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GRADUATE ON TIME MONITORING SYSTEM (GoTMS): THE DEVELOPMENT OF POSTGRADUATE STUDY PROGRESS MONITORING SYSTEM

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Abstract:

Abstract— Graduate on time (GoT) has become one of the important factors among postgraduate (PG) students. The Graduate on Time Monitoring System (GoTMS) is a sub-system designed for the School of Economics, Finance and Banking (SEFB), Universiti Utara Malaysia to monitor students' progress. The study aims to design and develop a monitoring system for post graduate students. In addition, GoTMS enhancement included some features that can store computerized data to replace the manual method that is difficult for the staff to store many data efficiently at the office. Hence, the stored computerized data and automated monitoring that comes from the reminder message function of GoTMS can completely change the way of data management and can observe postgraduate progression to graduate on time easily. The method used to develop the GoTMS is based on the Project Management Process, which covers every aspect of developing this system from the Project Initiation, Project Planning, Project Execution, Monitoring & Controlling, and Project Closing states. In the process of design and development of GoTMS, the Software Development Life Cycle (SDLC) Waterfall approach involved starting with identifying the requirements, code writing, and design, testing the code before releasing it to users, and monitoring the process before closing and evaluating it to produce a final report. The outcome for this proposed work was a high-fidelity prototype of GoTMS system was developed and undergo

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usability testing to SEFB experts and targeted users of the system to obtain feedback and comments on the system prototype, which is based on four main components: usefulness, ease of use, satisfaction, and security provided by GoTMS. Staff and post graduate students were the respondent for usability testing of GoTMS. As a result, respondents have expressed hope to implement this system as it will contribute to them in ensuring postgraduate students graduate on time.

Keywords:

Postgraduate, Graduate On Time, Postgraduate System, Computerized Data, Monitoring System

Introduction

Information and communication technologies have become a major focus on higher education at the level of master`s degree (Shariff et al., 2016). This is because the achievement of postgraduate students to graduate on time unsatisfactory level is a major problem arise by the university. According to Hoon et al. (2019) the level of postgraduate students' motivation is low compared to other factors such as students' problems, supervision, and institutions. The lack of student motivation will also make it difficult for the university to achieve the index of students who graduate on time. Other findings (Tharim et al., 2018) indicate that organizations have awareness in providing physical support to employees to help improve their performance. Three environmental factors to PhD students are required such as supervisor support, individual factors such as self-management, and competence in completing assignments effectively.

Apart from that, the problem in the SEFB department is the traditional method of storing documents which impede the students from tracing and accessing the related documents while conducting doctoral (PhD) studies. This is especially crucial during the COVID-19 pandemic. Based on Tharim et al. (2018), the result of the interview session stated that the postgraduate holder is aware of the Graduate on Time (GoT) importance. In this regard, the PG students strongly believe that GoT is a mechanism and a supporting factor in conducting a PhD, besides it also helps the university in achieving the expected KPIs and indexes. GoTMS is a sub-system created to monitor the postgraduate learning process in addition to helping the SEFB department achieve the index of GoT students more effectively. The system enhancement will include some features that can store data computerized to replace the manual method that is difficult for the staff to store many data efficiently at the office.

Graduate on Time Monitoring System (GoTMS) is a system that was purposely created for postgraduate UUM students who are doing their studies at the PhD level, lecturers, supervisors, examiners, coordinators, and administrative staff who are in charge of PhD programmes at the SEFB in UUM. This system is also a sub-system designed for the department to monitor student's progress. The main objective is to monitor and notify PG students at each phase of their studies until they complete their studies on time. It also aims to provide a reminder message that will be generated automatically from time to time based on the set-up date to remind students to be competent for each task before the deadline. As a result, steps will be taken to improve the quality of the academic journey.

With several improvements to the main features of the GoTMS, such as the computerized data store and automated monitoring that comes from the reminder message function, the SEFB's staff can completely change the way of data management from manually to computerized, and

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the staff can also easily observe the progression of the respective student from time to time. Aside from that, all users can do their tasks effectively and systematically by using the system. Due to the pandemic Covid-19 factor, this alternative can help all persons involved with their affairs and otherwise improve the quality of education. The system must then provide automated notification at a predetermined time. The purpose is to ensure that the student does not miss the deadline for finishing their coursework. At the same time, it raises the number of students who can graduate on time, regardless of whether they are studying part-time or full-time.

Literature Review

Graduate on Time (GoT)

GoT has become a popular issue among postgraduate students. By 2023, the Malaysian government has established a new objective of producing 60,000 Malaysian PhD holders (Shariff et al., 2016). It is essential for postgraduate students enrolled in master's and doctorate programs to finish their studies within the period assigned as Graduate on Time (Tharim et al., 2018). As a result, the purpose of this study is to learn about PhD holders' perspectives on postgraduate students work performance as they progress through their doctoral journey toward GoT. Most candidates believe that GoT is one of the processes and contributing causes that will force them to strategize and perform within the time frame provided. Individual (self-management and self-capability) and environmental (supervisor support) factors, on the other hand, play a role in students' task performance.

Students support is required in postgraduate education, which comprises different service areas aimed at providing high-quality education. It is necessary to address this issue at all levels, including departmental and institutional, to produce outstanding graduates for national transformation. To ensure the long-term development and implementation of outstanding research results, it is important to provide a conducive environment for student's studies (Abiddin & Ismail (2014)). Education may face additional difficulties when it comes to supporting longer-term student initiatives. In addition to their regular study load, the student is required to sustain interest and effort for a long period of time (Gray et al., 2016). Results from a study of previous research, six factors that influence PhD students in obtaining GoT have been identified such as student factor, financial factor, supervisor factor, skills factor, project factor, and institution factor (Chin et al., 2017; Shen, 2021). Furthermore, (Azman & N.F.A.M (2020)) stated in their study that their analysis based on PhD students' personality types of outcomes demonstrated that knowledge, skills, and abilities, as well as knowledge sharing behaviour, had a major impact on the outcome of graduating on time. (Tharim et al., 2018) believed that a person's performance could not be attained without the supervisor's help and own self-management. Highly respected supervisor support reflects the organization's commitment to the individual's development and improvement. Many students struggle during the thesis writing process, which is a regular occurrence at universities around the world. This has resulted in major doubt, despair, and hopelessness, as well as a standstill for studies and research. It has also forced supervisors and students to engage in alternative instructional and supervisory activities to reduce the negative impact on academic and research continuity (Ghani, 2020).

Apart from that, the importance of GoT in studies to minimize the period students need to graduate, resulting in fewer hours of study (Hasnan et al., 2015) as the lack of time management

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skills, as well as managing their many responsibilities as adult learners, were among the difficulties or troublesome factors identified by the respondents (Tharim et al., 2018). Institutions and their management are majorly primarily responsible for providing resources and support as engagement with the postgraduate students (Blakey, 2021). Students at the postgraduate level depended on the institution's and management's guidance to stay afloat. When effective services and resources are provided, the learning process becomes more convenient. At different stages of their graduate studies, postgraduate students require various resources and support. To complete these students' requirements, a variety of strategies might be used. This problem should be handled carefully, acknowledging the students' abilities and needs. There is no denying that many students start PG study with strong motivation, but once they are faced with obstacles, their encouragement may slowly decrease, leading to failure to GoT or complete withdrawal from the programmed (Hoon et al., 2019). Thus, a monitoring system is an important tool to track and monitor the overall student progress to promote the four-year GoT emphasized by the Malaysian government (Hasnan et al., 2015).

According to Rendeiro et al. (2013), monitoring from an educational perspective, generally requires that the activities progression be tracked systematically, following the objectives and fundamental concepts. Automated student progress tracking systems have been demonstrated in studies that can help save time and money by reducing system design and development workload, reducing development expenses, lessening the development time, and increasing effectiveness (Steindal et al., 2021). Every semester, the number of applications increases, and academic staff must review the documents before determining whether to accept or reject them. This is a time-consuming process, and students will only be notified of their application status after at least two weeks. Thus, previous study has presented the web-based monitoring application system as a solution (Faraj, 2009).

Perceived Supervisor Support (PSS)

The students require additional psychological support in terms of improving their academic skills and supervision from connected parties, such as supervisors and institutions. Research has indicated that competency in the related field and motivation towards GoT are associated to each other (Tu & Zhou (2015)). Other findings indicated that students regarded time spent and supervisor involvement as the most essential aspects that contribute to successful studentship (Hoon et al., 2019).

