DESIGN MANUAL

SMART ATTENDANCE MARKING SYSTEM

(SAMS)

Presented by:

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ABSTRACT

This project aims at designing a Smart Attendance Marking System which could be used to manage attendance of students at institutes like universities and colleges. A fingerprint recognition based identification system is used to identify the students and lecturers individually. Fingerprints are considered to be the best and fastest method of biometric identification. They are secure to use, unique for every person and do not change in one's lifetime. Through this system, the time consumed for regular attendance marking is reduced and this minimizes the illegal activities associated with attendance marking. The accuracy of the process is heightened through this system and the required analysis and reports are generated automatically. Students can go through their attendance reports and they can aware of their attendance progress easily and Teachers also can check their time tables, schedules through the web application.

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INTRODUCTION

Problem

Difficulties faced by students, teachers in manual attendance marking process.

Solution

Designing an attendance management system based on fingerprint recognition that is suitable for an educational institute.

Motivation

In many institutions and organizations the attendance management is a very important factor for various purposes and its one of the important criteria that is to follow for students and for the organization. It's very important for the functioning of the institute whether it's an educational institute or a business organization. But the regular systems and methods for marking attendance are pretty much inconvenient. In most of the schools, teacher has to call students by their names and then mark the attendance. It is somewhat inconvenient to the teacher and it takes a considerable time also. So, designing a better attendance management system for students so that records are maintained with ease and accuracy was an important key behind motivating this project. This would improve accuracy of attendance records because it will remove all the hassles of roll calling and will save valuable time of the students as well as teachers.

Use of biometrics

Biometric Identification Systems are widely used for unique identification of humans mainly for verification and identification. Biometrics is used as a form of identity access management and access control. So use of biometrics in student attendance management system is a secure approach. There are many types of biometric systems like

- Fingerprint
- Facial image/Facial thermograms
- Iris/Retina
- Voice
- Hand geometry
- Signature

Why Fingerprint?

- **Unique**

  The fingerprint recognition is widely used for many other purposes and it is widely popular technique. Fingerprint verification is very convenient and reliable way to verify the person's Identity. The reason for popularity of fingerprint technique is uniqueness of person arises from his behavior; personal characteristics are like, for instance uniqueness, which indicates that each and every fingerprint is unique, different from one other. Universality, that means every person hold the individual characteristics of fingerprint.

- **Security**

  It is believed that no two people have identical fingerprint in this world, so the fingerprint verification and identification is most popular way to verify the authenticity or identity of a person wherever the security is a problematic question.

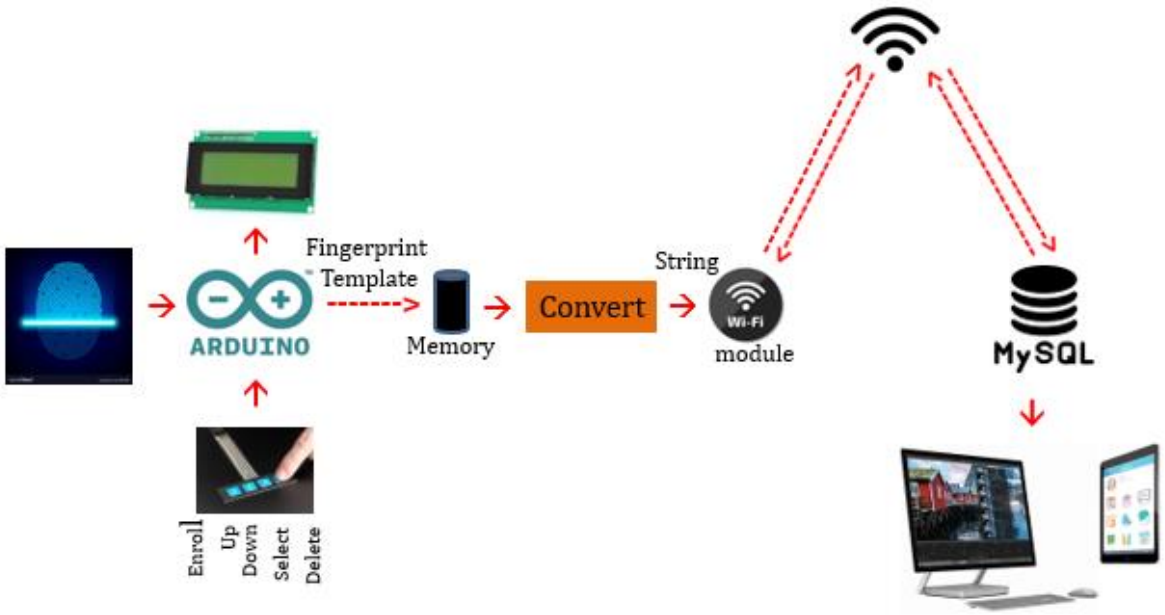
- **Long Term Permanence**

  Long term permanence means that fingerprint are permanent, are impossible to change or forgot, and can never be stolen.

