

# Facial Recognition Based Temporary Employee Management System

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**Abstract:** In Sri Lanka, 90% of temporary workers are employed in the private sector. Overall, around 60% of employees work as temporary workers; out of all 2.8 million private-sector employees in Sri Lanka. Although these temporary workers get a daily wage, they are not promised with continued work in the future; in other words, their job security is much lower compared to other private sector workers. Two of the key issues with their employment are the temporary nature of their occupations and the difficulty in controlling of these occupations because of the lack of permanent set of rules.

In many workplaces- at present, their work is obtained through brokers. Therefore, these temporary employees as well as the companies face many problems. With the intention of overcoming these issues this paper introduce an automated system for factories, to hire and manage temporary workers without the need of an intermediate broker. This application is developed mainly in four modules; employee registration, employee identification and attendance marking, rating the employees according to their performance, and payroll management. Attendance marking is operated using the (LBPH) face recognition technique. It enables the recognition of the real identities of the employees thus achieving a better level of accuracy in both identity recognition as well as attendance marking. After the identification of the employee, the system will display the tasks assigned to them on the particular day. Tasks are assigned considering the rating value of the employee which will be calculated based on their performance and proficiency on allocated work, as recorded in their work history. The sectional heads are responsible for rating the employees. Their arrival time and date are recorded to ensure the smooth functioning of the payroll system.

**Keywords:** temporary employee management system, face recognition, temporary employee

## 1. Introduction

As we have stated above, more than half of Sri Lanka's employees work as temporary workers. When comparing the numbers of permanent and temporary employees; the increase of the number of temporary employees within a year, is higher than that of permanent employees. According to the estimations done back in 2013 and 2016, the increase of the temporary employees (in private sector) was estimated to be 350,000 while the increase of

permanent employees was estimated to be 15,000. (Jayawardena, 2017).

During the covid pandemic, the recruitment of new employees into many private companies in Sri Lanka had decreased rapidly. It has been revealed that the unemployed population of Sri Lanka had increased by 100,000 in the first quarter of 2020, parallel to the onset of lockdowns (Jayawardena, 2020). Figure 1 shows Sri Lanka Unemployment Rate. (Anon., 2021)

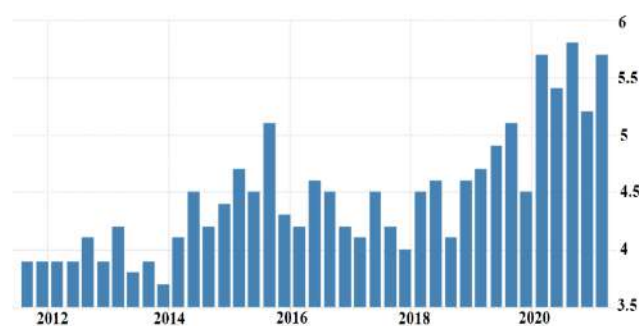


Figure 1 Sri Lanka Unemployment Rate  
Source: (Anon., 2021)

Many organizations who have temporary employees focus on doing the day-to-day tasks through them. Therefore, unlike permanent employees, temporary employees do not have a fixed monthly salary/ health insurance/ paid vacation/ paid personal days or paid sick days. Also, there is no assurance in these companies, ensuring the continuous service of the temporary employees. But they are a great assets of the company (not each worker individually, but the number of them as a whole), as the company gets maximum service without providing much facilities. Due to the difficulties in handling these temporary employees there is no proper software solution to manage them, other than the manual systems. In some situations there is a broker in between the company and the temporary employee who provides the needed number of workers to the company while managing all the tasks including their payments. Unfortunately, a considerable percentage of The wages of the temporary employees have to be given to the broker.

As mentioned above, due to the lack of proper software solution to manage temporary employees, they will face many difficulties in finding jobs, getting a salary, and proving their proficiency in work. Also, since all the tasks, including the payment, are handled by an intermediate

broker, these temporarily employees are less rewarded and less paid for their work. There is a timely need of having a hygienic system which is capable enough to use efficiently, even during pandemic situations, as some of the features in existing systems, like fingerprint attendance marking, has chances of further spreading the diseases. This paper introduces a system which can eliminate the above issue as our system will use facial recognition-based attendance marking, which allows the system to manage the temporary employee's attendance more accurately while storing the recorded data.

