

**Software Management Solution: Samsung Printer Arrangement
Project for Sepang University**

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Business Case

Introduction/Background

A large number of users (around 14,500) use the print devices (around 840 devices) on a daily basis, and the existing print service managed by a decentralized management system which is shared between the IT department, the Print Room, and Denko, which is their main print device supplier till now. Due to uncertainties on who should take ownership of the initiative, they were put aside the upgrade for the entire system and its services.

There were many aspects of the service that users were unhappy about. The contract with Denko, is coming to an end. There were issues with regard to the existing print management software that was designed in-house. The original programmer had left the University. Some of the print devices were managed by Silverra, tied to Denko's devices, which had its own set of problems in terms of management and licenses.

Business Objective

The business objective is to develop a whole new enhanced printing system and services that provide better user experiences. Completed software system should meet all users' needs and satisfaction. Besides, this project aims to explore a better supplier and software engineering experts for development.

Current Situation and Problem Statement

The current situation is that most of the staff and students are dissatisfied with the current printing system, there may be many reasons. Upgrading the service using the current software is unlikely to happen due to the quitting of original programmers. A decentralized management system increases problems of coordination among various units, establishing of various departments and employment of specialists in each department. All these problems will result in higher costs of further operations. Each department will tend to be self-centered ignoring the broader interests of other departments and that of the entire firm. Due to uncertainties on who should take ownership of the initiative, the whole plan was put on hold. Besides, some of the print

devices were managed by Silverra, tied to Denko's devices, which had its own set of problems in terms of management and licenses.

Problems negatively impact the business goals in current situation. There may be a series of events in which each event is the result of the one preceding and the cause of the one following.

Critical Assumptions and Constraints

Because of needs of separating different users into different types of account, all users in campus are categorized into two types, students and staffs. According to background information, default student and staff ratio is set to 1: 10, which is 13180: 1320.

By setting a default ratio for students and staffs, numbers of dorms and other buildings should also be assumed. Default numbers of dorms are set to 12 blocks, divided into total three building groups, four blocks in each group. Total numbers of lecture buildings are set to 15 blocks, and there are one library locating inside campus. All staffs' offices are randomly spreading over lecture buildings. Default size of office is set to 6 staffs per office.

Considering the contract between campus and Denko is coming to an end, school has to find new supplier for machine renewal. Therefore, total 360 personal printers and 420 large printers may be sold. In exchange, campus is able to purchase new printers without spending any money from budgets. Considering all these old printers are second handed, so the default depreciation rate is set to 30%. Assume per old personal printer is worth 100 USD, per large printer is worth 180 USD. As for the constructions of this campus, there will be 12 student dorms, one library, 15 lecture buildings. These numbers are set for further deployment schedules. The number of offices is designed according to plans, which will be stated in options.

PC devices that system connecting should be expanded. Instead of using limited desktops in campus that connecting the system, the devices should be expanded to personal PCs including laptops, smartphones that connect to the school LAN.

Analysis of Options and Recommendation

By combining assumptions and realistic issue, two plans are designed for this project. In order to help users get used to new system, there will be total three terms of renewing and placing printers. Each term contains four dorms and five lecture buildings. Printers in library will be the first term to replace. Because of the size of personal printers is way too small to handle large amount of printing jobs, all personal printers will be sold in the initial stage for money. The idea is to gather certain extra budgets for renewing old printers, whether to sell large printers is under consideration. Following are detailed plan introduction.

Plan one:

- Sell 360 personal printers without buying any new printer during initial stage
- Total 420 large printers, 60 multi-functional (online service) printers
- Will assign four printers per dorm
- 420 large printers are divided into 200 for students and 220 for staffs. Among 200 (for student) large printers, 150 are assigned to the lecture buildings, 26 are assigned to the library, 24 are assigned to the dorms (two per dorm). 220 (for staff) large printers are assigned to 37 offices.
- 60 multi-functional printers are divided into 24 for students and 36 for staffs. Among 24 (for student) multi-functional, 2 for each dorm.
- Among 36 (staff) multi-functional printers, 37 staff will share one of them.

Plan two:

- Sell all printers, the funds will be used on buying new type of Samsung printer (type SL-C430W) which worth RM 522.5 for each one and 60 multifunctional printers (type SL-X4250LX) which worth RM 22,000 each.
- Total 200 personal printers, 60 multi-functional printers (online service)
- Will assign three printers per dorm
- 200 personal printers are divided into 100 student and 100 staff. Among 100 personal printers (for student), 12 are assigned to dorms, 13 are assigned to library, 75 are assigned to lecture buildings. Among 100 personal printers (staff), they will be assigned to 17 offices
- 60 multifunction printers are divided into 24 (student) and 36 (staff). Among 24 multifunctional printers (student), two are assigned for each dorm. Among 36

multifunctional printers (staff), 37 staffs will share one.

