Straper: Implementation to an Online Project Collaboration Application with Project Management Tools

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***Abstract*— Straper is an online collaboration application that provides project management features for the Agile project team. This paper focuses on the implementation of Straper including technical investigation, system and architecture design and system testing. Trello, Jira and Slack are chosen as the similar systems for comparison and establish the design document. There are 12 software requirements of Straper are listed out along with their package version. In the architecture design, several components are integrated to enhance the system performance and scalability including Redis Pub/Sub server, SeaweedFS and load balancer. A complete ERD is created to demonstrate the data structure in MySQL database. The implementation result of Straper for main pages are shown with description. A complete unit testing and user acceptance testing are conducted by inviting four experts from the software industry. The result of testing is satisfied and all the requirements are fulfilled.**

***Index Terms*— Project Management tool, Collaboration, Load Balancer, Scalability**

1. INTRODUCTION

From the investigation paper of Straper, the result of system planning, requirement gathering and validation as well as system analysis are documented properly. In this paper, it focuses on the implementation of system architecture and system functionalities. The system architecture of the Straper application will be drafted by the developer in order to achieve the project objectives and ensure the project is implemented in a right track. There are four core features and elements in the Straper application which are real-time chatting and file sharing, task management and bug tracking for the user role and management dashboard for admin role. These core features will be described in detail below.

Straper, being a professional online workspace system, a real-time chatting feature is mandatory. According to the defined business rules, each workspace will be represented as a team project. Project members are able to communicate easily and conveniently through the channels in the workspace. There are two types of channels: default channel, this type of channel will be automatically created once a workspace is created. As the name suggests, it will be accessible to all the project members within the workspace; private channel, which can be created by any of the project members. Unlike the default channel, private channels can only be accessible when the project member joins the channel by using an invitation link.

Task management is another core feature in Straper application. Every workspace in Straper will provide a task board for the project team to manage the project task allocation. Therefore, the task board will act as a center place of task tracking and management, any changes regarding the project task can be made to the task board provided. On the task board, project team members are free to create a new task category list. Depending on different software methodology used, most of the project team will name the task category list based on the current phase of the task. In Scrum, the task category lists can be named as product backlist, sprint backlog, implementing, testing and deploying.

Bug tracking is essential when it comes into the project management domain. It helps the project team to improve the project quality as well as avoiding a ton of effort for maintenance. In Straper, every workspace will have a bug dashboard for the project team. Whenever the project team encounters any deviation from the actual business requirement, it can be called a defect. At that time, project team members can raise an issue in the bug dashboard. In order to manage the issue in a proper and efficient way, its detail and relation information should be recorded as detail as possible, including issue type, backlog priority, description, acceptance criteria, environment, workaround, current status and more.

Admin dashboard is designed especially for the Straper's admin role. For the security purpose the admin portal of Straper is separate from the client portal and it is implemented in an individual application. Therefore, the admin portal can be hosted privately afterward in order to avoid the risk of admin accounts being accessible by normal users. The main aim of this dashboard is allowing admin to manage and maintain user accounts and workspaces.

2. RELATED WORK

In order to have a better understanding of the architecture and design of Straper. There are three similar systems which are the most popular online collaboration application in the market and are chosen for detailed research and comparison. After that, the analyzed result will give a better insight to the Straper project.

2.4 Similar System

2.4.1 Trello

Trello is one of the most appreciated and most tweeted project management tools in the marketplace. It is a task management application that allows the project teams to organize their project into a virtual board. Back in the summer of 2010, a software company Fog Creek Software

started to design and develop a prototype that wished to solve the high-level planning issue faced by most of the project team at that time. In 2011, Trello was officially launched in both web and phone applications. After one year, Trello has unimaginable active members of 500,000. In the following few years, Trello started getting mature and integrated more useful features for its users. In 2017, Trello was acquired by Atlassian [1].

