

**SMART BLACKBOARD: THE SMARTEST ONLINE  
CLASSROOM**

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

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**DAFFODIL INTERNATIONAL UNIVERSITY**

**DHAKA, BANGLADESH**

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## **APPROVAL**

The project titled “**Smart Blackboard: The Smartest Online Classroom**”, submitted by Md. Nazmous Shakib, Md. Efta Khirul Alam, Md. Khorshed Alam and Dewan Mydul Islam to the department of Computer Science and Engineering. Daffodil International University has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and Engineering and approved as to its style and contents. The presentation has been held on May 2018.

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## DECLARATION

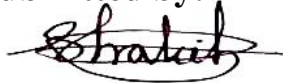
We hereby declare that, this project has been done by us under the supervision of **Ms. Nazmun Nessa Moon, Assistant Professor, Department of CSE** Daffodil International University. We also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

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## ABSTRACT

This project titled “**Smart Blackboard: The Smartest Online Classroom**” is an online classroom management system with University Management System bundled together. This project solves the issue of using multiple platforms for different uses like Google Classroom for class related discussion, student portal for student’s information management including course registration, results etc. Our projects aim is to create one central interface for all these things this will help both teacher and student from sufferings of previous online classroom. It will help teachers for sharing course information, post announcement, add or remove students into classroom, submit course results etc. It will help Students on the other hand to join on classroom simply by registering for the courses and don’t have to join the classroom separately with any invite code. Participation on classroom discussion, view lecture slides, syllabus, academic reports of the course.

The project is built with PHP as server-side scripting language using the Laravel Framework for the back-end. The web application is designed with HTML, CSS and the Bootstrap Framework, JavaScript and Vue.js for Interaction Design.

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# CHAPTER 1

## INTRODUCTION

### 1.1 Introduction

**“Smart Blackboard: The Smartest Online Classroom”** is an online based classroom management system where both teacher and student have an individual id to login and access. Our project enables a teacher to share resources, take online classes, announce notice, publish grade etc. On other hand a student can collect teacher’s uploaded resources, participate classes, get notification, submit assignment and can get his earned marks. Due to our project is portable both teacher and student can access our project from anywhere via a pc and internet connection.

### 1.2 Motivation

Worldwide mostly used online classroom is Google classroom. We also use this classroom. But we face so many limitations on it like, communication process between teacher and student is poor, can’t get semester schedule, and can’t get calendar and routine. Most of all for student to student communication we use social media. Another limitation is result; to collect our result we have to use another online portal.

Due to above limitations we motivated to develop an online portal to get rid of the limitations of previous online classroom.

We, a four-member team decide to develop an online classroom management system where a teacher can communicate with students and vice versa, can submit marks/grade, can take classes if the teacher is out of city or country. On other hand student can attend classes, submit assignment and also can make group discussion.

### **1.3 Objectives**

The main objective of this project is to reduce necessity of using multiple software of web platform related to our academic life. We have designed this project to bring an all in one academic platform to help using reducing usage of multiple platforms and repetition of doing same thing over and over. Following are the key objectives of the project,

- To make all the academic information available in one place
- To engage rich communication in between teachers and students.
- To reduce the repetition of doing same thing on multiple platforms.
- To register and join classroom easily just by registering for courses.
- To help teachers submit reports, course announcements and lecture slides easily.
- To help students ask questions and discuss about courses on classroom.
- To enable private communication with teachers and students via chat/messaging.
- To let teachers, take classes remotely via live video.
- To enable open discussion & communication engagement via Forum.

### **1.4 Expected Outcome**

The user interface of our project is very easy and simple both for teacher and student. Teacher can personalize his/her teaching process and student can personalize his/her learning process. This system is accessible from anywhere and anytime. Our system will save teacher's time due to its anywhere access mode. Student's grade marks will remain recorded. On every activity of student, he/she will get assessment feedback from course teacher. For both teacher and student turn in process on "Smart Blackboard" is easy and simple. Teacher can create lesson on individual topic.

Student doesn't need any paper or book to attend the online classes. Both teacher and student can't access others private profile. Only the public profile can accessible for others. Collaboration between each other. A discussion can be created between teacher-student and student-student. Teacher create's assignment and student have to submit it before submitted date. Otherwise it's late. There's no limitations of file format to submit assignment and a student can submit multiple file in a single assignment. Email feedback or notification can possible.

### **1.5 Report Layout**

This report has started by introducing the project, motivation behind developing this project, objectives of the project and expected outcome in the first chapter. On the next Chapter we have covered a bit about the background of this project, where we mainly put the old system reference and a comparison of these with Smart Blackboard and then the scope of this application. On Chapter three we have described the requirements specification by providing the business model, data model and use-case diagram with description. Chapter four is all about the design specification including the Front-End, Back-End, Interaction Design and UX. On Chapter five we have covered our implementation and testing reports. Finally, on the last chapter we have defined some advantages, disadvantages, the scope of it and future development opportunities.

## **CHAPTER 2**

### **BACKGROUND**

#### **2.1 Introduction**

We build “Smart Blackboard” to fulfill the limitation of other website that will help both teacher & student from sufferings of previous online classroom. To build this project we had to make a huge study on it.

Firstly, we check the Gmail and google classroom because at university life we faced so many limitations on it. All we need a Gmail id to handle google but to use a google classroom we must use the mail id that university gives to us. Google classroom doesn't have any chatting option for both teacher and student. Using this id, we can easily access the google classroom but to check our mail we have to use Gmail.

Then we have to access our university's website and student portal for teacher's info, our marks or, grade and university's notification.