Self-Management (SM)

The second is self-management, which is the path to achieving the desired position, such as academic success. Self-esteem, pride, self-confidence, a sense of competence, and other psychological characteristics can all be factors. Their individual practices and experiences also influence their study. Postgraduate must be aware of their roles and responsibilities as a postgraduate student. Besides that, they need to learn to work towards developing an engaging, meaningful and positive working relation with their supervisors.

Self-Competency (SC)

Motivation is the most important factor in postgraduate studies. It has been observed that students' demands and desires are diverse in this new era of learning in the 21st century. Students seek support since the educational circumstances of postgraduate study are difficult. Postgraduate students have the same sentiment. They require motivation in order to complete their studies (Hoon et al., 2019).

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Existing GoT Systems

The previous systems that have been developed for PG students and institutions to monitor and track the progress of students in completing their studies are discussed in this paper such as Electronic Logbook (E-logbook), Information Management System, MonSys — Monitoring System and Postgraduate Tracking System (POSTRACKER).

Electronic Logbook (E-logbook)

The Electronic Logbook System (E-log) is an important factor of the competency-based program. Logbooks are an effective tool for delivering feedback to residents, tracking their progress, and assisting them in organizing their clinical activities by the residency program's core curriculum. The success of the e-log system depends upon its use not only by the residents but also by their supervisors. Thus, there is a need to know the reasons that hinder the usage of e-logbook by the residents and the supervisors. If these factors are identified, then steps can be taken to improve the effectiveness of e-log for training and monitoring of residency training in Pakistan for future work (Gondal et al., 2017). In addition, there is a lack or absence of reminder function for this system.

Information Management System

The system can manage the comprehensive information of graduate students, adopt the Spring MVC three-tier architecture design a Java framework of web development, and establish the management log, which has good practicability and expansibility. The development of a graduate information management system is devoted to solving such problems and reducing the number of graduate students by helping teachers, postgraduate units, and institutions of major colleges and universities in managing and maintaining the information of postgraduate students through information management that is effective, safe, and fast. The amount of work required. So that the teacher can log on to the system as a different identity, users can enter basic student information, as well as the personal information of graduate students to track, as well as the administration of postgraduate documents and materials. After the system testing and modification, the postgraduate information management system to achieve the needs of the user function, to achieve the basic goal of the design which is to manage the student's information (Shen, 2021; Yu, 2017). In addition, there is a lack of GoT functions for this system such as reminder message and manage study plan.

MonSys — Monitoring System

The MonSys is designed to track academic achievement and student activity in Moodle in compliance with the UNASUS / UFMA Monitoring Coordination criteria (Franca et al., 2012; Warid et al., 2022). For example, the number of tutors and student accesses, student grades, activities that the tutors did not analyze, and activities that the students did not publish. The technicians that watch and monitor students and tutors in Moodle are the sole users in the MonSys. There is only one type of user in the MonSys which is the technician who assists students and tutors in Moodle. The user doesn't need to create another account to access it. All he needs to do is enter the Moodle access data, which means that the MonSys already has integration with the Moodle database for user authentication, which facilitates access. The MonSys provides the ability to monitor students and tutors on courses based on Learning Management System Moodle in an online and fast way, requiring less effort from the monitoring team to generate useful information for greater control and satisfactory progress of the course.

Journal of Information System and Technology Management
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Significant improvement was observed in the following daily UNASUS / UFMA's monitoring of courses through Moodle:

1. Quick identification of students and tutors with access difficulties or problems to attend.
2. Reduction in the time of the search for students and tutors who do not access the Moodle.
3. Reduction in the time of the search for students who didn't do a certain activity in a Moodle course.
4. Reduction in the time of the search for tutors who did not address a particular activity in a Moodle course.

In addition, there is a lack of GoT functions for this system such as monitoring GoT status for student and statistical analysis of time spent in the recovery of information from students and tutors.

Postgraduate Tracking System (POSTRACKER)

POSTRACKER system (Hasnan et al., 2015) aims to provide the most comprehensive student data management and monitoring system for postgraduate research students at an academic institution. This automated tracking system is effective in keeping track of postgraduate research students' work and reduces the time it takes for them to graduate and it is currently being handled by the administrators of the Postgraduate Department, Faculty of Accountancy at UiTM. The tracking system has contributed to a (71%) reduction in the time it takes to nominate a supervisor, an (83%) drop in the number of students scheduled for Defense Research Proposal (DRP), and a reduction in the time it takes for students to go through the viva voce procedure is (56%). The system components include student registration data, research working titles, supervisor(s), DRPs, student progress to date, viva voce, examiners, and deadlines for correction (after viva voce). POSTRACKER has shown the following positive outcomes and enhancements:

1. Reduction in the length of time for the supervisor nomination process (for newly registered students).
2. Reduction in the percentage of students scheduled for DRP.
3. Reduction in waiting time for students going for viva voce.

Even though POSTRACKER has shown positive outcomes and enhancements but still lacking some feature that can be added for future work such as Manage Colloquium and View Colloquium for postgraduate student and lecturer.

MyPhD Planner

MyPhD Planner is an online system that is developed to provide a platform for PhD Candidates in planning, coordinating and monitoring their PhD journey. The purpose of this online system is to assist the PhD candidates in organizing their studies and facilitate the organizations in achieving their target percentage of graduates on time for PhD students (Tharim et al., 2018). The system was also developed based on requirements stipulated by the scholarship awarded university and the Malaysian Minister of Higher Education. The findings of these studies show that the company is conscious of the importance of providing support to its staff, particularly in terms of resources, in order to help them achieve the desired results. Individual characteristics such as self-management and competency, in addition to environmental

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elements such as supervisor support, play a role in task effectiveness as well. This study tests the proposed conceptual model, which is based on existing empirical evidence and literature, by evaluating the contributions of three (3) independent factors to PhD holders daily task performance while finishing their PhD journey. The instruments employed in this study meet the reliability and validity analyses acceptable requirements. However, other factors such as management and rules of the university as well as support from families need to be taken into account and addressed in this system for the future work.

Comparison Between Previous Study and Previous Existing System

Based on the previous studies that are stated above, the GoTMS was developed to meet the needs of graduate students on time. The criteria of each phase that a postgraduate student must complete during their studies are covered by the GoTMS compared to previous related existing systems that kind of similar with the GoTMS, as shown in Table 1 below. Monitoring and tracking student's progress is a fast and easy way to maximize the percentage of students graduating on time at university. Based on Table 2 below, the GoTMS also provided a user-friendly online application system that allowed them to easily check for current information during their studies. Besides, the enhancement of two-way communication through the web system has made contact between students and institutions more effective especially during online distance learning (ODL) compared to previous related existing systems that being discussed.

Table 1: Comparison of Previous Related Existing Systems with GoTMS by Components for Lecturer/ Coordinator

System/Component	Manage Profile/Study Table	Manage Colloquium	Manage Proposal Defence	Manage VIVA	Manage Reminder Message
POSTRACKER	Yes	No	Yes	Yes	Yes
MyPhD Planner	Yes	No	No	No	No
GoTM System	Yes	Yes	Yes	Yes	Yes

Table 2: Comparison of Previous Related Existing System with GoTMS by Components for Student

System/Component	View Profile/Study Table	View Colloquium	View Proposal Defence	View VIVA	Update Research Work	View Reminder Message
POSTRACKER	Yes	No	Yes	Yes	Yes	Yes
MyPhD Planner	Yes	No	No	No	No	No
GoTM System	Yes	Yes	Yes	Yes	Yes	Yes

Methodology of The Study

The project methodology used to develop the GoTMS is based on the Project Management Process, which covers every aspect of developing this system from the Project Initiation, Project Planning, Project Execution, Monitoring & Controlling, and Project Closing states (Islam, et al., 2020; Jovanovic, 2018). (Refer Figure 1). In process of designing and development of GoTMS, The Software Development Life Cycle (SDLC) Waterfall approach was used starting with identifying the requirements, code writing, and design, testing the code before releasing it to users, and monitoring the process before closing and evaluating it to produce a final report (Scroggins, 2014). The SDLC approach was implemented as to provide a framework that can describes the activities performed during each phase of GoTMS

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development. Project management and SDLC would complement each other to form complete methodology for delivering high quality product to meet the needs (Ragunath, et al., 2010).

