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Research Article

Protrack: A Student-Teacher Project Management Tool

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Abstract: The internet has become one of the most important necessities in the present world. Web technology is a collective name for technology primarily for the World Wide Web (WWW). The three core languages that form up the globe Wide Web are HTML, CSS and JavaScript. The present student management system helps in maintaining student records and the project management system is an industry-based software that is used to assign work to a group of people. The student management system only manages the student information and the project management system doesn't allow a person to monitor the team and give instructions based on it. ProTrack incorporates both project management and student management software and brings an industrial workspace to the students. Here students can form teams with peer students to work on their innovative projects. ProTrack provides an environment where students could work - teachers could support. Hence improves the ability of the students to work as a team under supervision.

1. INTRODUCTION

1.1 Web Technology

The Internet has the distinctive ability to connect any user with another user, according to any quality possible relationships, goals, problems, identity or interests. Web technology is a collective name for technology primarily for the World Wide Web (WWW). It's an information system where documents and other web resources are recognized by Uniform Resource Locators (URL). Web technology is the crucial and use of mechanisms that make it possible for different computers to communicate. We can also allot resources or the building blocks of an effective computer networking system. Some examples of web technologies together with mark-up languages such as HTML, CSS, XML, CGI, JavaScript and HTTP as well as Programming language, web servers, databases and business applications are also parts of web technologies.

The amalgamation of Web technologies has an important place into the process of accomplishing companies. Its objectives to increase the competitiveness degree on the market by generating customers loyalty. Web technology is been used for various fields such as Real Time web analytics, Digital Advertising, E-Commerce, Publishing, Massively Multiplayer Online Games, Backend Services and Messaging, Project Management & Collaboration, Realtime Monitoring Services, Live Charting and Graphing, Group and Private Chat, etc.

1.2 Web Applications

A web application is an application software that runs on a web server, and is accessed by the user through a web browser with an active internet connection. In order to create websites that look and performance a specific way, web developers utilize different languages. The three core languages that form up the globe Wide Web are HTML, CSS and JavaScript. The Net is an important platform, whether it's for developing or for consumer use when developing an internet site. HTML is the backbone of most web pages. Essentially, it's accustomed to create the structure of how a selected website would appear as if, from the headings, to the paragraphs, the body, links, and even images. To make a data-centric web application from the bottom-up, it is commanding to understand:

- Front-end: For the look and feel of your web application. Front-end can include HTML, CSS, JavaScript, etc.
- Back-end: Control how web applications work. Back-end can include Python, Java, NodeJS, etc.
- DevOps: Deploying/hosting your web application. Some DevOps tools are GitHub, Jenkins, Docker.

1.3 Components of Web Application

All web-based database applications have 3 primary components: A web browser, a web application server, and a database server. Web-based database applications rely on a database server, which provides the data for the application. The database server sometimes also provides business logic in the form of stored procedures.

Depending on how the app logic is distributed among the client and server sides, there can be various types of web application architecture. A single page Web Application architecture will have client-side and a web server (server-side).

Server-side is the systems that run on the server, server-side is about working behind the scenes to manage data. Nearly all business logic runs on the server side, and this includes rendering dynamic web pages, interacting with databases, identity authentication, and push notifications. Server-side refers to the location where processes run. Client-side involves interactivity and displaying data. this includes what the user sees, such as text, images, and the rest of the UI, along with any actions that an application performs within the user's browser. Client devices send requests to the servers for web pages or applications, and the servers serve up responses.

When you visit websites on the internet, they are each hosted by a "server". A server is a computer located somewhere in the world that's connected to the internet, and that computer's job is to "serve" web pages to internet users that want to view them. A laptop computer shows web pages served by a "server" computer.

1.4 Web Technology Architecture

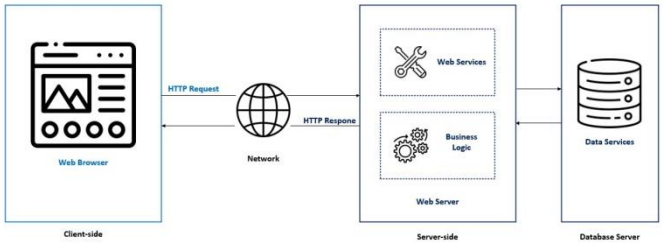

Figure 1. Architecture of 3-tier Web Application

Server-side is the systems that run on the server, server-side is about working behind the scenes to manage data. Server-side refers to the location where processes run. Nearly all business logic runs on the server side, and this includes rendering dynamic web pages, interacting with databases, identity authentication, and push notifications. Client-side involves interactivity and displaying data. Every UI element in a web page is divided into reusable components that can be used in various parts of the application.

1.5 MERN Stack

MERN stands behind the four key technologies MongoDB, Express, React, Node that make up the stack. The MERN stack is used to build web pages that fall into the premium category. Premier JavaScript web server MERN is one of the various MEAN Stack (MongoDB, Express, Angular, Node), in which the standard Angular.js frontend framework is replaced by ReactJS hosted by Facebook, Inc. MERN is also an open-stack of source technology and can classify as a full-stack.

