Educate Elevate Enlighten

JSS Mahavidyapeetha

JSS Science And Technology University

(Established Under JSS Science and Technology University Act No. 43 of 2013)

(Formerly Known as SJCE)

JSS SCIENCE AND TECHNOLOGY UNIVERSITY MYSURU

DEPARTMENT OF COMPUTER SCIENCE ENGINEERING

"WIRELESS DIGITAL NOTICE BOARD using Raspberry Pi"

Project report submitted in partial fulfillment of curriculum prescribed for the award of the degree of

BACHELOR OF ENGINEERING IN

COMPUTER SCIENCE AND ENGINEERING

By,

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

2019-20

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CERTIFICATE

This is to certify that the project report titled "**Wireless Digital Notice Board using Raspberry pi**" is submitted by **Vrushab H, Sampritha Rao** and **Hariprasad M V** for partial fulfillment of the award of the degree of Bachelor of Engineering in Department of Computer Science and Engineering, JSS Science & Technological University, Mysuru during the year 2019-20. It is certified that all corrections / suggestions indicated during report submission have been incorporated in the report. The project report has been approved as it satisfies the academic requirements in respect of project prescribed for the Bachelor of Engineering degree.

Signature of guide

_____

(Prof. Divakara N)

Panel Members	**Signature**
1. _____	_____
2. _____	_____
3. _____	_____

Date: **Signature of HOD**

Place: Mysore **(Dr. M. P. Pushpalatha)**

ABSTRACT

Notice Board is a board that is used to display important messages, dates or scheduled timing of events and so on for the public to view. But its contents need to be changed at regular intervals and done in a timely manner to provide its benefit to the public. But this is a very tedious task as one person needs to be appointed who takes care of putting up notice displays which are reliable and genuine generated from the administration authority. In such a setup there are chances of someone messing with the information and altering important messages which are to be displayed. Moreover, each and every notice must undergo many drafts and changes before it can be approved by the authorised official. This is a very time consuming and wasteful procedure. We believe that this system can be improved and computerised with the help of technology to make it more efficient and effective by keeping integrity of the data in mind.

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1. INTRODUCTION

Notice board is an essential tool that helps to gather and display important information to a group of people. Notice boards are used in various places such as bus stands, railway stations, shopping centres, schools, colleges, offices etc., to display public information such as advertising and announcing events to bring to the notice of the targeted audience. In earlier days, pamphlets, slates, black and white boards were used for displaying notices. This often quite a waste of time, energy and manpower. Furthermore, a lot of papers get wasted. Therefore, to overcome these disadvantages, we have come up with a system by making use the latest technologies to provide a more efficient way of displaying notices.

In this research project, we are building a wireless digital notice board using Raspberry Pi and GSM that is capable of receiving and displaying notices over the internet thus saving manpower and cutting down cost and time for the organisation. This makes use of a TV screen to display important information to the public.

1.1. AIM / STATEMENT OF THE PROBLEM

The problem statement is that many organisations such as schools, colleges, offices, bus stands, railway stations and many such places are still making use of traditional paper notices or hand written boards to display important information to the public which is very inefficient and non reliable. There is no guarantee that the information is genuine since anybody can change its contents and present incorrect information.

Thus closely analysing the problems faced by our college, we aim to build a digital notice board using Raspberry Pi which is capable of receiving notices wirelessly over the internet from authorised administrators and display it on the screen. This reliable information displayed is incapable of being manipulated and thus integrity of the data is maintained. It helps to reduce manual work of the staff and thus make departmental work easier.

1.2. OBJECTIVES

The proposed system will be efficient in terms of Implementation, Usage and Debugging. The following objectives will provide a suitable guidance for effective implementation of the system.

• To develop a wireless notice board that display message/multimedia files sent from the Authenticated user.

• To design a simple, easy to install, user friendly system which can receive and display notice in an easy way.

• To build a system that makes use of Bluetooth or Wifi as a wireless medium for message transmission.

• To build the system which is capable of receiving text messages from a non-android authenticated user and display the same in the notice board.

• A display connected to a Raspbian server should continuously listen for the incoming messages from Authenticated user, process it and display it on LCD screen.

1.3. INTRODUCTION TO THE PROBLEM DOMAIN

The hardships caused in paper works of our day to day activities like railway timings, to-do list, college notice board etc is a tedious job. There should be an automated system to reduce these tasks and make it much simpler, more effective and accessible globally.

Fig: Conventional Notice Board

1.4. APPLICATIONS

The wireless digital notice board can implement in a number of places where there is a need for public display of information. Some of the areas where it can be deployed are:

- Schools
- Colleges
- Offices
- Bus stands
- Railway Stations

1.5. EXISTING SOLUTION METHODS

Some of the existing solutions of notice boards are as follows:

- Manual typing and printing of notice on paper and sticking it on physical board.

- Using a board and changing slates.

- Bluetooth based notice board – This makes use of an android application. Here, the user sends a message from an Android device and it is received by a Bluetooth device at the display end. Only the user will know the password for the Bluetooth access. A microcontroller is then used to fetch the message sent by the user and displayed on the notice board that is a 16 * 2 LCD display. But this system is capable of functioning only when the user is within the Bluetooth connectivity network area of the device. Thus it is required that the user be physically present near the display system to be able to display the message.

- GSM Based notice board – In this system, the system is integrated with a GSM module (Global System for Mobile communications) which consists of a SIM in it. The user may use their phone to send an SMS consisting of the message to this system via the GSM. The SIM receives and retrieves the message. It is then displayed as it is on the board. But the drawback of this system is the need for the user to necessarily use a phone to send a notice and the necessity to have both devices under the network coverage.

1.6. PROPOSED SOLUTION METHODS

The proposed solution method for the display of notices and messages is as follows:

- The system mainly consists of three modules: Raspberry Pi, GSM and User interface.
- Raspberry Pi model B is used which has wireless network and bluetooth connectivity capability. This enables to receive messages from Android devices via Wifi or bluetooth from the authenticated user.
- GSM module consists of a SIM which is capable of receiving text messages from a non android phone in case the admin user does not have an android device and no wireless network availability.
- User interface – An application is developed which provide a user interface for both the administration users and the viewers. It displays and reveals only the authorised and appropriate information to each kind of user.
- A user who wants to access or to get the content on the digital notice board must have the internet connection and should be logged in to the web application provided.
- Once the user is authenticated, he/she will get the privileges according to his role i.e. student or faculty.
- If he/she is a faculty, they will connect to the page where they can upload documents such as image, doc files and pdf's.
- These files will be sent to the cloud from the user's internet and will be passed on to the raspberry pi.
- Once the raspberry pi listens to the document, it will process it and displays it on the Display device through HDMI interface.
- This proposed solution will enable the authorised user's to receive SMS from the Raspberry pi through GSM module integrated which helps students to get notified whenever a notice has been published on the board.

1.7. TIME SCHEDULE FOR COMPLETION OF THE PROJECT WORK.

	MARCH				APRIL			
	WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 1	WEEK 2	WEEK 3	WEEK 4
DETAILED DESIGN AND CODING								
DEPLOYMENT								
MODULE INTEGRATION								
SYSTEM TESTING								

2. LITERATURE SURVEY

1) Display Message on Notice Board using GSM.[1]

Author: Foram Kamdar, Anubbhav Malhotra and Pritish Mahadik.

This paper deals with an SMS based notice board incorporating the widely used GSM to facilitate the communication of displaying message on notice board via user's mobile phone. Its operation is programmed in assembly language. ASIM300 GSM modem with a SIM card is interfaced to the ports of the microcontroller with the help of AT commands. When the user sends a SMS via a registered number from his mobile phone, it is received by SIM300 GSM modem at the receiver send.
Limitations:

a) Unable to display Audio and Video.
b) No Scheduling.

2) WIRELESS ELECTRONIC DISPLAY BOARD USING GSM TECHNOLOGY.[2]

Author: N.JAGAN MOHAN REDDY, G.VENKARESHWARLU.

This paper discusses the design of SMS driven automatic display Board which can replace the currently used programmable electronic display and conventional notice boards. It is proposed to design receive cum display toolkit which can be programmed and later be used from an authorized mobile phone.
Limitations:

a) Uses LED Board.
b) Unable to display Audio and Video

3) Design and Implementation of Digital Notice Board Using Power Line Communication. [3]

Author: R.PudumaiNayagi, R Seethalakshmi.

The paper proposes one such application for automating an educational institution by replacing manual notice boards or circulars by digital notice boards. With a centralized database, frequent updating is easily possible. The system uses existing power lines to send the data to a special node or to broadcast to various power line nodes. The address is assigned to each receiver and it response based on their appropriate commands.
Limitations:

a) Limited number of Character.
b) Unable to display Audio and Video.
c) Need Power Line Communication.

4) Vinod B. Jadhav, Tejas S. Nagwanshi, Yogesh P. Patil,Deepak R. Patil at (2016) [1]

We had propose a remotely send notice to Digital Monitor from authorized PC on Raspberry pi card. A Wi-Fi is using for Data transmission. At any time we can add or remove or alter the text according to our requirement. A transmitter authorized PC is used for sending a notices. At receiving end Wi-Fi is connected to raspberry pi. When an authorized user sends a notice from his system, it is received by receiver. Wireless is a popular technology that allows an electronic device to exchange data wirelessly over a computer network, including high speed wireless connections. The data is received from authenticated user.

5) Ajinkya Gaikwad, Tej Kapadia, Manan Lakhani,DeepakKaria at (2013) [4]

Notice Boards are a common occurrence in variety of institutions which we come across on a daily basis. In the current scenario the notice/advertisement boards are being managed manually. There is a long process involved in order to put up notices on the notice board. This wastes a lot of resources like paper, printer ink, man power and also brings about loss of time. In this paper we have proposed a system which will enable people to wirelessly transmit notices on a notice Zigbee. In this paper we have proposed a system bywhich only authorized people can access the notice board using a graphical user interface. We can also make thesystem compatible with more than one wireless technology.

6) Bhumi Merai, Rohit Jain, Ruby Mishra at (2015) [5]

Notice board is primary thing in any institution or organization or public utility places like bus stops, railway stations or parks. But sending various notices day to day is a tedious process. This project deals with advanced noticeboard. It presents an SMS based notice board incorporating the widely used GSM to facilitate the communication of displaying message on notice board via user's mobile phone. Its operation is based on microcontroller AT89c52 programmed in assembly language. A SIM300 GSM modem with a SIM card is interfaced to the ports of the microcontroller with the help of AT commands. When the user sends a SMS via are registered number from his mobile phone, it is received bySIM300 GSM modem at the receivers end. SIM300 is duly interfaced to the microcontroller. The messaged is thus fetched into the microcontroller. It is further displayed on an electronic notice board which equipped with LCD display interfaced to microprocessor powered by a regulated power supply from mains. This project is our experiment on real time noticing.

3. SYSTEM REQUIREMENTS AND ANALYSIS

Software Requirements

1) Python – Python is one of the most efficient languages which consist of a variety of packages and updates.

2) Android- Android is used to be able to support the application on an android device so that notices can be sent from and to other devices such as monitors and phones.

3) Raspbian OS – This is an operating system that is supported by the Raspberry Pi and enables us to program the system according to our needs.

Hardware requirements

1) Raspberry pi

It is a single nano computer card or we can say series of single board computers which looks very similar to credit card when compared on the basis of size. It has the following specifications.

a) Model B
b) 512mb RAM
c) USB 3.0 socket
d) SD card socket
e) Ethernet Socket
f) HDMI socket
g) Micro USB socket

2) Mobile Phone
a) 4GB RAM
b) Android version 4.0 or above
c) Non Android phone

3) Wi-Fi module

It's a wireless network which uses radio waves, just like cell phones, televisions and radios do. In fact, communication across a wireless network is a lot similar like two-way radio communication. The Working of the same is elaborated as mentioned: 1. Computer's wireless adapter translates data into a radio signal and then transmits it using an antenna. 2. A wireless router receives the signal and decodes it, the router then sends the information to the Public Network i.e. Internet using a physical, wired Ethernet connection. The process is also able to work in reverse manner meaning that the routerreceivinginformation from the

Internet then translating it into a radio signal and sending it to the computer's wireless adapter.

It should have the following speed capability:
a) Wi-Fi module with a rate of 120mbps

4) LCD monitor
a) 6 X 6 complete LCD Display

5) GSM Module

GSM stands for Global System for mobile communication. This module helps to establish communication between a mobile or computing device and a GSM system which consists of a SIM.

4. TOOLS AND TECHNOLOGY USED

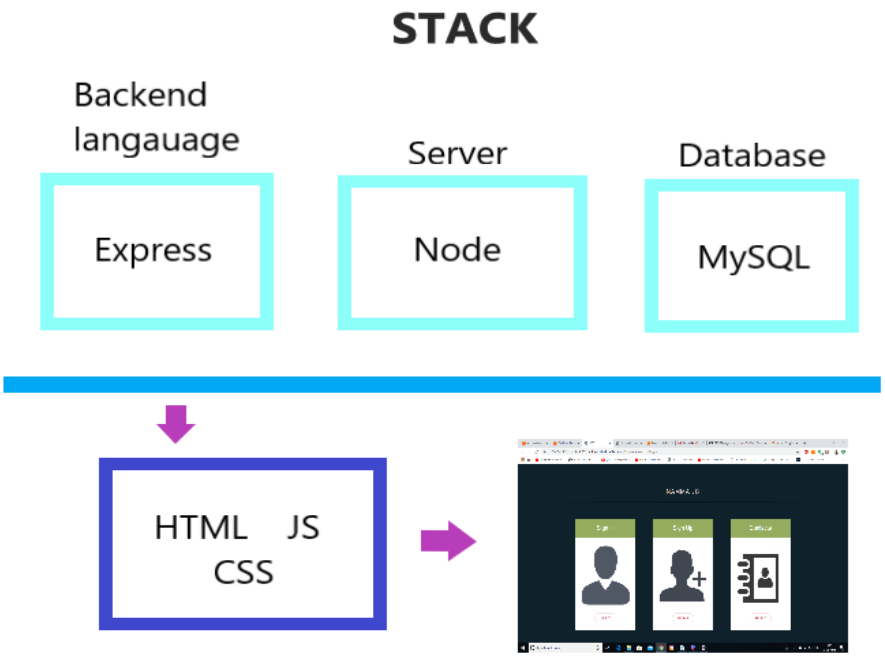


Fig: Web Stack of the application

Technologies used in the web application are:

Web Stack is a collection of software required for web development. The stack for our application is shown below.

- **HTML**

  HTML stands for HyperText Markup Language. 'Markup Language' is a system of annotating a document in a way that is syntactically distinguishable from the text. HTML is broken into Hypertext which is responsible for granting access to other texts through links and Markup is responsible for outlining the basic structure and appearance of raw text. HTML is the backbone of every web page, irrespective of what technology has been incorporated and the complexity of the website.In our application, we are making use of HTML5 because coding in it is easy, simple, clear and descriptive. It allows us to easily include audio and video contents just like including image tags without having to make use of plug-ins or APIs.

- **CSS**

  CSS stands for Cascading Style Sheets. It is a style sheet language used for describing the presentation of a document or page written in a markup language like HTML. It is like a website's accessories which is responsible for outlining the colours, fonts and positioning of the content on the website. In order for the styling and structuring to work properly, the style sheets must be linked to the HTML file, only then will the browser be able to display the page according to our needs and designs.
  We are incorporating CSS3 in our application which is the latest version and supports responsive design. It can be split into modules and allows us to perform better animations and 3D transformations.

- **JavaScript**

  JavaScript abbreviated as JS is a light weighted, interpreted, just-in-time compiled and client side scripting language. JavaScript controls the behavior of a website. It helps to make a website dynamic and interactive by including animations and functions that are evoked on click of certain parts of the website. JavaScript is a powerful language that helps to manipulate almost everything in the web page by using functions and importing libraries that provide a wide range of capabilities and features.

- **Express**

  Express is a minimal and flexible Node.js web application framework that provides a robust set of features to develop web and mobile applications. It facilitates the rapid development of Node based Web applications.

- **Node.js**

  Node JS is an open-source, cross-platform, JavaScript runtime environment that executes JavaScript code outside of a web browser.

- **MySQL**

  MySQL is the database that we are using to store user credentials and information about marks, attendance, announcement, documents and so on.

The technologies and used for connection and integration of the Raspberry Pi, GSM Module and the web application are as follows:

- **Raspbian OS**
  This is the recommended OS used in the raspberry pi. We installed this OS in the pi and worked on the Raspbian terminal with its own command set.

- **AT commands**
  These commands are used to interact with the GSM module to send and receive SMS from mobile phones to GSM module or vice versa.

- **MQTT Protocol Services**
  MQTT is a protocol that specifically sends data from devices of the Internet of Things and is supported by most microcontrollers and systems. To use Raspberry Pi MQTT communication, not much is needed, which is why this type of transmission is very interesting. In addition, it is really easy to use.

- **Python**
  Python syntax is very clean, with an emphasis on readability, and uses Standard English keywords hence it is used for coding the logic and automation.

- **Amazon Web Services** (**AWS**)
  AWS Cloud9 is a cloud-based integrated development environment (IDE) that lets you write, run, and debug your code with just a browser. It includes a code editor, debugger, and terminal. Cloud9 comes pre-packaged with essential tools for popular programming languages, including JavaScript, Python, PHP, and more, so you don’t need to install files or configure your development machine to start new projects.