Except for printers' deployment, employing a group of competent and suitable professionals to form a project team for temporary or long term (preferred) development and management is also a vital part in this project. As it is barely possible to update the original system, a new trustworthy team of programmers and manager are strongly required to develop a whole new printing system for school uses. For both plans, the number of each position is fixed. Following are detailed project team positions:

- Two UI designers
- Two software architects
- One database and server programming leader, two programmers
- One software functions programming leader, two programmers
- One UI programming leader, one programmer
- Three software testers
- Three part-time workers

Preliminary Project Requirements

Between these two plans, three types of user accounts are involved. Staff, student and admin have different authorities to access the printing system. The main features of these accounts include the following:

1. Students and staffs have ability to upload their files to printing system. Before they print those files out, they have chance to preview the whole file.
2. Access to system manuals. Many users won't get used to a new software in the first time. Thus, a detailed manual is necessary for them to get started.
3. Ability to make online appointments. Students and staffs may use printing system to make online printing appointments, which provides users much convenience when they are rushing time.
4. Online payment available. Student accounts can pay the printing fee online with their student cards, besides, offline card sensors are deployed on each machine for students to swipe to pay.
5. Feedback portal available. When any accidents occur (i.e. money deduction with broken printer), users may go through feedback portal on the software to contact manager and discuss solutions.

Following are use cases of these three types of accounts:

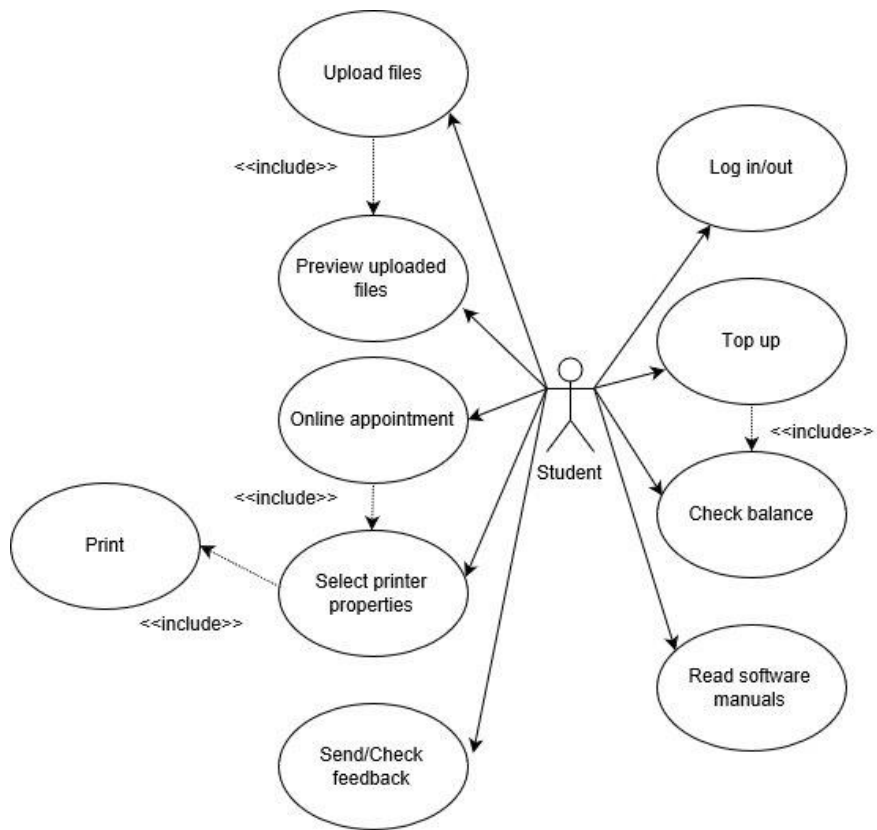


Figure 1.1: Student use case

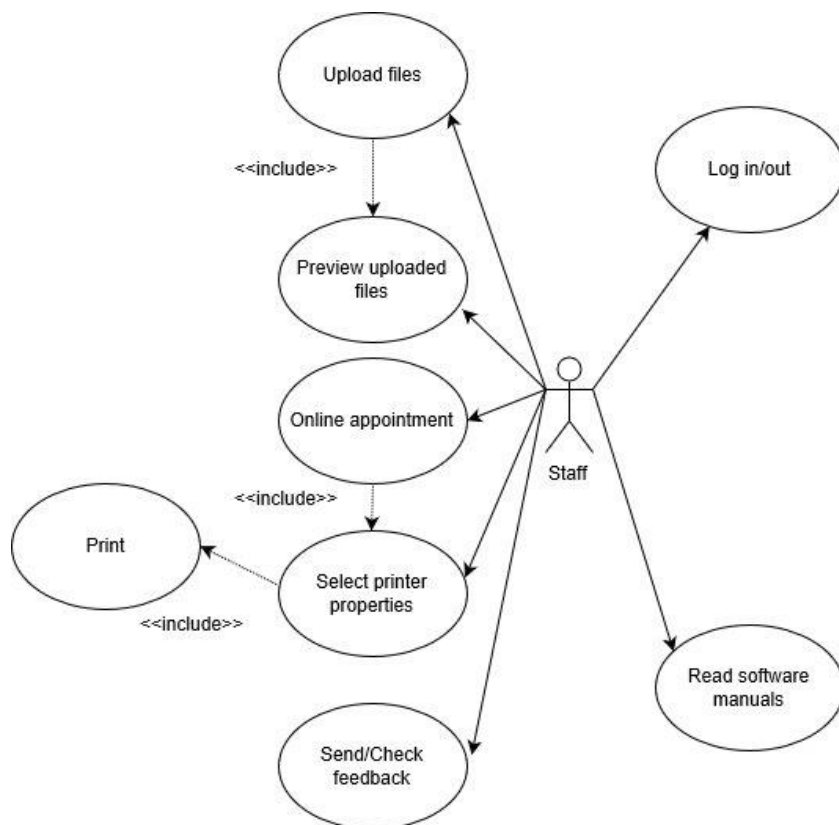


Figure 1.2: Staff use case

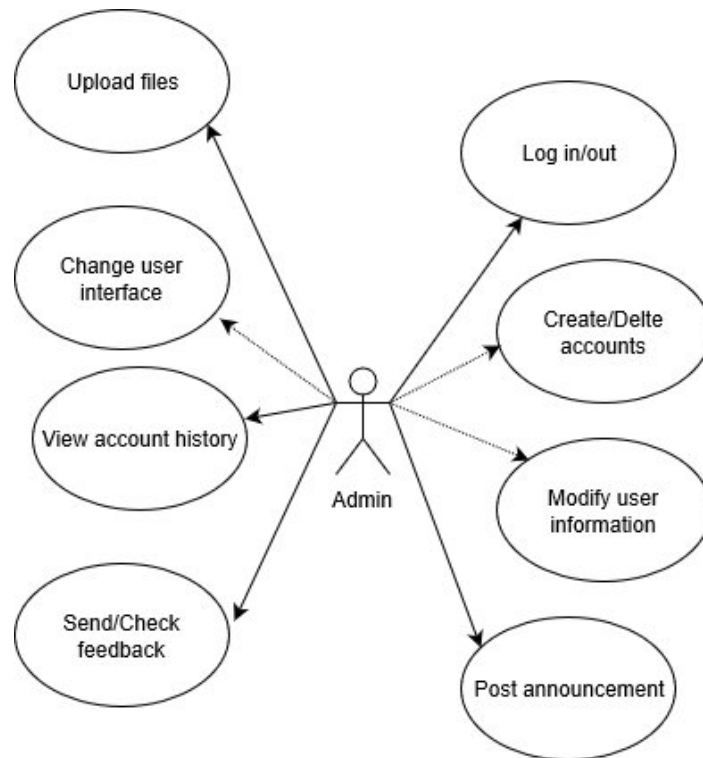


Figure 1.3: Admin use case

Budget Estimate and Breakdown

A preliminary estimate of costs for the entire project is RM 1,052,896. This estimation is based on eight hours working time. First stage of designing will last for one month. Two UI designers will take RM 7040 each. Software architect will take RM 10560 each. On the second stage programming, which will probably take three months to complete, database and server deployment team leader will take RM 31680 and two programmers will take RM 26400 each. For software functions programming team, leader will take RM 31680 and three programmers will take RM 26400 each. UI programming team leader will earn RM 26400 and programmer will earn RM 21120. On stage three testing, which will take about two months to complete, each tester will earn RM 2400 for total 2 weeks work. During testing, all three programming teams still have 10% of salary last for two months. Stage four is deploying and running, three part-time workers will earn RM 10 per day.

Choosing plan two will exchange all personal and large printers into approximately 200 new personal printers and 14 multifunctional printers without any cost on 1,500,000RM budget. All saved budget will used in further maintenance.

Schedule Estimate

Total schedule is divided into several parts:

Activity	Time
User Requirements Collecting	1 month
Define Requirements and Risks	1 month
Brief Development Team	1 week
Proposal Writing	1 month
Project Team Recruitment	2 months
Initial Software UI Design	1 month
Initial Software Architecture Design	1 month
Programming	3 months
White Box Testing	2 weeks
Black Box Testing	2 weeks
Debugging and Maintenance	2 months
Printers Purchasing and Shipping	1 month
Printers Deploying	1 month
Beta Testing	1 month

Table 1.1: Schedule Estimation

From Table 1, initial designing can be done together. Also, printers purchasing and shipping can be done while programming is proceeding. Therefore, the total amount of time is 14 months and one week.