We build this project to solve all the limitation that we discussed. We developed a website likely student management system named “Smart Blackboard” where teacher can publish routine, schedule, student's marks or, grade and live video lecture. On the other hand, student can collect routine, marks and join in video lecture to understand teacher's lecture.

#### **2.2 Related Work**

We have observed few related works but none of these were the complete solution we were looking for. Google Classroom is one of the repeated work that motivated us to create something like this. Smart Blackboard has incorporated the Google Classroom features and as well as other basic University Management systems. So, School/University Management systems can be also related with Smart Blackboard. Another remarkable project to mention is the student portal and forums for Daffodil

International University [1]. In Smart Blackboard we have combined all these into one platform so the students and teachers don't have to switch their browsers tab back and forth and instead they get all in one place.

Following are the few examples of similar kind of projects which are related with our one but none of these complete solutions but just partial implantation.

- Google Classroom [2].
- DIU Student Portal [3].
- NSU Portal [4].
- BRAC University Club Forum [5].
- East West University Student Portal [6].

### **2.3 Comparative Studies**

Our study aims to compare and evaluate the learning ability and performance for both teacher and student. Though we faced so many complications on online classroom that we use then we study hard and develop a platform that reduce all previous problem to us online classroom. So many online classrooms can find on Google but there's complication are found like teacher's info, student's info, no live videos, most of them can't send notification, mailing problem and mark calculation problem. The platform we develop are significant differences in knowledge score, problem solving ability and eventual project deliverable outcomes. Here performances between both teacher and student were compared to approximate and perceptible reasoning by university or, college.

### **2.4 Scope of the Problem**

Though we discuss limitations from a lot online classroom in comparative studies but it's time to discuss how we solve problems that we get from used online classroom. In our project firstly, we decide to build a user-friendly platform to use. Paperless

learning process means here student can learn without paper and personalizing process can be possible for both teacher and student. Our project “Smart Blackboard” will be accessible from anywhere and anytime. It saves teachers time because teacher can update and upload notifications and materials. If teacher unable to take schedule class, then teacher can lecture using live videos on our project. Here assignment submission to a teacher can very easy and student can get a feedback on assignment. On our project a forum can found where chatting discussion can be possible to solve lectures or, topics. Though our project must be needed self-hosting and maintenance cost but it will better than previous online classroom.

## **2.5 Challenges**

More and more teacher and student are want to join in an online classroom that helps them to submit topics and learn well. Due to their response we take a challenge to build a better platform of online classroom that helps them very much. A platform that helps a teacher to share slides, documents, suggestion, notifications to student, live video conferencing and a forum where both teacher and student can chat to each other to solve student’s weakness on a topic. Here student can discuss on a relevant topic, can submit assignment and get a feedback, quizzes, marks and projects. To build this project we faced the following challenges\_

- Provide detailed instruction and assume questions
- Notification announcement
- Provide rules and examples
- Live video streaming for lectures
- Teachers and student’s information
- Chatting sequence on projects forum to solve topics weakness

Accepting the challenges, we had done this project very well.

# CHAPTER 3

## REQUIREMENT SPECIFICATION

### 3.1 Business Process Modeling

The system design is described using data flow diagrams. The data flow diagram of user validation module shows in figure 3.1. The remaining are all same-level process related to the three different categories of Users-System administrator, Lecturer and Students.

