

Usability Testing in Kanban Agile Process for Club Management System

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Abstract—A Club management system is a centralized management and communications platform for clubs and societies. It is developed as a social innovation which aims to combat the limitations of current systems utilized by clubs, whereby there is no central repository for information, and each club utilizes their own methods for management, member communication, and event organization. A greater attention has been considered to Kanban as an agile software development method in developing such a management system. However, the adoption of this methodology is quite challenging to incorporate user experience and usability in an agile process. Hence, this study utilized the Kanban approach which is an implementation of Lean methodology to manage the software life cycle in developing a university club management system. The user requirements have been identified and documented in a Software Requirements Specification (SRS) along with the use case diagram and entity relationship diagram for the database definition. The software was developed using the Laravel PHP Framework. Functional testing and usability testing have been carried out to validate the user requirement. The result of usability testing shows that the system satisfies five usability factors. This will spark some new insights in the use of its technologies and methods for future research.

Keywords—club management system, kanban, usability

I. INTRODUCTION

The idea is to develop an application that allows for one-stop management and interaction with clubs and societies in the university environment. It will be developed as a social innovation which aims to combat the limitations of current systems utilized by clubs at, whereby there is no central repository for information, and each club utilizes their own methods for management, member communication, and event organization. Students' engagement plays an important role in maintaining the relevance of a club. The application will facilitate communication between individuals and groups to overcome the shortcomings of the current system which are excluding certain groups of people from engagement with the clubs.

A number of shortcomings of the current state of club management at university have been identified. Firstly, it is difficult for students to stay connected to the latest news and activities. Relying on social media and chat groups is excluding a certain group of people from engagement. Secondly, it requires great effort and time for clubs to recruit new members and promote an event. Current systems like signing up on paper, promoting using printed posters are limiting audience and increasing effort. Thirdly, there is no systematic club management for collecting membership fees,

activity fees, attendance and other related management tasks. Current system is relying solely on Facebook and WhatsApp which is considered an informal response platform. The club management is developed with the intention to benefit the students in terms of providing a systematic platform for efficient curriculum activity management. An effective club management system could increase the relevance of the clubs and societies in University by bringing more awareness and traffic from the students towards the club's activities and information at the convenience of having a web application.

In software development, Scrum and XP methodology are specific implementations of Agile, while Kanban approaches are specific implementations of Lean [13][14]. Kanban methodology is chosen in developing this application because of the benefit in improving the process, people and organization [1]. However, the adoption of this methodology is quite challenging to incorporate user experience and usability in an agile process [2]. There is an attempt to overcome this by embedding usability evaluation in agile software management tool and IDE and tightly coupled with the development process [3].

The objectives of the study are to develop the university club management system using Kanban methodology by identifying the problems and needs of the current club management system, design a centralized management and communications platform for clubs and societies operating within the university. Then, develop a club management system that satisfies the problems and needs, and lastly to evaluate the usability to validate the end result meets the user requirements. A study by [4] indicated that usability testing is the most chosen technique for HCI evaluation. In this study, the usability application type of "as is" where there is no modification of the existing HCI techniques.

The Kanban approach is more focusing on the use of Kanban Board in managing the project. The Kanban implementation will be discussed further in methodology section. A slight adjustment is used and the timeline is conceptualized within the Gantt chart.

II. RELATED WORK

First, this study is about the club management system development using the Kanban approach. Usability testing is conducted to evaluate the user experience of the end product.

A. Club Management System

Club management system is based on shared information and progressive web application concept. From a general perspective, information sharing can be defined as the dissemination of new knowledge to people via the use of communication media such as written text, audio, images, and

video. Acquiring information and sharing of knowledge is increasingly dominant in today's environment. In a more traditional form, people share information via formal and informal channels such as meetings, documentation, telephone conversations, etc. [6]. Information sharing in its traditional form can be limiting and ineffective at times to be compared to information sharing on the internet. The internet has brought new expectations of interactivity and collaboration in various processes in individual and organizations. The potential for interacting and exchanging information is enormous in the emergence of social software like collaborative systems, online community platforms, etc. that are designed to help people achieving individual tasks and support group interaction. Information sharing is strongly related to collaborative environments to facilitate and structure interaction. Fig.1 shows a groupware matrix diagram which was designed to describe computer applications that support group work [7]. A collaborative system provides a place for people within organizations to interact with each other [8].