In 1970, these temporary jobs were introduced in Europe for their companies. Accordingly, many countries had begun to use this method for their companies by 1980.

Figure 2 shows temporary workers (as a percentage) of waged employees, in selected Asian countries. (Huu-Chi NGUYEN, 2016)

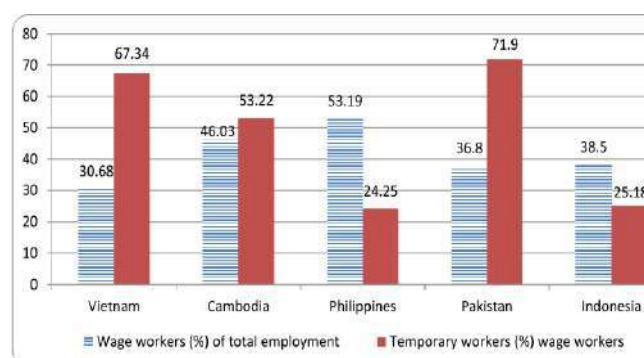


Figure 2 Temporary workers, as a percentage of wage employees, in selected Asian countries. Source: (Huu-Chi NGUYEN, 2016)

The images above show how temporary workers have spread to other parts of the world in addition to Sri Lanka. Thus, considering the proliferation of temporary workers in Sri Lanka, 56% of the total 4.7 million salaried employees in 2013 were in temporary employment. (Jayawardena, 2017).

Figure 3 shows Temporary workers and permanent employees as percentages of wage employees, in Sri Lanka.

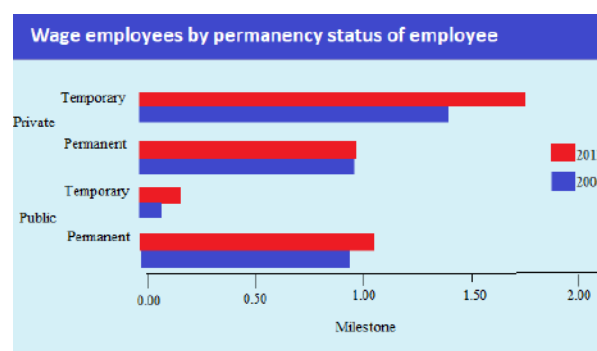


Figure 3 Temporary workers and permanent employees as percentages of wage employees, in Sri Lanka Source: (Jayawardena, 2017)

In 2016 and 2013, the increase in the number of temporary employees in the private sector was estimated at 350,000 and the increase in permanent employees at 15,000. (Jayawardena, 2017). With the increase in the number of temporary employees, the existing manual system has made it difficult to manage. Hence there is a timely need for developing a software solution for the effective management of the temporarily employees.

## 2. Literature Review

This research is mainly considered as a solution to find a systematic method to solve the problems of the temporary employees working in the private sector or government, while no systematic solution has been found for all these problems, at present. However, the findings that can facilitate in searching the right solutions are analysed as follows:

### A. Employee Identification Methods

Following shows the human identification methods and face identification methods used in various sectors to confirm the identity of people.

Jigar M. Pandya, Devang Rathod, Jigna J. Jadav administered a study on a Survey of Face recognition technique (Pandya JM, 2013). Facial recognition falls under the authentication and validation category.

This research paper describes that the face recognition system is accurate than biometric records consisting of fingerprints, voice, iris, ears, palm geometry, retina, etc.

It also describes the use of Neural networks, geometric function matching, graph matching, Eigen faces and Fisher face recognition strategies.

### B. Face Identification Methods

The accuracy of the management of temporary workers with facial recognition is extremely high, as found by above researchers through various scientific studies. Therefore, the method we choose should be able to successfully identify people under different environmental conditions, facial changes, and even with the use of masks.