5. SYSTEM DESIGN

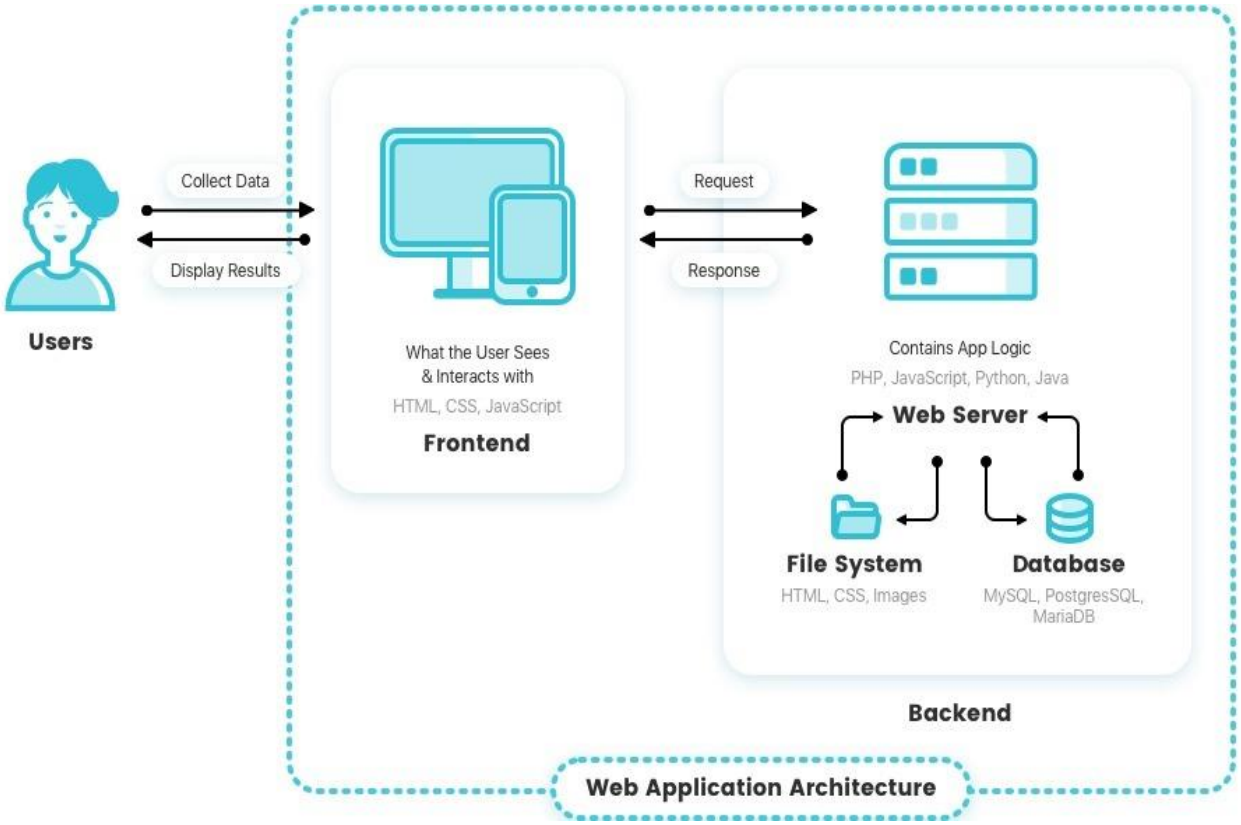


Fig. Architecture of the application

The diagram above shows the basic architecture of our web application. It describes the interactions between the applications front-end, middleware systems and databases.

When the user opens the application, the application will request the server for the page requested. The server responds by sending the required information to the application. The application then displays the necessary data to the end-users.

Every web page on the internet is developed using a sequence of separate instructions that is executed consequently one after the other. The web browser plays an important role in translating code into something that the users can view on the screen and interact with.

User Procedure:

• Client is the authorized user.

• He/she is prompted with an Authentication page so that the system can verify their credentials.

• After successful login the user can select the documents which he/she wants to display that on the notice board and can set the duration of the document on the board.

• Then the document will be uploaded to the cloud and it can be received by the Raspberry pi through the provided Internet access to it.

• If the uploaded document is larger than the limit size it can be resized and posted on the display device.

• Our system has provided a way to display the text message on the notice board for the non-android users via GSM services.

• If a student wants to download any documents which are displayed on the notice board can login to the page as a student and download the required documents.

• Note: The Upload and Modification privileges on the contents of the Notice Board are not provided for the Students.

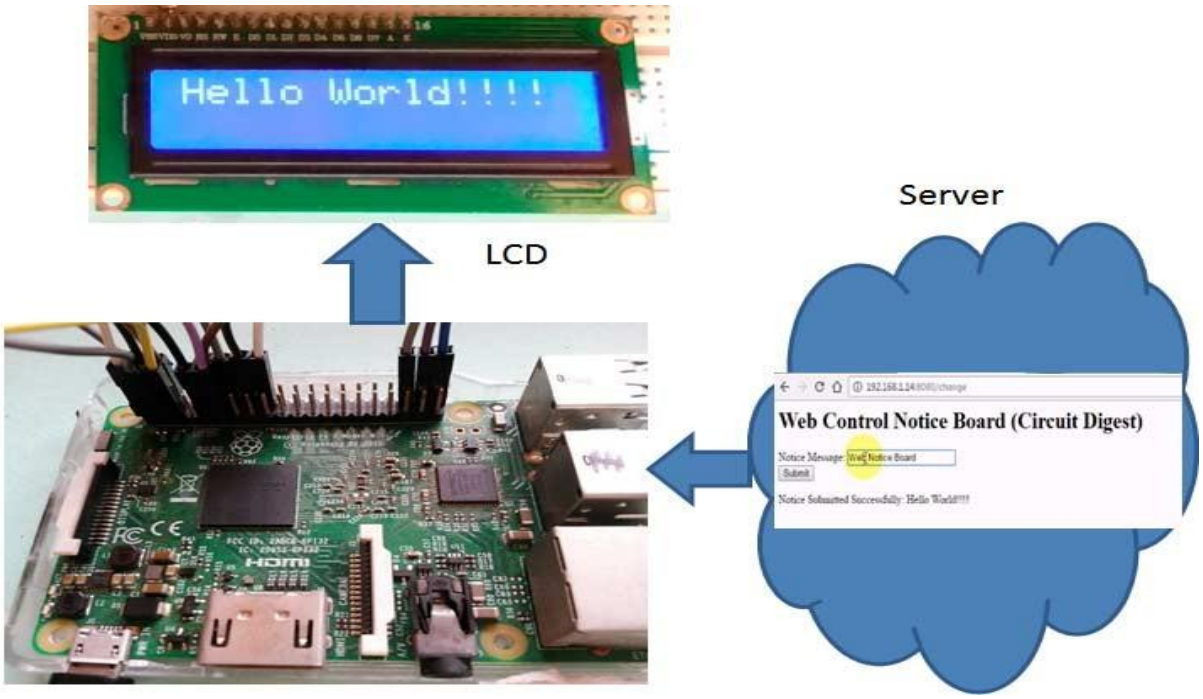
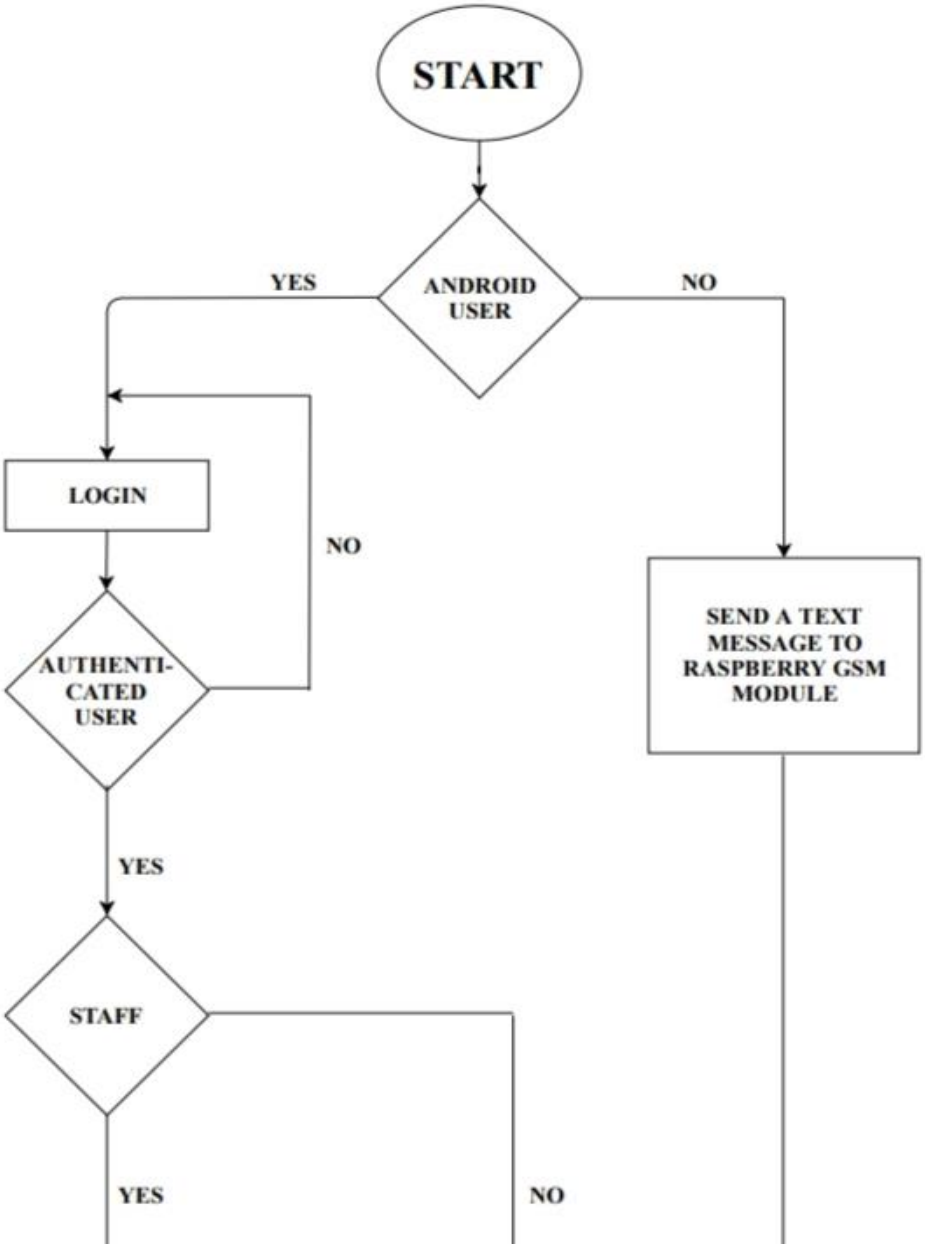
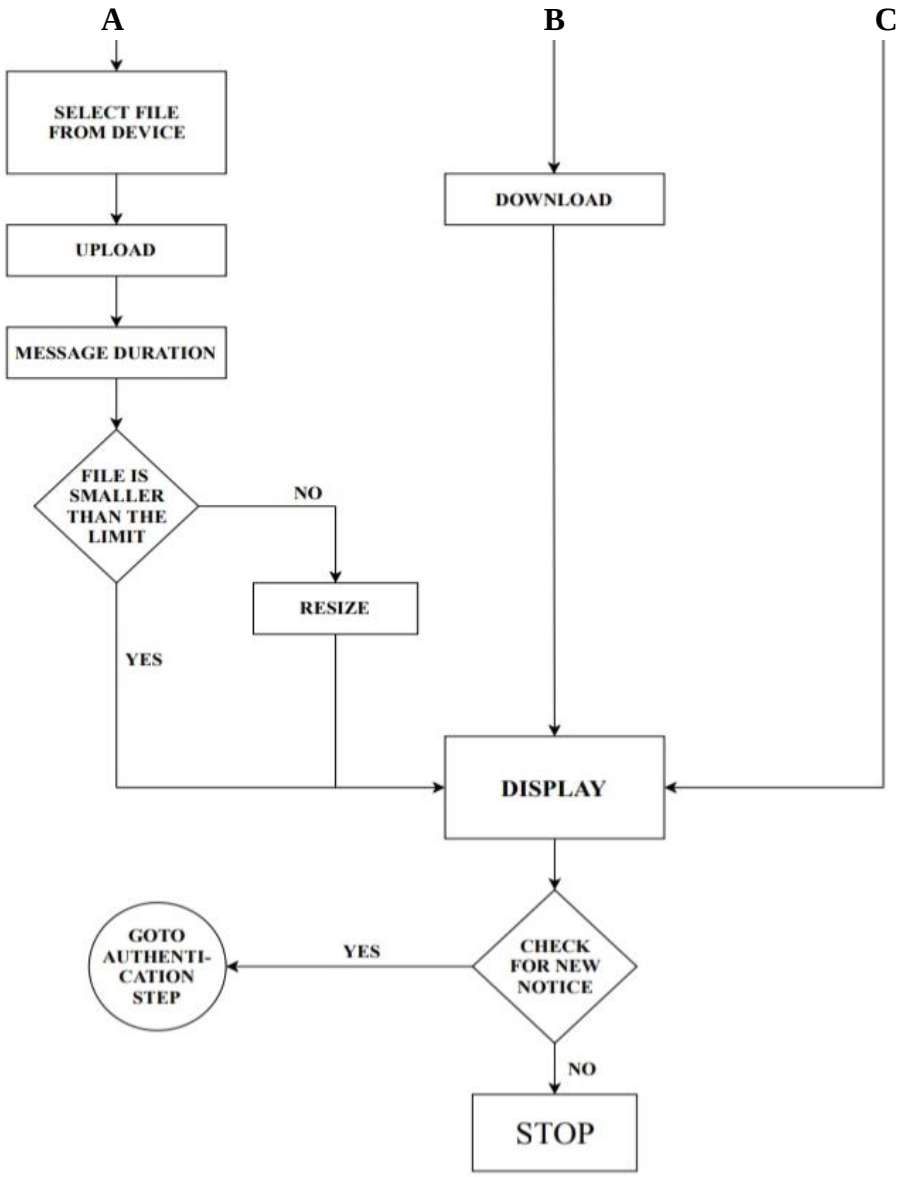


Fig: Proposed Methodology of Digital Notice Board

Flow Chart for the understanding of the workflow





The above figure shows the workflow of the entire system depending on whether the user has an android device or not. If the user has an android device, then he can make use of the internet to access the notice messages via the Wifi capability of the Raspberry Pi which will direct the required information that user demands.

If the user does not have access to an android device, then the GSM Module which has a SIM will be used to convey messages to the users. It basically shows the working of the Notice Board as a whole.

But due to constraints of working from home, the development of the entire system with all functionalities has not been possible. So the implementation of the web application is as shown below.

6. SYSTEM IMPLEMENTATION

The implementation of our project emerges with two parts:

- Software Implementation
- Hardware Implementation

Software implementation

A product's software implementation method is a systematically structured approach to effectively integrate software based service or component into the workflow of an organizational structure or an individual end-user. Software Implementation deals with the software logic and User interface section which can be seen below.

Fig. Structure of the three technologies

The three technologies- HTML, CSS and JavaScript that we just discussed are structured as shown in the diagram above where HTML defines the structure, CSS defines the presentational aspects and JavaScript defines the behavioural aspects. These three technologies work together side by side along with one another and makes up for the front-end of our application.

Node JS

Node.js is an open source, cross-platform runtime environment for developing server-side and networking applications. Node.js applications are written in JavaScript, and can be run within the Node.js runtime on OS X, Microsoft Windows, and Linux.

Node.js also provides a rich library of various JavaScript modules which simplifies the development of web applications using Node.js to a great extent.

A **Node.js server** provides the mechanisms for connecting to a service and sending/receiving data. This is done through TCP or UDP connections. This allows developers to create their own servers using these protocols or the protocols built upon them (like HTTP).

Node Package Manager (NPM) provides two main functionalities:

- Online repositories for node.js packages/modules which are searchable on search.nodejs.org
- Command line utility to install Node.js packages, do version management and dependency management of Node.js packages.

There is a simple syntax to install any Node.js module −

$ npm install <Module Name>

For example, following is the command to install a famous Node.js web framework module called express −

$ npm install express

Now you can use this module in your js file as following −

var express = require('express');

package.json is present in the root directory of any Node application/module and is used to define the properties of a package.

A package.json file affords you a lot of great things:

- It serves as documentation for what packages your project depends on.
- It allows you to specify the versions of a package that your project can use using semantic versioning rules.
- Makes your build reproducible which means that its way easier to share with other developers.

Built-in HTTP Module

Node.js has a built-in module called HTTP, which allows Node.js to transfer data over the Hyper Text Transfer Protocol (HTTP).

To include the HTTP module, use the require() method:

```
const http = require('http') // To use the HTTP interfaces in Node.js
const fs = require('fs') // For interacting with the file system
const path = require('path') // For working with file and directory paths
const url = require('url') // For URL resolution and parsing
```

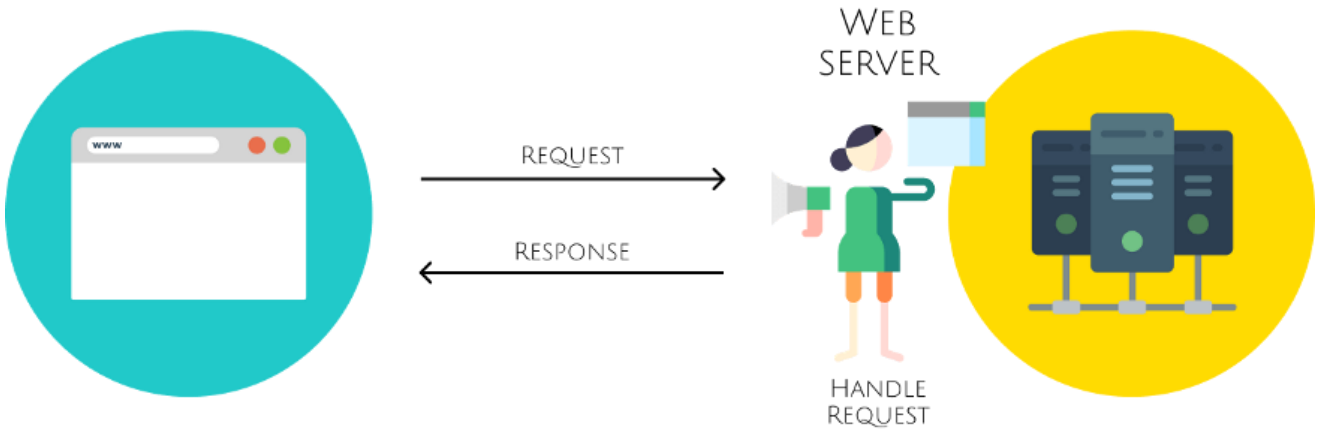


Fig. Handling of HTTP Requests

- **Node.js as a Web server**

The HTTP module can create an HTTP server that listens to server ports and gives a response back to the client.