Potential Risks

1. Based on assumptions and options, there could be several severe risks that project team would face.
2. Total depreciation may not exceed 30%. The percentage of depreciation rate took the reference from websites, which means in real case all personal and large printers may not exchange 200 new printers.
3. Cannot hire proper programmers/designers. This may end with low efficient work experience, and waste of money. If project team is not playing as a positive member, whole process will be slowed down and further cause damages to all stakeholders.
4. No space for deploying printers in dorms. Dorms are already designed before being built, technically it is hard to implement several big and new printers into public

area in dorms.

5. High rework rate and maintenance rate. This is may be both hardware and software problems. There will be certain conflicts when implementing software to printers. Thus, software needs to be reworked until it fits the printers and users' needs
6. System down at the same time the new system launch. As a matter of fact, the old system cannot be used during the upgrade because the development of the new system may require testing on the old hardware, which will trigger low performance and bad user experience in the entire school.
7. Project team may not fully know the requirement of the end users. As the new printing system is going to be applied in term of the entire university, it is necessary to use certain methods to get aware of new demanding from users (students and staff) in order to develop new functions.

Stakeholder Management Strategy

Introduction

The Stakeholder Management Strategy for Sepang University's Printing System Upgrade Project will be used to identify and classify project stakeholders, and determine stakeholder power, interest, and influence and also analyze the management approach and communication methodology for project stakeholders. So that we can identify key influential stakeholders to apply input for project planning and gain support as the project progresses. This will benefit the project by minimizing the possibility of encountering competing objectives and maximizing the resources required to complete the project.

Early identification and communication with stakeholders is necessary to ensure the achievement of the Sepang University's Printing System Upgrade Project by gaining support and input for the project. Some stakeholders may have interests which may be positively or negatively affected by the Sepang University's Printing System Upgrade Project. By initiating early and frequent communication and stakeholder management, we can effectively manage and balance all these interests while accomplishing all project tasks.

Identify stakeholders

The Sepang University's Printing System Upgrade Project Team will conduct a brainstorming session in order to identify stakeholders for the project. The brainstorming session will include the primary project team and project sponsor(if any). The session will be broken down into 2 parts. The first part will focus on internal stakeholders within Sepang University. These stakeholders may include functional managers, operations personnel, finance personnel, warehouse and material handlers, and any other Sepang University employee who will be affected by the project. The second part of the session will focus on external stakeholders. These may include suppliers, trial customers, partner organizations, or any other individuals who reside outside of Sepang University. Some criteria will be used to determine if an individual will be included as a stakeholder. Stakeholders from the same organization will be grouped in order to simplify communication and stakeholder management.

Key Stakeholders

The project team will identify key stakeholders who have the most influence on the project or who may be impacted the most by it, and also require the most communication and management which will be determined as stakeholders are analyzed. Then, the Project Manager will develop a plan to obtain their feedback on the level of participation they desire, frequency and type of communication, and any concerns or conflicting interests they have.

Based on the feedback gathered by the project manager, the determination may be made to involve key stakeholders on steering committees, certain groups, or other project meetings or milestones. Thorough communication with key stakeholders is imperative to ensure all concerns are identified and addressed and that resources for the project remain available.

Stakeholder Analysis

The project team will categorize and analyze each stakeholder to determine the stakeholders' level of power or influence, plan the management approach for each stakeholder, and to determine the appropriate levels of communication and participation each stakeholder will have on the project.

The chart below will be used to establish stakeholders and their levels of interest and influence.

Name	Level of Interest	Level of Influence	Potential Management Strategies
Staff	low	medium	Selected staffs communicate test results and performance specifications and obtain feedback.
Student	medium	high	Selected students communicate test results and performance specifications and obtain feedback on user requirements

			or any changes. Provide frequent status reports and updates.
School shareholder	high	low	Communicate project specifications as required.
Part-time worker	high	high	Maintain the Printing devices, pay attention to the status of each device and the volume of paper within it, always refill papers to the devices to ensure the printing service without interruption.
Hardware supplier	high	medium	Communicate project schedule and material requirements ahead of time to ensure delivery of hardware. Apply frequent updates and maintain plan for alternative supply source.
Software Engineer/ Programmer	high	high	Communicate project schedule and material requirements ahead of time to ensure delivery of software. Apply frequent updates and develop plan for alternative supply source. Communicate resource requirements early and ensure resources are released back to engineering when they are no longer required.
IT department	medium	medium	Communicate project schedule and requirements ahead of time to ensure the launch of whole system. Allow technical staff to work with stakeholder to answer questions and address concerns and provide test results for validation.

Project management team	medium	medium	Communicate project specifications as required. Solicit stakeholder as member of steering committee and obtain feedback on project planning. Frequent communication and addressing concerns are necessary.
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Table 2.1: stakeholders and their levels of interest and influence

Scope Statement

Project justification

a) To create a new, clear printing solution that can be managed to renovate by existing programmers in school.

Since it is not likely to happen to upgrade the old system because the original programmer has left the university, the only applicable way for continuously managing the printing system as well as revising it when necessary are either buy a printing system product developed by other company or develop one of the own for the university. However, with some specific new requirements came up from the users, products from other company may not be suitable for the project. In order to take all the concerns into consideration, develop a unique printing system for the university seems to be optimized.

b) To deliver the best products that is sustainable to use for students and staff.

