithm.

Hardware implementation using Raspberry PI 3+ is shown in Figure 3. Pin 3 is connected to the power supply board. Pin 18 is connected to the relay controlling the lights. Pin 19 and 20 are connected to the relay controlling the doors. Pin 39 is connected to the switch. Raspberry Pi environment setup is shown in Figure 4. Capturing of face image, face recognition and the database updating are demonstrated in Figures 5 and 6. E-mail alert message given to the participants are shown in Figure 7. Automation of conference hall door is demonstrated in Figures 8(a) and 8(b).

Figure 3 Hardware assembly (see online version for colours)

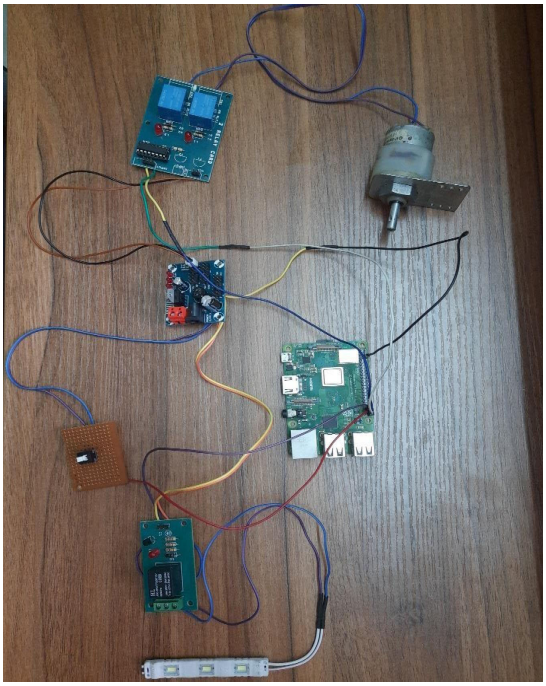


Figure 4 Raspberry Pi environment setup (see online version for colours)

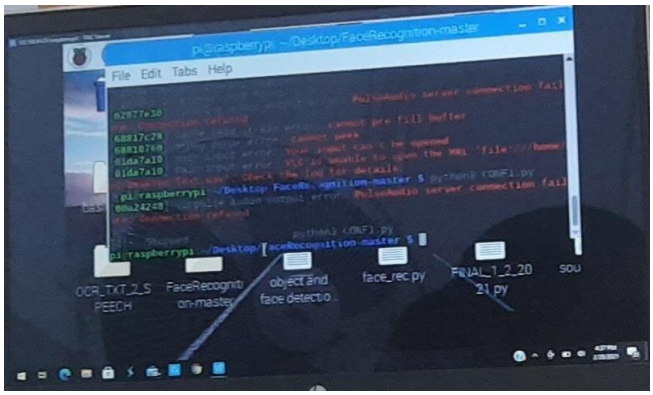


Figure 5 Capturing image (see online version for colours)

Figure 6 Face recognition

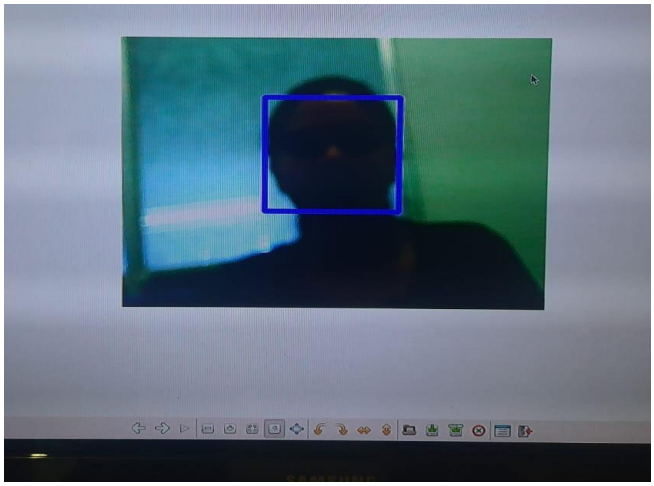


Figure 7 Intimation mail and attendance updation (see online version for colours)