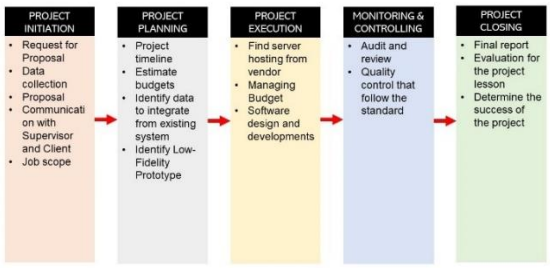

Figure 1: Project Management Process

The Initial Project stage begins with a detailed proposal that includes important aspects relating to the GoTMS collected throughout data collection. Furthermore, ongoing discussion and communication are required to ensure that the information required to construct this system is more accurate following the requirements of the client's scope of work. The second phase is Project Planning to determine the project timeline, the budget estimate needed so that the system can be built at the agreed rate. In terms of the database, it will be integrated with the current system to allow administrators to enter new data information rather than re-entering existing data. As a result, administrator's workload in managing large amounts of student data may be reduced. The requirements in terms of database aspects are according to the current system which is the Graduate Academic Information System (GAIS) that uses the Sybase database. Subsequently, low-fidelity prototypes were produced as a result. The third phase is Project Implementation, to make the system accessible to all staff and administrators while the system is being developed, the hosting servers are sought from vendors according to budget. Software implementation is also done during this period. Expert audits and reviews are undertaken during the Monitoring and Controlling phase so that the system can control the quality according to standards. Lastly, the Project Closing phase entails the completion of a comprehensive final report, evaluation of the project lesson, and determination of the project's success.

Design and Development of The GoTMS

This section describes the design and development of the GoTMS using (SDLC) phases. It consists of four main phases.

Planning and Analysis

Periodic discussions to gather relevant information were conducted together with all SEFB innovation members. The data collected are the result of observations on the GAIS system. For the GoTMS, there is an improvement in several functionalities that will notify the users of the events that have been set up once the data is stored. It also has a reminder message to notify the users and a warning letter will send to the student if they have not completed the task by phases based on study requirements. This function will help the users to be alert with the important date that is a prerequisite for the student to finish their studies on time and for the academic teachers, it will remind them to check on their schedule and task. Besides that, during the COVID-19 pandemic, this system is one of the methods that will allow the students to submit any document or task online because it is hard to meet the supervisor and other related people as well and vice versa. The time is taken to set a date with the supervisors, examiners

Journal of Information System and Technology Management
JISTM
EISSN: 0128-1666
Volume 7 Issue 28 (November 2022) PP. 66-95
DOI: 10.35631/JISTM.728005

also can be set up in this system by the admin staff to ease the students and their supervisor, examiners, and lecturers as well. Furthermore, the admin staff can store the real document into this system that is more convenient, accessible, and systematic to avoid any issue of the management quality. In addition, each enhancement function for this system has been referred to UUMIT, which takes into consideration the preferences of IT specialists. The UUMIT approval to integrate this subsystem complies with the predetermined objectives. The following Table 3 is the summary of the GAIS and GoTMS.

Table 3: Summary of the GAIS and GoTMS

GAIS SYSTEM	GOT MONITORING SYSTEM
- **Profile:** Student's vital information completed	- **Student Profile:** Student's vital information will be integrated from GAIS system based on listed.
- **Academic records:** information completed.	- **Table Study:** data from GAIS Academic records. **Additional option:** - Ability to upload/download/delete the documents. - Schedule date. - Automated notification at predetermined time.
- **Research and Publication work:** completed of information needed. **Functionalities/ Options:** - Schedule Date - Name of Examiners, Supervisors, Lecturers - Colloquium - Viva - Proposal Defense - Research Work - Thesis - Publication	- **Research and Publication work:** data from GAIS system. **Additional options:** - Congratulation's email (Colloquium) - Reminder message auto-generated based on schedule date that will be set up based on week of studies. - Warning Letters: if the student has not submitted the task yet. - Publication form: allow student to download and upload

Table 4 illustrates the main requirements of the GoTMS, which were created to meet the demands of school admin and lecturers in monitoring and tracking PG students so that they can graduate on time. The lecturers and admin staff will use the requirement IDs GOTS_01, 02, 04, 06, 09, and 11 to complete the tasks in this system. Meanwhile, GOTS_02, 03, 05, 07, 08, and 10 are for the student's authority, which allows them to accomplish the course according to their own time and as per their priorities.

Table 4: GoTMS Main Requirements

No.	Requirement ID	Requirement Description
1.	GOTS_01	Manage Profile/ Study Table
2.	GOTS_02	Login System
3.	GOTS_03	View Profile / Study Table
4.	GOTS_04	Manage Colloquium
5.	GOTS_05	View Colloquium Status
6.	GOTS_06	Manage Proposal Defense
7.	GOTS_07	View Proposal Defense
8.	GOTS_08	Student's Research Work
9.	GOTS_09	Manage VIVA
10.	GOTS_10	View VIVA status
11.	GOTS_11	Manage Reminder Messages

Journal of Information System and Technology Management
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Design

This system was created to meet the needs of its users, which include postgraduate academic staff, administrators, coordinators, and lecturers.

Figure 2 illustrates the communication between use cases and actors for this system. Two actors are the student and the coordinator. For student users, the major use cases are Login system, View Profile, View Colloquium Status, View Proposal Defense Status, Update Research Works, and View VIVA Status. Meanwhile, user coordinators have different authorities in use cases, namely, Manage Profile or Study Table, Manage Colloquium, Manage Proposal Defense, Manage VIVA, and Manage Reminder Message.

There are numerous sorts of requirements in this section, including Functional and Non-functional requirements, as well as Use Case Diagrams, and Activity Diagrams. The next step is to visualize and model the system's requirements using the proper methods and tools. The Unified Modelling Language (UML) was utilized to visualize and model the requirements in this project.

The use case diagram only shows the behavioural dynamics of the system. Hence, the operations involved while using this system according to the tasks handled by the users are illustrated in Figure 3, the activity diagram of GoTMS.

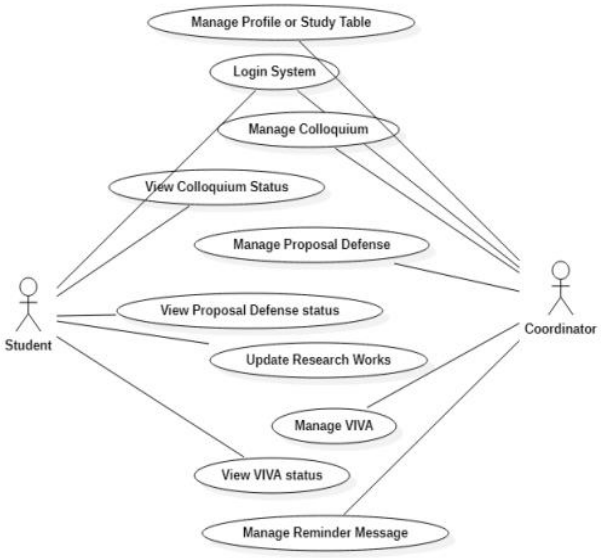

Figure 2: The Use Case Diagram of The GoTMS

The activity diagram in Figure 3 shows the main requirements of this system. Alternative activities are also shown in the diagram according to ID requirements. All these requirements have been developed in this system.

Journal of Information System and Technology Management
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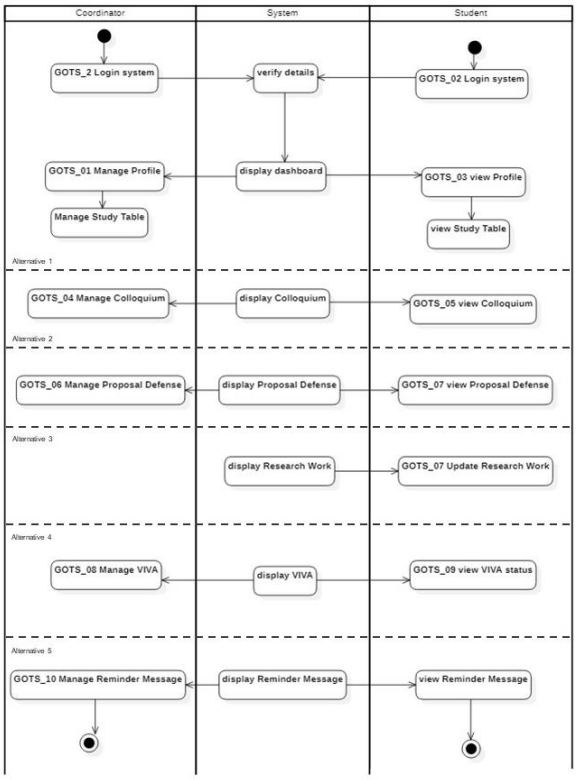

Figure 3: The Activity Diagram of GoTMS

Implementation

- System requirements:
  The main function of this system is to monitor and track the postgraduate student's progress that can estimate the time taken to graduate on time. This system also will change the manual method into the computerized method in performing the task as well.

