

Mobile-based Attendance Monitoring System Using Face Tagging Technology

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Abstract: Manual checking of attendance may lead to inconsistency of data inputs and may generate unreliable attendance result. Hence, Radio Frequency Identification (RFID) system has been developed to solve this problem, but it allows only checking student's attendance as they enter and exit the school premise only. In consequence, teachers in every subject still need to check and monitor students' attendance manually. Nevertheless, due to a usual large number of students entering and existing the school premise as they are tapping their RFID card, there is always a possibility of proxy attendance. Thus, Mobile-Based Attendance Monitoring System Using Face Tagging Technology (MBAMSUFTT) was developed to provide an attendance monitoring system through biometric authentication such as face recognition. The system serves as a tool for teachers to check and monitor student's attendance in most reliable and accurate way using their smart phones. The MBAMSUFTT generates attendance report intended for close monitoring and printing of student's attendance result. But the reliability of the attendance result (output) of the system depends on the quality of picture (input) sent by the user. Camera specification, ambiance lighting condition, and proper position of students while taking photo is exclusively required. The server and the mobile part can only run together if Wireless Fidelity is on, otherwise, monitoring will not be executed.

As a developmental research, this study used the Agile Model based on System Development Life Cycle (SDLC) intended for building a project that can adapt to change requests quickly. The MBAMSUFTT was evaluated based on the ISO/IEC 25010; MBAMSUFTT's software quality characteristics by the IT experts, and its functionality, performance efficiency, and usability by the teachers. The analysis of the data revealed that the MBAMSUFTT serves its intended purpose in checking and monitoring students' attendance per subject area with more accurate and reliable attendance results and has also met the ISO software quality standards.

Index Terms: Agile model, attendance, authentication, biometric, face recognition radio frequency, identification, smart phone, System Development Life Cycle.

1. Introduction

Regular school attendance is crucial to the development and education of learners. Attendance rate is important because students are more likely to succeed in academics when they attend school consistently (GreatSchools Org., 2019).

According to Usman et. al (2014), attendance management of students through the conventional method had been a challenge in the recent years. Moreover, the process of checking large number of student's attendance by means of calling their names one by one will notify the teacher if the student is present or not then recording the attendance result

in a form of paper and pen manually that may lead to inconsistency in data entry and generate errors that will give unreliable attendance result (Jacksi et al., 2018).

Hence, many systems have been developed to solve problems in checking and monitoring students' attendance in most accurate and reliable way. Nowadays, the use of Radio Frequency Identification (RFID) system in attendance monitoring is currently being practiced by most schools (public or private) under the Department of Education. The RFID attendance system has the ability of uniquely identifying each student based on their RFID tag type of ID card that makes the process of taking the attendance easier, faster and secure as compared to conventional method (Lim et al., 2009).

However, this system used to take student's attendance as they enter and exit the school premise only, so teachers in every subject still need to check and monitor students' attendance manually to see if there is no one doing cutting classes. According to Inamdar (2018), attendance marking in a classroom in every subject is not only burdensome but also a time-consuming task. It is extremely difficult for every teacher to manually identify the students who skip their subject on regular basis. As a result, school administrators and teachers still need to consume time and effort in doing attendance summary report religiously. Moreover, this system can easily be compromised through the help of fellow students tapping RFID tag on behalf of their friends. Due to a usual large number of students entering and existing the school premise as they are tapping their RFID card, there is always a possibility of proxy attendance (Chew et al., 2015).

Hence, modern methods like biometrics have been proposed as a solution to the problems faced by traditional methods. Biometric authentication is the process that utilizes unique human traits to identify a person in an accurate manner (Rountree, 2013). It requires any device that has digital photographic technology to generate and obtain the images to create and record the biometric facial pattern of the person that needs to be identified. Face recognition uses unique mathematical and dynamic patterns in order to recognize and identify a person in the safest and most effective one (<https://www.electronicid.eu/en/blog/post/face-recognition/en>).

Thus, the mobile-based attendance monitoring system has been developed. This system uses face recognition technology that makes attendance checking of students more reliable and efficient.

The project was conceptualized through the use of Agile model based on System Development Life Cycle that consists of six (6) different phases that was used to design, develop, and test the quality of the system. The Agile software development model is an iterative development intended for building a project that can adapt to change requests quickly. Each incremental part is developed over iteration for a full software development life cycle including planning, requirements, analysis, design, coding and testing before a working product will be released (Tutorials Point, 2020).

According to Nesehi (2013), agile have implemented several practices that deliver greater value to customers. Self-organizing teams' idea is the fundamental aspect of these practices as they were assigned to do their task at a pace that accommodate any modifications in requirements at any step through the development process. Moreover, customers or end-users are actively involved in the development process through the feedback that they are providing to the development team.

