2024 Secondary 3 Computing+ Coursework

Instructions to students

This is a group task. Please form a group of **two to three members**.

Issued on: Term 3 Week 1

Deadline: Term 3 Week 10, 28 August 2023, Wednesday, 1730 hours.
(We will check in with you on your progress on Term 3 Week 5 to 6. Please see below for details.)

Deliverables
Your group leader should make a copy of this document, complete it and submit it to your teacher by the deadline.

Important
There will be a penalty for late submission. Students who submit the task within 7-days (inclusive of the 7th day) after the deadline will be awarded 50% of the marks scored. A zero mark will be given if the task is submitted beyond 7 days after the deadline. Students are still expected to complete and submit the task even after 7 days of the deadline.

Declaration and statement of authorship:
1. This assignment is my/our original work and no part of it has been copied from any other student's work or from any other source except where due acknowledgement is made.   2. I understand that plagiarism is the presentation of the work, idea or creation of another person as though it is my own. It is a form of cheating and is a very serious academic offence. Plagiarised material can be drawn from, and presented in, written, graphic and visual form, including electronic data, and oral presentations. Plagiarism occurs when the origin of the material used is not appropriately cited.

	Name	Class/ Index No.	Role
Group Members	Tan Yu Kai James	S306/19	Lead Developer
	Jonaz Ho Hao Feng	S302/9	Martin Fun
	Martin Fun Jern Weng	S302/15	Jonaz Ho type shi

Learning Objectives

Students will be able to

- Gain a better understanding of Stages 1 and 2 of program development.
- Practice problem-solving techniques and apply computational thinking skills to solve a complex problem.
- Produce an algorithm to plan and design a digital solution for a problem.

Resources (for reference only)

- Google Science Fair Educator Resources

Timeline and Checkpoints

Week	Dates	Task(s) to be Completed
Term 3 Week 1	28 June, Friday	Form groups; Group leader submits the Grouping Form on your Google Classroom Coursework document is issued to the whole level.
Term 3 Week 1-4	28 June - 21 July	Groups ideate, research and complete Stage 1 of the Coursework. **Groups prepare draft for discussion with teachers.**
Term 3 Week 5-6	22 July - 4 August	Teachers check in on each group to check on their plans and provide feedback.
Term 3 Week 7-9	5 - 25 August	Groups plan their solutions in Stage 2 of the Coursework.
Term 3 Week 10	26 - 27 August	Groups finalise their Coursework and prepare for submission.
Term 3 Week 10	28 August 2024, Wednesday, 1730hrs	**Group leaders submit final Coursework to teachers.**

Grading and Evaluation

Marks (For Official Use)		
Stage 1.1	State a Problem Statement	**/ 3**
Stage 1.2	Background Research: Target Users	**/ 3**
	Background Research: Market Scan	**/ 3**
	Background Research: Citations	**/ 2**
Stage 2.1	Establish Design Criteria	**/ 3**
Stage 2.2	Preliminary Design	**/ 3**
	Pseudo-code or Flowchart	**/ 3**
TOTAL		**/ 20**
COMMENTS (if any)		

Task

"To nurture passionate innovators who apply knowledge of science and technology, guided by the spirit of the humanities for a better world."

- SST School Mission

Recall the five stages in developing a program:

Figure 8.1   Stages in developing a program

In this project work, we will focus on Stages 1 and 2. The two stages are broken into the following four steps:

Stage 1 - Gather Requirements

      1.1 State a Design Goal

      1.2 Background Research

Stage 2 - Plan Solutions

      2.1 Establish Design Criteria

      2.2 Preliminary Designs

While the actual code is not part of this coursework, you should still ensure that your planned solution can be carried out with the resources available to your group. When planning your solution, you should bear in mind that Python will be the main language of your eventual written code.

You should refer to the Scoring Rubrics to guide your solutions.

Stage 1 - Gather Requirements

1.1 State the Problem Statement

The first step of the design process is to define a need, which is based on what an identified group of users require. This need is then stated as a problem statement. For example, the need may be to find a faster way for computers to scan files for virus and spyware infections. The problem statement for this project might be "We want to write, test, and optimize software that decreases the time needed for a computer to scan files for virus and spyware infections."