This section gives an overview on the human resources management and facial recognition techniques for best temporary employee management system. Advantages and disadvantages of each method is also given. The considered methods are eigen faces, local binary pattern, fisher faces, scale invariant feature transformation and speed up robust feature. The approaches are analysed in terms of the facial representations they used.

Manisha M. Kasar, Debnath Bhattacharyya and Tai-hoon Kim achieved a review on a Face reputation the usage of neural network (Manisha M. Kasar, 2016). The research paper highlighted the form of the facial popularity machine. Additionally, defined the neural network and its process. Also, this research paper is focused on approach, algorithms, strategies, database for various systems which is used in face recognition.

Rajat Kumar Chauhan, Vivekanand Pandey, Lokanath M completed a study on smart Attendance gadget using CNN (Rajat Kumar Chauhan, 2018). This gadget defined the

usage of 4 steps initiative is face detection performed supported Histogram of Orientation Gradient (HOG) algorithm. 2d, face alignment is achieved supported face landmark estimation algorithm. 1/3, face encoding, Facenet algorithm-based totally technique is employed for face encoding, it is an accuracy of 99.63% on LFW dataset, finally SVM classifier is skilled with those 128-size values for each face. In technique, there are eight defined steps; enrolment of scholars, educate the gadget, check picture, face detection. alignment, face encoding, recognition, store attendance database.

Jyotshana Kant, Shubha Sharma accomplished in a search on automated attendance; the use of Face popularity supported PCA with synthetic Neural community. Throughout this paper it is described the way for automated attendance system, which makes the use of fundamental factor analysis (PCA) along facet synthetic Neural networks (ANN). The functions of the face snap shots are extracted the use of PCA, which extracts the variations inside the capabilities of face pix, which contains the very first-class statistics with decomposed dimensions (Jyotshana Kant, 2012).

Diverse strategies and methods are proposed to perceive the face. Steady with this Facial detection the use of deep learning research. The most benefits of this algorithm are expertise and approval over different areas. We would like its speed and accuracy to spot, but face detection also has a chain of several related problems. First, it has to digitally look at a photo and discover all the faces in it. Second, specific identification of each face, considering the possibility of a face coming at an unusual angle/ direction or in horrific lighting, while knowing it is nevertheless a separate individual. 0.33 pick out functions, which can be wanted to identify each face uniquely like size of the eyes, face etc. in the end, and examine these capabilities to records we ought to locate the individual's call (Brownlee, 2019)

Adrian Rosebrock written a define about open CV face recognition. It explained the way to use OpenCV to perform face reputation., first perform face detection, extract face embedding from every face using deep learning, train a face recognition version on the embedding, (Rosebrock, 2018)

Qi Jia, Xinkai Gao, He Guo, Zhongxuan Luo, and Yi Wang done a study on a Multi-Layer Sparse illustration for Weighted LBP-Patches based totally countenance recognition. In line with this paper, a singular countenance reputation approach based on sparse illustration is proposed. Maximum present day countenance recognition structures be afflicted by limited potential to handle image nuisances which incorporates low decision and noise. Especially for low intensity expression, maximum of the prevailing training techniques has quite low recognition prices. Prompted by using sparse representation, the matter is often solved by locating sparse coefficients of the check image by using the whole schooling set. Deriving an efficient facial representation from original face snap shots may be an essential step for successful countenance popularity. We examine facial representation supported weighted neighbourhood binary styles, and Fisher separation criterion is employed to calculate the weighs of patches. A multi-layer sparse representation framework is proposed

for multi-intensity countenance recognition, specifically for low-depth expressions and noisy expressions, which may be a vital trouble however seldomly addressed inside the prevailing works. To the present end, numerous experiments based on low-resolution and multi-intensity expressions are administered (Qi Jia, 2015).