The Agile model starts with Defining the Requirement where all the necessary information was gathered to give a clearer picture of the entire project and to anticipate possible issues that may occur in terms of economical, operational and technical areas. The second phase is the Design that clearly defines the over-all architectural design of the system. This serves as an input for the next phase of the model which is the Development phase which follows the design structure of the system by means of creation of database and actual coding to complete the system based on the given specifications. Testing activities will still be conducted under the Development phase to check for bugs and errors and to guarantee the quality of the software resulting to Quality Assurance phase. User Acceptance Testing is the second to the last phase where actual users test the system to see if all the required specifications is being carried out by the system. After the system has been tested, the Releasing phase will follow. This is where the final output of the system and the implementation phase will occur while the users keep on using the system to check the level of effectiveness to its intended purpose.

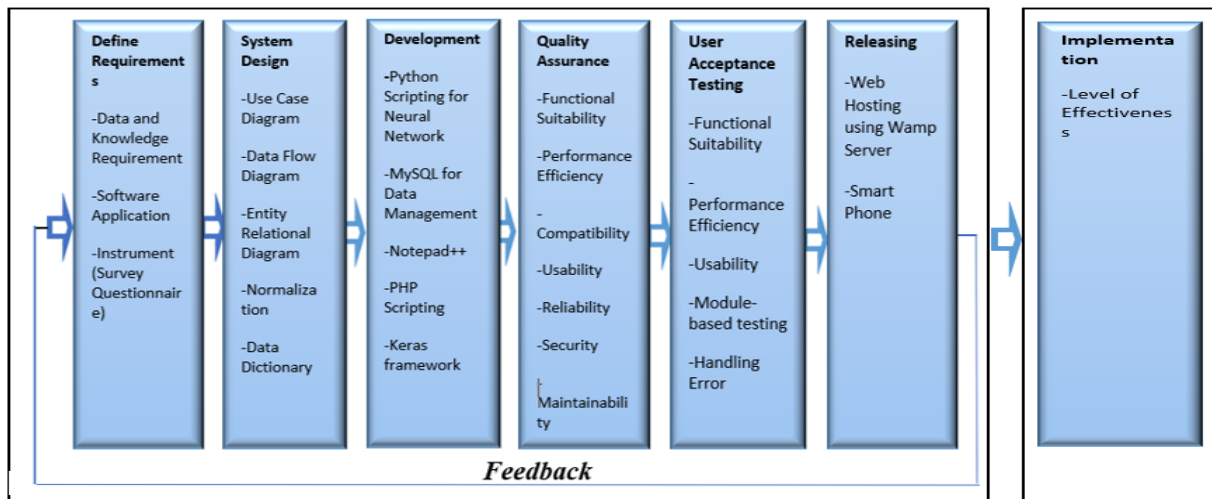


Fig.1. Research Paradigm

Figure 1 shows the research paradigm that serves as a guide in designing and developing the proposed system.

2. Methodology

A. Research Design

The researcher used a developmental method of research. Development research is the systematic study of designing, developing, and evaluating instructional programs, processes, and products that must meet criteria of internal consistency and effectiveness (Ibrahim, 2016).

The study has two phases: development and evaluation of the MBAMSUFTT. The Agile Model which is based on System Development Life Cycle (SDLC) was used as a developmental research design of the MBAMSUFTT. Evaluation was made by the IT experts and senior high school teachers.

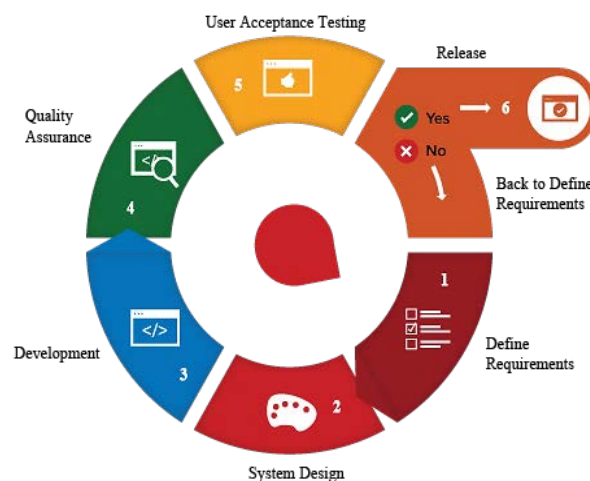


Fig.2. Agile Development Model

The development of the MBAMSUFTT is based on the Agile Development Model as shown in Figure 2. is a combination of iterative and incremental process models with focus on process adaptability and customer satisfaction by rapid delivery of working software product.

3. Results and Discussions

A. Design Phase

Typically, the process of using the MBAMSUFTT including the source of data, and how these interact with other data sources were identified to produce desirable output. The DFD at Level 0 also called as context diagram designed to show that the system is a single high-level process, with relationship to its external entities. It is the basic overview of the whole system process being analyzed or modeled as shown in Figure 3.