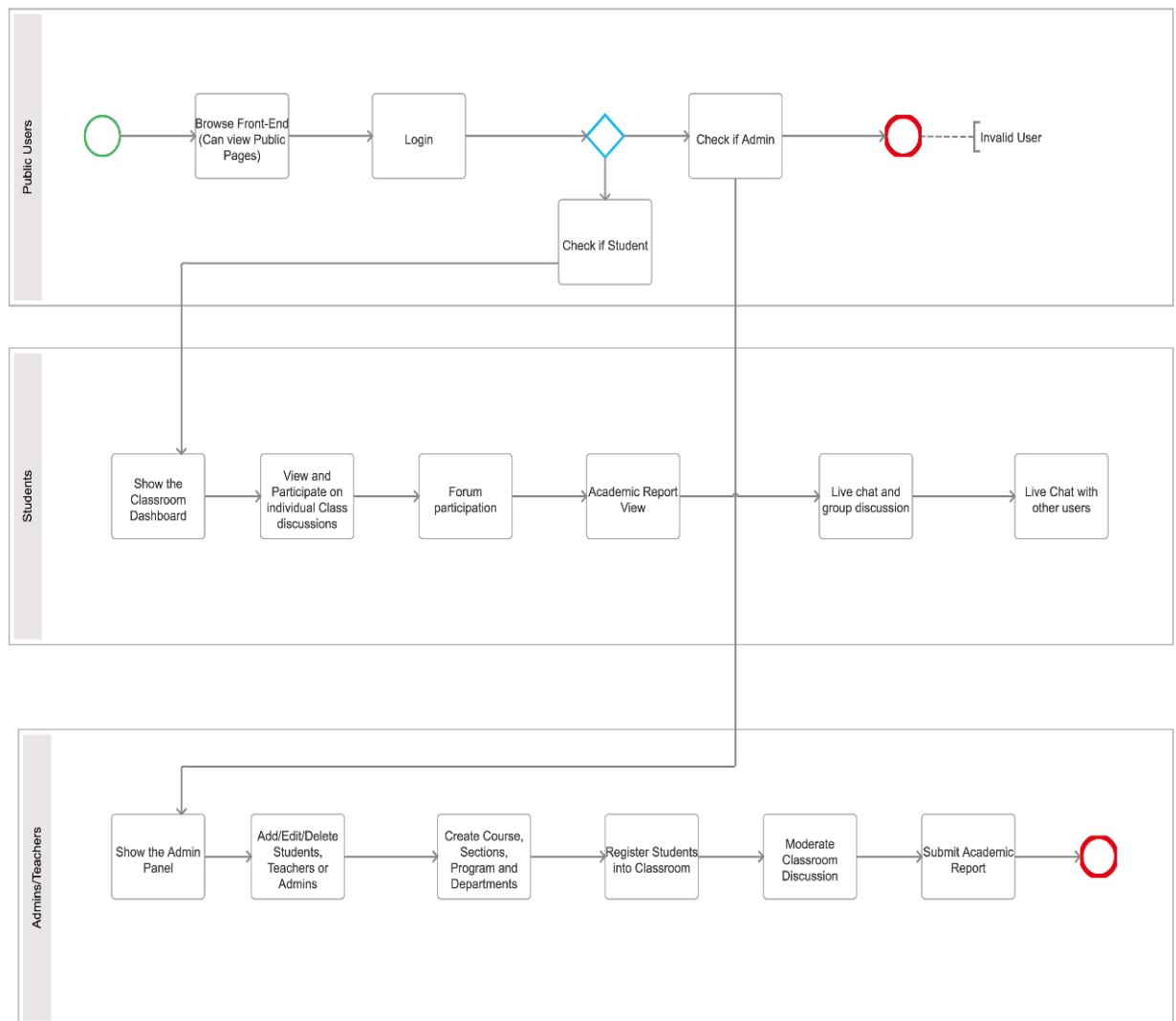


Figure 3.1: Data flow diagram

Figure 3.1, The data flow diagram showing information exchange at the student user level. The diagram contains lecture, answer questions and view solutions, check performance modules, contribute to forums, view discussion, and forum conversation modules.

### **3.2 Requirement Collection and Analysis**

Requirements analysis, also called requirements engineering, is the process of determining user expectations for a new or modified product. These features, called requirements, must be quantifiable, relevant and detailed. In software engineering, such requirements are often called functional specifications. Requirement Analysis is the process of understanding the user needs and expectation from a proposed system or application. Requirement is a description of how a system should behave or a description of system properties or attributes. It can alternatively be a statement of what an application is expected to do.

Following are the collected requirements for Smart Blackboard based on our analysis.

- i. Login and Registration System
- ii. User Roles and Permission Management for Admin, Teachers and Students.
- iii. Database Table/Column Management
- iv. File/Media upload (image/doc/video/audio)
- v. Database Operation - Add/Read/Edit/Delete for the following database tables:
  - Faculties
  - Departments
  - Programs
  - Courses
  - Batches



- Semester
- Course Registration / Classroom
- Forum
- Posts
- Pages
- Menu
- Results
- Users (Admin/Teacher/Student)

### **3.3 Use Case Modeling and Description**

Figure 3.2 the Use case diagram of Smart Blackboard described for each individual Actors.

Admin - Admins are the highest privileged users. Admin can do Create, Read, Update, and Delete operations on all available options.

Teacher - Teacher can access their classroom, post announcement, lecture-slides and participate and moderate their classroom discussion, can view students and teachers profile. Teachers can add/edit/update their own profile, submit student's marks on classroom. Teachers can also participate and moderate on open forum discussion.

Students - Students have access to view their registered classrooms, other students profile, and teachers profile. They can also participate in their classroom discussion, and the forum discussion. Students can also view their academic reports. Students can add/edit/update their own profile. A student must log-in first to access any protected data that belongs to an individual student.

