AGENT-BASED MONITORING & MANAGEMENT SYSTEM: UNIVERSITI TEKNOLOGI PETRONAS (UTP) GRADUATE ASSISTANTSHIP CLAIM PROCESS

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BUSINESS INFORMATION SYSTEMS

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Agent-based Monitoring & Management System:
Universiti Teknologi PETRONAS (UTP) Graduate Assistance (GA) Claim Process

By

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Dissertation submitted in partial fulfillment of
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BACHELOR OF TECHNOLOGY (Hons)

(BUSINESS INFORMATION SYSTEMS)

December 2012

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CERTIFICATION OF APPROVAL

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CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein has not been undertaken or done by unspecified sources or persons.

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TRINH TUAN DUONG

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ABSTRACT

This project investigates the process of allowance claiming which is done monthly by Graduate Assistants (GA) in Universiti Teknologi PETRONAS (UTP) and that eventually leads to the development of a Web-based system called "Agent-based Monitoring & Management System: Universiti Teknologi PETRONAS (UTP) Graduate Assistance Claim Process" (GACMS) in order to digitalize each and every step involved in that process. The main objective is to overcome problems such as human error, manpower waste and inconvenience caused by the manual approach, which is currently used. Moreover, in order to enhance system's capability, Multiple Agent Based (MAB) theory will be applied so that GACMS can be a smart personal assistant system that facilitates each step in the procedure.

Prior to development, a comprehensive research was conducted within the GAs' community to assess project's necessity and received strong support from participants. Furthermore, it is necessary to emphasize that the project is developed using prototyping methodology for better alignment with dynamic change of requirements from users. Thus, it's believed that GACMS, once implemented, will become a helpful platform to further boost up efficiency and productivity of allowance claiming process.

ABREVIATIONS AND NOMENCLATURES

UTP	Universiti Teknologi PETRONAS
CGS	Center of Graduate Studies
HoD	Head of Department
MSc	Master of Science
PhD	Doctor of Philosophy
GA	Graduate Assitant
GACMS	Agent-based Monitoring & Management System: Universiti Teknologi PETRONAS (UTP) Graduate Assistance Claim Process
MAB	Multiple Agent Based

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CHAPTER 1
INTRODUCTION

1. BACKGROUND OF STUDY

Over last 20 years, World Wide Web (WWW) has become backbone for the Internet as it keeps recreating itself regularly [1]. Along the history, many Internet based products such as Web 2.0, Cloud Computing and Web portal have changed the way we live everyday. Web portal, though not a new approach, still posed a great improvement in productivity of community, group and organization. Under the scope of higher education, many manual procedures such as course registration, academic result monitoring etc. can be done easily using Web portals. In Malaysia, portal concept is broadly used at most of universities and colleges including Universiti Malaya (UM), Universiti Sains Malaysia (USM), Universiti Teknologi PETRONAS (UTP) just to name a few.

In UTP, however, typical Web portals such as the e-Learning and PRISM are meant for the academic sector and only profit undergraduate students. Meanwhile, the number of Graduate Assistants (GAs) and researchers is dramatically increasing, as UTP is moving toward the Research University (RU) status. That brings to the university not only benefits but also lots of difficulties in management that still not be covered by any system. Monthly allowance claiming for GA is one of those.

Hence, Agent-based Monitoring & Management System: Universiti Teknologi PETRONAS Graduate Assistance Claim Process (GACMS) – which is a combination of Web portal and agent-based framework will be developed throughout this project to assist each party involving in the allowance claiming process.

2. PROBLEM STATEMENT

2.1. Problem Identification

Base on background study stated in previous sections and observation from the operation of Center for Graduate Study (CGS) in UTP as well as experiences shared from some GAs, it's concluded that there are several common issues regarding the allowance requesting procedure:

- By 15th of each month, each GA has to submit a form (UTP/PPS/003-A) to CGS Office stating clearly all the finished work such as laboratory demonstration, tutorial session together with daily research activity. In order for each form to be approved, lecturer/supervisor must manually check one by one and pass to Post Graduate Coordinator for signing. After that, GAs must have their forms endorsed by Head Of Department (HOD) and CGS Office before receiving their allowance. So, the form needs to be filled once but examined manually five times by five different parties.
- It is easy to see that lots of time has been wasted by using the traditional method, not only in processing but also in delivering the form between various places. Moreover, human resource is also not utilized effectively in this procedure. From an interview with Associate Professor Dr. Mohd Fadzil Hassan, Dean of CGS, it's clear that there is one staff under his division and another staff from Finance Department dedicatedly assigned to take care of the claiming process.
- Human errors are unavoidable as everything is carried out manually. When mistake is made, the procedure must be started all over again.
- There are unexpected situations in which some claims cannot be submitted on time. For instance, GAs or their lecturer/supervisor are travelling for work or having medical leave etc. Consequently, the issue gets bigger as it's impossible for a claim to be carried forward or pre-dumped.
- Administration people (HOD, CGS Dean) do not have any tool or method to monitor this process or assess GAs' performance.

2.2. Significance of the project

The final product of this project – GACMS – will:

- Digitalize the allowance claim process to save up time, human resource and reduce error.
- Provide a platform that enables the administration side to monitor performance of GAs as stated in their claims.
- Assist stakeholders to accomplish their tasks on time by email notification.
- Be available online so there is no installation required and users can gain access anytime, anywhere.

3. OBJECTIVES OF THE PROJECT

The objective of this project is to:

- To minimize hassle of GAs and administration people in handling the process of monthly allowance claim and save associated cost.
- To eliminate the duplication and improve information control by migrating related data currently saved as excel files to database server.
- To assist user by reminding them before due time of each step in the process.
- To present a historical summary of GAs' work fulfillment in smart-chart that aids lecturer, supervisor, HOD and CGS Office with decision-making.
- To integrate Web Portal platform with agent-based model to produce a smart system.

4. SCOPE OF STUDY

First of all, it's important to notice that GACMS is designed exclusively for UTP, especially for CGS Office.

Secondly, the system will contain most updated data of all stakeholders' info or association between different involving parties. It also produces default accounts varying from one user to another so no registration is needed.

Besides, a Content Management System (CMS) will be built as the backend for the administrator from CGS to manage system's data.

Last but not least, GACMS will be available online upon completion to facilitate any remote access of users regarding the allowance claim process. Further development may diversify the project into different mobile platforms to improve convenience and mobility.

5. RELEVANCY AND FEASIBILITY OF THE PROJECT

5.1. Relevancy

Core idea of this project comes from an existing problem so GACMS is built to be a solution. On top of that, an extensive research comprises of survey and interviews were conducted on target users including CGS Dean, GAs among others to double confirm the relevancy of the system. Result of this research, which is discussed with greater details in coming chapters, shows a high demand and strong support from stakeholders.

5.2. Feasibility

Technical feasibility:

- The system is written in PHP programming language with Eclipse Indigo as Integrated Development Environment (IDE). Hence, modularization, outsourcing and delegation can be done at a great ease since both IDE and the language are widely used open source tools.
- Content Management System is specialized based on project's requirement. This shortens the learning curve for developer and user.

Organizational feasibility:

- Users are not required to create any account to make use of GACMS. Instead, they can use either matrix Id (for GA) or PETRONAS email (for staff) as log in identity and start using right after the system is up online.

- Currently in UTP, most of academic issues are resolved on web-based systems. Thus, our product will not require much of training or guidance thank to users' familiarity.

Economic feasibility:

The project only needs very basic resources throughout its life cycle. Literally, those are the sunk cost that any system should require:

- Payment for developer
- Cost to set up a web server and buy domain name

Timing feasibility:

Based on the size and the number of compulsory modules, the estimated time to complete the first prototype is late December 2012, which is well aligned with planned time frame.

CHAPTER 2
LITERATURE REVIEW

1. BUILDING A UNIVERSITY WEB PORTAL

It would be hard to find a campus where someone—whether in university management or in an academic department—has never used a Web portal; it's so popular that some people even use without knowing.

Though they are widely used, the success of portals depends heavily on how the university perceives it. But one obvious reason for deploying portals is to improve productivity by increasing the speed and customizing the content of information provided to internal and external constituencies. Portals also serve a management function by dealing with information glut in an organized fashion. In some ways, portals offer a technical solution, but not a total answer as they are usually lack of crucial assistive abilities such as autonomy or pro-activeness [2].

Beyond institutional gains, portals benefits students, faculty members, staff members, and external stakeholders by:

- Online Web interface with information about courses, grades, class schedules and so forth.
- More effective communications between staffs and students.
- Simplified course management tools

2. USAGE OF WEB PORTALS IN UTP

2.1. UTP e-Learning

Content (shown in figure 1) [3]:

- The system provides information for subjects that student has registered; this is a channel for lecturer and administrations to communicate with their students.
- Users can view, download resources or join discussion groups.

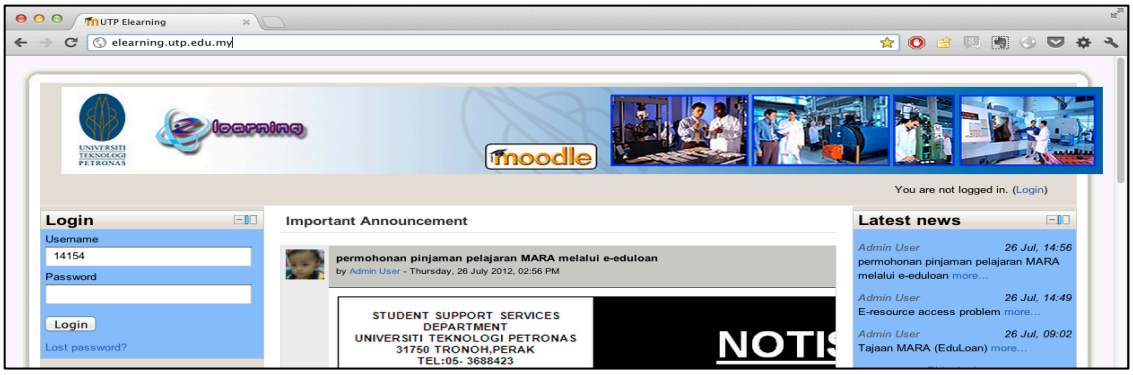


Figure 1: UTP e-Learning

Strength:

- A comprehensive academic approach for student to be aware of all events related to theirs course or information from the university authorities.
- Powered by Moodle, world most well known Course Management System.

Weakness:

- Is useful only to undergraduate student

2.2. UTP PRISM

Content (shown in figure 2) [4]:

- PRISM enables students to register for new semester, check hostel status and download academic result etc.
- This system maintains students' bio-data.
- Information and online application for industrial training is provided here.

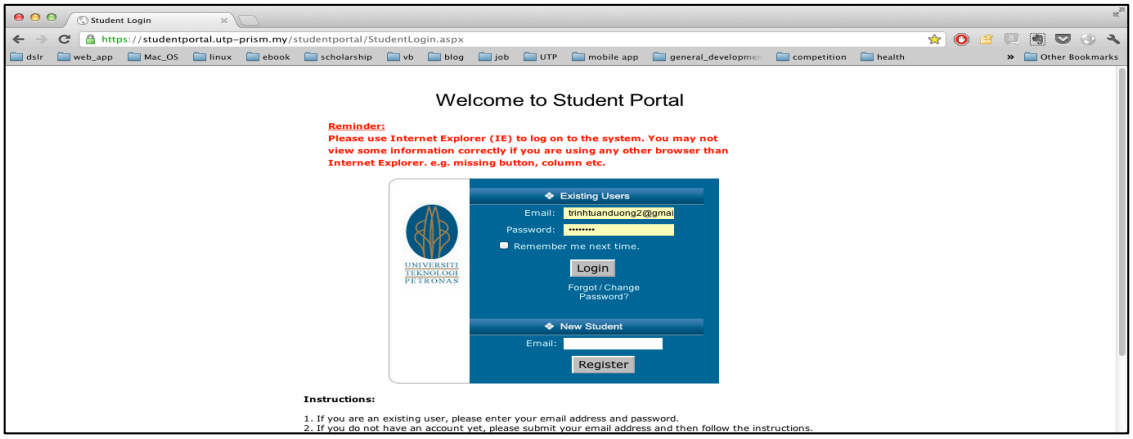


Figure 2: UTP PRISM

Strength:

- Assist students with the pre-class (registration) and post-class (result) work
- Very useful during internship period, students can get list of potential company and submit progress report through this portal

Weakness:

- Serve only undergraduate student.

It's easy to realize that both portals currently used in UTP are helping only undergraduate students. That was not a big deal few years back when the university had just a handful number of GAs. But thing has changed and post-graduate students are in need of such systems. That is where GACMS targets to fill in.

3. DIFFERENT CLAIMING SYSTEMS IN THE MARKET

3.1. C2Trak

Content (shown in figure 3) [5]: medical claim system for enterprise

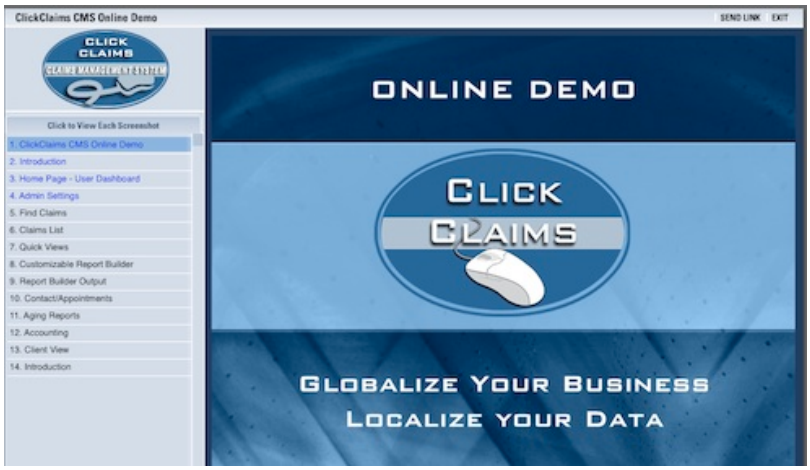


Figure 3: C2Trak System

Strength: interactive and easy to use.