### C. Employee Performance Calculation

Manasi Ashock, Wasif Ansari, Furqan Ansari and Prof Indu Anoop conducted research for Employee Appraisal Calculation System. it describe Value of an Employees. Who has work at correct time, work hard, has a suitable level of productivity consider as a good performer They also describe evaluating employee's performance is difficult for managers. To overcome this problem, they introduced performance appraisal which will be calculated based on the peer review, HR review and leave record. Also calculated their performance in previous months. In face recognition based temporary employee management system organization wants to quick performance calculation because this system based on temporary employees. Using these areas, we should maintain an automated rating system for temporary employees. (Manasi Ashock, 2020)

Studying literature reveals that the best method is to represent their (employees) values as a rating system. It is extremely easy to identify their performance and automatically build a competition among them. By literature reviews, being fair when evaluating temporary workers' web page is another idea for accurate performance calculation. It shows that, questionnaires and reviews are not suitable for performance calculation because these temporary employees work with different managers as well as different team members. It is way more effectively to evaluate continuously. Some of their given rating system benefits are, it being objective, being reflective to current situation, being adjustable, motivating etc. (Anon., n.d.)

Clockify website described Areas we should consider for calculating temporary employee rating system. Also, they described rating system should have same pattern system for all the employees and organization should consider the transparency of rating calculation. They give principal areas for calculating their performance. These areas are Communication, Productivity, Creativity, Integrity, Punctuality and Attendance. (Fisic, 2022)

The use of These literature reviews main ideas is focus on automatic rating system, it should be maintaining in section managers, it should continuously evaluate and considering the areas mention in clockfiy website.

### D. Employee salary Calculation

According to the Survey on facial recognition based temporary Employee Management system, there are four main methods to get their salary, these methods are by another person, by manpower of the company, directly through the company and other methods. According to these four methods, best method is chosen by conducting a survey; resulted as follows,

5) ඔබට මැදිහත් ලැබෙන සාකච්ඡා  
45 responses

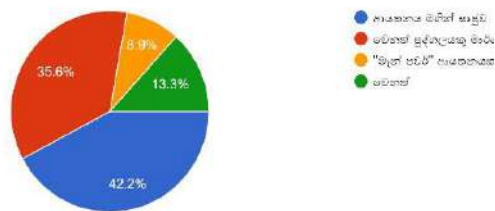


Figure 4 Survey Results  
Source: Author

6) වෙනත් පුද්ගලයකු මාර්ගයෙන් "මිනිස් පවරා" සායනයක් මගින් හෝ වෙනත් ක්‍රමයක් මගින් නම්,

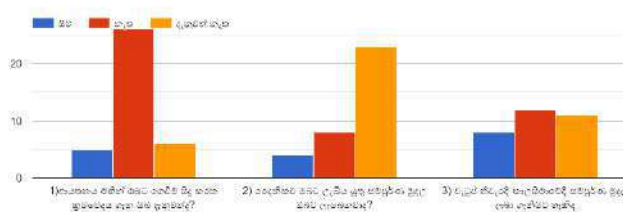


Figure 5 Survey Results  
Source: Author

### 3. Methodology and Design

#### A. Requirement Gathering and Analysis

This study, which is used to identify correct problem areas of temporary employees who worked in various sectors; we are mainly focused on the that of private sector. For that reason, we conducted a survey using 50 temporary employees. This survey is mainly focused on identifying the limitations of the current systems and the improvements which we expect to include in the proposed system. Other than this survey, we have conducted interviews with the temporary employees.

With the results obtained from this interview and survey, the research objectives were defined and then started to design the proposed system to fulfill each of them. Identified main problems of temporary employees are as follows;

- Attendance marking issues
- Not receiving the full salary given.
- Inability to know the location and direction of their assigned workplace.
- Do not receive recognition for their work
- Problems with labour and time management.

#### B. Proposed System Design

1) Overall System Architecture: The Overall system architecture is mainly based on three layers. They are Presentation layer, Application Layer, and Database layer. Dataflow of this system is done through these layers. All other subsections of this system are included in these 3 layers.