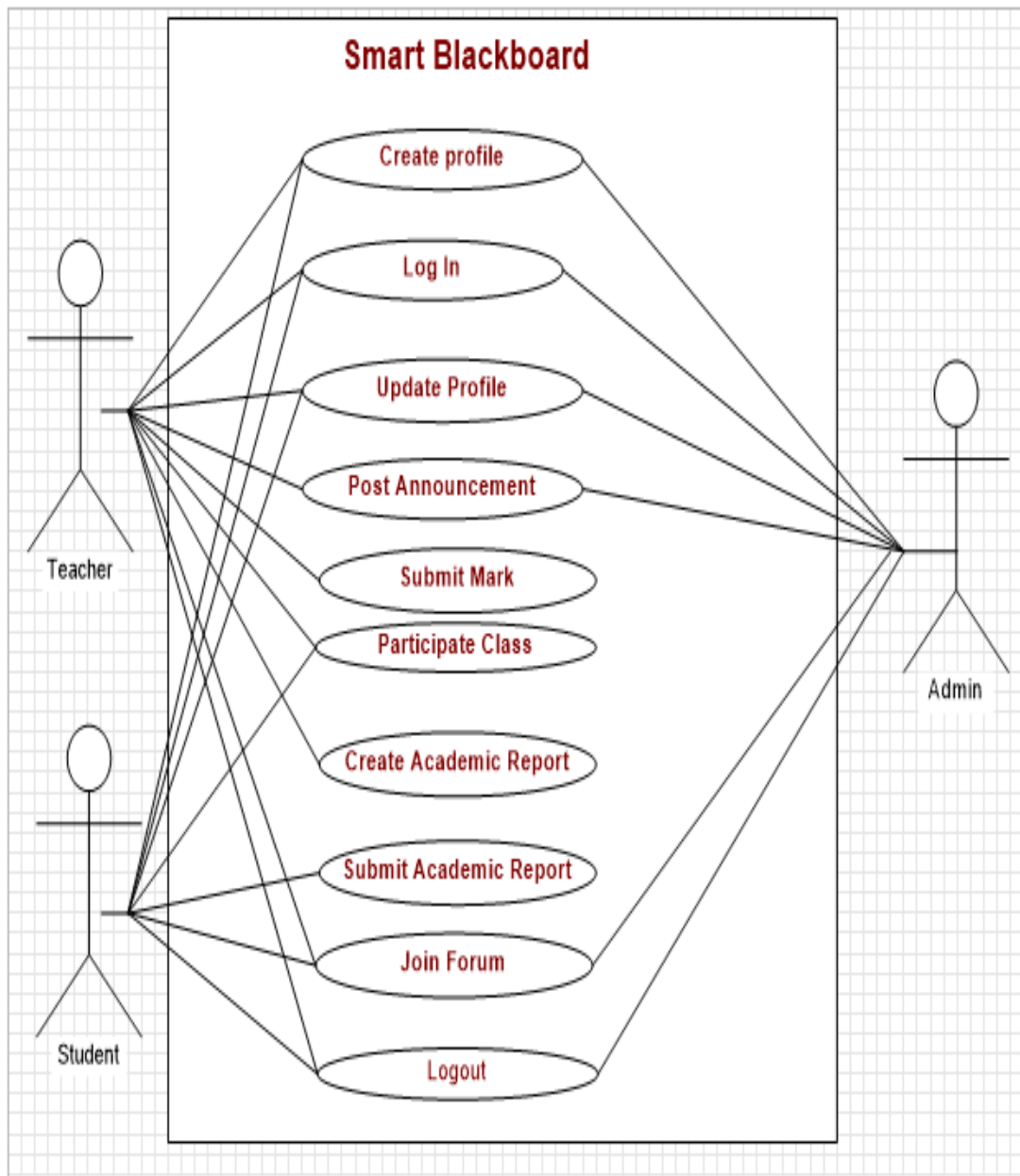


Figure 3.2: Use Case Diagram

### 3.4 Logical Data Model

The Database has designed with data relationship in consideration and normalized for efficient data read/write/update and delete operation. We have used a RDBMS (Any RDMBS would just work fine) to design and develop the application. Following figure 3.3 is the diagram that represents the Logical Data Model of our database also with the data model relationships.

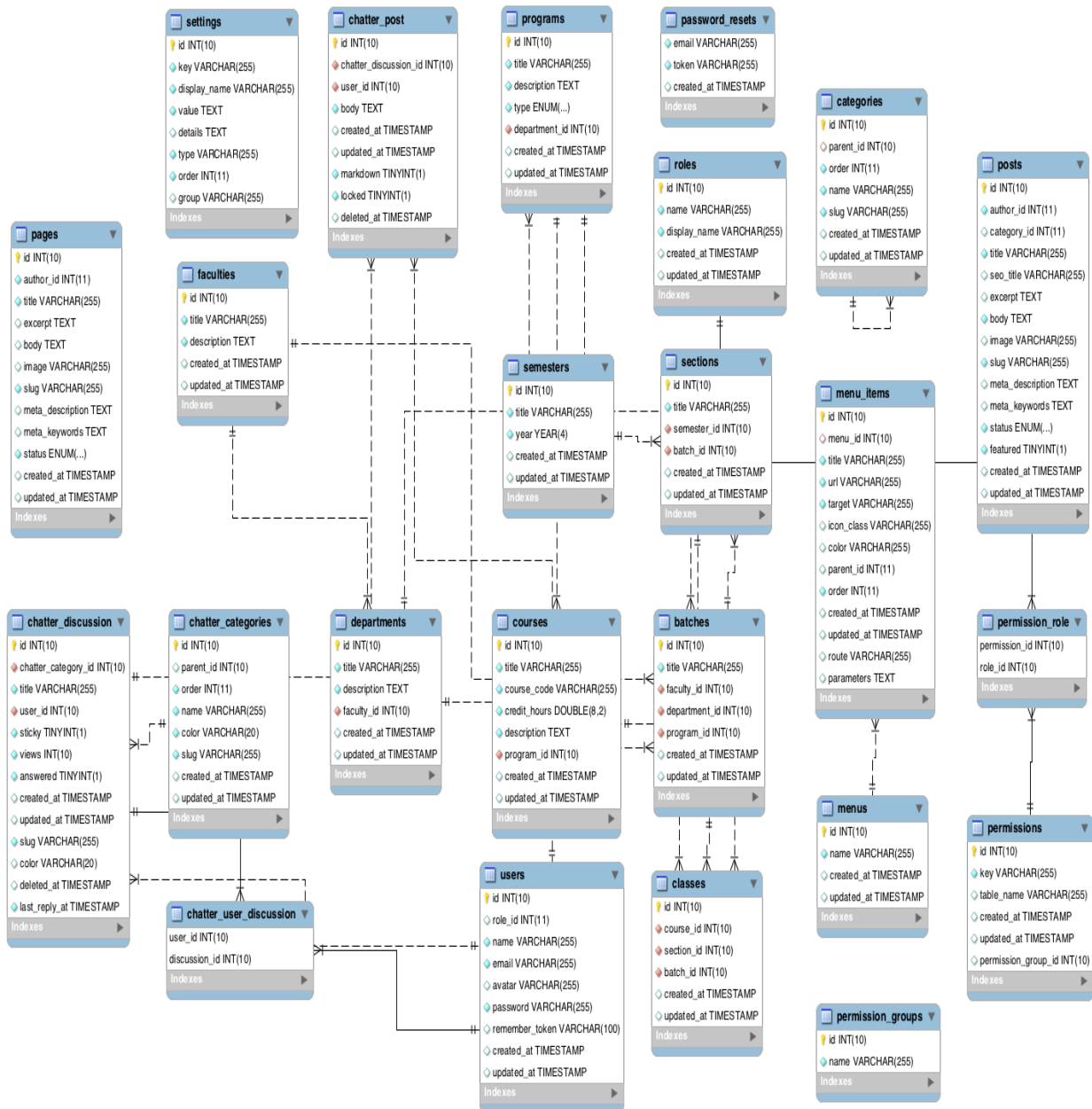


Figure 3.3: ER Diagram

### **3.5 Design Requirements**

The design requirements are mostly dependent on database models. We are using Laravel which is an MVC framework and it has good sort of support to design an application with MVC architecture. The technical requirements are mentioned on implementation requirements section of this report.

