Towards Developing Team Management Software for Online Freelancing Work Offices Using the Slack Collaboration Tool

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Abstract

Computers changed the way we think, learn, communicate, and recently, including the way we work. According to statistics, a lot of people are now engaging in what we now know as Online Freelance work, or what we commonly call as 'Online Jobs'. Because of this trend, employers have difficulty in managing their human resources especially if such online employees have to work in a virtual team. Therefore, this study addresses the issue on team management that is faced by different online organizations and offices nowadays. The authors come up with a solution to the manual monitoring of work teams which demands additional manpower and often difficult, costly and time consuming thus contributing to this under-researched area on virtual teams. An application was developed to monitor the working time of each employee with their respective tasks and

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projects with the use of chat commands in a particular messaging application called Slack. The authors achieved the solution by the used of evolutionary prototyping and gone through phases of analyzing, prototype developing and testing each feature before deploying it in actual online marketing agency.

Keywords: **Virtual Teams, Online Jobs, Time Tracker, Team Management, Software Engineering.**

Introduction

The idea that computers and the Internet destroy jobs is an over familiar refrain; but advances in technology have created new kinds of jobs (Thomsen, 2013). In today's business world, organizations and business firms are now taking advantage of what Information Technology (IT) has to offer in order to enhance their performance, improve their processes, cut operational costs, and gain competitive advantage. To achieve these, Greenberg, Greenberg, & Antonucci (2007) and Han, Lee, & Seo (2008) observed that organizations had started to do outsourcing or establishing virtual teams. These teams comprise of geographically dispersed groups of workers often across different time zones, a different location, organization, or at a different time, brought together by technology to collaborate interactively to achieve common organizational goals (Hertel, Geister, & Konradt, 2005) (Horwitz, Bravington, & Silvis, 2006)(Martins, Gilson, & Maynard, 2004).

While previous researches commonly focused on virtual teams as a whole with emphasis on leadership skills (Switzer, 2000)(Vaidyanathan, Sabbaghi, & Debrot, 2010) productivity of team members (Geber, 1995)(Townsend, DeMarie, & Hendrickson, 1996), trust and communication (Jarvenpaa & Leidner, 1999) (Cataldo, Herbsleb, & Carley, 2008) (Goo, Kishore, Nam, Rao & Song, 2007) (Greenberg, et.al., 2007) (Walther & Bunz, n.d.), among others things however, there is a scarcity of studies pertaining to the monitoring as well as the management of employee's attendance or time for accurate payroll and discipline within a virtual team.

As more and more Filipinos are now working online because it allows them to work anywhere, employers have difficulty in managing them especially if such online employees have to work in a virtual team. It should be noted that the number of Filipinos doing home-based online

freelancing work (commonly referred to as Online Jobs) is now closely approaching a million. This estimate is based on the combined number of Filipinos on three major online freelancing websites, namely oDesk, Elance, and Freelancer (Santos, 2014).

In many industries, online marketing agencies included, internal and external cost estimation, planning, reporting and salary payments depend on the exact recording of time and effort spent by each employee. Before, the work procedures were done by paperwork, which may cause many faults and inaccuracy of information (Relyea, 2000). To solve this, employers utilized different methods and devices such as, but not limited to, attendance cards, clock machines and registers ("A Guide to Managing Employee Attendance", 2008) (Indico, 2016). As the technology grows, Indico (2016) noted that biometric time and attendance system was being used by most companies to ensure that employees cannot clock in for one another and prevent employee time theft and buddy punching (Shahnewaz, 2015).

But rather than using the above-mentioned technologies, a lot of start-up companies instead used a software called Slack, a team collaboration tool in communicating to their clients and other employees and tracking their working time by monitoring conversations going on ("Slack", 2016). Basically, Slack is just an ordinary messenger tool just like Facebook messenger, Yahoo! Messenger or other social network messengers, except that it is a messaging application (app) for teams that is on a mission to make working life simpler, more pleasant, and more productive ("Slack", 2016).

In this paper, the authors chose Company MPMA (hereinafter MPMA), a performance-driven online marketing agency with offices located in Iligan City, Philippines; Texas, USA; and Abu Dhabi, UAE as a subject for this study since MPMA manages its team by utilizing Slack.

Problems and Objectives

Most online freelancing companies, MPMA included, are having issues in managing the working time of each employee since they are located in different places, hence encountering complications in managing the working time of each employee. While they used Slack, most online freelancing companies, if not all, do not have a database where they can store the records of each employee.

In MPMA for example, the records of each employee are stored only in a spreadsheet file, i.e. Microsoft Excel (as shown in Figure 1) by the office administrator where he manually calculates the time of each employee's clocked in and out, respectively.

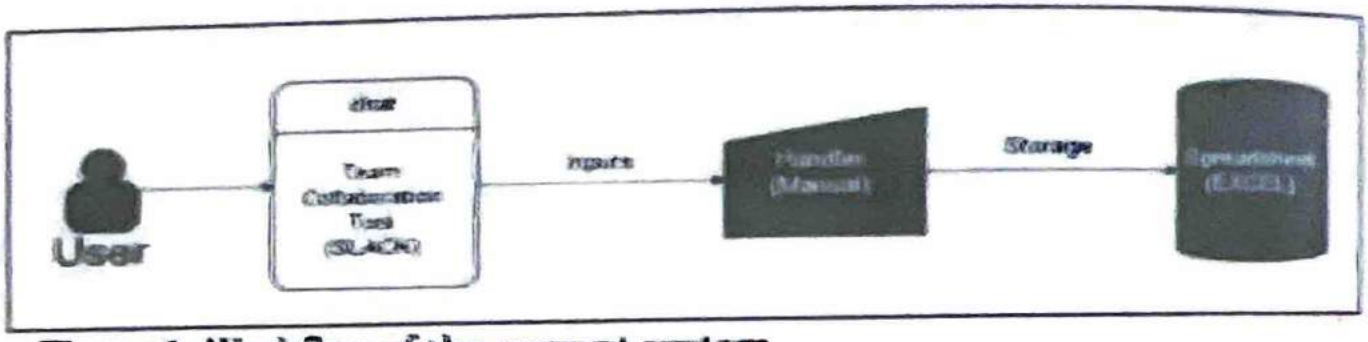


Figure 1. Workflow of the current system

Further, using biometric time and attendance system is not suitable to the company because there are also home-based employees for the reason that they are located far from the offices. So, even though they are using Slack for communication and time tracking, the company still experiences some difficulties because the employer would still need to use his account to check his employees via their respective chat commands on their channel.

If an online freelancer is employed in MPMA, he has to use Slack and must be able to abide by the commands convention implemented by the company. These commands are shown in Table 1.

Table 1. Conventional Chat Commands

Chat Commands	Implication
IN	The employee clocks in to work. The working time starts.
BRB	The employee will take a break. The working time pauses.
BACK	The employee goes back to work after taking a break. working time resumes.
OUT	The employee clocks out. The working time stops.

The following are the problems associated with the existing functionalities:

1. There is a need to access another application aside from Slack in order to track the time of each user or project;
2. It does not track the working hours of the employees including break hours and overtime;
3. It does not generate daily, weekly and monthly reports about the progress of each employee; and
4. It is difficult for the CEO and officer in-charge to monitor the performances through the time accumulated and progress reports of the employees for a certain day, week or month.

