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iLOGBOOK-'Easy Peasy, Logbook Squeezy': A Conceptual of Innovation as Educational Change

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ABSTRACT

Community College offers 114 programs, some of which mandate the completionof final-year projects as a core component of the curriculum. During the projectdevelopment process, students are required to diligently record their weekly progress in a physical logbook. However, issues such as misplacement and improper submission, such as unclean, torn, or disarranged handling, can arise. Given the importance of the logbook, the concerns may have an impact on the project's evaluation by lecturers, influencing grading and the ability to monitor progress weekly. The iLOGBOOK initiative has been conceived with three objectives: (i) to develop an online logbook for project progress on a digital platform; (ii) to provide students access to report and update project progress from any location using digital platforms; and (iii) to improve a way for both lecturer and supervisor to address marks and monitor progress more easily. The iLOGBOOK system's development involves two distinct components: front-end and back-end development. Front-end development is dedicated to crafting the user interface visible in the browser, while back-end development handles the background processes necessary for system access. In analogy, when users log in, they interact with the front-end, entering their username and password, while the back-end silently validates these inputs against the database, hidden from the user's view. The iLOGBOOK represents an efficient and user-friendly digital logbook system, offering benefits in terms of efficiency, accuracy, user satisfaction, environmental impact, and cost savings. This digital transformation successfully addresses previous logbook-related challenges, significantly enhancing project monitoring and assessment for both students and lecturers. Consequently, the development of an online application to document semesterprogress offers a promising solution to mitigate such issues in the future.

1.0 Introduction

In the dynamic landscape of education, the integration of innovative technologies is paramount to enhancing learning experiences and efficiency (Parsons et al., 2015; Walkington et al., 2023). This comprehensive introduction introduces the groundbreaking iLOGBOOK, "EASY PEASY, LOGBOOK SQUEEZY," an innovative digital tool poised to revolutionize the traditional concept of logbooks in educational settings. Recognizing the need for a streamlined and user-friendly solution, iLOGBOOK offers a seamless approach to logbook management, providing an

intuitive platform that simplifies the recording, tracking, and assessment of student activities (Saud et al., 2023; Yaghi et al., 2022). iLOGBOOK is designed with the modern educational environment in mind, where traditional paper-based logbooks can be cumbersome and prone to inefficiencies (Carroll et al., 2021; Dmitrienko et al., 2017; Fedorov et al., 2021). This innovative digital solution aims to alleviate the administrative burden on both students and educators, promoting a more agile and organized approach to logbook management (Kundra et al., 2022; Pais et al., 2022).

One of the key features of iLOGBOOK is its user-friendly interface, making logbook entries as simple as a few taps or clicks (Corso-Radu & Avolio, 2020; Gondal et al., 2017). This intuitive design ensures that students can effortlessly document their activities, reflections, and achievements, fostering a more interactive and engaging learning experience (González-Pérez et al., 2021; Kosmadoudi et al., 2013; Reeves et al., 2021). Moreover, iLOGBOOK incorporates features such as multimedia uploads, allowing students to enrich their entries with photos, videos, or documents, providing a more holistic representation of their educational journey(González-Pérez et al., 2021; Kosmadoudi et al., 2013; Reeves et al., 2021). In addition to simplifying the logbook process, iLOGBOOK is equipped with advanced analytics and reporting capabilities (Hamad et al., 2019). Educators can gain valuable insights into student progress, identify patterns, and assess the impact of various activities on learning outcomes (Erikson & Erikson, 2019; Lin et al., 2017; Wahono et al., 2020). This data-driven approach not only facilitates efficient assessment but also enables personalized guidance and feedback tailored to each student's unique academic journey (Chemsi et al., 2019; Shetu et al., 2021).

Furthermore, iLOGBOOK embraces the principles of collaboration, fostering communication between students and educators (Govindaraju & Seruji, 2022; Nisar et al., 2022). The platform enables real-time feedback, discussions, and mentorship, creating a more connected and supportive educational ecosystem (Ramírez-Montoya et al., 2022). This collaborative aspect extends beyond the classroom, allowing for seamless communication among students and educators, whether on campus or in virtual learning environments (Herrador-Alcaide et al., 2019; Rashid et al., 2021). iLOGBOOK responds to challenges in traditional logbook management by introducing an innovative online platform. Concerns like misplacement and improper submissions pose potential threats to project evaluation and progress monitoring. The research aims to achieve three objectives: (i) to develop an online logbook for project progress on a digital platform; (ii) to provide students access to report and update project progress from any location using digital platforms; and (iii) to improve a way for both the lecturer and supervisor to address marks and monitor progress more easily. In the evolving educational landscape, iLOGBOOK represents a transformative tool, aligning with the shift towards efficient, collaborative, and personalized learning experiences.

1.1 Development System Theory

Developmental systems theory (DST) emerged in the 1990s, building on earlier developmental systems perspectives. Conrad Hal Waddington's introduction of the "developmental system", Gilbert Gottlieb's concept of probabilistic epigenesis, Susan Oyama's attention to the role of information in the developmental system, and finally Donald Ford and Richard Lerner's explicit identification of a "DST". In the realm of educational innovation, iLOGBOOK emerges as a transformative solution, aligning with development systems theory principles. It pioneers a shift from conventional paper-based logbooks to a digital platform (Albin-Clark et al., 2018). This echoes the significance of dynamic systems in educational settings, recognizing the intricate networked dimensions of teachers' relationships and experiences (Tiberio & Capaldi, 2019). Drawing parallels to the integration of neurobiological development, systems theory, and attachment theory in early human development (Meyer et al., 2013), iLOGBOOK harmonizes technology and education. Moreover, iLOGBOOK exemplifies the application of systems theory in capacity development, providing a conceptual framework for evaluating and enhancing its functionality (Klier et al., 2022). As it contributes to the green development discourse, iLOGBOOK aligns with the principles of green

behavior and development systems theory (Li et al., 2020). The tool's evolution can be guided by this theoretical foundation, ensuring continual improvement and adaptability.