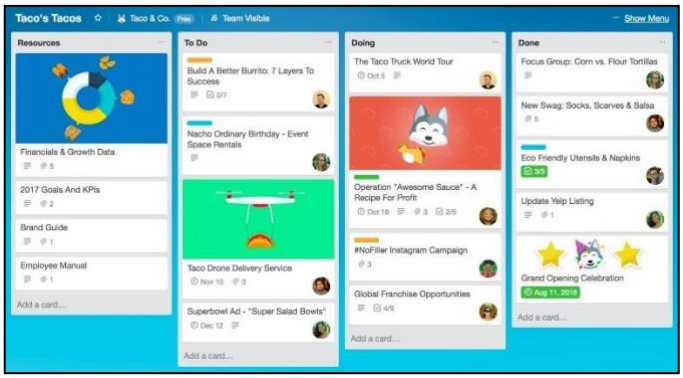

Figure 1: Trello Task Board [1]

2.4.2 Jira

Jira is a part of a bundle of products that is used for work management and project organization. Jira is originally a bug tracking and issue application that was first launched in 2002 by Atlassian Corporation. Unlike other project management tools, Jira primarily focuses on Agile development. It provides both Scrum and Kanban boards for task management. Jira provides a drag-and-drop feature for the task board, therefore it allows the project team to arrange the order of stories, bugs, and issues in a very convenient way. Jira is also supporting various estimation techniques such as story or hours [2].

2.4.3 Slack

Slack is an online communication and business collaboration application that aims to connect people together and share information. It is written in PHP and Java for the backend server and a mixture JavaScript framework, including pure JavaScript, jQuery, Monkey scroll plugin. The main feature of Slack is it provides a powerful collaboration mechanism that allows a company of people to work together and maintain a strong connection. Slack introduces the concept of workspace, which is made up of a group of channels. Whenever a member joins a workspace with the email address, he or she will have a new Slack account. Every channel is a separate group of communication, project members can perform real-time messaging and also share files and attachments [3].

3. TECHNICAL REQUIREMENTS

The minimum software requirements for the development and execution of the Straper are as per following:

Name	Type	Version
Go	Programming Language	Go 1.16.4 linux/amd64
Visual Studio Code	Source Code Editor	1.60.2
React	JavaScript Library	17.0.2
Tailwind	CSS Framework	2.2.7
Axios	HTTP Client Library	0.21.1
Zustand	State Management Library	3.5.7
Gorilla Mux	Go Library	1.8.0
Viper	Go Library	1.8.1
SQLX	Go Library	1.3.4
Squirrel	Go Library	1.5.0
Linux Ubuntu	Operating System	20.04
Google Chrome	Web Browser	95.0.4638.54

Table 1: Straper Software Requirement

4. DESIGN

4.1 Architecture Design

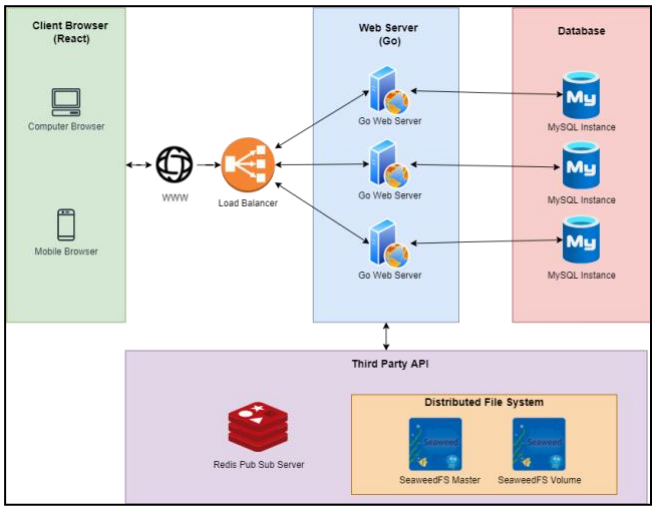

Figure 2: Straper Architecture Diagram

The diagram above shows the system architecture diagram of the proposed Straper application. Straper application is a web application that has a three tiers architecture. Unlike traditional applications, Straper is a single-page application (SPA) where the client side and server side are completely separated. React is used as the frontend application and Go is used as the web server. Since SPA does not update the entire page, rather it will download the entire page at the first initialization and update the portion of the page at the following action. Therefore, the render speed of the webpage will be significantly improved compared to traditional multiple page applications.

Other than the separation of client and server sides, there is a load balancer designed in the architecture diagram above.

When the application load becomes extremely high, the maintainer of Straper can increase the instance of the web server and the load balancer can help to distribute the traffic and requests equally to other web servers. This system design allows the system to scale horizontally.