Adapted Google Science Fair Resource Link (for your reference):
- Slides: 1. Identify a problem
- Idea Generation

Deliverable:
- Complete the table below to derive the problem statement.

Area What is the area of interest you are interested to explore?	Job search automation User experience enhancement in job applications Efficiency in job application processes Tools to automate repetitive tasks in applications Data-driven insights for job seekers Improved communication between job seekers and employers
Problem Statement Outline your identified problem.	How might we simplify and speed up the job application process for candidates with career breaks or specialised qualifications while ensuring better responses and feedback to improve their job search experience?
Impact Briefly state who would benefit from a solution and the challenges they face.	Job seekers with career breaks or specialised qualifications would benefit from a solution that simplifies the application process. These candidates need help with tasks like time-consuming applications, high rejection rates, lack of feedback, and unprofessional interview practices, which lead to frustration, reduced morale, and prolonged unemployment. A streamlined, responsive solution would help them navigate the job market more effectively, increasing their chances of securing meaningful employment.

1.2 Background Research

The second step of the design process is to do background research. During this part of the project, the student should seek out information related to his or her general area of interest or need (in the case of our example, this would be antivirus/antispyware software). In addition to becoming intimately familiar with his or her area of study, the student doing a computer science project should seek to understand the needs of their target user, and research software that may or may not currently exist to address the student's stated problem statement. They should also do research that will allow them to state specific design criteria.

Understanding the needs of the target users will help the student define the design criteria (the next step of the engineering design process). For example, a graphical user interface could be important for faster antivirus/spyware scanning if the target user for that product is a typical PC user. Becoming familiar with both the needs of the end-user of the product/program and the capabilities of existing products/programs will help the student write meaningful and measurable design criteria.

Adapted Google Science Fair Resource Link (for your reference):
- Slides: 2. Generate ideas
- Research Guide: Some tips for doing your own research into your area of interest
- Getting ready for your research: A framework to help you get curious about your area of interest, and keep the research focussed and meaningful

Deliverable:
- A *write-up* of your background research, in complete sentences and paragraphs with at least **300 words**, detailing:
  - What you have found out about the target users (area of interest) and their specific needs
  - Current solutions or partial-solutions that address the needs
  - The strengths and shortcomings of these solutions, analysed using the Opportunities and Threats analysis chart
- A *list of references* in APA format

Write-up *(expand the box as required)*

- A **write-up** of your background research, in complete sentences and paragraphs with at least **300 words**, detailing:
  - What you have found out about the target users (area of interest) and their specific needs
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  - The strengths and shortcomings of these solutions, analysed using the Opportunities and Threats analysis chart
- A **list of references** in APA format

Jobs play a vital role in keeping today's community thriving, acting as the background of society. They provide people with their livelihoods, as well as allow big companies to do their menial tasks.

In today's world, even with an improvement in quality of education(Szyliowicz et al., 2024) as well as the number of graduates from universities increasing(OECD, 2019), it is still very hard to find a job, with teens in the EU taking up to potentially 2 years or more to find a job(Quintini et al., 2007). Not only that, the application for the different jobs that fresh graduates do apply for are often time consuming and tedious, as not only do you have to fill up applications that may take up to more than 30 minutes (Cox, 2016), which oftentimes contain repeated information that are already in your resume, but waiting for responses from the company about the success of your application.

Making matters worse, job applications are typically submitted through the employer's website, making it hard to track everything in one place. Employers often don't update applicants on their application status, leaving them in the dark. It's not until weeks or even months later that job seekers realize their application didn't make the cut as employers often take a long while to repy.(Grainger, n.d.).

On average, landing a job requires about 162 applications(Fennell, 2023), and out of all those rejections, feedback is rarely given. Providing feedback to every candidate is too tedious for most employers.

Then, when a job offer does come through, the salary can be another issue. Many job seekers face the challenge of low salary brackets, and some may not know what a fair salary looks like for the job. They might accept the role, not realizing they're being underpaid.

The issues that need to be addressed are clear: making job applications more efficient, centralizing information, providing feedback to applicants, and ensuring transparency around salary expectations.

All of these problems must be solved without adding frustration for employers.