1.6 NodeJS

Node.js is an open-source, cross-platform, JavaScript runtime environment that executes JavaScript code outside a web browser, primarily used for non-blocking, event driven servers, due to its single-threaded nature. It used back-end API services, but was designed with real-time, push-based architectures in mind which is considered as an additional advantage.

1.7 MongoDB

MongoDB is a cross-platform, document-oriented, open-source, NoSQL database program. MongoDB data are JSON-like documents. It stores data records as documents which are gathered together in collections. A database store can have one or more collections of documents. The main advantage of MongoDB is that the data fields can vary from document to document and data structure can be changed over time. It supports dynamic queries on documents including a document-based source language that's nearly as powerful as SQL.

1.8 React

React also called ReactJS is an open-source, front end, JavaScript library for building user interfaces or UI components. It is maintained by Facebook and a community of individual developers and firms. ReactJS is employed as a base within the event of single page or mobile applications. However, ReactJS is simply concerned with state management and rendering that state to the DOM, so creating React applications usually requires the use of additional libraries for routing. React Router is an example of such a library.

1.9 Express

Express or Express.js is a fast and minimalist web framework for Node.js designed for building single-page, multi-page, and hybrid web applications. It can manage a server and routes for a web application allowing setup middleware to respond to HTTP Requests. Express makes routing easy with the functionality to build robust API. Express is MVC like structure. Libraries like Mongoose for MongoDB needed for object-relational mapping.

2. RELATED WORK

2.1 College Activity Management System

2.1.1Authors: M. Ashok Kumar, Ch. Mohan Srinivas, K. Vishnu Vardhan Reddy, K. Kiran Kumar

The College activity management system is used to maintain college events. The base idea of this project is to develop an android based Mobile application for development of institution and educational system. The aim is to give output for reaching the student data framework and UI is to reduce the present paper records. Staff can exchange investment and results, they also can establish notices through a safe, online interface using an android gadget. There are different modules for different users such students, teachers, HOD, placement officers. The system uses MySQL as its database for simplicity and flexibility. This module stores every single data of students, faculty and models their data on specified operations. These operations can be storing student attendance, result data or can be authentication Credentials. The staff module uses mobile phones to take attendance, upload results and notifications.

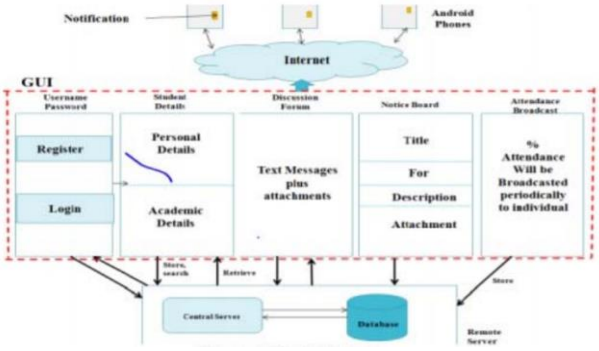

Figure 2. College Activity Management System Architecture

The entered admin details are encrypted and sent to the server for verification. Only after successful authentication the actions are performed. If the username and Password match then he/she can enter into the attendance page. The proposed framework gives the better approach for registering and showing a task with a responsive and alluring UI.

2.2 The Design of Embedded Web System based on REST Architecture

2.2.1 Authors: Yunwei Zhao, Xin Wan

As there is a rapid development of network technology, embedded web system development the integration of web technology with embedded systems makes it more intelligent. The traditional development mode of embedded web systems has a high coupling degree between the front-end and back-end. The development mode of embedded web systems has a high degree of coupling between the front-end and back-end. There are some

problems such as high memory consumption, long development cycle, high costs for maintenance and poor expansion performance. To solve these kinds of problems the paper proposes an integration of a web system with an embedded system that has a system design scheme based on REST architecture.

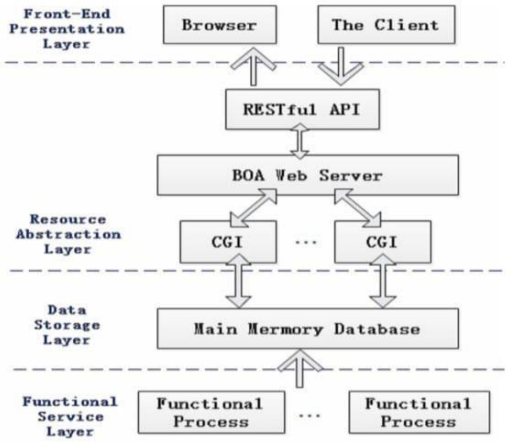

Figure 3. Embedded Web System Architecture

The REST API is an API interface based on REST architecture. Compared with the front and rear end coupling development scheme, The REST API maintains the adaptability of the interface. The front and rear end separation architecture using REST API has the advantages of low coupling, low complexity and high expansibility. According to the principles of REST, different business types and data can be abstracted as resources and represented by URI. Users can retrieve resources by URL. The URL is mainly composed of the network protocol (HTTP, HTTPS), server address, URI and parameter list. This kind of development reduces the resource cost and improves the response speed.