Hence, the main objective of this study is to develop a team management software that can manage the working time, projects and tasks of each user on a team in Slack thereby contributing to this under-researched area (i.e., monitoring as well as the management of employee's attendance or time for accurate payroll and discipline) on virtual teams. The application was integrated with Slack through Slack Application Program Interfaces (APIs). The user would still use the chat commands for their work status. The Command Handler, an integrated Slack Bot, will process the chat commands entered and give responses. The chat commands will be stored in the database (Figure 2) with its respective user information using Slack API. In order to identify the current location of a user, every clock in must be paired with a location. If the user failed to enter a location in clocking in, the default location would be in the office

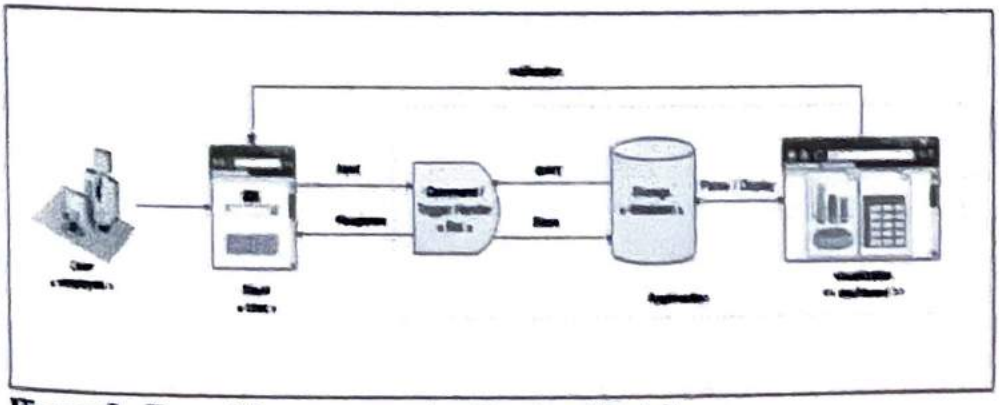


Figure 2. Team Management Application Workflow

A work extension *cron* was also incorporated which notifies if the user already accumulated eight (8) working hours and asks if the user wants to extend the current shift ("Cron", 2014). The maximum hours per shift is limited to 16 hours only and if the user fails to clock out and reach the maximum hours, his or her shift is automatically cut. A dashboard will be created where it will display and organize the data from the database, so that the information can easily be managed and monitored. Since the application is integrated with Slack, a user still has to utilize his or her Slack account in accessing the dashboard.

Methodology

The methodology used in developing the application was evolutionary prototyping. This includes four phases which are the Requirement Analysis, Prototype Development, Test and Evaluate Prototype and Deliver Prototype as shown in Figure 3. Evolutionary prototyping is best suited for MPMA as the software is developed in increments and where the researchers and developers have frequent, informal interactions with MPMA end-users so that the system can readily be modified in response to end-user and customer feedback (Carey & Mason, 1983)("Evolutionary Prototyping", 2002).

The analysis of the requirements phase allowed the authors to have a clearer view of how the application should be developed taking into consideration the client's expectations with regards to the application's features. The authors gathered specific information through observations in MPMA and through discussions with the employees who works in the office and those who are working at home. After further discussions with MPMA, some of the requested features are modified and some features were added and removed.

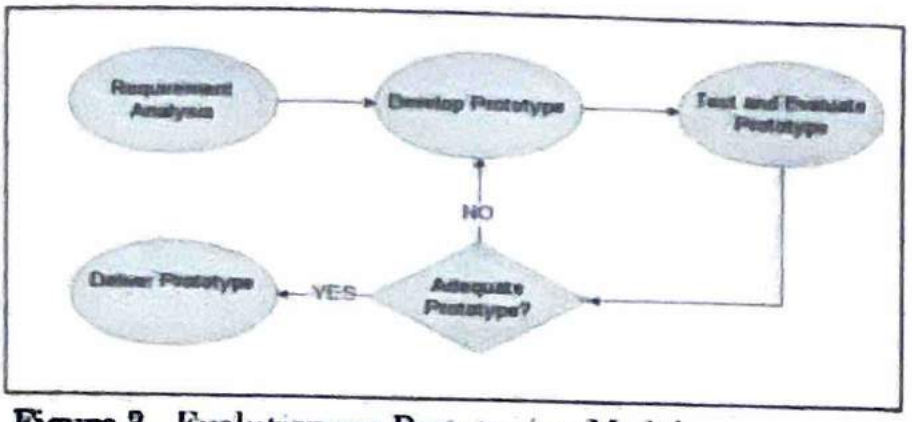


Figure 3. Evolutionary Prototyping Model

The developers then analyzed the information gathered and formulated the requirements specification of the application.

Testing and evaluation were done after the running prototype of the application was finished. In this phase, two types of testing were conducted namely: the alpha testing done by the developers, and the beta testing done by end-users. Alpha testing is simulated operational testing by potential users which are the developers ("What is Alpha Testing", 2016). After the alpha test, the beta testing was done online with the use of Google forms. In this test, the end-users tested and evaluated the application and made some suggestions.

Certain issues that affected the performance of the application were assessed and noted for further revisions and improvements. Centercode stated that "the number of testers is varied on who will use the product or application. It also states that the business products should be tested anywhere in 10 - 50 testers while minding the available resources" ("Centercode", 2009).

The developers chose testers who have background knowledge of Slack software or at least have an experience with an online job that uses time tracking applications. Two questionnaires were used to evaluate the application's functions and performance. The User Profile Questionnaire was used to evaluate the users if they are qualified to be one of the beta testers. A test user must at least have one of the following qualifications:

- Has an experience in online jobs that use time tracking applications;
- Has a background in Slack; and
- Has tried using Slack.

The Evaluation Form consists of statements that were tested and evaluated by beta testers and a rating by which they were to give based on their evaluation. The questionnaire was based on an online survey bank where respondents indicate their responses in a five-degree Likert scale (Johns, 2010). It is noted further that questions used were crafted based on the findings of several authors on virtual teams and team management (Indico, 2016) (Guzmán, Ramos, Seco, & Esteban, 2011)(Kirilov, 2016)(Doman, Besmer, & Olsen, 2015).

Results and Discussion

Requirement Analysis and Prototype Development

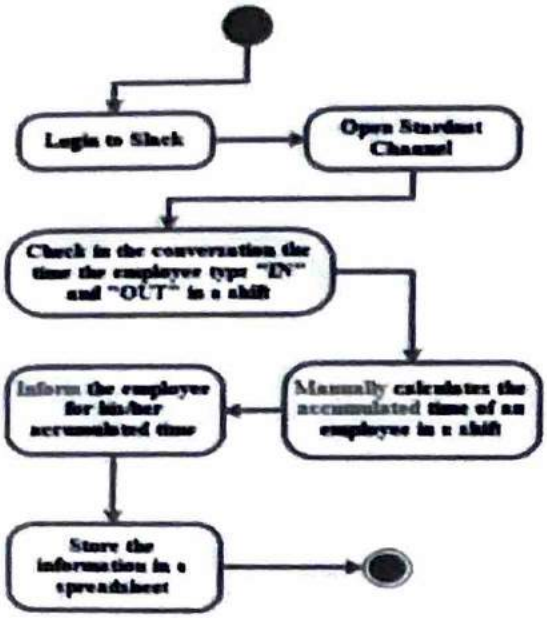
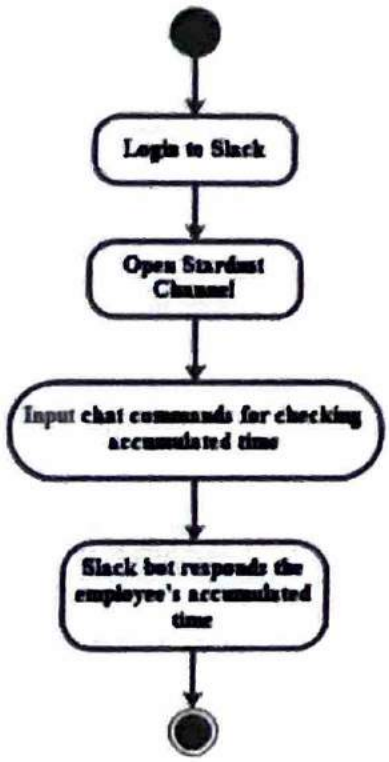
For a period of six (6) months, the developers had remained at the Iligan City office of MPMA in order to gather and understand the requirements for developing the team management application. The series of meetings and consultations were documented in order to come up a user requirements specification. After some thorough discussions with MPMA, some of the requested features for the application were modified and some features were added and removed.

