AUTOMATIC STUDENT ATTENDANCE MANAGEMENT
SYSTEM USING IMAGE PROCESSING

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This Report Presented in Partial Fulfillment of the Requirements for the Degree of Bachelor of Science in Computer Science and Engineering

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APPROVAL

This Project/internship titled "**AUTOMATIC STUDENT ATTENDANCE MANAGEMENT SYSTEM USING IMAGE PROCESSING**" submitted by Md Touhiduzzaman ID: 162-15-7727, Abu Sayed ID: 162-15-7872 and Shahed Khan Ripon ID: 162-15-8030 to the Department of Computer Science and Engineering, Daffodil International University has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and Engineering and approved as to its style and contents. The presentation has been held on October 2010.

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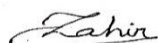Daffodil International University

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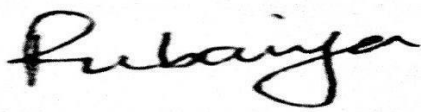**Dr. Md. Saddam Hossain**   **External Examiner**
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DECLARATION

We hereby declare that, this project has been done by us under the supervision of **Rubaiya Hafiz, Senior Lecturer, Daffodil International University, Bangladesh**. We also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.
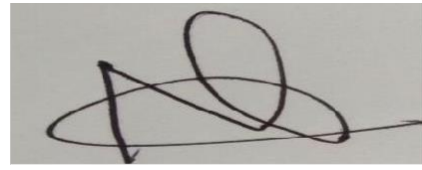
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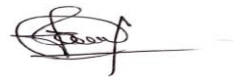
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.

ABSTRACT

In this modern age student attendance management system is one of the most important thing in an institute. In general attendance system Proxy attendance is one of the major issue. In modern days everything based on computer or Artificial intelligence(AI) that's why we develop our research based project in machine learning. In this paper we will propose an extremely basic method to perceive proxy attendance and try to improve accuracy of attendance. Compare training image and test image then it will automatically generate attendance. I Prediction is much easier when there is "Machine Learning". The main purpose of the current study is to predict the addiction of people on Facebook and aware of their daily routine with high accuracy. To complete our research based project, we use six 'Machine Learning' classification algorithms such as Histogram of Oriented Gradients(HOG), Affine Transformation, Face Landmark Estimation Algorithm, Embedding Method, Tweak Neural Network, Support Vector Machine (SVM).

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CHAPTER 1

INTRODUCTION

1.1 Introduction

As of 1 January 2020, the population of Bangladesh was estimated to be 169,872,008 people. According to UNESCO, an adult literacy rate of 72.89% [1]. Every institution has attendance system that make sure student present. Calculation of consolidated attendance is major task which may cause manual errors [2].

Maintenance of student attendance is the one of the most difficult task in all of institutions. Image recognition is very complex and challenging one affecting variety of parameters such as intensity, orientation, expression and size [3]. The proposed system is intended to detect and recognize the students from facial image captured in video. The entire system works autonomously and gives efficient results.

There are lots of technique to automatic student attendance system but main problem is some are very costly, some are not accurate at all. In this paper, image processing approach we are trying to improve accuracy rate [4]. We work with for the most part two component. One is training dataset and test data. First of all pre-processing all the training data set and compare with test data then final attendance result automatic show.

There are lots of techniques have been applied to figure out automatic student attendance Like Principle Component Analysis(PCA), Discrete Wavelet Transform(DWT), Discrete Cosine Transform(DCT), N*N Resolution, Eigen Vector, Radial Basic Function(RBF), Local Binary pattern(LBP) [5,6]

In Our System we used Histogram of oriented gradients(HOG) Algorithm, Affine transformation method, Face landmark estimation algorithm, Embedding method, Tweak neural network method and Support vector machine(SVM) Classifier.

1.2 Motivation

Now a day, there are many video monitoring systems like door access control, network security uses biometric authentication, finger-print. It's very useful because every person has unique finger- print and it does not change in whole lifetime and in door access control they use radio frequency identification (RFID) system [7].

They use it in the transportation, health case, agriculture, hospital and industry.

In RFID tagging uses small radio frequency identification device for detect the object. Now a day in many university, school, college they use RFID based attendance system. It takes automatically attendance of university, school, college and company. We all know that we are like in technology based generation. So it's very helpful but in RFID it's very expensive every student should have a small radio frequency identification device and these RFID device is very costly when a student punched it then a little bit noise pollution occur and it takes the same time like normal attendance system and sometime proxy attendance can possible in RFID system. One student can hold his friend RFID device in these system. So RFID is not good for technology based attendance system [8,9].

In normal attendance system there are a lot of time and energy waste That's why we are interested to multiple image based student attendance system.

In multiple image system there are more than one picture for every student for recognize their face correctly.

Time and energy waste could be avoided and ensure their have no proxy attendance happen these systems. we are try to use face emotion to capture the picture what the reaction in the classroom of the student.

Back in 2012-13, when we upload a photo in facebook, then if we want to tag someone we have to type name manually. But current days when we upload a photo in face it's automatically tag [10].

And also, in phone camera when we click a selfie sometimes its create a rectangle in our face. In Figure 1.2.1 it's show that phone camera automatically detect face.
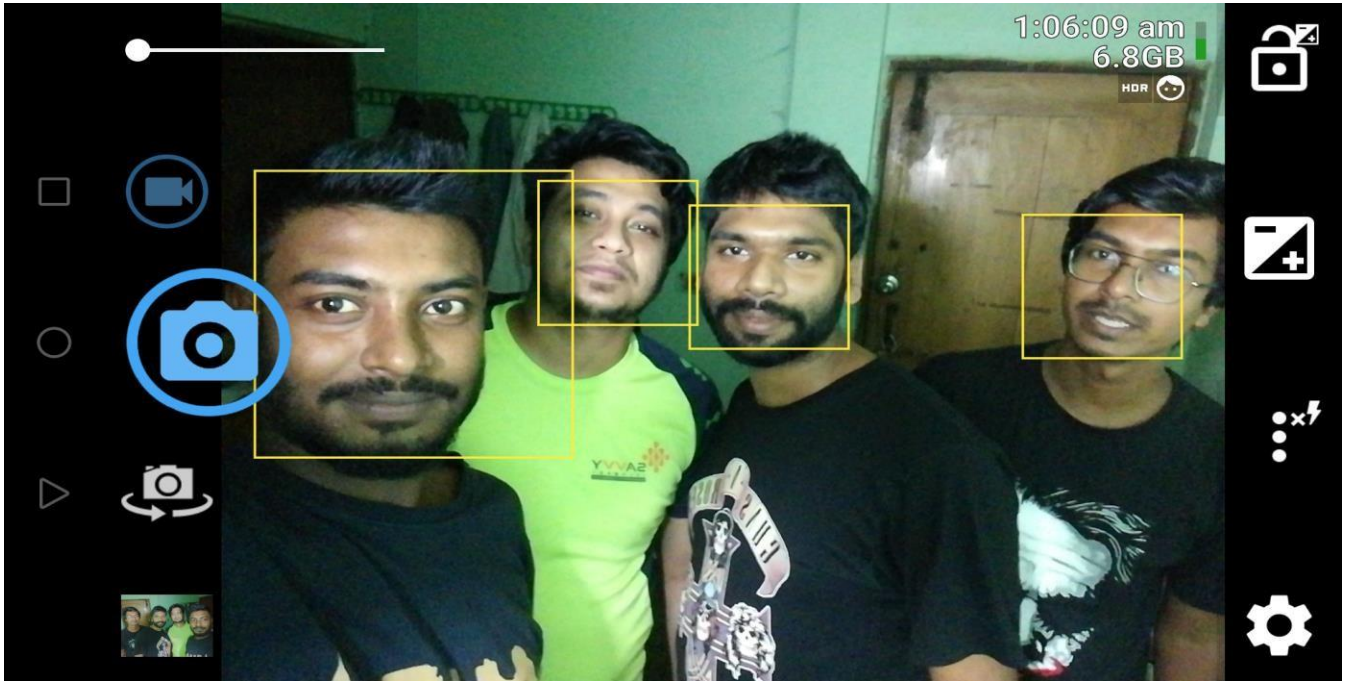
Fig 1.2.1: Phone camera automatically detect face