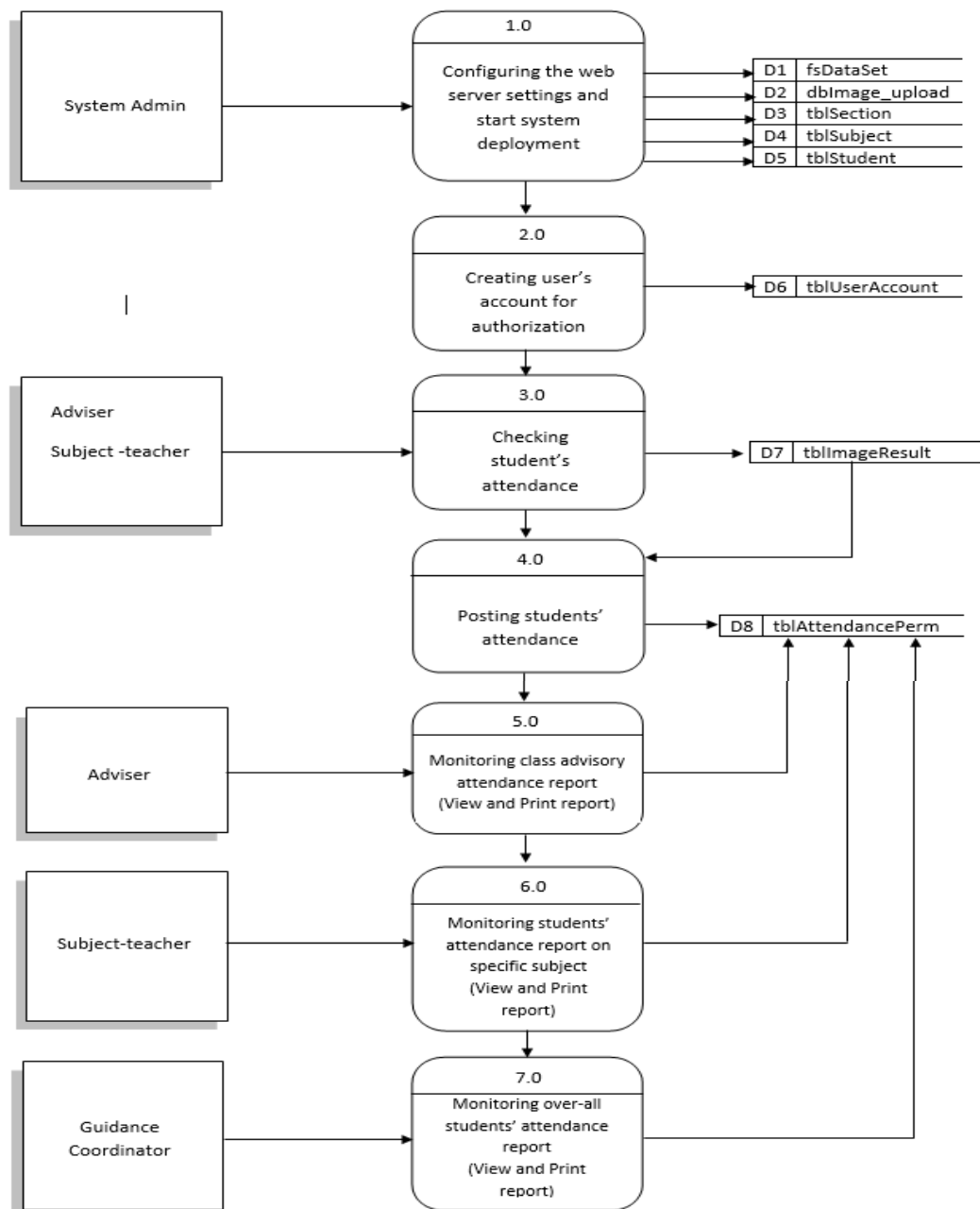


Fig.3. DFD Level 0

Meanwhile, the MBAMSUFTT set some perimeters of access to its external entities such as the adviser, subject-teacher, guidance coordinator and administrator. The attendance monitoring system allows the adviser and subject-teacher to login, check attendance, post attendance, view attendance report and print attendance report of the students while guidance coordinator allowed only to log-in, view attendance report and print attendance report of the students for monitoring purposes. The system produces an attendance report as an output for the users. However, the system also allows the admin to configure the web server settings which includes encoding and recognizing student's faces, adding section, adding subjects, creating user accounts, and back up database. On the other hand, all users are allowed to search student's name and section for some instance of inquiries.