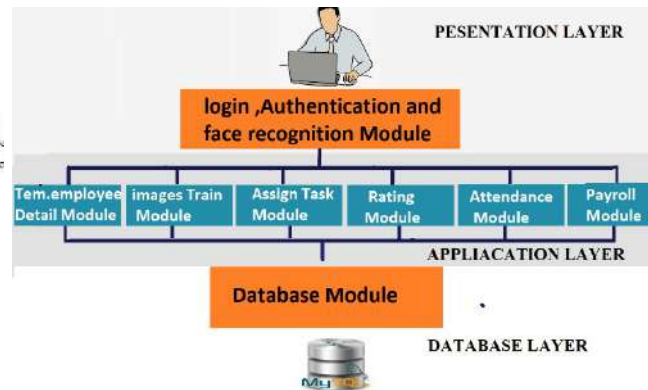


Figure 6 Overall System Architecture  
Source: Author

2) System Model Design: The main component is the standalone application, which will perform all the functionalities. Also, there is a this includes web-based system that enable the temporary employees to see their assigned task and their payment details.

#### C. Technology Adaptation

1) Desktop Application: Facial recognition based temporary employee management system is a desktop application where there are two main roles for the login: Sectional Head and Admin. The functionalities of each role can be described as follows:

- Admin – Registers new temporary employees to the system. Able to edit temporary employee's details, able to see temporary employees' details, captures the temporary employee images and trains those, able to check the attendance sheet, payroll system, and gives salary to temporary employees.
- Sectional Head section – Able to assign the temporary employees to a task, rates the employees according to the performance and the proficiency they have shown in the assigned task.



Figure 7 Desktop Application Home Page  
Source: Author

2) Web based Application: Web based system is mainly used for viewing purpose of temporary employees, as desktop application is used for company usage only.

Moreover, its main usages are, new temporary employees can register through the WhatsApp chatbot, get their next day working section details, get their payment details, get location of company using google API in the web system.



3) *Database Architecture*: In computerizing temporary worker information, the next question was what specific information should be known about temporary workers?

Thus, temporary employee can register into the system by filling the registration form of company desktop or website. And their collected information such as name, email, contact number, address, their capabilities, what tasks they can do and get their sample images for the face recognition purpose. After registration, company gives full rating marks for them, and assigns works and sections for temporary employees next day requirements. According to their performances they give rating value for the temporary employees. It is recalculated with previous rating marks, and it is done by the sectional heads. These all-rating marks are stored in the database and calculated. Also, payroll management details and next day workers details are managed using the database. Company has both desktop application and web-based system connecting only one database- php MYSQL is used for the database of this face recognition system. System changes can be done by only the authorized people. Web based system mainly use for the view purposes and the registration of temporary employees.

### 3) Face Recognition Using LBPH Algorithm

In a digital image table of numbers have between range 0 to 255 and the smallest element of digital image is pixel. Dark pixel has small numbers of values and light pixel has high number of values. Local binary pattern is one of technique used for image representation. According to this algorithm image into array. It uses 3\*3 pixel.

for (x,y,w,h) in features:

```
cv2.rectangle(img,(x,y),(x+w,y+h),(0,255,0),3)
id,predict=clf.predict(gray_image[y:y+h,x:x+w])
confidence=int((100*(1-predict/255)))
```

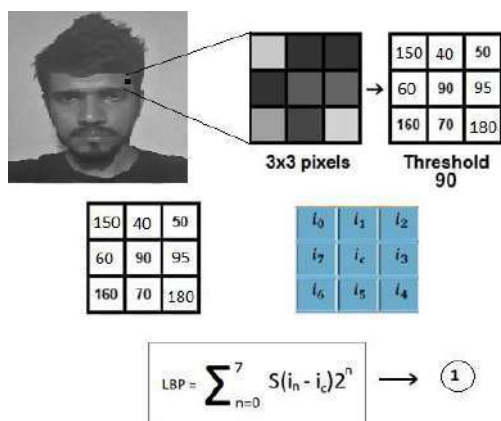


Figure 8 LBPH Calculation  
Source: Author

Company gets a set of images of temporary employee and train these images using LBPH algorithm. The LBPH algorithm has an accuracy of 80% is the most suitable model for face identification for temporary employees.

This application was developed as a desktop application for company use and a web system for temporary employees.