2.3Splay: A Lightweight Video Streaming Application

2.3.1 Authors: Nilesh S Inkane, Siddhi A Kotak, Amitkumar S. Manekar

Splay is a video streaming web application which uses YouTube as a server and storage and the app itself inhabits our own desired server. It is developed to figure on any device and any platform provided, the device incorporates a browser. It uses React.js for developing the UI which is the front end and achieving a single page application model for the more native-like experience. The front end works without reloading the web page and renders components instead of HTML pages for each request sent. This avoids sending multiple HTTP requests to the server and saves a lot of time and makes the app faster Node.js and MongoDB are the ones powering the back end of the application.

Splay considered MongoDB as the database for the video streaming application. MongoDB uses collections and documents instead of rows and tables. Splay uses the Mongoose - a node package instead of the default available MongoDB drivers. Every route in the application which node serves is made a middleware for security of the routes.

The advantages of Splay are many be a strong and reliable resolution for small-scale and large-scale establishments and organizations for video streaming. performs as a better solution to the content management problem of institutions desiring their own video streaming application.

2.4 Student Information Management System

2.4.1 Authors: Dipin Budhrani, Vivek Mulchandani, Yugchhaya Galphat

The motive of the Student Information Management system is to provide an integrated information technology environment for students, HOD, faculty, staff and administration. The system is equipped with a logging system to track all users-access and make sure conformity to data access guidelines and is anticipated to increase the efficiency of the institution's record management, thereby decreasing the work hours needed to access and deliver

student records to users. It is mainly useful for educational installation to manage student data which also facilitates all individual associated information for easier navigation on a daily basis. It presents facilities for entering student tests and other assessment scores, tracking student attendance and managing many other data needs in an institution.

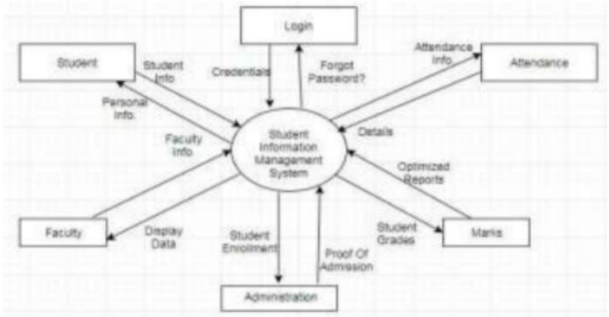

Fig. 4. Student Information Management System Architecture

The study's integrated institution administration application would be used to reduce time spent on administrative tasks, as to concentrate on other skilful practical activities other than book worming. It can acquire, process and generate reports at any given point of time accurately. All these problems are solved using a student information management system which provides the online interface for students, faculty etc., Increasing the efficiency of college record management, Decreasing the time required to access and deliver student records which make the system more secure.

2.5 Analysis of REST API Implementation

2.5.1Authors: Chaitanya Mukund Kulkarni, Prof. M. S. Takalikar

RESTful web services deliver an architectural style for developing the web services and way of devouring those APIs for clients. The APIs, developed using http protocol may not be following all the REST constraints. The motivation of this paper is to construct the method for API validation which checks if the implementation is developed as per the demand of the specification document of the respective API. To deliver a way for analysing the implementation of REST services, this paper provides a method for analysis with the help of OpenAPI Specification document 2.0. Our main aim will be to provide a way to compare the implementation and its documentation and give the detailed report on the REST API implementation.

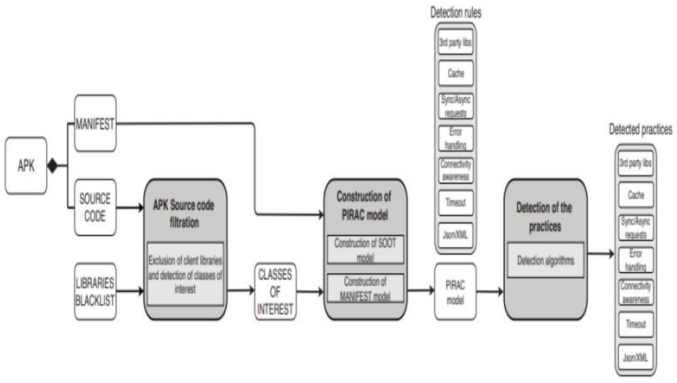

Figure 5. REST API Architecture

Our main objective will be to provide a way to compare the implementation and its documentation and give the detailed report on the REST API implementation. This report will also have the details about gaps between the implementation and the documentation. We visualize that knowing and analysing these data in detail will allow

deriving fitting approaches for resolving the identified loss, helping to improve the state of the art with purposeful solutions.