Background of current solutions and/or partial solutions

There are tools to help, but they're not perfect. Job aggregator sites like Indeed and LinkedIn make it easier to find jobs in one place, but you often have to visit external sites to apply. Automated resume builders like Resume.io and Jobscan can speed things up by creating tailored resumes and even auto-filling applications, but they don't fully solve the time-consuming nature of applying.

Job application tracking systems like Huntr help organize your job search, but they don't ensure employers will update you. Salary transparency tools like Glassdoor give insights into what you should earn, but the data isn't always accurate. There has also been the recent controversy of Glassdoor stealing user data when it was meant to be kept totally anonymous, thus making the site unreliable.

AI-powered job matching, like LinkedIn's recommendations, can suggest roles that fit your profile, but it's not always spot-on.

Some employers are using feedback platforms to explain why candidates weren't selected, but this isn't common yet. There are also services like TopResume that will apply to jobs for you, though they can be expensive and may lose the personal touch.

While these tools help with some of the issues, the job search process is still frustrating, with issues like lack of feedback and unclear salary expectations remaining. More streamlined solutions are definitely needed.

Market Scan

Based on your research on the current solutions to the problem you identified, fill up the chart below to summarise:

- **Your Opportunities**: components or features that are not well implemented or missing in existing solutions, that you can leverage on as a selling point in your solution
- **Your Threats**: components or features that are well implemented in exiting solutions, that may threaten the uniqueness or sellability of your solution

Add your responses on the topic to each box.

Opportunities	Threats
Comprehensive Feedback System - Most solutions and products do not have a comprehensive feedback system to provide feedback to applicants who did not succeed in landing the job. Having this as a solution will be a critical point in selling the idea of our product. Centralized Application Management - A tool that collates and tracks all applications in one place, regardless of where they were submitted Salary Benchmarking - While salary transparency tools exist, integrating real-time salary data directly into the job application process (maybe negotiation tips) could add significant value, helping candidates make informed decisions. Streamlined Multi-Platform Applications - A tool that reduces the number of steps needed to apply for jobs across different platforms by automating and simplifying the application process could be a major draw for job seekers tired of repetitive tasks.	Established Job Aggregation Platforms - Platforms like Indeed and LinkedIn have already perfected job aggregation, making it hard to compete purely on the basis of job `listings. AI-Powered Job Matching - Many platforms already use advanced AI to match job seekers with potential roles, making it difficult to compete on recommendation accuracy. Resume Optimization Tools - Automated resume builders and optimization services are already well-developed, offering convenience that could diminish the appeal of new solutions in this area. Brand Recognition - Established platforms have strong brand recognition and user trust, which could be a barrier for new entrants in the market. User Base and Data - Large platforms have extensive user data and networks, allowing them to continuously improve their services, making it harder for new solutions to offer better value.

List of References

Grainger, C. (2024, August 20). How many applications does it take to get a job? here's the real answer. Resume.io. https://resume.io/blog/how-many-applications-to-get-a-job

Szyliowicz, J. S. , Shimahara, . Nobuo , Nakosteen, . Mehdi K. , Anweiler, . Oskar , Bowen, . James , Chen, . Theodore Hsi-en , Graham, . Hugh F. , Riché, . Pierre , Marrou, . Henri-Irénée , Gelpi, . Ettore , Lauwerys, . Joseph Albert , Arnove, . Robert F. , Lawson, . Robert Frederic , Swink, . Roland Lee , Scanlon, . David G. , Meyer, . Adolphe Erich , Mukerji, . S.N. , Moumouni, . Abdou , Vázquez, . Josefina Zoraida , Chambliss, . J.J. , Ipfling, . Heinz-Jürgen , Thomas, . R. Murray , Browning, . Robert , Huq, . Muhammad Shamsul and Naka, . Arata (2024, August 17). education. Encyclopedia Britannica. https://www.britannica.com/topic/education

Organisation for Economic Co-operation and Development (OECD). (2019). *Benchmarking higher education system performance*. OECD Publishing. https://doi.org/10.1787/be5514d7-en

Quintini, G., Martin J. P., Martin S.(2007, January), *'The Changing Nature of the School-to-Work Transition Process in OECD Countries'*. Econstor. https://www.econstor.eu/bitstream/10419/33781/1/527494933.pdf

