© INTERNATIONAL JOURNAL FOR RESEARCH PUBLICATION & SEMINAR
ISSN: 2278-6848 | Volume: 14 Issue: 03 | April - June 2023
Paper is available at http://www.jrps.in | Email : info@jrps.in
Refereed & Peer Reviewed
Special Edition
NCASIT 2023, 29th April 2023
Department of Computer Engineering,
St. Vincent Pallotti College of Engineering & Technology, Nagpur,

Designing and Implementing a System for Automation of Lab using IoT and Computer Vision

Shreyash Sarage[1], Vaishnavi Panse[2], Amish Patil[3], Atharva Likhitkar[4]
[1,2,3,4] Student of Electronics and Telecommunication Engineering,
st. Vincent Pallotti College of Engineering and Technology, Nagpur,India.

Abstract– Face recognition attendance system is a tool for recognizing the faces while taking attendance by using face biometrics based on monitor camera image capturing. In the smart attendance system, a raspberry pi system will be able to find and recognize human faces. The proposed system is based on face recognition to maintain the attendance record. The recognized students are marked as present and their attendance is updated with corresponding student name, date & time.

Recently computer vision focused on building systems for observing humans and understanding their look, activities, and behavior providing advanced interfaces for interacting with humans, and creating models for various purposes. To function the system, they require methods for detecting people from a given input image or a video. To detect the moving human body from the background image in video sequences for human body tracking for automation of the lab. It involves the control and automation of the lights, fan and electricity supply to the computers. The main purpose is to make the lab automated with the help of Raspberry Pi.

This paper presents an algorithm for detecting moving objects based on background subtraction where the moving humans are accurately and reliably detected. This will help to reduce the cost, electricity consumption which are high & to get rid of unnecessary usage of the electricity. The proposed method runs rapidly, exactly and fits for the concurrent detection of humans and recognizing their face. Such a system would have the capability to provide secure monitoring of laboratories.

I. INTRODUCTION

As the world is stepping into the 21st century, it is becoming more advanced & digital. In this digital revolution, there is growing interest in smart security systems in various fields such as Schools, colleges, offices, industries, and many more corporate areas. There are many types of research done in order to design various types of automated security systems. Besides, there are many methods available to identify a person through biometric systems such as fingerprint, RFID scanner, retina, voice, and face identifications, etc. All these methods which are often practiced in many places have some advantages and many disadvantages. In order to avert any risk, this biometric system is designed and developed which contains reliability, flexibility, and accessibility. In this, physical contact with scanning devices and other parameters is necessary.

In our project, we have some separate models so as to automate the lab in such a way that each model should work perfectly. The Face recognition model will allow the entry of only recognized persons in the lab to enter and avoid unwanted people entering the lab. The people count model will count the number of people present in the cubicles periodically, in such a way as to turn ON/OFF the fan and light of that particular cubicle by counting the population density of that particular area.

In this project the Pi Camera module with cable attached to the Raspberry Pi through a little socket. This gives continuous input to the Raspberry Pi board. This camera will detect the presence of human beings for every second and it will give the feedback to the Raspberry Pi. This Raspberry Pi sends the signal to the camera to capture the image. This capture image will be compared with the available face in the system and take some necessary action. If the captured image recognized by the system will automate the system .

© INTERNATIONAL JOURNAL FOR RESEARCH PUBLICATION & SEMINAR
ISSN: 2278-6848 | Volume: 14 Issue: 03 | April - June 2023
Paper is available at http://www.jrps.in | Email : info@jrps.in
Refereed & Peer Reviewed
Special Edition
NCASIT 2023, 29th April 2023
Department of Computer Engineering,
St. Vincent Pallotti College of Engineering & Technology, Nagpur,

II. LITERATURE SURVEY

Face recognition- Current scenario is that we call the name of each student and there is always a chance of proxy attendance. This is time overwhelming and infrequently results in human error. The old technique that uses paper sheets for taking students' attendance will now not be used. Facial recognition technology can be used to identify individuals in various places. The technology can be used to facilitate access to secure areas, such as computer systems or research labs. Facial recognition technology can improve the efficiency of various processes, such as identity verification and can identify individuals with high accuracy in a crowded environment. The system uses deep learning algorithms to analyze facial features and can be used for security applications. The face recognition technology has engaged an overwhelming number of researchers and it is gradually supplanting other biometric security frameworks.[1]