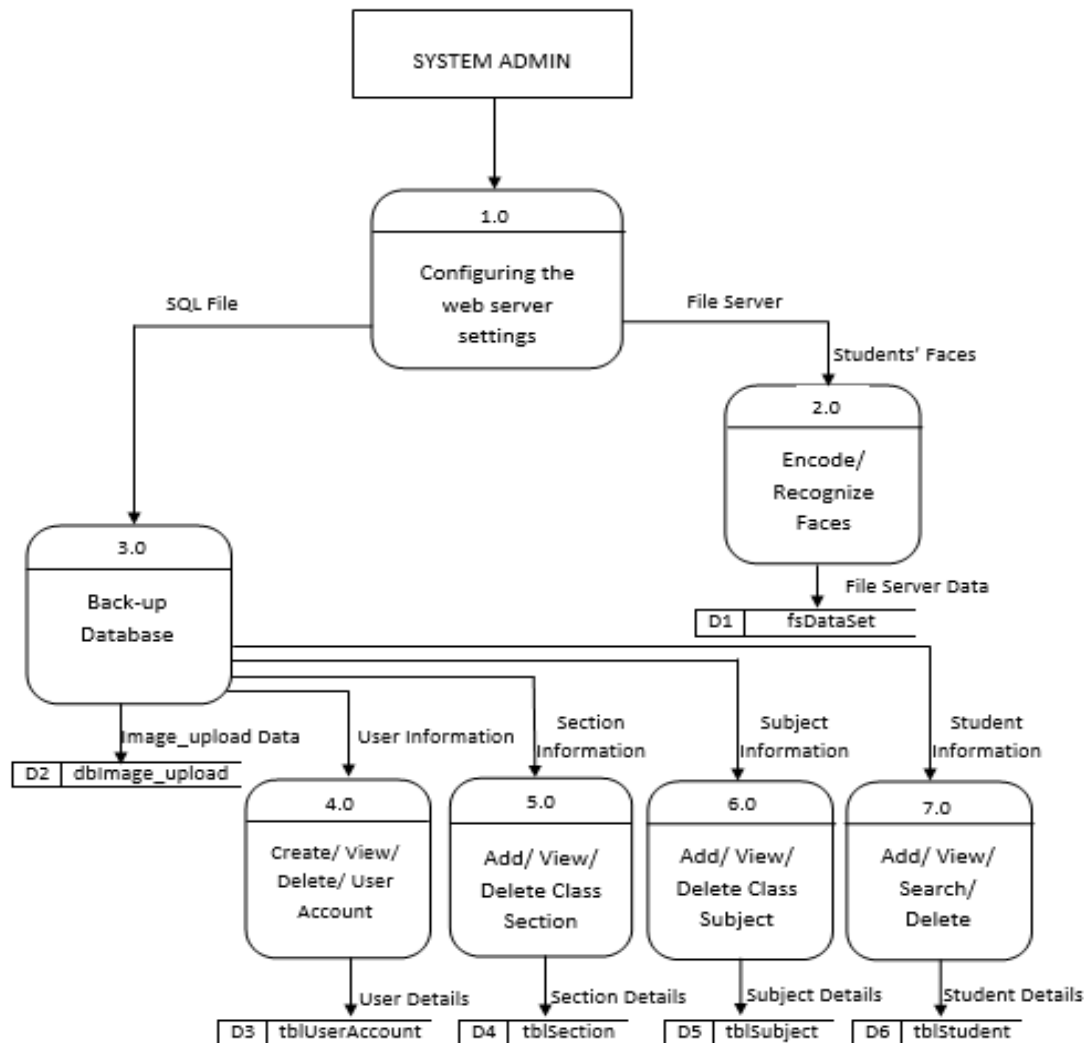


Fig.4. DFD Level 1 Admin

DFD Level 1 Admin in Figure 4 intends to provide more detailed processes available for admin specifically configuring the web server settings that includes encoding and recognizing student's faces from file server; adding, viewing and deleting section; adding, viewing, and deleting subjects; adding, viewing, and deleting students; searching students; creating user accounts; and back up database in SQL File. The needed data and where data stores were specified in order for the admin to perform each process.