- Software requirements:
  This system will use a web-based platform that is compatible with the GAIS system to extract the data. The programming used are HTML, C++, PHP, and JavaScript. The system can be accessed only through a laptop as this is an early stage of the learning method for postgraduate students. CSS code is used to create a user interface that will make the system attractive and engaging to users.

Testing and Integration

The importance of testing and integration after a new system is developed will help a developer in producing a system that is safe to use from data loss, bugs, and so on. Field testing was conducted to obtain feedback from users who performed the evaluation process. In addition, the testing process is also made by members of KIK SEFB, and every problem or deficiencies found in the system have been modified and made improvements according to the requested standards. According to the testing, the recommended resolution for the GoTMS is 1920x1080. Furthermore, as the MySQL database is not the same as the Sybase database used by the GAIS system, this system needs to acquire permission from UUMIT to obtain the student database from the GAIS system. Using excel files, the student database is then imported into a MySQL database.

Journal of Information System and Technology Management
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The Prototype Development

A prototype for the GoTMS has been developed. This system was purposely developed for the postgraduate student, coordinators, and administrative staff of the SEFB department. These users will be authorized users for the system.

Figure 4 shows the design of the login system interface. On this page, there is a GoT logo as the header. The user needs to key in the username or email and the correct password to log in. The navigation bar has two menu buttons which are Home and About Us, that will show the information of SEFB.

Figure 4: The Login System Interface

Student Authority

The student's authority to access this system is different from the authority obtained by the coordinator. Among the authorities allowed to students are as described in the diagram use case diagram of the GoTMS.

Figure 5 shows the student's dashboard when the login session is successful. On the top navigation bar, the name of the student will appear based on the user login details. There are seven menu buttons which are student profile, study table, colloquium, proposal defense, research work, viva, and reminder message.

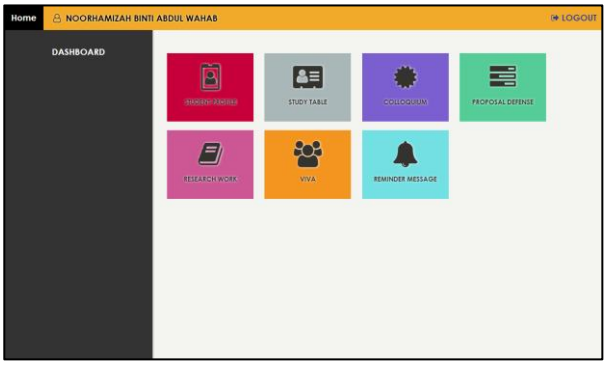

Figure 5: The Student's Dashboard User Interface

Then, the figures 6 shows the user interface of the system based on all the menus in the dashboard. Based on Figure 6 above shows when the student clicks the Profile button, the student can view their information data. students can only view this page.

Journal of Information System and Technology Management
JISTM
EISSN: 0128-1666
Volume 7 Issue 28 (November 2022) PP. 66-95
DOI: 10.35631/JISTM.728005

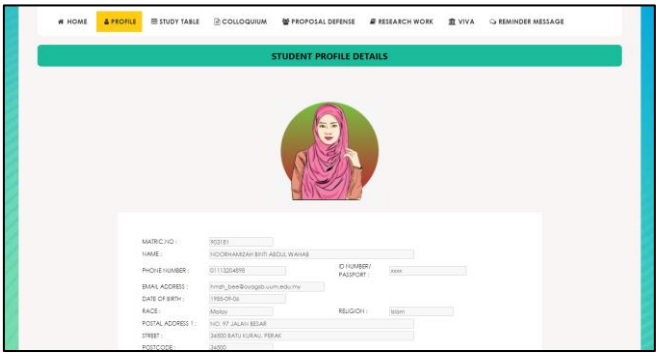

Figure 6: GOTS_03 View Profile

Figure 7 shows the student Study Table. On this page, students can see and check from time to time about the study status, current semester, enter session and current session, estimate graduate date, and the name of supervisors 1 and 2. The estimated date of graduation will change if the student's progress in this system is not implemented according to the prescribed course time.

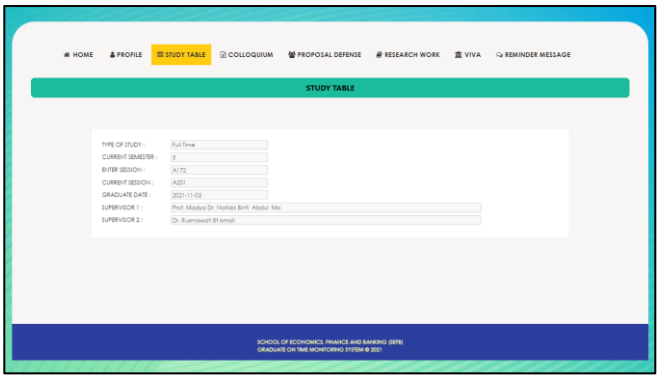

Figure 7: GOTS_03 View Study Table

Figure 8 shows the student colloquium interface system. Students who have successfully registered as postgraduate students must attend the colloquium. So, important information that needs to be informed to students will be updated in this system such as colloquium status, colloquium date, and title. Then, the date of intention to submit the publication form, the names of examiners 1 and 2 can be checked by the student through this system.

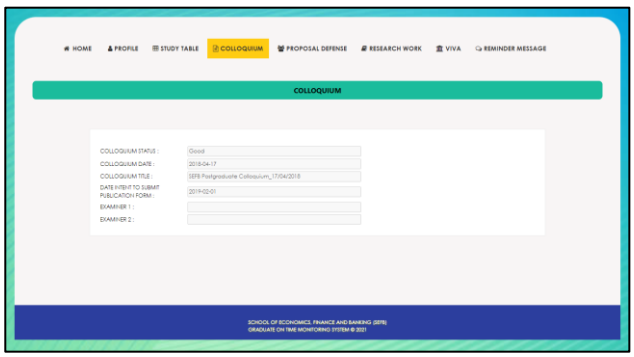

Figure 8: GOTS_04 View Colloquium

Journal of Information System and Technology Management
JISTM
EISSN: 0128-1666
Volume 7 Issue 28 (November 2022) PP. 66-95
DOI: 10.35631/JISTM.728005

Figure 9 above shows the Proposal Defense interface. This interface will show the Proposal Defense (PD) information such as the title of the PD, date of intent to submit the proposal, status of PD, name of examiner 1 and 2, and name of the chairman.

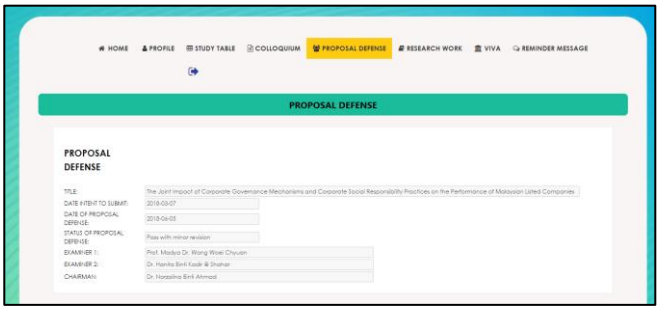

Figure 9: GOTS_07 View Proposal Defense

Figure 10 shows the user interface for research work where postgraduate students can view the submission date of the publication form, curriculum vitae, thesis, and appointment letter that need to be notified. Moreover, when students have submitted or not their assignments, the submission status will change from time to time according to the student's progress. Students need to upload the file and click the submit button.