Background Subtractor - Detection of moving humans in videos from static cameras is widely performed by background subtraction methods. The origin in the approach is that of detecting the moving objects from the difference between the existing frame and a reference frame, frequently called the "background copy", or "background replica". The background image must be a representation of the scene with no moving objects and must be kept regularly updated so as to adapt to the varying luminance conditions and geometry settings. More difficult models have extended the concept of "background subtraction" beyond its literal meaning. The background subtraction method is the common method of motion detection. It is a technology that uses the difference of the current image and the background image to detect the motion region, and it is generally able to provide data including object information. The key of this method lies in the initialization and update of the background image. The effectiveness of both will affect the accuracy of test results. [2]

IOT- The Internet of things is a technology of the future. IOT based automation using raspberry pi for automation of appliances allowing users to control them easily through the internet. By connecting the physical objects like devices, appliances and other items embedded with hardware, software, sensors and network connectivity that enable all the objects in collecting and exchange of data to work for common goals.[3]

Therefore, this project aims for a computer-based student attendance system that supports the institutions to keep records of attendance and uses an effective method in real time for controlling light and fan through motion detection and also through internet.

1. Dr. J. Preetha, M. Manirathnam, A. Chaitanya, R. Prakash Raj (Raspberry Pi based Face Recognition System)
2. Rupali S.Rakibe , Bharati D.Patil (Background Subtraction Algorithm Based Human Motion Detection)
3. Mr. Bhuvanagiri Viswanadh, Dr. Ashish Singh (Monitor and Control of Remote Appliances using Raspberry Pi through IoT)

III. IMPLEMENTATION DETAILS

A pattern recognition task performed exclusively on faces is termed as face recognition. It can be described as classifying a face either known or unknown, after matching it with stored known individuals in a database. The working methodology is divided into 3 parts, namely Face recognition, Person count and Automation.

A.Face recognition:

Face recognition is a technology that is used to identify and verify the identity of an individual by analyzing and comparing their facial features. There are two main types of face recognition: verification and identification. Verification, also known as authentication, is the process of confirming whether a person is who they claim to be by comparing their face to a known identity. Identification, also known as recognition, is the process of identifying a person by comparing their face to a database of known faces.

Face recognition using Haar cascades is a computer vision technique that uses Haar-like features and cascading classifiers to detect and

© INTERNATIONAL JOURNAL FOR RESEARCH PUBLICATION & SEMINAR
ISSN: 2278-6848 | Volume: 14 Issue: 03 | April - June 2023
Paper is available at http://www.jrps.in | Email : info@jrps.in
Refereed & Peer Reviewed
Special Edition
NCASIT 2023, 29th April 2023
Department of Computer Engineering,
St. Vincent Pallotti College of Engineering & Technology, Nagpur,

recognize faces in images or video streams. Haar-like features are simple rectangular features that are used to distinguish different regions of an image. These features are extracted from an image by moving a window across the image and computing the difference between the sum of the pixel intensities inside the window and the sum of the pixel intensities outside the window. A cascade classifier is a series of classifiers where each classifier is trained to detect a particular feature in an image. The classifiers are organized in a cascade such that the output of one classifier serves as the input to the next classifier. This allows the cascade to quickly reject non-face regions of the image, and focus only on regions that are likely to contain a face. To recognize faces using Haar cascades, a classifier is first trained using a dataset of positive and negative images. Positive images contain faces, while negative images do not. The classifier is then used to detect faces in new images by scanning the image with a sliding window and applying the classifier to each window. If the classifier detects a face, the location of the face is recorded. Once the faces have been detected, they can be recognized by comparing them to a database of known faces.

- Haar Cascade Classifier: A Haar Cascade Classifier is a type of object detection algorithm used to identify objects in an image or video. It was introduced by Viola and Jones in 2001.The algorithm uses a series of simple rectangular features called Haar features to identify objects in an image. These features are calculated by subtracting the sum of the pixel values in one rectangular region from the sum of the pixel values in another rectangular region. By comparing the values of these features at different positions in the image, the classifier can determine whether an object is present in a particular region.