2.0 Literature review

2.1 The importance of logbook

The logbook plays a crucial role in various fields, serving as a valuable tool for documentation, analysis, and improvement. In the realm of smart campus implementation, Study by Hasri et al., (2023) of iBeacon technology is proposed to automate manual practices, such as attendance tracking and navigation, to achieve a smart campus status. In healthcare, telehealth utilization during the COVID-19 pandemic was documented in logbooks, allowing for a retrospective review of patient encounters and demonstrating its effectiveness in maintaining healthcare delivery, especially for high-risk populations like sickle cell disease patients (King et al., 2023). Similarly, in surgical training, a trainee's logbook recorded details of cataract surgeries, demonstrating how logbooks contribute to skill enhancement and improved surgical outcomes (Ripa & Sherif, 2023). Furthermore, logbooks in the fisheries sector aid in quantifying the vulnerability of bycatch species, providing insights into conservation priorities (Reis & Figueira, 2023). Logbooks also play a pivotal role in education, where they are utilized to track learners' progress, such as in analyzing initial learner profiles and subsequent trajectories over the academic year (Toffoli, 2023). Additionally, logbooks contribute to predicting and analyzing student performance, as demonstrated in a study evaluating classification techniques for final year projects (K. Ng et al., 2023). Overall, logbooks serve as indispensable tools for documentation, analysis, and improvement across various domains, facilitating enhanced decision-making and outcomes.

2.2 Multifaceted Applications of Logbooks in Various Industries

The utilization of logbooks across diverse fields emerges as a vital element for documentation, analysis, and decision-making. In aviation maintenance, Gerhardinger et al., (2023) introduce an expert system that analyzes aircraft logbooks to predict the remaining useful life of structural components, enhancing maintenance decision-making for operational safety. Prosser & Kromer, (2023) explore the educational uses of electronic research notebooks (ERNs), emphasizing their increasing prevalence in academia and industry. Additionally, logbooks play a pivotal role in construction management, as Signorini et al., (2023) present a Digital Building Logbook framework, utilizing semantic web technologies for improved data access and knowledge extraction, fostering digital twin applications. These logbooks aid in achieving higher sustainability objectives in the construction phase and ensure building performance aligns with safety, health, and environmental requirements. The importance of logbooks extends to healthcare, as diagnostic reference levels are established for hand and wrist procedures using mini C-arm fluoroscopy, contributing to standards and enhancing patient safety (Madhvani et al., 2023). Furthermore, logbooks play a crucial role in translanguaging pedagogies, where Schmidt & Molin, (2023) utilize teachers' logbooks to investigate how theoretical concepts are transformed into multilingual classroom practices, highlighting the evolution in pedagogical thinking. Additionally, Alonso et al., (2022) stress the importance of digital building logbooks in circular economy practices, providing traceability for carbon dioxide emissions and waste in construction projects. In the maritime industry, Schenone, (2022) emphasizes the role of digitalization and data-driven decision-making through electronic logbooks to enhance regulatory compliance and optimize operational measures, addressing challenges posed by global decarbonization targets. Collectively, logbooks emerge as indispensable tools across various domains, contributing to efficiency, safety, and sustainability.

2.3 Impact of Digitalization on Various Logbook Applications

During the COVID-19 pandemic, increased reliance on digital devices for work, study, and socialization led to concerns about negative effects. A study by Gregersen et al., (2023) investigated the experiences of 59 university students, revealing high online fatigue but also creative digital device use for social connections. In healthcare training in Zambia, e-logbooks

proved feasible for monitoring medical licentiate students' skills, although usability challenges were identified (Barteit et al., 2022). The European initiative for a Digital Building Logbook (DBL) aimed to address information gaps in the building stock. However, analyses in Spain and Italy revealed existing data sources' limitations for DBL implementation (Gómez-Gil et al., 2023). Digitalization's potential impact on engineering logbooks was explored, introducing a visual e-logbook app to enhance project design efficiency (K. W. Ng et al., 2024). The European's push for building decarbonization was assessed in Spain using Measurable Progress Indicators, highlighting data availability challenges and proposing a digital building logbook (Arbulu et al., 2023). Addressing polypharmacy risks, a study Brünn et al., (2022) evaluated a computerized decision-support system, revealing challenges in implementation due to technical barriers. A study in Maryland explored the impact of logbook format (paper vs. electronic) on self-reported driving behavior, finding no significant differences and high satisfaction with an electronic logbook (Ehsani et al., 2023). Efficient querying of building energy consumption data was addressed through a proposed framework that combines dynamic and semantic data, enabling high-level visualization services (Touloumis et al., 2023). Besides, Building Passports were examined for their role in overcoming information silos in building data management, highlighting challenges and opportunities (Buchholz & Lützkendorf, 2023). Lastly, the potential of digital twin technology for standardized building documentation was explored as a means to transform facilities management, enhance energy efficiency, and support long-term maintenance (Al-Sadoon et al., 2023).

3.0 Methodology

The iLOGBOOK system adopts the Rapid Application Development (RAD) methodology, a dynamic and iterative information system development approach illustrated in Figure 1. Recognized for its agility and efficiency, RAD has been applied in various industrial settings, including knowledge-based web applications, Geographic Information System (GIS) projects, and educational systems. The RAD process for iLOGBOOK consists of four key phases: Requirement Planning, Prototyping (User Design and Construction), Testing, and Cutover. These phases ensure stakeholder involvement, iterative prototyping, rigorous testing, and seamless implementation. Additionally, the development tools utilized, encompassing Hypertext Markup Language (HTML), Cascading Stylesheet (CSS), JavaScript for the front-end and Hypertext Preprocessor (PHP) with MySQL for the back-end, enhance the system's user interface and processing capabilities.