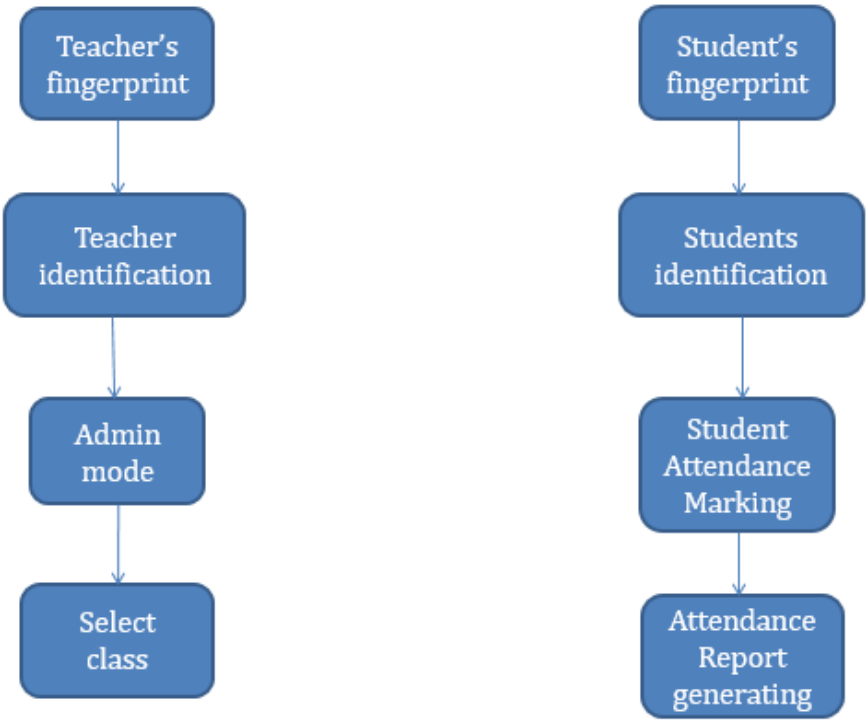
- **Easy to use**

  There are a lot of expectations that the use of fingerprint recognition will increase which is dependent of some factor involved like small fingerprint capturing devices, fast computing hardware, and awareness on easy to use methods for security.

BLOCK DIAGRAM



FLOW CHART

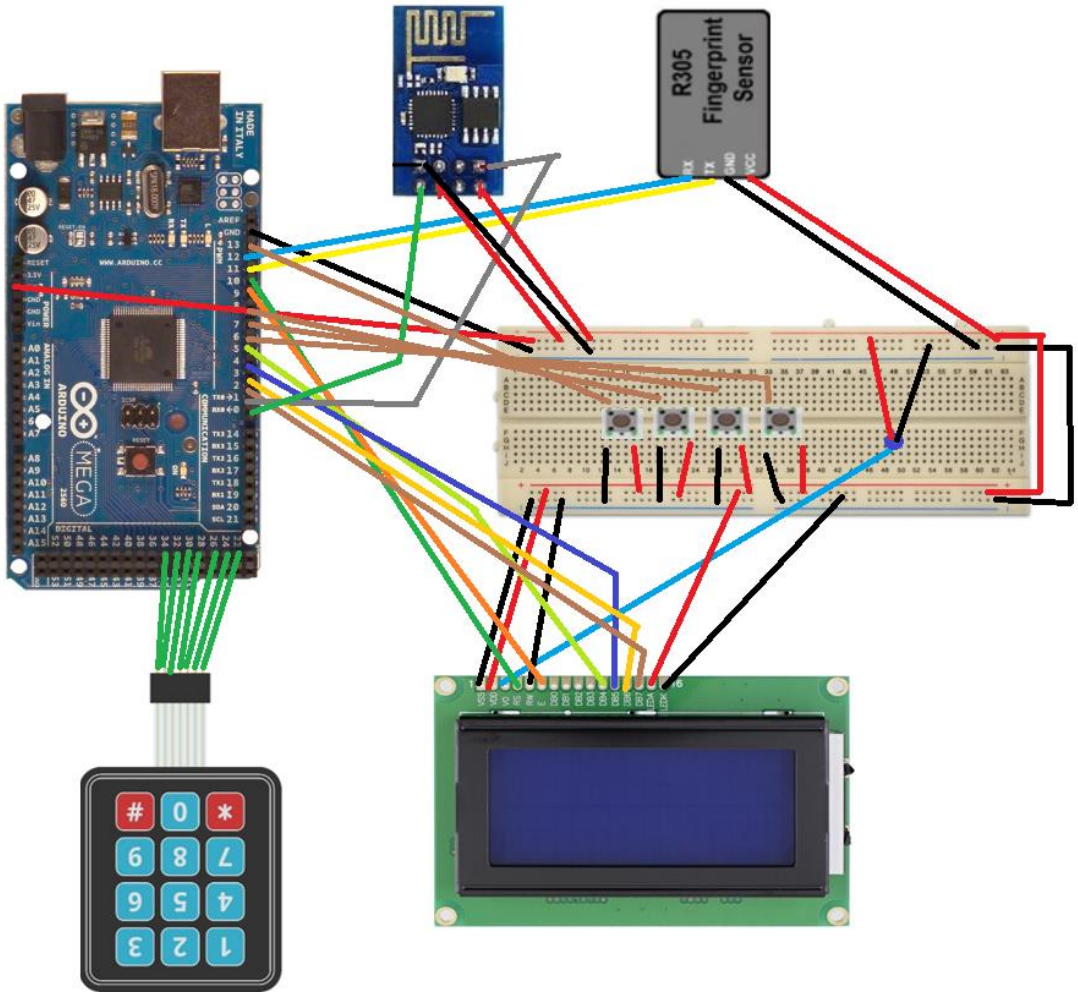


1. Node Hardware (Finger Print, LCD, KeyPad, Wifi connectivity)

Components

- R307 Fingerprint sensor
- LCD display
- ESP8266 Wifi module
- Keypad
- Push buttons
- Arduino mega
- Rechargeable battery

Circuit diagram



Functions of the components

- **Arduino mega:**

  Microcontroller

- **Fingerprint sensor:**

  Take fingerprints to register students.

  Take fingerprint to mark the attendance.

- **LCD display:**

  Display the corresponding details of the current state and inputs and output of the each state.