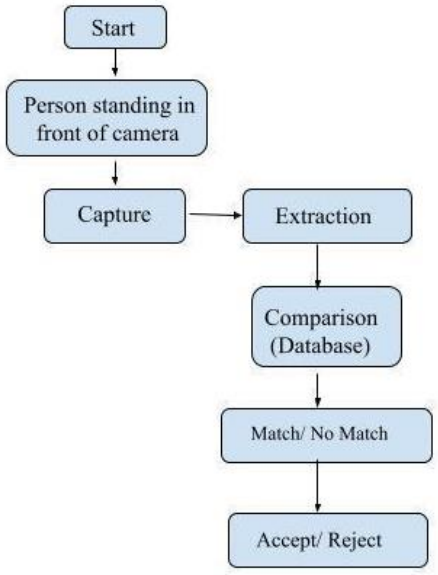


Figure 1 Flow chart model

The different parts of face recognition system are:

- Capture: A physical or behavioral sample is captured by the system during enrolment and identification or verification process
- Extraction: Unique data is extracted from the sample and a template is created.
- Comparison: The template is then compared with an existing sample.
- Match/non match: The system decides if the features extracted from the new samples are a match or a non-match and accordingly accept/reject

B. People Count:

This is the process of detecting human beings in digital images or video footage. The process of person detection typically involves several steps. The first step is to use an object detection algorithm to identify potential human objects in the image or video. Once potential human objects have been identified, the algorithm must determine which ones are actually humans. This is typically done by analyzing the object's size, shape, and color, as well as the context in which the object appears in the image or video. For example, humans are generally taller and have more complex shapes than most other objects in a scene.

After the algorithm has identified human objects, it can track them over time, allowing for person tracking and behavior analysis. This can be

© INTERNATIONAL JOURNAL FOR RESEARCH PUBLICATION & SEMINAR
ISSN: 2278-6848 | Volume: 14 Issue: 03 | April - June 2023
Paper is available at http://www.jrps.in | Email : info@jrps.in
Refereed & Peer Reviewed
Special Edition
NCASIT 2023, 29th April 2023
Department of Computer Engineering,
St. Vincent Pallotti College of Engineering & Technology, Nagpur,

particularly useful for surveillance applications, where it is necessary to track an individual's movements and actions.

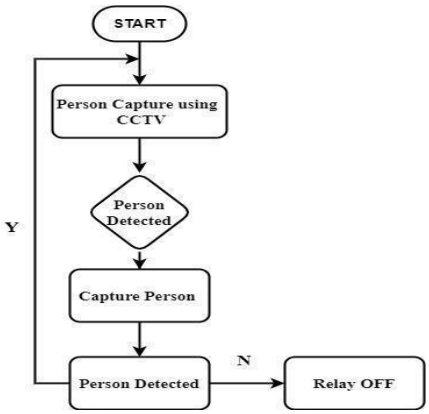
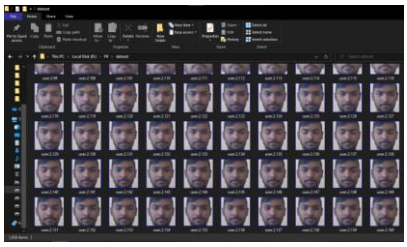


Figure 2 People count model

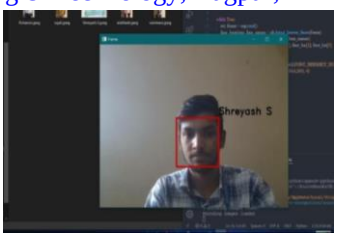
III. TESTING PROCEDURE AND RESULT

The proposed system works are as follows:

- Interface the camera to capture live face images.
- Create a database of an authorized person by using Graphical user interface shown in below image.



- After clicking on start one video frame window will open. It captures the images and compares them with the images in the dataset and will show that the person is identified or not as follows:



- After comparison the results will be stored in google sheet. If the Face gets identified the raspberry will trigger the relay circuit and automation will work.
- The next step is to detect the number of people present in the lab to calculate population density or the number of people present in the lab. This will check for the count and if the count will be zero. The cctv camera will send a zero value to the raspberry pi Gpio pins.
- The GPIO pins will then trigger the relay circuit and if the population density tends to be zero it will cut off the power supply and will shut down all the systems.
- After recognizing the face the raspberry pi will send the data for example, face id of the recognized person, time stamp at which the face is recognized.
- The G-sheets are further linked to a web page will be hosted on the static IP of the raspberry pi condition to the same network connected in the device used to view the web page.
- The web page will have functions to remotely operate the system and view the data stored on the spreadsheet.