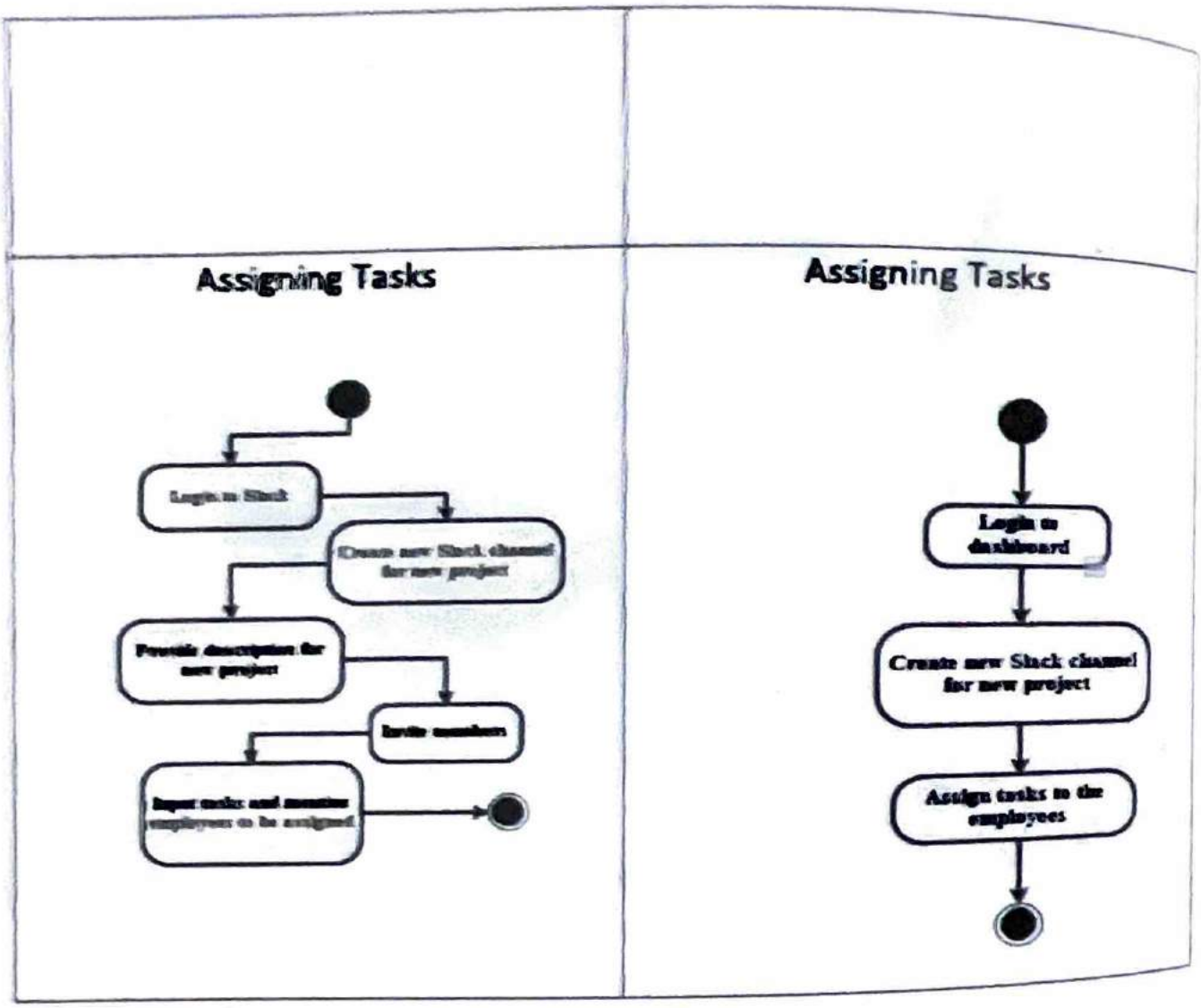
An evolutionary prototype had then developed in increments and the researchers and developers continued to have frequent, informal interactions with MPMA end-users so that the system can readily be modified in response to given feedbacks.