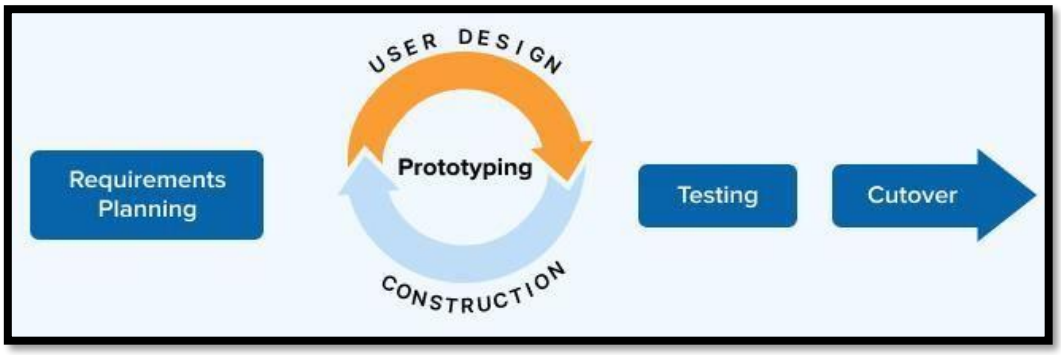

Figure 1: Rapid Application Development (RAD)
Source: Sharma Kamal (2020)

Figure 1 above shows the RAD process which is one of information system development methods which has been implemented within industrial practise and resembles of that agile model in terms of features such as user involvement and repetitive development (Berger & Beynon-Davies, 2009). It provides a faster and better quality of deliverables compared to traditional software development life cycle approach (Sasmito et al.,2020). This method has been vigorously implemented due to its advantages against conventional methods thatconsume a lot of time which seems to be less relevant in current technological advancement period. In the development of knowledge-based web application to research, RAD has been adopted due to its ability to mitigate

against the time loss due to the burden caused by evolving data and schema (Poulovassilis et al., 2020). In Indonesia, a group of lecturers built a GIS, a web-based system to record, store, write, analyse, and display geographical data in determined area and community (Sasmito et al., 2020). These lecturers have employed RAD as development method for their project. RAD also has been actively adopted in educational setting such as web-based library information system (Handayani & Astuti, 2023) and new student registrationsystem (Anugrah Ramadhani, 2021). Therefore, RAD method is seen as most suitable approach to develop iLOGBOOK system. RAD comprises of several phases which are planning, analysis, design and implementation. These stages are further elaborated as follows:

3.1 Requirement Planning

Stakeholders hold regular meeting to define requirements and process flow of the system. As for the iLOGBOOK, active involvement of developers, project lecturer, supervisors and students are crucial in order to make sure the system meets the user expectation. In this phase, goals, expectations, timelines and budget were specified and ensuring every stakeholder is on the same page helps the development process become much easier as well as avoiding miscommunication and costly mistakes later on. The requirement process implements RAD approach is more efficient since it is based on feature-based delivery, meaning that the development of subset of a system is completed at a time in a specific cycle. To simplify, if a whole system hasten (10) main features to be developed, each feature will be developed at a cycle until the cutover phase before proceeding to the next feature based on the priority level.

3.2 Prototyping (User Design and Construction)

Once requirements have been fully satisfied, a working prototype is developed to be presented in stakeholders' meetings for constant reviewing process. This phase involved two additional stages which are user design and rapid construction. During user design stage, the prototype is build based on what has been agreed upon previous phase. The design and look of the system is developed and repeatedly shown to the stakeholder for any adjustment and approval. Then, once approved, rapid construction is begun to add functionality to the design constructed. Constant reviewing and testing is needed to ensure the system to be more robust, less error-prone, and better structured for future design additions.

3.3 Testing

Completed feature is then fully tested against test-cases in intensive scale testing procedure to ensure all the functionalities working as expected and the process flow follows exactly as specified. This phase is vital to make sure the system work as intended.

3.4 Cutover

After the testing of the system is done, the feature will be implemented to server to make it available for use. In this phase, support is necessary in case of unwanted abnormality of the system occurs. Next cycle isinitiated to implement next feature of the system.

3.5 Development Tools

iLOGBOOK is developed as a web-based application, there are several requirements tools needed to configured in constructing initial prototype. iLOGBOOK system comprises two parts which are front-end and back-end development. Front-end development focuses on building what the user will see on their browser while back-end development manages the request to access the system. Analogically, when user wants to login into their bank account, the user will only 'see' the system appears to ask for a username and password, while the 'process' to validate the inserted input against available data in database which does not appear to the user. To sum up, the front-end process only caters to what the user needs to see on their browser, while the back-end phase processes the request without the user knowing the details of what is happening. The relation between front-end and back-end can be illustrated as in Figure 2.