Use the createServer()method to create an HTTP server:

```
var http = require('http');
//create a server object:
http.createServer(function (req, res) {

res.write('Hello World!'); //write a response to the client
  res.end(); //end the response
}).listen(8080); //the server object listens on port 8080
```

Express JS

ExpressJS is a web application framework that provides you with a simple API to build websites, web apps and back ends. With ExpressJS, you need not worry about low level protocols, processes, etc.Express.js is a modular web framework for Node.js

Express provides a minimal interface to build our applications. It provides us the tools that are required to build our app. It is flexible as there are numerous modules available on npm, which can be directly plugged into Express.

EJS

EJS or Embedded Javascript Templating is a templating engine used by Node.js. Template engine helps to create an HTML template with minimal code. Also, it can inject data into HTML template at the client side and produce the final HTML. EJS is a simple templating language which is used to generate HTML markup with plain JavaScript. It also helps to embed JavaScript to HTML pages.

MySQL

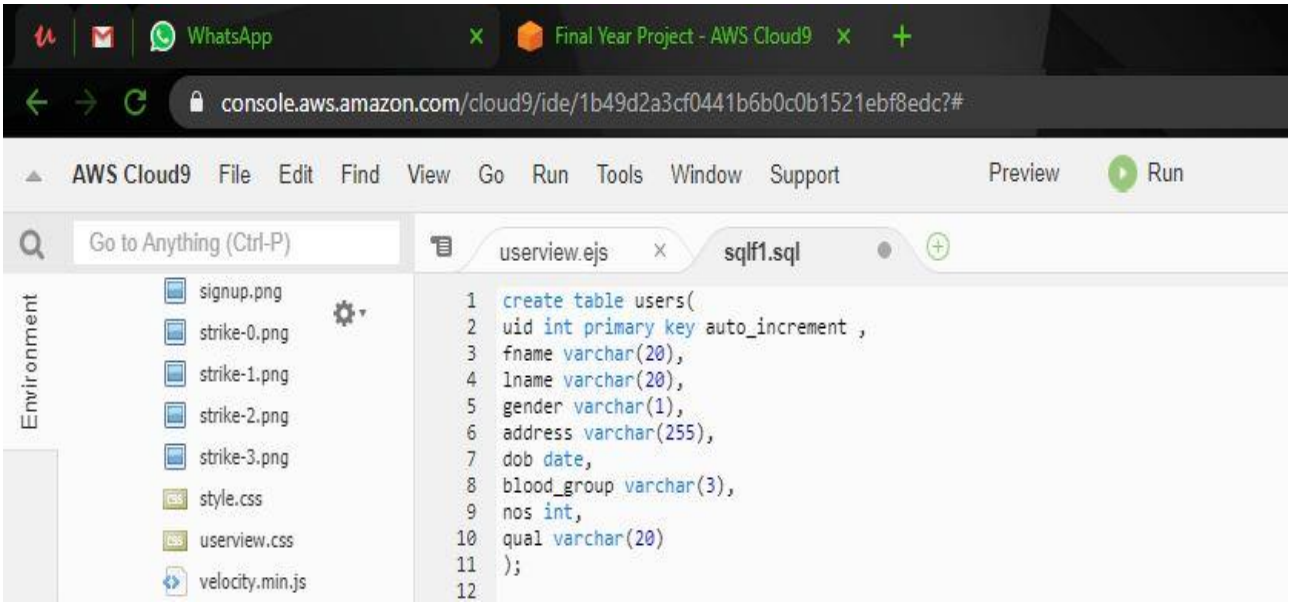
MySQL is a freely available open source Relational Database Management System (RDBMS) that uses Structured Query Language (SQL). SQL is the most popular language for adding, accessing and managing content in a database. It is most noted for its quick processing, proven reliability, ease and flexibility of use.

Our project makes use of MySQL that helps us for storing and fetching data related to the students and so on. Using MySQL we have created different tables for storing information related to different components and established a relationship between them.

The following tables are created according to our project needs,

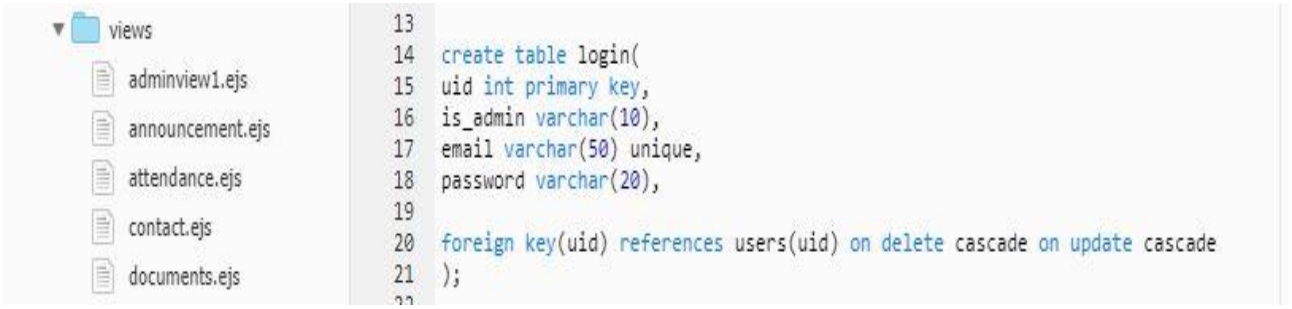
- Users:

  This relation stores the users details while signing up i.e while registering for the notice board site, the following details are required for any student or staff's for registering and creating an account in our notice board.



- Login:

  This table stores the userid i.e email ID and password and a trigger is encountered to check the credentials of the login personal with the user realtion in our database and allow him to login once he/she is authorized.

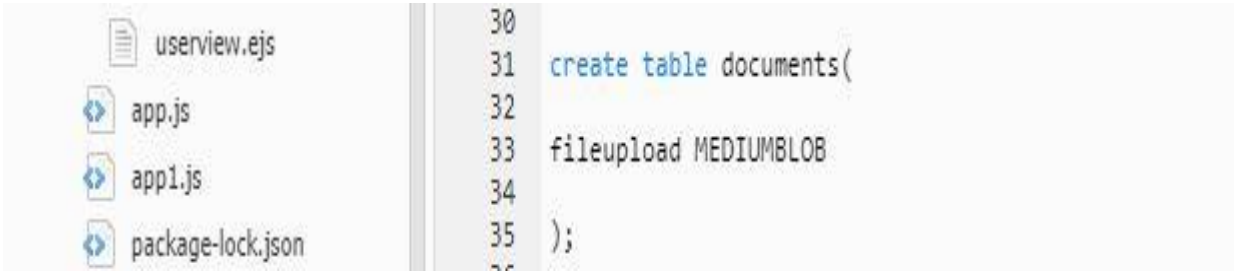


- Announcement

  This tables stores the announcement made and a small description for understanding the announcement.

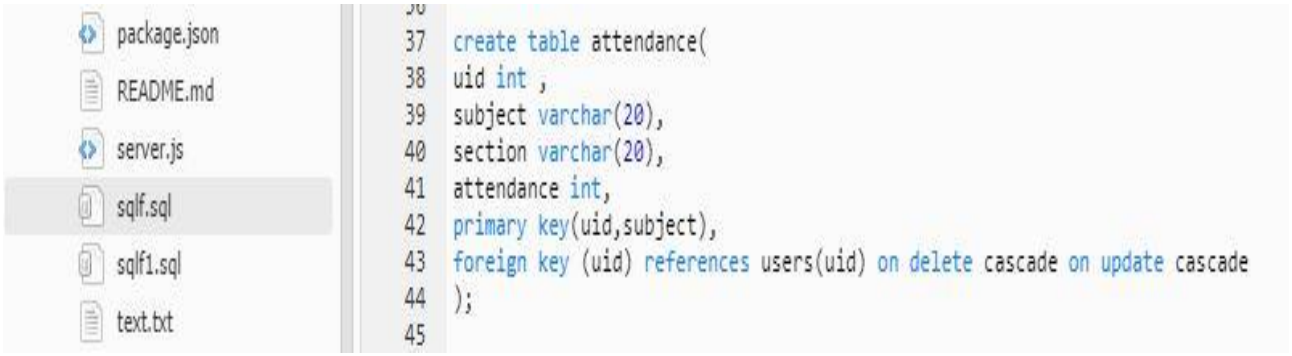
- Document:

  This relation stores the media file uploaded. i.e Document or PDF or Image and display the same in the board.



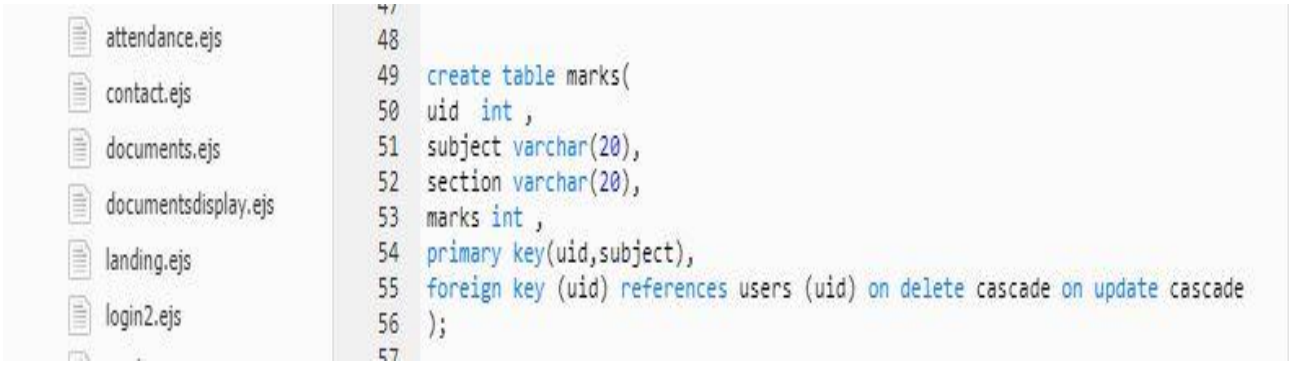
- Attendance:

  This table stores the attendance of individual student of respective subject, section, semester and year.

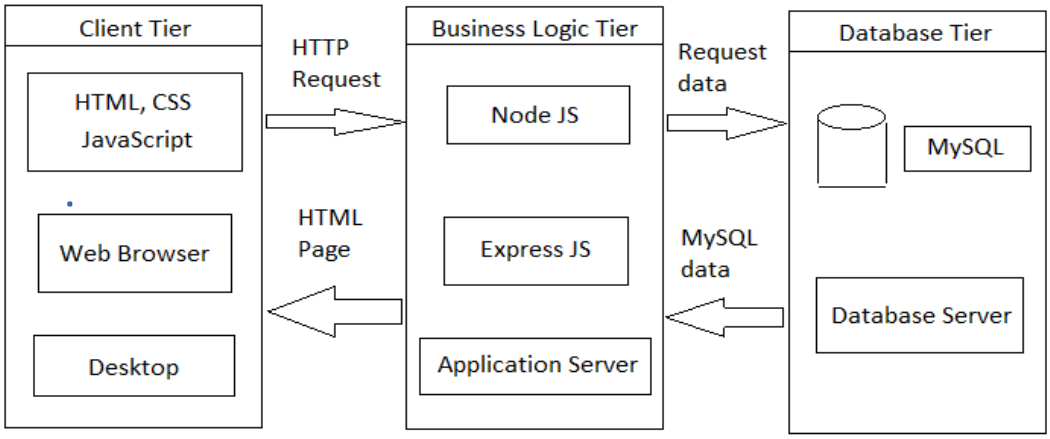


- Marks

  This table stores the marks of individual student of respective subject, section, semester and year.



All these tables and associated attributes are used in our project. User views triggers were also used in our project depending upon the needs and can be seen while operating.



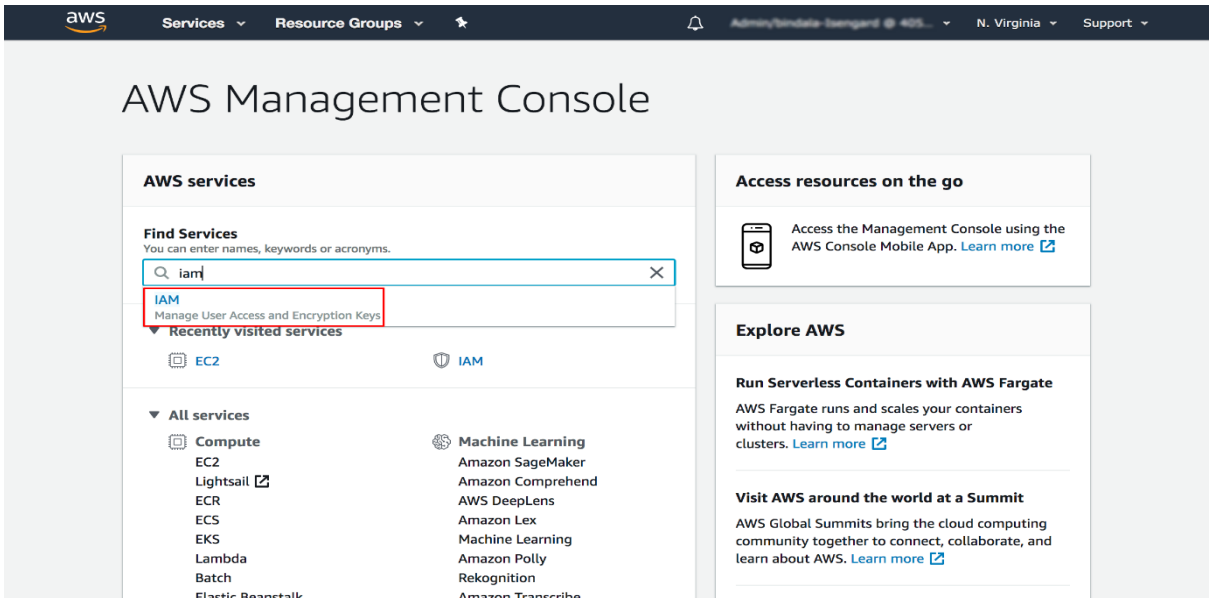
Working of the web application

The image above shows how all the technologies explained above are interconnected and interdependent on each other. They work alongside one another to provide a smooth interface to the end users, providing them the necessary information by fetching them from the database via the servers. The diagram gives us a basic understanding of the working of the web application which the teachers and students will use to store and obtain information about marks, attendance , notices , PDFs and so on

Before that, let's see how Amazon's EC2 instance has been used in our project and how the connectivity between Amazon's cloud instance and our mysql database has been done.

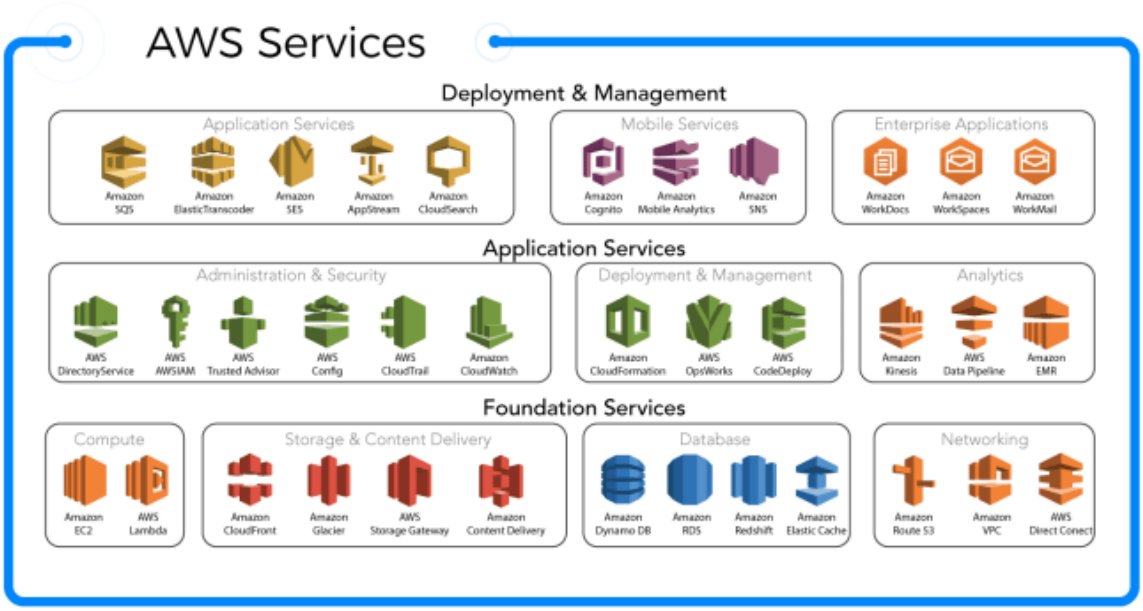
Amazon Web Services (**AWS**) is a subsidiary of Amazon that provides on-demand cloud computing platforms and APIs to individuals, companies, and governments, on a metered pay-as-you-go basis. In aggregate, these cloud computing web services provide a set of primitive abstract technical infrastructure and distributed computing building blocks and tools. One of these services is Amazon Elastic Compute Cloud (EC2), which allows users to have at their disposal a virtual cluster of computers, available all the time, through the Internet.
The AWS technology is implemented at server farms throughout the world, and maintained by the Amazon subsidiary. Fees are based on a combination of usage (known as a "Pay-as-you-go" model), hardware, operating system, software, or networking features chosen by the subscriber required availability, redundancy, security, and service options. Subscribers can pay for a single virtual AWS computer, a dedicated physical computer, or clusters of either. As part of the

subscription agreement, Amazon provides security for subscribers' systems. AWS operates from many global geographical regions including 6 in North America.



AWS SERVICES

As of 2020, **AWS** comprises more than 212 **services** including computing, storage, networking, database, analytics, application **services**, deployment, management, mobile, developer tools, and tools for the Internet of Things.



The services that we are using are cloud9, EC2, S3 and Amazon RDS.