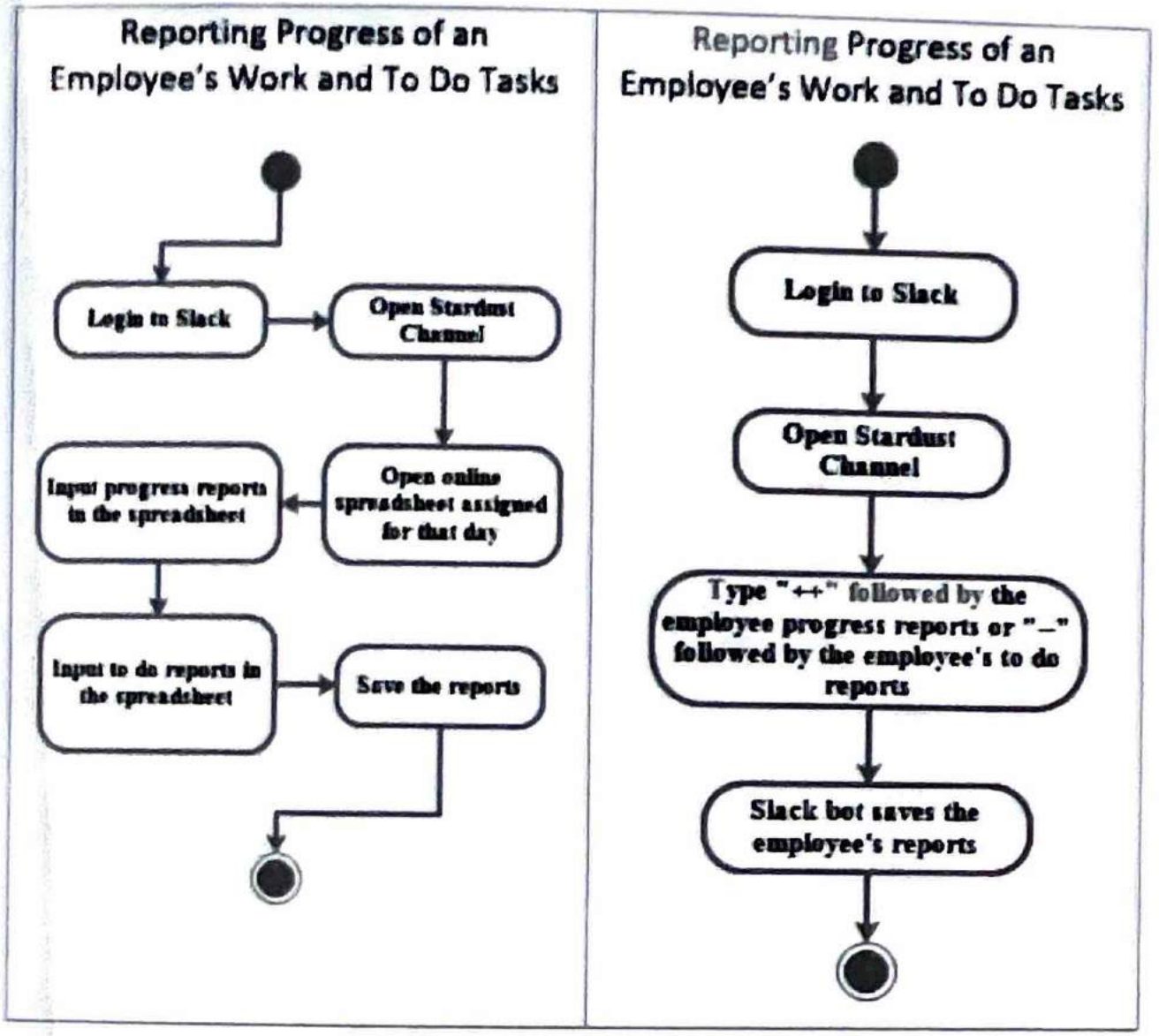
New process model

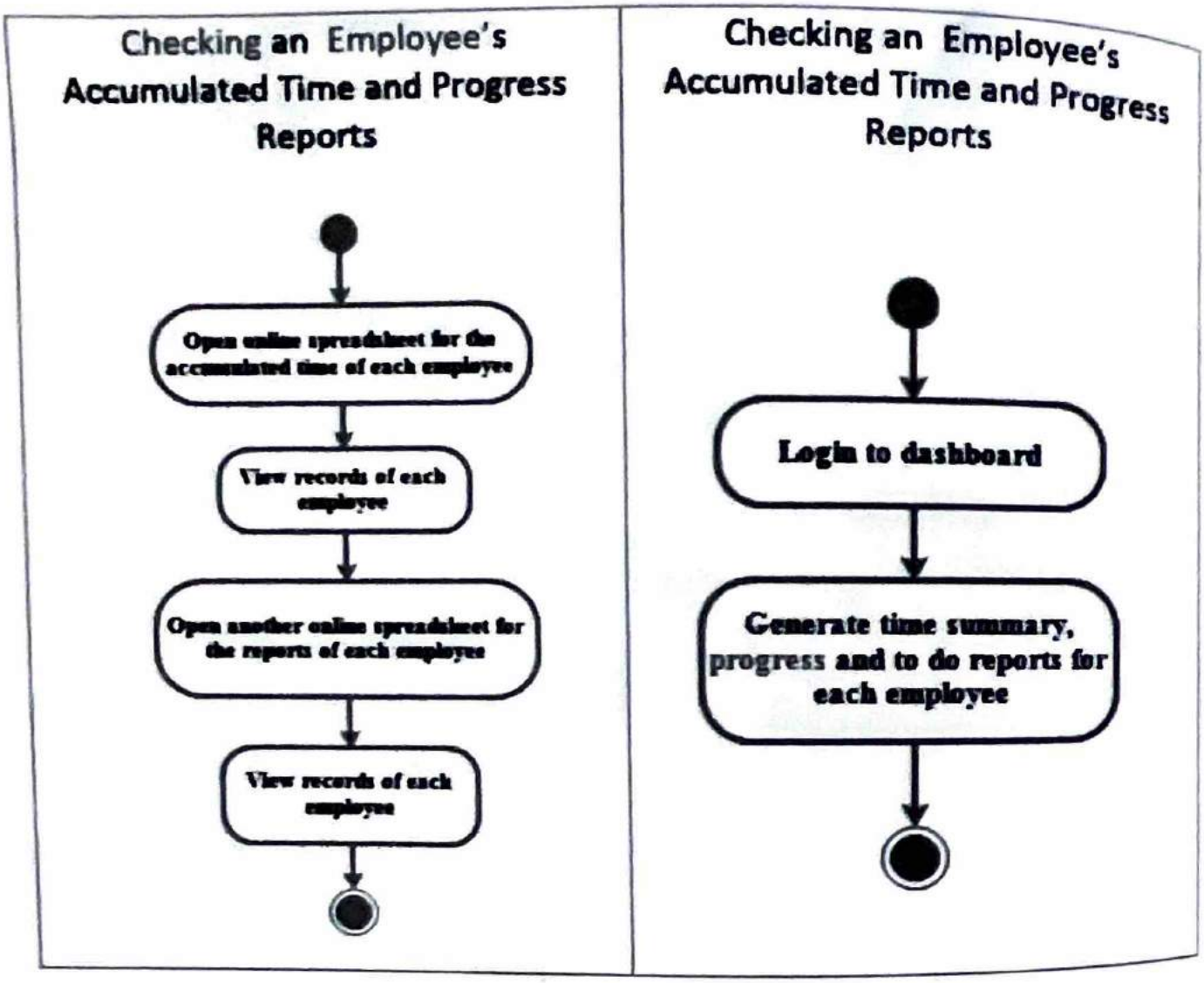
Table 4 shows the comparison of transaction between the existing system (using spreadsheets) and in Team Management Application with Slack Bot Integration.

Table 4. Existing Process vs. New Process

Existing Process	Team Management Application with Slack Bot Integration
Calculating the Accumulated Time of the Employees 	Calculating the Accumulated Time of the Employees 


Assigning Tasks
Assigning Tasks
Login to dashboard
Create new Slack channel for new project
Assign tasks to the employees


Reporting Progress of an Employee's Work and To Do Tasks
Login to Slack
Open Stardust Channel
Open online spreadsheet assigned for that day
Input progress reports in the spreadsheet
Input to do reports in the spreadsheet
Save the reports
Reporting Progress of an Employee's Work and To Do Tasks
Login to Slack
Open Stardust Channel
Type "++" followed by the employee progress reports or "--" followed by the employee's to do reports
Slack bot saves the employee's reports



Hence, Table 4 does not only show that the team management application makes the process flow more efficient but also shows how it makes the process more accurate and secured. Moreover, Table 5 below compares the manual management system and the Team Management Application with Slack Bot integration as to the time spent for each process or procedure. This makes managing the employees' working time, tasks and schedule faster.

Table 5. Manual Management System vs. Team Management Application

Flow of the Manual Management System of MPMA	Time Spent	Flow of the Team Management Application with Slack Bot Integration	Time Spent
Manual calculating the accumulated time of the employees and storing them in an online spreadsheet	24 hours	Automatically calculates the accumulated time of the employees and storing them in the database	Less than a minute
Assigning tasks in Slack	3 minutes	Assigning tasks in the dashboard	2 minutes
Reporting progress of employee's work and To Do tasks in online spreadsheets	10 minutes	Reporting progress of employee's work and To Do tasks in Slack using commands	5 minutes
Checking employees' accumulated time and progress reports in online spreadsheets	10 - 15 minutes	Checking employees' accumulated time and progress reports in the dashboard	3 minutes

Hence, with the developed Team Management Application with Slack Bot Integration, unnecessary processes or steps are eliminated such as the following: the manual calculation of accumulated time and using online spreadsheet for the information; inviting all members and mentioning the specific users for the assigned task; accessing of the Online Spreadsheets for a certain day; and accessing separate online

spreadsheets for the accumulated time and progress/to do reports of the employees.

Testing and Evaluation of Functionality of the Application

An evaluation test was done to guarantee its functionality as planned and to find out and solve unexpected problems.