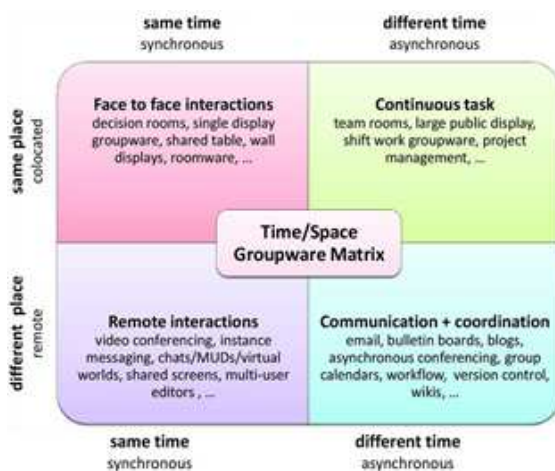


Fig.1. Groupware matrix.

PWA (Progressive Web Application) is an approach in developing website that functioning in web browser and at the same time accommodating users with experience of a native app. The biggest advantage of making a PWA is that we only need one source code that needs to deploy and maintain. Social media like Facebook and Twitter have completed their transition into PWA which allows users to install the web application without going extra steps installing the application from native app stores like Google Play Store and Apple App Store [8]. PWA can be seen as a bridging path between the web and native applications, and extremely convenient for programmers who do not have expertise in building native applications [9][10]. The learning curve is much lower and the development time can be reduced greatly.

Several approaches had been conducted to develop the club management system such as prototyping or evolution model and [5]. However, there is a need to venture a new approach because the club management system is a kind of collaborative and communication intensive workflow information system. Hence, more agile mechanism with the aid of digital collaborative tools that can trace the user and project records and activities is highly recommended.

B. Agile Software Development and Kanban

The Kanban approach in software development has become the emerging practice in Lean over the past 3-4 years. Kanban is a lean production method from the Toyota Production System, adapted in the early 2000s for software engineering [12]. It is acknowledged that in [13] Kanban approach in software development is not well defined yet as it is considered more of a set of principles rather than a practical guideline you can follow. However, research has been done regarding the effectiveness of Scrum and Kanban where Kanban's productivity is proved to be comparable with Scrum [13]. Kanban reduces chaos in workflow by making the need for prioritization and focuses clear. Where time and cost is a constraint, Kanban is a good call for low team population projects as it offers more flexibility [14]. Furthermore, research by [1] indicated that 5 contributions of Kanban-related research are framework/method/technique, guidelines, lesson learned, model, tool and advice/implication. This study is specifically a lesson-learn for a Final Year Student Project.

C. Usability

Usability is the term referring to the quality attributes of software involving the user interface the interaction between the user and the system [4]. Usability testing is the most evaluation techniques in software development stage compared to evaluation by experts and follow-up studies of installed system which are 68.9%, 17.8% and 13.3% respectively [4]. Several usability techniques had been applied in an agile approach such as with modification or as it is. This research adopted the usability by [15] approach in relation to Kanban.

III. METHODOLOGY

This section will explain the approach to Kanban methodology in this particular project. A Kanban approach can be said as a specific implementation of lean methodology to help visualize work, limit work-in-progress and optimize efficiency. Kanban board as shown in Fig. 2 is used and the timeline will be conceptualized within the Gantt chart. This allows the developer to see where they are at any given time. All basic software development life cycles will be carried out from the analysis phase to the deployment phase.

To implement the Kanban method, there will be a Kanban board to visualize the whole development process. In general, the board will consist of six columns which are:

- Pending - where a task is queued
- Analysis - where planning and user requirement identified
- Design - start creating a detailed architecture
- Development - where a task is in development
- Quality Assurance - feature is in review
- Deployed - feature is accepted and included in application release

There will be two sub-columns in analysis, design, development and quality assurance which are:

- Work in Process - feature is in development process
- Done - feature is completed

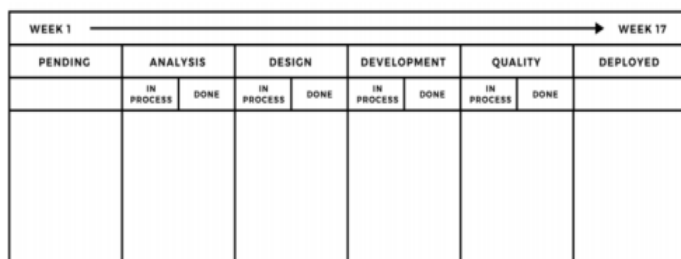


Fig.2. Kanban board.