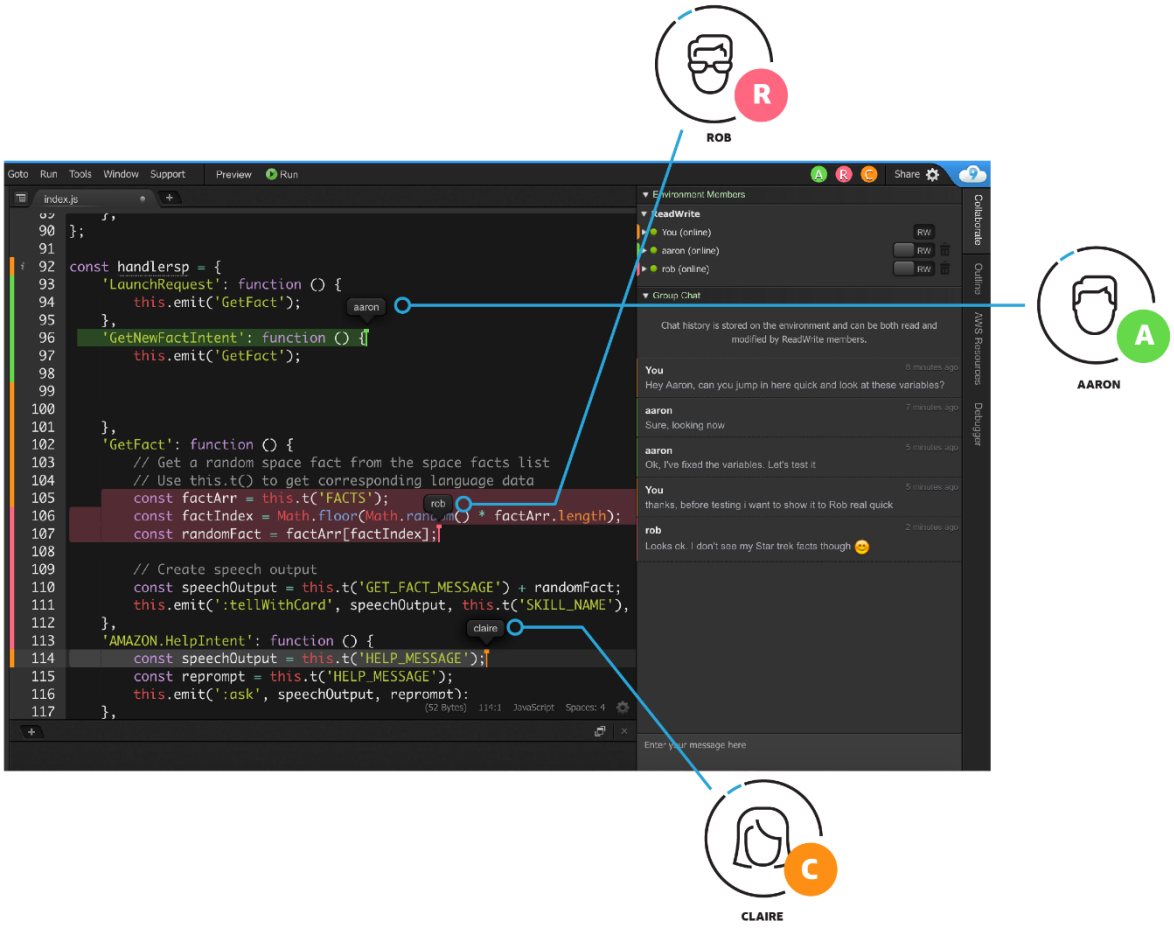
AWS cloud9

AWS Cloud9 is a cloud-based integrated development environment (IDE) that lets you write, run, and debug your code with just a browser. It includes a code editor, debugger, and terminal. Cloud9 comes pre-packaged with essential tools for popular programming languages, including JavaScript, Python, PHP, and more, so you don’t need to install files or configure your development machine to start new projects. Since your Cloud9 IDE is cloud-based, you can work on your projects from your office, home, or anywhere using an internet-connected machine. Cloud9 also provides a seamless experience for developing serverless applications enabling you to easily define resources, debug, and switch between local and remote execution of serverless applications. With Cloud9, you can quickly share your development environment with your team, enabling you to pair program and track each other's inputs in real time.

Benefits

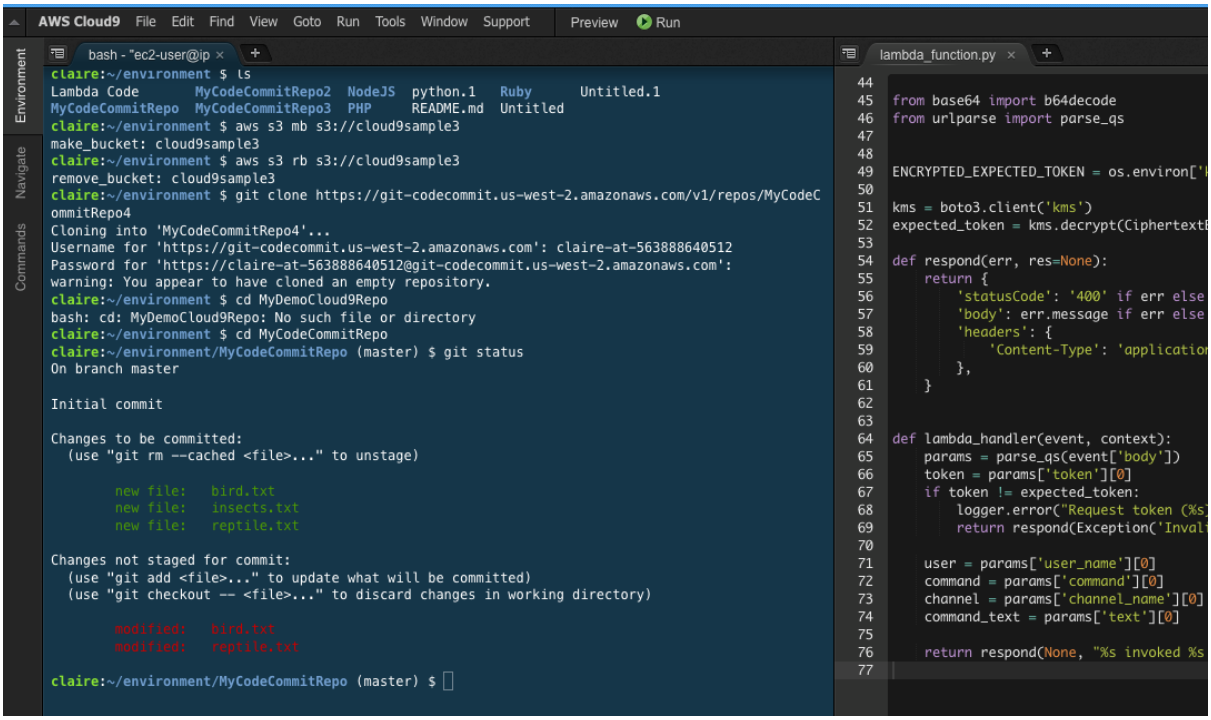
- **CODE WITH JUST A BROWSER**

- **CODE TOGETHER IN REAL TIME**

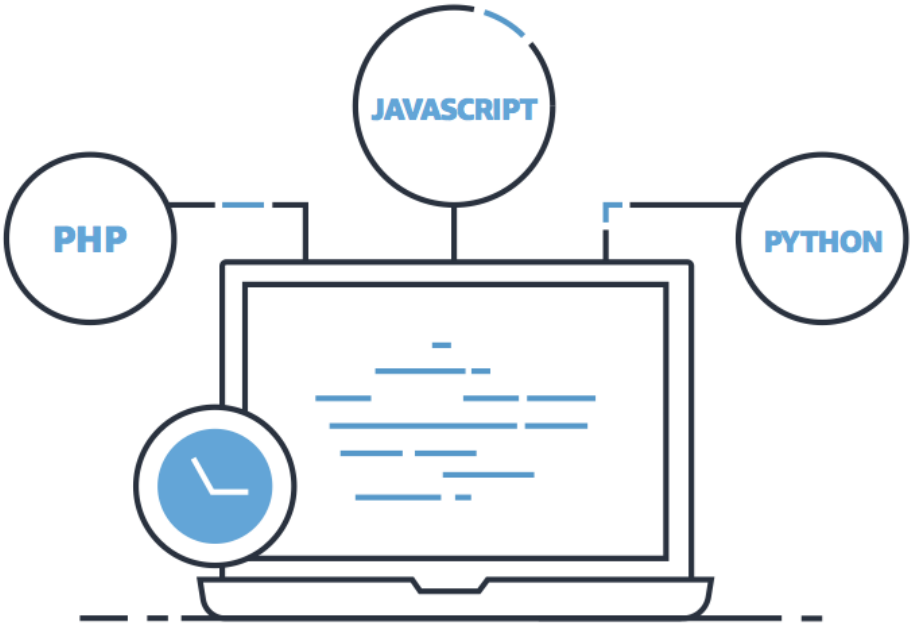


- **BUILD SERVERLESS APPLICATIONS WITH EASE**

- **DIRECT TERMINAL ACCESS TO AWS**



- **START NEW PROJECTS QUICKLY**



OUR ENVIRONMENT

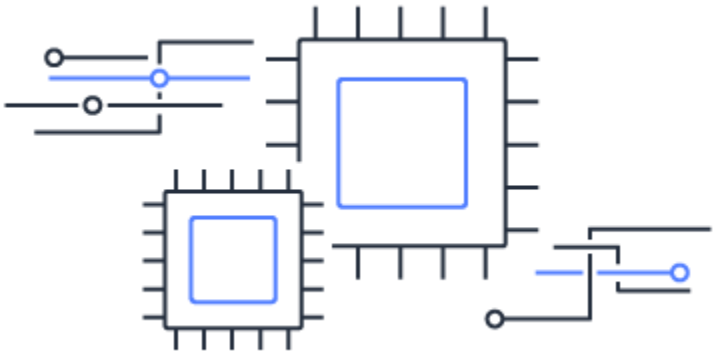
EC2 (Elastic compute cloud)
Amazon Elastic Compute Cloud (Amazon EC2) is a web service that provides secure, resizable compute capacity in the cloud. It is designed to make web-scale cloud computing easier for developers. Amazon EC2's simple web service interface allows you to obtain and configure capacity with minimal friction. It provides you with complete control of your computing resources and lets you run on Amazon's proven computing environment.
Amazon EC2 offers the broadest and deepest choice of instances, built on the latest compute, storage, and networking technologies and engineered for high performance and security.
Building Blocks

Faster innovation and increased security with AWS Nitro System

The AWS Nitro System is the underlying platform for our next generation of EC2 instances that offloads many of the traditional virtualization functions to dedicated hardware and software to deliver high performance, high availability, and high security while also reducing virtualization overhead. The Nitro System is a rich collection of building blocks that can be assembled in many different ways, giving us the flexibility to design and rapidly deliver new EC2 instance types with an ever-broadening selection of compute, storage, memory, and networking options.

Choice of processors

A choice of latest generation Intel Xeon, AMD EPYC, and AWS Graviton CPUs enables you to find the best balance of performance and price for your workloads. EC2 instances powered by NVIDIA GPUs and AWS Inferentia are also available for workloads that require accelerated computing such as machine learning, gaming, and graphic intensive applications.

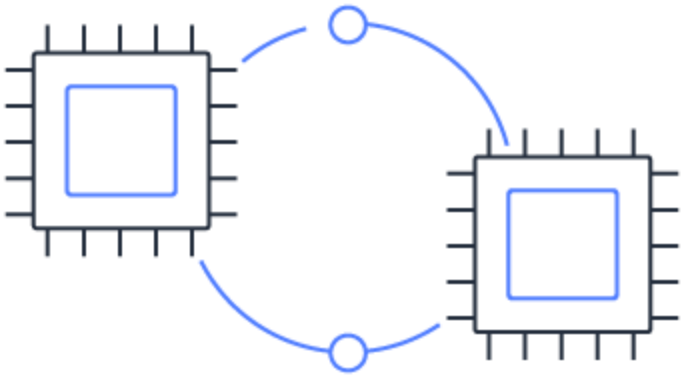


High performance storage

Amazon Elastic Block Store (EBS) provides easy to use, high performance block storage for use with Amazon EC2. Amazon EBS is available in a range of volume types that allow you to optimize storage performance and cost for your workloads. Many EC2 instance types also come with options for local NVMe SSD storage for applications that require low latency.

Enhanced networking

AWS is the first and only cloud to offer 100 Gbps enhanced Ethernet networking for compute instances. Enhanced networking enables you to get significantly higher packet per second (PPS), lower network jitter, and lower latency. For high performance computing (HPC) applications, Elastic Fabric Adapter is a network interface for Amazon EC2 instances that offers low-latency, high-bandwidth interconnect between compute nodes to help scale applications to thousands of cores.



S3 (simple storage service)

Amazon Simple Storage Service (Amazon S3) is an object storage service that offers industry-leading scalability, data availability, security, and performance. This means customers of all sizes and industries can use it to store and protect any amount of data for a range of use cases, such as websites, mobile applications, backup and restore, archive, enterprise applications, IoT devices, and big data analytics. Amazon S3 provides easy-to-use management features so you can organize your data and configure finely-tuned access controls to meet your specific business, organizational, and compliance requirements. Amazon S3 is designed for 99.999999999% (11 9's) of durability, and stores data for millions of applications for companies all around the world.

Benefits

Industry-leading performance, scalability, availability, and durability

Scale your storage resources up and down to meet fluctuating demands, without upfront investments or resource procurement cycles. Amazon S3 is designed for 99.999999999% (11 9's) of data durability because it automatically creates and stores copies of all S3 objects across multiple systems. This means your data is available when needed and protected against failures, errors, and threats.

Wide range of cost-effective storage classes

Save costs without sacrificing performance by storing data across the S3 Storage Classes, which support different data access levels at corresponding rates. You can use S3 Storage Class Analysis to discover data that should move to a lower-cost storage class based on access patterns, and configure an S3 Lifecycle policy to execute the transfer. You can also store data with changing or unknown access patterns in S3 Intelligent-Tiering, which tiers objects based on changing access patterns and automatically delivers cost savings.

Unmatched security, compliance, and audit capabilities

Store your data in Amazon S3 and secure it from unauthorized access with encryption features and access management tools. S3 is the only object storage service that allows you to block public access to all of your objects at the bucket or the account level with S3 Block Public Access. S3 maintains compliance programs, such as PCI-DSS, HIPAA/HITECH, FedRAMP, EU Data

Protection Directive, and FISMA, to help you meet regulatory requirements. S3 integrates with Amazon Macie to discover and protect your sensitive data. AWS also supports numerous auditing capabilities to monitor access requests to your S3 resources.

Easily manage data and access controls

S3 gives you robust capabilities to manage access, cost, replication, and data protection. S3 Access Points make it easy to manage data access with specific permissions for your applications using a shared data set. S3 Replication features manage data replication within the region or to other regions. S3 Batch Operations helps manage large scale changes across billions of objects. S3 integration with Amazon Macie automatically provides an inventory of buckets and continually evaluates your S3 buckets to alert you to any unencrypted buckets, publicly accessible buckets, or buckets shared with AWS accounts. Since S3 works with AWS Lambda, you can log activities, define alerts, and automate workflows without managing additional infrastructure.

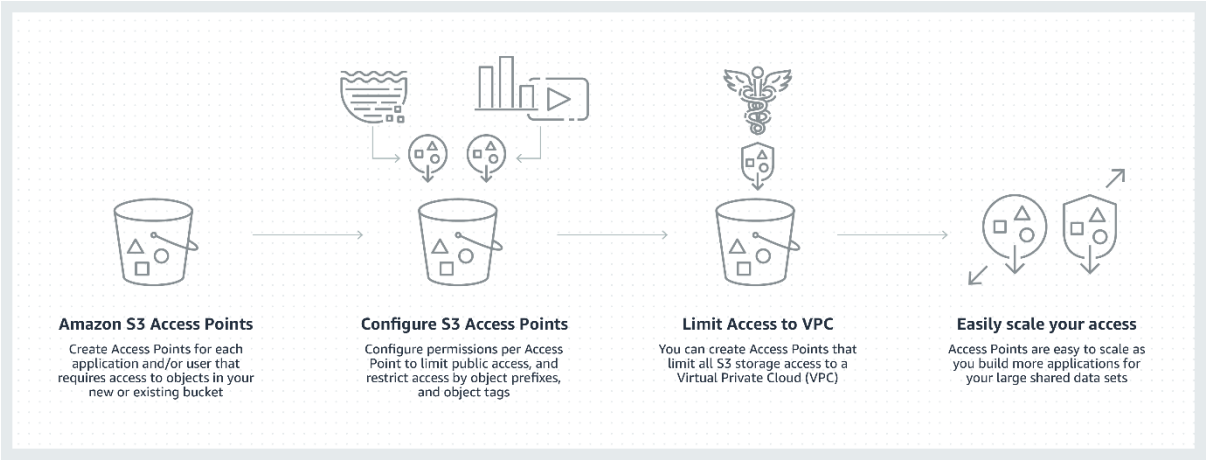
Query-in-place services for analytics

Run big data analytics across your S3 objects (and other data sets in AWS) with our query-in-place services. Use Amazon Athena to query S3 data with standard SQL expressions and Amazon Redshift Spectrum to analyze data that is stored across your AWS data warehouses and S3 resources. You can also use S3 Select to retrieve subsets of object data, instead of the entire object, and improve query performance by up to 400%.

Most supported cloud storage service

Store and protect your data in Amazon S3 by working with a partner from the AWS Partner Network (APN) — the largest community of technology and consulting cloud services providers. The APN recognizes migration partners that transfer data to Amazon S3 and storage partners that offer S3-integrated solutions for primary storage, backup and restore, archive, and disaster recovery. You can also purchase an AWS-integrated solution directly from the AWS Marketplace, which lists over 250 storage-specific offerings.

How it works



Amazon S3 Access Points simplifies managing data access at scale for applications using shared data sets on S3. With S3 Access Points, you can now easily create hundreds of access points per bucket, representing a new way of provisioning access to shared data sets. Access Points provide a customized path into a bucket, with a unique hostname and access policy that enforces the specific permissions and network controls for any request made through the access point.