Besides the original uses that the old system contains, the new printing solution will add some new functions that will make staff a lot more systematic to use, empower students to focus on learning as well as saving time. The additional renovations include hardware connecting to the system and software functions attaching to it.

c) To provide a convenient, manageable and systematic solution for admin to access and resolve.

The new solution intends to make every printing tasks visible to the system in order to let admin inspect, manage and report whenever necessary. Because the old personal printers are not able to connect to any printing system, therefore, any tasks from them are not able to be accessed by admin. In this case, replacing the old personal printers with new machines that can attach to the printing system seems to be indispensable.

Product characteristics and requirements

a) User Level Tracking

Users are able to view their own account information via the user interface of PC software (Available for Windows and Mac) or mobile application (Available for

Android and IOS) within the school LAN, which provides services to users that enhance the print tracking experience.

- Summary page: Display the user's printing credit in real-time, users can check balance and balance history.
- Redeem Card page: add top-up/ pre-paid card value to user balance.
- Transfers page: Transfer balance to other users (i.e. for student group projects).
- Recent Print Jobs page: A user's reference for their print history and may also request for refunds with supporting detail.

b) Printer Level Tracking

Tracking by printer helps us to understand and collect the data of how much printers are used, by who and when. This assists decisions such as purchasing a new printer or re-allocating existing printers to achieve more efficient usage in the campus.

- Compare and analyze printer usage to determine which printers are used most
- See detailed logs for each printer
- Visual charts help admin to understand utilization

c) Reports generating

All of logging is available for viewing or export as reports. Admins can generate reports, samples of the available reports including user based reports, printer based reports and so on. With the use of filters and sorting, the work can be more productive and efficient. All reports are available in PDF, CSV/Excel and HTML format for further analysis or presentation.

- Report should sort loggings and jobs by names, users, time, file formats (PDF, Words, Power points, etc.).
- Specify every jobs by marking users' ID, type of terminal that operated, printer that received the tasks, and whether jobs are succeeded, pending or canceled.
- Generate the report in a given time period unless there are special circumstances.

d) Appointment printing

Some end users especially students who do not have time to wait for their jobs to be done can make an appointment on the system by uploading the files, setting printers available for working and time of fetching. Then they can fetch their files at

the specified time without waiting for the job pending. However, there are some certain rules to follow by using this function.

- Users should fetch their items strictly on time, or the files might be missing and no responsibility will be taken by the school.
- One machine will only work for 3 person in an hour, so the appointments available will be relatively limited.
- Error reports will be sent to the admin to solve whenever happening and later will be induced to the reports as well.

User acceptance criteria

1. Whether the whole project plan given is suitable for this project.
2. Whether the requirement analysis meets the reality.
3. Whether the cost management plan is reasonable.

All the cases that cost budget is considered and the budget is estimated in a reasonable way.

4. Whether the schedule management plan is reasonable.

The project time management plan is design in a reasonable way, the time given to each parse neither too short nor too long. A good length of time for milestone is setting to provide the reasonable focused on the goal and help developer finish the given task on time.

5. Whether the print software design meets the users expected

The software is design base on the project requirement and can meet all the requirement that the users given. All the function that the print software was expected to have is well design in an easy accomplish way.

6. Whether the software is achieved following the software design

The printer system software is meet the requirement and achieve the final design.

Functionality:

- The softwre can be used in both printer side and user side. The user side software can use three different mode including administer, student and staff mode.

- The software can achieve the print reservation function.
- The software can achieve the top up and fee deduction function.
- The user information can be correctly stored in the database system and the database system information can be managed by the user who has the right.

User friendly:

- The software user interface is user friendly, all the words used in the software are correct.
- All the prompt information is clear and easy to understand.
- The interface of the print software is consistent in style.

7. Whether the printer arrangement is reasonable

- The old printers that cannot use the new system are sold in a reasonable price and the new printers are bought use the given budget.
- All the printers are installed the software and can run correctly.
- All the printers are settled down in dorms, school building and library.

8. Whether the whole print system work correctly

The print system can work correctly, fulfill all the staffs and students print needs.

Deliverables

1. Printing System Software Installation Procedure and Code

The software installation procedure should include printer side software installation procedure and user side installation procedure. All the installation procedure and code meet the requirement and be fully tested and debugged.

2. Project related documents

1	Project Development Plan
2	Requirements Specification
3	Project Cost Management document
4	System Preliminary Design Specification
5	System Detailed Design Document
6	Database Design Specification

7	Printer Procurement Program
8	Progress Report
9	FAT&SAT Report
10	Trial Run Report
11	Project Implementation Report
12	Maintenance Manual
13	System Operation Manual
14	Project Closure Report

Table 3.1: list of project related documents

3. Print system hardware

- Expected numbers of printer equipment. The whole printers used in the print system includes newly purchased printers and old printers that can use our new print system.
- All printers have the required printing system software installed and can be used as expected.
- All printers are placed correctly in dorms, school buildings and library following the plan, the part-time workers are hired to responsible to the print machines.