A test was done to determine the end users satisfaction in using the application. A survey was done to 16 respondents which responded by indicating their level of agreement with each of the statements in a five-degree Likert scale (Strongly agree to Strong disagree).

Out of 16 respondents, seven (7) have a background with Slack software and nine (9) have experience with an online job that uses time tracking applications. They were asked to evaluate the application in terms of its interface and functionalities. Testers that have a background with Slack software were given administrator accounts and the others were given standard user accounts for testing.

The following are the visual presentations of the results of each statement:

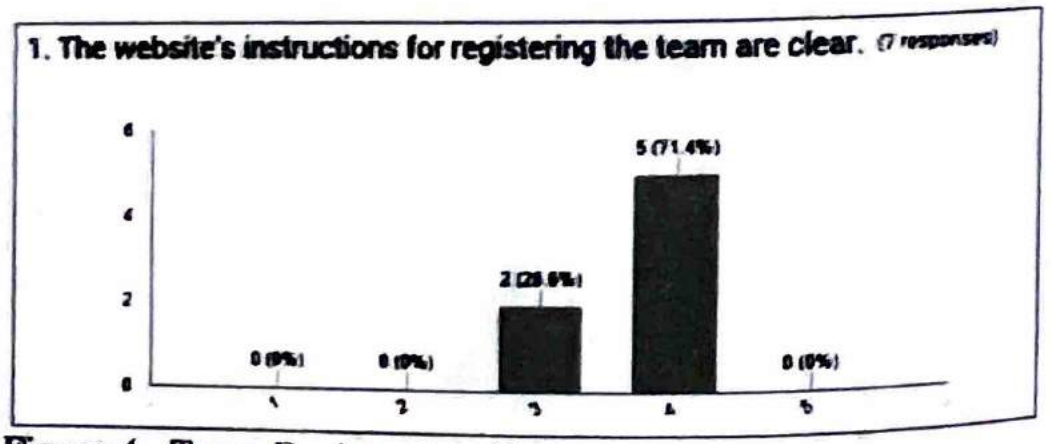


Figure 4. Team Registration Test

The seven (7) respondents who have a background and experience with Slack were given administrators accounts and were then asked to test the team registration. Based on Figure 4, 71.4% agreed that the website instructions for registering the team were clear.

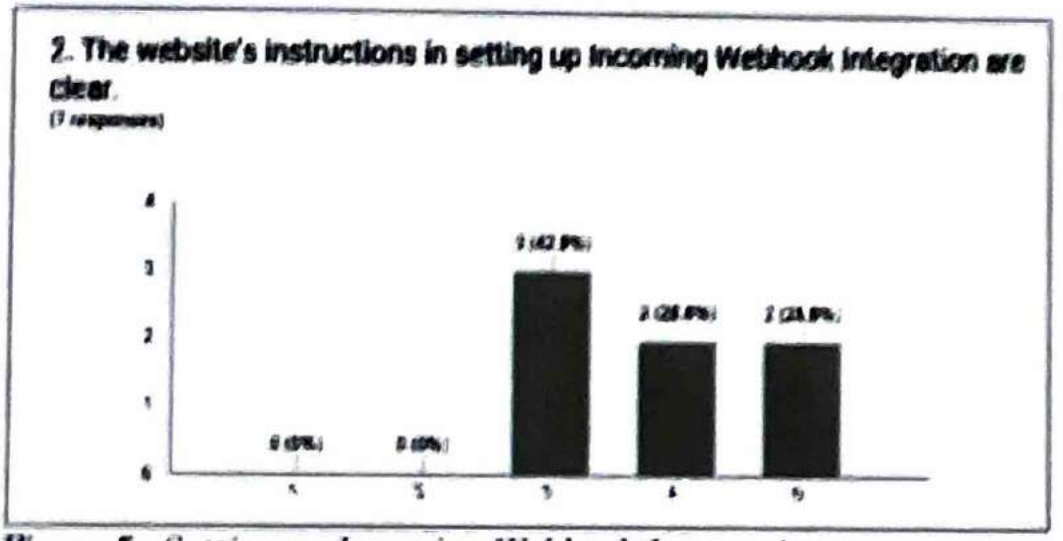


Figure 5. Setting up Incoming Webhook Integration

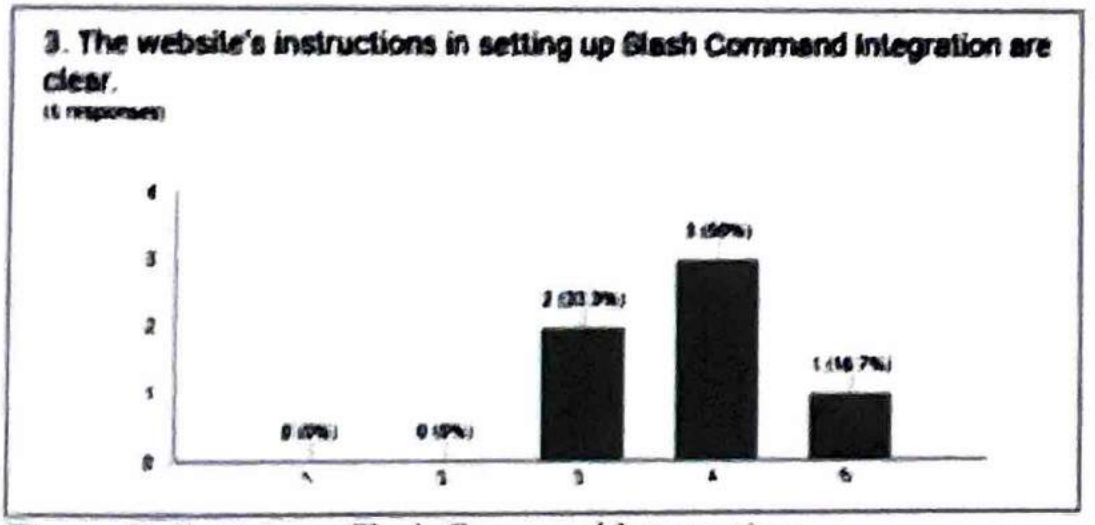


Figure 6. Setting up Slack Command Integration

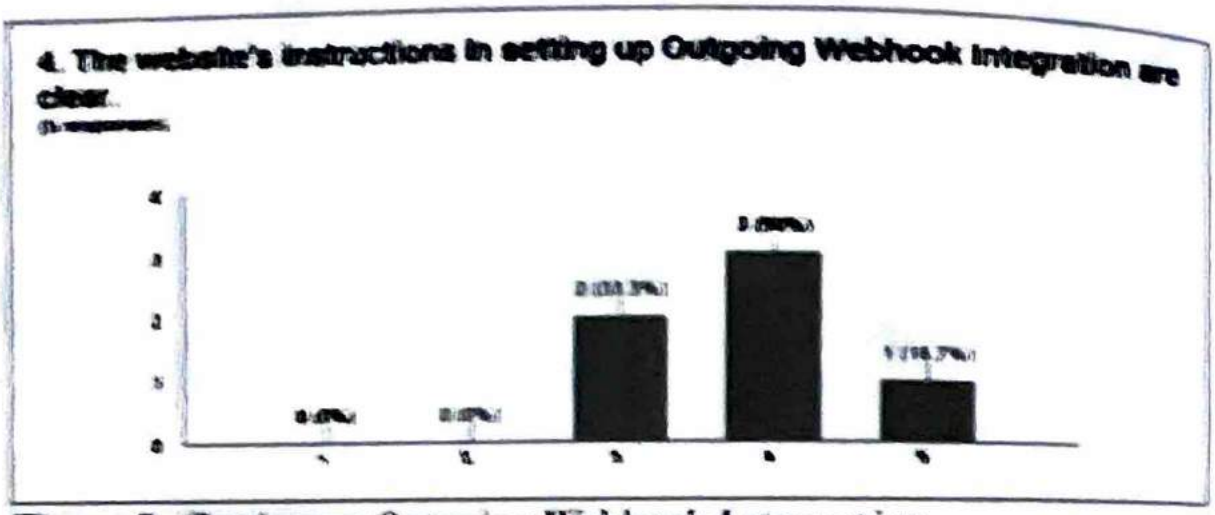


Figure 7. Setting up Outgoing Webhook Integration

Based on Figures 5, 6 and 7, 50% of the respondents agree that the instructions for setting up the Incoming Webhook integration, Slash Command integration and Outgoing Webhook integration in the website were clear.