Amazon S3 offers a range of storage classes designed for different use cases. These include **S3 Standard** for general-purpose storage of frequently accessed data; **S3 Intelligent-Tiering** for data with unknown or changing access patterns; **S3 Standard-Infrequent Access (S3 Standard-IA)** and **S3 One Zone-Infrequent Access (S3 One Zone-IA)** for long-lived, but less frequently accessed data; and **Amazon S3 Glacier (S3 Glacier)** and **Amazon S3 Glacier Deep Archive (S3 Glacier Deep Archive)** for long-term archive and digital preservation. Amazon S3 also offers capabilities to manage your data throughout its lifecycle. Once an **S3 Lifecycle** policy is set, your data will automatically transfer to a different storage class without any changes to your application

Amazon RDS

Amazon Relational Database Service (Amazon RDS) makes it easy to set up, operate, and scale a relational database in the cloud. It provides cost-efficient and resizable capacity while automating time-consuming administration tasks such as hardware provisioning, database setup, patching and backups. It frees you to focus on your applications so you can give them the fast performance, high availability, security and compatibility they need.

Amazon RDS is available on several database instance types - optimized for memory, performance or I/O - and provides you with six familiar database engines to choose from, including Amazon Aurora, PostgreSQL, MySQL, MariaDB, Oracle Database, and SQL Server. You can use the AWS Database Migration Service to easily migrate or replicate your existing databases to Amazon RDS.

Benefits

Easy to administer
Amazon RDS makes it easy to go from project conception to deployment. Use the Amazon RDS Management Console, the AWS RDS Command-Line Interface, or simple API calls to access the capabilities of a production-ready relational database in minutes. No need for infrastructure provisioning, and no need for installing and maintaining database software.
Learn more »

Highly scalable
You can scale your database's compute and storage resources with only a few mouse clicks or an API call, often with no downtime. Many Amazon RDS engine types allow you to launch one or more Read Replicas to offload read traffic from your primary database instance.
Available and durable
Amazon RDS runs on the same highly reliable infrastructure used by other Amazon Web Services. When you provision a Multi-AZ DB Instance, Amazon RDS synchronously replicates the data to a standby instance in a different Availability Zone (AZ). Amazon RDS has many other features that enhance reliability for critical production databases, including automated backups, database snapshots, and automatic host replacement.

Fast
Amazon RDS supports the most demanding database applications. You can choose between two SSD-backed storage options: one optimized for high-performance OLTP applications, and the other for cost-effective general-purpose use. In addition, Amazon Aurora provides performance on par with commercial databases at 1/10th the cost.

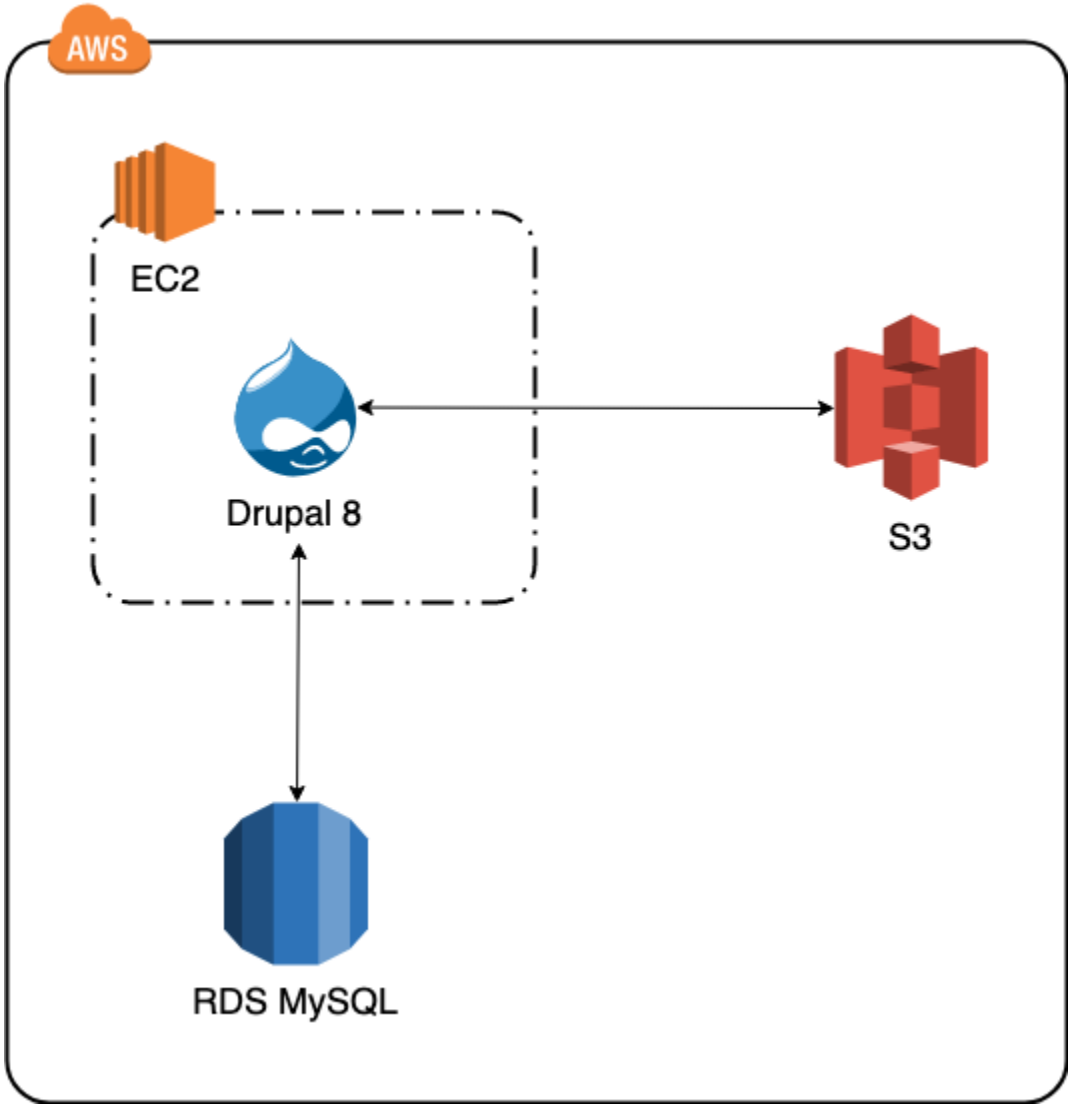
Secure

Amazon RDS makes it easy to control network access to your database. Amazon RDS also lets you run your database instances in Amazon Virtual Private Cloud (Amazon VPC), which enables you to isolate your database instances and to connect to your existing IT infrastructure through an industry-standard encrypted IPsec VPN. Many Amazon RDS engine types offer encryption at rest and encryption in transit.

Inexpensive

You pay very low rates and only for the resources you actually consume. In addition, you benefit from the option of On-Demand pricing with no up-front or long-term commitments, or even lower hourly rates via our Reserved Instance pricing.

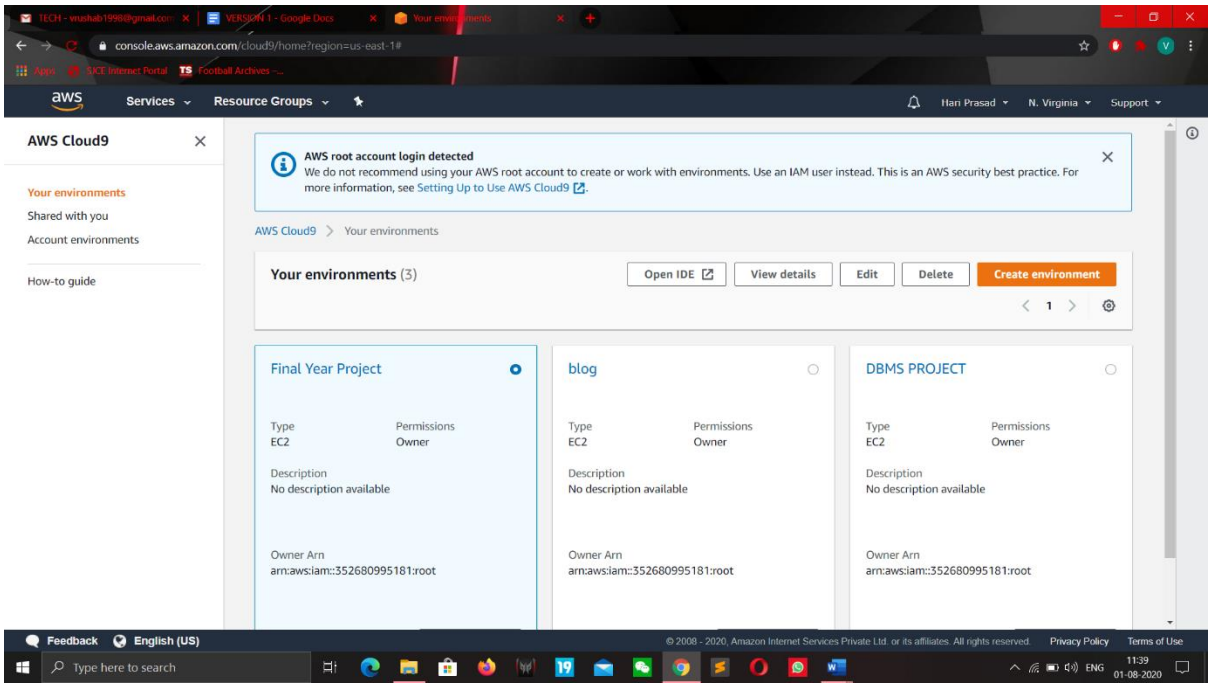
Relationship



IMPLEMENTATION

The implementation involves the following components:

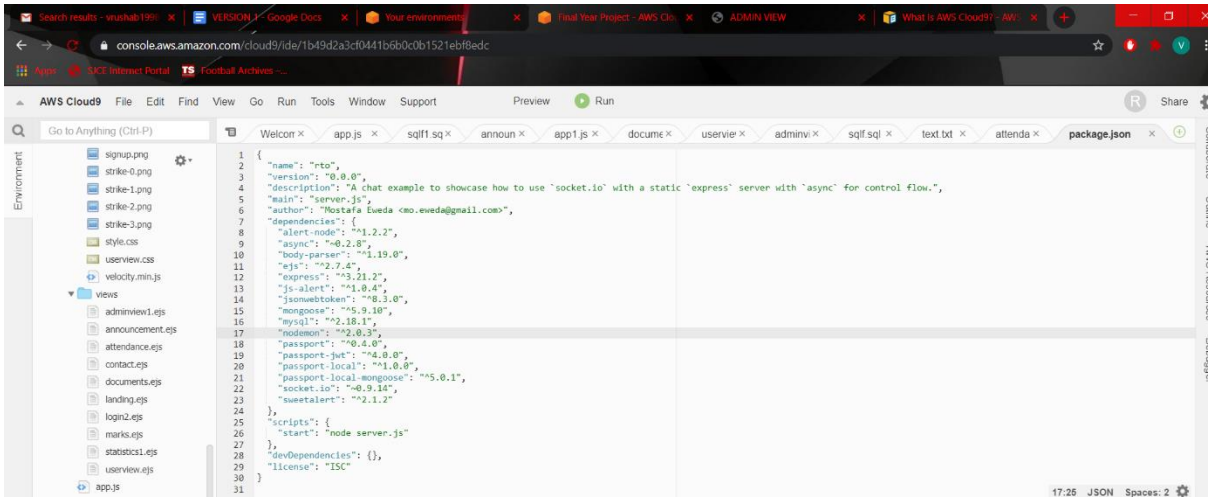
1. Setting up the cloud9 environment
    - Create an AWS account
    - Create an AWS account or sign in to your existing account.
    - Set up AWS Cloud9
    - Choose the Cloud9 usage pattern that applies to you and set up Cloud9.
    - Create an AWS Cloud9 environment
    - Create your first Cloud9 environment so you can start coding.
    - Complete a basic tutorial
    - Start coding and explore AWS Cloud9.



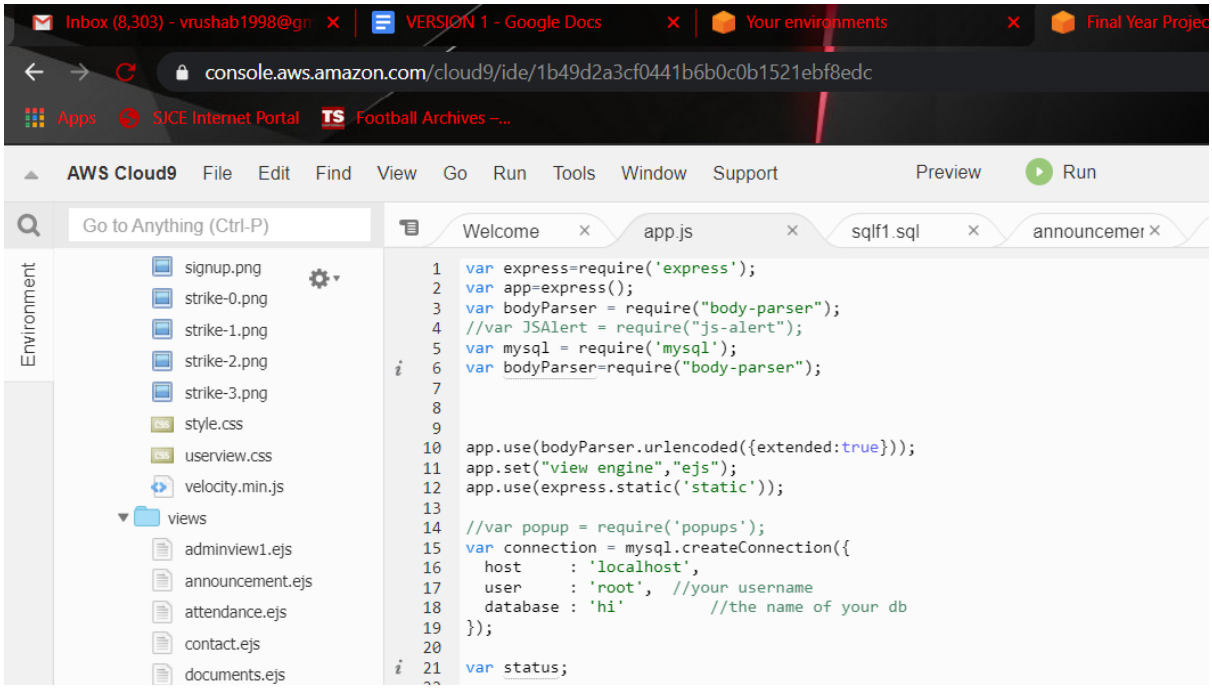
2. Then we go to the current directory by using the cd command and start the project.
3. Installing the node mudules by using the basic node syntax

    npm install package-name –save

    These are stored in the package.json file



4. After the node packages were installed we import then in the app.js file

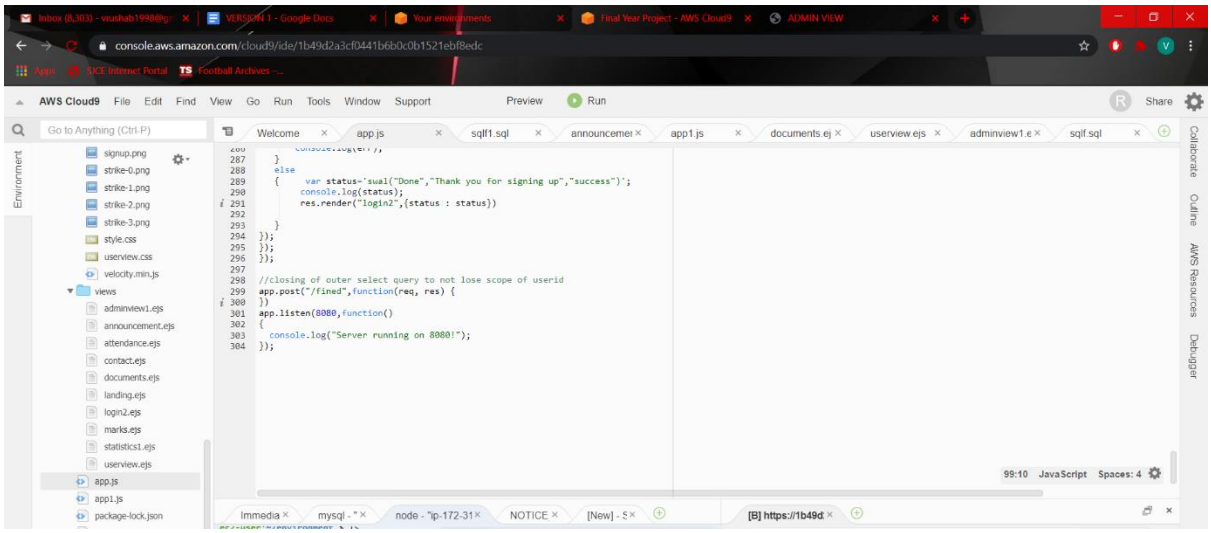


We use the syntax var package = require(‘package’)

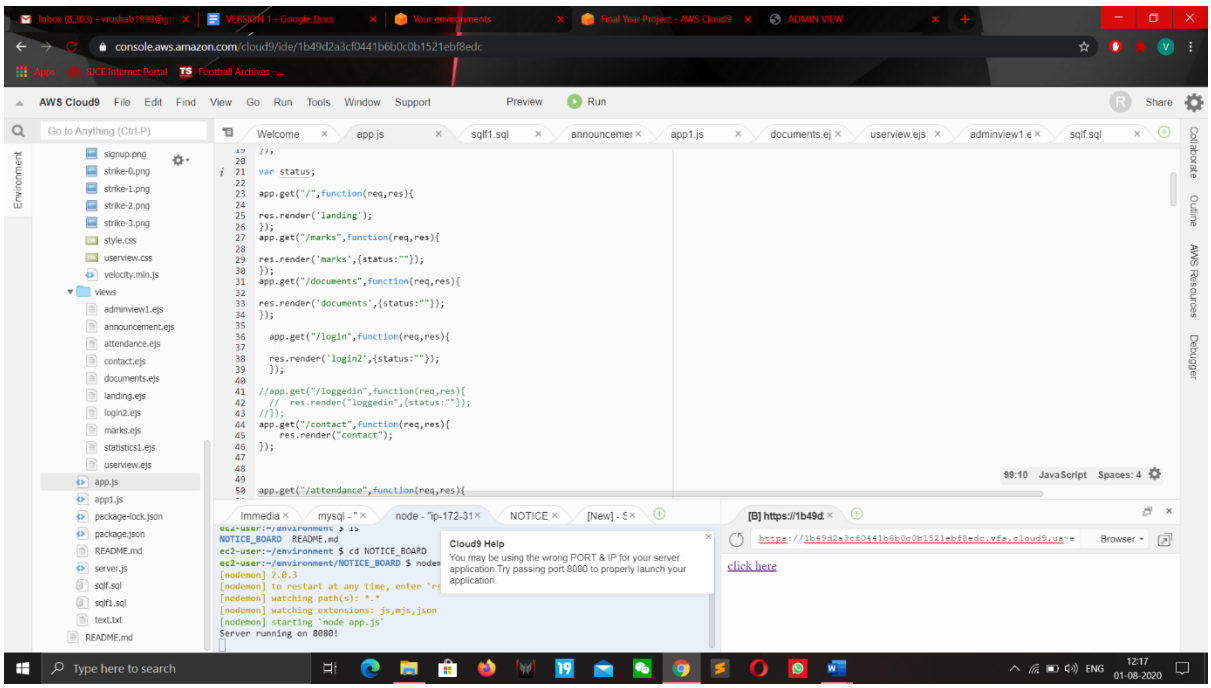
Mysql.createConnection is used to create a mysql connection it has 3 parts