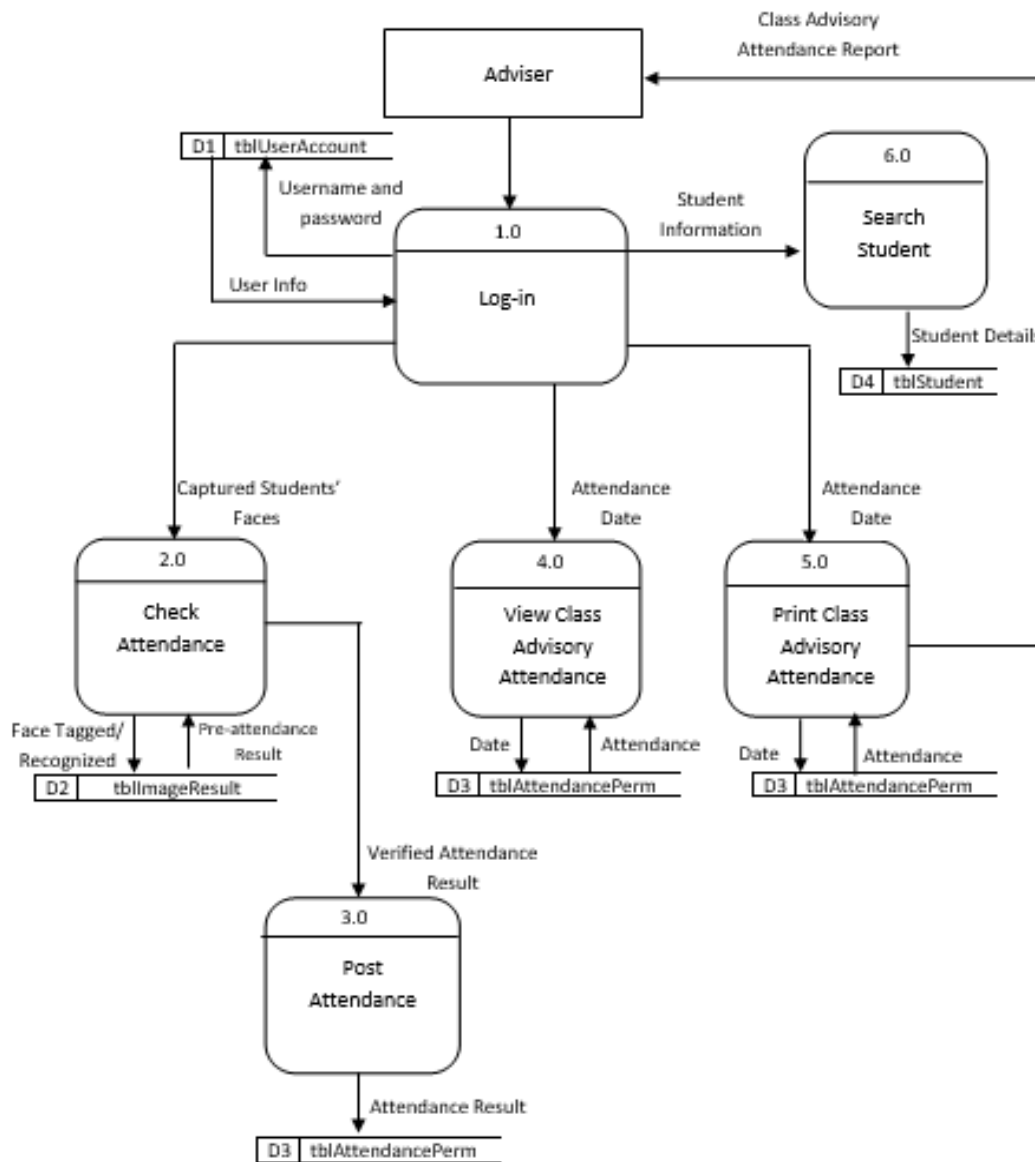


Fig.5. DFD Level 1 Adviser

Figure 5 shows the DFD level 1 Adviser with different processes available for adviser such as login, check attendance, post attendance, view class advisory attendance report, print class advisory attendance report and search student's name and section. Each process requires specific data and data stores in order to be accessed by the advisers.

Fig.6. DFD Level 1 Subject-Teacher

The DFD Level 1 Subject-teacher shows in Figure 6 determine the different processes available for subject-teacher such as login, check attendance, post attendance, view students' attendance report on specific subject, print attendance report on specific subject and search student's name and section. Each process requires specific data and data stores in order to be accessed by the subject-teachers.

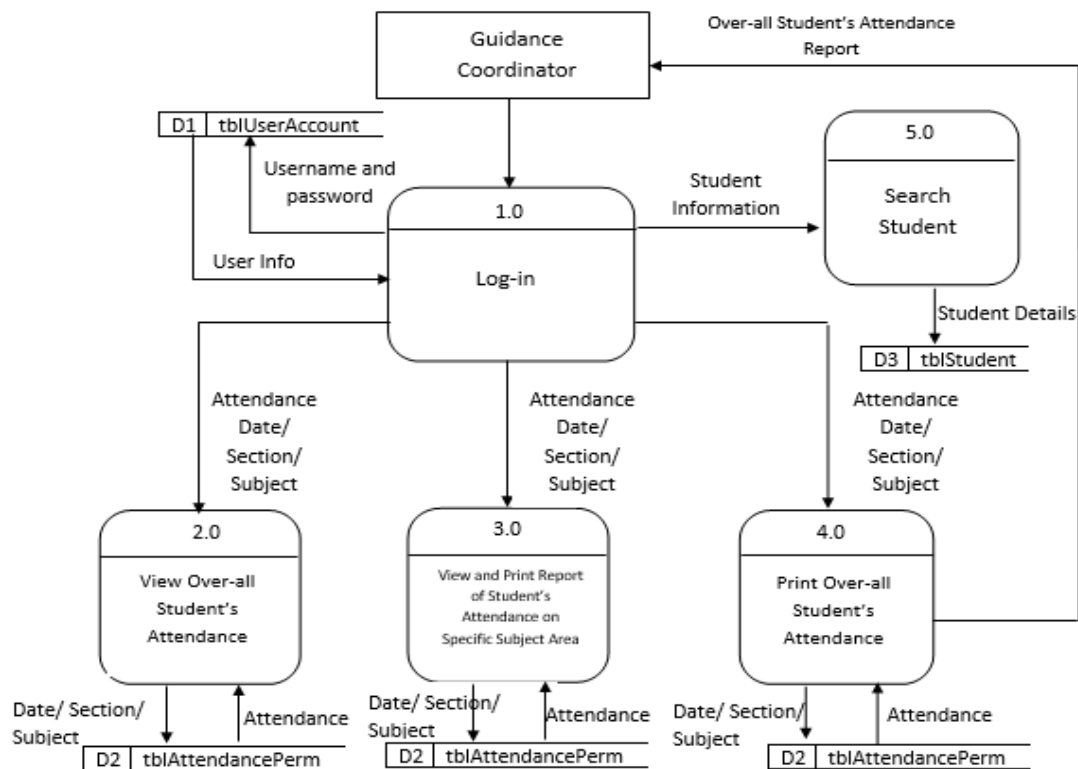


Fig.7. DFD Level 1 Guidance Coordinator

The DFD Level 1 Guidance Coordinator implies different processes available for guidance coordinator such as login, view over-all students' attendance report, print over-all students' attendance report and search student's name and section. Each process requires specific data and data stores in order to be accessed by the guidance-coordinator.