1.3 Rationale of the Study

The opportune of discover automatically attendance system can stope energy, time and also remove proxy attendance. Proxy attendance is regular problem in every school, college, university and every institute. For getting read lot of research we are going to handle these problems. For this situation, Machine learning is one of the great method to detect face and compare training and test image. On the off chance that we can distinguish proxy attendance at the beginning period by various machine learning techniques, we can diminish the rate of proxy attendance.

1.4 Research Question

These following questions arise when we thought to implement our idea -

- How to detect the face area with higher accuracy?

- What will our original data be like?
- How to reduce Proxy attendance?

- Does our data and machine learning will be compatible?

- Do we need to train our original data to the machine learning model?

1.5 Expected Outcome

- To deploy the prototype of automatic attendance management system

- To recognize the face area by using image processing methods

- To apply image processing method generate attendance automatically

1.6 Objectives

- Detect face area using histogram of oriented gradients (HOG) algorithm

- Detect different angle image's using affine transformation method

- Detect face point using face landmark estimation algorithm
- Detect unique face measurement point using embedding method
- Use support vector machine(SVM) algorithm to find the match face person

1.7 Contribution Summary

- We create our own dataset

- Most of the time it detects all of our face test image but when face area face low light, torn image it does not detect face.

1.8 Report Layout

There are six chapters in this research paper. They are: "Introduction", "Background", "Research Methodology", "Experimental Result and Discussion", "Implementation", "Summary and Conclusion".

Chapter One: Introduction, Motivation, Rationale of the Study, Research Questions, Expected Output, Report Layout.

Chapter Two: Introduction, Related Work, Research Summary, Scope of the Problem, Challenges.

Chapter Three: Introduction, Data Collection Procedure, Research Subject and Instrumentation, Research Subject, Research Instrumentation, Proposed Methodology, Data Preprocessing, Statistical Analysis, Implementation Requirements.

Chapter Four: Introduction, Experimental results, Description analysis, summary.

Chapter Five: Introduction, Comparative studies, Challenges, Work schedule both for research and development, Business process modelling, Future Scope.

Chapter Six: Summary of the study, Conclusions, Implication for Further Study

CHAPTER 2

BACKGROUND

2.1 Introduction

In modern era we know that everything is based on technology. General attendance system is one of the important things that we have to change and try to convert into technology based attendance system. Now-a-days, face detection is the main problem for everybody which is related with some Machine Learning. Predicting the accuracy rate of face detection is simpler by using the classification algorithm in' Machine Learning.' The training and testing data belonging to distinct classes were classified using multiple method's in' Machine Learning.' It seems vital to increase the accuracy rate through machine learning techniques in the Face Detection. The purpose of this project is to assess distinct classification methods is the detect the face area of all the students who present in the class room. But using the method of ' Machine Learning ' can change the whole scenario.

2.2 Related Work

To build an automatic students attendance system first of all recognize the face using their face from camera, video. And calculate their attendance by using variant facial feature. Using viola jones algorithm and Fisher face algorithm these proposed model complete. The accuracy rate of these model is 45% to 50% [11]

Without human interface this system will work. Using one of the most popular Eigen Face method to compare training and test image. In these system camera is set in a fixed position in the class room. Then camera capture an image and compare then automatically generate attendance in database. Accuracy rate of this system is 65 % to 70% [12]

With the help of MATLAB GUI then use Eigen face method and PCA method for automatically attendance system. This is computer vision part of face detection from image or video camera and generate attendance in excel sheet. Accuracy rate of this model is 78% [12]

With the help of Principal Component Analysis(PCA), Linear Discrimination Analysis (LDA) to complete the video based automatic attendance monitoring system. In this system initially separate the face and non-face area and if valid match the detected face then register the student in excel sheet. Accuracy rate of this system 83.57% [14]

2.3 Research Summary

There are lot of students who prepare to go to school but they do not go to school and parents don't know about it. Because of proxy attendance. And we all know that school, college, university gives us proper knowledge that's why these type of students occurred many bad things in our society. In general attendance system it takes lot of time and waste energy. There are some systems that takes automatically attendance but their accuracy rate not preferable in most of the university.

- Selection of topic

- Definition of problem

- Literature survey and reference collection

- Actual investigation

- Data analysis

- Result

- Report

2.4 Scope of the Problem

General attendance system is one of the common problems and unawareness about the time is the main reason. RFID based attendance system and general attendance takes same time and proxy attendance can possible in general attendance system and RFID based attendance system. That's why we decided to research Automatic attendance system and Detects the face area so that by our system we can reduce the proxy attendance and also improve the accuracy rate. We proposed a system that takes a test image and then compare this test image with our training image. If test and training image are match then our system automatically generate attendance with exact date and time and also generate these value in excel sheet.

2.5 Challenges

There are some quite challenges in the way of properly Face detection technology in machine Learning Part. Instead of all challenges face detection is one of the Hot topic in Machine learning to detect the face area. Everything has its dark side. That's why we faced a lot of difficulties to research and implement our system. Sometimes it was so tough to handle but by the grace of Almighty, we have passed these difficulties. These following difficulties made our research more difficult –

1. During data collection
2. During the selection of algorithm
3. For applying machine learning classification algorithm
4. For implementing our proposed system

During the selection of external and internal factors of Face Detects

CHAPTER 3

Research Methodology

3.1 Introduction

In this research, we are going to take attendance automatically by using Six machine learning algorithms such as Histogram of oriented Gradients(HOG), Face Landmark Estimation, Affine Transformation, Tweak Neural Network, Embedding, Support Vector Machine (SVM), because of its huge accuracy compared to other algorithms. For applying these algorithms, first of all, we had to collect datasets Like, students name and different type of image. By studying research papers, we have already known that these six machine learning techniques give more accuracy Sometimes it gives around 100% accuracy. Preprocessing of data is exhibited in an understandable introduction by transforming raw information into an accessible setting for a reason. Data cleaning is a procedure where information is cleaned by eliminating missing information, copy information and settling information irregularities. Subsequently, information quality is improved bringing about the helpfulness of information. Change of information or data starting with one organization then onto the next arrangement is known as data transformation. It is typically done when a source configuration is expected to change over into the required organization for a particular reason. Figure 3.1.1 demonstrates the methodological framework to carry on this research.

3.2 Data Collection Procedure

For completing our project based research, we need to collect data. We collected the data both online and offline We all know that there are two type of data one is training data another is test data. In training data we store the input picture of all the students and in test data set compare the picture with the training image and calculate the result. In our research is automatically student attendance that's why in our research data means image of students. There are lot of sources to collect the training data. Now-a-days most of the students are active on social site. We collect most of our training image from facebook.

In our proposed model, at first, we will gather our information. So we to initially amass training image. Note so as to run our preparation tests. Thus, we collected around 1000 image from all the students of our class.