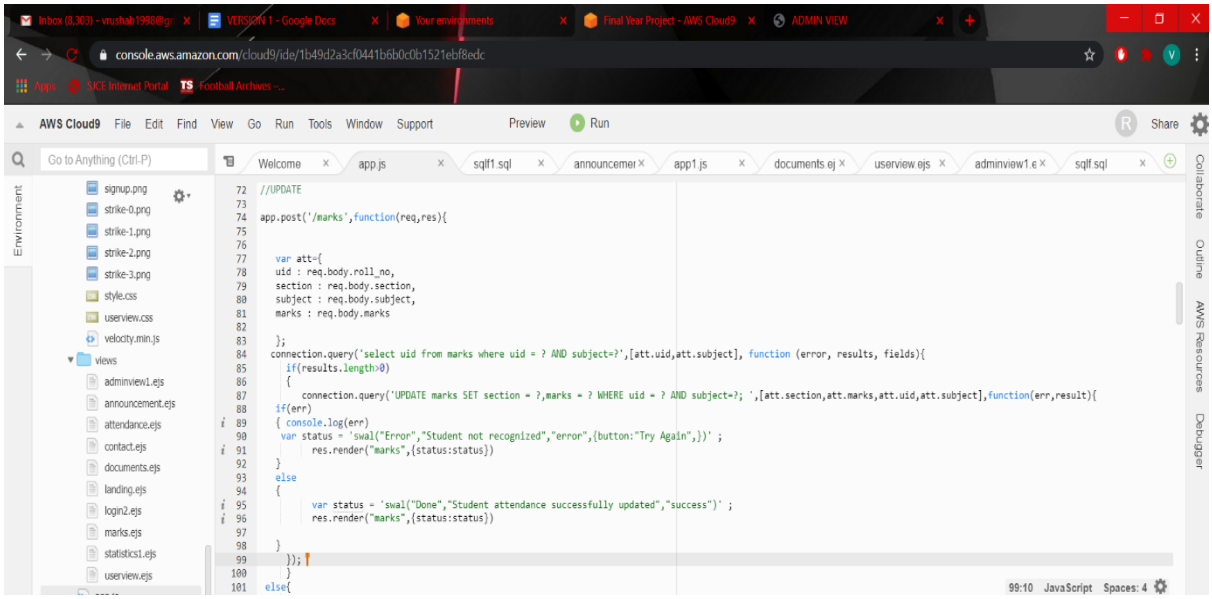
- Host
- User
- Database

5. We listen to the server by using app.listen

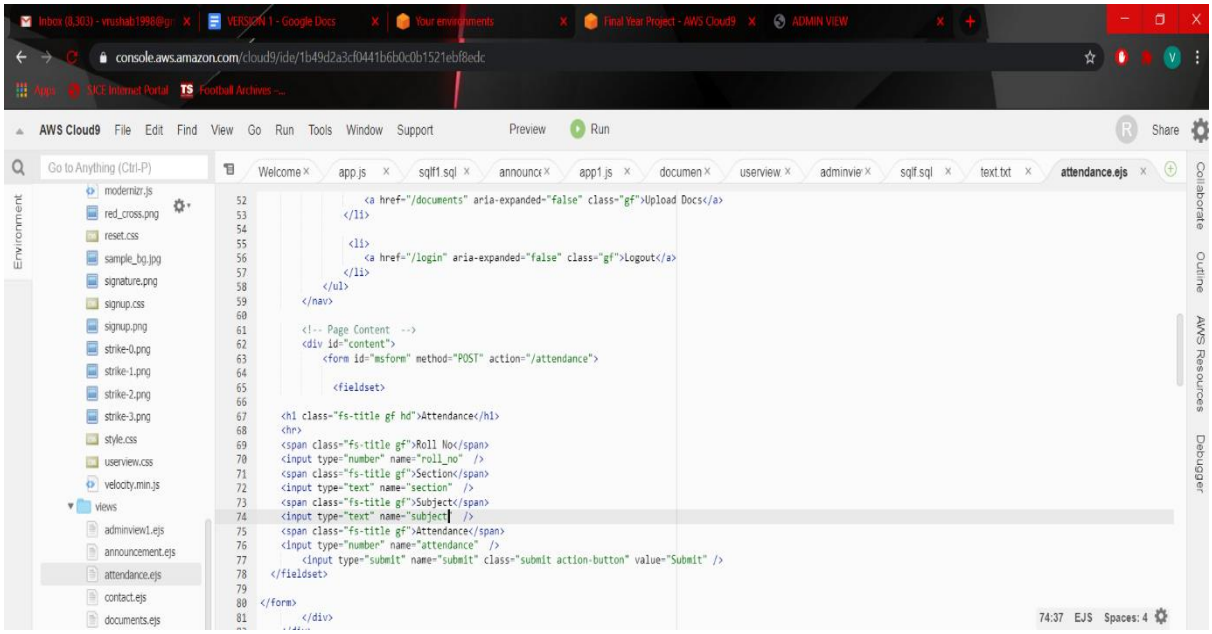


6. We connect to the pages by using express routing by using Restful API's like get,post etc

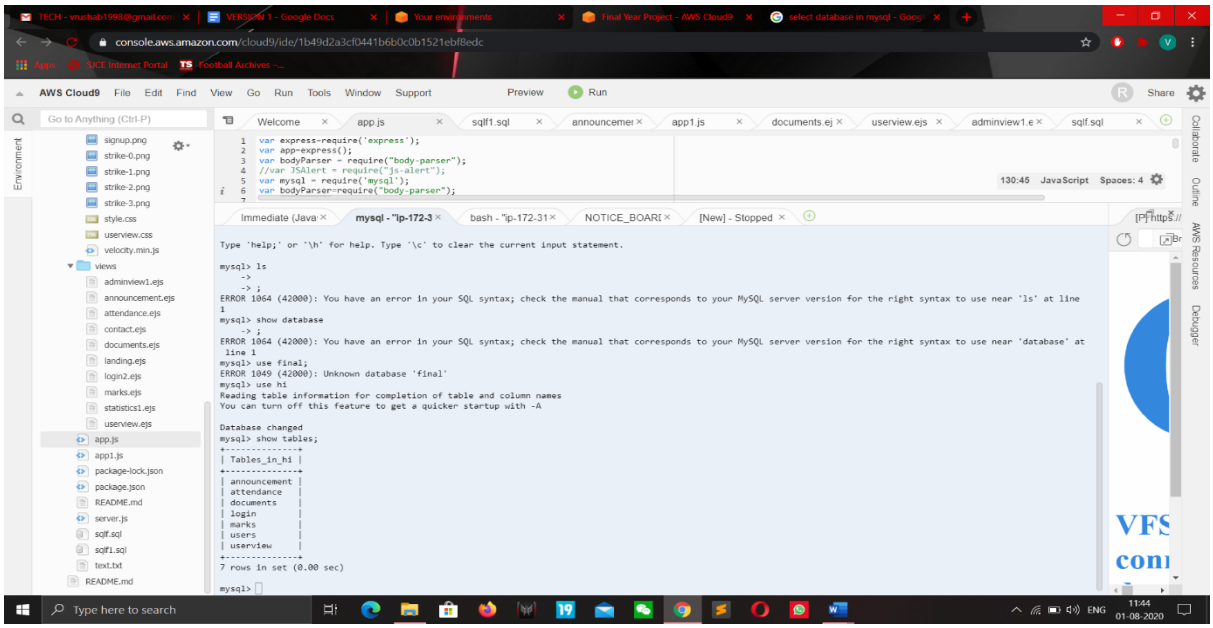


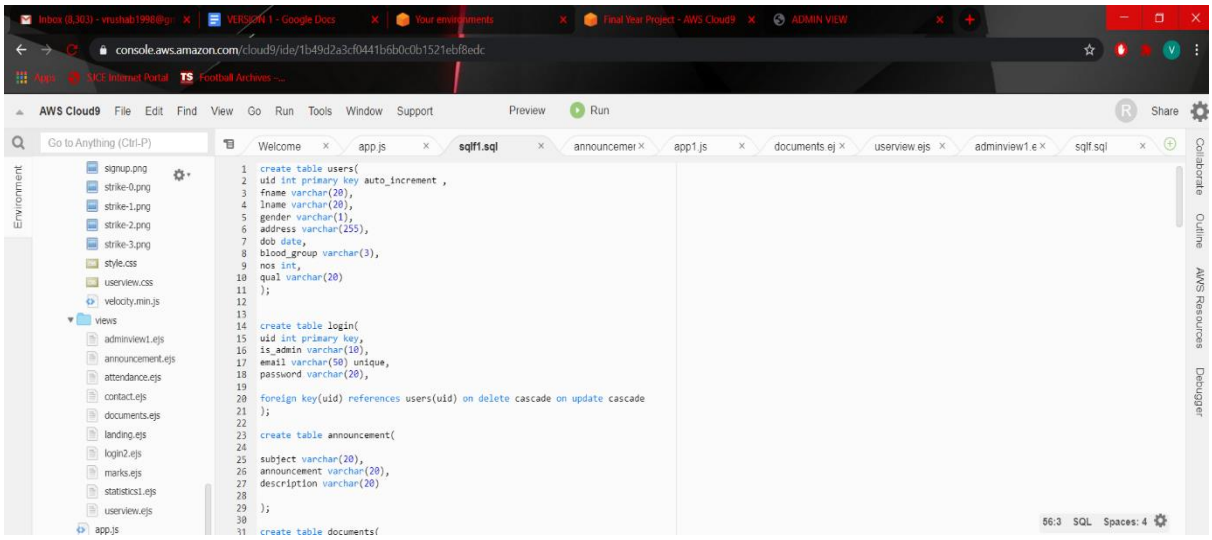


7. We do not use the traditional html we make use of something called ejs to substitute that.

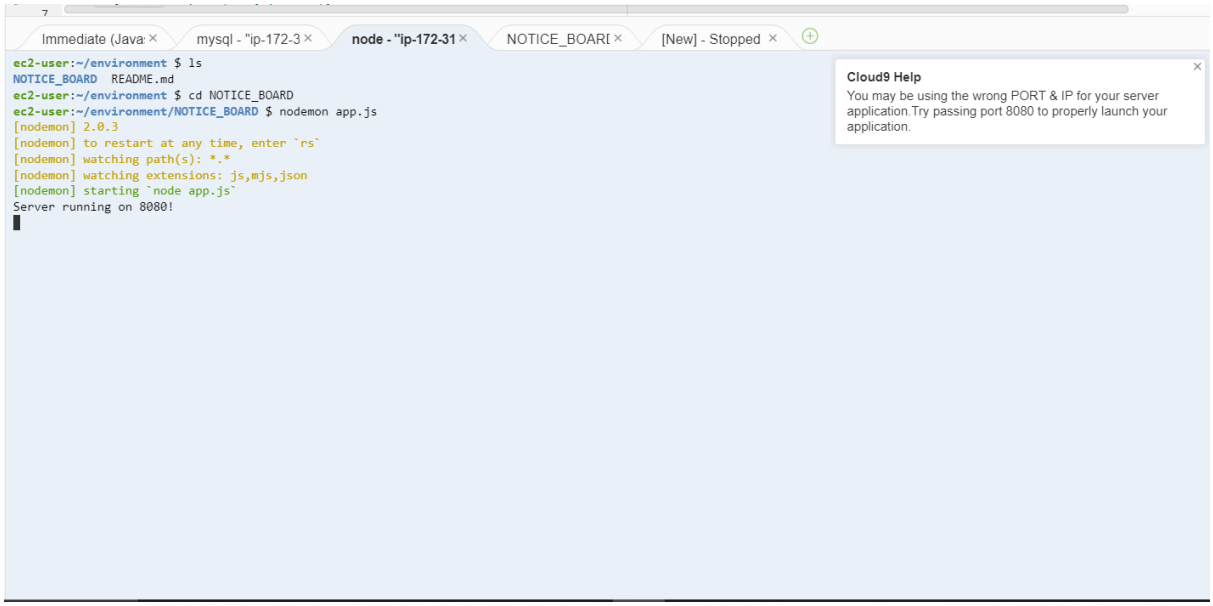


8. The database is set and the tables are defined





9. The server is then run by using node app.js



Hardware implementation

Hardware implementation deals with the device or electronic chipset that runs on some computer programs. Our project's hardware implementation/ interaction between hardware components and been classified as two ways.

- Interaction between Raspberry pi and the display Monitor.
- Interaction between Raspberry pi and the GSM Module.

Interaction between Raspberry Pi and the Monitor

- Raspberry pi can be connected to the monitor either by the VGA cable or by the HDMI cable. (We used HDMI cable)
- A software program has been written in the Raspberry pi to receive files or documents or any announcement texts from the authorized users or to be precise Admins.
- The textual contents or multimedia files has been received by the Pi and upload the same into the notice boar, which is the Monitor.
- A brief explanations and codes are described in the software implementation part of the report.

Fig. Pi connecting to monitor via HDMI

Interaction between Raspberry pi and the GSM Module

- A GSM modem is a device which can be either a mobile phone or a modem device which can be used to make a computer or any other processor communicate over a network. A GSM modem requires a SIM card to be operated and operates over a network range subscribed by the network operator. It can be connected to a computer through serial, USB or Bluetooth connection.

- Working of GSM Module

    - Place a valid SIM card from a wireless carrier into a mobile phone or GSM modem, which is then connected to a Raspberry pi.

    - After connecting a mobile phone or GSM modem to a computer, you can control the mobile phone or GSM modem by sending instructions to it.

    - The instructions used for controlling the mobile phone or GSM modem are called AT

    - commands (ATtension commands).

- There are vast versions of GSM Modules are available, some useful modules among them are:
    - SIM800
    - SIM900
    - SIM868

Introduction to AT commands:

AT commands are commands which are used to control the modems where AT stands for Attention. These commands were derived from Hayes commands which were used by the Hayes smart modems. Every wireless, as well as the dial up modems, requires an AT command to interact with a computer machine. These AT commands along with other extended commands also require Hayes command set as a subset.

There are 4 basic types of AT commands:

1. **Test:** The test command is utilized to check the compatibility of a command by a modem.

   SYNTAX: AT=?

2. **Read:** command is used for extracting the mobile or modem settings required for operations.

   SYNTAX: AT?

3. **Set:** This commands is used to make changes into mobile phone or modem settings required for the operation.

SYNTAX: AT=value1, value2, …, valueN

4. **Execution:** As the name suggests, this command is used to execute the said operation.

   SYNTAX: AT=parameter1, parameter2, …, parameterN

Most commonly used AT Commands

The below 7 are the most commonly used AT commands:

1. **AT:** Used to check the interaction between the computer and the module. This command is usually replied with an OK if the port and the module can connect correctly, else wise it comes back with a result code ERROR.
2. **CMGF:** Used to setup the SMS mode. By adding 1 or 0 with the command text or PDU mode can be selected. Here the text mode is easy to operate although it only allows a few limited features of SMS. Where as the PDU mode allows a more detailed access to the SMS service, although to use this you require some basic knowledge of TDPU.

   SYNTAX: AT+CMGF=<mode>

3. **+CMGS:** Used to send SMS to a particular phone number

   SYNTAX: AT+CMGS= serial number of message to be send.

4. **ATD:** Used to make call to a particular number

   SYNTAX: ATD;(Enter)

5. **ATA:** Used to answer the incoming calls. The calls are denoted by a message 'RING' which duplicated for every ring of the call. After the call ends a message saying 'NO CARRIER' is displayed.

   SYNTAX: ATA(Enter)

6. **+CMGW:** Used to store a message in the SIM. After the execution of the command, the '>' sign appears in the next line where the message can be entered.

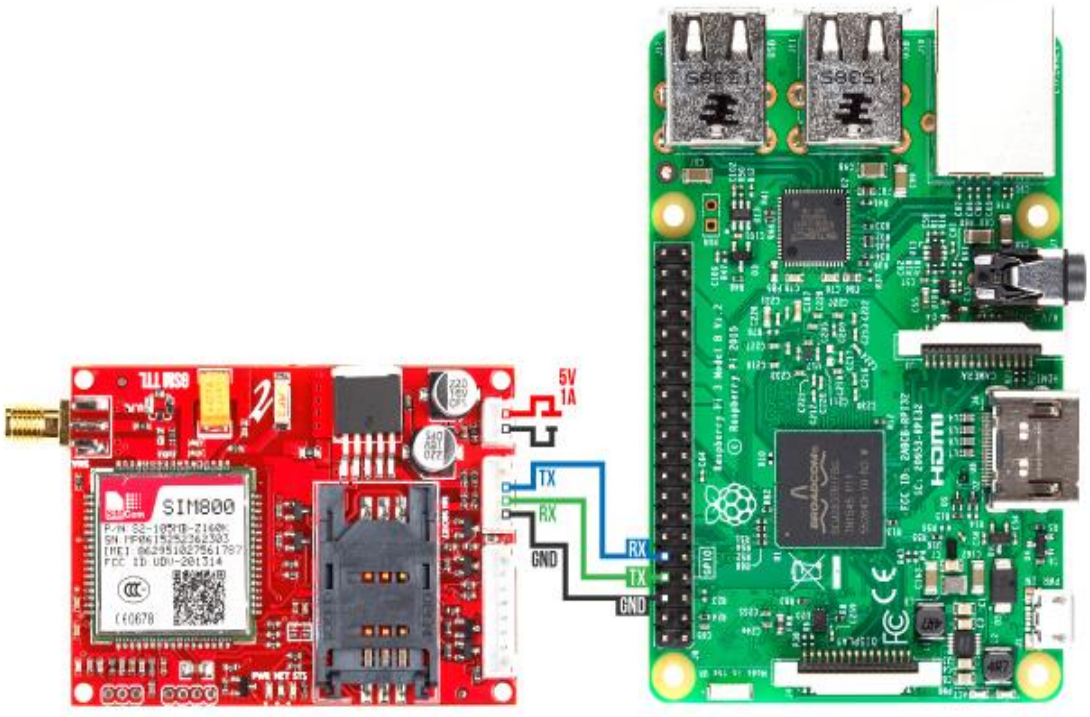
SYNTAX: AT+CMGW=" Phone number"> Message to be stored Ctrl+z

7. **ATH:** This command is utilized to disconnect a remote user with the GSM module.