Request for Proposal

Background Information

Sepang University, consists of totally 14,500 staff and around 840 printing devices, is in need of an update of the printing system to support the daily printing demands due to three contract issues as below:

1. The current existing print service is made up of multiple types of print devices, and managed by a decentralized management system.
2. A survey shows that users are unhappy about the printing service.
3. The ten-year contract with our main printer supplier Denko is coming to an end.

Thus, to deal with these issues, a project on the printing system needs to be implemented. The main objectives of the project are to:

1. Sell the 840 old printing devices in the campus which have been used for a long time.
2. Purchase 200 personal printers and 60 multi-functional printers for printing use.
3. Develop a new printing software with online services as a new function.

The objective of this Request for Proposal is to seek sources that will provide the best overall value to Sepang University. Other details will be fully described in the sections below.

Basic Requirements

For the printing software, there are 3 requirements as below:

1. The software should have all the basic functions to be used for printing in a campus. These functions should allow users to log in and log out the system, top up and check balance, upload and preview files, read platform manuals, select printer properties and print.
2. Based on the normal functions, the software should have a new function which is to allow users to make an online appointment to print. For example, a user can choose to reserve a printing mission with a specific time one day before the date.
3. This software is better to have a mobile version application to facilitate users.

The careers desired for the printing software developing are shown as below with corresponding requirements:

1. 2 seats for UI designers, responsible for the user interface design of the printing software. People have experience of designing UI and good at this area are considered. Salary for each designer will be around RM7000 for the whole project.
2. 2 seats for architecture designers, in charge of the overall architecture design for the software. Relevant work experience is required. Architecture designers should have certain awareness about the basic structure of a software. Salary for each designer will be around RM10000 for the whole project.
3. 3 seats for database and server programmers, to develop the database and server of the software. One leader among three developers is needed to supervise other programmers and discuss work process with other team leaders. The one most technically able in the team will have priority to become the leader. Programmers are required to master in coding part about data and server developing. Salary for the leader will be around RM30000 and for each programmer will be around RM25000 for the whole project.
4. 4 seats for software function programmers, taking responsibility for the coding part to realize software functions. One leader will be selected for the person with highest ability among four programmers. The leader needs to supervise team members and discuss work process with other programming leaders. The one most technically able in the team will take precedence to serve as the leader. Programmers more technically acceptable will be optimal choices. Salary for the leader will be around RM30000 and for each programmer will be around RM25000 for the whole project.
5. 2 seats for UI programmers, aim at the coding part about user interface. There will be one lead programmers between the two, who will take additional responsibilities to discuss work process with other leaders. The requirement for UI programmers is to be proficient in user interface programming part, the one more technically able will take precedence to take the chair of team leader. Salary for the leader will be around RM25000 and for the other programmer will be around RM20000 for the whole project.

6. 3 seats for testers, whose job is to ensure the software is usable and of release quality. Testers are required to be experienced in testing area and know how to test a software thoroughly. Salary for each designer will be around RM2500 for the whole project.
7. 3 seats for part-time workers who are responsible to manage the number of papers in each online service printing machine. There is no other requirement if you are one of students studying in Sepang University. There is no need to stay at the printing machines for the whole day, you can only come for each two or three hours as long as the paper for machines are enough. Salary for each part-time worker is RM10 per day.

Tendering Process

Sepang University will use the competitive tendering approach to procure goods and services required. The tendering process for the project consists of following stages:

1. Advertise to procure services

To start recruiting, we will publish tenders on the website of Sepang University and national newspapers. Individuals or companies who are interested in participating in any tenders can seek for detailed information and requirements, answer and submit the prequalification questionnaire on Sepang University website.

2. Bidders Conference

Bidders who receive response and approval after submitting the prequalification questionnaires will be invited to attend the bidders conference held by Sepang University. During the conference, bidders are able to meet project managers, receive detailed instructions and ask questions about the proposal.

3. Receive proposals / quotations

After the conference, bidders who are still willing to cooperate with Sepang University are required to hand in a proposal to detail collaboration plan on the project implementation with a certain quotation.

4. Short-list

Sepang University will examine and evaluate bidders according to the proposals and quotations. The technical part will be the first evaluating criteria, bidders more technically able will be chosen. The second criteria will be the commercial part, bidders who are not only technically acceptable, but also with high commercial value will have a higher priority to be recruited. The shortlisted bidders will be informed privately.

5. Contract negotiations and technical presentation

The shortlisted bidders will have access to meet with project managers again to negotiate on contract related issues. Detailed requirements and further considerations can be put forward by both sides. Bidders need to present the technical part for managers to prove their abilities.