Weakness:

- Only suitable for medical claim purpose
- Developed for Windows platform, installation required

3.2. HRA Claims Monitoring

Content (shown in figure 4) [6]: medical claim system for enterprise

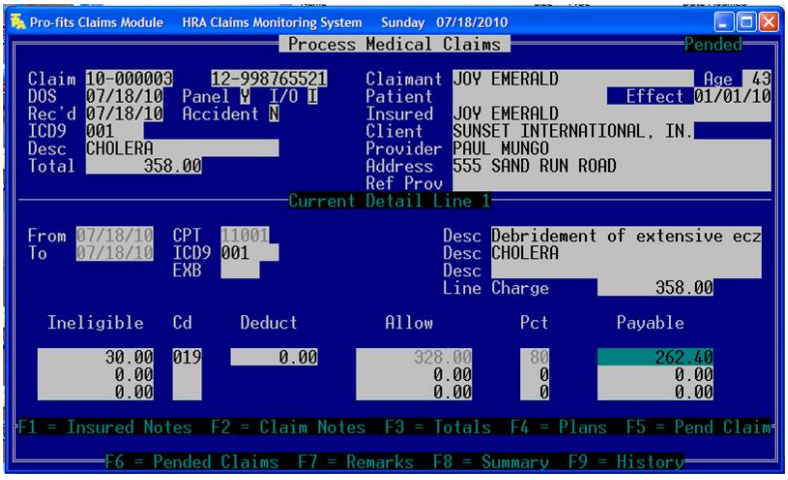


Figure 4: HRA Claiming System

Strength: small size and easy to use.

Weakness:

- Only suitable for medical claim purpose
- Windows platform, installation required
- Not intuitive interface.

3.3. Metrix

Content (shown in figure 5) [7]: medical claim system for enterprise.

Figure 5: Metrix Claiming System

Strength:

- Small size,
- Interactive and cross-platform (Web-based)

Weakness:

- Only suitable for medical claim purpose

As GA allowance claiming is a very specific process in UTP so it's hard to find a ready-made system to resolve the problem. Existing claiming systems mostly focus on medical claim and contain many drawbacks that make them not applicable in this situation.

4. MULTIPLE AGENT-BASED (MAB) SYSTEMS

An intelligent agent is generally regarded as an autonomous object, which senses and acts in some environment and an agent-based system is the one in which the key abstraction is agents [8]. Agent-based systems have properties [9-12]:

- Autonomy: agents possess some state and make decision based on the state without intervention of other agents
- Reactivity: agents can perceive the surrounding environment and can react to it;
- Pro-activeness: not only responding the environment, agents can even initiate the goal-oriented action.
- Social ability: agents interact with other agents and engage in social activities via some kind of agent-communication language.

In this project, for example, we expect GACMS can independently produce an executive report about the performance of GAs and the unsolved cases in a specific month and deliver to authorities automatically. That is the meaning of autonomy. Additionally, the system should be able to response promptly to unexpected circumstances such as there are too many connection at same time. That is reactivity. Besides, GACMS is expected to do some pre-compiled task like sending notification email to GA who did not fill in the form after a specific day of that month. That describes the word ‘pro-activeness’. Lastly, this system should be capable of interact with other system, firstly in UTP, whenever there is a change in data of user, for instance. So GACMS can engage in social activity.

5. APPLY AGENT-BASED CONCEPT INTO GACMS

5.1. Smart chart

PHP scripts will be used to gather and refine data from databases and pass mined data into a special tool to generate Flash (.swf) charts and graphs. This tool is a PHP library named PHP/SWF Charts; it makes the best of both the PHP and SWF worlds: PHP scripts provide integration, and Flash provides the best graphic quality (shown in figure 6).

GACMS, in this scenario, has become an intelligent system that plays role of executive assistant tool.

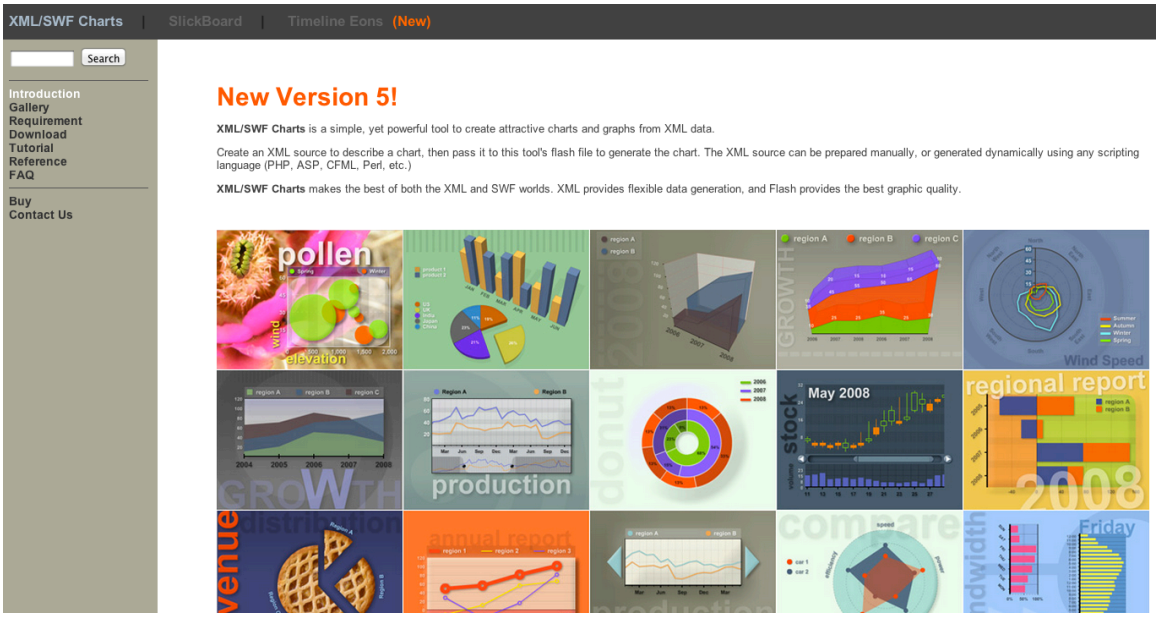


Figure 6: PHP/SWF Charts

5.2. Reminding email

Another PHP library name PHPMailer (shown in figure 7) might be utilized to send reminding email to each user notifying about the due time as well as action should be taken by him/her. This feature makes GACMS an autonomous system where it can perceive the surrounding factors like user or time to make necessary move.

Figure 7: PHPMailer

CHAPTER 3
METHODOLOGY

1. RESEARCH METHODOLOGY

Before designing and implementing the project, an intensive study regarding literature review and background information was carried out via various available sources such as Internet, books and journals. These channels are accessible personally as well as from Information Resource Center (IRC), UTP.

Interviews and questionnaires regarding the proposed topic were also conducted both at post-graduate students' and administrations' side. After that, data analysis was carefully performed to reinforce the relevancy before project's implementation.

Last but not least, after deployment phase, feedbacks and comments are to be collected from users to ensure the efficiency of this system.

2. DEVELOPMENT METHODOLOGY

When the business model is likely to be modified as the project proceeds or when time constraint is taken into account, developer is put into a highly uncertain situation. As a result, prototyping becomes the most suitable methodology to pursue. Figure 8 shows the common phases of Prototyping Development Methodology. The Analysis, Design, and Implementation phase are performed only once, yet they will be reviewed from time to time. The cycle repeated continually based on the sponsor comments until the prototype successfully meets the requirements. The last version of the prototype will then be called the final system. Prototyping development needs only initial basic

analysis and design, but as the result, important system functions may not be recognized until somewhere in the middle of project.

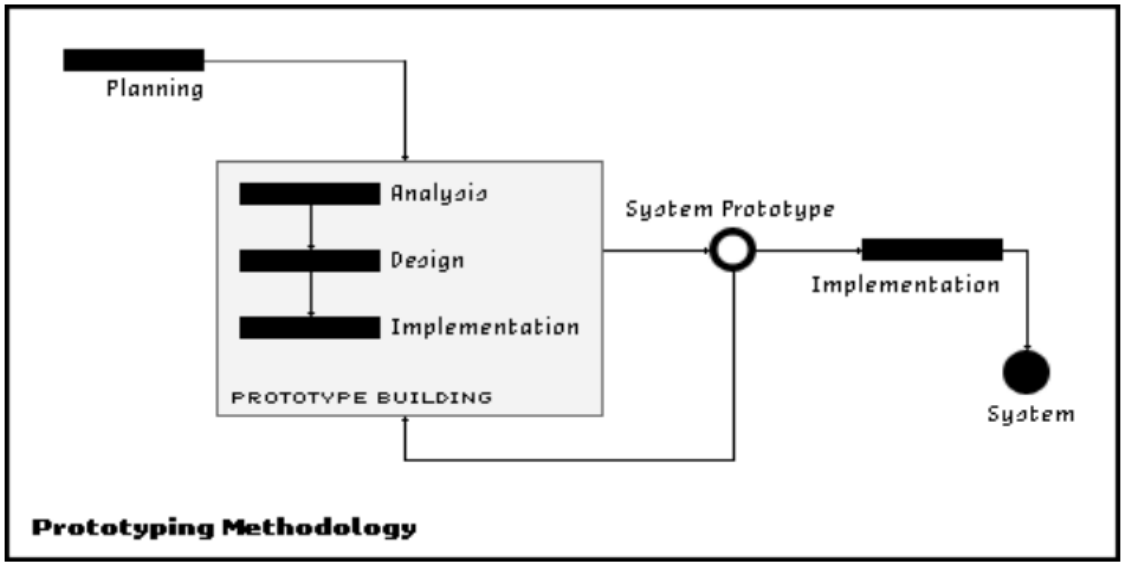


Figure 8: Prototyping Methodology

3. PROJECT ACTIVITIES

The list of tasks that should be completed for the project and their status are described as in Table 1.

Table 1: Project activities

Task No	Task Name	Duration (days)	Status
1	Identify a topic area and define title	5	Completed
2	Discuss with supervisor on the next step	3	Completed
3	Prepare for literature view, background studies, objectives, and methodology	7	Completed
4	Create work plan and Gantt Chart	2	Completed

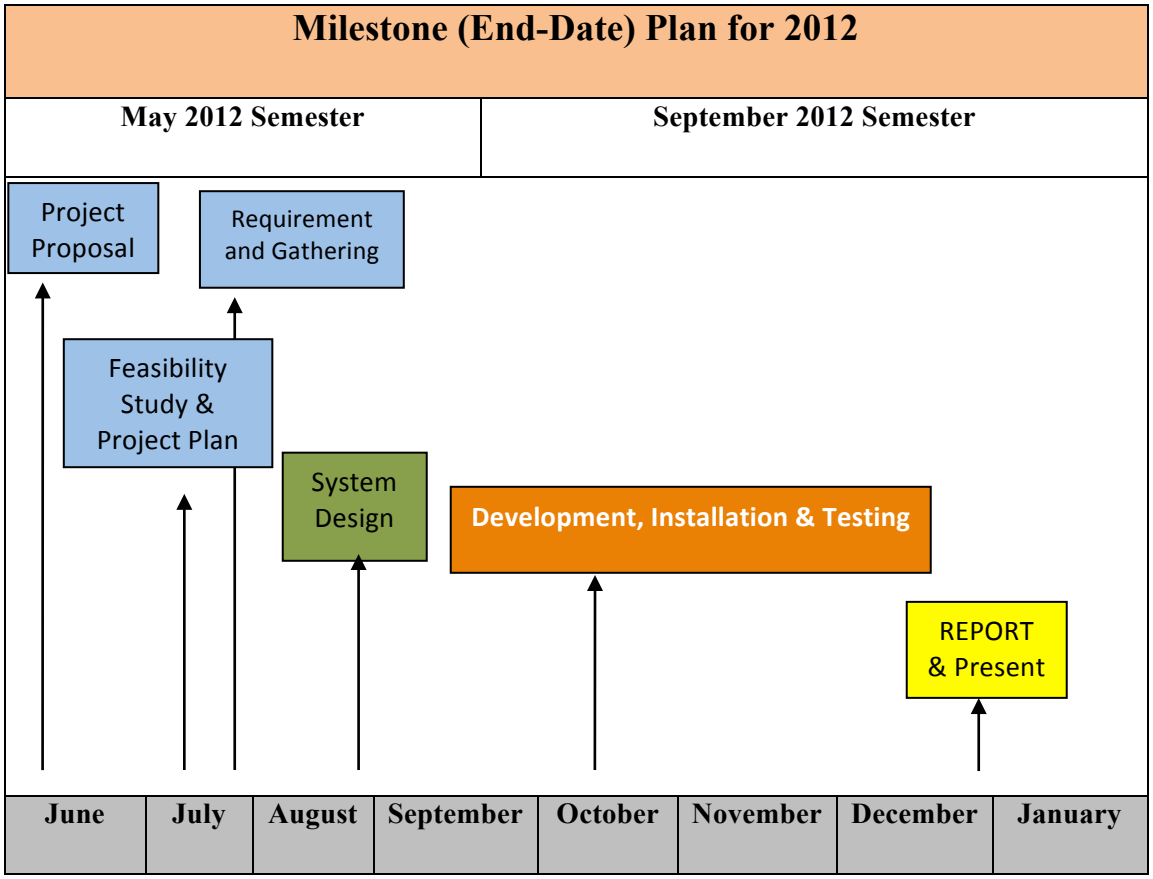
5	Analyze as-is process and define to-be process	4	Completed
6	Gather requirements and data necessary for the analysis	7	Completed
7	Finalize the functions (system specification)	3	Completed
8	Create functional, structural and behavioral models	7	Completed
9	Develop Design Strategy	3	Completed
10	Architecture and Interface Design	5	Completed
11	Program Design	5	Completed
12	Development of the system	90	Open
13	Testing	5	Open
14	Provide Feedback to and fro Users and Modify requirement if any	5	Open
15	System Implementation and Documentation	14	Open

Certainly, system development is carefully allocated a suitable time period while smaller tasks are given less time. This allocation of time provides convenience for development as the final system can be achieved only after a few refinement cycles from the release of first prototype.