   SYNTAX: ATH (Enter)

For implementing this module, we have to follow some steps to get everything done properly:

- Connect the Raspberry pi to the SIM800 Module by making use of the given connection table.



SIM800`	Raspberry Pi 3
RX	TX
TX	RX
GND	GND

- Disable serial console to enable communication between the pi and SIM800 via `serial0`.
- Open the terminal on your pi and run
  sudo rasp-config
  Select Interfaces → Serial
  Select "No" to the 1st prompt and "Yes" for the 2nd.
- Now it's time to code.
  Import the necessary module

7. RESULT ANALYSIS AND SYSTEM TESTING

OUTPUTS OF OUR PROJECT:

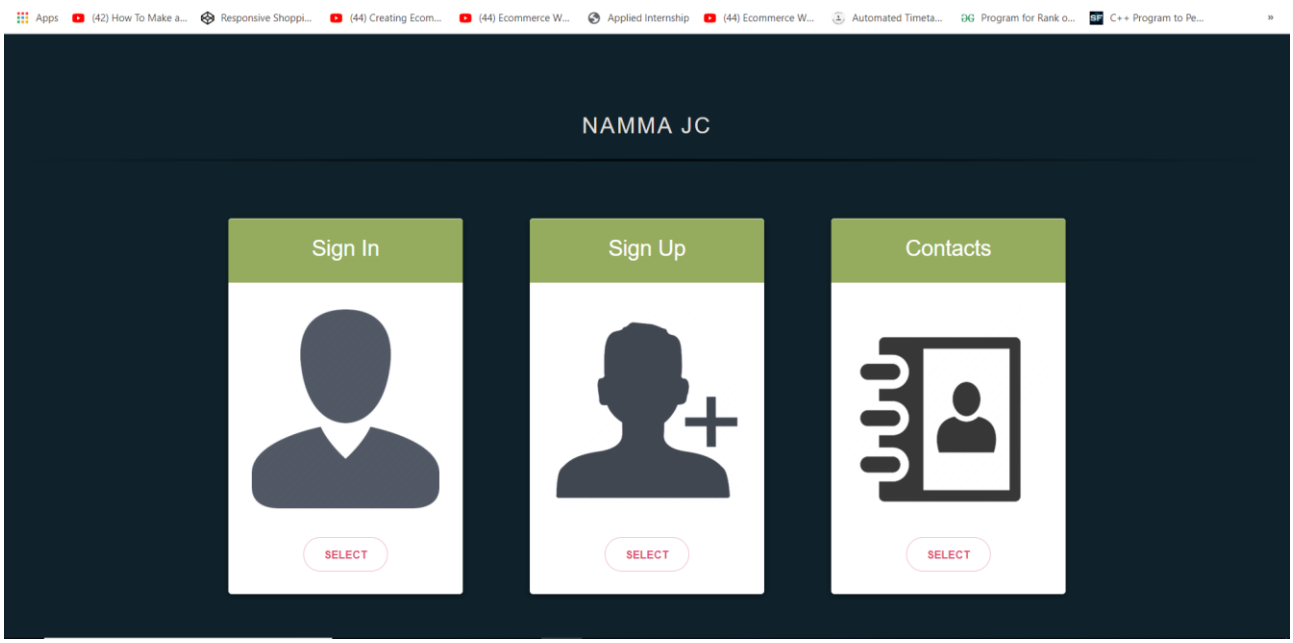


Fig: Landing Page

This is the front page of the application. It has three features- Sign In, Sign Up and Contacts page. Depending on what the user wishes to do, he can select the appropriate card.

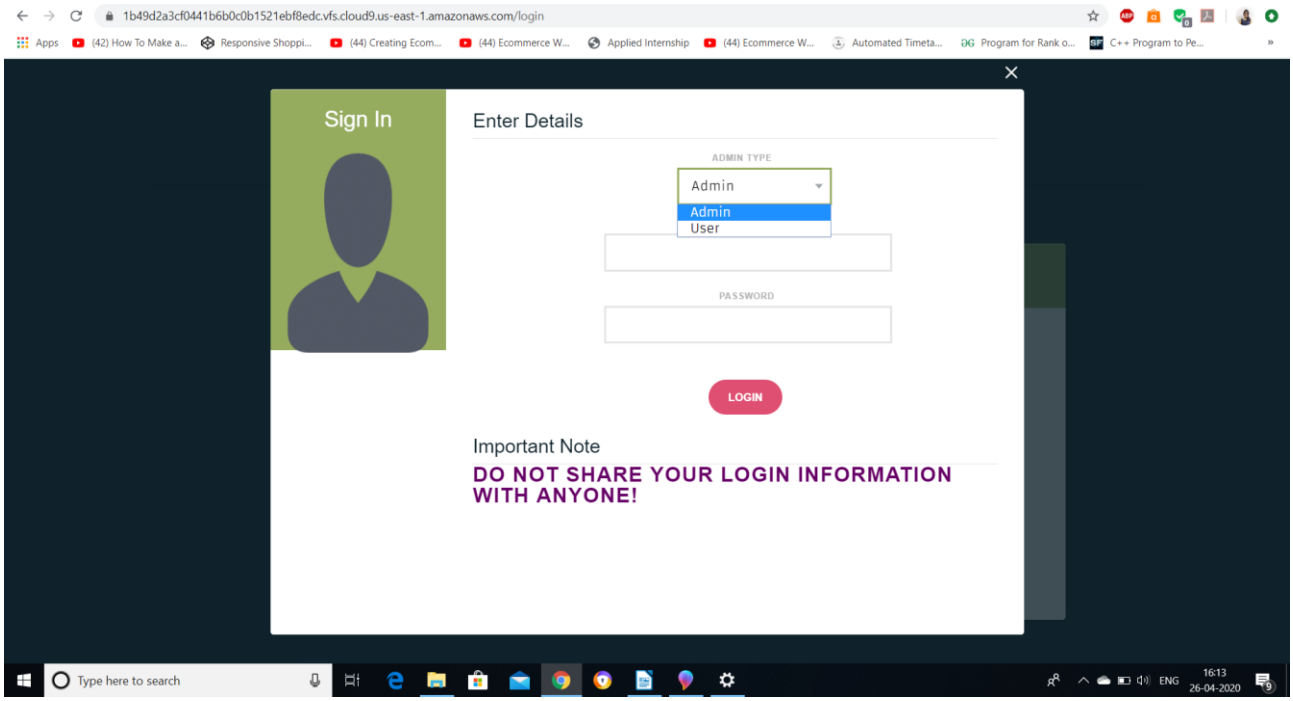


Fig: Sign In

- If the user is not a first time user of the application, then he can directly open the Sign In page which allows him to login to the application.
- This page gives an option to login as an admin or a user.
- Admins are the authorised staff who will be handling the entry of notices, attendance and marks of students.
- Users are the students and parents who wish to only view the information.

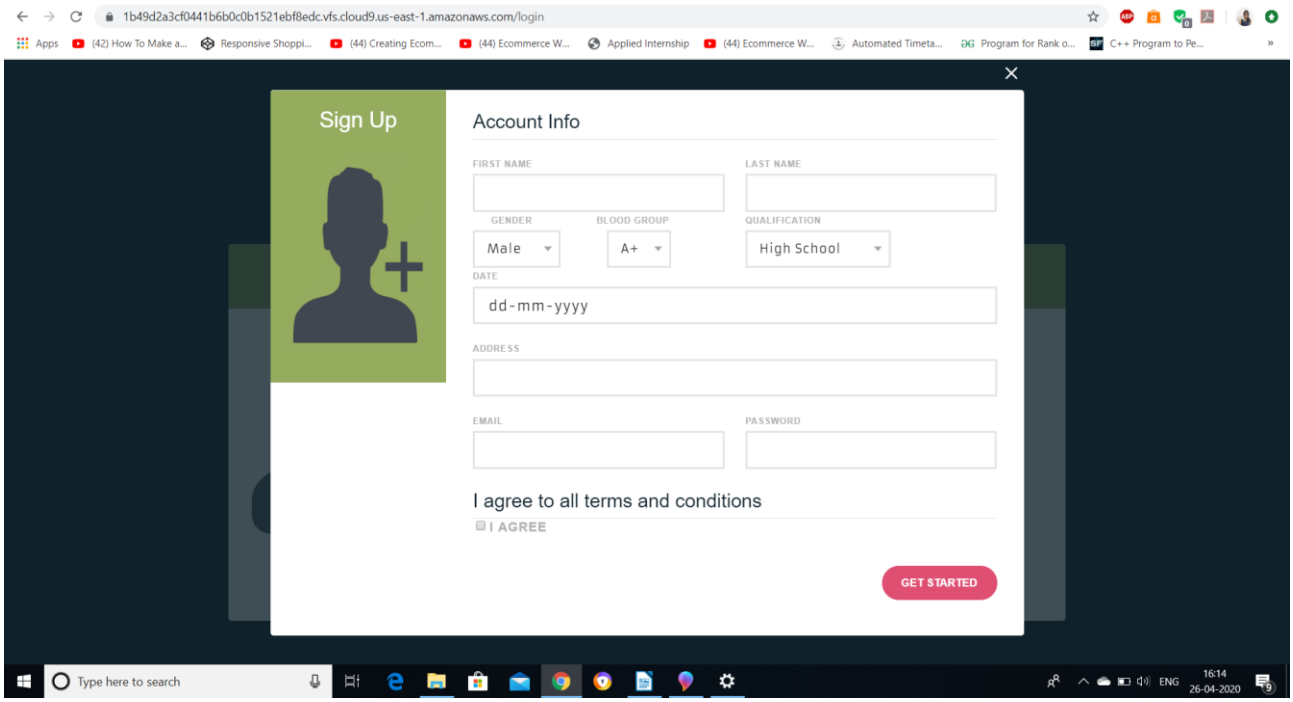


Fig: Sign Up

- If the user is a first time user of the application, then he has to select the Sign Up card after which this page will be displayed.
- Here the user must enter the correct credentials, which will be stored in the database and used for authentication purposes while logging in the future.
- Each user will be assigned a unique user ID to be able to distinguish one from another.

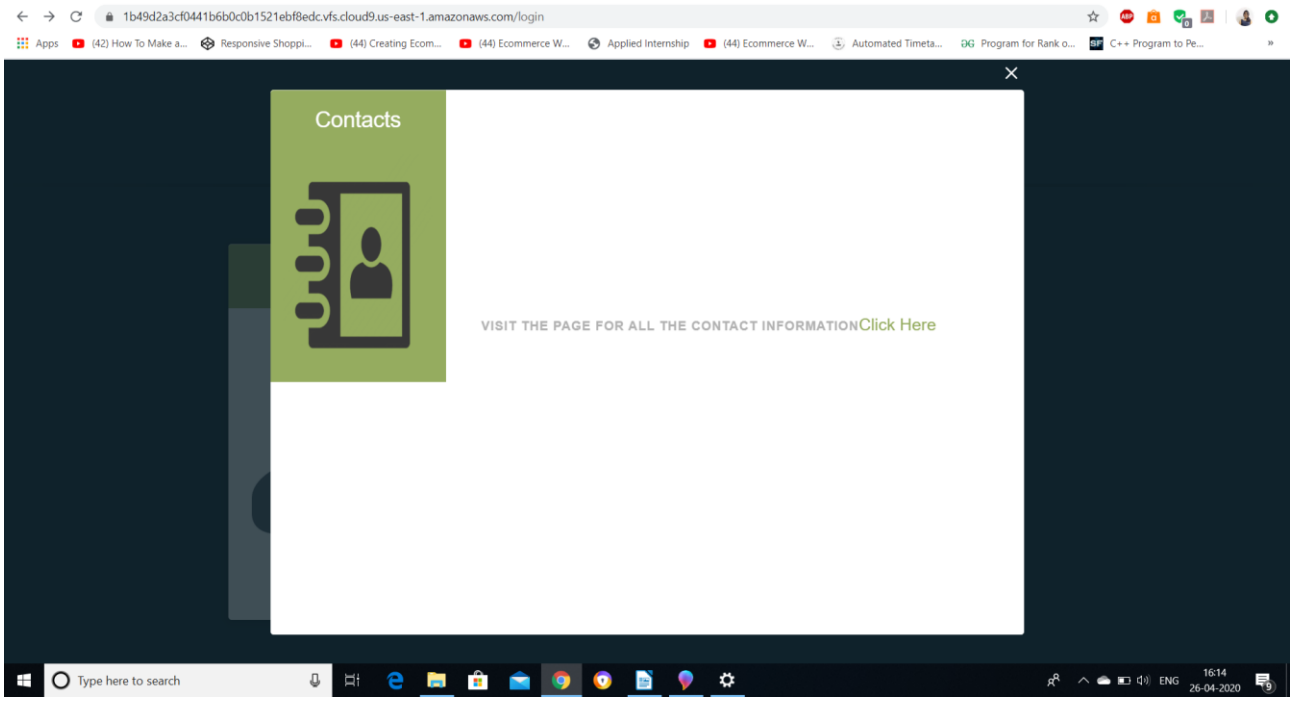


Fig: Contacts

This page displays the contact details of all the users. It is like a directory that helps the users if the want contact information of one another.

The pages shown below are the functionalities provided to the admins. The admins can post an announcement notices, attendance and marks of the students, upload documents which can be downloaded by the students and so on. The update and upload feature capability of information is given only to the admins and not to the users.

- The announcement page allows admin to upload any notice that will be displayed to the users.
- The attendance form is used to update attendance of each student.
- The marks form allows admin to enter marks of each student according to the subject.
- The upload form allows admin to select a document which needs to be uploaded to the database so that it can be retrieved by the users by downloading it.

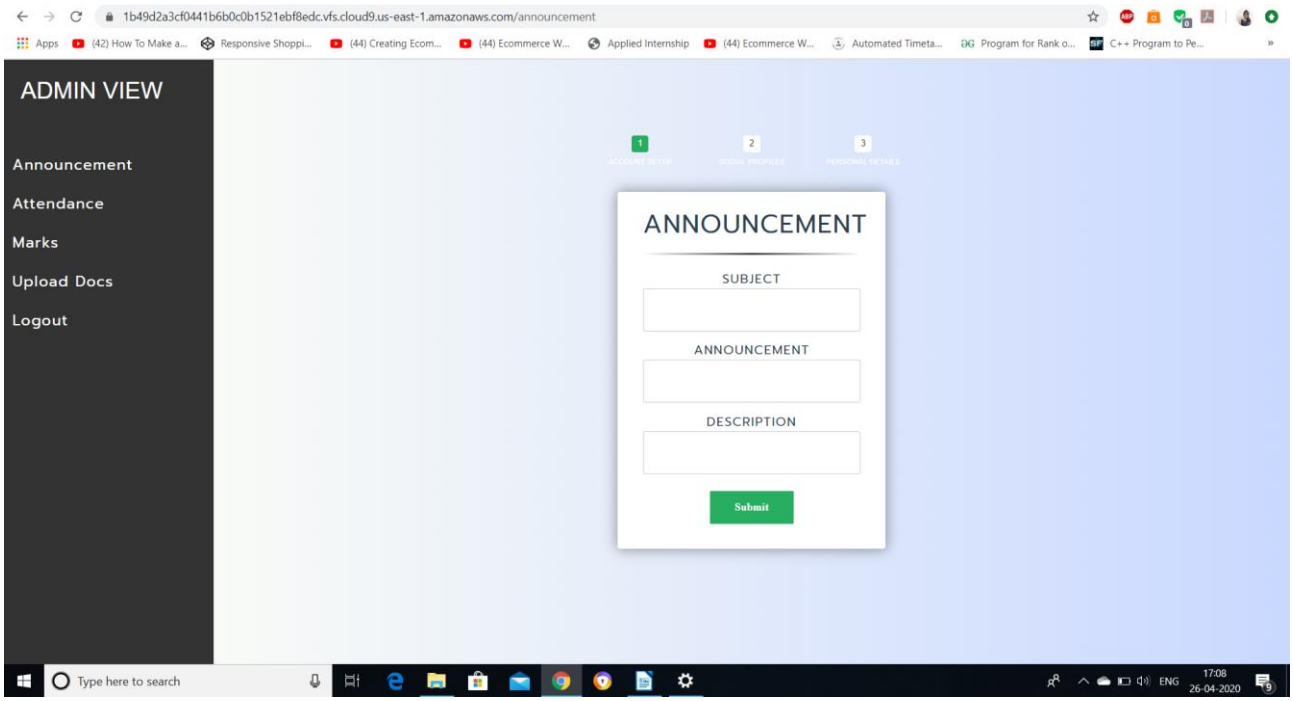


Fig: Announcement

- Announcement tab specifies the admin or any staff of the particular subject can provide an announcement based on his/her needs. It can be
    - Subject wise attendance shortage list.
    - Any upcoming events.
    - Seminars.
    - A list of Students with minimum CIE.

- A simple description to elaborate the announcement for the better understanding of the students.