- **Wifi module:**

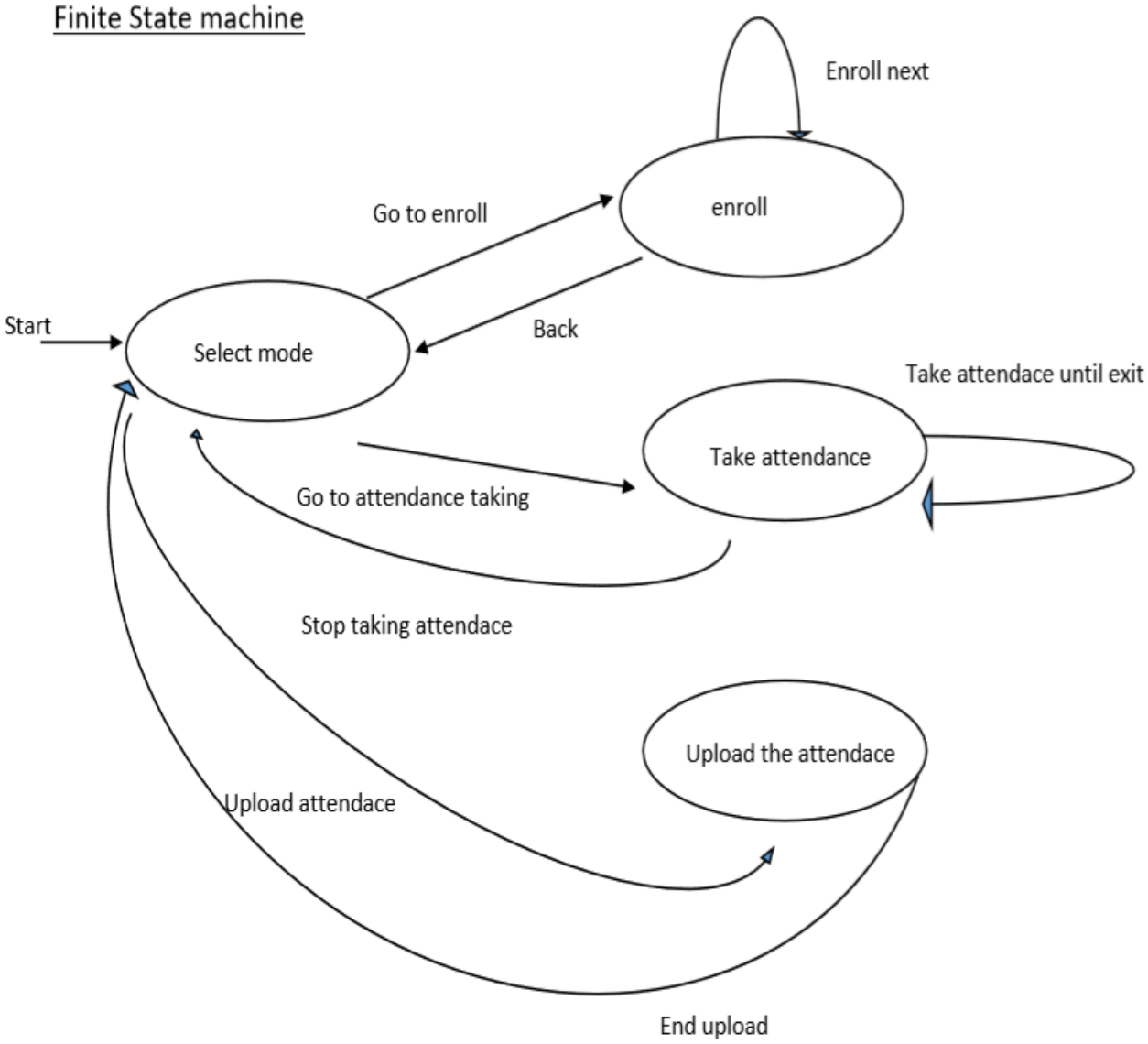
  Make the connection between the microcontroller and the backend.

- **Keypad:**
  - Get the input form the user.
  - Main inputs get using keypad are id number of the users, wifi password and the ssid , device password, class name.

- **Push button:**

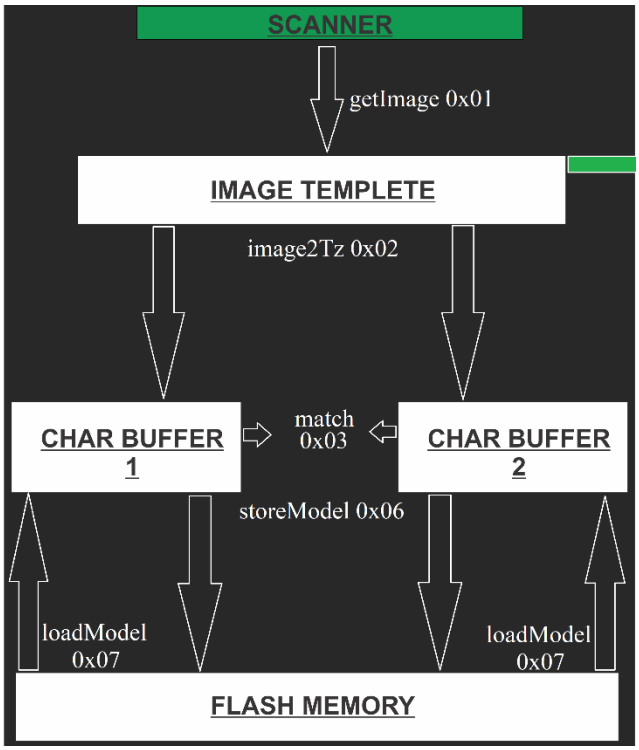
  - To select the state enroll, search, upload
  - To go back and to confirm inputs
  - To enter the wifi settings

Finite State machine



Each component functions in details

1. Fingerprint sensor



Inputs to the sensor

- Enroll mode :

  User fingerprint

- Attendance marking mode:

  2 arrays containing fingerprint data which are download form the database.

- Upload mode:

  none

Output form the sensor:

- Enroll mode:

  None (Store the corresponding fingerprints inside the sensor).

- Attendance marking mode:

  Id number of the corresponding student.

- Upload mode:

  Fingerprint templates that store in the enrolling mode.

2. ESP8266 WIFI module

Wifi module is use to communicate with the database using HTTP protocol. To send and get data form the database, module send http request to the PHP files that are store in the server.