Besides, the project timeline is divided into two semesters, May and September 2012. In short, phases from planning up to design were done during May semester, while implementation, testing, report and presentation will be accomplished and concluded in September semester (end in early January 2013).

4. KEY MILESTONES

Table 2: Key milestones



5. GANTT CHART

Table 3 is a Gantt chart showing the estimation of time needed for every task to be completed. It is similar to the list of project activities above, but Gantt chart provides a greater detail of each step in a calendar view. It helps reader easily identify which activities can be done in parallel, and which ones need to be done separately.

Table 3: Gantt chart

No.	Task	Duration	Week (estimated to require 7 months - 28 weeks to complete the project)
			1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
Planning Phase			
1	Identify Topic Area and Define Title	1 Week	(25/05/2012)
2	Project Feasibility Study	1 Week	(01/06/2012)
3	Project Plan	2 Weeks	(15/06/2012)
Analysis Phase			
4	Methodology Analysis	2 Weeks	(29/06/2012)
5	Intensive Literature Review and Information/ Data Gathering	2 Weeks	(06/07/2012)
6	Result and Analysis	2 Weeks	(13/07/2012)
7	Requirements Gathering	2 Weeks	(20/07/2012)
Design			
8	System Design	4 Weeks	(17/08/2012)
9	Architecture and Interface Design	4 Weeks	(17/08/2012)
10	Database Design	4 Weeks	(17/08/2012)
11	Program Design	4 Weeks	(17/08/2012)
Implementation			
12	System Construction	13 Weeks	(16/11/201
13	Installation	13 Weeks	(16/11/201
14	Testing and obtain users' feedback	1 weel	(23/11/2012)
Report and Presentation			
15	Support Plan and Documentation	2 Weeks	(07/12/2012)

end of semester Jan 2012

* dates are subjected to change

6. TOOLS REQUIRED

Hardware

- Apple iMac Coputer
    - Intel® Core™ 2 Duo 2.5GHz
    - 4GB RAM
    - 320 GB Hard Disk (internal)
    - 1 TB External Hard Disk (for back-up)
- Online hosting (ServerFreak - http://www.web-hosting.net.my)

Software

- XAMPP for Mac OS X 1.7.3:
    - PHP 5.3.10
    - Apache 2.2.21
    - MySQL 5.5.20
    - phpMyAdmin 3.4.10.1
- TextWrangler (text editor)
- MySQLWorkBench 5.2.40
- Eclipse Indigo

Programming Language

- PHP, MySQL for databases
- HTML, CSS for formatting the webpage
- jQuery (Javascript)

CHAPTER 4
RESULTS & DISCUSSION

1. DATA GATHERING

In this project, two methods were used in data gathering: interview and questionnaire.

1.1. Interview

The purpose of interviewing is to clarify the business logic and technical requirements from project sponsor – the Center for Graduate Study (CGS). Result will be elaborated in "FINDING" section.

Person Interviewed: Associate Professor Dr. Mohd Fadzil Hassan
Department: Center for Graduate Studies
Date/Time: 1st June 2012, 3:00 PM

1.2. Questionnaire

Questionnaire distribution was carried out online using Google Spreadsheet. So far there were sixty responses from Post Graduate (PG) Students – in Master and PhD Program. The result of this survey will be modeled and further discussed in "DATA ANALYSIS" section.

2. FINDING

From the interview, some useful information about the allowance claiming process was obtained.

- CGS is the body that caters all claims and related issues.
- A claim can be submitted by GA or department but either way, it still has to get through five layers of endorsement before reaching Finance department. Those are approval from lecturer of the subject that GA is tutoring, direct supervisor,

Post Graduate Coordinator in each department, Head of Department (HoD) and CGS Office.

- Real payment will be based on actual teaching/research hours and days recorded. This means the recorded time must be stored for further calculation.
- Pre-dumping or Carry-forward is not allowed.
- Total teaching time should not be lower than 5 hours a week or 20 hours a month.
- A minimum of 22 research days must be fulfilled in a month.
- Claim form must reach CGS office by 5pm, 15th of each month.
- Time spent for preparation, test/quiz/report marking is not counted for payment.
- Claims are processed one by one manually.
- Data are maintained stored as excel files and only one staff from CGS Office can understand clearly the content.

Obviously, it's not possible for any manager to monitor the performance of GAs even in one month, let alone a historical summary. Besides, each department stores information about their respective subjects in different format and there was no standard method to combine the association between lecturers and GAs from all departments.

According to Dr. Fadzil, if a Monitoring & Management System is built to replace the manual approach, it must meet some requirements:

Compulsory Requirements:

- GA just needs to perform claiming once.
- All info must be maintained in database and manageable by CGS Office.
- A staff can play many roles in the system (i.e. lecturer/supervisor, HoD etc.).

Optional Requirements:

- The system can auto-remind all users about due time by email.
- Supervisor can directly access from PETRONAS inbox for better security and convenience.
- A historical summary of GAs' performance is made available.

3. DATA ANALYSIS

Figure 9 shows 100% of the respondents confirmed that they have to fill in the claim form every month. Clearly, it is compulsory for all GAs to complete this task in order to get their allowance.

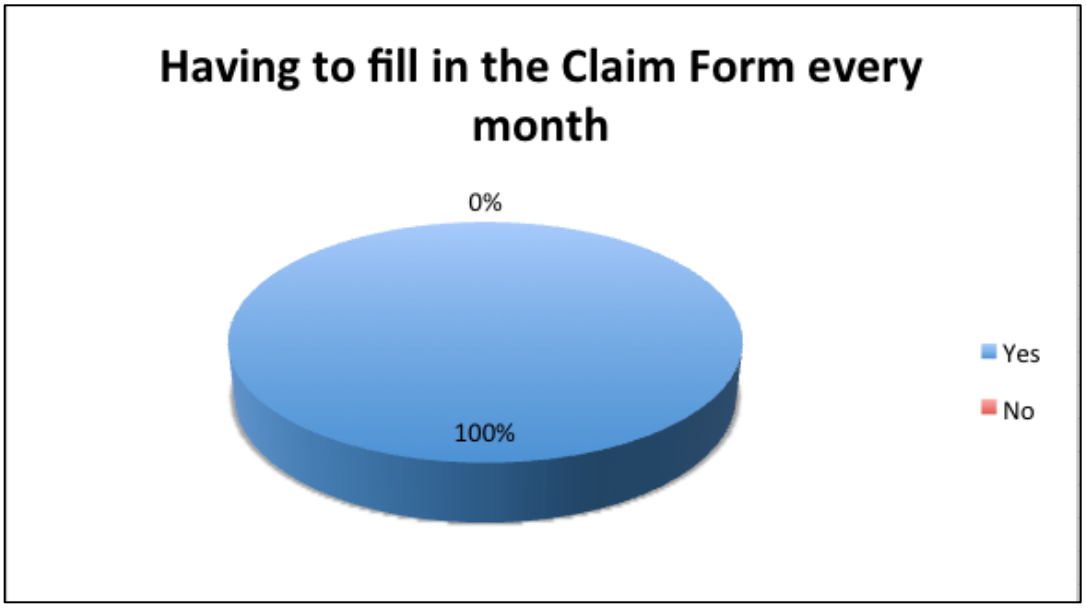


Figure 9: Monthly claim form submission

Besides, it's easy to see in figure 10 that the amount of time each GA spends to perform the claiming process also vary from one person to another. In average, around 74% are able to finish it before 4 days (majority goes to 2-4 days), while the rest take one week or more. The total time wasted for this non-productive task in one year can be a huge number and GACMS can save it all, or at least, most of it.

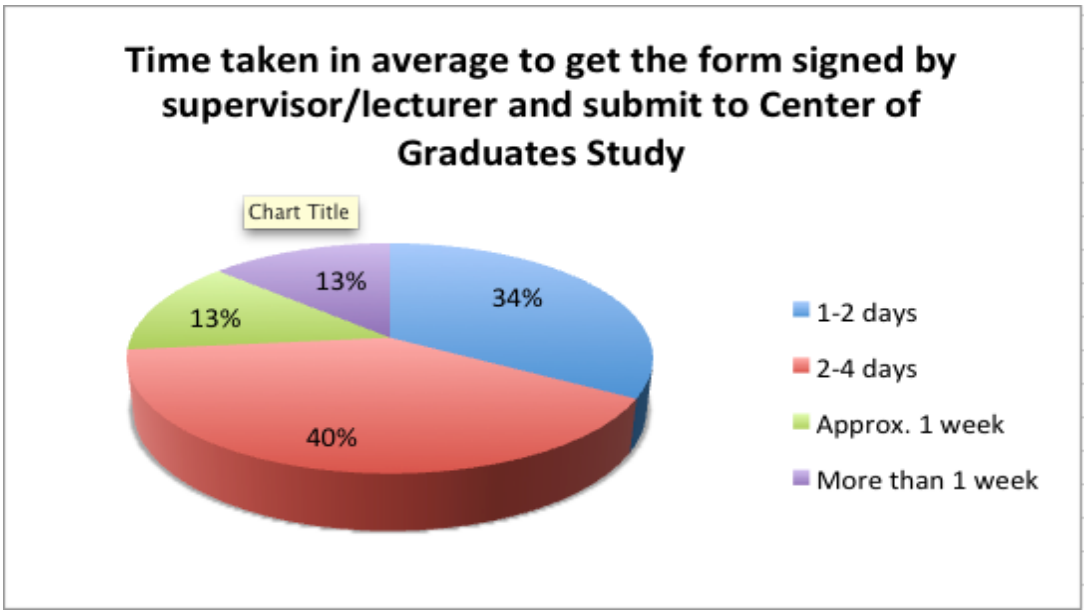


Figure 10: Time taken to have a form approved

Figure 11 describes GAs' opinion when being asked to give feedback on the effectiveness of the current claim process. 37% think that it is not really good and 20% claim that it is very bad but there was no satisfactory response (very effective). It's concluded that most of them do not find the manual method effective enough.

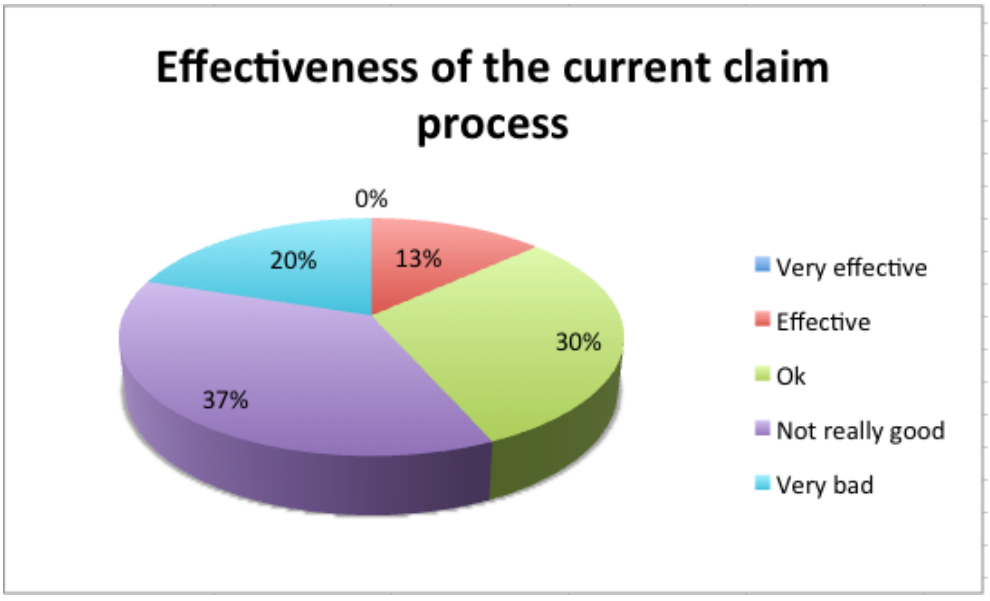


Figure 11: Effectiveness of the current claim process

On top of that, figure 12 shows more than half of the respondents (55%) complaining about problems they sometimes have with the claim process. The reasons can be the availability of the supervisor, medical leave or travelling to name a few. Among others, 13% say they have such issues quite often but only 10% never face any problems.

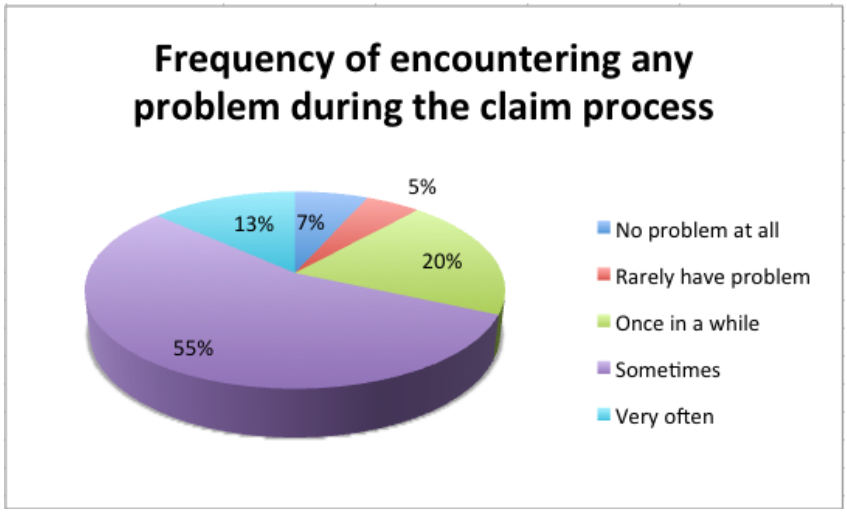


Figure 12: Frequency of occurring problems

When being introduced with an online system, majority of participants (73%) agree that it can help this claim process. Figure 13 also reveals that 20% even strongly support and encourage the idea. Obviously, there was no disagreement to the idea of having the process done online.