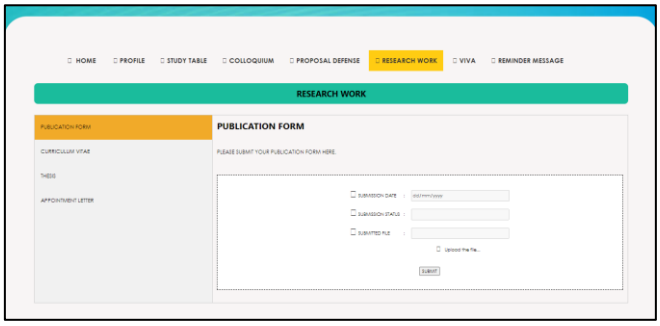

Figure 10: GOTS_08 Update Research Work

Figure 11 also shows the oral examination (viva) user interface. In this section, students can view their viva title, important dates like pre-viva date, intent to submit date, thesis submission date, viva date. Then, they can also view the names of chairmen 1 and 2 as well as the names of examiners 1 and 2 as well. All important information will be displayed.

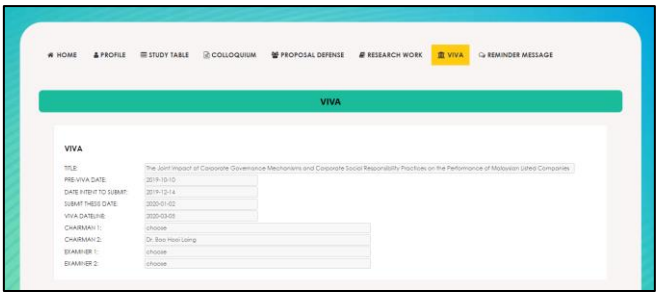

Figure 11: GOTS_10 View VIVA Status

Figure 12 shows the student user interface Reminder Message. This reminder message will display the message that students will receive according to a specific time. For students who

Journal of Information System and Technology Management
EISSN: 0128-1666
Volume 7 Issue 28 (November 2022) PP. 66-95
DOI: 10.35631/JISTM.728005

attend the colloquium course, they will receive a congratulations message. Students will also receive a reminder message as a reminder message to submit their assignments before the dateline. This is because postgraduate students have other major commitments and this will interfere with their performance in current studies. Also, if students do not submit assignments beyond the dateline, they will receive a warning message.

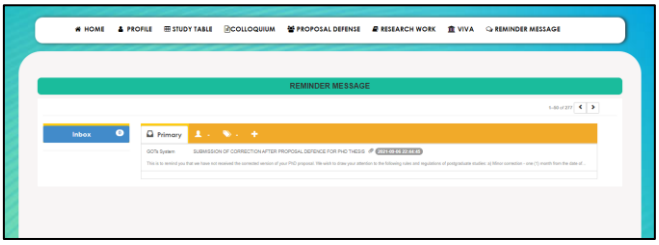

Figure 12: View Reminder Message

Coordinator Authority

For authority coordinators, they can manage and monitor student progress. The figures below show the coordinator user dashboard and the user interface of the functionalities.

Figure 13 shows the user interface coordinator dashboard. there are 8 main menu types as described in the previous section.

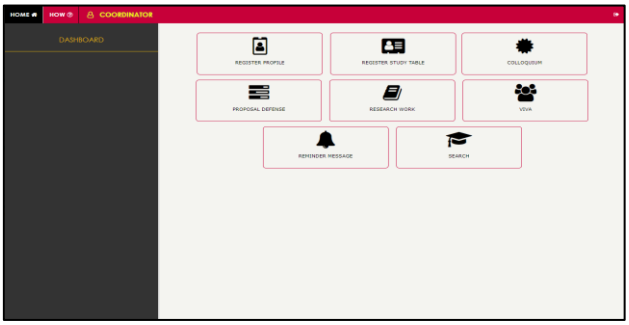

Figure 13: Coordinator's Dashboard UI

Figure 14 shows the interface for student profiles through the account coordinator. The coordinator or administrator can edit and update all student personal data by clicking the edit button in the upper right if necessary.

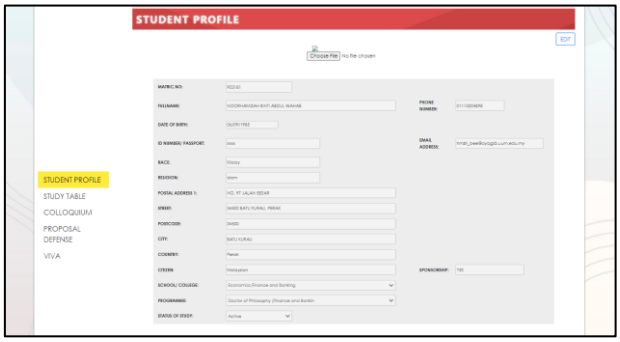

Figure 14: GOTS_01 Manage Profile

Journal of Information System and Technology Management
JISTM
EISSN: 0128-1666
Volume 7 Issue 28 (November 2022) PP. 66-95
DOI: 10.35631/JISTM.728005

Figure 15 shows the user interface student study table. The coordinator can manage the study table data after registering new students in the student profile section. This study table can also be edited at any time if necessary.

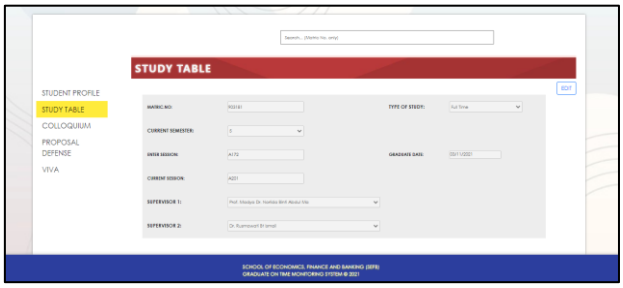

Figure 15: GOTS_01 Manage Study Table

Figure 16 is the user interface for the coordinator to manage the student Colloquium. The coordinator can edit the Colloquium data such as title, status, names of examiners 1 and 2 as well as the date of the Colloquium and the date of intent to submit the publication form which will be displayed on the student's account.

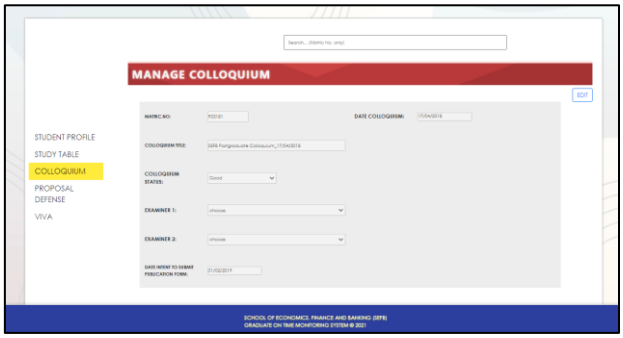

Figure 16: GOTS_04 Manage Colloquium

Figure 17 shows the user interface for Proposal Defense and Re-Defense where the coordinator can manage this information as needed.

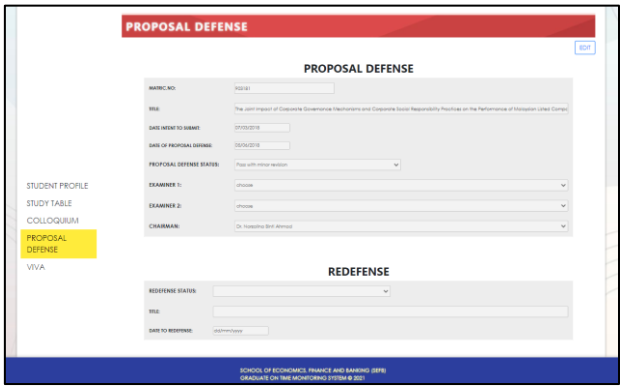

Figure 17: GOTS_06 Manage Proposal Defense

Figure 18 shows the user interface for viva where there are 3 main sections namely the Previva section, Viva, and Reviva section. The coordinator can also update, if necessary, as needed.

Journal of Information System and Technology Management
EISSN: 0128-1666
Volume 7 Issue 28 (November 2022) PP. 66-95
DOI: 10.35631/JISTM.728005

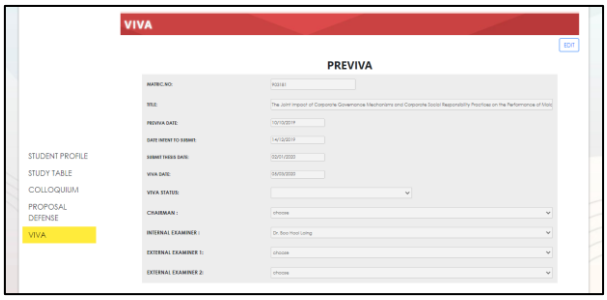

Figure 18: GOTS_09 Manage VIVA

Figure 19 shows the user interface for a Reminder Message form that can be sent by the coordinator to students easily. There are three main functions of this reminder message, including sending a congratulatory message, a reminder message to students from time to time about assignments that need to be completed, and a warning letter will be sent when students do not send assignments past the dateline.