In that point, we utilized camera to gather every one of the photos to apply them on Pycharm.

This part is the image acquisition part. The highlights of face area that we are thinking about are face landmark positon of the portrait of the face.

3.3 Proposed Model

Figure 3.3.1 shows the block diagram that speaks to the execution system of the proposed model. It demonstrates the block diagram of the proposed algorithm. In the proposed algorithm at first gather all the information which we will enter in Pycharm as a JPG or JPEG picture. At that point we will preprocess all the pictures to get only the face from hole image in the training data set part we do these work. Then compare test image with the train image and take attendance.

Image collection is the first part of our research. Training image collect then set all the training image initially. Then preprocessing all these image like face encoding then find face image, analyze facial features, compare against known face, make a prediction. Feature detection is one the major part of processing. There are many type of feature detection, SIFT(Scale Invariant Feature Transformation), SURF(Speed Up Robust Feature), Ransac, BRISK. In Our research we use HOG(Histogram of Oriented Gradients) method to find the face area then use Face Landmark Estimation method to find the face point. And then use Embedding method to find face measurement point. Finally use SVM(Support Vector Machine) classification to calculate the final expected output.
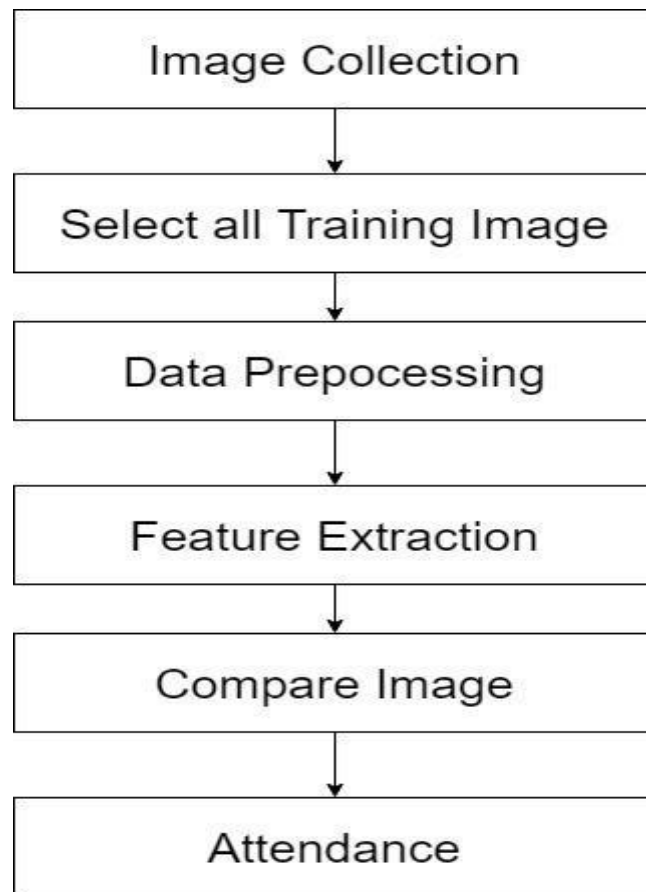
Fig 3.3.1: Proposed Diagram

3.3.1 Data Collection

Data Collection is one of the most important part of our project. Initially when we start our work first of all we collect around 1000 picture for our project.

3.3.2 Select Image

Select image from any source and any type of image is acceptable. But Dirty and torn image should be avoided for these project.

3.3.3 Image Preprocessing

For getting the accurate result we need to perform some preprocessing operation. In our project we don't need color data for find the face. That's why initially we resize every image in one fourth size then convert our color image into black and white image Using RGB to GRAY. Then we remove all the noisy and torn image form our training data set.

3.3.4 Feature Extraction

In the feature extraction part, we detect the face area part and create a rectangle on the face area. In Figure 3.3.2 shows that face area part.

Fig 3.3.2: Face Area

In face area part we use Face Landmark estimation algorithm to find 68 face point. In figure 3.3.3 shows that face land mark point.
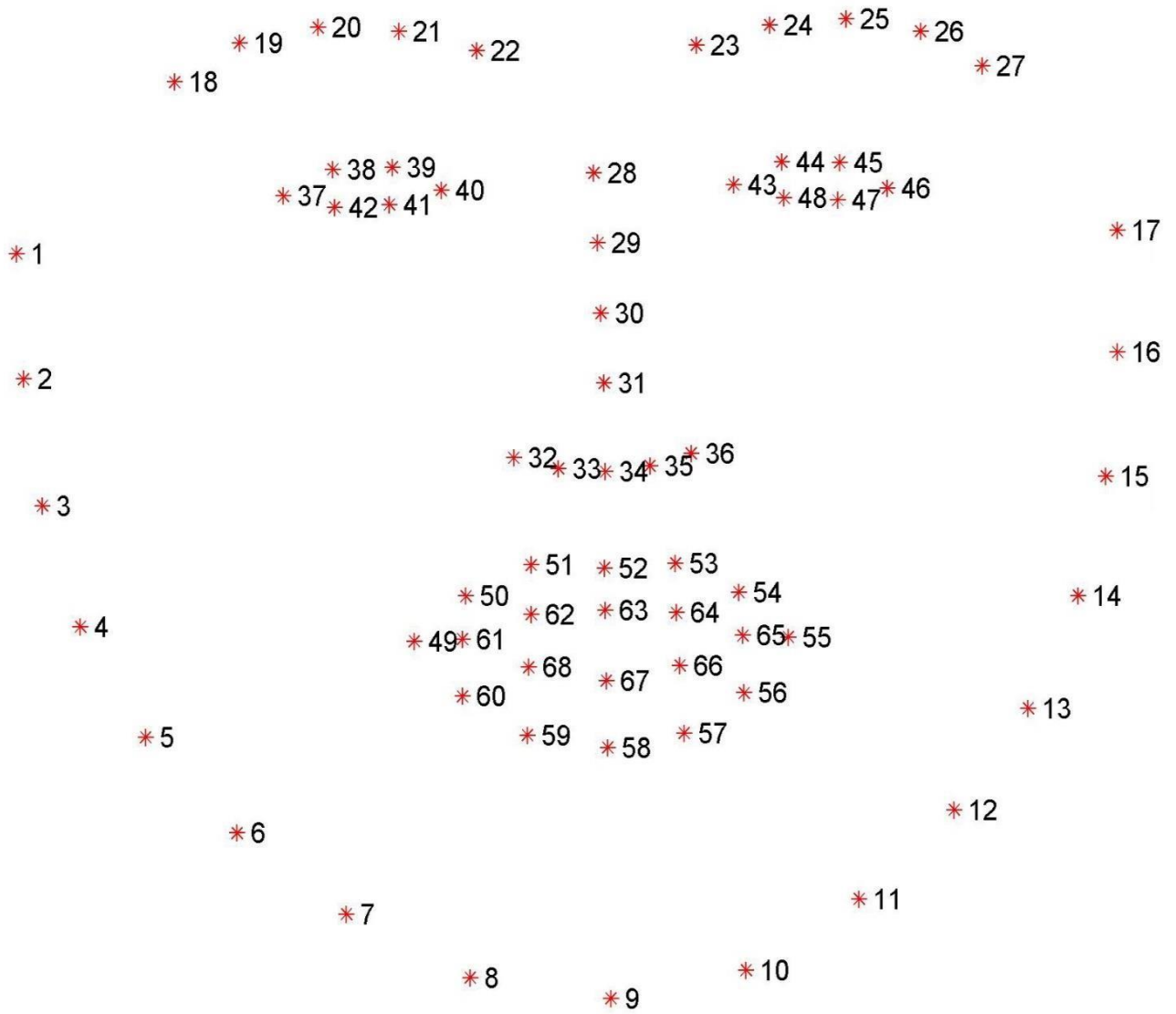