Cox, C. (2016). *How long should you spend on a job application?*. Cranberry Panda. https://www.cranberrypanda.co.uk/ecommerce-blog-post/how-long-should-you-spend-on-a-job-application

Grainger, C. (n.d.). *How many applications does it take to get a job? Here's the real answer*. Resume.io. https://resume.io/blog/how-many-applications-to-get-a-job

Fennell, A. (2023, October). *How many applications to get a job?* . StandOut CV. https://standout-cv.com/how-many-applications-to-get-a-job

Stage 2 - Plan Solutions

2.1 Establish Design Criteria

The third step of the design process is to establish design criteria. They are requirements that the student specifies that will help them develop their software and determine the extent to which the final product/program resolves the stated problem statement. For our example, some of the design criteria in our example problem statement might be:

(1) scans 1,000 files in 0.5 seconds with 99.5% detection accuracy,

(2) performs a complete system scan in less time than Brand X antivirus/antispyware software,

(3) consumes less than 15 MB of memory while running.

Adapted Google Science Fair Resource Link (for your reference):
- Slides: 4. Design the test

Deliverable:

- A write-up of the design criteria for your project work, using the table on the next page, with:
  - at least **3 independent criteria**, stated in as much detail as possible (use the SMART acronym) and
  - an explanation of why you believe each criterion to be necessary to resolve the problem statement and meet the needs of the target users.
- The write-up should be completed in the table on the next page

Problem Statement Restate your Problem Statement from Stage 1.1	How might we simplify and speed up the job application process for candidates with career breaks or specialised qualifications while ensuring better responses and feedback to improve their job search experience?
Design Criteria 1	*Criteria* Load different pages and all data in less than 3 seconds
	Explanation This is important to ensure that users do not get frustrated with the user experience, and have a easy time using the application.
Design Criteria 2	*Criteria* 90% accurate salary benchmarking
	Explanation This is to ensure that results and data given to users are accurate enough to give users a good sense of the job market.
Design Criteria 3	*Criteria* *Able to personalise search results*
	Explanation This is to add on to user accessibility and personalise job results based on preference (example: general location, work hours, experience level)

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2.2 Preliminary Design

The fourth step of the design process is to draw up a preliminary design of your approach or methodology. In the case of a computer science project, this step usually involves writing an outline explaining the program you will develop to solve the problem, complete with pseudo-codes or flowcharts of the algorithms for the overall program and key functions inside the program. The write-up should explain clearly how each design criteria will be addressed in the solution.

The outline and pseudo-code/flowchart should give an overview of the program; it does not need to contain all the details, but it should give an understanding of how you intend to solve the problem. If the pseudo-code or flowchart gets too large, the student is encouraged to split it into smaller pseudo-codes/flowcharts, one for each key function of the program. This key function can then be referred to by name in the main pseudo-code/flowchart.

Adapted Google Science Fair Resource Link (for your reference):
- 3. Develop a solution
- SCAMPER Creative Brainstorming Tool: A guide to help you think more thoroughly about your idea and how you can improve on it

Deliverable:
- A *write-up* of the preliminary design, describing an overview of the program and explaining how each design goal will be addressed in the solution, with at least **300 words**
- (A) *flowchart*(s) for the overall program and key functions inside the program, showing the broad overview of how the user will interact with your program and how information will flow through it

Write-up *(expand the box as required)*

Job hunting can be an exhausting and frustrating experience, especially with the tedious and inefficient processes that job seekers have to endure. Our platform is designed to tackle these pain points head-on, offering a solution that simplifies and enhances the job search experience. The focus is on making the process smoother, more transparent, and less time-consuming by addressing key areas that current solutions miss.

One of the biggest frustrations for job seekers is not knowing why they didn't get the job. Our platform will change that by including a feature where employers can easily provide personalized feedback to candidates. This feedback will help job seekers understand what went wrong and how they can improve, turning rejections into valuable learning opportunities. It's a win-win, as it also helps employers by encouraging more qualified and prepared applicants.

Keeping track of job applications across multiple websites is a nightmare. Our platform will bring everything into one easy-to-manage dashboard, where users can see all their applications in one place. It'll track the status of each application, send notifications for updates, and remind users when it's time to follow up. No more hunting through emails or logging into five different sites just to see where you stand.