6. Best and final offer

The final offer for the project can be negotiated and determined if the two sides reach an agreement.

7. Sign contract

When all issues have been confirmed, the both sides can draw up and sign contract to formally reach a collaborative relationship and start work arrangement at an appointed time.

8. Announcement of results

At the end of the tendering process, the results of shortlisted companies or individuals will be announced on Sepang University website to notify all the bidders.

The process flow diagram is shown as below:

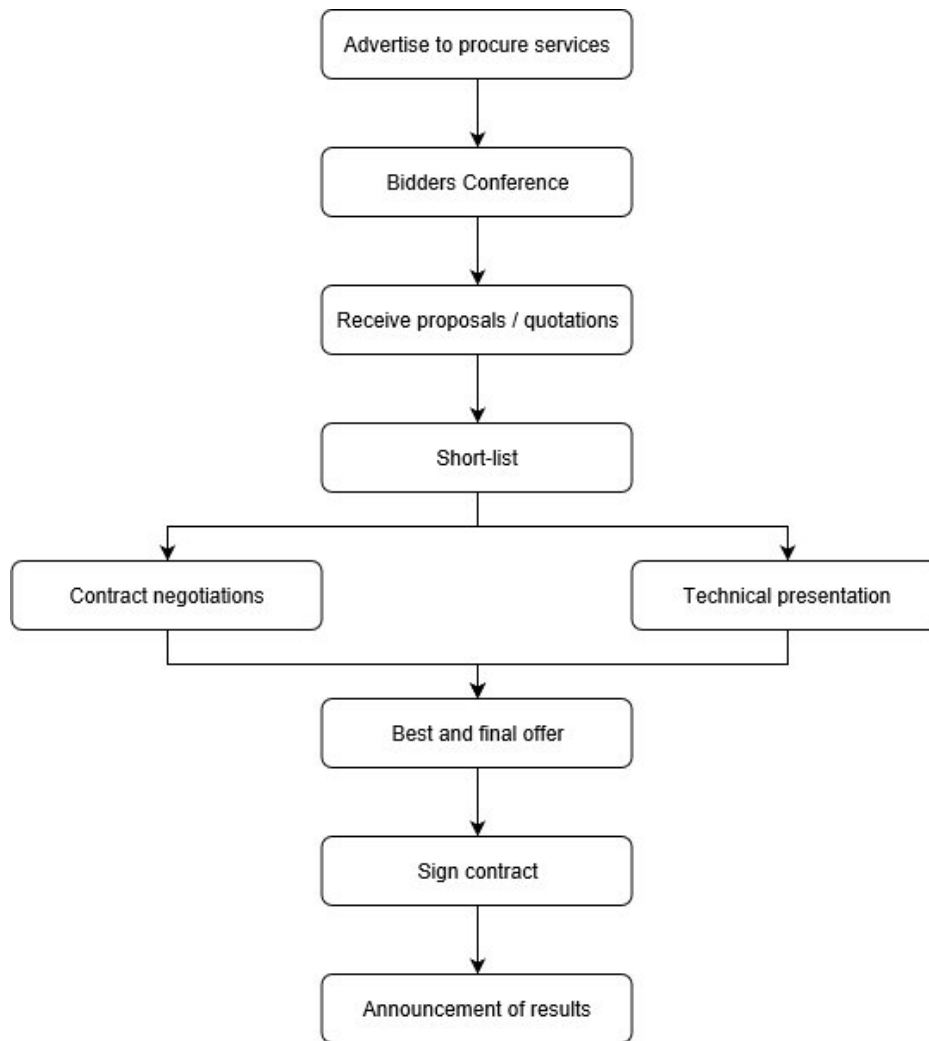


Figure 4.1: Process Flow Diagram

Statement of work

1. Scope of Work

a. Renewal printer

- Selling original printer

The original printers have been used in university for ten years and university wants to develop a new printing system for student and staff. Therefore 360 personnel printers, 420 large printers and 60 multi-function printers will be sold at a 30% default depreciation rate.

- Purchasing new printer

Considering the number of staff and student and their printing requirement, school will purchase 260 new Samsung printers to adjust the new system.

b. Develop system

University strongly requires a whole new printing system developed by a trustworthy team of software engineers and manager for student and staff.

- Employing professionals

The university will employ UI designer, software architect, database and server programming leader, software functions programming leader, UI programming leader, programmer and software tester to form a project team for the new printing system.

- Develop a new printing system

The project team members should work closely to develop a new printing system for school. After having a meeting with project manager, they need to plan the time of each task, which is initial software UI design, initial software architecture design, programming and testing.

2. Location of Work

All the work must be performed in Sepang University.

3. Period of Performance

The project starts in 1st, August, 2019 and end of 9th, October, 2020, which is last fourteen months and one week. Following the table is the working hours and salary of each employee, and the salary for the long-term part-time job is RM10 per day.