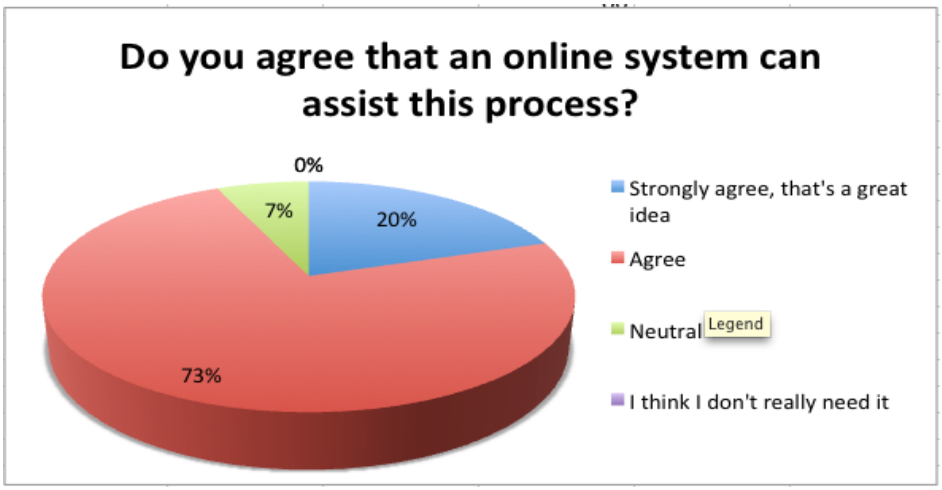


Figure 13: GAs' opinion about an online claim system

In figure 14, all of respondents are willing to try the new system, and they seem to be very enthusiastic with the idea. Besides, they also agree that the system should be smart and autonomous.

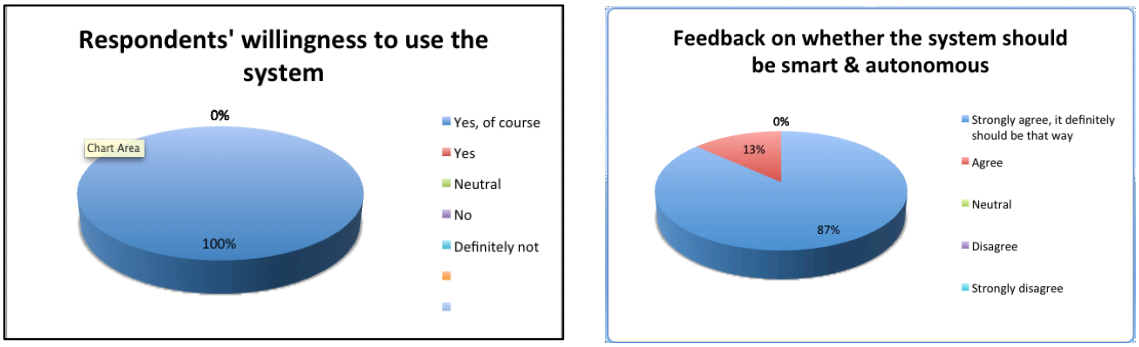


Figure 14: Respondents' willingness to try new system

Apart from that, some GAs also left some supportive comments as following:

- "A centralize system will be very helpful in this regard as UTP has lots of data duplication in every department, has no coordination among them. Sure, any step in this regard is appreciated."
- "Thanks a lot to the team who's developing this system."
- "Sometimes I can't find my supervisor or lecturers for signing the form as they are in meeting or seminar outside campus."
- "Wonderful idea, please implement it"

4. PROTOTYPE MODELLING

4.1. Activity Diagram

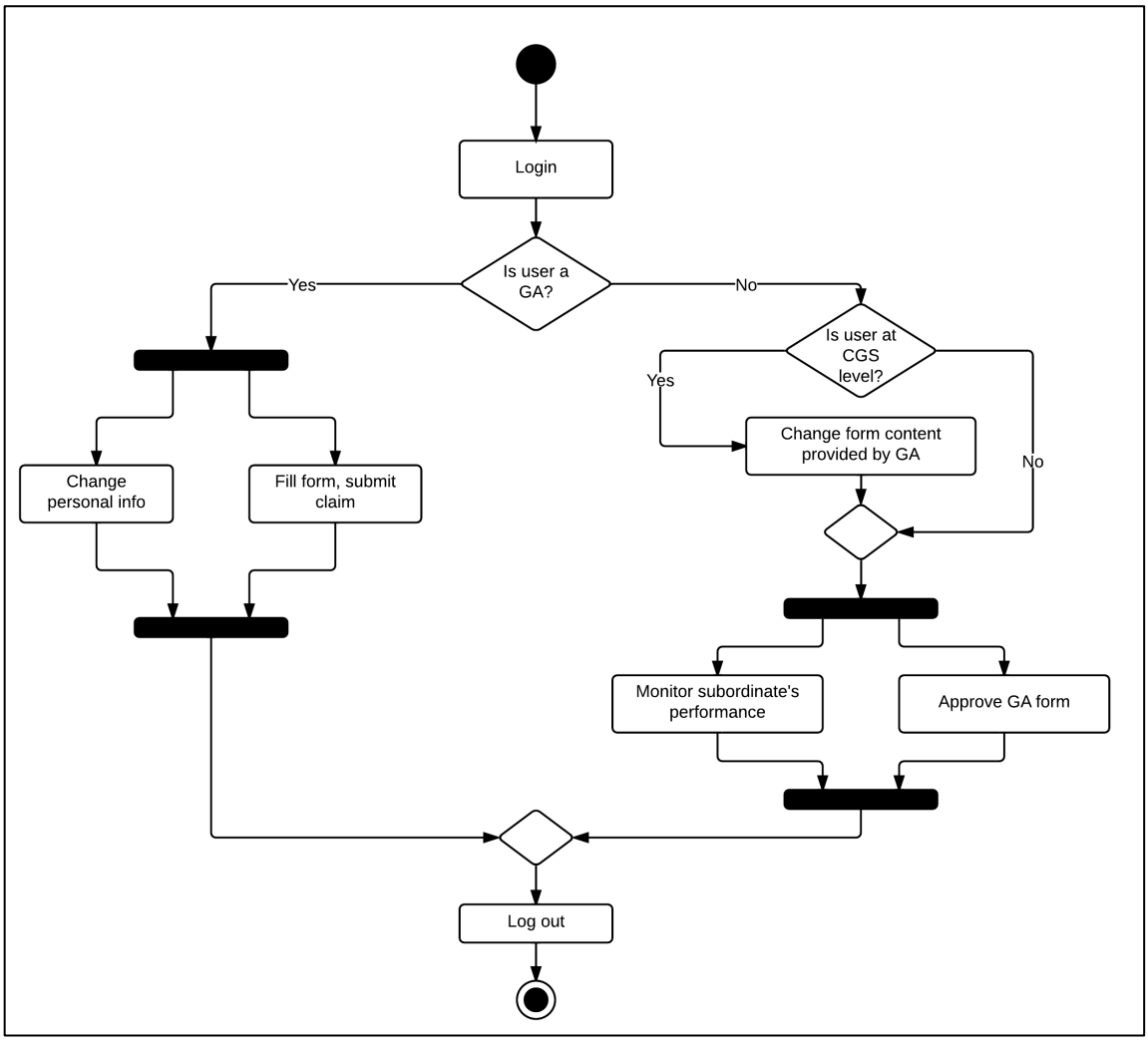


Figure 15: Front-End Activity Diagram

User, after signed in at frontend, will be categorized based on a user_class parameter.

Table 4: User access right

	GA	Lecturer / Supervisor	Post Graduate Coordinator	Head of Department (HoD)	CGS Office
user_class	1	2	3	4	5

There are some conditions set by the systems that are compulsory for user to follow:

- *user_class* value will decide the access right of one user. User with higher *user_class* can gain access to more modules.
- Each user only has one *user_class* value. If (s)he plays many roles, the role with highest *user_class* will be chosen e.g. a user can be HoD and supervior at the same time, so his *user_class* should be 4.
- Only CGS Office can modify the content of claim after it has been endorsed (at least at 1 level).
- Head of each Department or Post Graduate Coordinator can view historical summary of GA from his/her department only.
- Lecturer/Supervisor can only view claims from his/her subordinate GAs.

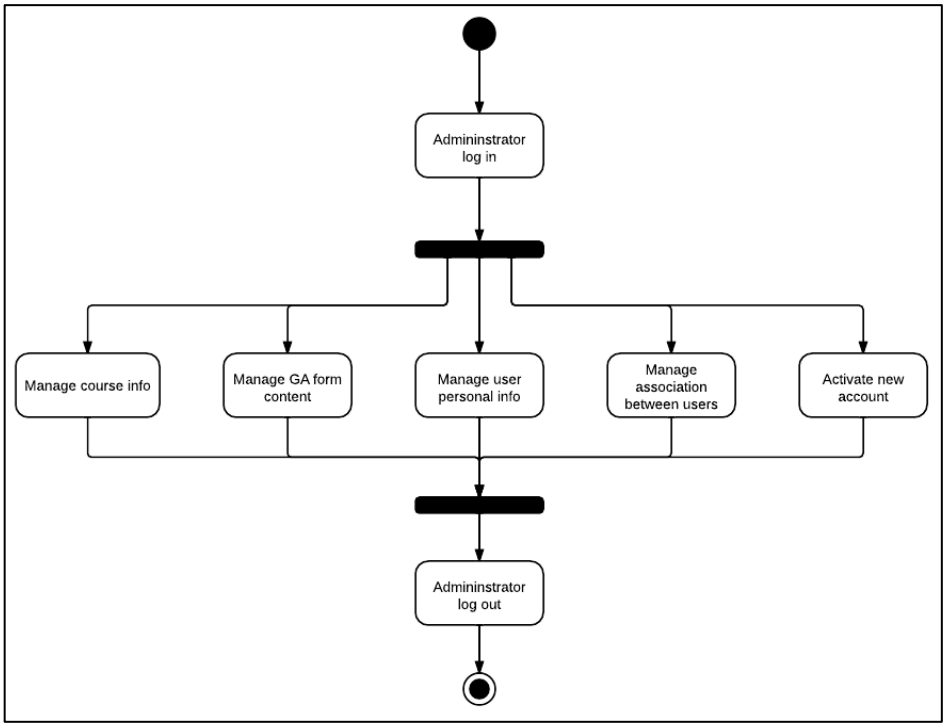


Figure 16: Back-End Activity Diagram

Backend of GACMS is a Content Management System where administrator from CGS Office can manage and make change to any data including user account.

Basically, each module will handle an object at frontend e.g. GA, lecturer, subject. In which, administrator can perform four actions: “View”, “Add”, “Update” and “Delete”.

4.2. System Architecture

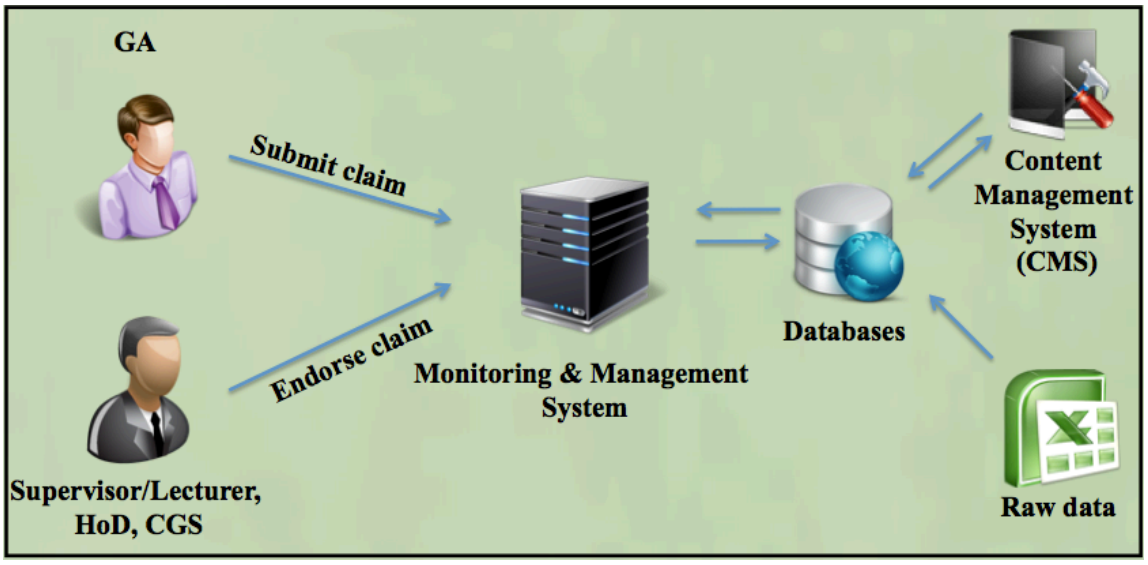


Figure 17: System Architecture

The development phase comprises of many steps.

- Design database structure to be aligned with structure used in excel files
- Extract necessary info from raw data using a PHP class called “Excelreader” and insert into database
- Refine the inserted data to improve usability
- Build a Content Management System to handle all tables in database
- Build frontend as interface for all users.
- Publish the system

After the system is ready, following tasks can be preformed:

- User sends request to webserver via GACMS frontend, by inputting a claim (if GA) or endorse claims (if not GA).
- The system will process the request, by obtaining the data from database for any view request or updating database upon valid request.
- If there is any change needs to be made on database content, administrator will do at backend.