B. Use Case Diagram

In the use-case diagram, interactions between the admin and the system were defined. Figure 8 presents the use – case diagram for MBAMSUFTT where the roles and boundary of the actors, which are the subject-teacher, adviser, guidance coordinator and system administrator in relation to the elements of the system, were specified.

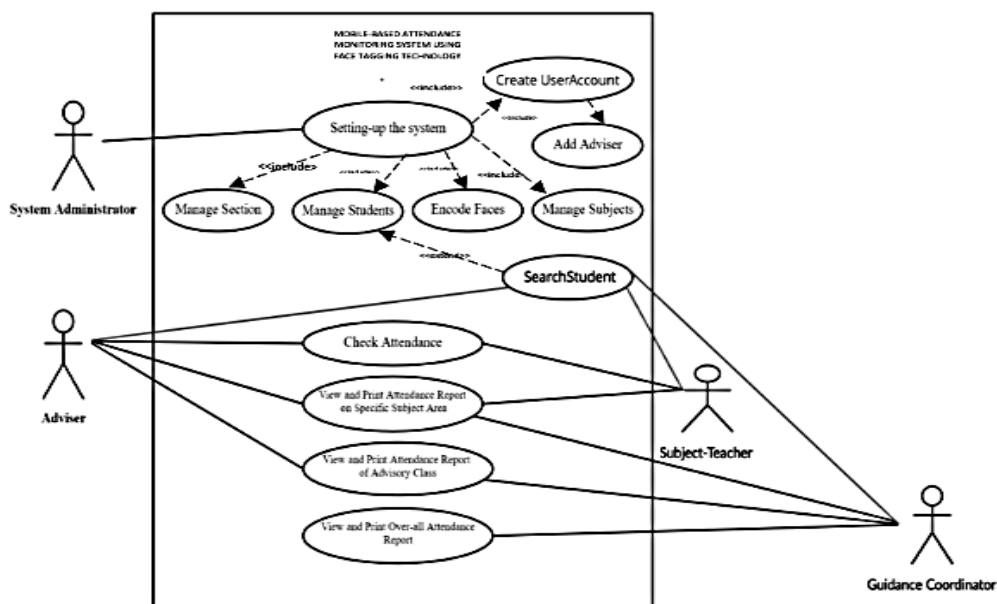


Fig.8. Use – Case Diagram

The adviser and subject-teacher are both allowed to perform check the student's attendance using the system, post the attendance result to the server, and monitor the student's attendance based on the attendance report. In addition to this, the adviser is also allowed to view and print his/her advisory class attendance report per specific subject area. The subject-teacher, on the other hand, is only allowed to view and print attendance report of students under his/her subject. The guidance coordinator, can also login but can view and print the over-all attendance report of the students in all subject area. The admin has a number of specific roles that are not available to the adviser, subject-teacher, and guidance coordinator such as setting-up the system that includes creating user accounts, adding sections, adding subjects, encoding names and pictures of students per class into the system, update and back-up database. Otherwise, all users are allowed to search student's name and section for some instance of inquiries.

C. Coding Environment

The layout and functions of the MBAMSUFFT were developed using JavaScript, CSS, and PHP While the database was constructed using MySQL while PHP, a GUI tool for the RDBMS MySQL was used to manage the database.



```

autorunfacerecognizer.py - Notepad
File Edit Format View Help
import mysql.connector
import os
import time
from mysql.connector import Error
import sys
import time

connection = mysql.connector.connect(host='localhost',database='image_upload', user='root',password='', port='3308')

uid = int(sys.argv[1])
sql_select_Query = """SELECT * FROM images WHERE uid =%s Order by id desc LIMIT 1"""
cursor = connection.cursor()
cursor.execute(sql_select_Query, (uid,))
row = cursor.fetchone()
imagenam=row[1]
inp=row[2].split(';')
section=inp[0]
subject=inp[1]

mycursor = connection.cursor()
mycursor.execute("SELECT MAX(aid) FROM attendance WHERE uid =%s limit 1", (uid,))
myresult = mycursor.fetchone()
myresult=myresult[0]
if myresult is None:
    myresult = 0
print(myresult)
t2 = int(myresult)+1
#print(imagenam)
#print('python recognize_faces_image.py --encodings dataset/%s/encodings.pickle --image images/%s'%(section,imagenam))
os.system('python recognize_faces_image.py --userid %s --encodings dataset/%s/encodings.pickle --image images/%s'%(uid, section,imagenam))
#print("natapos")
#sql_update_query = """Update newresult set hasNewResult = 1 where id = 1"""
#cursor.execute(sql_update_query)
connection.commit()
cursor.close()
#print("Record Updated successfully ")

```

Fig.9. Coding Environment

Figure 9 presents the coding environment used to develop the system.