A slightly different approach is used due to some factors being taken into consideration. The artifacts of this project will be maintained using GitHub, an online versioning control system for software development. The artifacts include documentation, source code, project management, issue management, etc. For project management, GitHub provided an automated Kanban board to visualize tasks. Fig. 3 shows the Kanban board being utilized in GitHub. There are five columns altogether: To Do, In Progress, Review In Progress, Reviewer Approved, Done. Each task is organized as a card, which you move across the lists as they are queued up, worked on, and completed. The benefit of using GitHub Kanban is it tracks your progress automatically.

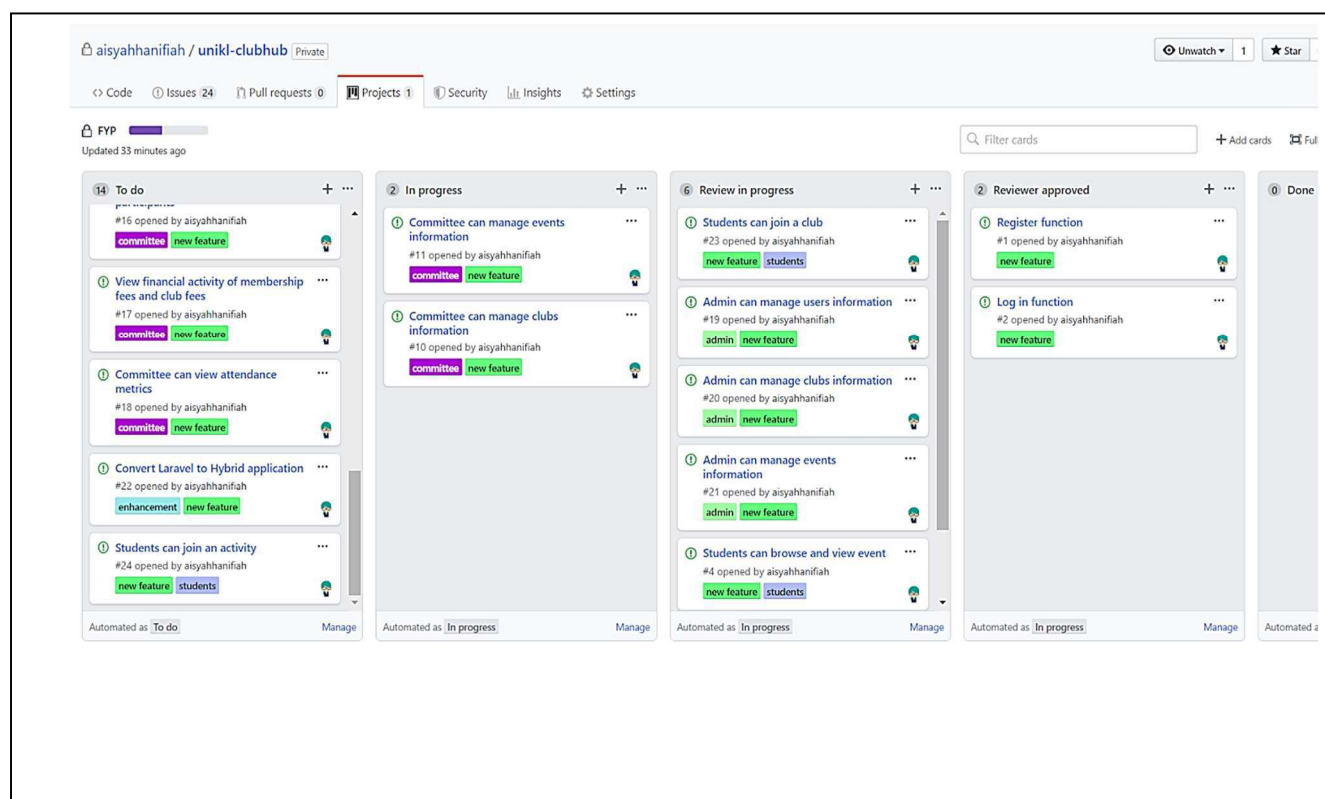


Fig. 3. Kanban board in GitHub.