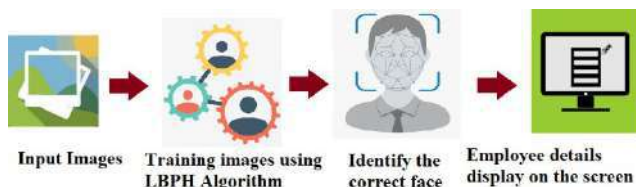


Figure 9 process of face identification  
Source: Author

After recognising the employee identity through the face, system displays the assigned working section and task for the particular day. Also, it automatically marks their attendance.



Figure 10 the process after identifying the face  
Source: Author

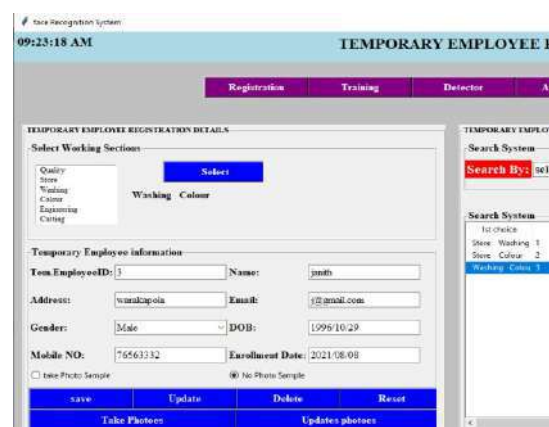


Figure 11 Temporary Employee Registration Form  
Source: Author

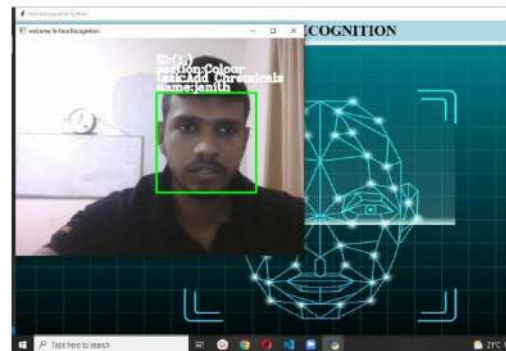


Figure 12 Temporary Employee Identification  
Source: Author



Figure 13 Employee Attendance sheet  
Source: Author

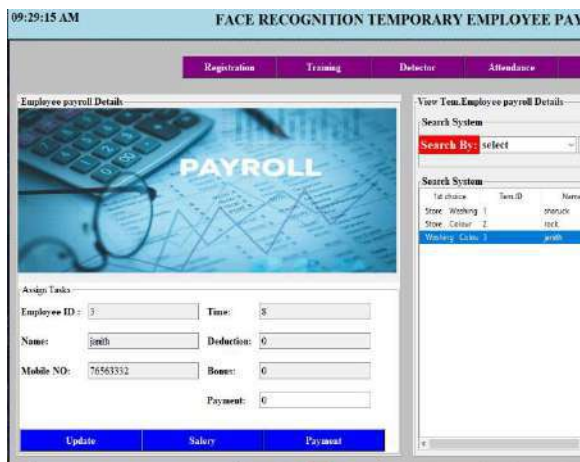


Figure 14 Payroll sheet  
Source: Author

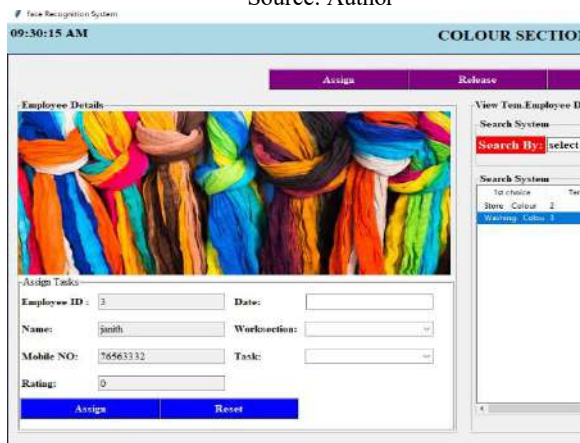


Figure 15 Section detail sheet  
Source: Author

5) *Google Map API*: It is used for identifying the location of closest factories.