Input to the module

- Enroll mode:

  Class name(String)

- Attendance marking mode:

  Class name(String)

- Upload mode:

  Fingerprint data(String)

  Attendance (integer 1)

Output form the module

- Enroll mode:

  Id numbers form the database

- Attendance marking mode:

  Id numbers form the database

  Fingerprint data from the database(Strings)

- Upload mode:

  None

3. **Key pad**

   Get the user input and return the input as a string or integer.

4. **Push buttons**

   Input:

   User gives input by pressing the buttons

   Output:

   Since digital circuits operate with two voltage levels (Vdd, GND), button produce both of these voltages based on some user action. In this case 1 or 0;

Data structures use in the design

Arrays

To store the id numbers of the selected class and to store the attendance of each student.

Algorithms and time complexity

Arrays are used to store the id numbers and attendance. To represent each student and attendance of the student, index of the array is used.

So to check whether id number is there during the enrolling process it takes a constant time. So the complexity of search of an id is 0(1).

Marking the attendance also takes a constant time. So complexity is O(1).

2. Physical design

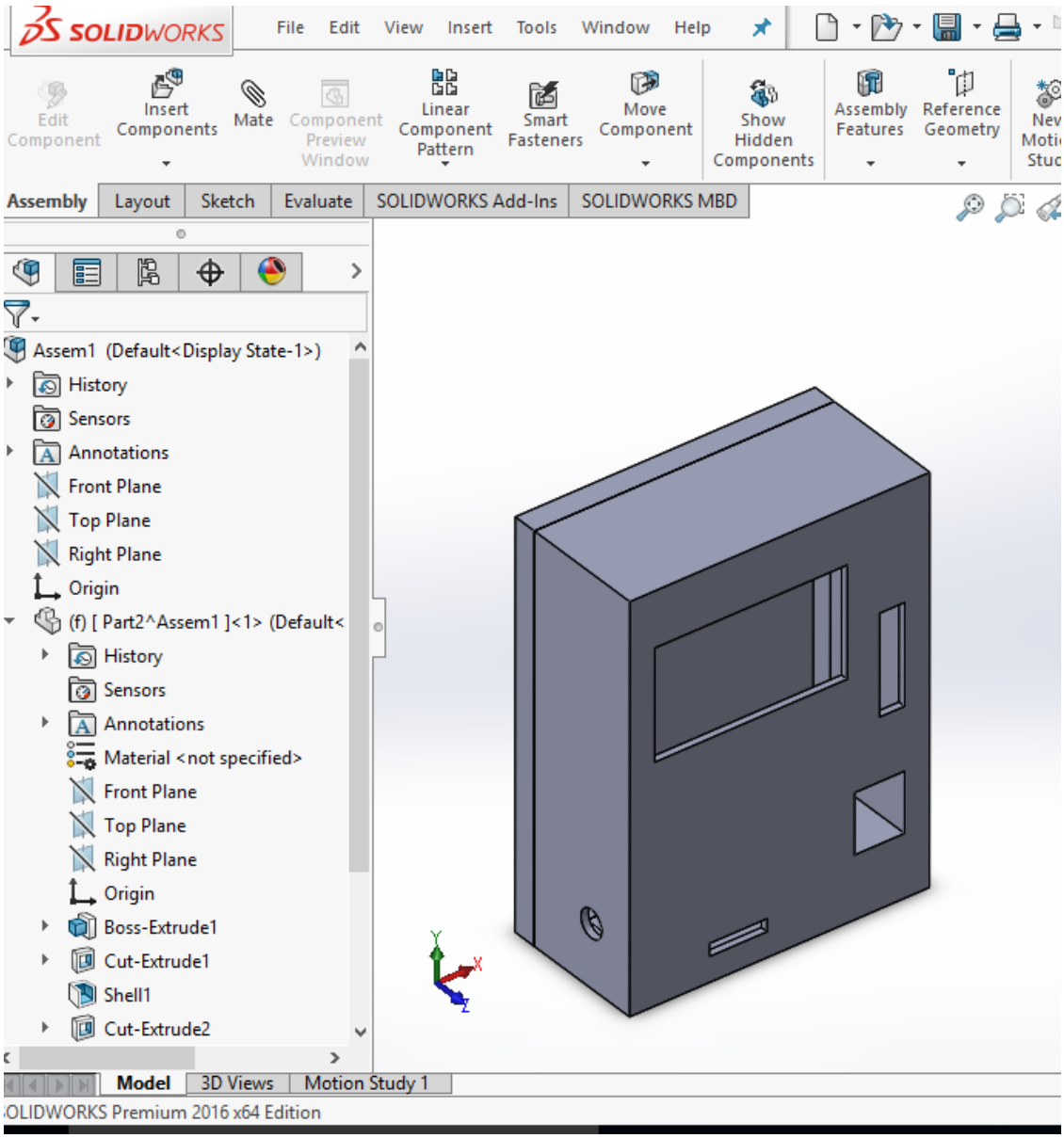
Design Plan

In our physical structure design of the SAMS, LCD display, keypad, fingerprint sensor and four push buttons (for enroll, search, upload, back) have to be reachable by the user. So they should be visible to the outside as shown in the bellow sketch.

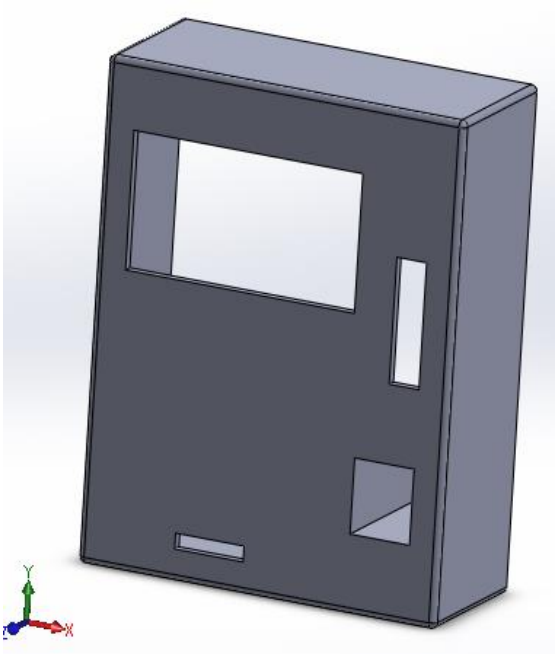
To design the physical structure of SAMS, we used the software SOLIDWORKS.
SOLIDWORKS is a solid modeling computer-aided design (CAD) and computer-aided engineering (CAE) program that runs on Microsoft Windows.