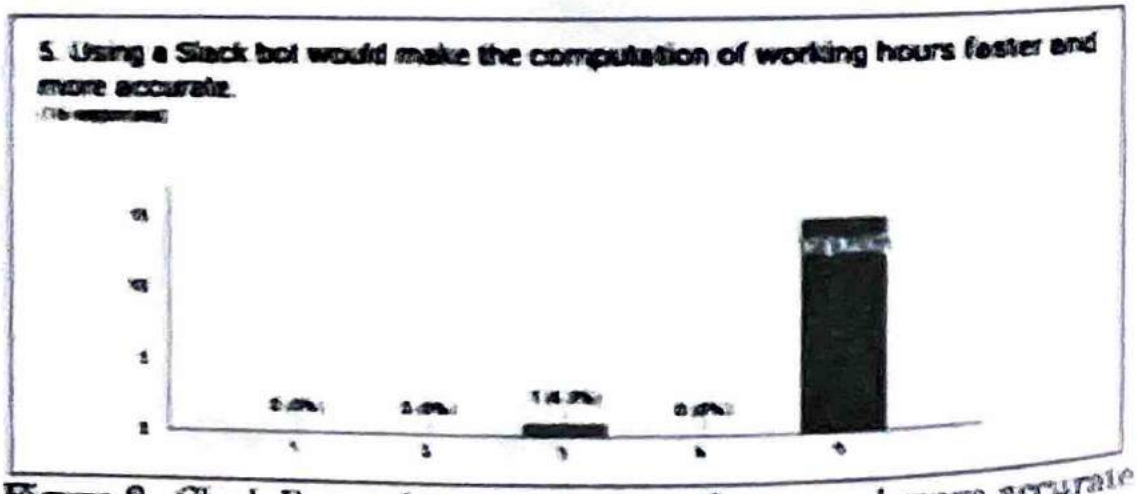


Figure 8. Slack Bot makes computation faster and more accurate

In figure 8 above, 93.8% of the 16 respondents strongly agreed that using a Slack Bot makes the computation of the working time of each employee faster and more accurate.

Further in Figure 9, out of 16 respondents, 68.8% strongly agreed that using a database for the records instead of a spreadsheet would make the information more secured.

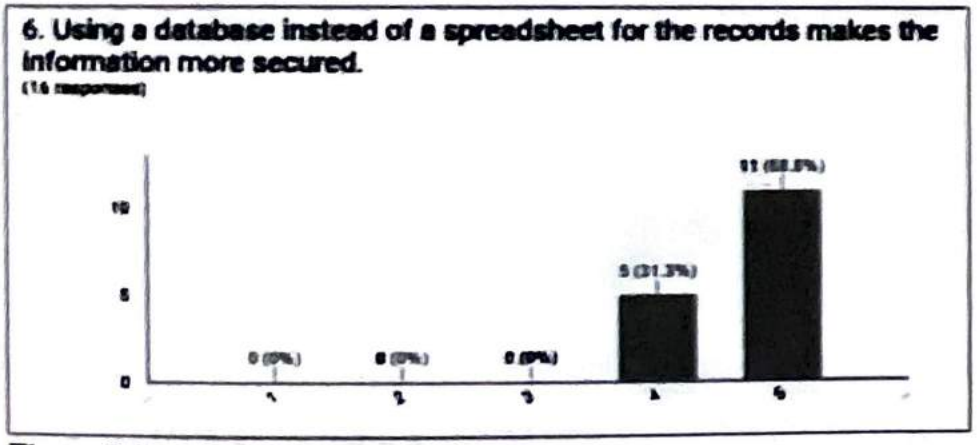


Figure 9. Database over spreadsheets

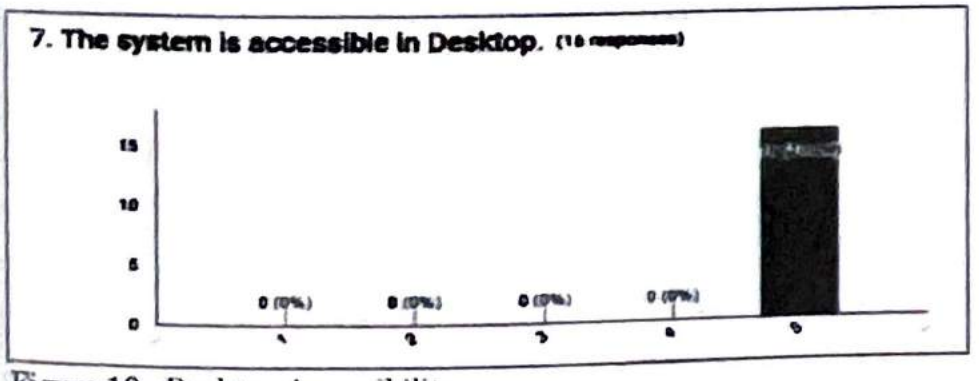


Figure 10. Desktop Accessibility

On the accessibility of the application, out of 16 respondents, 100% strongly agreed that the system is accessible in desktops (see Figure 10). 87.5% strongly agreed that it is also accessible in mobile devices (see Figure 11) and 81.3% strongly agreed that they accessed it in tablet devices (see Figure 12).