Getting underpaid is a real risk, especially for those new to the job market. To help with that, our platform will include real-time salary data right where users need it—during the application process. We'll show what similar roles are paying, based on location, industry, and experience level, and even throw in some negotiation tips. This way, users can make informed decisions and avoid settling for less than they deserve.

Communication is key, but it's often lacking in the job search process. Our platform will make it easier for employers to stay in touch with candidates by prompting them to update application statuses and provide quick feedback. This transparency not only keeps job seekers in the loop but also helps employers build a positive reputation by showing they care about the candidate experience.

Applying for jobs on different sites can feel like running in circles. Our platform will streamline this by automating parts of the application process and reducing the number of steps needed to apply. We'll integrate with various job boards and company websites, so users can apply to multiple jobs with just a few clicks. It's all about saving time and cutting out the repetitive tasks that make job hunting so draining.

In short, our platform is designed to make job hunting less of a chore and more of a straightforward, positive experience. By focusing on feedback, centralization, salary transparency, employer engagement, and application streamlining, we're creating a tool that will truly help job seekers navigate the job market more effectively and with less stress.

Flowchart

https://drive.google.com/file/d/1113ayOhkPEw0xseI1E7VOcRx_7yoxZ43/view?usp=sharing

Scoring Rubrics

Criteria	3 Excellent	2 Proficient	1 Adequate	0 Limited
State a Problem Statement	The Problem Statement is written clearly with reference to the challenges faced by the target users.	The Problem Statement is written clearly, though the reference to the challenges faced by the target users is not well drawn.	The Problem Statement is vague or haphazardly defined. There is no link between the Problem Statement and the target users' challenges.	The Problem Statement is vague or haphazardly defined. The target users' challenges are not stated.
Background Research: Target Users	The background research is thorough. The target users and the challenges they face are described in a manner that emphasises a compelling need for a solution. The effects of these challenges on society or the larger community are described in detail.	The background research is done adequately. The target users and the challenges they face are described in some detail, though the sense of compelling need for a solution is not clearly brought across.	The background research is brief. The target users and the challenges they face are stated without details.	The background research does not include any information about the target users and the challenges they face.
Background Research: Market Scan	The background research is thorough. The current solutions or partial solutions to the identified problem are well elaborated. The opportunities or threats to the solution the group intends to propose are accurately identified in great detail.	The background research is done adequately. The current solutions or partial solutions to the identified problem are described in some detail, but the opportunities or threats to the solution the group intends to propose are not well fleshed out.	The background research is brief. The current solutions or partial solutions to the identified problem are stated without details, or with misidentified details, of any opportunities or threats to the solution the group intends to propose.	The background research does not include any information about current solutions or partial solutions to the identified problem.
Background Research: Citations in APA Format	N/A	A wide variety of relevant sources are used and accurately cited using a recognisable citation format. Both in-text citations and a list of references are shown.	Relevant sources are limited. While citations are shown, they do not follow a recognisable citation format.	Relevant sources are not cited, or else not consistently cited.

Criteria	3 Excellent	2 Proficient	1 Adequate	0 Limited
Establish Design Criteria	Three or more **meaningful** design criteria are developed, stating all of the components of the SMART acronym. There are clear explanations with references to the problem statement or the target users.	One or two **meaningful** design criteria are developed with all components of the SMART acronym, or three criteria are stated with only some components of the SMART acronym described. The explanations contain some reference to the problem statement or the target users.	The design criteria developed are not adequately meaningful and are too vague or unrealistic to guide the group in building, testing and refining their program. The explanations for the criteria fail to show how they are necessary to fulfil the problem statement.	**No** design criteria are developed that would be able to guide the group in the building, testing and refinement of the program.
Preliminary Design	The selected solution is sound and feasible. It effectively addresses the problem and elaborately shows how the design goals are met. Creativity and originality are demonstrated in the design of the solution.	The selected solution mostly makes sense and is sufficiently feasible. It addresses the problem and attempts to show how the design goals are met. Some creativity and originality are discernible in the design of the solution.	The selected solution makes some sense and is somewhat feasible. It only vaguely addresses the problem and cannot sufficiently show how the design goals are met. The solution lacks originality.	The selected solution is superficial or entirely unfeasible. It fails to address the problem and meet the design goals. The solution absolutely lacks originality.
Flowchart	The flowchart is highly detailed and clearly comprehensible. The links to smaller flowcharts are clear and show the modularity of the final source code.	The flowchart has most of the critical details, but is missing some explanations. Though not complete, the links to smaller flowcharts that are included show the modularity of the final source code.	The flowchart is missing critical details and lacks clarity. There is no consideration of the modularity of the final source code.	No flowchart is submitted, or is too brief to discern any details of how the final solution will look like.