2.6 Modern Web-Development using ReactJS

26.1 Author: Sanchit Aggarwal

ReactJS could be a component-based library that is deployed for the event of interactive user interfaces. Currently, it's the foremost fashionable front-end JS library. It incorporates the read (V) layer within the MVC (Model read Controller) pattern. It's supported by Facebook, Instagram and a community of individual developers and organisations. React primarily allows the event of huge and sophisticated web-based applications which might amendment its information while not consequent page refreshes. It targets to produce higher user experiences and with blazing quick and strong internet apps development.

ReactJS could be a JavaScript library that is deployed to develop reusable computer programme (UI) parts. React primarily allows the event of huge and sophisticated web-based applications which might amendment its information while not consequent page refreshes. React abstracts the Document Object Model (DOM), so giving an easy, acting and strong application development expertise.

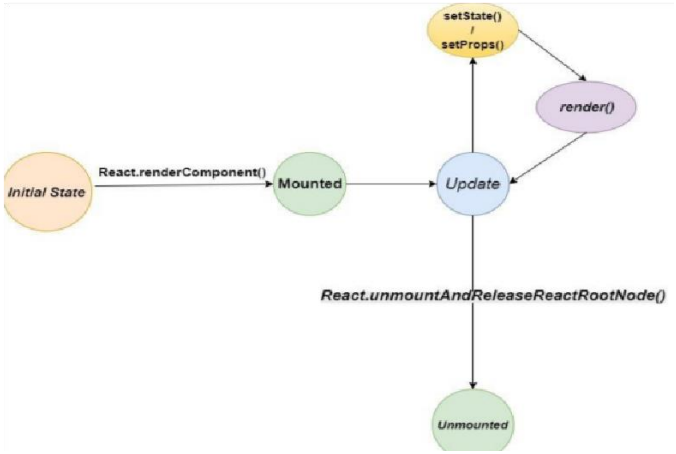

Figure 6. ReactJS Architecture

React principally renders on the server-side victimization NodeJS. React implements simplex information flow so simplifying the boilerplate and therefore proves to be a lot easier than ancient information binding**.**

2.7 A Review on Various Aspects of MongoDB Databases

2.7.1 Author: Anjali Chauhan

MongoDB is an open-source document database that provides high convenience and automatic scaling. A record in it is a document, which is a data structure composed of field and value pairs. Its documents are similar to JSON objects. It is most popular among the NoSQL databases. For building data warehouses, it is a perfect tool mainly because of its ability to fully utilize so-called “sharding-nothing cluster architecture.” It is an open-source database, which makes it ideal for building high-performance data warehouses. This paper provides a review of various aspects of MongoDB and some key issues are framed. In future, research can be made on any of these issues. new, updated versions are published practically every day, so one has to approach the project for which MongoDB is considered with a sense of adventure.

The next-generation NoSQL databases are mostly non-relational, distributed and horizontally scalable and are able to meet most of the needs of the current-day applications. The main characteristics of these databases are schema-free, no join, easy replication support, simple API and eventually consistent. The result of this study opens new avenues for future research of the performance of data access when there are hotspots in data because it supposes all the data will be accessed in the same patterns.

MongoDB is considered as most reliable database because of its:

- High Performance - MongoDB provides high performance data perseverance. In particular, it supports embedded data models, reduces Input and Output activity on database systems, indexes support faster queries and can include keys from embedded documents and arrays.
- Rich Query Language - MongoDB supports a rich query language that supports create, read, update and delete (CRUD), write operations as well as Data aggregation, Text Search.
- High Availability – MongoDBreplica setprovides automatic failover and data redundancy. A replica set is a group of MongoDB servers that maintain the same data set, providing redundancy and increasing data availability.
- Horizontal Scalability–MongoDB provides horizontal scalability as part of its core functionality. Sharding distributes data across a cluster of machines.

3.EXISTING SYSTEM

The existing system such as Basecamp, Asana, Zoho Projects are some software used in the well reputed firms which has almost everything that an employee needs to complete his work in time and also helps to keep it in an organised manner and also notify his team about it. Many project managers have started utilizing various software project management tools to manage and support their product activities. These tools are mainly utilized in planning, monitoring and controlling projects. The most important 17 criteria are Task Scheduling,Collaboration, Time Tracking, Project analysis/reporting, Communication Tools, Access Control, etc. They are completely personalized so they can fit the needs of teams of different magnitudes and with different goals. Most growing companies benefit from moving their project management system to the cloud which reduces the risk of data loss. It helps the employer to keep a record of all the work done by an employee and whether it is done in time.

Some other systems such as DyKnow, Socrative, Hero are software used in educational institutes to monitor the progress of the students. Student management system is an environment where all the processes of the student in the institution are handled. It is done through the automated computerized method. Normally this system is done using papers, files and binders. This system saves the time of the student and of the institution. It includes processes like registration of the student's details, assigning the department based on their course and maintenance of the record. This system reduces the cost and workforce required for this job. As the system is online the information is present worldwide to everyone. This makes the system easy to handle and feasible for finding the omission with updating at the same time. As the system used in the institute is outdated as it needs papers, files, which will need the human workforce to maintain them. To get registered within the institute, a student during this system one should come to the university.