Planned tasks are being placed in the To do column and will be moved to In progress column when the developers are ready to proceed with the features. Afterward, the cards will be moved to Review In Progress where verification is being done whether the feature is being implemented correctly based on the requirement. When review is done, the reviewer will approve the feature to be deployed in the application. Lastly, a reviewed feature can be placed in the Done column and the feature will be closed for reviewing. Each card is being labeled respectively: the assignees, category label, priority, closed or open. The category label is being used to describe the cards according to their respective user modules and other traits like 'new features', 'bug', 'update', etc. This Kanban board will be used throughout the whole lifecycle of the project.

A. Use Case Diagram

Use case diagram describes the interactions between the actor and the use case. It captures the user requirements comprehensively and measurable by doing functional testing. Each use case is accompanied by their own use case description that will define more detail regarding the flow of the use case, input, output, error handling, etc. which then specified in the Software Requirements Specification (SRS). Fig. 4 shows the example of a use case diagram for students. Students are the user of the Club management system that have to login. Then, they can view their profile, activities, search for club and events, join the club, make and view payment history. This example is for student only while other actor such as the administrator of the club and the committee members of the clubs are also part of the use case.

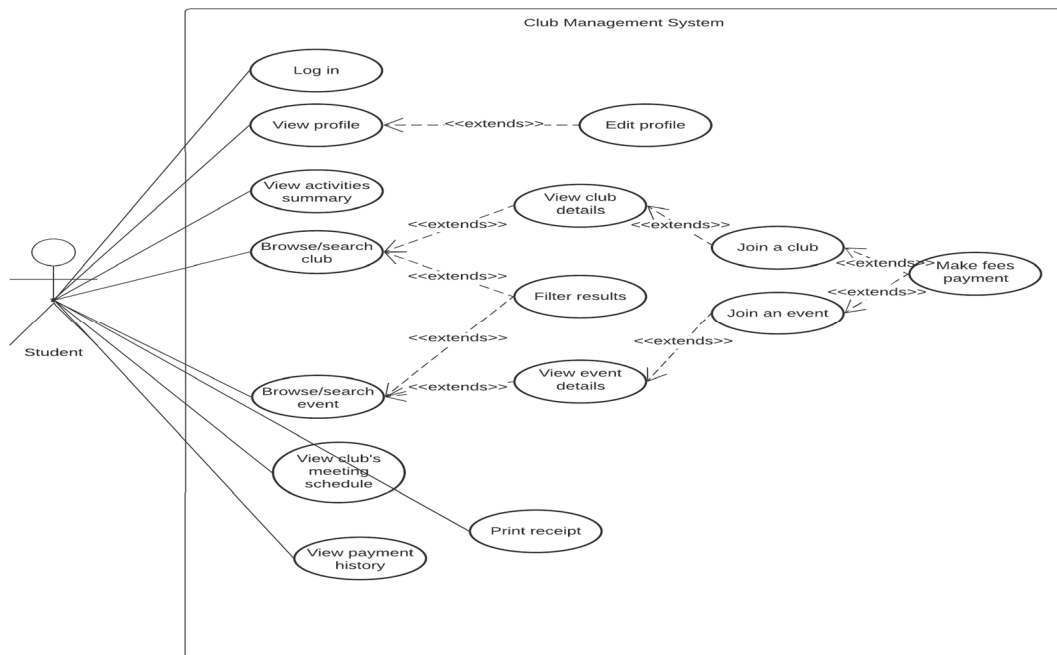


Fig. 4. Use case diagram for student.