4.3. Database Design

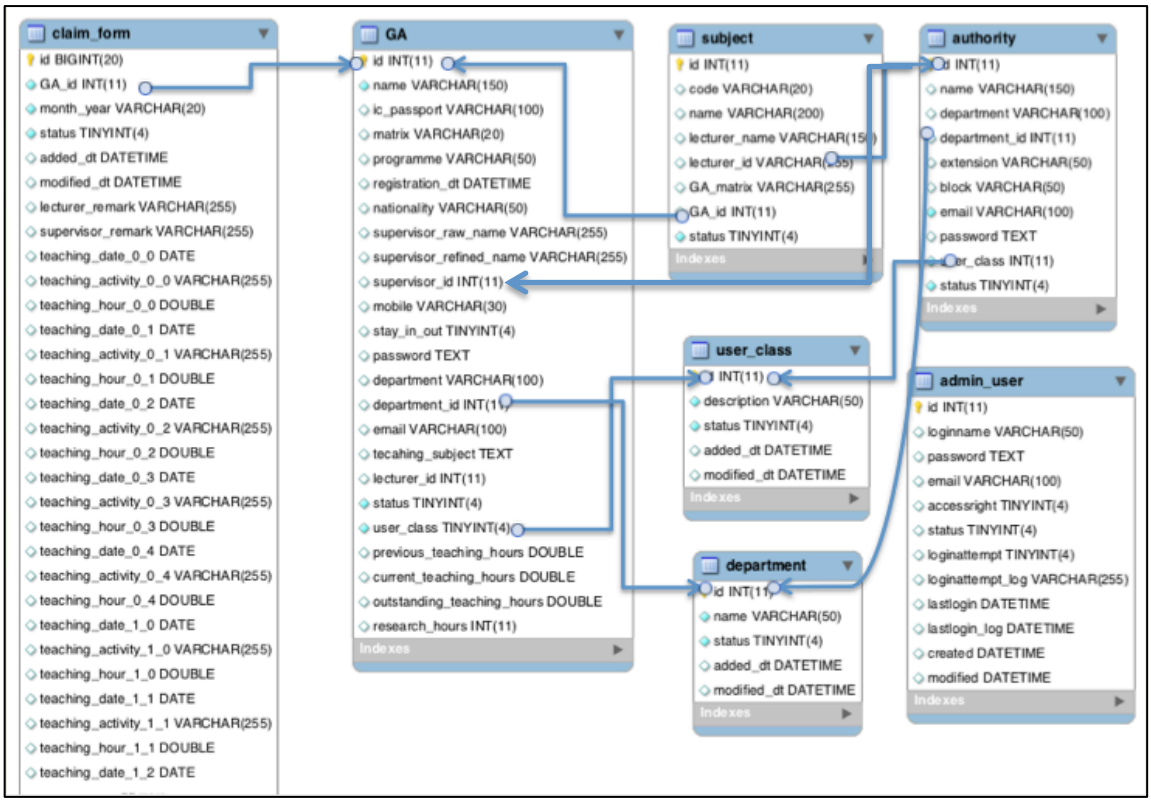


Figure 18: Database Schema

- Table “GA” stores all the GAs’ particulars like name, matrix Id (used to login), nationality, department_id etc.
- Table “claim_form” saves each claim as a uniques record with the compound foreign key “GA_id” and “month_year” to identitfy a claim made for which month and by whom. So a record with “GA_id” equals to 2 and “month_year” equals to “10_2012” stands for a claim made in October 2012 by the GA with 2 as id. Besides, each day in a month will be allocated several fields for activities happened. For instanse, “teaching_day_0_0” keeps the date of first teaching day (0) in first week (0) and so forth.
- Table “subject” maintains right details of all subjects offered. Unfortunately, due to the mismatch of data format, only subjects from Computer & Information Science are migrated into database for testing purpose. The table will specify for each subject, who are lecturer or tutor (GA).

- Table “authority” keeps a full list of UTP staffs with complete bio-data such as “email”, “name”, “phone extension”, “block” etc.
- Table “admin_user” saves only few records for adminitrators at backend.
- Other tables contain fixed information such as list of all countries (to be reference for GA’s nationality), list of all departments (will be refered by “authority” and “GA”) or list of user_class mentioned earlier.

4.4. User Interface

4.4.1. Frontend

At login page (shown in figure 19), GA can use matrix number and lecturer/supervisor can use email as login identity. Default password for GA is “123” and for lecturer is “utp123”.

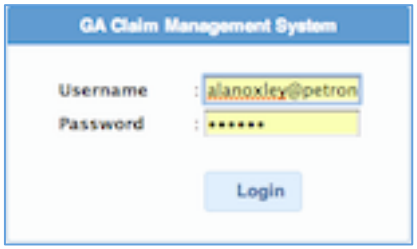


Figure 19: Login page (front end)

Figure 20 and figure 21 show the frontend after GA user has logged in. There are 3 options for GA: “VIEW CLAIM”, “SUBMIT/EDIT” OR “LOGOUT”; in which:

- At “VIEW CLAIM” (figure 20), all displayed information is read-only. It will list out all details that GA has entered earlier including date, activities and time amount spent.
- At “SUBMIT/EDIT CLAIM” (figure 21), any claim found in database is also displayed. The record is editable only if due date for submitting is not yet passed and there is no lecturer or supervisor has endorsed the claim. User can change date easily by clicking on any date input field and pick up the right one.
- Clicking on “LOGOUT” will navigate user back to the login page.

The displayed details are what GA has entered earlier including date, activities and time amount spent. Besides, one GA can view and edit his/her claim only.

If no record found, there will be an error message (red color) on top of the page content to inform user.

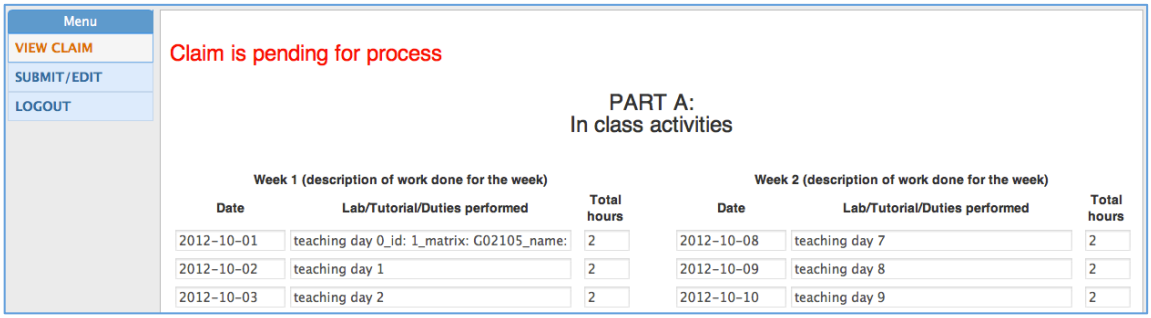


Figure 20: View claim (for GA)

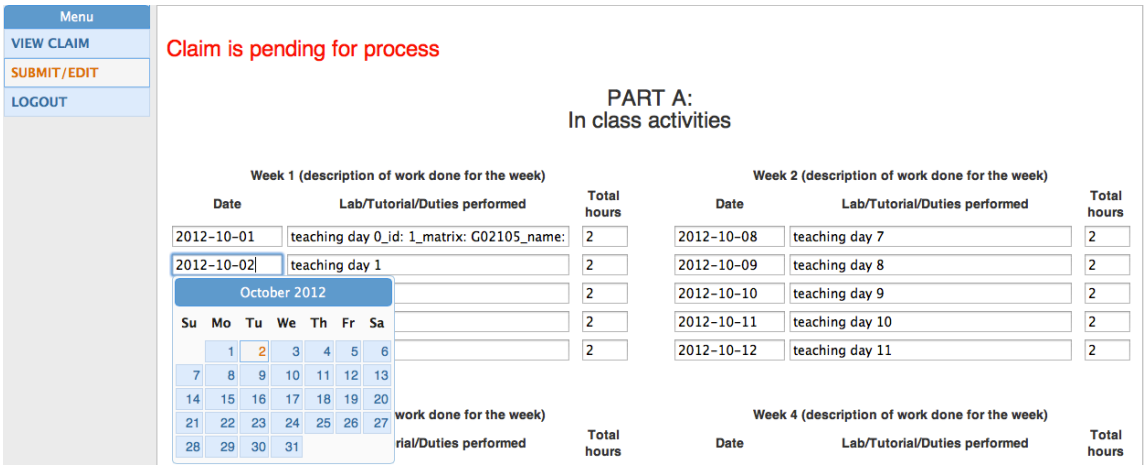


Figure 21: Submit claim

Figure 22 and figure 23 show the frontend after lecturer/supervisor/HoD user has logged in. User can view and endorse claims from his/her subordinates. Each GA is display separately in one tab. “DEPARTMENT” module is made available only for HoD. (This module is under development)

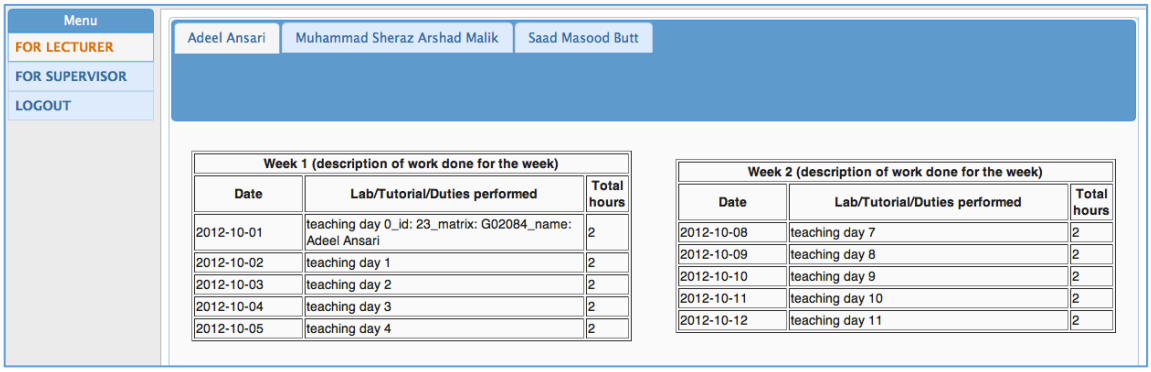


Figure 22: View/Endorse claim (for lecturer/supervisor)

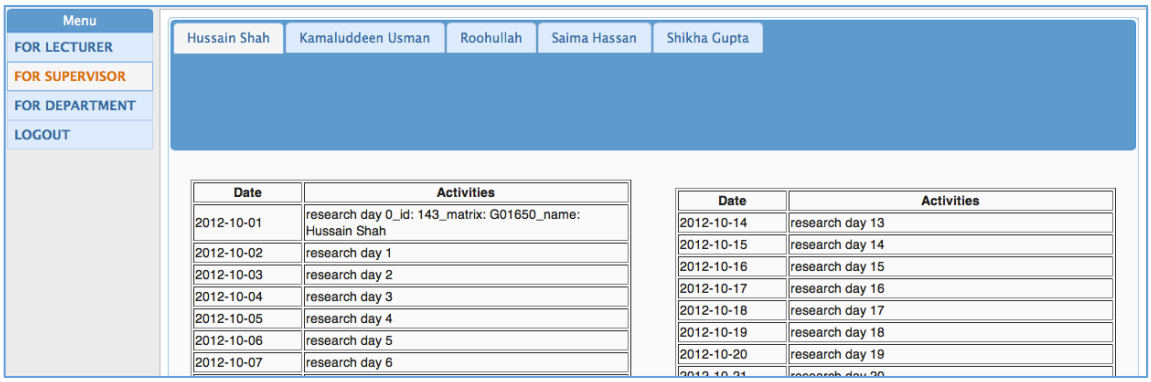


Figure 23: View/Endorse claim (for HoD)

4.4.2. Backend / Content Management System

Backend is available exclusively for administrator from CGS. There are 4 modules namely "GA", "Claim", "Authority" and "Subject" which provide very similar features. Each module covers only one table in database and allows administrator to view, add, edit and delete any record. For simplicity, only GA module will be fully explained, the others possess the same programming logic and operation flow.

Figure 24 displays the login page at back end, user name "admin" and password "123" are set as default. This is also the only identity can be used to assess backend.

Figure 24: Login page (backend)

Figure 25 shows the full list of GAs in UTP, which is divided into many pages. Administrator also can search for a specific record. Besides, the list can be sorted by "NAME", "MATRIX", "PROGRAMME" etc. A click on each label will toggle sorting either ascending or descending on that label. Additionally, each record comes with 2 possible actions: "Edit" and "Delete" which are self-descriptive.

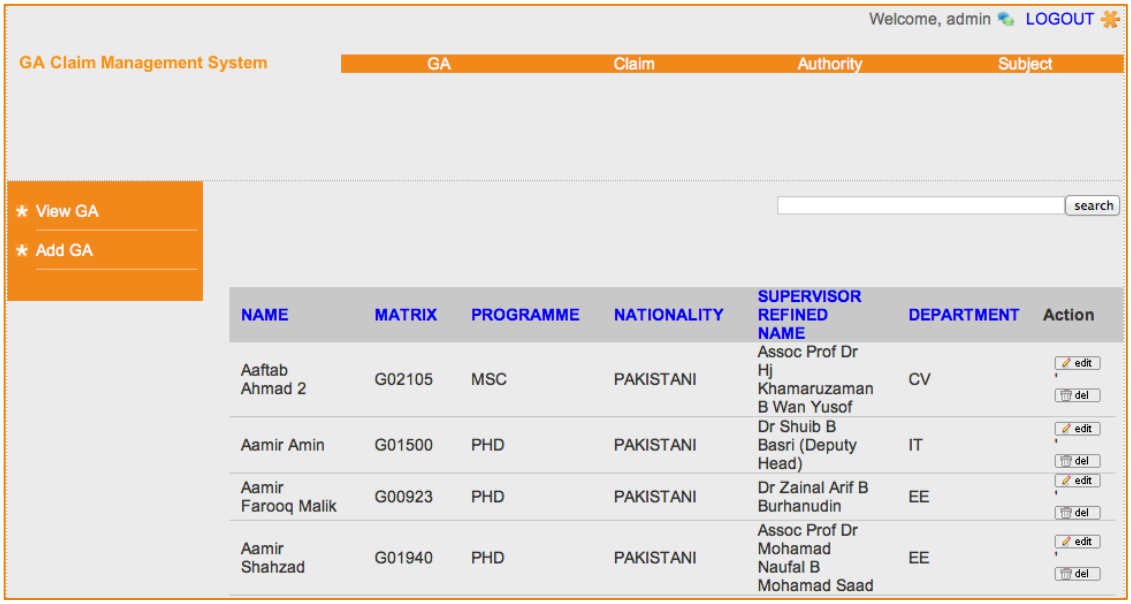


Figure 25: GA module -View (backend)

Figure 26 is all about the procedure to add a new GA into database. Each input is made for one field in "GA" table. Options for each dropdown list are queried from respective table in database e.g. supervisor for a GA can only be chosen from a list of active record from "authority" table. It's easy to see that all field in "Add GA" page are left blank.