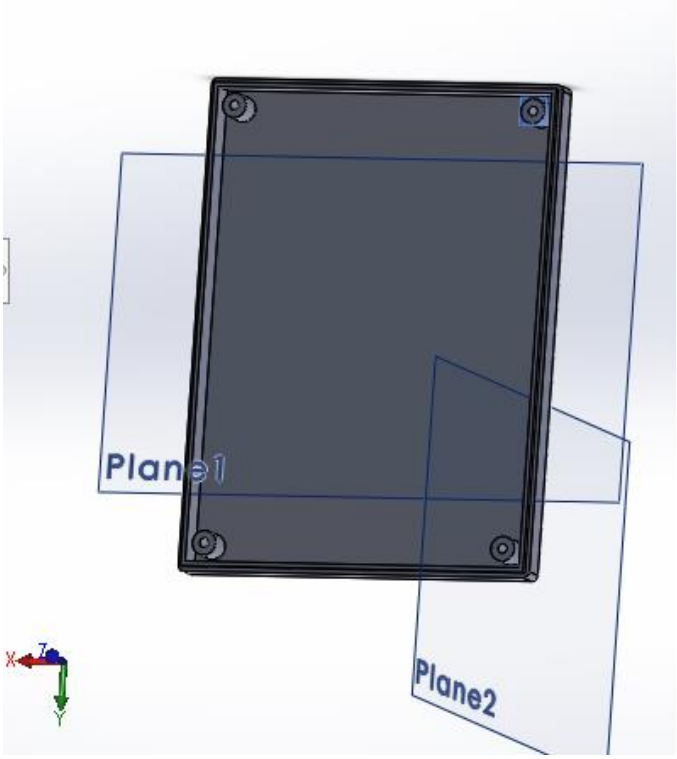
Physical Structure Design View

Our SOLIDWORKS design is shown in the bellow.



Physical structure is consisting with two parts. Design of the two separate portions is shown in the below.





This design is 3D printed to get the final product outer covering.

3. Web interface

Why a web interface?

All user parties can access the information through any internet connected device such as PC, Mobile etc.

Technologies

- PHP 5.6.25
- HTML 5
- CSS 3
- Jquery 3.3.1

Questions to ask before designing the web

Who?

- Who is the site for?

  SAMS site is for students, teachers and Admins who use SAMS

Why?

- Why are they visiting your site?

  The above type of users visiting the site
  - Students, teachers- To retrieve information
  - Admins-To add new users, control users

What?

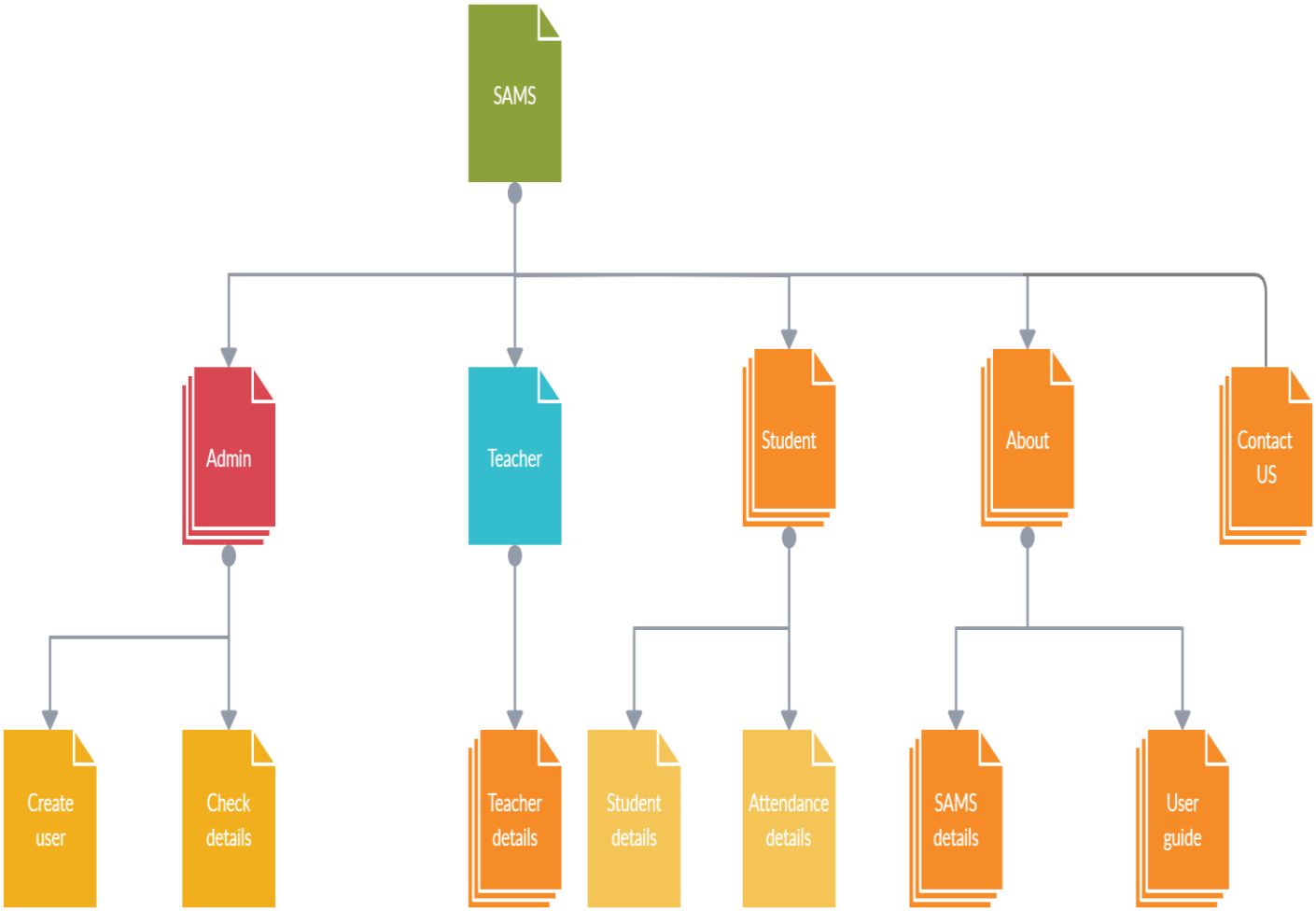
- What are they trying to achieve?