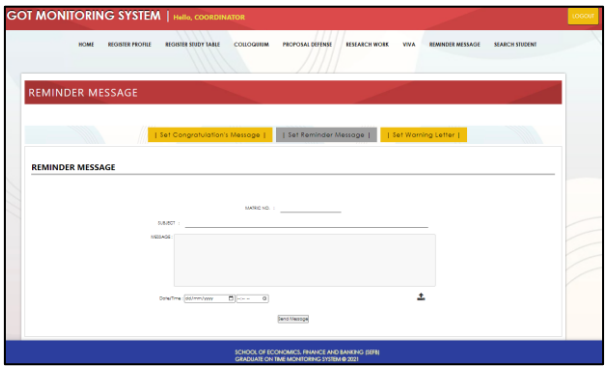

Figure 19: GOTS_11 Manage Reminder Message

Usability Evaluation

The Evaluation

The process of the evaluation was carried out, as shown in the flowchart above. The respondents have completed answering the questionnaire through personal WhatsApp base on the following activities.

i. The Information Sheet and Participant Consent Form will be given to the respondents as consent to be agreed being involved as respondent.
ii. The usability evaluation questionnaires Google Form link is sent after the Consent Form is completed.
iii. The respondents need to fill in the questionnaires in Sections A, B, and C of this evaluation.
iv. In Section A, the participant's data will be collected such as email, name, mobile number, gender, age group, the status of the study, and how often the respondents use the Internet for demographic background.
v. For Section B, the questionnaire is about the usability of the system.
vi. Section C is to collect the evidence from respondents to prove that the evaluation activity is real and qualified for data collection.
vii. If the respondent needs to assist, they can contact to guide them synchronously.

Journal of Information System and Technology Management
JISTM
EISSN: 0128-1666
Volume 7 Issue 28 (November 2022) PP. 66-95
DOI: 10.35631/JISTM.728005

Figure 20 below is the Flowchart of Evaluation Process that has attached the Google Drive link in the Google Form Questionnaire to the respondents as reference.

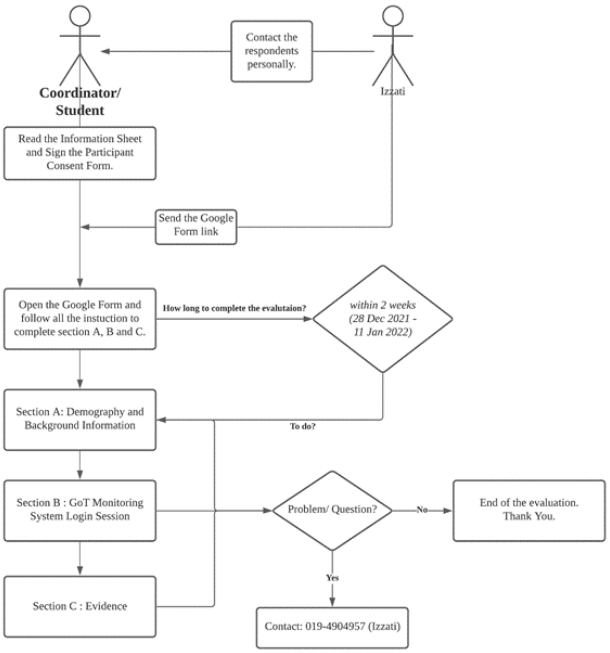

Figure 20: Flowchart of Usability Evaluation Steps

In addition, respondents also need to access cloud storage to view a more detailed manual to use this GoTMS on their own as shown in Figure 21 and Figure 22 below. All respondents can use this system at the same time and answer the questions in google Form. They are also given a password and username to log into the system according to their status as SEFB students or staff.

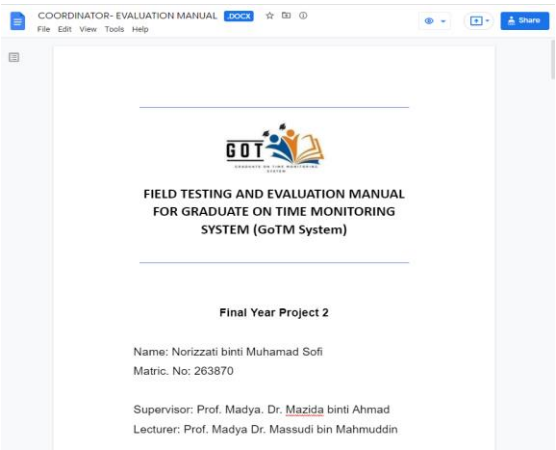

Figure 21: Coordinator Manual Evaluation on Google Drive

Journal of Information System and Technology Management
JISTM
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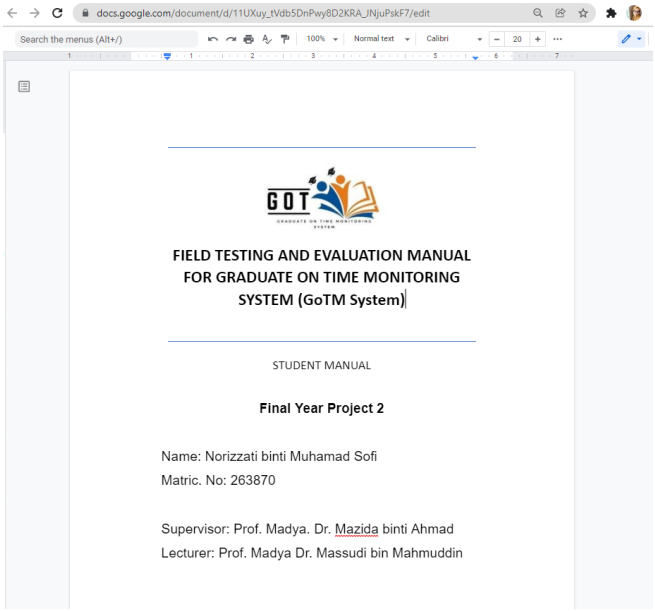

Figure 22: Student Manual Evaluation on Google Drive

The Respondents' Demographic Information

The total number of respondents obtained is 10 people for usability evaluation consist of staff and post graduate students. The number of respondents for usability evaluation of this system is more than enough as mentioned by (Alroobaea, et al., 2014; Bastien, J. C., 2010; Nielsen, J., 2012), which stated the best results come from testing no more than 5 users and running as many small tests as can afford. The purpose of usability testing being done was to improve the design, reduce problem and not just to document its weaknesses.

Based on table 5 below, the analysis of demographic information of the respondents showed that the gender of the respondents for the staff were found to be 100% female equivalent to 5 people. Meanwhile, for the respondent students, 80% are 4 male postgraduate students and 1 female student which is 20%. The total number of respondents obtained is 10 people for usability evaluation and the majority are female. The second question is related to the age group of the respondents can be seen in three primary groups, with 60% being above 46 years old, 20% being between 26 and 35 years old, and 20% being between 36 and 45 years old. Meanwhile, the respondents for the student total percentage of data obtained is that the two main age groups are 60% of respondents aged 26-35 years, while 40% of respondents aged 36-45 years. The third question is about Internet usage. Both staff groups and student respondents use the internet daily by 100% on average. The fourth question was posed to the students to obtain this information. 80% of students are pursuing postgraduate courses full-time, while 20% are doing it part-time.

Journal of Information System and Technology Management
JISTM
EISSN: 0128-1666
Volume 7 Issue 28 (November 2022) PP. 66-95
DOI: 10.35631/JISTM.728005

Table 5: Demography and Background Information

Respondents		Staff	Student
Question			
Gender	Male	/	4 (80%)
	Female	5 (100%)	1 (20%)
Age Group	16-20	/	/
	21-25	/	/
	26-35	1(20%)	3 (60%)
	36-45	1(20%)	2 (40%)
	Over 46	3 (60%)	0
Internet Usage	Daily	5 (100%)	5 (100%)
	Weekly	/	/
	Monthly	/	/
	Occasionally	/	/
	Never	/	/
Status of Study	Full-time	/	4 (80%)
	Part-time	/	1 (20%)

The Usability of GoTMS

The usability testing technique has been used to test the usability of GoTMS. The respondent tested the system and answered the questionnaires in order to evaluate the GoTMS. In the questionnaire, four Likert scale has been used to ensure the respondent to form a view and avoid neutral point from the respondent (Xiao, 2017). The four Likert scale was used to collect respondent's opinions, attitudes and to do a usability testing for GoTMS. The Likert scale ranges from strongly disagree to strongly agree. The usability testing of GoTMS was evaluated in terms of four main components: usefulness, ease of use, satisfaction, and security provided by GoTMS.