As the number of the scholars increases within the institute, manually managing the strength becomes a busy job for the administrator. This computerized system stores all the info within the database which makes it easy to fetch and update whenever needed.

3.1 Issues in the system

3.1.1. Both systems serve different environment

The existing system one is a software which totally serves the work environment and has no use for students in educational standards and the other system is totally based on the educational institute. One is not related to the other and it cannot be used by the irrespective group which makes the software monochromes. As a result of this the students have no experience about the work environment that they have to face in their upcoming future.

3.1.2. Project management system doesn't support the student environment

The project management system is used in industries to assign work to their workers, this cannot be used in a student environment since the students may need guidance and constant monitoring. The software does not provide an environment where a person could learn and improve it, just a software where a person could assign a task and others couldbe able to complete it.

3.1.3. Student management system doesn't have work environment

The student management system is a system which has the total record of the students under an institution from their personal records to their scores in the last evaluation. But still, it does not provide the student an experience in the work environment which they need in their foreseeable future.

4.PROPOSED SYSTEM

The proposed system ProTrack - consists of the combination of both the existing systems which are student management system and project management system. ProTrack is a hybrid of both existing systems which has both merits and avoided all possible demerits. The software proposed provides a sophisticated environment for the students to form a team and develop projects under the guidance of their teacher. Unlike both its parents, the proposed system is not monochromes since it helps the students to work on a project as a team as they would do in an industrial environment. It also allows the teacher to keep track of their student's work and guide them accordingly so that if there is any difficulty or any other kind of disturbance that could be taken care of immediately.

Since ProTrack is a web-based application, it can be accessed from any device. Students can log in to ProTrack with the credentials provided by the institution and add projects that they need to work on. For the added project, ProTrack automatically assigns a teacher as a project guide. If the student who created the project also known as the Project Lead needs a team, he/she can raise a request to the guide to form a team with the peer students. ProTrack features both project management and task management. The project lead can break down the projects into multiple modules and assign tasks to team members. The tasks can be prioritised as its importance to the project and a deadline can also be assigned so that the work can continue without any due as per schedule. As all these processes can be monitored by respective project guides, they are also provided with a login and can monitor all the teams that are assigned to them to be taken care of. The project guides can accordingly give commands which may be a guideline for the team.

ProTrack provides a common platform where students can organize their projects also where teachers simultaneously monitor and support students. ProTrack gives students an experience of the work environment in which they are about to work in their near future. This gives students a chance to improve leadership qualities, ability to work under pressure, time management, team work, ability to follow orders, etc.

5.SYSTEM ARCHITECTURE

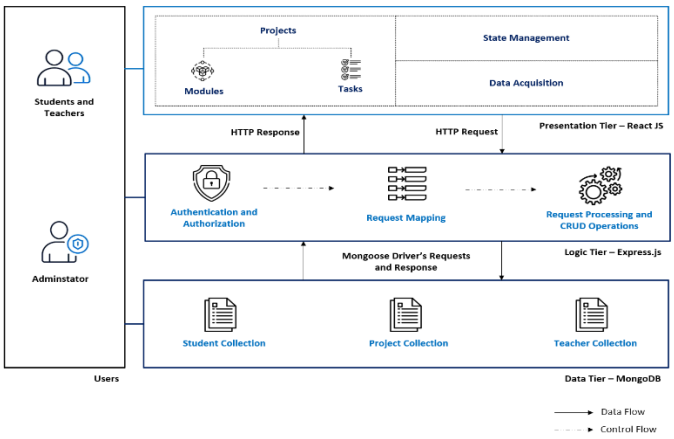

Figure 7. System Architecture

ProTrack is a web application based on a three-tier architecture. The three tiers: the presentation tier, the logic tier and the data tier. The presentation tier is the frontend with interactive UI elements built with ReactJS. This top-level tier will run on a web browser. The users - Students and Teachers can access ProTrack through this tier to display and collect data. ReactJS takes care of the user's data acquisition and state management. Also helps users with API calls to communicate with the logic tier.

The logic tier, also known as the business tier is the heart of the application. It contains the functional business logic, set of business rules which drives the application's core capabilities. The logic tier is developed with Express.js on top of the NodeJS. Initially, the user is authenticated. If authentication succeeds, the authorized user's request is mapped to the respective processing unit based on the HTTP request's method and endpoint. All the information collected in the presentation tier is processed accordingly. If needed the logic tier communicates

the data tier using Mongoose driver and continues request processing with any of the CRUD (Create, Read, Update, Delete) Operations.