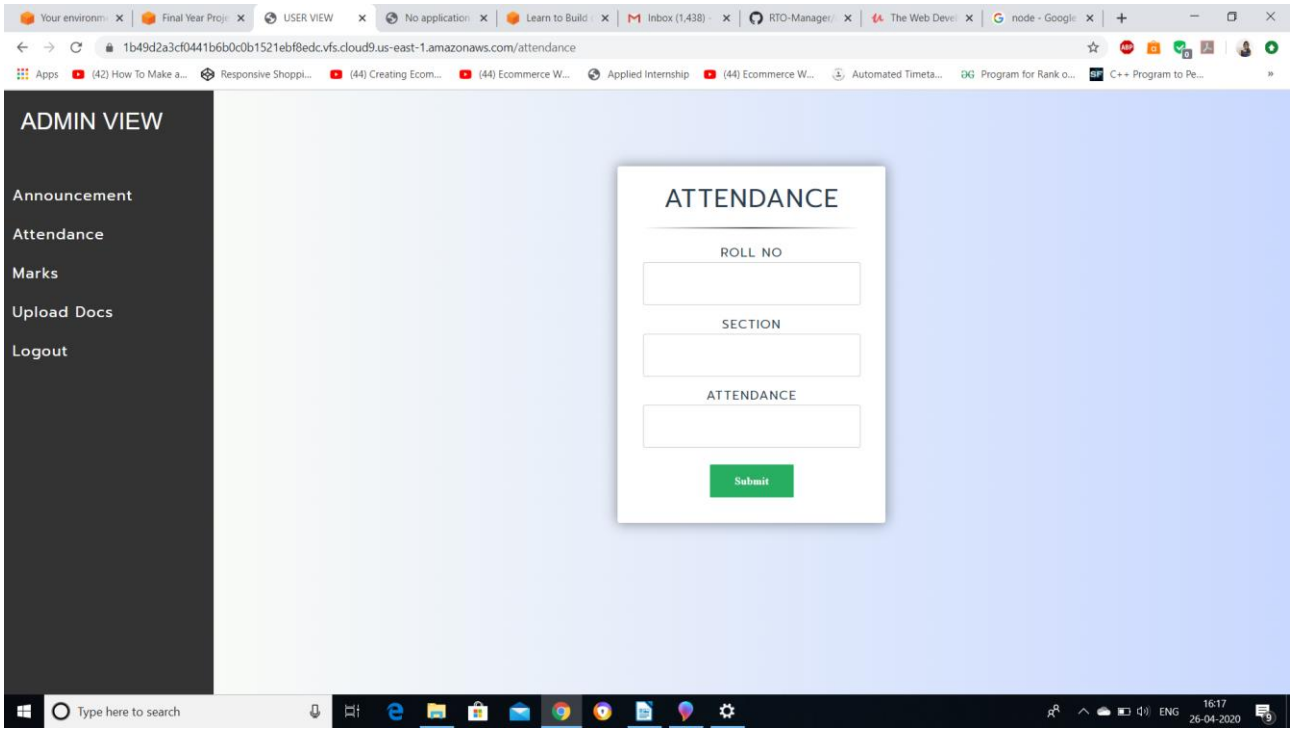


Fig: Attendance

- As mentioned above the attendance of the students with detailed percentage is entered in this section of our project, which has the following fields.
    - Roll Number of the Student.
    - Section in which the student belongs to.
    - And his/her attendance percentage.

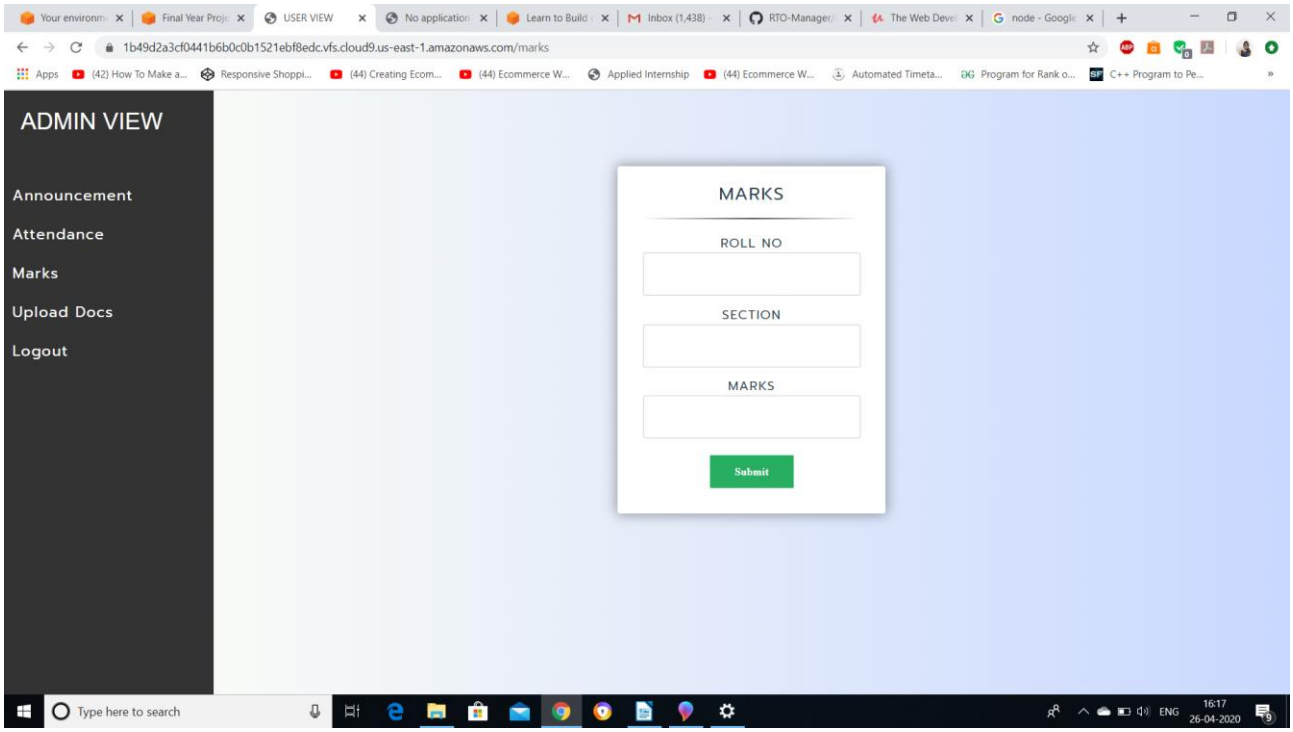


Fig: Marks

- As mentioned above the marks of the students are entered in this section of our project, which has the following fields.
    - Roll Number of the Student.
    - Section in which the student belongs to.
    - And his/her marks in the corresponding subject selected.

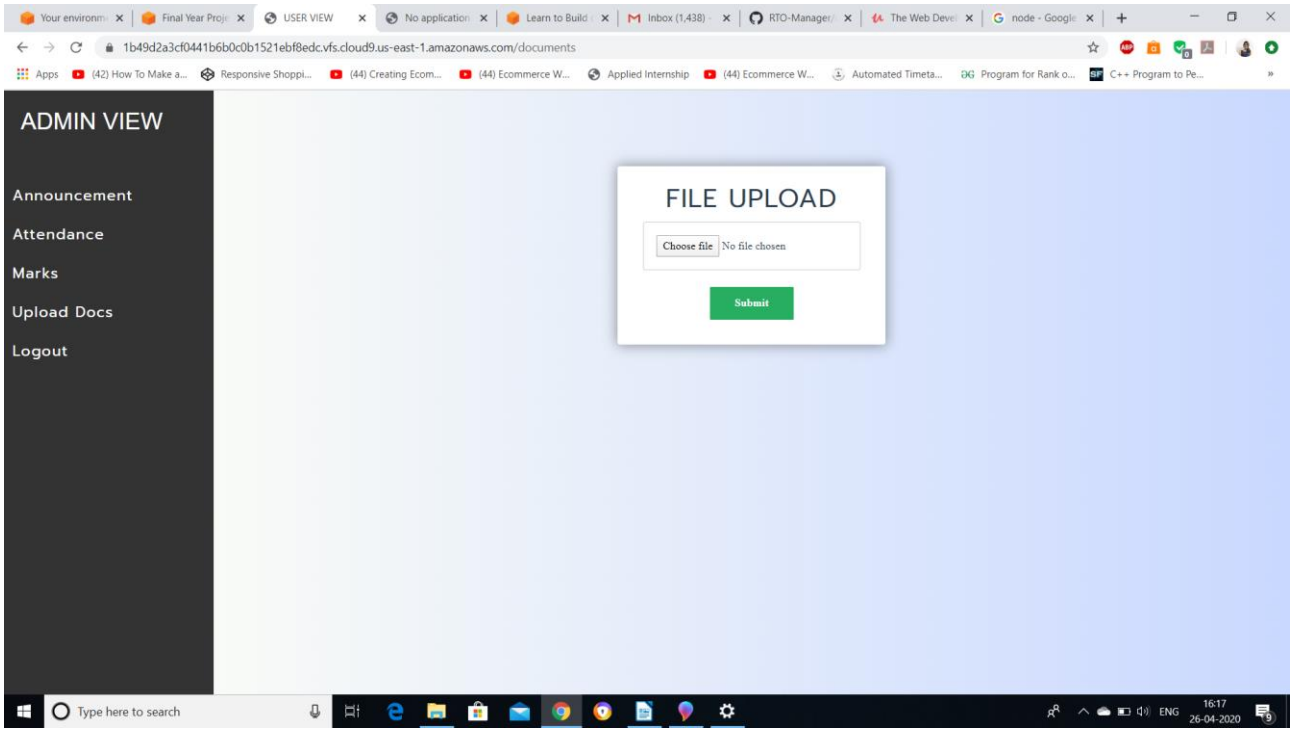
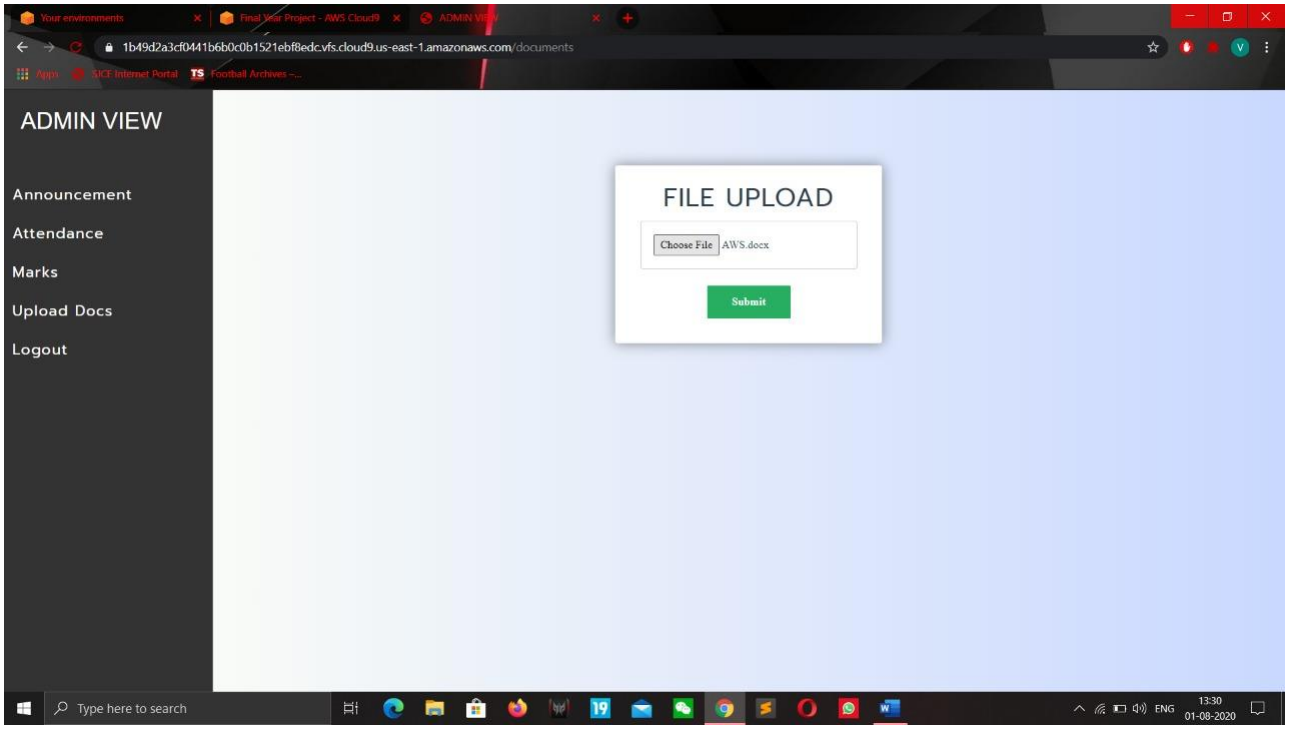


Fig: File Upload

This section of our projects depicts how an admin can upload the files or documents to the notice board.



The User view of the application after the Sign In Page is as shown below.

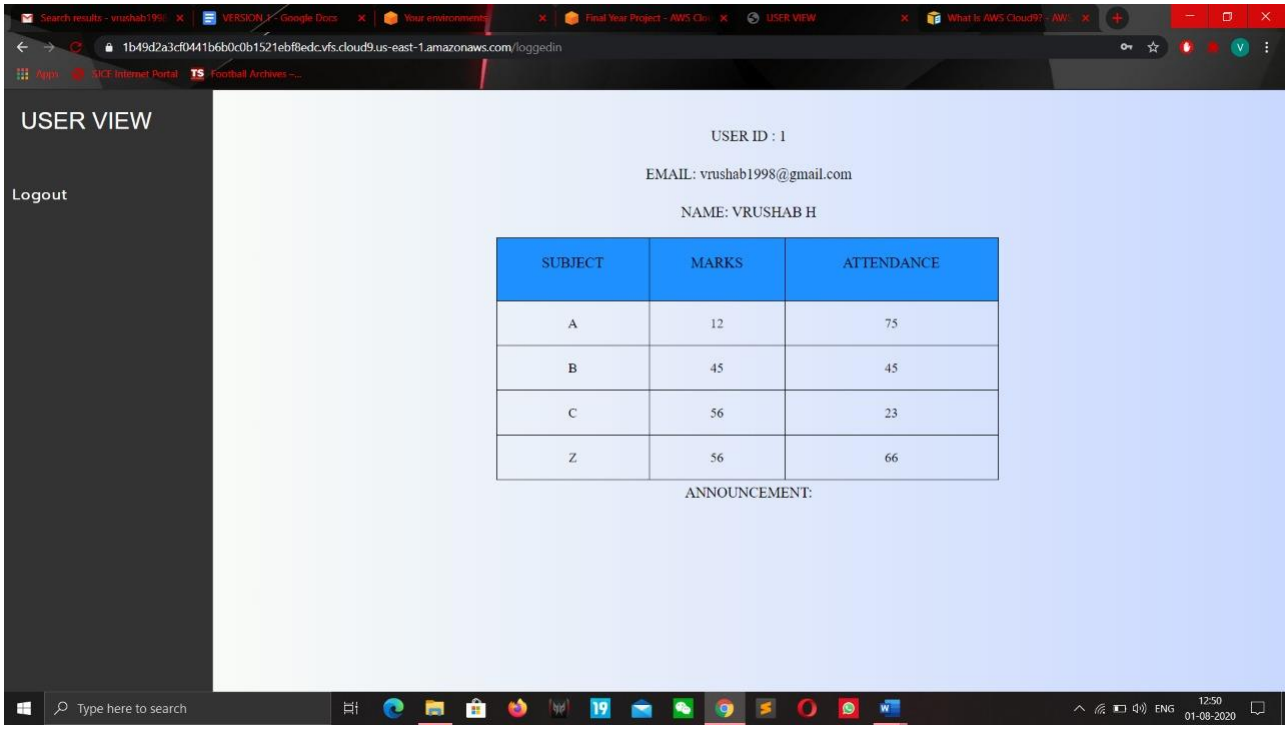


Fig. Subject-wise marks and attendance of a particular student

The above showed image depicts the respective student's marks in particular subject and this can be viewed in either a PC/Laptop or a mobile phone with proper internet facility.

SYSTEM TESTING

Software part of our project is working well and good in our environment and needed to be testes in college environment.

Hardware implementation of our project was incomplete because of the uncertainty of the COVID-19 situation, not able to meet the teammate's in-personal, lacking of components and online delivery and return issues, connecting and interacting online and discussing the project was not so effective. So whatever is done is given by our best.

8. CONCLUSION AND FUTURE WORK

The wireless digital notice board developed helps to ease the process of displaying notices. It makes use of Raspberry Pi and GSM module to be able to display and view important messages to the public via the internet on Android phones and as a text message on non Android phones. This overcomes the difficulties of manually typing notices, printing it, getting it approved by the authority and then sticking it up on the notice board which most of the time goes unnoticed by the targeted public.

The proposed and presented system gives the administration officials to directly send notice via their phones which is given admin privileges wherein they can choose what to send and whom to send it to. If the notice is meant for the teachers, it will be directed to them, similarly to students and parents whomsoever it concerns. In this manner, we can save a lot of paper, ink and time it takes to make drafts of notices before it is finalised by the official. Whereas here it is the authority themselves in control of sending what is important and needed.

Currently, the system is capable of supporting text messages, images, links, etc which can be displayed. It is also possible to upload student attendance status, internal marks and so on provided the teachers keep updating this information.

The futuristic scope of this project are the following features:

- Display of QR code for the public to scan and view any notices or images or website, which can be displayed on the monitor situated in campus.

- Display the information about the status of the classes currently going on. For example, a student can view which classroom to go to at a particular hour and also know if there has been a cancellation of any class or if the class has been moved to a different room or slot.

- Provide a page for faculty and facility feedback from which can be filled by all students and then analysed by the department administration to realise what improvements and changes need to be done to give satisfactory education to the students.

- Get daily news updates on the happenings in colleges by various clubs and the activities they are conducting. Also provide option for enrolling to these events online itself.

- Incorporation of the Bluetooth 4.1 capability of the Raspberry Pi so that in case of WiFi malfunctioning, the users can send notices via Bluetooth.

Appendix A: PROJECT TEAM DETAILS

Vrushab H

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Appendix B: CO's and PO's Mapping

Project outcomes

1. Understanding the basic tools and technologies involved in web interface design.
2. Familiarizing with the IOT Domain.
3. Simulating a model design describing the working of the raspberry pi unit.
4. Integrating the Software and Hardware modules.
5. Analysing the Hardware module circuits and its features.
6. Analysing the results of the wireless digital notice board and testing the system against the given sample input data.

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