MySQL is used as the relational database in Straper and the data of the system will be stored in the database instance. Same with the web server, in order to handle a large amount of data or backup the system data, the MySQL database should also be designed to be easily scaled in future. The maintainer of Straper can perform horizontal scaling to the MySQL instance by simply increasing the number of instances.

In Straper, there are some external APIs that are integrated to perform specific systems functionally. First and foremost, Redis Pub Sub server is used to distribute all the WebSockets messages. In the workspace channels and task board, most of the requests are done through WebSockets, the problem with WebSockets is it is stateful protocol. When the web server is scaled in future, the connection cannot be shared between multiple servers. Therefore, Redis Pub Sub server comes to the play. When the server is started, it will subscribe to the channel in the Pub Sub server. If the server receives any messages that require push from the server to the client, it will publish to the Pub Sub server, and those subscribed servers can receive the message and send it to related clients.

SeaweedFS is used as the distributed file system in Straper application. In reality, files such as images or documents are not advised to store in the database because it costs a lot of storage and money. Other than that, the retrieving speed can be very slowed. Therefore, SeaweedFS is used to store all the file objects in Straper. It has two objectives which are to store billions of files and to serve files fast. Instead of managing all file data in the central master, it uses volumes servers to manage files and metadata and one master server to handle the volume of those volume servers. In idealcally, it can archive O(1) complexity for spreading file metadata from master server to volume servers.

4.2 Database Design

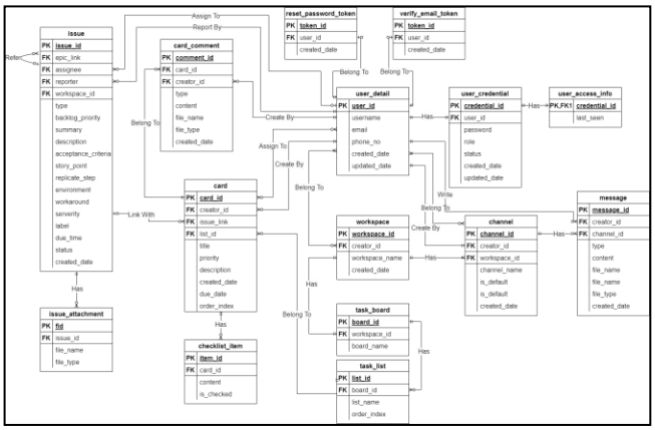

Figure 3: Straper Database Diagram

The ERD above shows the data structure of Straper in the actual MySQL database. There is a total number of 14 entities including the associate entity. All the relations and constraints are strictly designed and implemented to the database.

5. IMPLEMENTATION

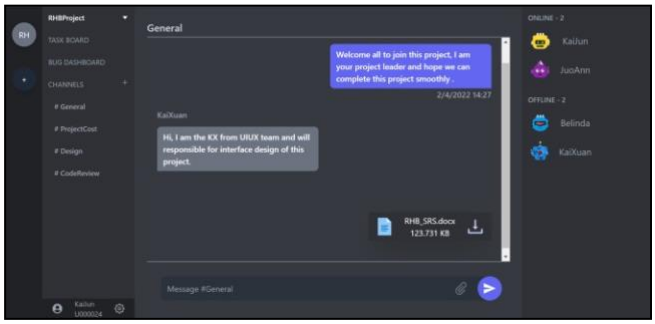

Figure 4: Workspace Page

Workspace page is the landing page for the logged in users. All the activities that related to workspace management will be done at this page. In the concept of Straper, a workspace represents a project. In the workspace page, there is a workspace navigator at the leftmost part. Therefore, a project team can create own workspace by clicking the add icon in the workspace navigator and the create workspace dialog will be shown. Other than creating own workspace, the project team member can join the existing workspace by entering the invitation link in the join workspace dialog. The project member can also modify the project name in the edit workspace dialog.

Channel acts as a chat room in the workspace. Project team can create different channel for distinct purposes. Same as creating workspace, project team member can create or join a channel by clicking the add icon besides the channels title. The create channel dialog allows project team member to create a new channel in the workspace and the join channel dialog allows project team member join an existing channel. After added to the channel, the member has the ability to modify the channel name in the edit channel dialog.

The main purpose of channel is for communication. The project team member can send text message in the channel. The message will be received by other active project team members in real time. There is also an attachment icon in the chat input which allows project team member uploads file attachments. If the file type is an image, it will display as an image preview. The project team member can download the file by clicking the uploaded file.