Section B: GoTMS Login Session

Coordinator Evaluation

According to Table 6 below, the overall percentage for both questions about satisfaction in answering this questionnaire is the same, with as much as 20% of respondents are agree that it is easy to complete this task within few minutes, while 80% of those respondents are strongly agreed. Furthermore, 20% of respondents agree and 80% strongly agree when it comes to the time it takes to complete the task where it does not interfere with their other commitments.

Table 6: The Overall Evaluation

Questions	**Scale**			
	Strongly disagree (1)	Disagree (2)	Agree (3)	Strongly Agree (4)
Overall, I am satisfied with the ease of completing this task.	0	0	1 (20%)	4 (80%)
Overall, I am satisfied with the amount of time it took to complete this task	0	0	1 (20%)	4 (80%)

The questions about the system's usefulness are shown in table 7 below. The responders were asked nine questions. For all items in the table above, the overall percentage answered by respondents is the same in this section, with 20% agree and 80% strongly agree. The

Journal of Information System and Technology Management
JISTM
EISSN: 0128-1666
Volume 7 Issue 28 (November 2022) PP. 66-95
DOI: 10.35631/JISTM.728005

respondents believed that the approach is valuable since it is effective, productive, and makes it easier to monitor and track the progress of PG students. Apart from that, all of the respondents agree that this approach has helped them minimise their workload and complete their tasks more quickly. The time savings and expected performance when using the system are both considered to be beneficial to the system as a whole.

Table 7: Usefulness of GoTMS

Questions	Scale			
	Strongly disagree (1)	Disagree (2)	Agree (3)	Strongly Agree (4)
GoTMS enhances my effectiveness in accessing the system.	0	0	1 (20%)	4 (80%)
GoTMS increases my productivity.	0	0	1 (20%)	4 (80%)
GoTMS makes it easier to monitor the student's progress.	0	0	1 (20%)	4 (80%)
GoTMS gives me greater control over my work.	0	0	1 (20%)	4 (80%)
GoTMS enables me to accomplish tasks more quickly.	0	0	1 (20%)	4 (80%)
GoTMS saves my time when I use it.	0	0	1 (20%)	4 (80%)
GoTMS meets my needs.	0	0	1 (20%)	4 (80%)
GoTMS does everything I would expect it to do.	0	0	1 (20%)	4 (80%)
GoTMS is useful overall.	0	0	1 (20%)	4 (80%)

Table 8 below shows questions about the ease of use of GoT Monitoring System. There are 10 types of questions asked. For the first question which is easy to use and user-friendly, the total percentage of respondents agree is 40% and another 60% of respondents answered strongly agree. As for the second question, whether GoTMS can make it easier for coordinators to search for students quickly, 80% strongly agree while only 20% agree. The third question is the flexibility of the system. A high percentage of respondents answered strongly agree where as much as 60% and the rest only agree which is 40%. The fourth question related to the use of GoTMS only requires a few steps for respondents to accomplish their task without any problem. Respondents who answered agree with the above statement is as much as 40% and the rest is as much as 60% strongly agree that they can complete their task without problems. The fifth question asked to the respondents was that this system is easy to learn to use. The results of the highest percentage of 60% of respondents answered agree and 40% strongly agree

Journal of Information System and Technology Management
EISSN: 0128-1666
Volume 7 Issue 28 (November 2022) PP. 66-95
DOI: 10.35631/JISTM.728005

that the system is easy to learn for them to use. Next was the sixth question asked about respondents being able to use this system without written instruction. A total of 80% agreed and 20% strongly agreed with this system requires a written instruction method so that users can use this system more easily and understood. In the seventh question, respondents answered strongly agree by 60% and another 20% agree that this system is easy to remember about how to use it. The eighth and ninth questions have the same total percentages.

The question posed for question eight is about the consistency of the system and question nine is whether the respondent can recover the mistakes made quickly and easily is the answer agree 60% and the respondent who answered strongly agree is 20%. The tenth question is whether this system can be always used successfully. Respondents who answered strongly agree 60% is higher than agree only by 40%.

Table 8: Ease of Use of GoTMS

Questions	Scale			
	Strongly disagree (1)	Disagree (2)	Agree (3)	Strongly Agree (4)
GoTMS is easy to use and user-friendly.	0	0	2 (40%)	3 (60%)
GoTMS enables to search for a student quickly.	0	0	1 (20%)	4 (80%)
GoTMS is flexible.	0	0	2 (40%)	3 (60%)
GoTMS required fewer steps to accomplish what I want to do without any problem.	0	0	2 (40%)	3 (60%)
GoTMS is easy to learn how to use it.	0	0	3 (60%)	2 (40%)
I can use GoTMS without written instructions.	0	0	4 (80%)	1 (20%)
I can easily remember how to use it.	0	0	2 (40%)	3 (60%)
I don't notice any inconsistencies as I use GoTMS.	0	0	3 (60%)	2 (40%)
I can recover from mistakes quickly and easily when using GoTMS.	0	0	3 (60%)	2 (40%)
I can use GoTMS successfully every time.	0	0	2 (40%)	3 (60%)

Table 9 below shows the question about the level of satisfaction with the use of GoTMS used by respondents during the usability evaluation. The overall average number of respondents answered strongly agree that is 100% with the questions asked that the respondents are satisfied with this system and need a system for management.

Journal of Information System and Technology Management
EISSN: 0128-1666
Volume 7 Issue 28 (November 2022) PP. 66-95
DOI: 10.35631/JISTM.728005

Table 9: Satisfaction of GoTMS

Questions	Scale			
	Strongly disagree (1)	Disagree (2)	Agree (3)	Strongly Agree (4)
I am satisfied with GoTMS.	0	0	0	5 (100%)
GoTMS works the way I want it to work.	0	0	0	5 (100%)
I feel I need to have GoTMS.	0	0	0	5 (100%)
GoTMS is wonderful and pleasant to use.	0	0	0	5 (100%)
GoTMS is ideal for management.	0	0	0	5 (100%)

Table 10 below shows questions about system security. The first question is that the system stores only a single credential. As many as 80% answered strongly agree and another 20% answered agree. The second question shows the same percentage of questions that the system verifies users of 20% answered agree and the remaining 80% answered strongly agree. The last question that respondents prefer to use this system is 80% strongly agree and 20% only agree.

Table 10: Security of GoTMS

Questions	Scale			
	Strongly disagree (1)	Disagree (2)	Agree (3)	Strongly Agree (4)
GoTMS only kept a single credential.	0	0	1(20%)	4 (80%)
GoTMS authenticates users.	0	0	1(20%)	4 (80%)
GoTMS is secure and makes my life easier.	0	0	0	5 (100%)
I prefer to use GoTMS.	0	0	1(20%)	4 (80%)

Student Evaluation

According to Table 11, the overall percentage for both questions about satisfaction in answering this questionnaire is the same, with as much as 20% of respondents are agree that it is easy to complete this task. While 80% of those respondents are strongly agreed. Meanwhile, 40% of respondents agree and 60% strongly agree when it comes to the time it takes to complete the task.

Journal of Information System and Technology Management
JISTM
EISSN: 0128-1666
Volume 7 Issue 28 (November 2022) PP. 66-95
DOI: 10.35631/JISTM.728005

Table 11: The Overall Evaluation

Questions	Scale			
	Strongly disagree (1)	Disagree (2)	Agree (3)	Strongly Agree (4)
Overall, I am satisfied with the ease of completing this task.	0	0	1 (20%)	4 (80%)
Overall, I am satisfied with the amount of time it took to complete this task	0	0	2 (40%)	3 (60%)

Questions about the usability of the system are shown in table 12 below. For the first, second and third questions, the total percentage is the same which are 20% student respondents agree that GoTMS is effective, increases productivity and makes it easier for them to track for graduation on time and the rest is 80% strongly agree with these questions. The fourth question is that this system can help students meet deadlines with academics and the fifth question is to enables the student to accomplish tasks more quickly. As many as 40% of student respondents agreed and another 60% answered strongly agree this system can help them. The sixth question is this system can save students time when using it. As many as 80% of respondents answered strongly agree and 20% are disagree with time saving when using this system because the student is still unfamiliar with the new system to be adapted as an alternative to graduate on time. Moreover, the use of this system is still not explained in detail with more effective methods. For the seventh question, this system can help students meet their need to stay focused is 40% of student respondents answered agree, while 60% strongly agree. the eighth question is that the system does everything that students expect and as many as 80% of student respondents agree and only 20% answer strongly agree. The ninth question, this system is useful overall only 60% strongly agree and 40% agree this system is useful to them.