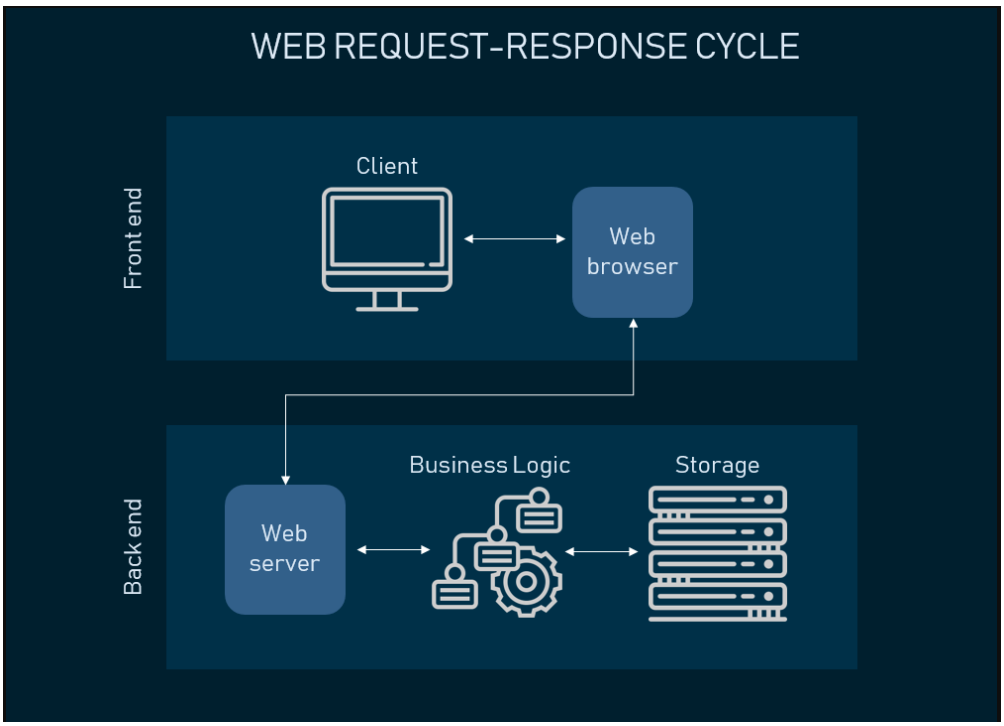

Figure 2: Front-end and Back-end Request and Response Cycle
Source: Eugene (2024)

To develop front-end interface (what the user 'sees' on their browser), HTML, CSS and JavaScript were used. HTML tells web browser what to display on the web browser. Each HTML element has different purposesdepending on the respective tag being used. CSS is then used to describe how each HTML element should be displayed or styled on the web browser. In simple terms, it is used to make web pages to be more presentable. JavaScript, a client-side scripting) manipulate the behavior of web pages to make it more interactive. Example: background color is changed when a button is clicked.

In the back-end development (process each user request), PHP language is chosen as server-side scripting. PHP is an open-source scripting language for web development. This language is used to handle and manipulate data during process requests. In simple terms, PHP is used to handle processes which is requestedby the user however the details of execution are hidden. PHP also handle the exchange of data between front-end and back-end process by accessing storage on the server-side. iLOGBOOK used MySQL database to store records of data for data creation, retrieval, update, and deletion.

4.0 Discussion of analysis and findings

In the iLOGBOOK system, a comprehensive digital platform designed for managing weekly project progress during the development phases, Figure 3 illustrates the login page, granting access to lecturers, supervisors, and students based on specified roles. The system employs a color-coded status display in Figure 4, with red indicating 'No Action,' yellow for 'Drafted,' and green for 'Submitted.' The subsequent sections, illustrated in Figures 5 to 11, depict the sequential process undertaken by students, supervisors, and lecturersin reporting, reviewing, and providing feedback on weekly logbook progress. This discussion delves into the functionalities of iLOGBOOK, highlighting its ability to streamline and enhance the logbook management process for academic stakeholders while eliminating issues associated with manual handling and submission.

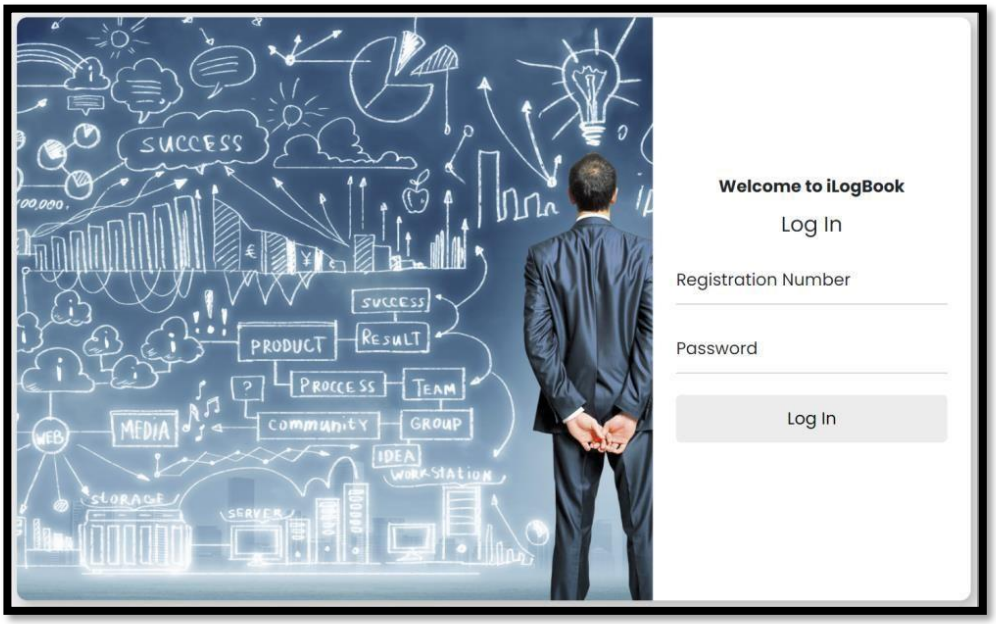

Figure 3: iLOGBOOK Login Page

Figure 3 shows the login page of iLOGBOOK system. Lecturers, supervisors and student will be granted access based on the role specified by the system. Different role has different accessibility.