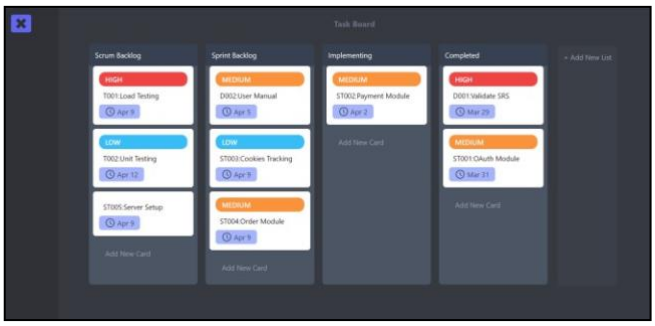

Figure 5: Task Board Page

Task board page is used to schedule and allocate the task in the project. In order to provide an excellent user experience, all the action in this page will be done in real-time which means other online workspace members can receive the changes immediately. In the task board page, the components can decompose to three layers from highest to lowest which are board, list and card. The project team member can add a new list by creating the '+ Add New List' button. After entering the list name, the new list will be added. If there is a need of changing the list name, the member can modify the list name input directly. After that, the member can add any number of cards to the list by clicking the '+ Add New Card' button.

Unlike traditional task board, the task board in Straper provides the drag and drop feature to the users. The order of list and card can be changed by drag and drop. The card is not restricted to move within a particular list. The project member can move the card to other lists smoothly. If the priority of the card is added, it will be also showed out and highlighted with different colour based on its urgency level. The due time of the card is also displayed for a better visualization to the overall project task schedule.

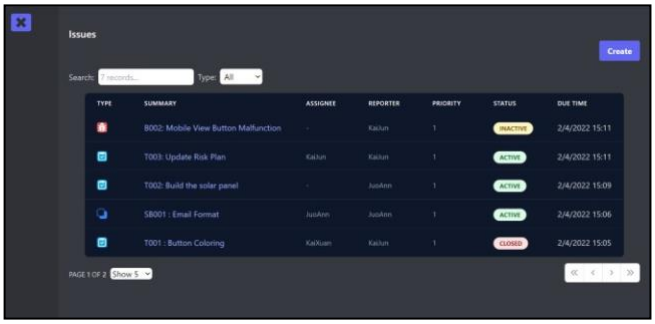

Figure 6: Bug Tracking Page

Bug tracking is one of the core features in Straper, this bug tracking page allows project team manages all the potential issues to the project. Instead of naming the project issue as the bug, Straper takes one abstract level and calls it as an issue. Depending on the nature of it, it can categorize to several subtypes including bug, task, subtask, epic and story. Each workspace will have own issue board. The project team member can raise an issue by clicking the create button. In the creating issue dialog, there is a number of issue information can be supplied. The issue type and summary are the mandatory fields that should fill during the creation. Other detail information can be updated after the issue analysing by the project team in the daily meeting. If the project team decides to resolve the issue, all the information should be updated completely, otherwise the status can be updated to invalid.

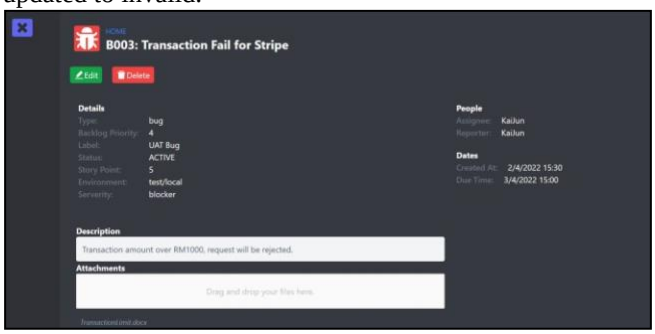

Figure 7: Bug Detail Page

As the name suggested, the issue detail page shows all the information of the issues. In this page, the issue information is separated to 8 sections which are details, people, dates, description, attachments, acceptance criteria, replicate step and workaround. The details section lists down the basic information for that issue including the type of the issue and its status. The people section records the assigned and reporter of the issue and the dates section records the created and due time of the issue. In the attachments section, the project member can upload any file that is within 2 MB. The download attachment option is also available.