## **CHAPTER 4**

### **DESIGN SPECIFICATION**

This chapter includes the discussion about overall design including the front-end, back-end interaction design, and user-experience of the Smart Blackboard application. The design of the application consists of two major parts, the Front-End Design and the Back-End Design. Interaction Design and user-friendly User Experience is one of the key way to make an application useful and popular. We have designed Smart Blackboard with a keen consideration of design aesthetics, user experience and interaction to make it attractive. We have designed both the front-end and the back-end with a minimal designed user-interface to make it look clean and distraction free.

#### **4.1 Front-End Design**

Front-End is referred as the public facing interface the application. We have tried our best to make the front-end design modern and user friendly with simple user-experience. The front-end has built by following the trending design ideas, flat colors and usability in mind. As the nature of Web Application, the front-end is structured with HTML and styles applied by using CSS. Following figure like 4.1, 4.2, 4.3 and 4.4 are screenshot of the application front-end.

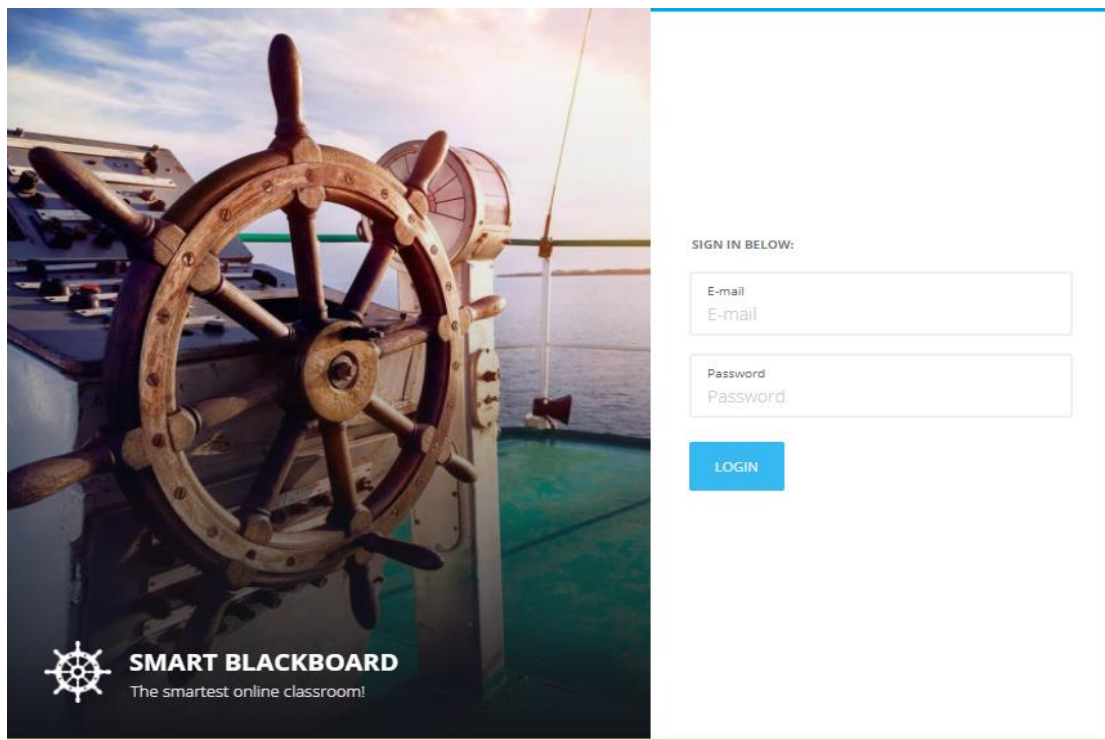


Figure 4.1: Login Screen of the application

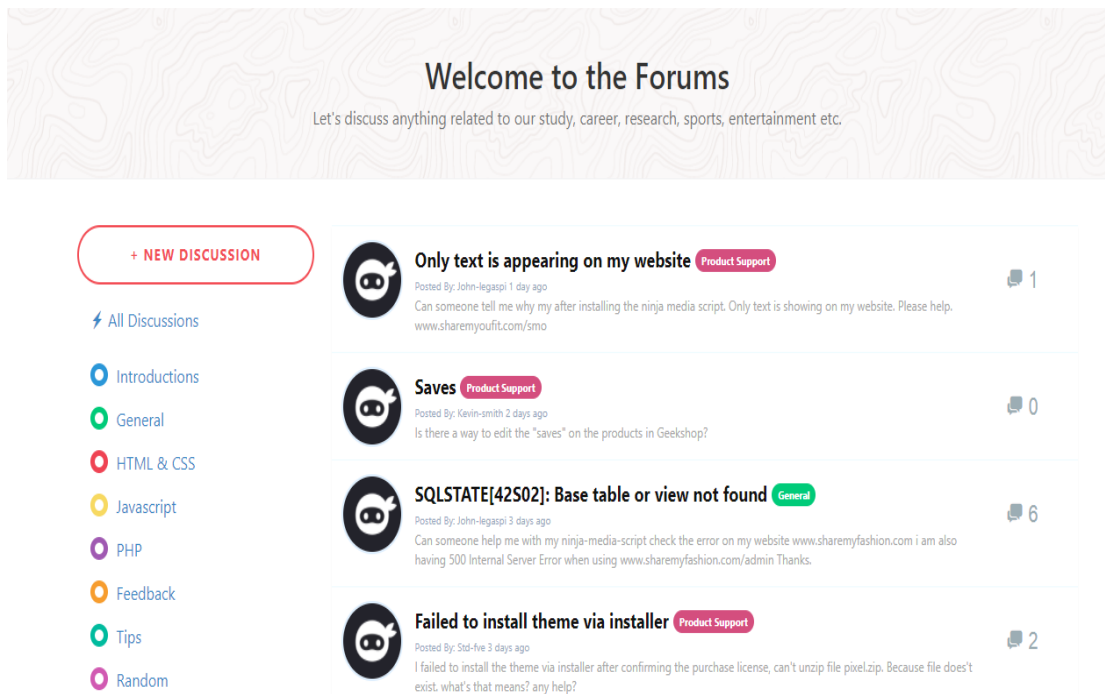


Figure 4.2: Front-End Forum for Open Discussion