Table 12: Usefulness of GoTMS

Questions	Scale			
	Strongly disagree (1)	Disagree (2)	Agree (3)	Strongly Agree (4)
GoTMS enhances my effectiveness in accessing the system.	0	0	1 (20%)	4 (80%)
GoTMS increases my productivity.	0	0	1 (20%)	4 (80%)
GoTMS makes it easier to keep me on track to graduate on time.	0	0	1 (20%)	4 (80%)
GoTMS helps me meet deadlines with my academics.	0	0	2 (40%)	3 (60%)
GoTMS enables me to accomplish tasks more quickly.	0	0	2 (40%)	3 (60%)

Journal of Information System and Technology Management
JISTM
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GoTMS saves my time when I use it.	0	1 (20%)	0	4 (80%)
GoTMS meets my needs to remain focused.	0	0	2 (40%)	3 (60%)
GoTMS does everything I would expect it to do.	0	0	4 (80%)	1 (20%)
GoTMS is useful in overall.	0	0	2 (40%)	3 (60%)

Table 13 below has ten questions. The first question posed is that the system is easy for students to use. As many as 40% agreed and 60% strongly agreed that the system is easy to use. Then, the second question is the user -friendly system. Respondent students only agree is 60% while 40% strongly agree which mean the system is acceptable by the respondents even for the first time, they used it. The third question concerned the system's ease of use. 20% of student respondents disagree with this assertion since some functions are lacking and need to be improved on a regular basis. However, respondents who answered agree and strongly agree have the same percentage of 40% for both scales, indicating that the system is simple to use despite some flaws. It also shows clearly that the system can cover the main requirement function with some limitations. The fourth question is whether this approach requires only a few steps to do what students want to do without difficulty. As many as 60% of student respondents agreed with the scale, while 20% disagreed. This indicates that this system can benefit the user in completing their task with minimal difficulty. Meanwhile, 20% of students disagree due to various with any other expectation that can be taken into consideration for future improvement. The fifth question is if this system is simple to use. On the agree scale, the highest average was 60%, whereas 20% disagreed and strongly agreed equally for both. As a result, the technique is simple to learn and manage with minimal explanation, that also may be one of the reasons why some students were disagreed. Sixth question, students were able to use this system without written instructions agreed by 80% of the respondents and 20% disagreed if there were no written instructions. In response to the seventh and eighth questions, 20% of respondents disagreed that the system is easy to remember how to use and that they did not discover inconsistencies while using the GoTMS because there are no written instructions. Where 40% of respondents agree or strongly agree with the statement, proving that they are adaptive to new systems and have a good understanding of how they will do the task. The ninth question is that students easily and quickly recover from errors while using this system. As many as 20% of respondents who gave the scale strongly disagreed. While for the scale agree and strongly agree have the same percentage of 40% both for this question. The tenth question about this system can be always used successfully. As many as 60% of respondents strongly agree, 20% agree and another 20% disagree with this question. This means that the system still needs to develop and use the SDLC Waterfall technique to address all the issues.

Table 13: Ease of Use of GoTMS

Questions	**Scale**			
	Strongly disagree (1)	Disagree (2)	Agree (3)	Strongly Agree (4)
GoTMS is easy to use.	0	0	2 (40%)	3 (60%)
GoTMS is user friendly	0	0	3 (60%)	2 (40%)

Journal of Information System and Technology Management
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DOI: 10.35631/JISTM.728005

GoTMS is flexible.	0	1 (20%)	2 (40%)	2 (40%)
GoTMS required fewer steps to accomplish what I want to do without any problem.	0	1 (20%)	3 (60%)	1 (20%)
GoTMS is easy to learn how to use it.	0	1 (20%)	3 (60%)	1 (20%)
I can use GoTMS without written instructions.	0	1 (20%)	4 (80%)	0
I can easily remember how to use it.	0	1 (20%)	2 (40%)	2 (40%)
I don't notice any inconsistencies as I use GoTMS.	0	1 (20%)	2 (40%)	2 (40%)
I can recover from mistakes quickly and easily when using GoTMS.	1 (20%)	0	2 (40%)	2 (40%)
I can use GoTMS successfully every time.	0	1 (20%)	1 (20%)	3 (60%)

Table 14 below shows a table of questions on the satisfaction of using this system. For the first question asked is student satisfaction with this system. The percentage data for the agree scale was as much as 60% agree and another 40% were strongly agree that they were satisfied with the system. The second question is this system performs the way the students want it to work. Student respondents gave a disagreement scale of 60% and 40% were strongly agree. This shows a significant contrast between the two scales obtained from the respondents, indicating that the disagreement is due to the student's inexperience of how the system works, as the system is a tracking system that complies to the PG courses requirements for graduate. The third question is whether this system is needed by students in furthering their studies. As many as 80% strongly agreed with the scale and 20% agreed that they felt the need for a timely graduate system. As a result, it is necessary for them to operate as a support system and assist the student in graduating on time. The last question related to satisfaction is that this system is wonderful and pleasant to use, it was agreed by 60% of the respondents and 40% of the respondents strongly agreed with this question. Overall, the respondents are in supporting of this approach being implemented in the real system.

Table 14: Satisfaction of GoTMS

Questions	**Scale**			
	Strongly disagree (1)	Disagree (2)	Agree (3)	Strongly Agree (4)
I am satisfied with GoTMS.	0	0	3 (60%)	2 (40%)
GoTMS works the way I want it to work.	0	3 (60%)	0	2 (40%)
I feel I need to have GoTMS.	0	0	1 (20%)	4 (80%)

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GoTMS is wonderful and pleasant to use.	0	0	3 (60%)	2 (40%)

Table 15 above shows questions about system security. For the first question, the system only keeps one credential. As many as 40% of those respondents responded they strongly agree and agree that the question is completely right. Another 20% disagreed with the question since the student's system authority is limited due to security concerns. The second question concerns system user's authentication. 60% of respondents said they highly agreed, and 40% said they agreed with the level of security that this authentication technique provides. For the third question, this system allows students to login multiple websites with a single credential. The total for the disagree scale was 60% of the respondents and 40% of the respondents strongly agreed with this question. The fourth question is whether this system is safe and convenient for students to use. A total of 20% of respondents disagree and agree on the scale, indicating that they are unsure about the construction of a security mechanism for this system. Another 60% of respondents strongly agree that the system is secure and easy. The fifth question is about students preferring to use this system. As many as 60% of the respondents gave a strongly agree scale while 40% gave an agree scale to choose to use this system during postgraduate studies.

Table 15: Security of GoTMS

Questions	**Scale**			
	Strongly disagree (1)	Disagree (2)	Agree (3)	Strongly Agree (4)
GoTMS only kept a single credential.	0	1 (20%)	2 (40%)	2 (40%)
GoTMS authenticates users.	0	0	2 (40%)	3 (60%)
GoTMS allows me login multiple websites with a single credential (i.e: username and password)	0	3 (60%)	0	2 (40%)
GoTMS is secure and makes my life easier.	0	1 (20%)	1 (20%)	3 (60%)
I prefer to use GoTMS.	0	0	2 (40%)	3 (60%)

Conclusions and Future Works

The main goal in establishing the GoTMS is to provide a useful framework for every postgraduate student and management staff to meet their goals and graduate on time. The system also intends to track and monitor student development, as well as receive positive comments from management staff, lecturers, and students. Furthermore, all the respondents have given significant comments, insisting that they want the system to be used in real-time and that it will help them in graduating on time. For future work, due to the level of security, the user interface for student accounts, and usability testing being still not solid and dependable, the system will need to be modified from time to time before it can be formally implemented. In addition, the GoTMS can be improved for monitoring study plan of undergraduate student in higher learning institution.

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