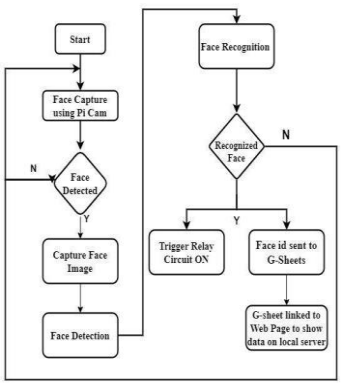


Figure 3 System Architecture

© INTERNATIONAL JOURNAL FOR RESEARCH PUBLICATION & SEMINAR
ISSN: 2278-6848 | Volume: 14 Issue: 03 | April - June 2023
Paper is available at http://www.jrps.in | Email : info@jrps.in
Refereed & Peer Reviewed
Special Edition
NCASIT 2023, 29th April 2023
Department of Computer Engineering,
St. Vincent Pallotti College of Engineering & Technology, Nagpur,

IV. CONCLUSION

It can be concluded that the automation of the lab using IOT and Computer vision works efficiently. This project is very helpful for the whole world as its secures the personal information of any person. So, this project is implemented on IoT based face recognition using Raspberry Pi which is much lighter and more convenient than any other biometric and face recognition systems. This project utilizes OpenCV library to work on necessary commands and also Python IDE software to edit and run the program. In the future the proposed project can be designed and implemented for face recognition and many other applications which will assist to record detailed information of a person. On the other hand, this project still has a big room of improvement to be done, especially in the efficiency of the image processing part. Due to the module used which is Raspberry Pi 3, the processing time of the coding took a long time so process the image and take action. By using another better module, this project can be improved greatly.

V. REFERENCE

[1] Dr. J. Preetha, M. Manirathnam, A. Chaitanya, R. Prakash Raj "Raspberry Pi based Face Recognition System" , IJERT, Issue 2020.

[2] Rupali S.Rakibe , Bharati D.Patil "Background Subtraction Algorithm Based Human Motion Detection", International Journal of Scientific and Research Publications, Volume 3, Issue 5, May 2013 1 ISSN 2250-3153

[3] Mr. Bhuvanagiri Viswanadh, Dr. Ashish Singh "Monitor and Control of Remote Appliances using Raspberry Pi through IoT"

[4] Arihant Kumar Jain, Richa Sharma, Anima Sharma, "A Review of Face Recognition System Using Raspberry Pi in the Field of IoT", 2018

[5] Ashish Ernest Rahul, "Face Detection and Recognition System Using Raspberry Pi", International Journal of Research in Engineering, Science and Management Volume-1, Issue-12, December-2018

[6] A.R. Al-Ali, Imran A. Zualkernan, Mohammed Rashid, Ragini Gupta, Mazin AliKarar, "A Smart Home Energy Management System Using IoT and Big Data Analytics Approach", IEEE Transactions on Consumer Electronics, Vol. 63, No. 4, November 2017

[7] Satish D. Pore, B. F. Momin, "Bidirectional People Counting System in Video Surveillance", EEE International Conference On Recent Trends In Electronics Information Communication Technology, May 20-21, 2016

[8] Kruti Goyal, Kartikey Agarwal, Rishi Kumar, "Face Detection and Tracking", International Conference on Electronics, Communication and Aerospace Technology ICECA 2017

[9] Ei Phyu Myint, Myint Myint Sein, "People Detecting and Counting System", 2021 IEEE 3rd Global Conference on Life Sciences and Technologies (LifeTech 2021)

[10] S.A. Radzi, M.M.F. Alif, Y.N. Athirah, A.S. Jaafar, A.H. Norihan, M.S. Saleha, "IoT based facial recognition door access control home security system using raspberry pi" ,Int. J. Power Electron. Drive Syst., 11 (1) (2020)

[11] S. Pawar, V. Kithani, S. Ahuja, S. Sahu, "Smart home security using IoT and face recognition", 2018 Fourth International Conference on Computing Communication Control and Automation (ICCUBEA), IEEE (2018, August)