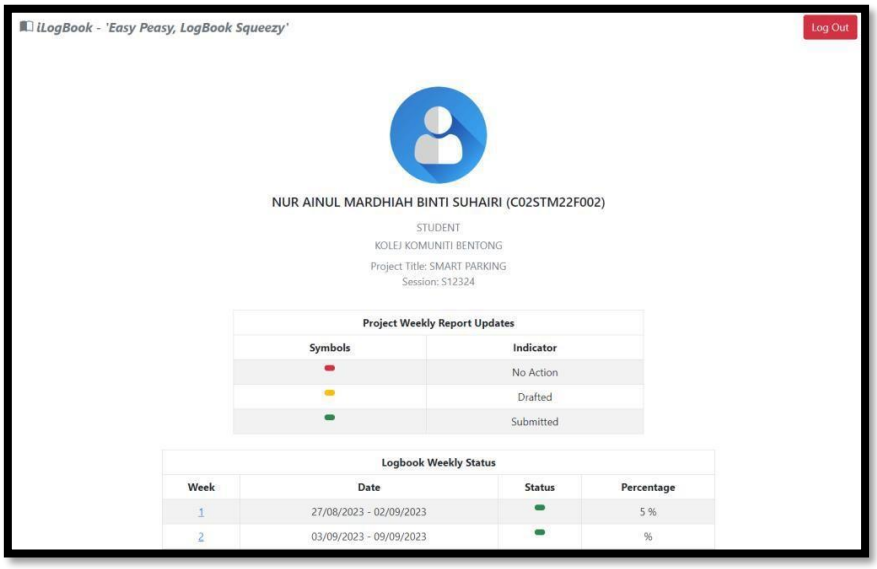

Figure 4: Student's Logbook Interface

Once students successfully login into the system, a web page displaying the progress of weekly report will be shown by the indicated by the status color code as in Figure 4. Red represents "No Action", yellow represents "Drafted" and green represents "Submitted" respectively. They are able to access each individual week by clicking week hyperlink shown on web page.

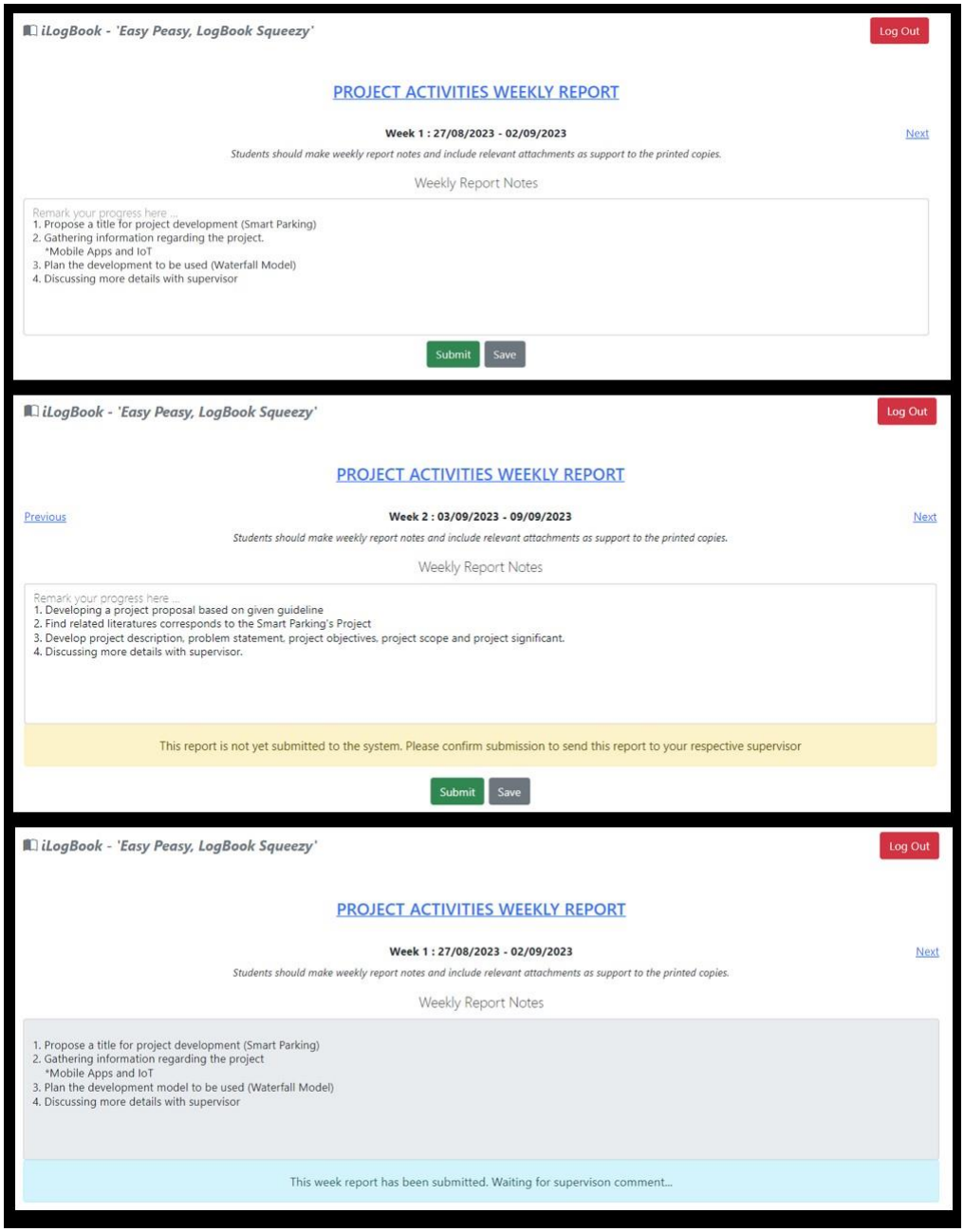

Figure 5: Weekly Report Page

Students are then able to report their weekly progress as they meet their supervisor or lecturer regularly during fourteen (14) weeks of teaching and learning period. Figure 5 shows the display on weekly basis where studentcan report their weekly report and save the progress. Saving progress only for students to store the report however not submitted to their respective lecturer or supervisor. To achieve this, students are required to submit the report so it will appear on the supervisor's side.