On the other hand, the database management environment is the PhpMyAdmin interface that was used to construct the database of the MBAMSUFFT as presented in Figure 10.

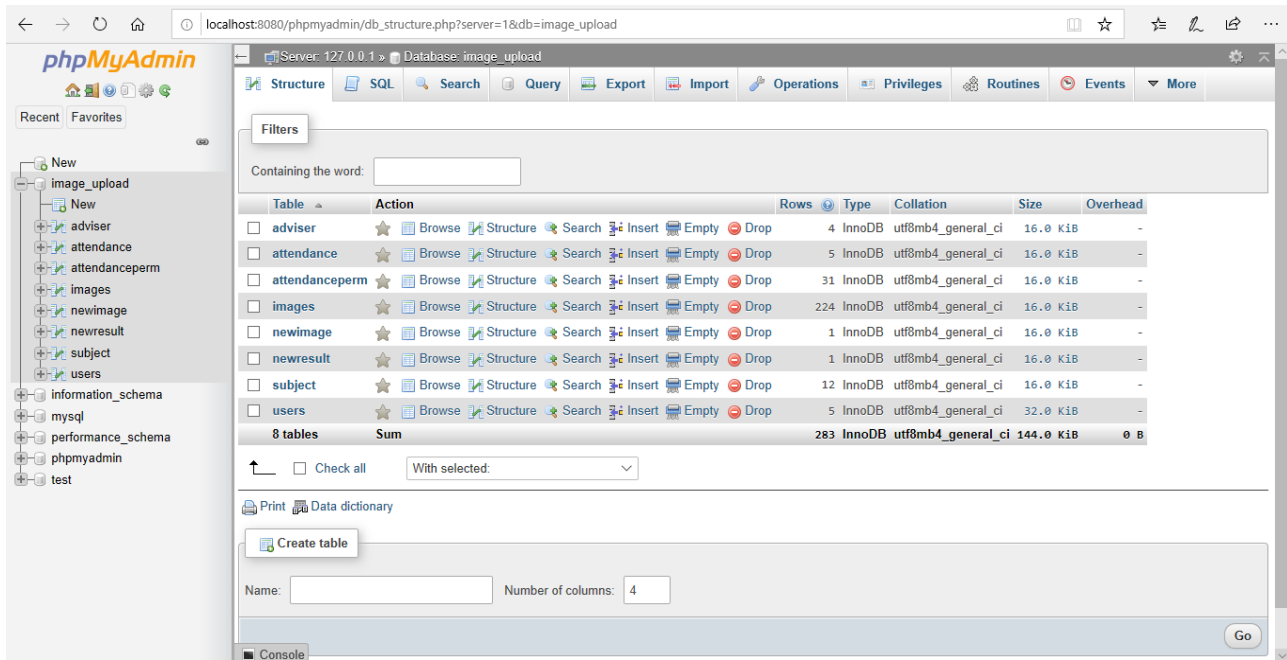


Fig.10. Database Management Environment

D. Development Phase

The development phase of the system was concurrently done with the System Design Phase including detecting of errors. During the coding of the program, Python Scripting, Anaconda prompt, Convolutional Neural Network based on Keras framework, Wamp, JavaScript and CSS based on Bootstrap framework, PHP, MySQL, and Notepad ++, were used to create the system.

During the implementation of MBAMSUFFT, the following hardware are needed: the server part of MBAMSUFFT requires a desktop computer with Windows operating system, Core i5 7th generation processor, 8gb RAM, 1tb hard disk and at least 6gb NVIDIA GEFORCE video card that cost forty thousand pesos (P40,000.00); a Wi-Fi router is also required that will serve as a gateway for sending pictures (input) to the server and sending back the attendance result (output) to the user that cost two thousand five hundred pesos (2,500.00); and a mobile monitoring part that requires a smartphone with at least 16mp of camera to capture students' attendance vividly for more reliable result that cost ten thousand pesos (10,000.00).

Table 1. Costing of MBAMSUFFT

Hardware Devices	Cost
Desktop Computer Core i5 7 th Gen, 8gb RAM, 1tb HDD, 6gb NVIDIA GEFORCE	P 40, 000.00
Wi-Fi router w/ repeater	2,500.00
Smartphone w/ 16mp camera	10,000.00
Total Cost	P 52,500.00

E. Quality Assurance Phase

Software quality measurement is the key factor in the development of any software system. Various software quality models are devised to measure the performance of a software system that determines which quality will be considered when evaluating the properties of a software product (Sanjay et al., 2015). The quality of a system is the degree to which the system satisfies the stated and suggested needs of its various users and thus provides usefulness.