Fig 3.3.3: Face Landmark Point

3.3.5 Compare Image

In many algorithms they use many thinks to compare image. Sometimes they use Ear Size, Nose length, Eye Color, somethings else. In our project we apply a Deep Learning algorithm because we know that deep learning algorithm does better job compare to others. Embedding algorithm, these algorithm shows 128 different measurements point for each image. Figure 3.3.4 shows the different point of face area.


```
[-0.1761844   0.05214171  0.04693097 -0.05248538 -0.10003365 -0.05920248
 -0.03742662 -0.13461751  0.18795508 -0.16140257  0.17816898 -0.03982083
 -0.18510394 -0.12232952 -0.01778299  0.13339549 -0.08704091 -0.10598118
 -0.05484068 -0.09900539  0.04874309 -0.0084963   0.03029515  0.09489562
 -0.15841372 -0.32541782 -0.09431419 -0.1364166  -0.08973849 -0.06787688
 -0.04158715  0.01939797 -0.19021262 -0.06263144 -0.01181041  0.10468426
  0.0267516  -0.03273353  0.11671096  0.00443542 -0.12944625 -0.19872817
  0.05721106  0.19749364  0.10275582  0.00550122  0.02985333 -0.03258984
  0.1271348  -0.21525513  0.00737869  0.07718381  0.09527401 -0.01881505
  0.12540081 -0.07243437  0.05823363  0.03125254 -0.1571468   0.01393575
  0.05014215 -0.04679842 -0.16761759 -0.00903489  0.29703784  0.16874745
 -0.10256488 -0.10762582  0.16629492 -0.12417629 -0.03125732  0.04118758
 -0.1091614  -0.16213034 -0.27446899  0.00531912  0.46990973  0.10154239
 -0.1680184   0.00214585 -0.16849914 -0.00644251  0.06585571  0.00428225
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 -0.099637    0.0077275  -0.08102043 -0.00840066  0.18606947 -0.06710083
  0.02541076  0.06898353 -0.21137546  0.05274333  0.00054395 -0.08140454
  0.02594215  0.01373623 -0.23968762 -0.08154538  0.12877984 -0.2041412
  0.11754385  0.10870576 -0.03725581  0.14339323  0.04781093  0.07847843
 -0.0059361  -0.02897267 -0.06133002 -0.09037765  0.08216883 -0.03535833
  0.04515423 -0.03589766]
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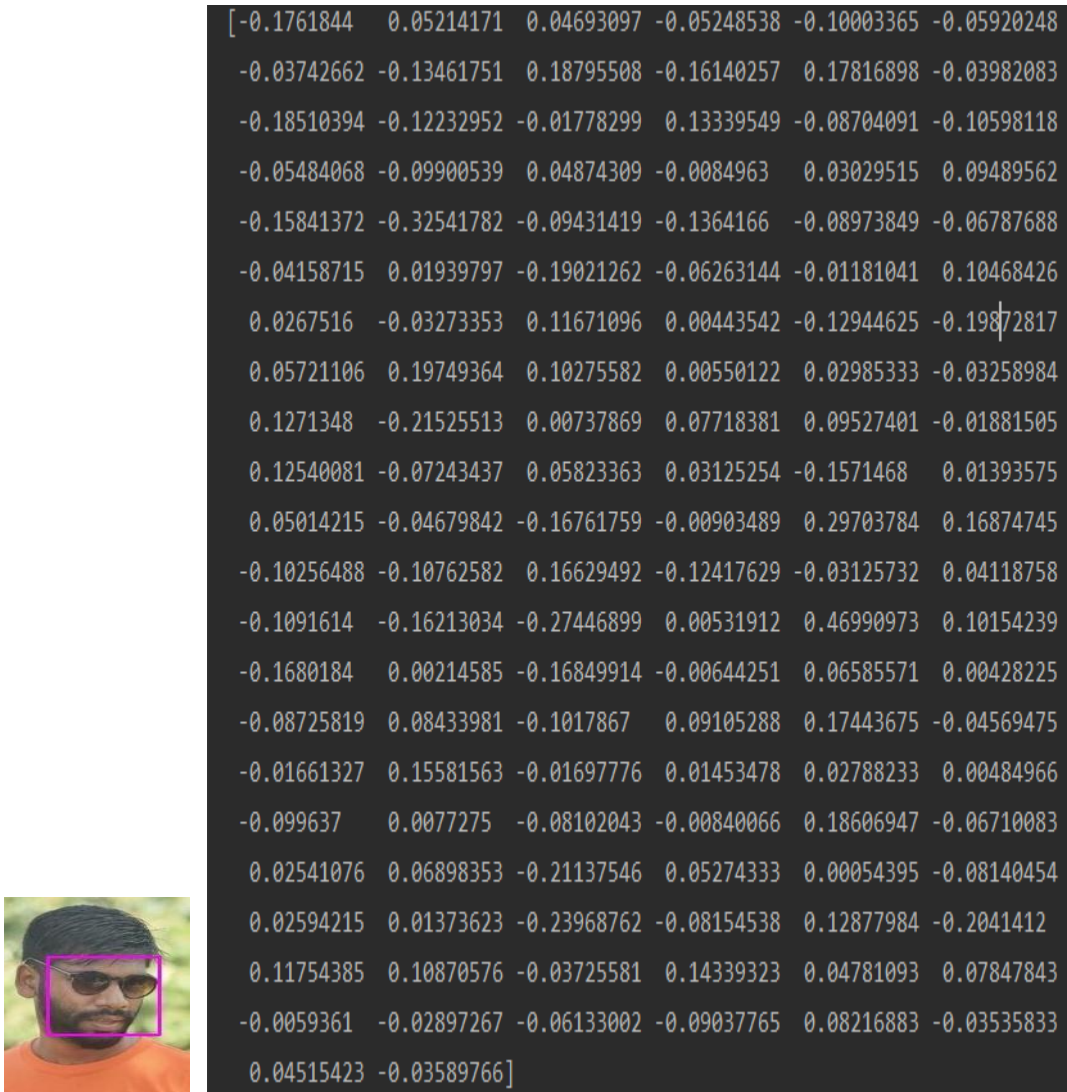
Fig 3.3.4: 128 different measurement point

3.3.6 Attendance

Here we compare all training data with test image or video capture image, in these part we use Support vector machine (SVM) algorithm to generate attendance. Use date time function it update data like student name and time in attendance csv file. We all know that csv is the excel extension. So all data are store in excel sheet.

One student at a time give attendance that shows in Figure 3.3.5

Fig 3.3.5: One Students give attendance at a time

At the mean time attendance csv file automatically generate attendance. That shows in the figure 3.3.6
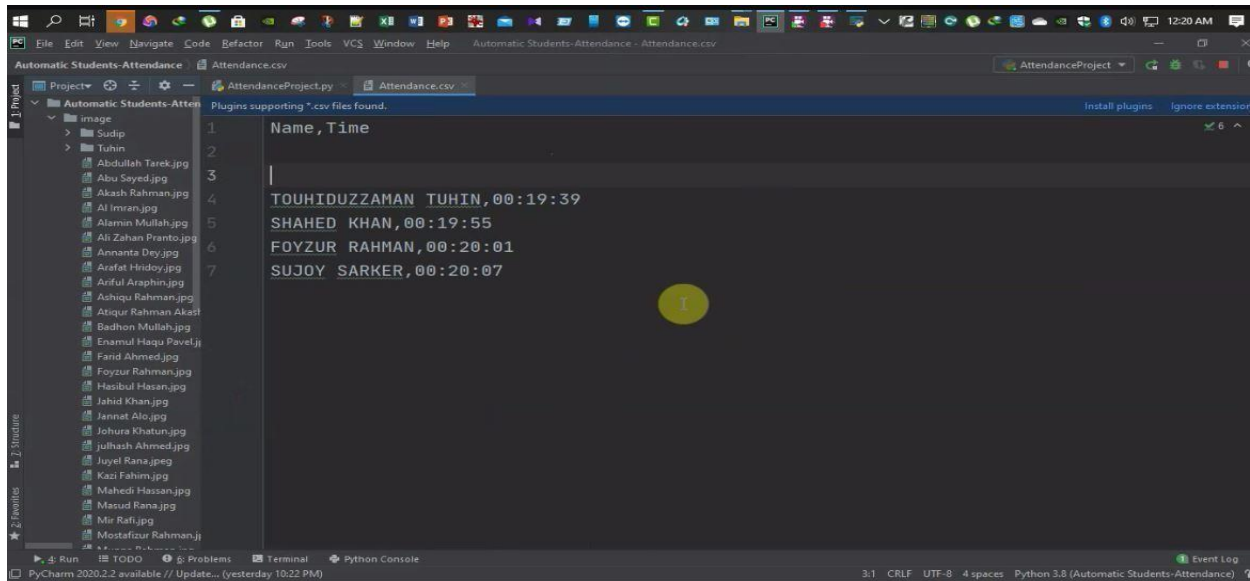

Fig 3.3.6: Attendance Sheet (1)