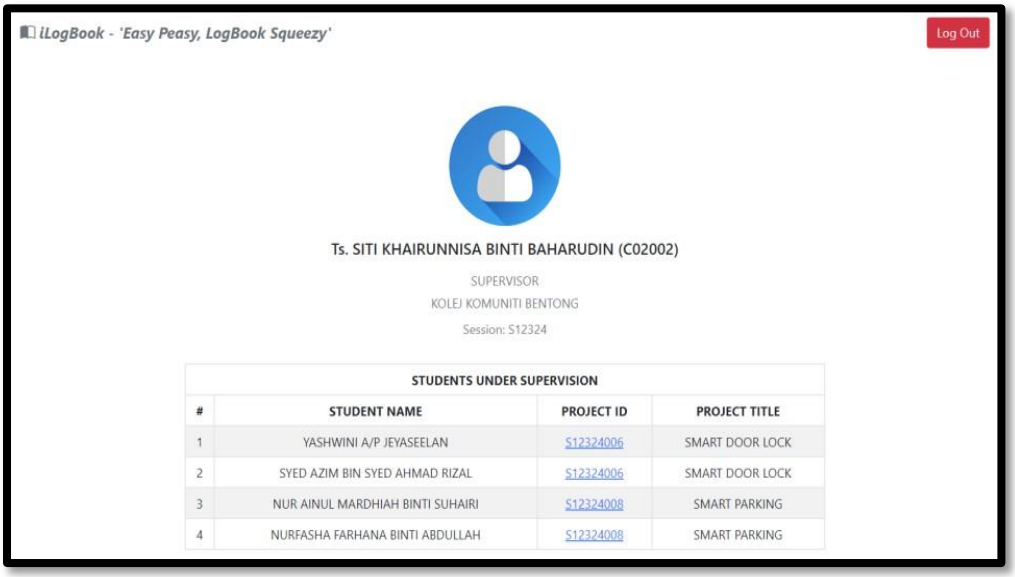

Figure 6: Supervisor Landing Page

Figure 6 shows the supervisor or lecturer landing page. After login into the system, supervisor or lecturer is able toview students and their related project title. In order to review weekly logbook progress, supervisor need to click on theproject ID for each individual project listed.

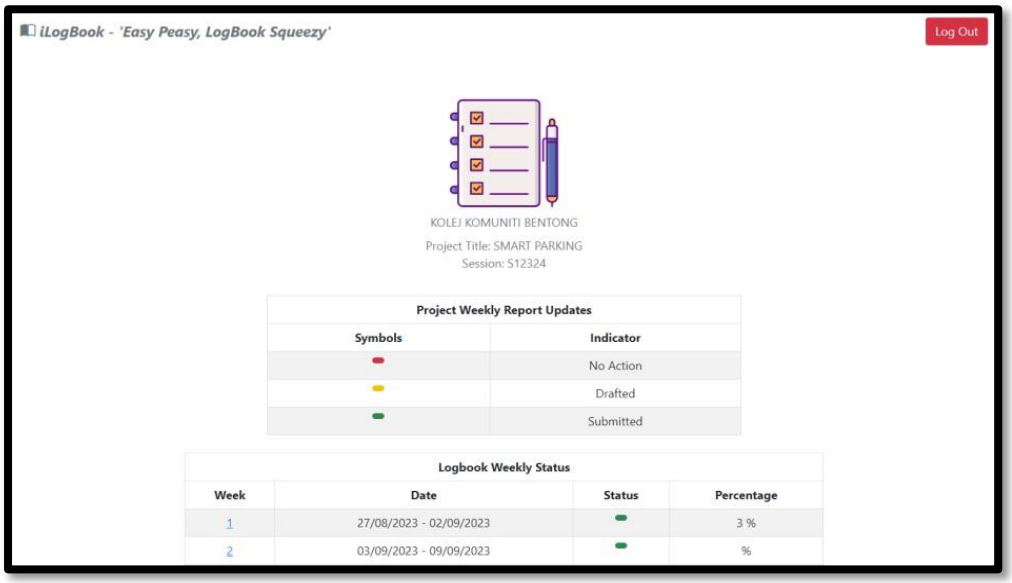

Figure 7: Project Supervisor Supervision Page

Supervisor or lecturer is then redirected to supervision page as illustrated in Figure 7. On this page, supervisor is able to view logbook progress weekly and only green status will be displayed to the supervisor or lecturers. Supervisor orlecturer can click on the week which the report has already been submitted by students to give feedback on the report.