  Information regarding the attendance marking

- What information do they need?

  Whether their attendance is okay

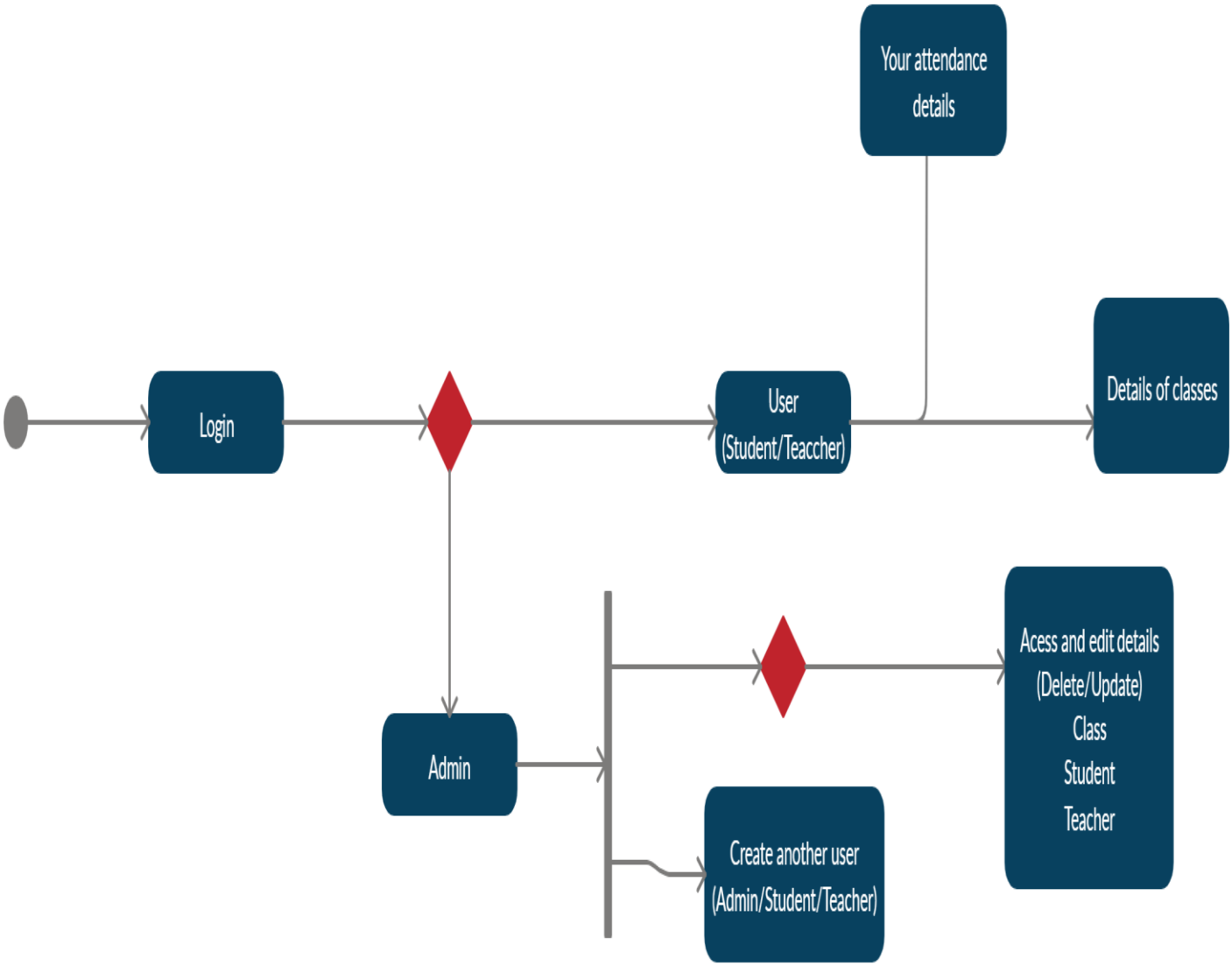
Site Map for SAMS



State diagram of Web site

Following diagram explains the two separate models

- Admin
- User(Student/Teacher)