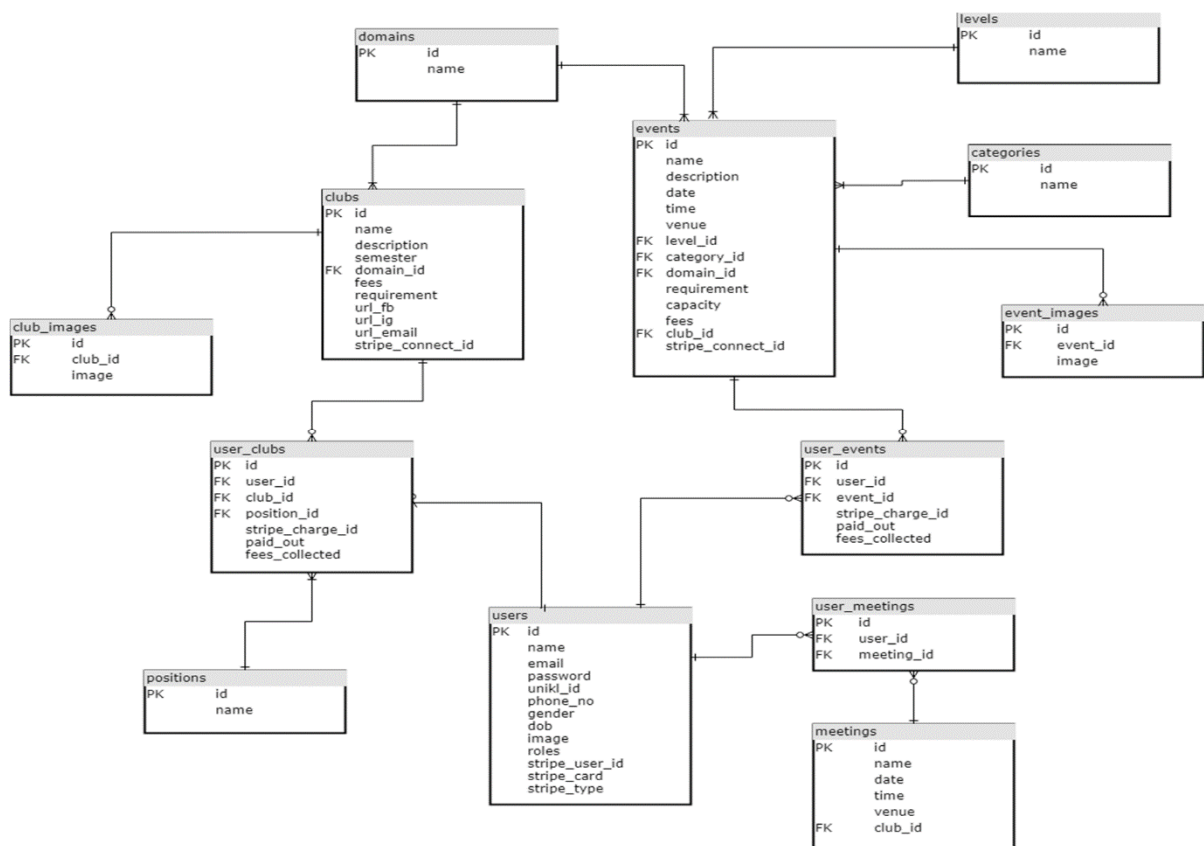


Fig.5. Entity relationship diagram.

B. Database Design

Data modeling or design is an important aspect in any information system. The database design is depicted through ERD (Entity Relationship Diagram) which illustrates the entities and their attributes to help define business processes and as the basis for the creation of the database for data storing. The Fig. 5 illustrates the designed ERD based on the requirements of the user. The information about clubs, events, users and meeting were stored in the database.

C. System Architecture

The Club Management System for UniKL ClubHub is a web and mobile-responsive application. It is a system for managing clubs, events, and members in UniKL MIIT. The database will be used to store data and communicate with the applications. The database will allow data retrieving and manipulation from the application interface. The context diagram in Fig. 6 illustrates the entities and interactions.

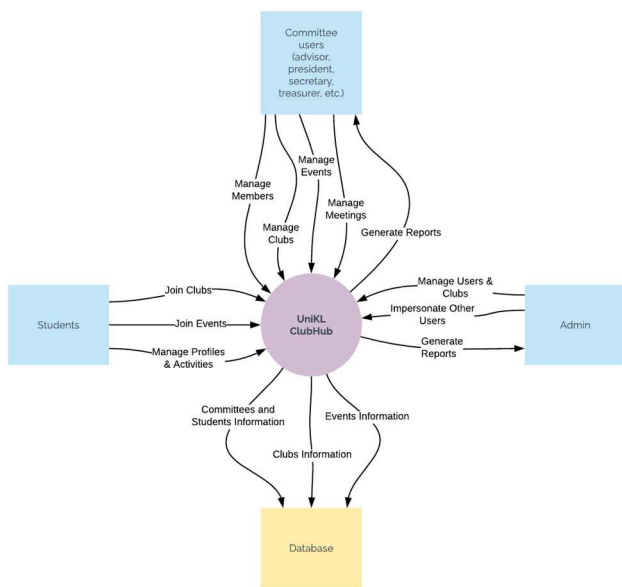


Fig.6. Context diagram for UniKL ClubHub.

Note: Committees are specialized forms of Students (in addition to lecturers as advisors) and have access to all Students' actions in addition to their own specialized actions. Administrators have access to all actions within the system in addition to their own specialized actions.