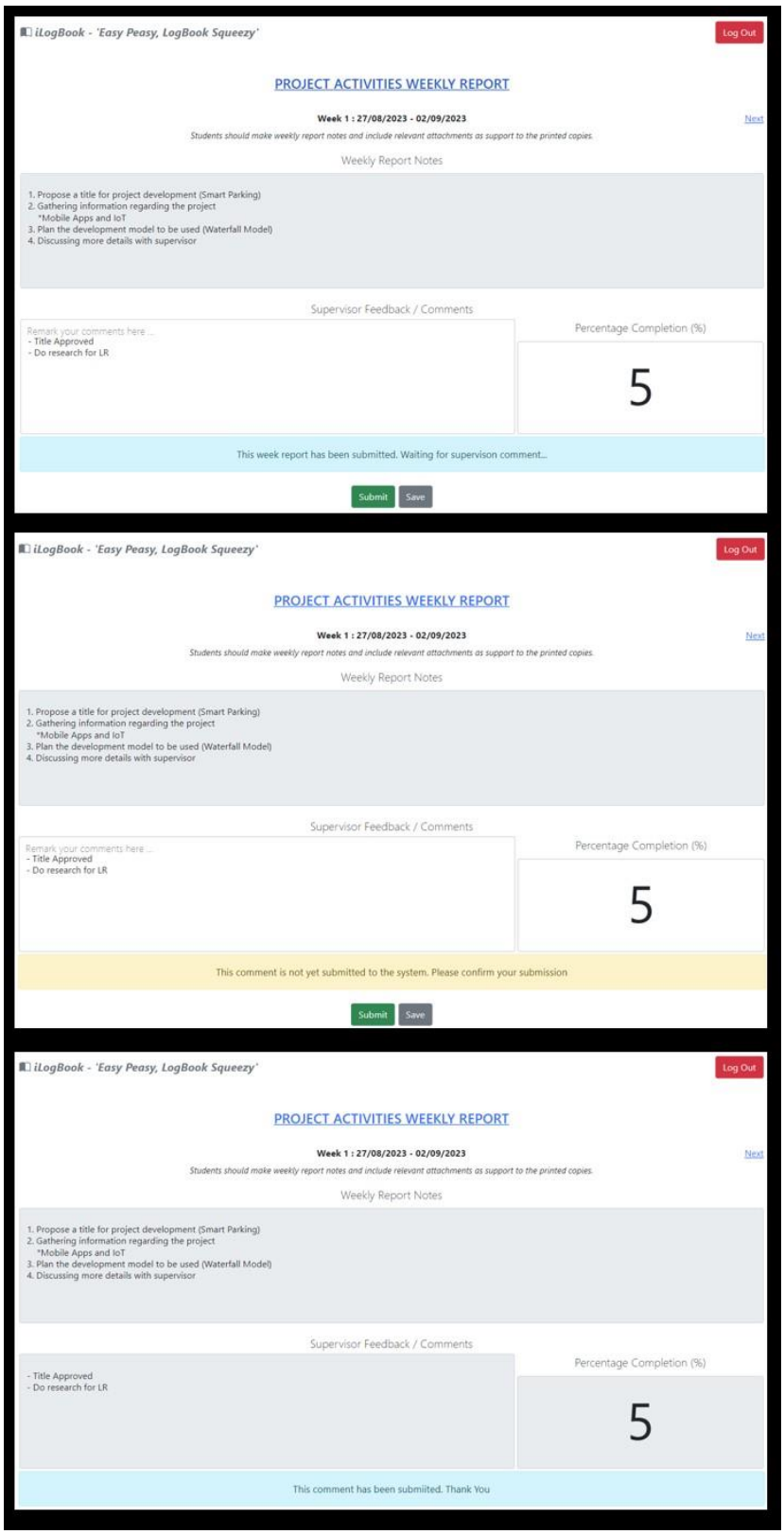

Figure 8: Supervisor Weekly Report Review

Similar to the process for students to save and submit weekly report, supervisor or lecturer might as well save and submit their response and remark the percentage of completion using the system. Once submitted, the feedback cannot bemodified and will be displayed to the students as refer to Figure 8.

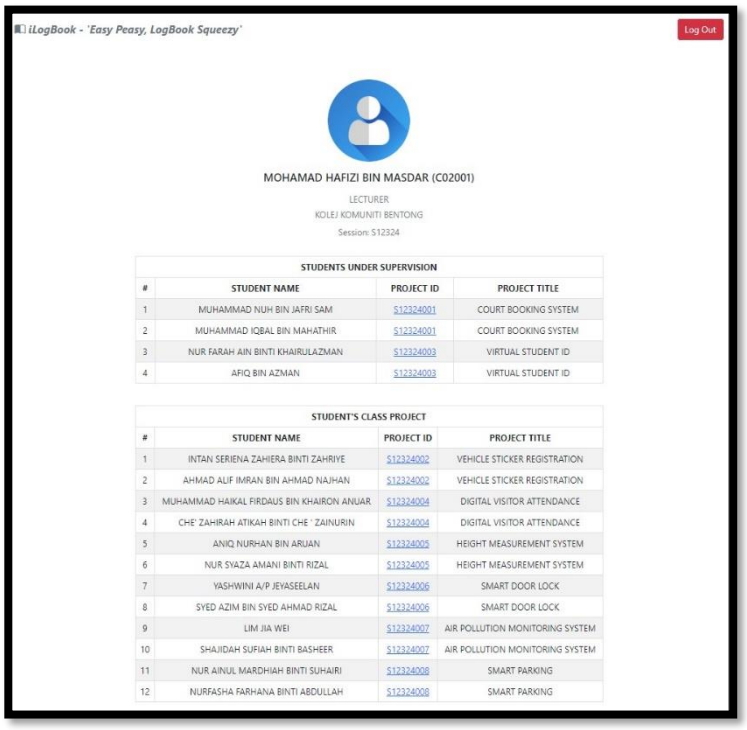

Figure 9: Lecturer Landing Page

Figure 9 shows the page display after lecturer login into the system. Lecturer or supervisor for final year project does have to monitor students under supervision as well as the entire class progress from time to time.