If more than one students come at a time our project will also work. That shows in the figure 3.3.7
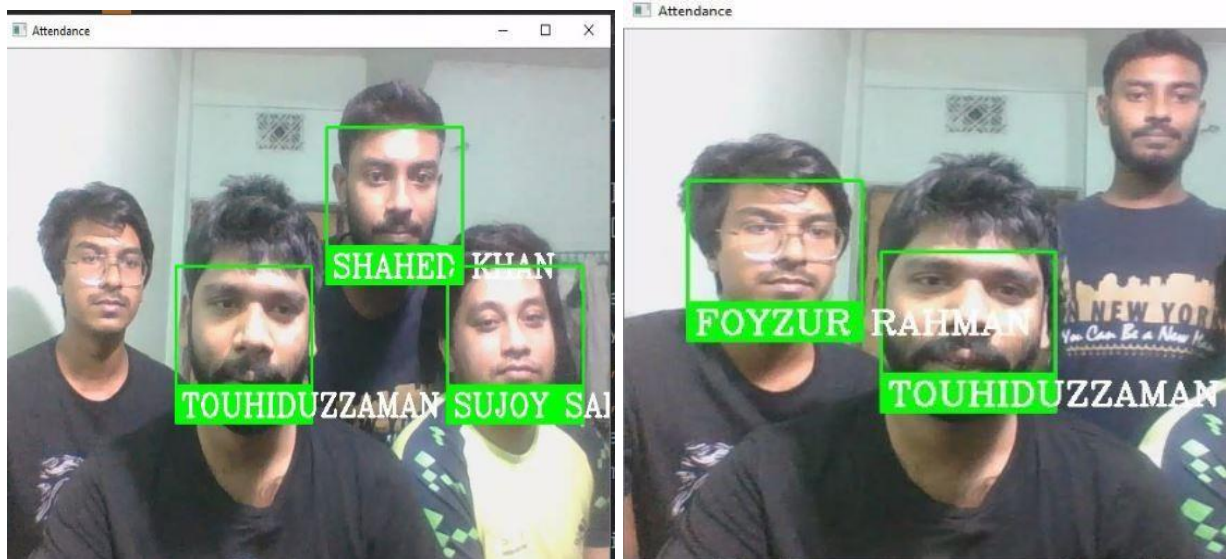

Fig 3.3.7: More than one students give attendance at a time

At that times it will generate the attendance sheet. Here also same time more than one students give attendance. In line number 4 and 5 Touhiduzzaman Tuhin and Sujoy Sarkar attendance time is same, that shows in the figure 3.3.8
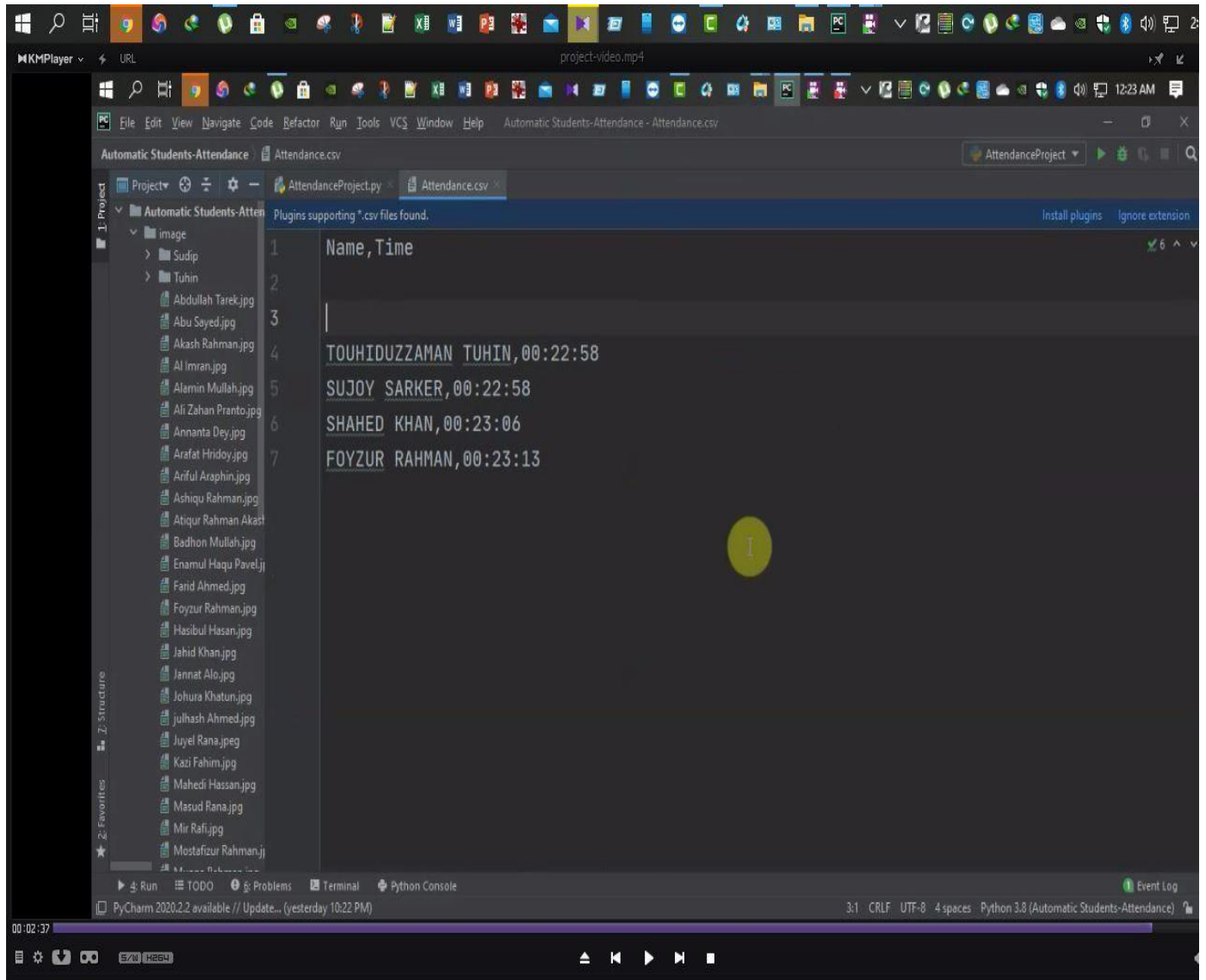

Fig 3.3.8: Attendance Sheet (2)

3.3 Work Flow

Figure 3.3.1 is the proposed model. At first of detect the face area using Histogram of oriented Gradients(HOG). Then we apply Face Landmark Estimation Algorithm to find only the face area point, it will generate 68 point of face. Then we use Affine Transformation to rotate, scale and shear image in perfect view. If it not possible to remove these type of image from training data set image. Then we compare training and test image using Embedding algorithm. To finding person and generate the final Output result we use SVM algorithm.
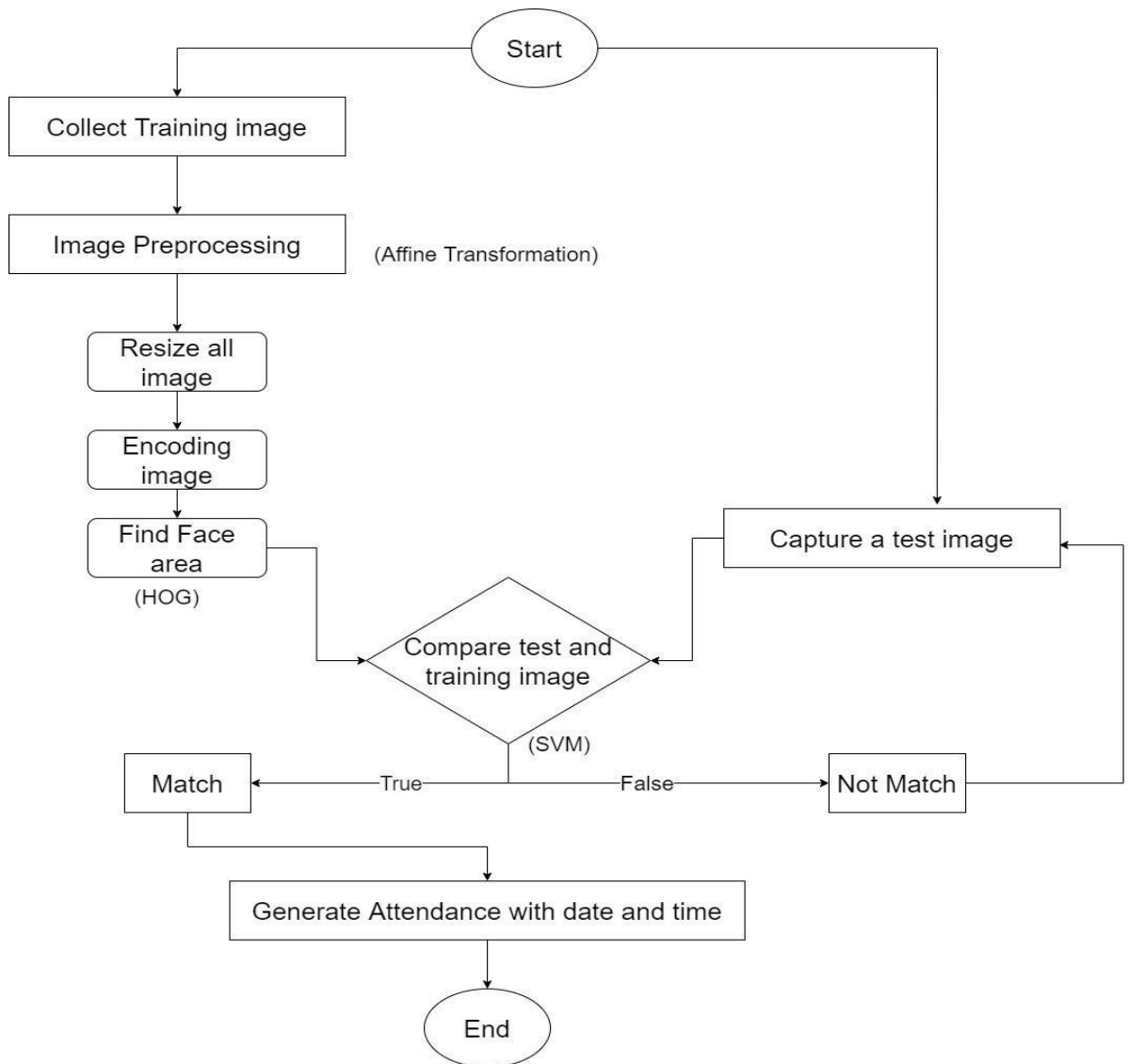

Fig 3.4.1 Proposed Workflow

3.4 Result Analysis

When training image and test image are match it will print True. In figure 3.5.1 shows that training and test image are match
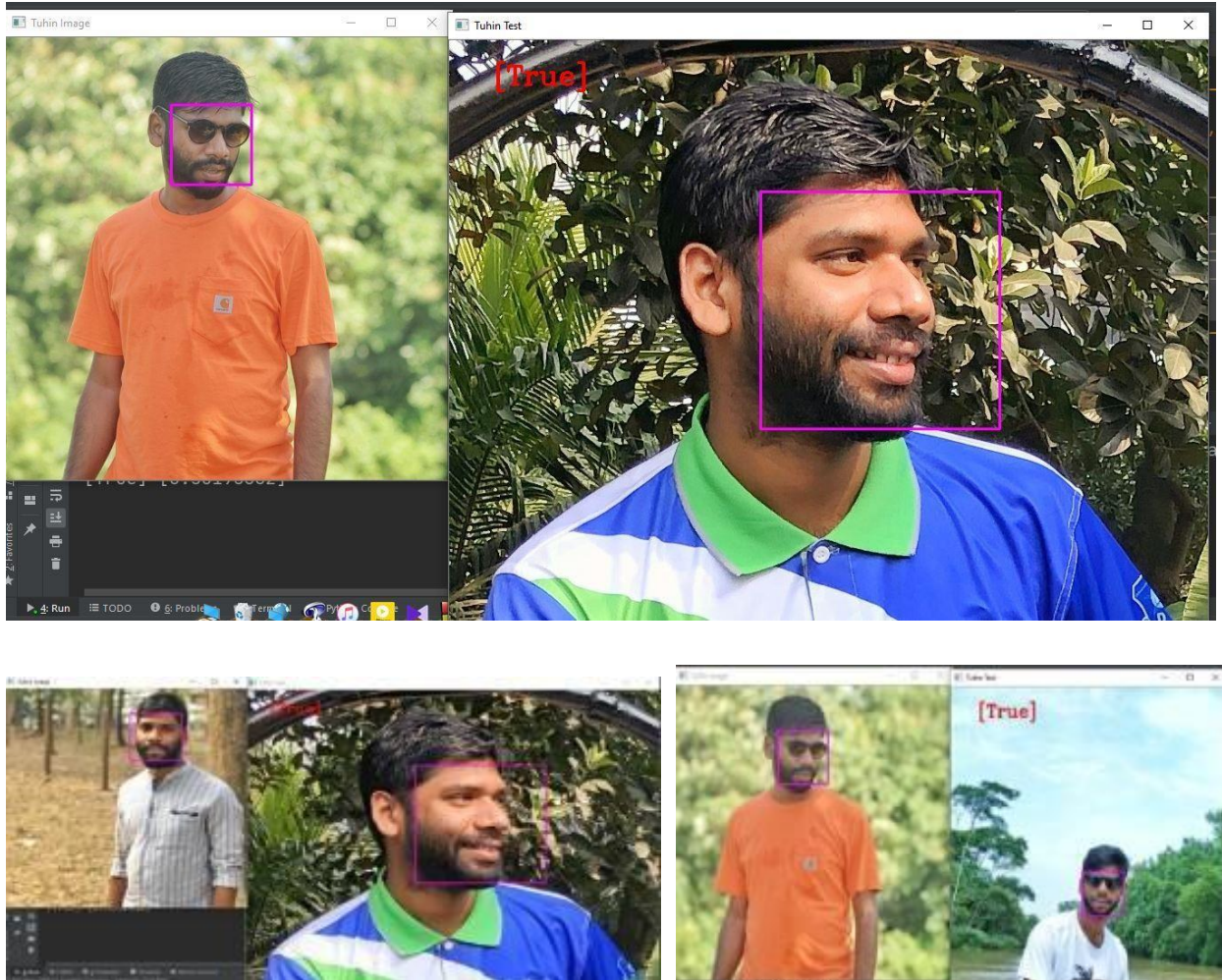

Fig 3.5.1: Training and test image are match

When training and test image are not match it will print False. In Figure 3.5.2 shows that training and test image are not match.
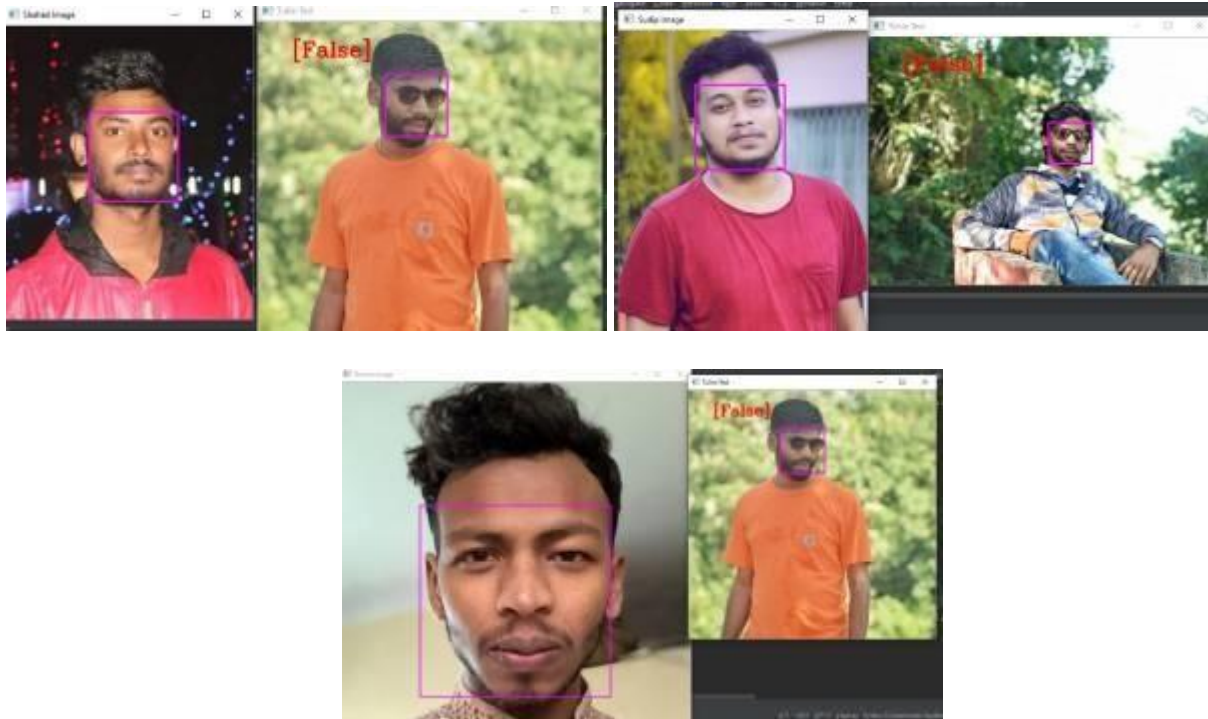

Fig 3.5.2: Training and Test image are not match

3.5 Implementation Requirements

List of Required device, tools and Programs

- Python 3.8(64 bit)

- Pycharm 2020

- Visual code community 2020

We have compare our test and training data in Pycharm (version 2020.2.1 (64 bit) so a computer was used to perform all the experiments which all bearing the configurations as follow.

CPU: Intel® core TM i5-5200 CPU @ 2.20 GHz 2.20 GHz

Ram: 8.00 GB (7.89 GB usable)

Operating System: Windows 10 64 bit

In Our Project we choose Pycharm/Opencv over MATLAB because it's free and open source code. In our project we try to apply many algorithms to find better accuracy. In Pycharm implementation any algorithm is easy compare to others.

Chapter 4
Experimental result and Discussion

4.1 Introduction

In training a facial dataset, we applied the Histogram of Oriented Gradients(HOG) used for face area detection, Face Land Mark Estimation Algorithm used for feature extractions in order to obtain the 68-point face landmarks and converting them to 128 dimensions by Affine Transformation. For the dataset, we used 25 correct face samples and 25 incorrect face samples, for each of the 50 test subjects, and that resulted in a total of 191 sample faces. Results are recorded based on accuracy of the face detection and recognition.