Admin functions

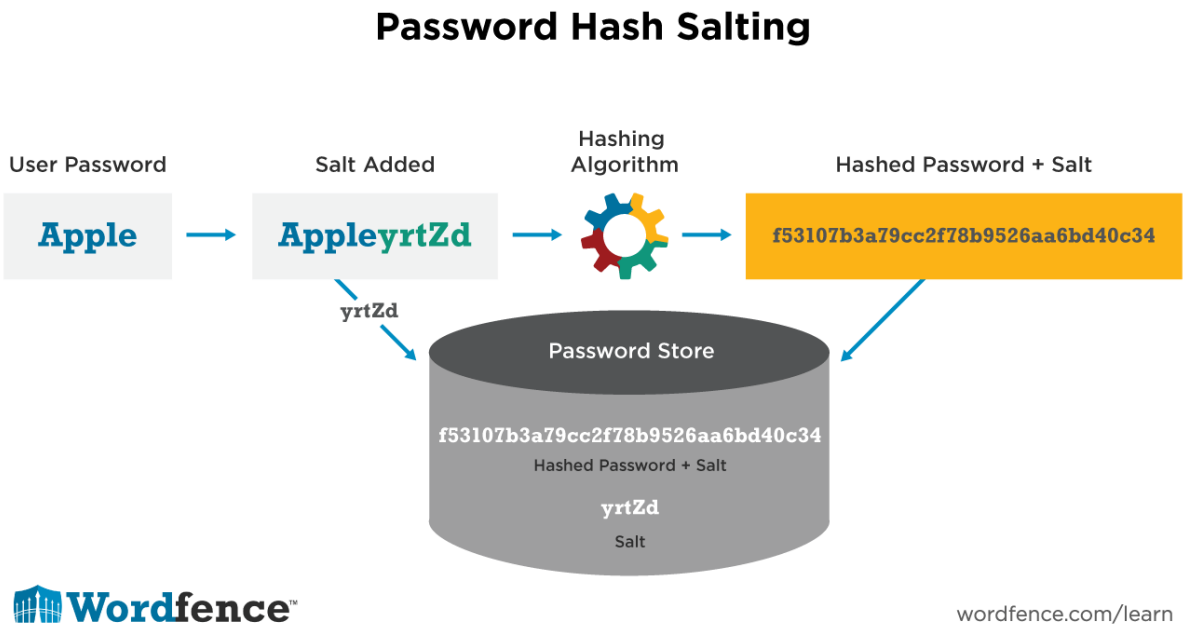
- Users (Students, Teachers) are created by admins.
- Class details are fixed by admin
- Days for a specific subject is entered in to the database by admin, depending on that the 80% attendance of student is calculated.
- Create another admin

How admin / User model is differentiated?

The database for users contains a separate field to identify the type of user.

Depending on that the user is open to different functionalities

Security



Only admins have right to access sensitive data. While Users only get capability to read their information.

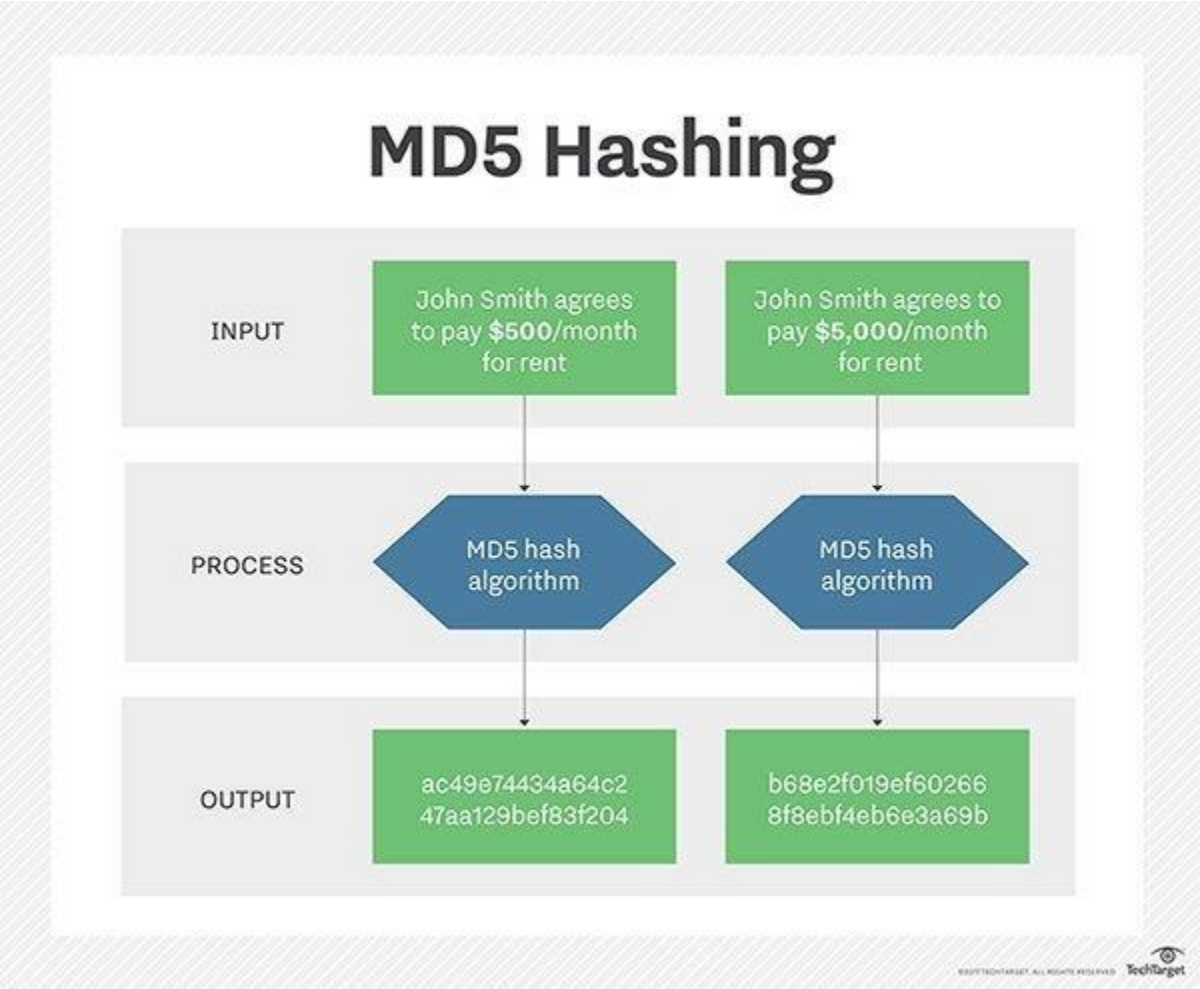
(In case of fault in the data users should contact an admin (facility provided))

Each and every password is hashed

It ensures that even if a hacker manages to gain access to your database, they would not be able to read your password.