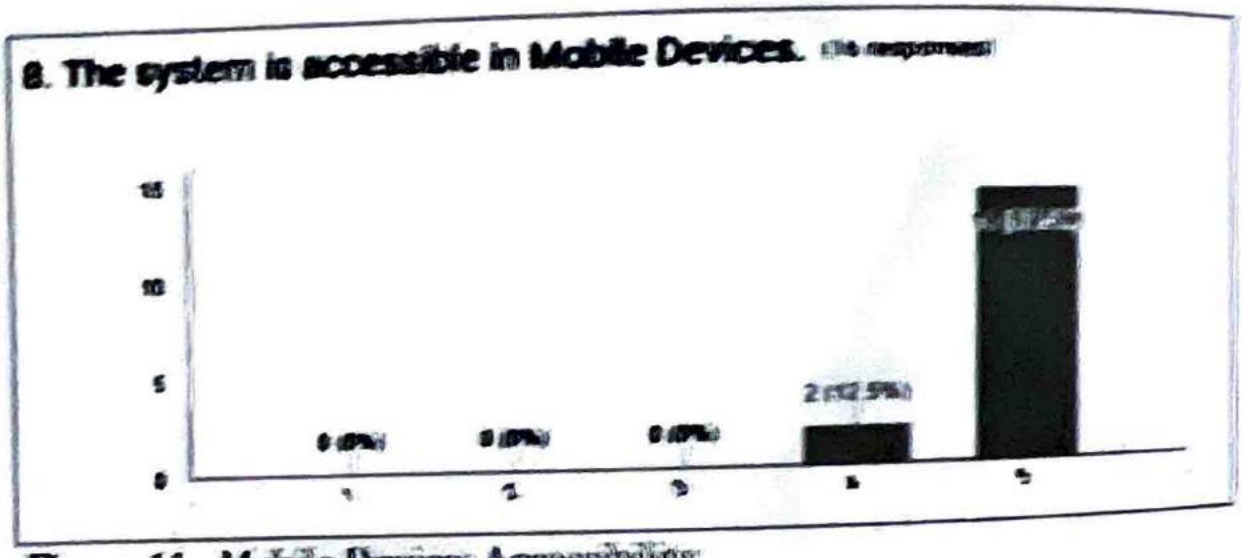


Figure 11. Mobile Devices Accessibility

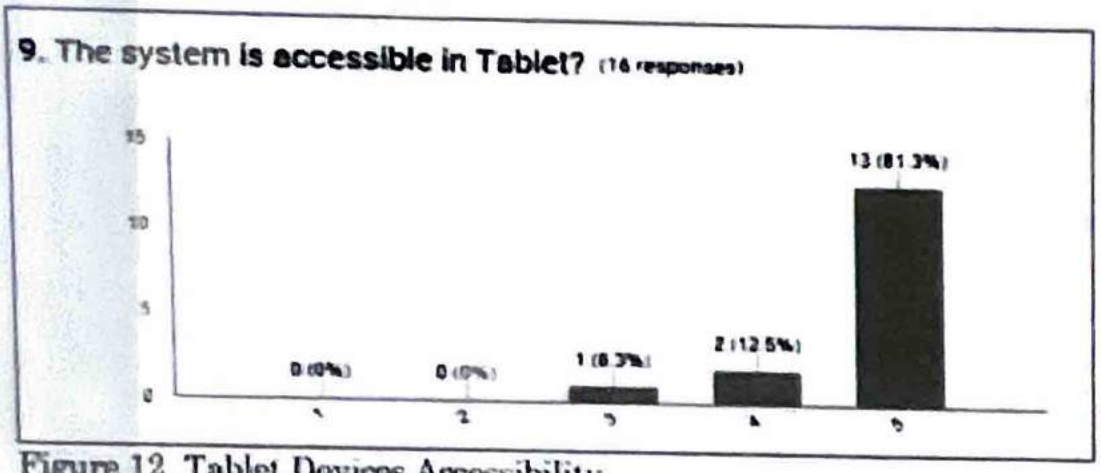


Figure 12. Tablet Devices Accessibility

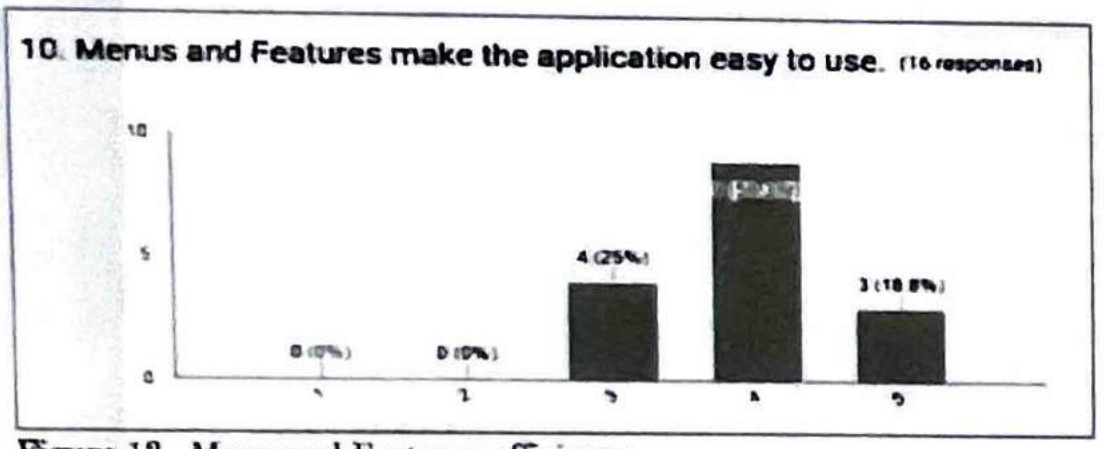


Figure 13. Menu and Features efficiency

Figure 13 above shows that 56.3% of the respondents agreed that the menus and features in the application were easy to use. Thus, it makes the application efficient.

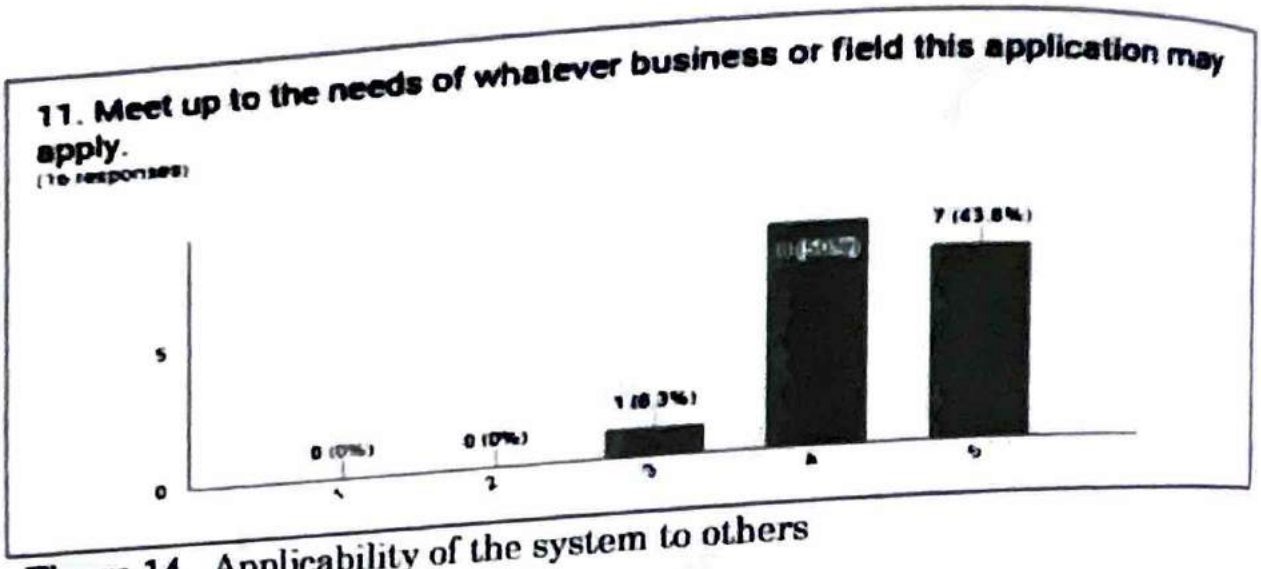


Figure 14. Applicability of the system to others

Based on figure 14, 50% of the respondents agree that the system can also be applicable to other business or fields and 43.8% strong agreed with this statement.