4.2 Experimental result

In our system we test 191 image with manually with our thousands training image and 179 image detect perfectly in our system. Others not detect because of low light, torn image, luminous background. In all previous system of automatic attendance system accuracy rate are around 80- 90 and sometimes it gives unexpected result like detect unknown people.

In Table 1 show's that these accuracy rate calculation and table of recognition value.

In Figure 4.2.1 show's that multiple recognition of one student at a time.

And in Figure 4.2.2 show's that multiple recognition of different students at a time.

Accuracy Rate

Student Name	Test images	Test image recognize	Accuracy Rate
Tuhin	10	9	90.00
Sayed	12	11	91.67
Shahed	39	38	97.43
Shanto	6	5	83.33
Foyzur	9	9	100.0
Sudip	24	23	95.83
Asif	5	5	100.0
Ratul	18	17	94.44
Rakib	3	3	100.0
Pranto	6	5	83.33
Juyel	10	9	90.00
Mehedi	10	9	90.00
Pithula	5	5	100.0
Sakila	9	8	88.89
Mostafiz	7	6	85.71
Pronob	12	11	91.67
Shimul	6	6	100.0
Accuracy Rate	**191**	**179**	**93.71**

Table 4.2.1: Level of Recognition.

Figure 4.2.1: Multiple recognitions of one student.

Figure 4.2.2: One-to-one recognition of multiple students.

The overall level of recognition from the experiment does meet high expectation, except low lighting.

4.3 Description analysis

We used level of recognition to get accuracy. For recognition, we take 191 images for texting purposed and get 179 as expected. We get 12 images as not expected.

For first five students we take 76 images for detect purposed and get 72 as expected. We get 4 images as not expected.

For middle five student we take 56 images for detect purposed and get 53 as expected. We get 3 images as not expected.

For last seven students we take 59 images for detect purposed and get 54 as expected. We get 5 images as not expected.

4.4 Summary

As our result, we get 93.71% accuracy from our level of recognitions.

CHAPTER 5

Implementation

5.1 Introduction

Using Pycharm, we created an easy strategy for automatically detect face and generate attendance. Several algorithms were using for this work and we make prototype for the work easier. Collect image from all of our class mate. Apply six algorithms to find the final Outcome of our project. Machine learning technology has been used to match the person.

5.2 Challenges

- It can only detect face from a limited distance.

- Difficulties with big data processing and storing without GPU and RAM below 4GB

- low-lighting

- torn image and luminous background

- Delude by identical twins.

- Difficult illumination condition.