## 4.2 Back-End Design

The Back-End is referred as the admin only and non-public facing interface of the application. The Back-End is capable of controlling the over-all application without writing codes. Admins can access the Back-end with their separate login credentials and can manage the whole application from one place. Following are the overview of key parts of back-end in our application. Figure 4.3 and 4.4 is the screenshot of admin panel after login as admin.

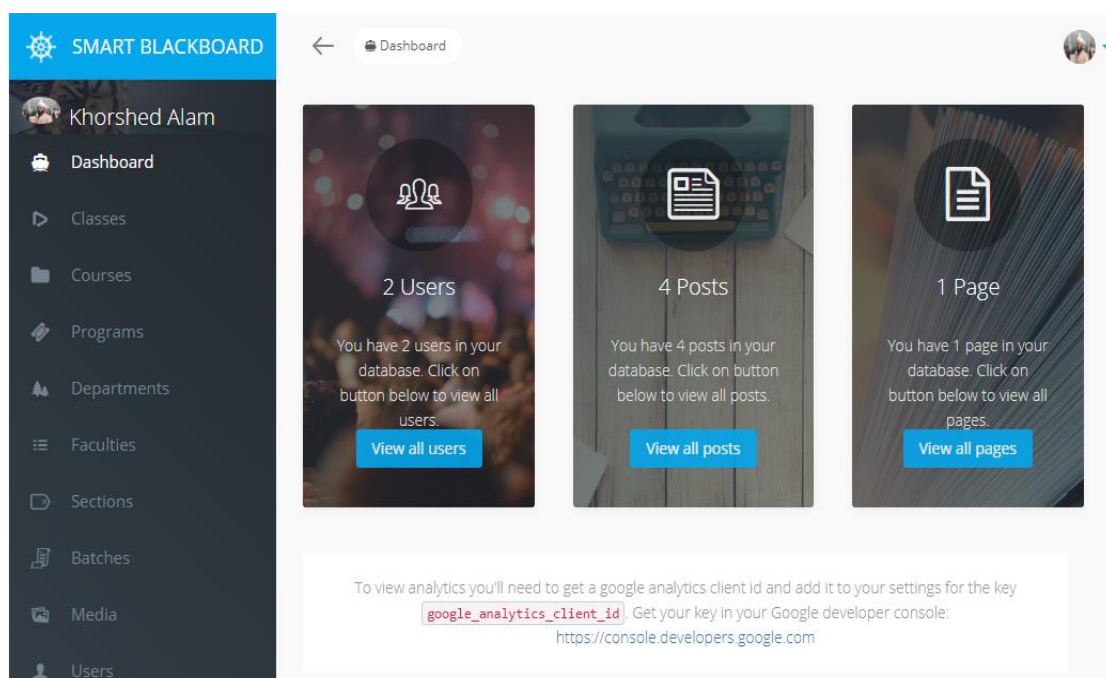


Figure 4.3: Front-End Forum for Open Discussion

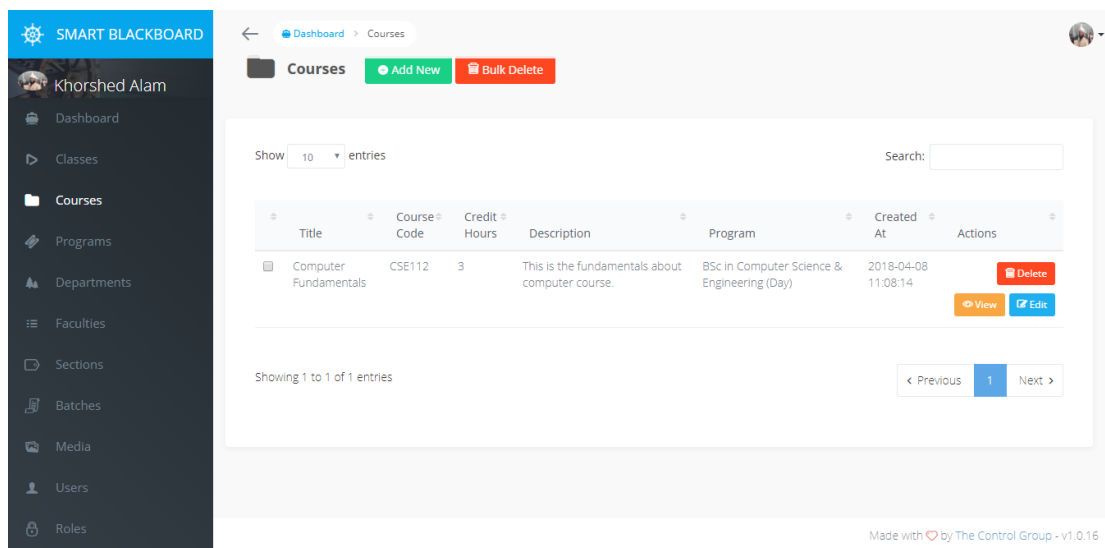


Figure 4.4: Front-End Forum for Open Discussion

### 4.3 Interaction Design and UX

Interaction Design and UX (user-experience) is another key part of any software application. Better interaction is the true necessity to response the user quickly and better interaction design leads an application as a better UX. Web application requires client-server communication in most cases to response for a request made by the users. So, it's really time consuming and require page reloads to send the response from the server. We have implemented the modern interaction features which send the request to server via AJAX, receive the response and reply back to the user promptly without any page reload. We believe this also improves the UX of the application and feels like users are using any native app instead of web app.