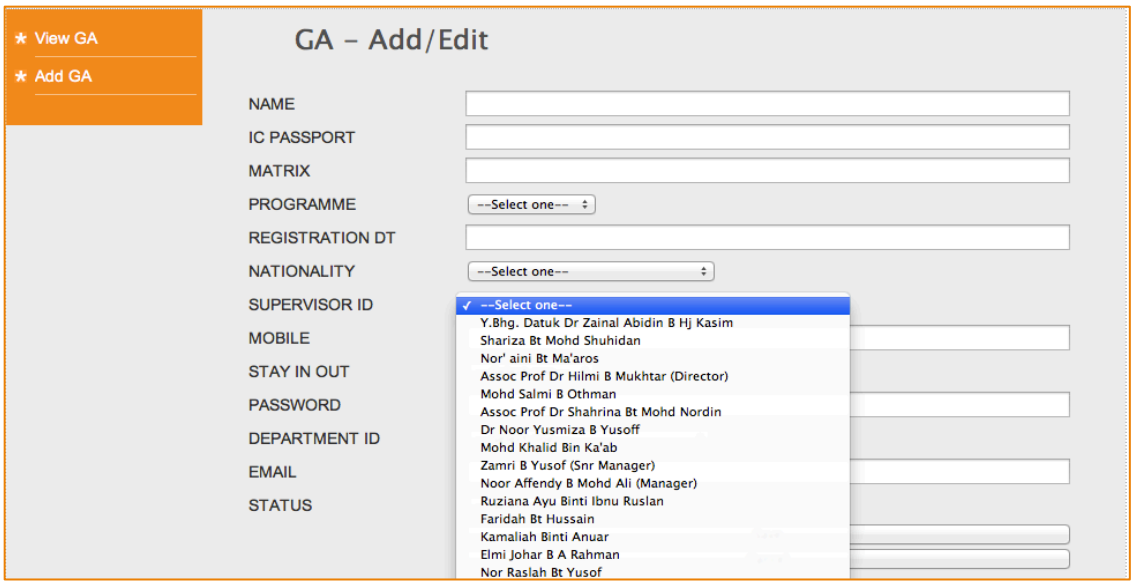


Figure 26: GA module – Add

Figure 27 depicts the modification of a GA record. It's pretty much similar to "Add GA", the only difference is that the existing values will be loaded into input fields.

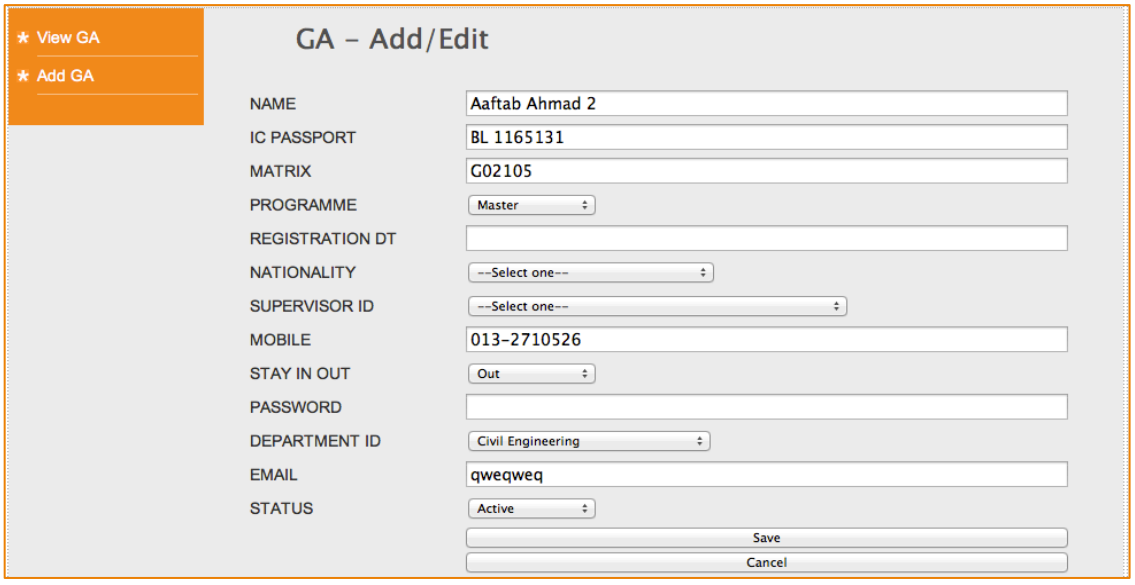


Figure 27: GA module - Edit

In figure 28, there is a popup window confirming before any record is deleted.

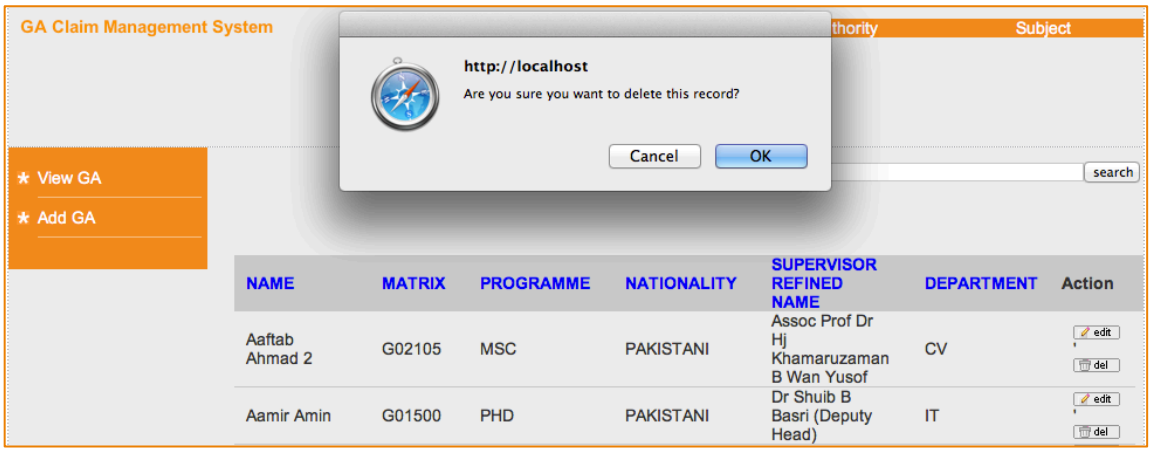


Figure 28: GA module – Delete

4.5. Testing

Testing is an important part of any system development. It helps to find the bugs and unwanted events as well as to realize the limitations of the system itself. For GACMS, testing has been done online at www.pluzme.net/GACMS/.

- Functional Testing: is to make sure that the main functionalities of the system are working. Main functionalities of the system tested and verified are:
    - Login
    - View claim
    - Edit / Submit claim
    - Check claim submitted by subordinate GA
    - Endorse claim
    - CMS: viewing, deleting, updating, and adding of records

Table 5: User's recommendation

No	Recommendations/Suggestions	Actions To be taken by developer	
		To be changed	To be kept in consideration
1	Refine database structure	✓	
2	Make the number of input become dynamic in stead of static	✓	
3	Profile page for user at frontend and administrator at backend	✓	

Chapter 5
CONCLUSION AND RECOMMENDATION

1. CONCLUSION

GACMS 1.0 is the working prototype that covers all the hard constraints set earlier in the project initiation. It is able to let GAs submit their allowance claim and authorities endorse. The prototype also provides a basic Content Management System (CMS) to assist administrators in maintaining the system. The prototype itself is actually very close to being "implementable". We only need the more input from other departments rather than Computer & Information Science, some more time and configuration, then the system will be up and running.

In conclusion, the project has achieved its objectives in helping UTP GAs and administrative staff in processing allowance claim more effectively. The system also makes it more convenient for the management as it will bring about fewer changes to be made for each semester. Since GACMS is the first of its kind, the system is certainly the best possible temporary solution, in which GAs are strongly looking forward for the project to be implemented.

2. FUTURE WORK CONTINUATION

Certainly, GACMS should be able to serve its main objective is to assist user finishing allowance claim procedure. Upon achieving that, there are several enhancements should be made:

- Providing a historical summary of claim is a good idea. It's useful to observe the change in performance of one GA over the time.
- Creating chart from mined data is great for investigating group's average performance e.g. comparing between departments.

- User will probably like a profile page where they can mange their own bio-data without asking for help from the university management.

- At this point of time, auto-reminding by email is still under development but it will surely appear in the real implementation.

- Last but not least, having GACMS on mobile platform is obviously more attractive to user. Thus, porting to mobile is also included in our ‘wish list’ to be considered in the future.

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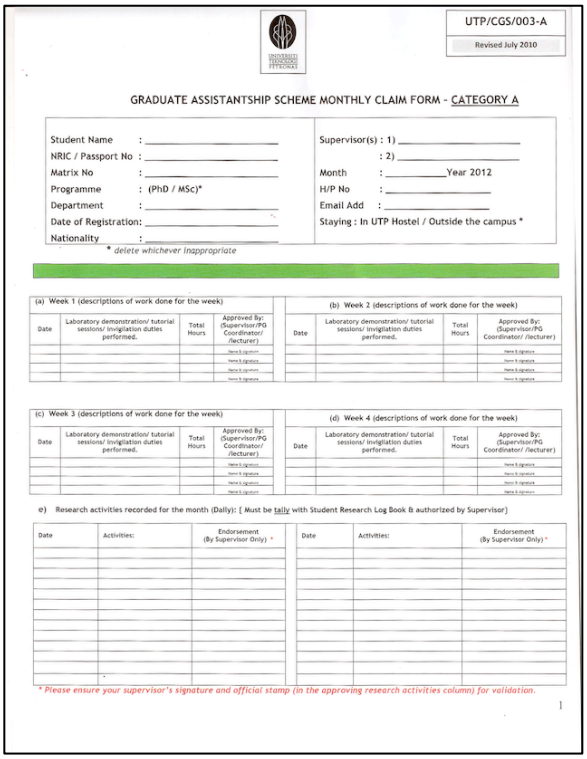
APPENDICES

Appendix 1. Graduate Assistant Scheme Monthly Claim Form



UTP/CGS/003-A

Revised July 2010

GRADUATE ASSISTANTSHIP SCHEME MONTHLY CLAIM FORM - CATEGORY A

Student Name : _____
NRIC / Passport No : _____
Matrix No : _____
Programme : (PhD / MSc)*
Department : _____
Date of Registration: _____
Nationality : _____

Supervisor(s) : 1) _____
: 2) _____
Month : _____Year 2012
H/P No : _____
Email Add : _____
Staying : In UTP Hostel / Outside the campus *

* delete whichever inappropriate

(a) Week 1 (descriptions of work done for the week)

Date	Laboratory demonstration/ tutorial sessions/ invigilation duties performed.	Total Hours	Approved By: (Supervisor/PG Coordinator/ /lecturer)
			Name & signature
			Name & signature
			Name & signature
			Name & signature

(b) Week 2 (descriptions of work done for the week)

Date	Laboratory demonstration/ tutorial sessions/ invigilation duties performed.	Total Hours	Approved By: (Supervisor/PG Coordinator/ /lecturer)
			Name & signature
			Name & signature
			Name & signature
			Name & signature

(c) Week 3 (descriptions of work done for the week)

Date	Laboratory demonstration/ tutorial sessions/ invigilation duties performed.	Total Hours	Approved By: (Supervisor/PG Coordinator/ /lecturer)
			Name & signature
			Name & signature
			Name & signature
			Name & signature

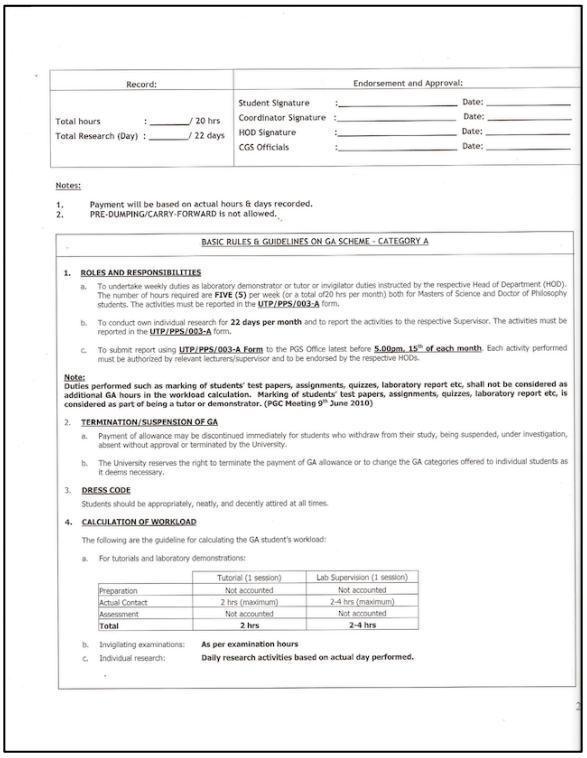
(d) Week 4 (descriptions of work done for the week)

Date	Laboratory demonstration/ tutorial sessions/ invigilation duties performed.	Total Hours	Approved By: (Supervisor/PG Coordinator/ /lecturer)
			Name & signature
			Name & signature
			Name & signature
			Name & signature

e) Research activities recorded for the month (Daily): [Must be tally with Student Research Log Book & authorized by Supervisor]

Date	Activities:	Endorsement (By Supervisor Only) *	Date	Activities:	Endorsement (By Supervisor Only) *

* Please ensure your supervisor's signature and official stamp (in the approving research activities column) for validation.