5.3 Recommendations

There are many remaining areas of interest to be explored, at present time we have worked on the face area find and face measurement point find. The Face recognition is achieved through important steps of apply affine transformation, face area detect, 68 positon find of the face, 128 measurement point, SVM classifier. Face detection has a great future in the school, college and university area. If properly research & utilized it will change many things. This is the part of deep machine learning area and we all know that Machine learning is one of the best thing in next ten years.

Already many researchers are taking interest in this topic and they are doing hard-work & research on face detection and face recognition.

- Torn and Dirty image can be added to the work

- By developing more efficient algorithm, we can handle this more accuracy

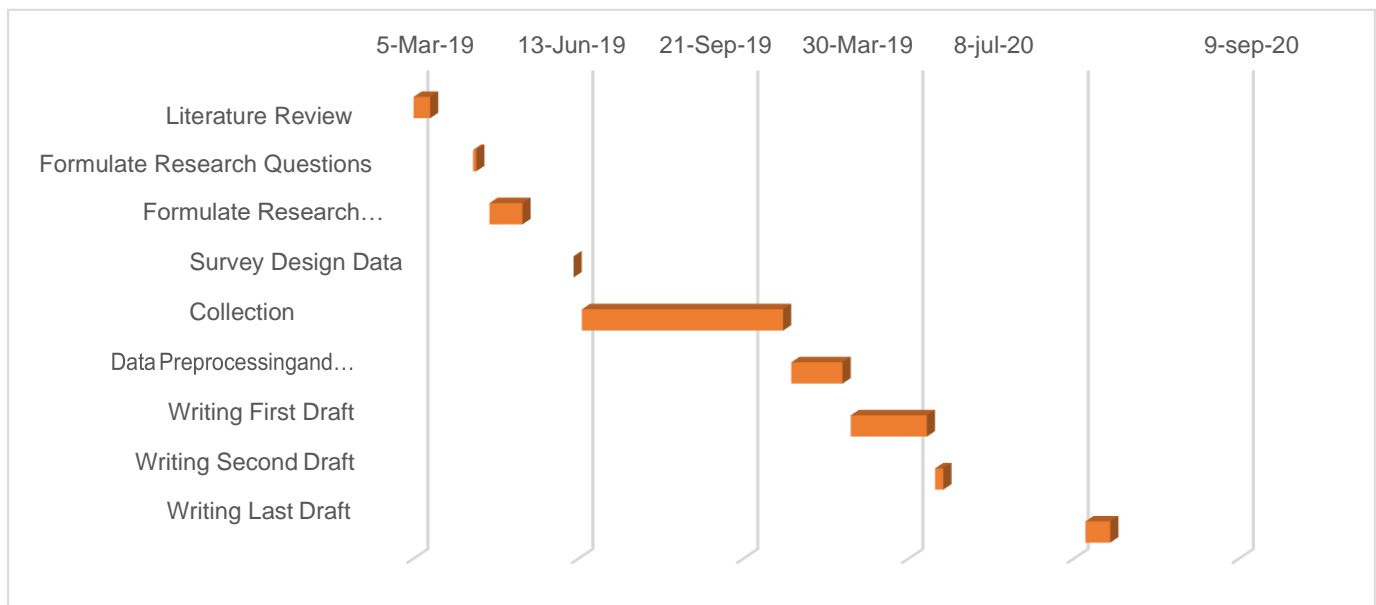## 5.4 Work schedule both for research and development

Table 5.4.1 Gantt chart for Automatic attendance system (Research Part)

5.5 Future Scope

In Our System we automatically update attendance in excel sheet, In modern time everything in online based. So our next step is using these data create a website that automatically update Attendance.

There are some faces which can be further modified such as recognized distance can be extended. Graphics processing unit (GPU) can be used for a large amount of the database and quick processing, data storage can be made server-based and can be integrated with multiple cameras at the same time.

In our system it's automatically generate an excel sheet but in modern days everything is website based. That's why we started to build a website. Our demo is almost ready now, we are trying to implement and build a website for automatically attendance management system.

And also We are already prepared for publish a paper on this topic. And we start writing our paper.

Learning was one of the most fun and challenging part of this project as Artificial Intelligence was the topic we wanted to explore further. Face Detection, Face Recognition, Neural Network, File manipulation, Data Security, and Substantially many more.

CHAPTER 6
SUMMARY AND CONCLUSION

6.1 Summary of the study

Attendance is one of the most important thing in school, college, university. Teachers take manually attendance in the class times. There are lots of time and energy waste to take the attendance. But we all know that proxy attendance can possible in this attendance system. We also know that there are many attendance systems like Radio Frequency Identification Device(RFID) based attendance system. It's very expensive, every student should have carry small RFID device. When they punch it a little bit sound pollution occur, and proxy attendance can possible in these attendance system.