### 4.4 Implementation Requirements

We have used the popular PHP Framework, Laravel (v5.6) to develop the back-end system and utilized the cutting-edge tools and technology to fasten the development process. Laravel has some its own server requirements that needs to meet in order to implement the system. Laravel requires the latest version of PHP with some PHP extension. A relational database also needs to have installed and connected to the system to ensure data storage. Following are the all implementation requirements in a detailed manner.



## Server Requirements

- PHP  $\geq$  7.1.3
- Apache and or Nginx

## PHP Extensions

- OpenSSL PHP Extension
- PDO PHP Extension
- Mbstring PHP Extension
- Tokenizer PHP Extension
- XML PHP Extension
- Ctype PHP Extension
- JSON PHP Extension
- GD Library ( $\geq$ 2.0) or Imagick PHP extension ( $\geq$ 6.5.7)

## Database

- MySQL or PostgreSQL (Optimized to run on any Relational Database Management System)

## CHAPTER 5

### IMPLEMENTATION AND TESTING

#### 5.1 Implementation of Database

Smart Blackboard requires a Database to store all the data associated with the students, teachers, classroom discussion, results etc. Also, Database Implementation is a must for any application that needs to have persistent data storage mechanism. A DBMS (Database Management Systems) helps to deal with all persistent data storage needs.

The main functionality of DBMS is to store, update, delete and fetch the data from database. DBMS helps to store the data in an efficient manner organized under tables and the data is stored as rows. This makes the application free from worrying about data storage and the application talk to the database whenever a data related operation is required.

Smart Blackboard has been implemented using a RDBMS (Relational Database Management System) called MySQL and also optimized to work under any RDBMS, so switching from MySQL to PostgreSQL would just require a simple configuration change which specify the database connectivity.

As we stated before we are using the PHP's Laravel Framework, Laravel comes to database support out of the box. So, it's pretty easy to implement database connectivity with Laravel. Laravel uses a .env configuration file, it just requires to address the proper database credentials to setup a database connectivity with the application. We have used Laravel's Schema builder tool to create the database tables and Eloquent ORM (Object Relationship Manager) to work with the database on a higher-level manner.

Following is the screenshot that's used to configure the database connectivity with Database type and other database credentials.

## **5.2 Implementation of Front-end Design**

The Front-End Design implementation has done with HTML, CSS and some related libraries to speed up the workflow. We have used some open-source packages to avoid re-inventing the wheel and used the better one.

Bootstrap is one of the most popular UI framework that's built on top of HTML, CSS and JavaScript. We have utilized this framework for our front-end design implementation. And for the admin panel design we have used another popular package called Voyager.

Libraries and Tools:

- Material UI
- HTML
- CSS and Sass
- JavaScript
- Bootstrap
- Voyager

## **5.3 Implementation of Interactions**

We have used JavaScript and few popular JavaScript libraries to implement great interaction design into Smart Blackboard. The implemented interaction design enables a native application feeling into the web application which response promptly without requiring page refresh.

Libraries and Tools:

- JavaScript
- Bootstrap
- Vue.js
- jQuery

#### **5.4 Testing Implementation**

We have mostly tested the overall application functionality manually and also used some Unit testing feature for testing class functionality. Test cases for class tests are written using PHP Unit framework which basically test if the application is up and running with no major error, this test will fail if the expected output doesn't meet with result.

We have also benchmarked the performance results using Chrome's built-in Developer tools which measure the site loading performance across various devices and internet bandwidth. It also analyzes the performance of the scripts and their loading time respectively.

Libraries and Tools:

- PHPUnit
- Chrome DevTool

## 5.5 Test Results and Reports

PHPUnit Test Report is showed on Figure 5.1



```
1. khorshed@Khorsheds-MacBook-Pro: /Volumes/Macintosh HD/Sites/blackboard (zsh)
→ blackboard git:(master) ✕ phpunit
PHPUnit 6.5.7 by Sebastian Bergmann and contributors.

..
2 / 2 (100%)

Time: 455 ms, Memory: 20.00MB

OK (2 tests, 2 assertions)
→ blackboard git:(master) ✕
```