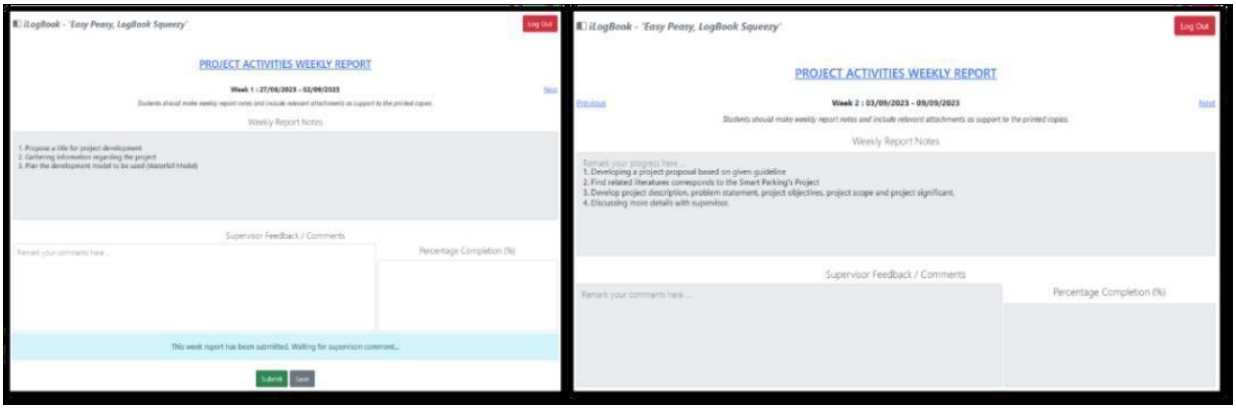

Figure 10: Supervisor Weekly Report Review

Project lecturer or supervisor has the role similar to other supervisor in giving feedback and remark the percentage completion of the project for students under supervision as in left-side picture in Figure 10. However, lecturer can only view the progress of weekly report for other students which are not under the supervision (refer the right-side picture).

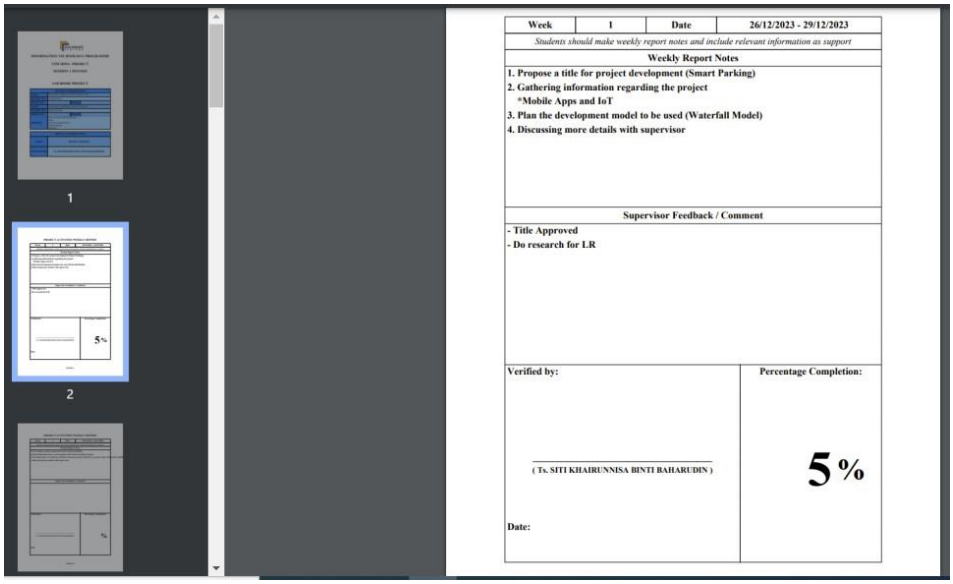

Figure 11: Generate Weekly Report

Lastly, after students, lecturers and supervisors both completed fourteen (14) week of weekly report review and responseprocess, students are able to compile and print overall report to be submitted as proof of logbook completion to final year project as in Figure 11 above. To summarize, iLOGBOOK is capable of providing better way for lecturers, supervisors and students to store weekly project progress during project development phases by utilising digital platform. Additionally, this enable issues such as misplacement and improper submission due to unclean, torn, or disarranged handling to be avoided entirely

5.0 Conclusion and Future Research

As conclusion, iLOGBOOK enables lecturers, supervisors and students to benefitting digital platform by replacing current conventional ways of logging in project progress in paper-based format. It helps users to store and monitor the progress on weekly basis without having to worry about losing the progress due to improper handling of report and can be done anytime and at any place. It is no doubt that the system can be further improved in the future in term of user interface and user experience for ease-of-use and user-friendly features. However, following the concept of RAD methodology, functionality of the system and further improvement can beenhanced as the cycle continues on the next cycle. It is fully suggested that iLOGBOOK to undergo continuous future improvement and modification to meet user's expectation from time to time. Besides, future research couldfocus on enhancing the user interface and user experience of iLOGBOOK to ensure greater ease-of-use and user-friendly features. Conducting usability studies and obtaining user feedback will be crucial in refining the system. Additionally, exploring ways to integrate advanced technologies, such as artificial intelligence or machine learning,could further optimize iLOGBOOK's functionality and provide an even more streamlined experience for lecturers, supervisors and students. Continuous improvement cycles, aligned with the RAD methodology, should be undertaken to adapt the system to evolving user expectations and technological advancements.

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Author Contribution

M.H. Masdar: Technical Writing, Application Developer, Writing-Reviewing, Editing; **E.M.E. Abdullah:** Conceptualization, Methodology, Writing-Original Draft Preparation, Reviewing, Editing; **D. Burhan:** Technical Review, Reviewing, Editing, Application Tester.

Conflicts of Interest

The authors confirm that the manuscript has not been previously published and is not under consideration by any other journals. All authors have reviewed and approved the submission, and they declare no conflicts of interest related to the manuscript.

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