* Note: The marks of individuals within a group are also determined based on peer evaluation.

Extension: SSEF 2025 (Singapore Science & Engineering Fair)

The **Singapore Science & Engineering Fair (SSEF)** is a national competition organised by the **Ministry of Education (MOE)**, the **Agency for Science, Technology and Research (A*STAR)** and the **Science Centre Singapore (SCS)**. The SSEF is affiliated with the prestigious International Science and Engineering Fair **(ISEF)**, which is regarded as the Olympics of science competitions.

This competition is an excellent platform for our budding scientists and engineers to showcase their passion in their respective fields by communicating their findings to industry experts. Winners will even get to represent Singapore and compete at the ISEF. SSEF award winners will also be eligible to move on to the [A*STAR Talent Search](#) (ATS) competition.

Criteria:
SSEF is open to all secondary and pre-university students between 15 and 20 years of age.

Application for SSEF 2025 will likely open in November 2024. Groups that are interested to extend their projects for SSEF 2024 will need to complete their project by **31 December 2024**. They also need to be from one of the following categories:

1) **ROBOTICS AND INTELLIGENT MACHINES (ROBO)**
- <u>Biomechanics (BIE)</u>: Studies and apparatus which mimic the role of mechanics in biological systems.
- <u>Cognitive Systems (COG)</u>: Studies/apparatus that operate similarly to the ways humans think and process information. Systems that provide for increased interaction of people and machines to more naturally extend and magnify human expertise, activity, and cognition.
- <u>Control Theory (CON)</u>: Studies that explore the behavior of dynamical systems with inputs, and how their behavior is modified by feedback. This includes new theoretical results and the applications of new and established control methods, system modelling, identification and simulation, the analysis and design of control systems (including computer-aided design), and practical implementation.
- <u>Machine Learning (MAC)</u>: Construction and/or study of algorithms that can learn from data.
- <u>Robot Kinematics (KIN)</u>: The study of movement in robotic systems.
- <u>Other (OTH)</u>: Studies that cannot be assigned to one of the above subcategories. If the project involves multiple subcategories, the principal subcategory should be chosen instead of Other.

2) **SYSTEMS SOFTWARE (SOFT)**
- <u>Algorithms (ALG)</u>: The study or creation of algorithms – step-by-step procedure of calculations to complete a specific task in data processing, automated reasoning and computing.
- <u>Cybersecurity (CYB)</u>: Studies involving the protection of a computer or computer system against unauthorized access or attacks. This can include studies involving hardware, network, software, host or multimedia security.

- Databases (DAT): Studies that create or analyze data organization for ease of access, management and update.
- Human/Machine Interface (HMC): Software application that presents information to a user about the state of a process and to accept and implement the operator's control instructions.
- Languages and Operating Systems (LNG): Studies that involve the development or analysis of artificial languages used to write instructions that can be translated into machine language and then executed by a computer or system software responsible for the direct control and management of hardware and basic system operations of a computer or mobile device.
- Mobile Apps (APP): A study involving a software application developed specifically for use on small, wireless computing devices. These studies may include front-end development techniques, such as user interface design and cross-platform support, and/or back-end development techniques, such as data services and business logic.
- Online Learning (LRN): Studies that focus on utilizing electronic technologies to access educational curriculum outside of a traditional means. Studies explore the design of learning activities and programs with online technologies, as well as the effective use of e-learning systems.
- Other (OTH): Studies that cannot be assigned to one of the above subcategories. If the project involves multiple subcategories, the principal subcategory should be chosen instead of Other.

More details on SSEF can be found here:

Singapore Science and Engineering Fair (SSEF)
SSEF 2024 Entry Form
All Categories - Society for Science

Students who are interested in SSEF can look for your Computing+ teacher for more information.