Figure 5.1: Unit Test Report

Chrome Performance Test Report is showed on figure 5.2

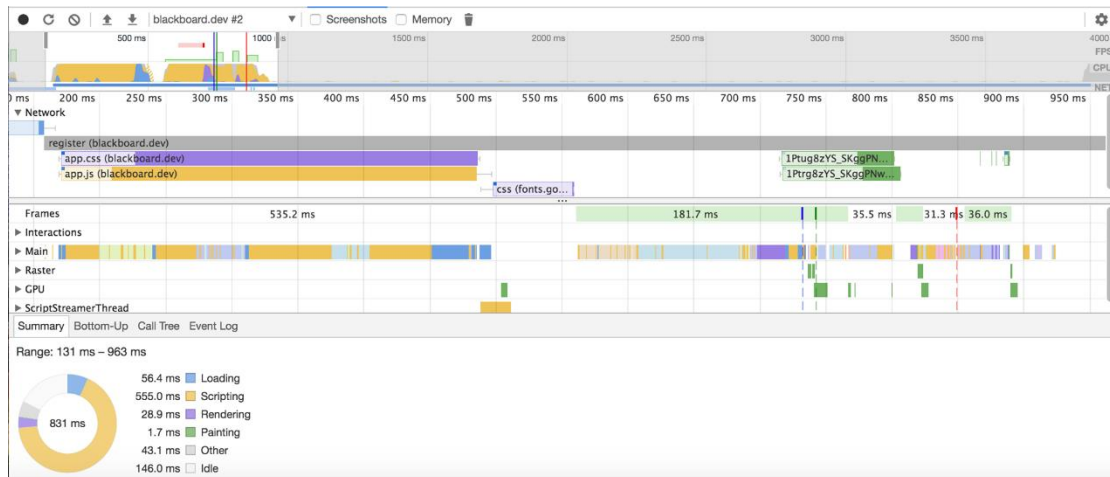


Figure 5.2: Performance Test Report

## **CHAPTER 6**

### **CONCLUSION AND FUTURE SCOPE**

#### **6.1 Discussion and Conclusion**

Nowadays both teacher and student use Gmail, Google Classroom, and Facebook groups to check notification or communicate between each other. But we think that if we develop a platform to do all the previous work on one place. That's why we develop "Smart Blackboard" where we can get all documents from teacher and can chat between each other to solve our problems. Our project has User friendly interface for Paperless learning process, and personalized learning. It can save time for all who is connected for academic activities including teachers, students and management. It can be accessed from anywhere and anytime through any internet connected device. Teachers can do live video lecture. We also have developed an Open Forum to discuss anything both for teachers and students. The limitations of this project are, it's a web-based application and don't has any mobile application yet and its also self-hosted web application which may require maintenance and development cost

#### **6.2 Scope for Further Developments**

For future scope we want to make our project complete university management system. Right now, it's a web-based application but we want to develop a mobile application as soon as possible. If the mobile application comes it makes our project performance best. We will want to provide SaaS system to avoid hosting or, maintenance cost.

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- [4] NSU Portal <http://portal.northsouth.edu/>(Accessed on 15.03.2018 at 10.02 AM)
- [5] Brac Club Forum <http://www.bracu.ac.bd/campus-life/club-forum> (Accessed on 22.03.2018 at 10.02 AM)
- [6] East West University Student Portal <https://cams1.eastwest.edu/estudent/login.asp> (Accessed on 22.03.2018 at 10.02 AM)

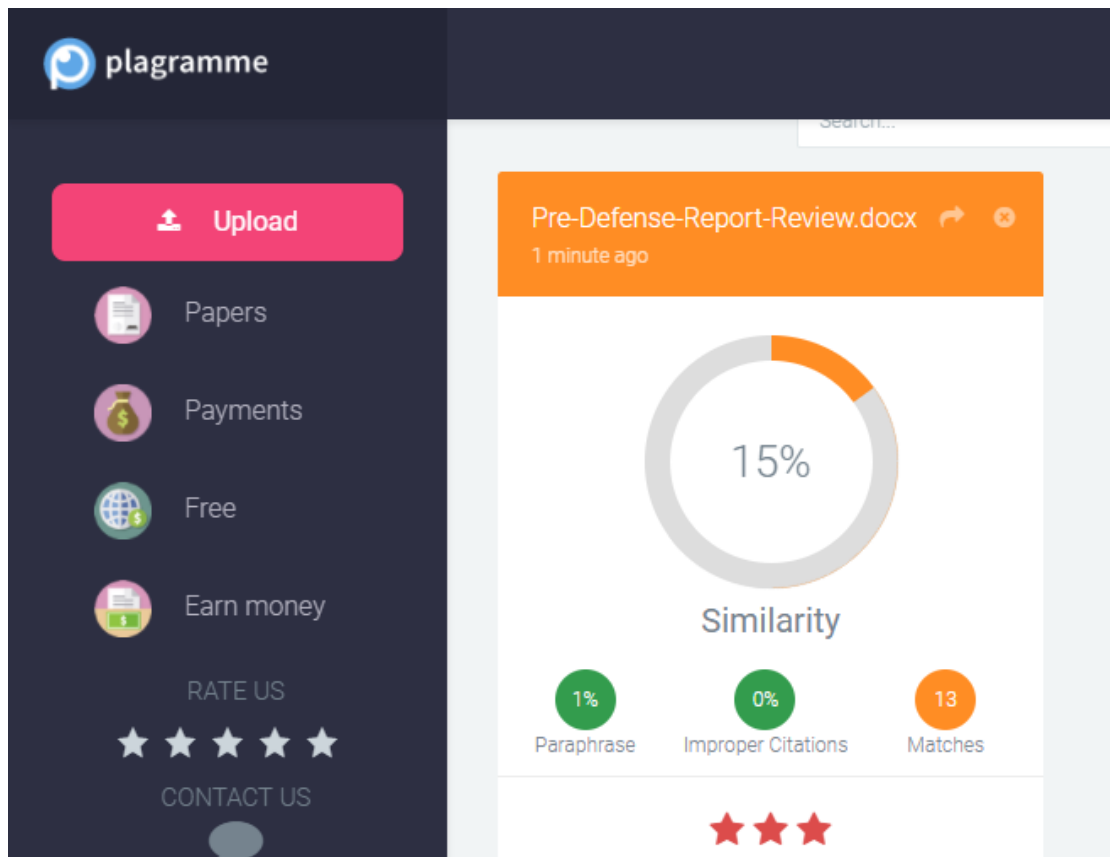


Figure: Plagiarism Test