Fig.11. ISO/IEC Quality Standards

Figure 11 shows the ISO/IEC Quality Standards developed by International Organization for Standardization (ISO) and International Electro-Technical Commission (IEC). The quality model defined in ISO/IEC 25010 comprises the eight quality characteristics with sub-characteristics that served as a basis for the software product quality of the developed system.

F. User Acceptance Testing Phase

The testing stage evaluates the software for errors and bugs if there are any. The researcher tested the fully integrated system through local hosting with the use of a desktop server and mobile phone to check how components interact with one another. The system also tested thoroughly to verify if it meets the technical and functional specification.

However, due to Covid-19 existence and face to face interaction is highly avoided, the researcher created a video presentation providing initial testing for user then immediately follow by actual user testing showing how the system works in actual application to make sure that it can handle required tasks in real-world scenarios according to specification.

All functions of the system were tested based on the flow chart as shown in Figure 12 and 13.

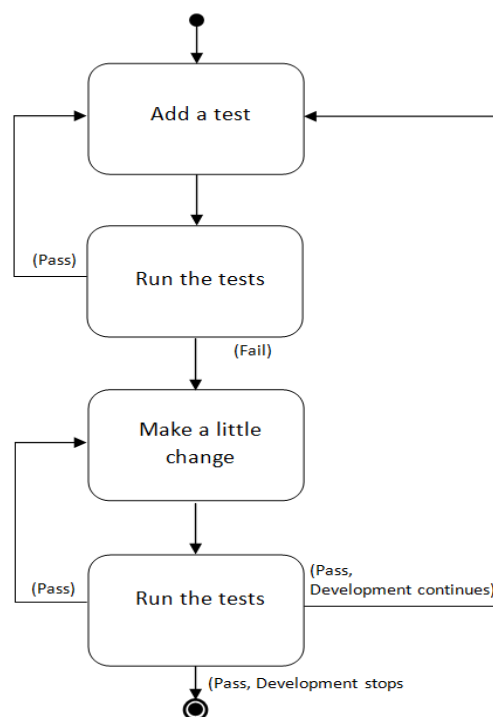


Fig.12. User Acceptance Testing



Fig.13. During Acceptance Testing

The user acceptance testing started with the system trial and if there was a bug, the developer would make a little change to debug and run the system to test again. If passed, the testing will continue to other function, on the other hand if failed, the debugging will start again and run the test.

G. *Releasing Phase*

In this phase, the system was fully tested, and no prime issues remain in the mobile-based attendance monitoring system using face tagging technology. It was deployed in a secure local hosting server and has a localhost name of 127.0.0.1/image_upload where users were able to access the system. It was accessible if the required specifications for hardware requirement are being met.

A web hosting involves using a computer that serves as a server where all data are being stored and retrieved. It can be set up via a local web stack called Wamp which provides a web server for local hosting, MySQL for database, and interpreter for scripts written in the PHP programming language used by the system. In addition, mobile phone serves as a server client that uses to fetch the input data needed by the system and later create an output after the system run its functions.

4. Conclusions and Recommendations

The study focused on the development and evaluation of a Mobile-Based Attendance Monitoring System Using Face Tagging Technology for Senior High School Students of Sto. Domingo National Trade School (MBAMSUFTT). The MBAMSUFTT was designed for senior high school teachers and guidance coordinator in their monitoring of student's attendance and releasing of students' attendance report. The teachers including guidance coordinator can check attendance, view and print the attendance report of their respective students using MBAMSUFTT. The MBAMSUFTT was developed using the Agile Model based on System Development Life Cycle (SDLC).

Based on the results of the study, the following conclusions are drawn.

1. The MBAMSUFTT clings to the software quality requirements of software application development set by ISO/IEC 25010. As such, it serves its purpose as a monitoring tool for student's attendance through face recognition and provides attendance reports in every subject.
2. The MBAMSUFTT possesses good qualities of a system development for the purpose of monitoring student's attendance using face tagging technology resulting to very acceptable ratings of the IT experts in terms of functional suitability, performance efficiency, compatibility, usability, reliability, security, maintainability, and portability.
3. The MBAMSUFTT serves its intended purpose to the teachers including guidance coordinator in checking and monitoring student's attendance using face tagging technology ensuing very acceptable ratings of end-users in response of functional suitability, performance efficiency, and usability.
4. The MBAMSUFTT is a highly effective system as rated by both IT experts and end-users. The system has very satisfactorily met the acceptable level of effectiveness in necessary functions should have for attendance monitoring during its implementation.

Based on the findings and conclusions drawn, the following recommendations are offered:

1. The Mobile-Based Attendance Monitoring System Using Face Tagging Technology (MBAMSUFTT) can now be utilized by the Sto. Domingo National Trade School at the soonest time possible as an alternative way of checking and monitoring student's attendance.
2. The SDNTS must conduct orientation and trainings to end-users on the use of the MBAMSUFTT before it is finally adapted.
3. The use of server desktop or laptop with high specifications of graphics card is recommended to enhance MBAMSUFTT functionality.
4. The use of the MBAMSUFTT is recommended to undergo a regular monitoring, maintenance, and evaluation to ensure its continued effectiveness.

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