6) *WhatsApp Chatbot*: Using WhatsApp chat Temporary Employees can register to the system and give their confirmation for next day's task.

7) *Performance Calculation*: Rating marks given by sectional heads according to their performance. It is done

by focusing six areas. These areas are communication, productivity, creativity, integrity, punctuality and attendance. Following code shows the rating calculation method of a task. This is the new calculated rating value.

```
def addition():
    clear_data()
    add()
    self.var_n_ratingb.set("")
    firstnumber = int(communicationField.get())
    secondnumber = int(productivityField.get())
    thirdnumber = int(creativityField.get())
    fourthnumber = int(integrityField.get())
    fifthnumber = int(punctualityField.get())
    sixthnumber = int(attendanceField.get())
    seventhnumber = float(self.var_ratingb.get())
    eighthnumber = float(self.var_rating.get())

    answer = (((((firstnumber/4 +
secondnumber/4+thirdnumber/4 + fourthnumber/4 + fifthnumber/4
+ sixthnumber/4)*4)/6)+seventhnumber)/2);

    answerdisplay.insert(10, str(answer))

    total = ((seventhnumber+ eighthnumber)/2)
    if (total<2.5):
        grade="POOR"
    if (3.5>total>2.5):
        grade="GOOD"
    if (5>total>3.5):
        grade="Very Good"
```

Average method without weighting - Competencies			
Competency	Item numeric rating	Max. numeric rating	Decimal score
Communication	4	5	0.8
Productivity	5	5	1.0
Creativity	3	5	0.6
Integrity	4	5	0.8
Punctuality	5	5	1.0
Attendance	2	5	0.4
Sum of the decimal score			4.6
Section rating calculation			
Total decimal score	Total max. decimal score	Max. numeric rating	Section rating
4.6	6	5	3.8

Figure 16 rating calculation method  
Source: (Fisic, 2020)

2<Grading Average value < 2.5 = Poor

2.5<Grading Average value < 3.5 = Good

3.5<Grading Average value < 5 = Very Good

#### 4. Results

Here are several test cases that are implemented to validate the proposed system's ability in recognising the identity of person in several types of conditions. Also, after identifying the person, the system should be able to display his/her assigned task on that particular date.

Test Case 1: Validate the face identification of various facial appearances.

Test Data: Persons who are bearded, not bearded and wearing facemasks.





Figure 17 Face Recognition with bearded  
Source: Author

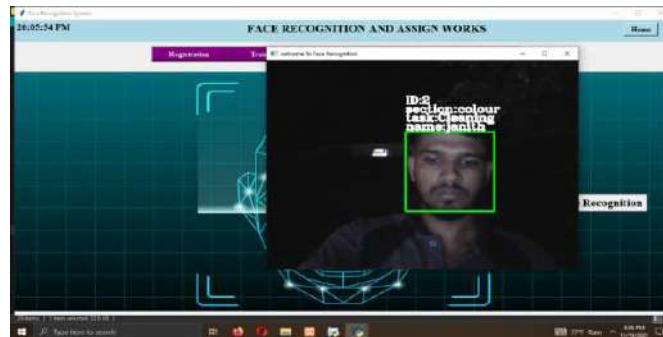


Figure 21 Persons with dark background.  
Source: Author



Figure 18 Face Recognition without bearded  
Source: Author

Test Case 3: Validate the face identification of various face angles.  
Test Data: Persons with different angles.



Figure 22 Persons with different angles test data 1  
Source: Author



Figure 19 Face Recognition with mask  
Source: Author



Figure 23 Persons with different angles test data 2  
Source: Author

Test Case 2: Validate the face identification in various lighting conditions.  
Test Data: Persons with light background and dark background.



Figure 20 person with light background  
Source: Author

Test Case 4: Validate the face identification of different people.  
Test Data: Different persons.