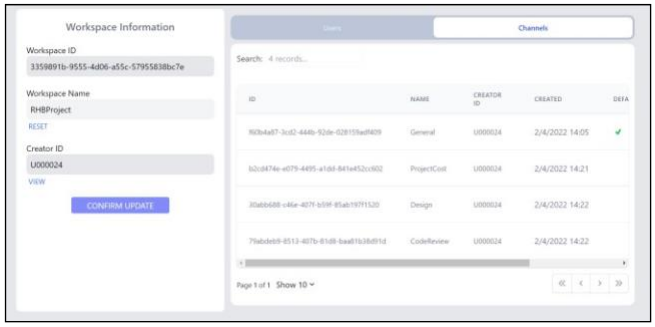

Figure 9: Workspace Dashboard Page

In the workspace dashboard, it consists of two main parts, the workspace information component and the workspace tabs. The workspace information component records the basic information including workspace id, workspace name as well as the creator id. The admin can update the workspace name in this form or track the creator account by clicking the creator link.

For the second part which is the workspace tabs, it has a total number of two tabs which are users and channels. The users tab will display all the users that are added to this workspace. The basic information of the user account is displayed. The admin can use the edit user button to navigate to user dashboard page and the delete button to remove the particular user from the workspace. On the other hand, the channels tab shows the available channels in the workspace.

The basic information of the channel is displayed as a record in table format. Same with users table, edit and delete option are available for workspace channel. The admin can edit the channel name in the edit channel dialog after clicking the edit action or completely delete the channel from the workspace. In order to make the admin job easier, searching functionality is available for both workspace tabs in order to find certain records in the fastest way.

6. TESTING

There are two types of testing method are conducted in this phase. In this first section, unit testing is conducted by the developer of Straper for all the modules of Straper. There are a total number of 20 modules are being tested. The unit testing result is positive, and all the output of test cases are as expected. After the unit testing, the completeness and accuracy of functions in the Straper application is guaranteed.

At the second section of this phase, the user acceptance testing (UAT) is conducted. There are four experienced project team members from the IT industry are invited to participate the UAT of Straper. The duration of UAT is 30 minutes. The developer of Straper will introduce Straper to the tester before the test and the result of UAT are all documented. From the feedback result of UAT, the overall grade for the criteria is positive. There are two tester gives a good grade only for the user interface of Straper. This is because the user interface problem that they encounter during the testing including the user status pop up overflowing issue and the navigation bar overlapping issue. Other than these, two of the testers encounters a similar issue which there is not loading status displaying during the email sending and this confused them. These issues are solved and the changes will be shown in the next release. Lastly, there is one tester give some feature enhancement suggestion for the task board module including the searching feature and card archive feature. These features will be considered in the future release due to the project time constraint.

7. CONCLUSION

At the end of the journey of Straper project, a successful and ready launched product – Straper is developed. All the objectives that defined in the early stage are met. It provides a professional virtual workspace to the project team an increase their daily productivity. The system allows real-time collaboration within the project team and a ton of powerful features such as task board management and bug tracking. These features help to align the project objective and reduce the project development cost in the long run. On the other hand, all the mentioned requirements in the SRS are implemented completely and accurately.

In this wonderful Straper development journey, a ton of technical and non-technical knowledge are learnt. Project management is definitely the most important soft skill that requires for a project to success. It involves all the things start from initiating, planning, executing, monitoring and controlling, and closing. Those techniques and tools involved are helpful for managing the project schedule as well as the quality of the final product. In term of the technical skill, the developer of Straper has gained a new level of understanding to the web application. The system architecture determines the future quality of the product. Therefore, it is extremely important to have a scalable and fault tolerance architecture in the first place.

The investigation and research are considered sufficient for the proposed Straper project. Various domain and technical research are conducted, all the study outcome is matched with the expected achievement of the researcher. On the other hand, the researcher still requires further exploratory research for some application-level knowledge which is not covered in the current report. The researcher will conduct another research study for pub-sub server architecture. Although Redis is used in the current architecture, the channel in Redis is now used as public channel which every server is subscribed to one and only one channel. In fact, each of the Straper server should only subscribe to separate channels that they wish to receive message. This is the future research direction of Straper in order to improve the system performance and provide better user experience. At last, the proposed project is considered successful and a lot of valuable knowledge is gained from this journey. The Straper project will proceed to the next journey in the future.

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