Record:	Endorsement and Approval:
Total hours : _____/ 20 hrs Total Research (Day) : _____/ 22 days	Student Signature : _____ Date: _____ Coordinator Signature : _____ Date: _____ HOD Signature : _____ Date: _____ CGS Officials : _____ Date: _____

Notes:

1. Payment will be based on actual hours & days recorded.
2. PRE-DUMPING/CARRY-FORWARD is not allowed.

BASIC RULES & GUIDELINES ON GA SCHEME - CATEGORY A

1. **ROLES AND RESPONSIBILITIES**
   a. To undertake weekly duties as laboratory demonstrator or tutor or invigilator duties instructed by the respective Head of Department (HOD). The number of hours required are **FIVE (5)** per week (or a total of20 hrs per month) both for Masters of Science and Doctor of Philosophy students. The activities must be reported in the **UTP/PPS/003-A** form.
   b. To conduct own individual research for **22 days per month** and to report the activities to the respective Supervisor. The activities must be reported in the **UTP/PPS/003-A** form.
   c. To submit report using **UTP/PPS/003-A Form** to the PGS Office latest before **5.00pm, 15th of each month**. Each activity performed must be authorized by relevant lecturers/supervisor and to be endorsed by the respective HODs.

Note:
Duties performed such as marking of students' test papers, assignments, quizzes, laboratory report etc, shall not be considered as additional GA hours in the workload calculation. Marking of students' test papers, assignments, quizzes, laboratory report etc, is considered as part of being a tutor or demonstrator. (PGC Meeting 9th June 2010)

2. **TERMINATION/SUSPENSION OF GA**
   a. Payment of allowance may be discontinued immediately for students who withdraw from their study, being suspended, under investigation, absent without approval or terminated by the University.
   b. The University reserves the right to terminate the payment of GA allowance or to change the GA categories offered to individual students as it deems necessary.
3. **DRESS CODE**
   Students should be appropriately, neatly, and decently attired at all times.
4. **CALCULATION OF WORKLOAD**
   The following are the guideline for calculating the GA student's workload:
   a. For tutorials and laboratory demonstrations:

	Tutorial (1 session)	Lab Supervision (1 session)
Preparation	Not accounted	Not accounted
Actual Contact	2 hrs (maximum)	2-4 hrs (maximum)
Assessment	Not accounted	Not accounted
Total	**2 hrs**	**2-4 hrs**

   b. Invigilating examinations: **As per examination hours**
   c. Individual research: **Daily research activities based on actual day performed.**

Appendix 2. Questionnaire

Agent-based Monitoring & Management System: UTP Graduate Assistance (GA) Claim Process

We are going to develop a portal that allows all PG students to fill up the claiming form and submit them for further processing in order to get their allowances every month. The portal aims to increase the sufficiency of the claiming process, as well as assist the management people to have a comprehensive look of Graduate Assistants' performance. Please spend a few minutes of your time to fill in the survey in order to help us improve the effectiveness of the system.

1- If you are PG student, are you persuing Master or PhD?

○ Master

○ PhD

○ Not a PG stduent

2- Do you have to fill in the Claiming Form every month?

○ Yes

○ No

3- If you have to fill in the Claim Form every month, at what time do you usually do it?

○ Week 1

○ Week 2

○ Week 3

○ Week 4

4- In average, how long does it take you to get the form signed by supervisor/lecturer and submit to Center of Graduates Study?

O 1-2 days

O 3-4 days

O Approximately 1 week

O More than 1 week

5- How do you rate the effectiveness of the current claim process?

O Very effective

O Effective

O Ok

O Not really good

O Very bad

6- Have you ever encountered any problem with the claim process? For example: cannot finish it on time or there are mistakes during the process?

O No problem at all

O Rarely have problem

O Once in a while

O Sometimes

O Very often

7- Do you agree that an online system can assist this process? Imagine you can do it from your hostel or even from your home country if you happen to be away for a short time.

O Strongly agree, that's a great idea

O Agree

O Neutral

O I think I don't really need it

O No, that kind of system will not help me at all

8- Currently, a system like mentioned above is being developed to facilitate your monthly claim. Will you be willing to use it?

O Yes, of course

O Yes

O Neutral

O No

O Definitely not

9- The system is meant to be smart and autonomous. That means it can remind you when you should do he claim, and also inform you the progress as well as help the management to process your claim faster and in a more accurate manner. Do you think it is better that way or just a normal online system will do?

O Strongly agree, it definitely should be that way

O Agree

O Neutral

O Disagree

O Strongly disagree. I'm happy with the manual way. I do not need the system

10 Please feel free to drop us any comments or suggestions. Thank you very much for your time.

Appendix 3. Technical Paper

Agent-based Monitoring & Management System: PETRONAS University of Technology Graduate Assistantship Claim Process

Trinh Tuan Duong, AP Dr. Mohd Fadzil Hassan

Computer and Information Science Department,
PETRONAS University of Technology

ABSTRACT

This paper is intended to investigates the process of allowance claiming which is done monthly by Graduate Assistants (GAs) in PETRONAS University of Technology (UTP) and that eventually leads to the development of a Web-based system called "Agent-based Monitoring & Management System: PETRONAS University of Technology Graduate Assistantship Claim Process" (GACMS) in order to digitalize each and every step involved in that process. The main purpose is to overcome problems such as human error, manpower waste and inconvenience caused by the manual approach, which is currently used. Moreover, Multiple Agent Based (MAB) theory will be applied to enhance system's capability.

Strong support was received from target users in a survey conducted prior to development. Hence, it's believed that GACMS, once implemented, will become a helpful platform to further boost up efficiency and productivity of allowance claiming process.

Keywords*: Graduate Assistants, Agent-based Monitoring & Management System: PETRONAS University of Technology Graduate Assistantship Claim Process, PETRONAS University of Technology, Multiple Agent Based.*

I. INTRODUCTION

Along the history, many Internet based products such as Web 2.0, Cloud Computing etc. have reformed our daily life [1]. Web portal, though not a new approach, still posed a great improvement in productivity of community, group and organization. Under the scope of higher education, many manual procedures such as course registration or academic result monitoring can be done easily using Web portals. In Malaysia, portal concept is broadly used at most of universities and colleges including Universiti Malaya (UM), Universiti Sains Malaysia (USM) and PETRONAS University of Technology (UTP).

In UTP, however, typical Web portals such as the e-Learning and PRISM are meant for the academic sector and only profit undergraduate students. Meanwhile, the number of Graduate Assistants and researchers is dramatically increasing, as UTP is moving toward the Research University (RU) status; that brings to the university not only benefits but also lots of difficulties in management. Monthly allowance claiming for GA is one of those.

II. PROBLEM STATEMENT

Based on observation from the operation of Center for Graduate Study (CGS) in UTP as well as precise measurement in GAs' community, it's concluded that there are several common issues regarding the allowance requesting procedure:

- By 15th of each month, each GA has to submit a form (UTP/PPS/003-A) to CGS Office stating clearly all the finished work such as laboratory demonstration, tutorial session together with daily research activity. In order for each form to be approved, lecturer/supervisor must manually check one by one and pass to Post Graduate Coordinator for signing. After that, GAs must have their forms endorsed by Head Of Department (HOD) and CGS Office before receiving their allowance. So, the form needs to be filled once but examined manually five times by five different parties.
- It is obvious that much of time and human resource has been wasted by using the traditional method, not only in processing but also in delivering the form between various places. Moreover, according to Associate Professor Dr. Mohd Fadzil Hassan, Dean of CGS, there is one staff under his division and another staff from Finance Department dedicatedly assigned to take care of the claiming process.
- Human errors are unavoidable as everything is carried out manually. When mistake is made, the procedure must be started all over again.
- There are unexpected situations in which some claims cannot be submitted on time. For

instance, GAs or their lecturer/supervisor are travelling for work or attending conference etc. The issue even gets bigger as it's impossible for a claim to be carried forward or pre-dumped.

- Administration people (HOD, CGS Dean) do not have any tool or method to monitor this process or assess GAs' performance.

Significance

GACMS provides a digital platform that enables all stakeholders to perform their task in the claim process online effortlessly without a problem.

Objective

The objective of GACMS is to integrate agent-based model into Web Portal platform and develop a system that facilitates the allowance claiming process. Besides, this project also aims to migrate data from excel files to database server so no registration is needed for stakeholders and content management is improved.

Scope of Study

The scope of the prototype would be firstly to provide the main functions for claim process such as submitting, endorsing claim and content management for system administrator. Besides, it's important to emphasize that GACMS is designed exclusively for UTP, especially for CGS Office.

Upon completion, GACMS will be available online to facilitate any remote access of users regarding the allowance claim process. Further development may diversify the project into different mobile platforms to improve convenience and mobility.

Relevance and Feasibility

First of all, core idea of GACMS comes from an existing problem thus the development of this project as a solution received strong support from stakeholders since beginning.

Secondly, users are not required to create any account to make use of GACMS; instead, they can use either matrix Id (for GA) or PETRONAS email (for staff) as log in identity and start using right after the system is up online. This will shorten training time or guidance for the new system.

On top of that, open source developing tools and programming languages (PHP, Eclipse Indigo) were chosen so modularization, outsourcing and delegation can be done at a great ease at the lowest cost.

Last but not least, based on the size and the number of compulsory modules, the estimated time to complete the first prototype is late December 2012, which is well aligned with planned time frame.

III. LITERATURE REVIEW

It would be hard to find a campus where someone—whether in university management or in an academic department—has never used a Web portal; it's so popular that some people even use without knowing.

Though they are widely used, the success of portals depends heavily on how the university perceives it. But one obvious reason for deploying portals is to improve productivity by increasing the speed and customizing the content of information provided to internal and external constituencies. Portals also serve a management function by dealing with information glut in an organized fashion. Nevertheless, portals can offer a technical solution, but not a total answer because they are usually lack of crucial assistive abilities such as autonomy or pro-activeness [2].

However, the new system can independently produce an executive report about the performance of GAs and the unsolved cases in a specific month and deliver to authorities automatically. These features are powered by using PHP/SWF Charts and PHPMailer, which are two open-source libraries that transform GACMS into a Multiple Agent Based system.

On the other side, systems such as UTP eLearning [3] or UTP PRISM [4] are currently used in UTP to help only undergraduate students not GAs. Furthermore, typical existing claim management systems like C2Trak [5], HRA Claims Monitoring [6] or Metrix [7] either focus only on medical claim or depend too much on a specific platform (e.g. need to run on Windows or Java Runtime Environment). Such drawbacks make them not applicable in this situation. That is where GACMS targets to fill in.

IV. METHODOLOGY

Research Methodology

Before designing and implementing the project, an intensive study regarding literature review and background information was carried out via various available sources such as Internet, books and journals. These channels are accessible personally as well as from Information Resource Center (IRC), UTP.

Interviews and questionnaires regarding the proposed topic were also conducted both at post-graduate students' and administrations' side. After that, data analysis was carefully performed to

reinforce the relevancy before project's implementation.

Last but not least, after deployment phase, feedbacks and comments are to be collected from users to ensure the efficiency of this system.

Development Methodology

When the business model is likely to be modified as the project proceeds or when time constraint is taken into account, developer is put into a highly uncertain situation. As a result, prototyping becomes the most suitable methodology to pursue. Figure 8 shows the common phases of Prototyping Development Methodology. The Analysis, Design, and Implementation phase are performed only once, yet they will be reviewed from time to time. The cycle repeated continually based on the sponsor comments until the prototype successfully meets the requirements. The last version of the prototype will then be called the final system. Prototyping development needs only initial basic analysis and design, but as the result, important system functions may not be recognized until somewhere in the middle of project.

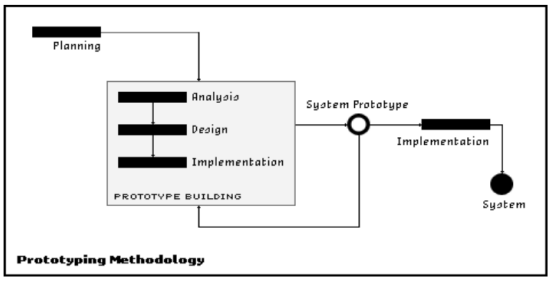


Figure 1: Prototyping Development Methodology

Tools Required

Hardware

- Apple iMac Computer
  - Intel® Core™ 2 Duo 2.5GHz
  - 4GB RAM
  - 320 GB Hard Disk (internal)
- External Hard Disk 1 TB (for back-up)
- Online hosting (ServerFreak - http://www.web-hosting.net.my)

Software

- XAMPP for Mac OS X 1.7.3 (PHP 5.3.10, Apache 2.2.2, MySQL 5.5.20, phpMyAdmin 3.4.10.1)
- TextWrangler (text editor)
- MySQLWorkBench 5.2.40
- Eclipse Indigo

Programming Language

- PHP, MySQL for databases
- HTML, CSS for formatting the webpage
- jQuery (Javascript)

V. RESULTS AND FINDINGS

Data Gathering

In this project, two methods were used in data gathering: interview and questionnaire.

Interview

The purpose of interviewing is to clarify the business logic and technical requirements from project sponsor – the Center for Graduate Study (CGS). Result will be elaborated in "Finding" section.