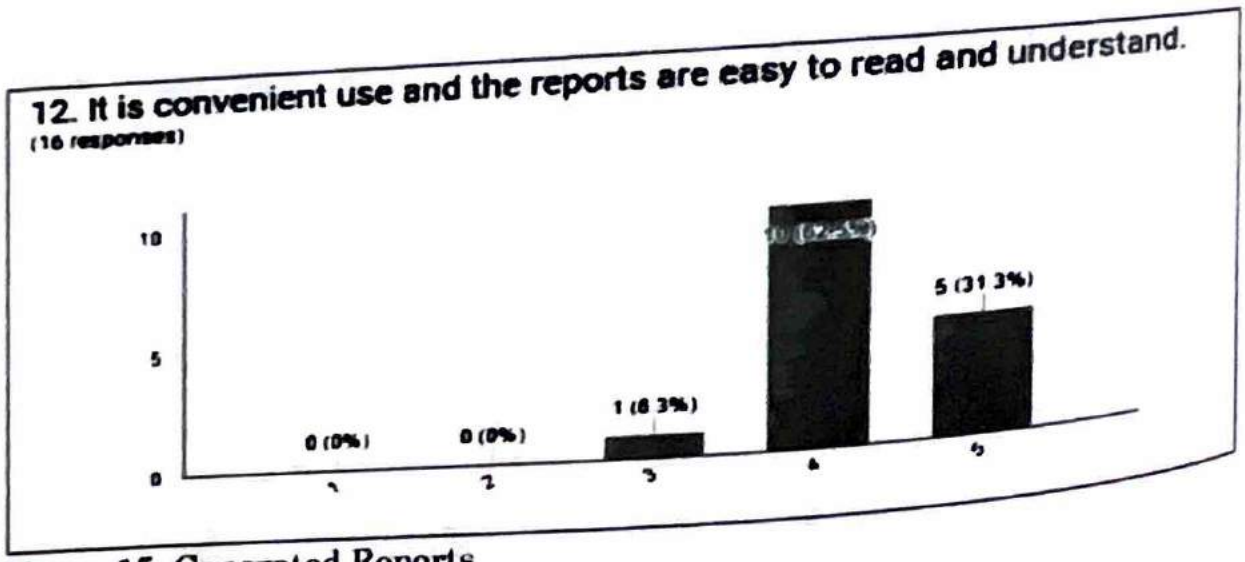


Figure 15. Generated Reports

Based on the responses, 62.5% agreed and 31.3% strongly agreed that the generated reports were convenient and easy to read and understand. (see Figure 15)

Lastly, figure 16 shows that 62.5% of the respondents strongly agreed and 31.3% agreed that the graphics, media elements and contents in the website are clear and appealing.

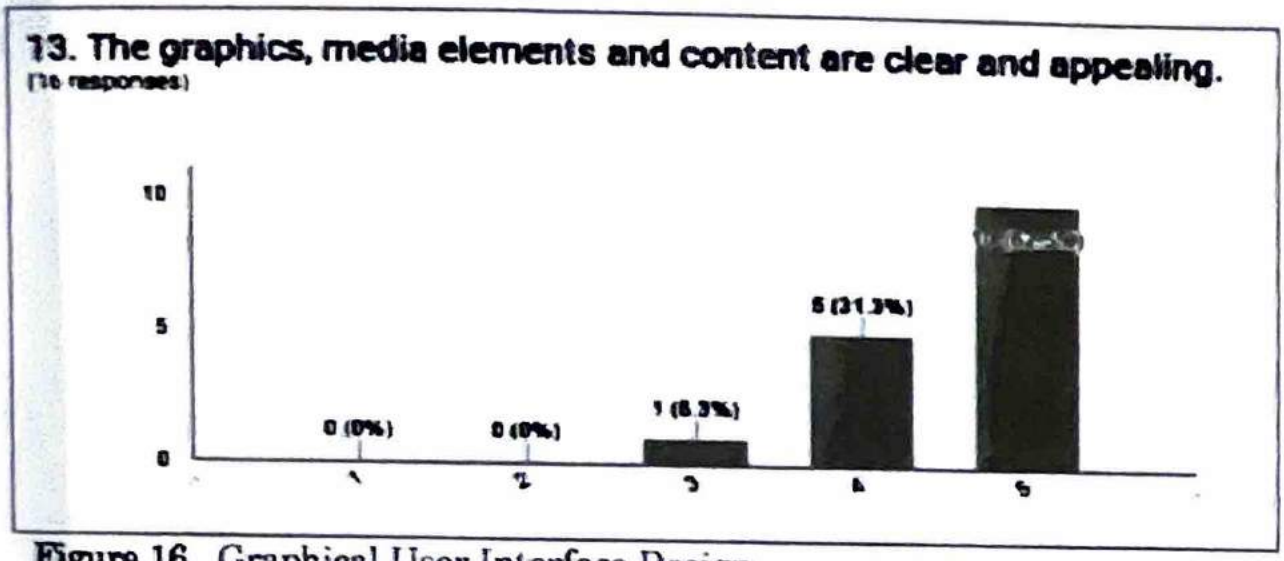


Figure 16. Graphical User Interface Design

The test shows the mode rating of the system from 16 respondents. The test shows that most of the testers strongly agree that the Slack Bot is capable of making computations of working hours faster and more accurate, especially with the use of a database rather than a spreadsheet. Such would also make the information more secured. Most of the respondents also strongly agree that they are comfortable with using the new application compared to the previously used one. The application is accessible in desktop, tablet and mobile devices.

The authors put the application into testing for two weeks. User testing was done through data inputting, updating, deleting and viewing of data from the application. Both valid and invalid inputs have been considered and the outputs were recorded.

The testing phase of the implemented application was crucial in determining the ease of use of the application proven by the end users. Based on the results of alpha and beta testing done by the developers, the entire functionalities of the application were tested and consequently, showed that the system functions as intended.

Conclusions and Directions for Further Research

Being in the online community, it is indeed a problem to manually monitor the performance of a work team as mentioned by Guzmán, et. al. (2011). Hence, there is a need to develop a software to help the employers solve this particular problem. This Team Management Application is a web-based application with Slack Bot Integration as well as free software developed for Online Freelancing Companies to improve the speed and accuracy of time tracking computations and generation of daily, weekly and monthly reports and to organize project and tasks assignments and schedules.

Based on the study conducted, the authors have further made the following conclusions: most of the time tracking computations of online freelancing companies such as MPMA were done manually which could be a tedious and slow process and can also be prone to human errors and data manipulations; with the Team Management Application integrated with Slack, there is no need to access another application aside from Slack in order to track the time of each user or project — the application uses the Slack Bot to monitor the working hours, break hours and overtime of each user, to generate daily, weekly and monthly progress reports and to manage the assignment of tasks and projects; and based on the survey and test conducted, it showed satisfactory results — the application being deployed and utilized in MPMA for a period of two (2) weeks for testing purposes. Thus, this software helped the company efficiently managed their work teams.

However, while this research constitutes an initial step toward a better understanding in the area of monitoring as well as the management of employee's attendance or time for accurate payroll and discipline within a virtual team, it raises many questions and concerns that need to be addressed in future research. In the developed application itself, the authors would like to challenge future researchers to enhance the user interface (UI) for mobile and tablets, to fully support touch screen functionalities across different browsers as researches nowadays are geared towards mobile computing; improve the interfaces of reports and graphs as visualizations are also imperative in data analytics research; allow user to change view on dashboard reports based on selected time zone; add a secured reset/forgot password functionality; and add features for employers to view records of disabled team member

accounts on dashboard. Further, researchers from different fields may also propose new theoretical approaches than the evolutionary prototyping in order to efficiently develop team management applications.

Lastly, we hope that the ideas and preliminary results put forth in this paper will motivate researchers on virtual teams and online freelance work offices management to move beyond the development and implementation of a team management software and study the efficiency of this application to other online freelancing work offices and the observation as to its performance be done in a longer period of time. We also hope that this paper may serve as a starting point for empirical research on monitoring and management of virtual teams which remains a relatively unexplored area in our field.

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