The data tier handles user's data in NoSQL Database server - MongoDB. Here the data records of students, teachers and projects are stored as documents in a single database but as different collections of documents. These collections are accessible by the logic tier via Mongoose driver's API calls. The database hosted in the MongoDB server will be managed by the Administrator. The primary benefit of three-tier architecture is its logical and physical separation of functionality. It offers high scalability to the application and gives more independence for developers to work on different tiers.

6.MODULES

6.1 Student module

Students enter after entering into the landing page, they need to login with their ProTrack credentials and can access the student module i.e. a student home page. There they can create new projects and get information about the upcoming tasks and the recent project that the student is working on. When students select a project, it takes them to a page where there is an elaborate detail about the particular project from due date to the percentage of completion. They can also work on the modules, add modules, add tasks, delete them, edit them, etc. The key tasks of student modules are

- Project Management
- Task Management
- Fix Room

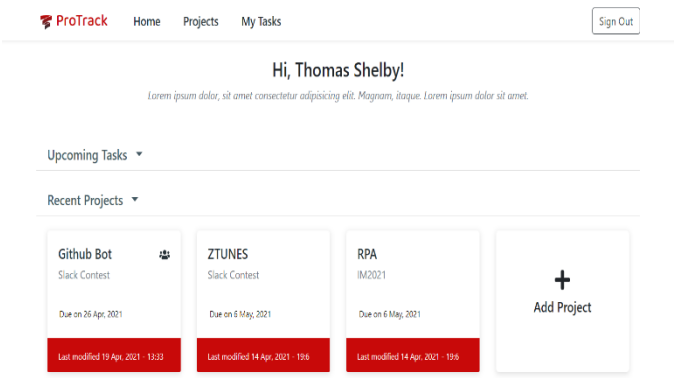

Figure 8. Student Dashboard

6.1.1 Project Management

1. Create & Manage Projects - Students can create a project and add team members.
2. Organize Project Modules - The Project can be divided into many small modules and weightage can be given to it as per its importance.
3. Project Status - The status of the project can be reported periodically to the respective teacher so that the progress can be noted.