	Working hours per day	Salary per hour(RM)
UI Designer	8	40
Software Architect	8	60
Data/Server Leader	8	60
Data/Server Programmer	8	50
Function Leader	8	60
Function Programmer	8	50
UI Leader	8	50
UI Programmer	8	40
Tester	8	30

Table 4.1: working hours and salary for each position

4. Acceptance Criteria

- The requirement analysis meets the reality.
- The printing software design and functionality meets the user requirements.
- The schedule plan can be achievable.
- The whole printing system can work correctly.
- The whole system is easy to understand and use for user.

Schedule Information

1. User Requirements Collecting

The first step in software development process is gathering requirements. Because the purpose of a software development process is to take the user's requirements and transform them into a functional software system. This step helps to articulate the requirements the functional software must satisfy. It will cost one month, from 1st, August, 2019 that is the start of the project and using questionnaire forms to collect student and staff requirements about printing system.

2. Define Requirements and Risks

After gathering requirements, project manager should organize them to complete use case diagrams. It will spend one month in defining requirements and risks that may appear in the following development process, and complete system preliminary design specification structure.

3. Proposal Writing

In terms of the requirements, project manager should plan the initial project schedule, cost and what kind of software developers are needed by the project. This part will spend one month to finish project development plan, project cost management document and recruitment plan.

4. Project Team Recruitment

This step must be done after the proposal writing work has been completed. According to the recruitment plan, those who are satisfied to the requirements will be hired. In order to find the most professional employees in the field of print system development, this step will take a longer time – two months.

5. Brief Development Team

This step focus on the communication between project manager and development team mainly leaders of different parts about how to implement requirements in software. It will spend one week in modifying project development plan and project cost management document.

6. Initial Software UI Design

This part will spend one month in planning the UI design of the system and finishing system preliminary design specification, and it can be done simultaneous with initial software architecture design.

7. Initial Software Architecture Design

This part will spend one month in planning software architecture design and finishing preliminary design specification, and it can be done simultaneous with initial software UI design.

8. Programming

First, programmer leaders, database and server programming leader and software functions programming leader will finish system detailed design document and milestones schedule in programming part which takes three months. Then each leader should divide their task to every programmer and ensure their progress on schedule. This step should complete whole system.

9. Testing

This step is testing the whole system by using black box testing method and white box testing method. This process takes one month, which are black box testing two weeks and with box testing two weeks.

10. Debugging and Maintenance

In this process, program team should debug the errors that appeared in testing part, and maintain the whole printing system. This process takes two months.

11. Printers Purchasing and Shipping

This step spends one month in purchasing new printers (200 Samsung SL-C430W and 60 Samsung SL-X4250LX), and it can be done simultaneous with previous work to save time.

12. Printers Deploying

This process starts at second week on August, 2020 which is the summer holiday and lasts one month to avoid influencing students' using of printers.

13. Beta Testing

Last process is beta testing that takes one month. The whole printing system will be used in university to test whether it can run smoothly under daily work.

Figure 4.2 is the schedule of this project by using Gantt Chart form, starts in 1st, August, 2019 and end of 9th, October, 2020.

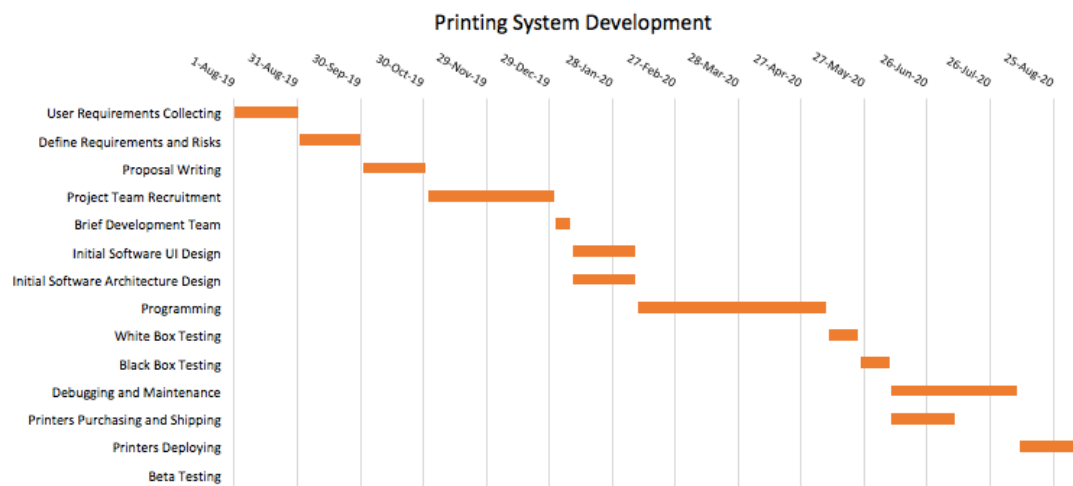


Figure 4.2: Gantt Chart of Printing System Development