Laravel framework which is based on MVC (model-view-controller) design pattern is used to develop the application [11]. The basic concept is to separate the logic layer from the interface layer to allow independent programming. This contributes to the maintainability attribute of the system when we separate the workload between the front-end and back-end, and improve the traceability of defects in the system.

IV. RESULT AND DISCUSSION

Functional and usability testing were conducted to evaluate the functional requirement and non-functional requirement.

A. Functional Testing

Testing of the application should focus on any target requirements that can be traced directly to use cases and business rules. The goals of these tests are to verify proper data acceptance, processing, and retrieval, and the appropriate implementation of the business rules. This type of testing is based upon black box techniques, that is, verifying the application by interacting with the application via the user interface and analyzing the output and results. Each use case flow is executed and entered into test case register and passed all of the test cases. The test is completed when all planned tests have been executed and all identified defects have been addressed.

B. Usability Testing

WAMMI (Website Analysis and Measurement Inventory) template is used to do the usability testing. The usability testing description is shown in Table I. WAMMI is a scientifically proven analytic report for website usability with global reliability of 90% [15]. The questionnaire contains three sections where the first section is the demographic data of participants, and the rest is Likert scale based statements where participants are to choose (1 - Strongly disagree) to (5 - Strongly agree) based on the statement given. The questionnaire was distributed by online Google form since it is hard to reach potential users due to external factors. Seven undergraduate students of Information Technology background participated in this study.

The questionnaire consists of 20 statements. All of the statements are being calculated by their mean from the total responses. Those 20 statements are then grouped into 5 variables which are Attractiveness, Controllability, Efficiency, Helpfulness and Learnability, and their mean is calculated.

TABLE I. USABILITY TESTING DESCRIPTION

Test Objective	Testing how easy a design is used on a group of representative users
Participants	Performs by end users
Technique	Prepare questionnaire <ul style="list-style-type: none"> Choose participants Distribute software to users Distribute the questionnaire to users Analyze the results
Completion Criteria	<ul style="list-style-type: none"> No further participant Results are analyze
Special Considerations	Application code should be fully developed <ul style="list-style-type: none"> After all other levels of testing are completed All the reported defects should be fixed and tested before usability testing
Test Deliverables	Usability testing questionnaire Usability testing result

Based on Table II, we can see that all of the usability factors have a mean of more than 4 which is greater than our test value which is 3. Our test value is 3 because we are using a 5-point Likert scale where less than 3 is scale for disagree and more than 3 is scale for agree. A one sample t-test is carried out to find a significance difference sample mean and test value. If significant value is less than 0.05, that means our variables results data are satisfactory. Table II shows that the significant values of our variable Attractiveness, Controllability, Efficiency, Helpfulness and Learnability are less than 0.05 which means we passed all our usability factors. This is a positive impact on our application visitors.

TABLE II. RESULT OF FIVE USABILITY FACTORS I

Variable	N	Mean	Std. Deviation	Std. Error Mean
Attractiveness	7	4.786	0.1430	0.0540
Controllability	7	4.500	0.2972	0.1123
Efficiency	7	4.355	0.5530	0.2090
Helpfulness	7	4.462	0.2442	0.0923
Learnability	7	4.179	0.6426	0.2429

TABLE III. RESULT OF FIVE USABILITY FACTORS II

Variable	Test value = 3					
	<i>t</i>	<i>df</i>	<i>Sig.</i> (2 tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Attractiveness	14.5556	6	5.11936E-08	1.786	1.653247	1.917753
Controllability	4.4524	6	1.09142E-05	1.500	1.225138	1.774862
Efficiency	1.6986	6	0.000641065	1.355	0.843279	1.866221
Helpfulness	5.0054	6	4.01712E-06	1.462	1.236147	1.687853
Learnability	0.7245	6	0.002844344	1.176	0.584235	1.772765

V. CONCLUSION

This paper focuses on the Kanban method in the development of the university Club management System and the significance of its application towards the students (end users). Various key concepts and technologies have been identified. To sum up, it is developed with the intention to benefit the students in terms of providing a systematic platform for efficient curriculum activity management, whereby there is no current system that can offer that. This system adopts a lot of modern technologies and current software development management systems to ensure quality deliverables of software products. The development of UniKL ClubHub should spark some new insights in the use of its technologies and methods for future research.

In this case, having an online systematic system for club management may improve the overall effectiveness of clubs in a particular university. Students and lecturers could greatly benefit from it and in return improve the relevance of the club system in the university. Based on the result of the functional and usability testing, we can conclude that Kanban approach is applicable in producing usable software.

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