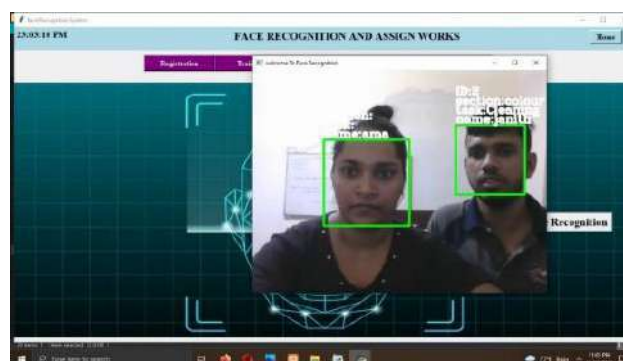


Figure 24 Different persons Test Data 1  
Source: Author



Figure 25 Different persons Test Data 2  
Source: Author

Test Case 5: Validate the face identification of digital images.

Test Data: Digital images taken from a camera.

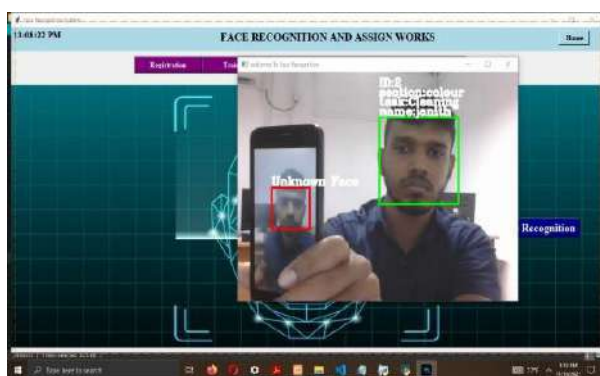


Figure 26 Test case 5 result  
Source: Author

Unit testing have done by using temporary employees of MAS fabric park company. This unit testing has done by considering Login and Authentication Module, Registration Module, Assign Task Module, Face Recognition Module, Rating module and Attendance and Payment module.

## 5. Discussion

One of the main parts of temporary employee management is the facial recognition system. The reasons to choose Local Binary Pattern Algorithm (LBPH) from other various techniques are its greater accuracy level when identifying the faces and the lower complexity of the algorithm. After capturing data images (nearly 200 images) system is trained with these images using the LBPH algorithm. The system has more than 77% accuracy of performing this task. This system takes about 10 seconds to capture 100 photos and ten seconds to train these photos. As soon as the camera opens, it recognizes the person and displays details such as employee ID, his working section, his task, and his name on the screen.

Employee registration is done by the admin because most of the temporary employees do not have adequate English knowledge to proceed with the system. The agile scrum methodology was followed to develop the proposed system. The development was carried out in four main subsections:

Employee Registration, Attendance Marking, Rating the Employees, and Payroll Systems.

The system can be used only within the company premises. Hence a web system will be developed which facilitates the temporary employees to get the information on their assigned tasks, payment details and location of the assigned tasks. Both desktop system and the web-based systems will work parallelly.

The accuracy of recognizing the faces depends on the environmental conditions and the lighting conditions. However, it can be overcome by capturing more images and having better lighting conditions.

## 6. Conclusion and Future Works

The main beneficiaries of this software solution are temporary employees and the companies. Through this system, the temporary employees will be able to receive their full stipend without paying part of it to agents and the brokers. Also, the temporary employees can carry out their duties in an effective and convenient way.

In addition, the companies will also be benefited by this system as this facilitate admin to assign employees to predetermined tasks without wasting the time. Also, since the respective sectional heads able to rate the proficiency and performance of the individual temporary employee assigned to that section, at the next instance the admin will be able to select the best employees for each section. With this, companies can get maximum service from the daily workers without wasting time and money.

Since many temporary employees find it difficult to use the system due to lack of English knowledge, we hope to upgrade this system using the Sinhala language in the future.

It is expected to incorporate a chatbot to the web-based system to stay in touch with temporary employees and organizations.

Also, as future work, it is expected to show the details that appear after the phase of face recognition, to make available in any language of their preference.

## Acknowledgement

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