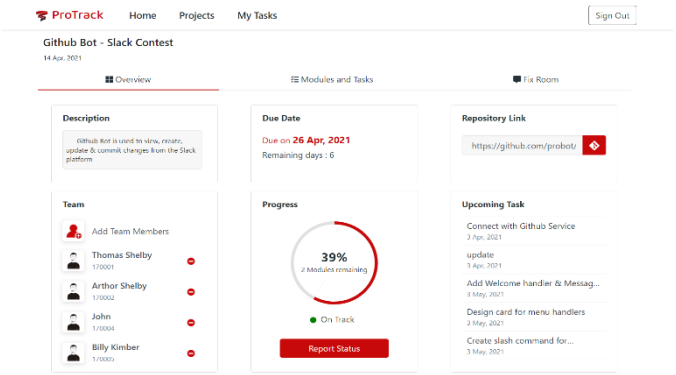

Figure 9. Student-Project Dashboard

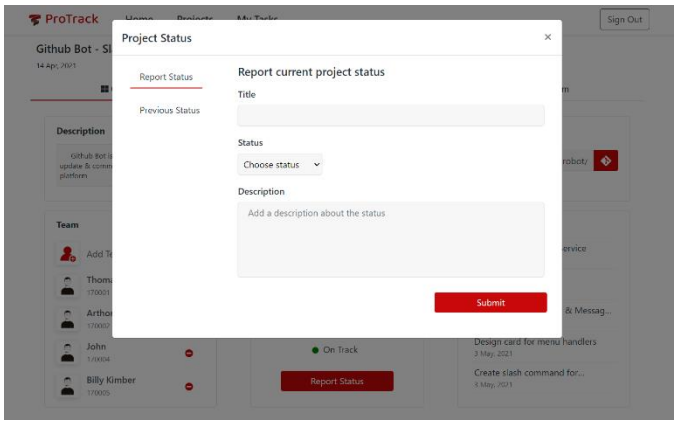

Figure 10. Create Report Status

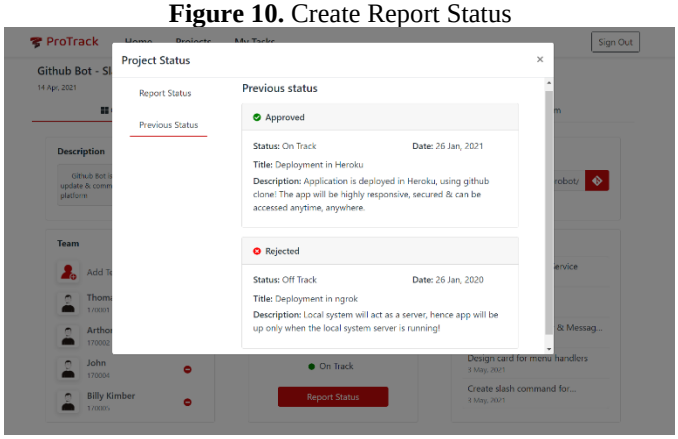

Figure 11. View Previous Report Status

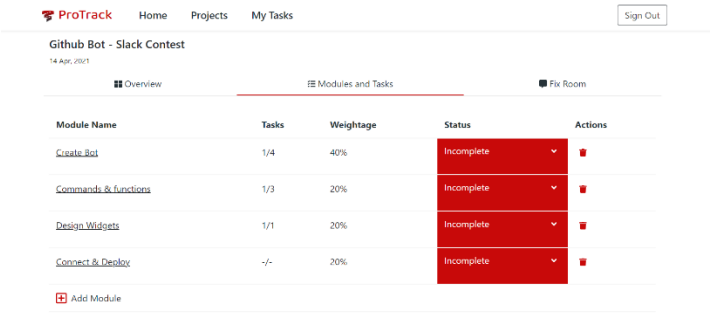

Figure 12. Add Module

6.1.2 Task Management

1. Personal Tasks - Students can create a task that he/she desire to do in a particular time period.
2. Tasks under Project Modules - Multiple tasks can be created in the project under each specific module.
3. Assign tasks to team members - Tasks can be assigned to the team members as per their skills.

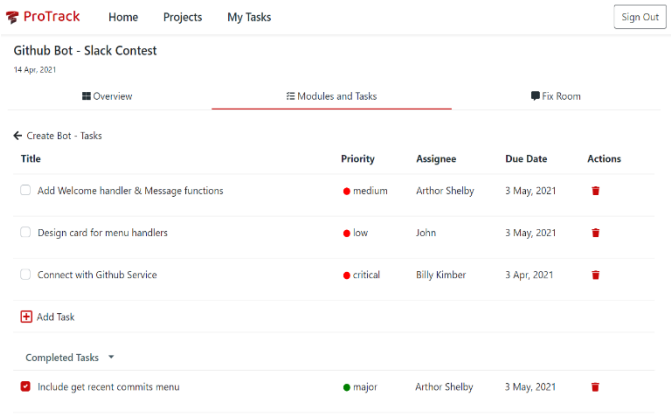

Figure 13. Add Task

6.1.3 Fix Room

The FixRoom is a chat room which helps in the inter team communication inside the application so that the difficulties can be overcome. This provides an advantage by eliminating the need of external communication applications. This helps in conservation of time since every team member and the guide can see this whenever they are logged in, which increases the possibility of being noticed.

6.2 Teacher Module

When a teacher tries to login using the login page with their ProTrack credentials they get access to the teacher module, where he or she initially enters into the landing page which is basically a page which explains the usages of the application. They can sort the teams under them by project name, event name, etc. When they get into a project, they can view the modules and tasks created by the students. The key tasks of teacher modules are

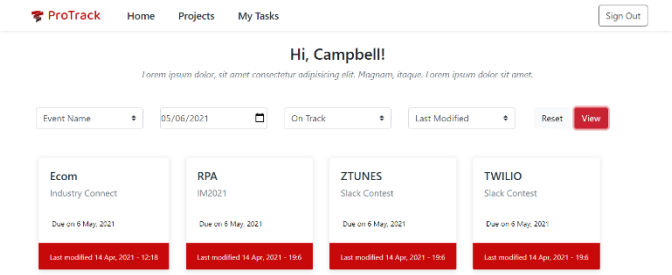

Figure 14. Teacher Dashboard

1. View student's projects - When a teacher is assigned to a specific team, he/she can view the projects that have been performed by the team.
2. Monitor student's day-to-day work - They can monitor a particular student's day to day work so that the contribution of a student in a project will be known.
3. Verify student's project status - They can know about the status of the project that has been done by the students and work contribution done by every student
4. Interact with project team members - When a student need guidance or to guide them with a more efficient solution, the teacher can interact with the student through the Team Discussion feature

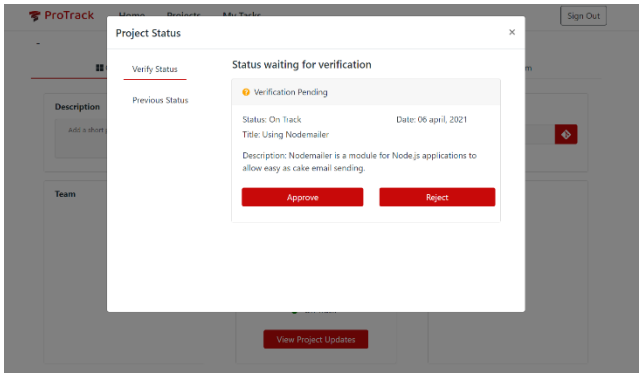

Figure 15. Verify Report Status

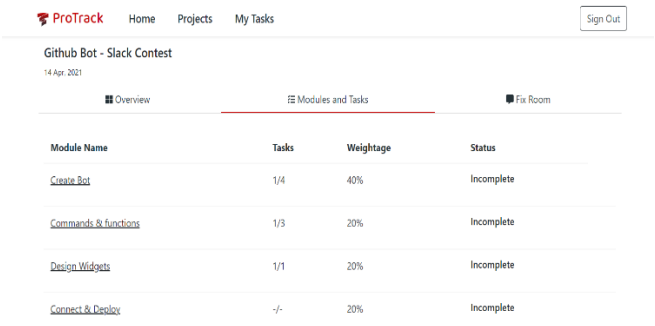

Figure 16. View Module

6.3 Admin Module

When an admin tries to login using the login page with their ProTrack credentials they get access to the admin module, where he or she initially enters into the landing page which is basically a page which explains about the usages of the application. The admin is the authority for the student and teacher information storing, editing, deleting. They can also add, edit, delete events. The key tasks of teacher modules are