Hashing algorithms used

- **Md5**



Design Criteria

1. Improving readability

2. Portability

    - Browser compatibility
        – different browsers (Chrome, Firefox, IE, Opera, Safari) & different versions

– different support and compliance with W3C standards
– ideally tested web site on a wide variety

•Connection speed
– cater for users with slow connection speeds (dialup?)
– try to limit total bytes downloaded per page
– carefully consider large embedded multimedia elements

• Operating system
– different browsers available, different fonts installed

• Screen resolutions
– desktops have larger displays (1280x1024 and up)
– tablets have medium size displays (1024x768)
– mobile phones have smaller displays (320x480)
– design page to look OK at different resolutions

3. Page layout

• Avoid trying to present too much information at once
– Some of the cleanest corporate sites have very limited content on the main page

• Create an orderly page structure
– Use some form of grid/block layout
– Use active whitespace
– Use borders and background colors to clearly show sections
– Use lots of headings – easier for users to skim
– Align text and graphics

• Understand how the user's eye typically moves over page
– Users mostly scan - don't read
– Put important info where they will look first
– Guide their eye (various layouts promote different eye paths)

The above design criteria are strictly maintained to ensure higher user experience in SAMS.

4. Database

- MySQL database

TESTING

Load Testing

Load testing is a type of non-functional testing. A load test is type of software testing which is conducted to understand the behavior of the application under a specific expected load. Load testing is performed to determine a system's behavior under both normal and at peak conditions.

What to test:

PHP server

What we test:

What happens when huge data is sent into the php server by multiple nodes. Here we only have a single node implemented. So what we did was , as we know the largest size of data transferred into the server at once through a single node is calculated.

Assumption 500 class rooms in an large scale university. So 500 TCP requests were sent into the php server at same time.

Input

Maximum of 500 TCP requests, at same time.

Testing environment

Localhost server

Tool used

https://www.webperformance.com/php-load-testing/

Expected output

Storing the data in Mysql db in PHP server

Results:

Php server didn’t crashed due 500 TCP reqeuests at once.

Special remarks

This is not a kind of DoS attack. Here we assume that system is totally protected over DoS attacks. Using the above tool we gave access only upto three TCP requests within a given time period.

Compatibility Testing

Compatibility Testing is a type of Software testing to check whether your software is capable of running on different hardware, operating systems, applications, network environments or Mobile devices.

According to data sheet the R307 finger print module

• Working environment: Temperature: -20 ℃ - +40 ℃ Relative humidity: 40% RH-85% RH (no condensation)

• Storage environment: Temperature: -40 ℃ - +85 ℃ Relative humidity:

Supply voltage: DC 4.2 ~ 6.0V (Supplying 5v would be ideal)

• Search time: <1.0 seconds (1: 1000 hours, mean value) . marking can be done under one

second which would be suitable

• Fingerprint image input time: <0.3 seconds (Enrolling can be done twice of this size . i.e

it will take 0.6 s to enroll a new user)

Range of esp-8266 wifi module 300m line-of-sight outdoors less than 10 metres or less indoors if the signal needs to pass through 2 or 3 walls. We can extend the range by using external antennas. But this range would be enough because a class room is not extended via 2-3 walls. Also the problem is solved when there are powerful wifi signals are available.

The Operating voltage of finger print module is also around 4.2 ~ 6.0V so with the use of the rechargeable battery we have to check the boundry value analysis to analyze it.We can conclude that 5v would be ideal.

- Input

Used two finger prints within time measured as 5ms Enrolled two users within 5ms

Working environment: Temperature: -20 ℃ - +40 ℃ Relative humidity: 40% RH-85% RH (no

condensation.

Wifi enriched zone

- Expected output

LCD outputs as successfully enrolled two users.

- Results:

Finger print sensor identified as two users enrolled seperately

- Special remarks

Time will be more than 5ms when in practical scenarios. So the product will ensure safety.

Integration Testing

Bottom-Up approach .Integration testing is a level of software testing where individual units are combined and tested as a group. The purpose of this level of testing is to expose faults in the interaction between integrated units.

Test cases

- **Finger print**

Just input taken and searched.

With network connectivity input taken and string is checked inside the database.

- When enrolling a student, fingerprint confirmation is matches with the original fingerprint.
- Searching for an student outputs the registration number of the student

Functional Testing

Functional testing is a type of software testing where by the system is tested against the functional requirements/specifications. Functions (or features) are tested by feeding them input and examining the output. Functional testing ensures that the requirements are properly satisfied by the application.

Here we divided the system into single units or functions and test each function whether it gives expected outputs. Equivlance partitioning is used which divides the input data of a software unit into partitions of equivalent data from which test cases can be derived.

Test cases,

- When enrolling a student, his/her student details are entered into the database.
- Angular has capability of live server development. Therefore we can easily Test at each
- Update function should update the corresponding values in the database with respect to the given input through wifi.
- Give some known data to the uploading function and check whether the given data are stored in the database .

- **Finite State Machine**

What to test:

State machine of the embedded system

What we test:

Provide input to each state and check to see if it goes to the next proper state.

Input

Using key pad give the corresponding input. Ex –when in select mode state there are there inputs: enroll, search and upload

Expected output

Go to the correct state when gives the input.

CONCLUSION

The above report consists the design structure of Smart Attendance Marking System (SAMS). Here we mainly discussed about the design structure in three aspects.

- Node hardware
- Physical design
- Web interface

Under Node hardware, we focus about the details and the functionality of the hardware components and how they used in our system.

Physical design consists with the product outer covering design and the finishing of the product.

Web interface design includes all the details and reports related to attendance of students and teacher details also. It consists with user(Teacher/Student) and admin models and it focuses about the use of hashing algorithms for the security and authentication.