- Person Interviewed: Associate Professor Dr. Mohd Fadzil Hassan
- Department: Center for Graduate Studies
- Date/Time: 1st June 2012, 3:00 PM

Questionnaire

Questionnaire distribution was carried out online using Google Spreadsheet. So far there were sixty responses from Post Graduate (PG) Students – in Master and PhD Program. The result of this survey will be modeled and further discussed in "Data Analysis" section.

Finding

From the interview, some useful information about the allowance claiming process was obtained.

- CGS is the body that caters all claims and related issues.
- A claim can be submitted by GA or department but either way, it still has to get through five layers of endorsement before reaching Finance department. Those are approval from lecturer of the subject that GA is tutoring, direct supervisor, Post Graduate Coordinator in each department, Head of Department (HoD) and CGS Office.
- Real payment will be based on actual teaching/research hours and days recorded. This means the recorded time must be stored for further calculation.
- Pre-dumping or Carry-forward is not allowed.
- Total teaching time should not be lower than 5 hours a week or 20 hours a month.
- A minimum of 22 research days must be fulfilled in a month.
- Claim form must reach CGS office by 5pm, 15th of each month.
- Time spent for preparation, test/quiz/report marking is not counted for payment.
- Claims are processed one by one manually.
- Data are maintained stored as excel files and only one staff from CGS Office can understand clearly the content.

Obviously, it's not possible for any manager to monitor the performance of GAs even in one

month, let alone a historical summary. Besides, each department stores information about their respective subjects in different format and there was no standard method to combine the association between lecturers and GAs from all departments.

According to Dr. Fadzil, if a Monitoring & Management System is built to replace the manual approach, it must meet some requirements:

Compulsory Requirements:

- GA just needs to perform claiming once.
- All info must be maintained in database and manageable by CGS Office.
- A staff can play many roles in the system (i.e. lecturer/supervisor, HoD etc.).

Optional Requirements:

- The system can auto-remind all users about due time by email.
- Supervisor can directly access from PETRONAS inbox for better security and convenience.
- A historical summary of GAs' performance is made available.

Data Analysis

The amount of time each GA spends to perform the claiming process also vary from one person to another. In average, around 74% are able to finish it before 4 days (majority goes to 2-4 days), while the rest take one week or more. The total time wasted for this non-productive task in one year can be a huge number and GACMS can save it all, or at least, most of it.

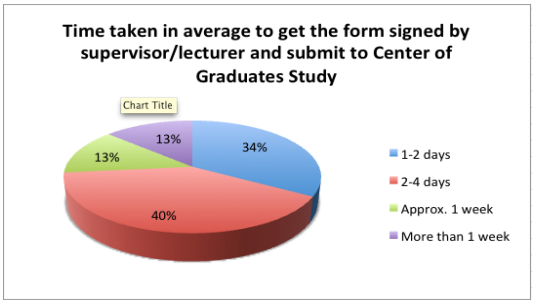


Figure 2: Time taken to have a form approved

Figure 3 describes GAs' opinion when being asked to give feedback on the effectiveness of the current claim process. 37% think that it is not really good and 20% claim that it is very bad but there was no satisfactory response (very effective). It's concluded that most of them do not find the manual method effective enough.

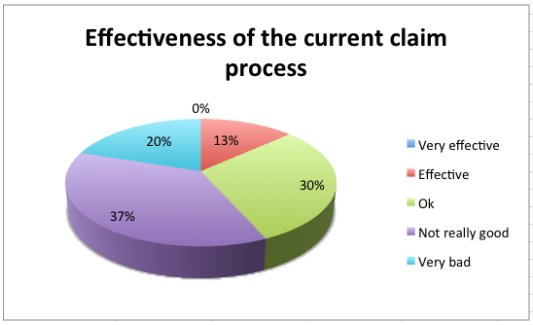


Figure 3: Effectiveness of the current claim process

On top of that, figure 4 shows more than half of the respondents (55%) complaining about problems they sometimes have with the claim process. The reasons can be the availability of the supervisor, medical leave or travelling to name a few. Among others, 13% say they have such issues quite often but only 10% never face any problems.

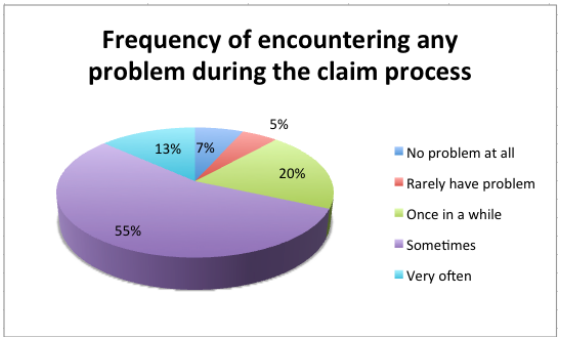


Figure 4: Frequency of occurring problems

When being introduced with an online system, majority of participants (73%) agree that it can help this claim process. Figure 5 also reveals that 20% even strongly support and encourage the idea. Obviously, there was no disagreement to the idea of having the process done online.

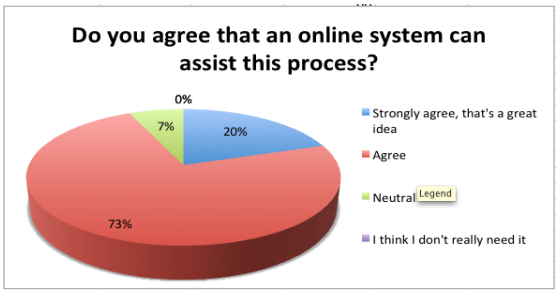


Figure 5: GAs' opinion about an online claim system

Activity Diagram

User, after signed in at frontend, will be categorized based on a user_class parameter. There are some conditions set by the systems that are compulsory for user to follow:

- user_class value will decide the access right of one user. User with higher user_class can gain access to more modules.
- Each user only has one user_class value. If (s)he plays many roles, the role with highest user_class will be chosen e.g. a user can be HoD and supervior at the same time, so his user_class should be 4.
- Only CGS Office can modify the content of claim after it has been endorsed (at least at 1 level).
- Head of each Department or Post Graduate Coordinator can view historical summary of GA from his/her department only.
- Lecturer/Supervisor can only view claims from his/her subordinate GAs.

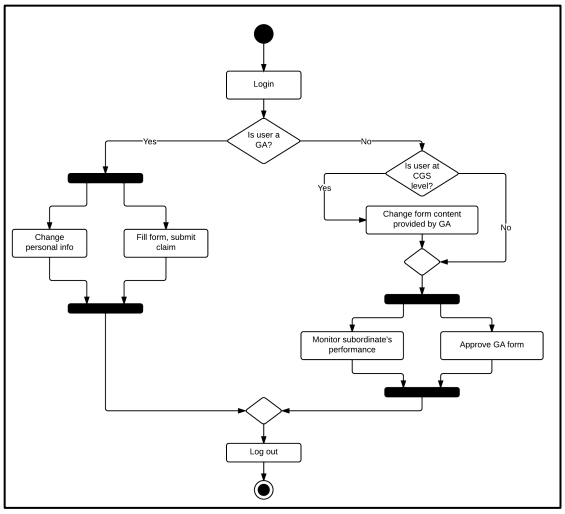


Figure 6: Front-End Activity Diagram

Backend of GACMS is a Content Management System where administrator from CGS Office can manage and make change to any data including user account. Basically, each module will handle an object at frontend e.g. GA, lecturer, subject. In which, administrator can perform four actions: "View", "Add", "Update" and "Delete".

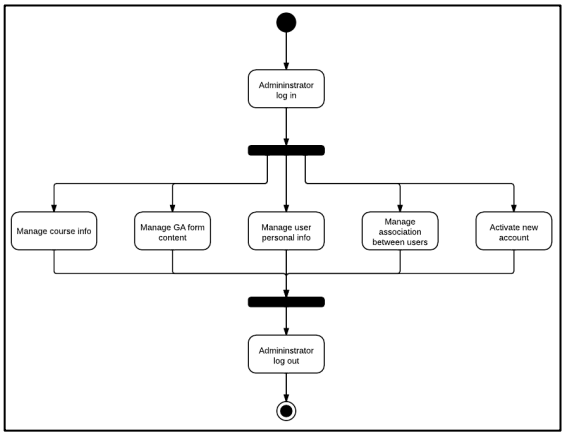


Figure 7: Back-End Activity Diagram

System Architecture

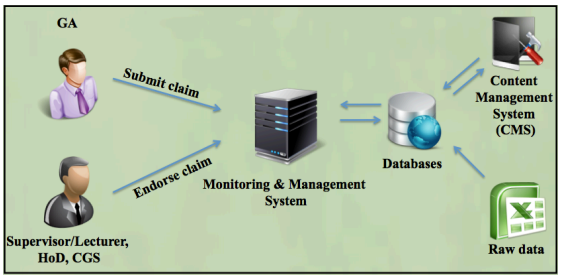


Figure 8: System Architecture

The development phase comprises of many steps.

- Design database structure to be aligned with structure used in excel files
- Extract necessary info from raw data using a PHP class called "Excelreader" and insert into database
- Refine the inserted data to improve usability
- Build a Content Management System to handle all tables in database
- Build frontend as interface for all users.
- Publish the system

After the system is ready, following tasks can be preformed:

- User sends request to webserver via GACMS frontend, by inputting a claim (if GA) or endorse claims (if not GA).
- The system will process the request, by obtaining the data from database for any view request or updating database upon valid request.
- If there is any change needs to be made on database content, administrator will do at backend.

Database Design

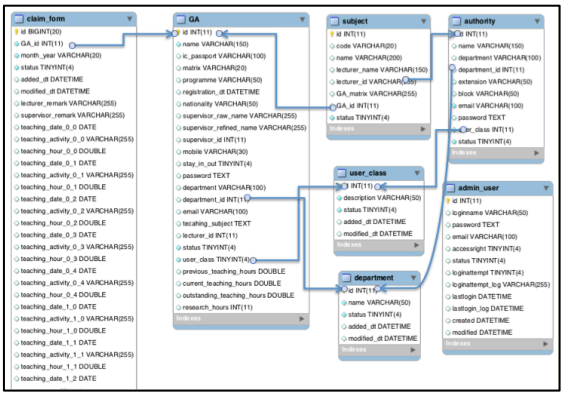


Figure 9: Database Schema

User Interface

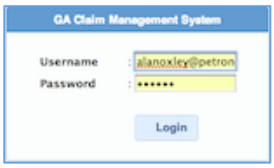


Figure 10: Frontend Login

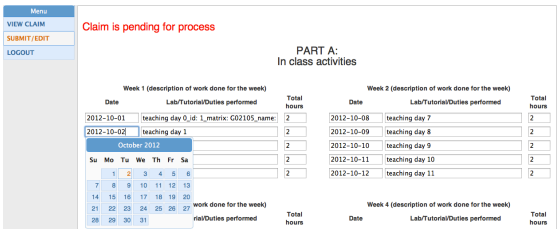


Figure 11: Submit Claim

Figure 12: Backend Login

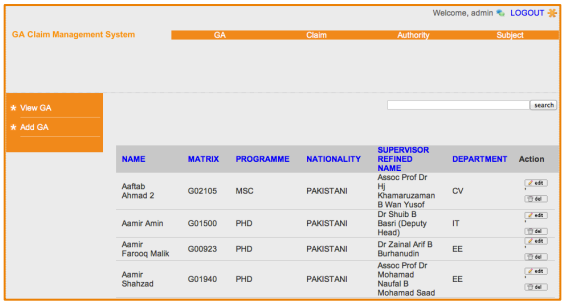


Figure 13: GA module -View (backend)

Testing

Testing is an important part of any system development. It helps to find the bugs and unwanted events as well as to realize the limitations of the system itself. For GACMS, testing has been done online at www.pluzme.net/GACMS/.

Functional Testing: is to make sure that the main functionalities of the system are working. Main functionalities of the system tested and verified are:

- Login
- View claim
- Edit / Submit claim
- Check claim submitted by subordinate GA
- Endorse claim
- CMS: viewing, deleting, updating, and adding of records

User's recommendation

- Refine database structure
- Make the number of input become dynamic instead of static
- Profile page for user at frontend and administrator at backend

VI. CONCLUSION AND RECOMMENDATION

GACMS 1.0 is the working prototype that covers all the hard constraints set earlier in the project initiation. It is able to let GAs submit their allowance claim and authorities endorse. The prototype also provides a basic Content Management System (CMS) to assist administrators in maintaining the system. The prototype itself is actually very close to being "implementable". We only need the more input from other departments rather than Computer & Information Science, some more time and configuration, then the system will be up and running.

In conclusion, the project has achieved its objectives in helping UTP GAs and administrative staff in processing allowance claim more effectively. The system also makes it more convenient for the management as it will bring about fewer changes to be made for each semester. Since GACMS is the first of its kind, the system is certainly the best possible temporary solution, in which GAs are strongly looking forward for the project to be implemented.

Future Work Continuation

Certainly, GACMS should be able to serve its main objective is to assist user finishing allowance claim procedure. Upon achieving that, there are several enhancements should be made:

- Providing a historical summary of claim is a good idea. It's useful to observe the change in performance of one GA over the time.
- Creating chart from mined data is great for investigating group's average performance e.g. comparing between departments.
- User will probably like a profile page where they can mange their own bio-data without asking for help from the university management.
- At this point of time, auto-reminding by email is still under development but it will surely appear in the real implementation.
- Last but not least, having GACMS on mobile platform is obviously more attractive to user. Thus, porting to mobile is also included in our 'wish list' to be considered in the future.

VII. ACKNOWLEDGEMENT

Author would like to express his gratitude to Associate Professor Dr. Mohd Fadzil Hassan, Dean of Center for Graduate Study, PETRONAS University of Technology (UTP) for his constructive advice and continuous guidance. He also wants to thank Ms. Nem Sopha, an outstanding alumna of Computer and Information System Department, UTP and all Graduate Assistants from the different departments of the university, who participated in the research phase for giving up their precious time to support and provide valuable opinion glossing the project.

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