1. Add & maintain students profile - the admin can add a student to the stack of student records and maintain it for further updates.

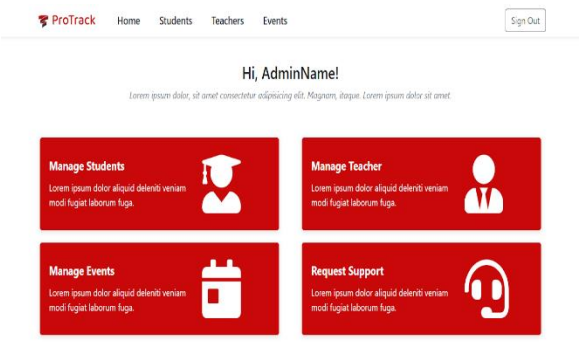

Figure 17. Admin Dashboard

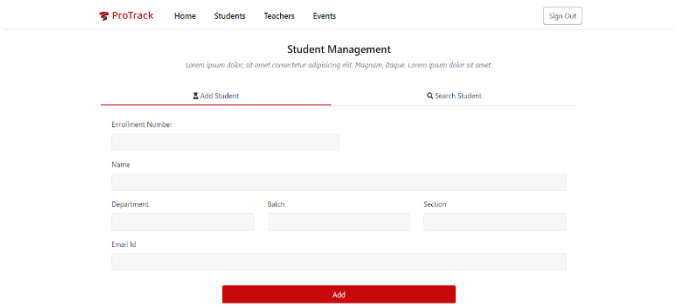

Figure 18. Create New Student Record

2. Add & maintain teacher's profile - the admin can add a teacher as soon as he/she enrolled for the job and maintain till further updates.

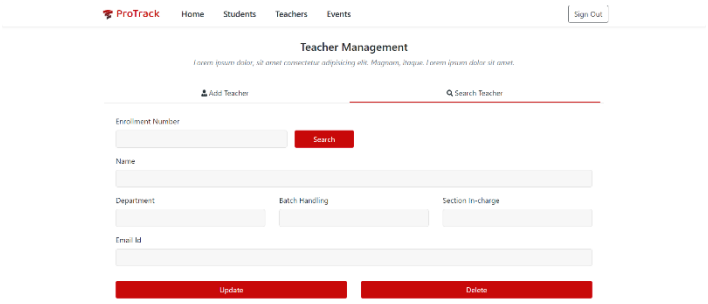

Figure 19. Search Teacher Record

3. Manage ongoing competitions - when a contest is announced the admin will be in charge for notifying as well as setting parameters such giving due dates etc.

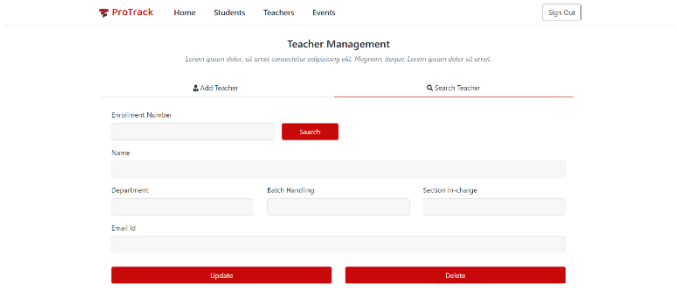

Figure 22. Find Event

7. FUTURE SCOPE

1. Event Announcement Panel - This feature helps the students to know about the upcoming events and also the changes and updates about the existing events.
2. Organize Webinars & Team Meet (using Third Party Service) - We have planned to introduce a new feature that allows either the teacher or the team leader of a particular project to schedule a meeting using a third-party application and notify the members about it through mail.
3. Allow teachers to assign tasks to team members - We have planned to provide the teacher with some additional permission which allows them to assign tasks to a team member directly.
4. Due Notifications - This feature will notify the team members about the due date of their project periodically.

8. CONCLUSION

Web based applications are used in most places in our day-to-day life. These are easy to operate and can be accessed from any part of the world. Even Though there are web-based student management systems and project management systems at present there is no application where these two systems co-exist to provide students a work-based environment so that a student could form a team and work on a project of his/her desire under the guidelines of a teacher. ProTrack can be a solution for this issue since this is a hybrid of both the above-mentioned systems, it provides an environment a student could develop a project just as a work environment.

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