6.2 Conclusion

Our automatically student attendance management system successfully implemented. In our research we used image processing part of machine learning. In general attendance system there are lot of time and energy waste.

Also, since there has been many technical improve in every area. Now, most of institute are use AI(Artificial Intelligence) based system. In many school, college, university are use RFID based attendance system.

In modern days there are many video monitoring systems like door access control and network security. Most of them use RFID based device, but proxy attendance can happen in every system. In our system we are try to remove proxy attendance problem and also increase accuracy rate.

In our theory work, we have effectively proposed a calculation that accomplished 93.71% accuracy rate of our proposed calculation.

6.3 Implementation of further Study

In our Project we are not considered torn and grimy images which can be feature extraction of our project. In any case that will be the complex extraction of our project. In our project we apply a simple deep machine learning algorithm called support vector machine(SVM) algorithm. Next time we will try to apply different to ignore the torn and grimy image issue. We're going to add another chapter where we're generating some information about the students. And, teacher, students, parents all are see the attendance in live web site. It's very helpful for the parents Because, they will aware about their child.

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APPENDEX

Appendix A: Research Reflection

Having finished this endeavor, we have discovered the best approach to higher contend a factor in a paper utilizing statistics and examples, our contentions end up being that bounty higher. A reader takes our contentions all the most basically while we have records to bring down back them up, explicitly data inquired about from sound sources. Getting a greater part of these statistics from explicit perspectives shaped my own focuses. When we utilize these certainties, the paper itself changes completely. They were in any case our contentions however they had been financed through believable assets.

Appendix B: Research reflection

One of the issue is accumulation of Face detection images. To make a preparation data set without training picture it is absurd. There are few difficulties happen that impact the system when it is running. The nature of the picture tests was obscuring and sometimes it is not able to be process.

PLAGARISM REPORT

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