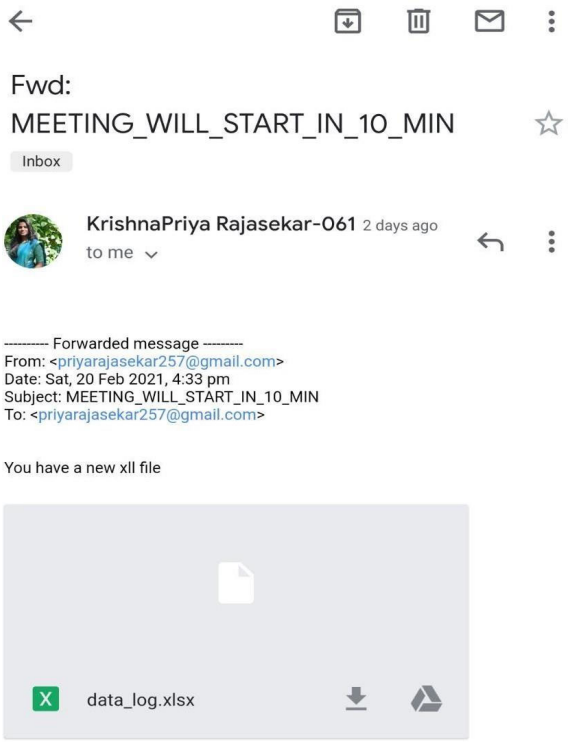
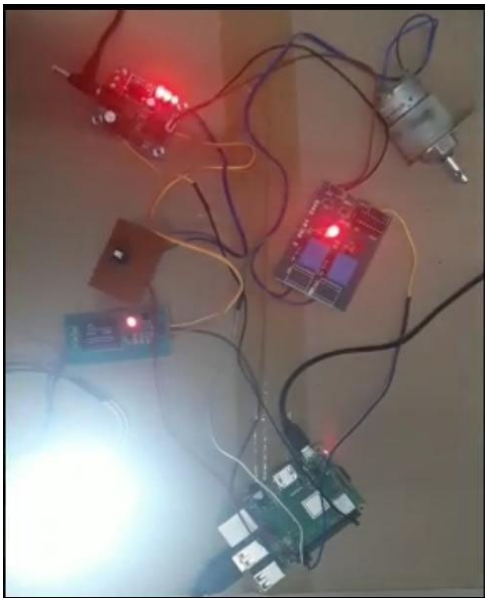
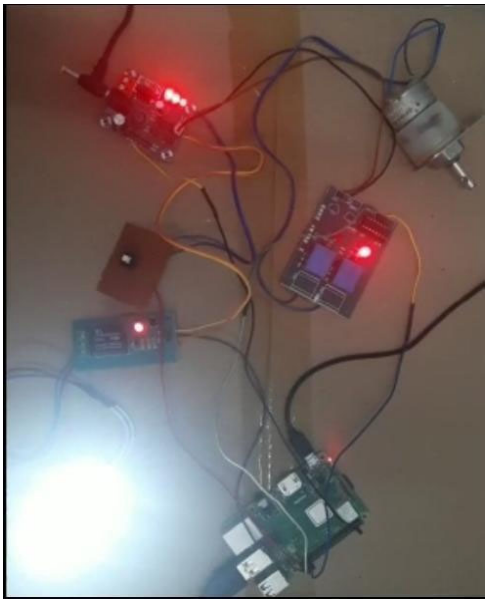


Figure 8 Automation, (a) door opening (b) door closing (see online version for colours)



(a)



(b)

5 Conclusions

The conference hall automation system design plays a vital role in the colleges and large educational institutions. In this venture, the Raspberry Pi-based savvy meeting corridor computerisation framework has been planned and created to control and incorporate all electrical gadgets naturally relying upon the quantity of individuals inside the room. The arrangement of an intelligent client menu makes the framework to be reasonable for fluctuating corridor (hall) limit. The proposed technique diminishes manual exertion to work on electrical gadgets, along these lines saving energy and work and improving the framework's quality, precision, and execution. The proposed automated system

can be enhanced further by incorporating additional features.

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