Proposal of Online Trail Making Test, LarkDetect

Ang Zhan Phung
Ang Yong Xin
Brenda Ng Xin En
Emmanuelle Vania
Sam Jian Shen
How Mo Xuan
CoronaSG
School of Computer Science and Engineering

Submitted to—
Shen Zhiqi
School of Computer Science and Engineering

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Executive Summary

With the growing concern of ageing population in Singapore. One in 10 people aged 60 and above may have dementia, according to a study by Well-being of Singapore Elderly (WiSE). Families are unprepared when their loved ones are diagnosis with dementia. There is evidence that medications for dementia may be more beneficial if given early in the disease process. Even though the medication is not a cure, early diagnosis allows prompt access to medication and medical attention.

With the consideration in mind, LarkDetect is an online platform for age 40 and above where they will be needed to do the test annually. This will enable records to be stored and analyzed for individual assessment.

LarkDetect will be designed with the consideration of integrating with HealthHub (Singapore Health Platform). This way even if the elderly is not tech savvy or forget their annually test, their family member will be aware and ensure they are able to get their test done.

Statement of Problem

Dementia is not a part of normal aging. It is a condition that causes progressive intellectual decline leading to increasing difficulties in coping with everyday activities. This condition affects the brain causing the brain cells to die at a faster rate than normal. There is currently no definitive test for diagnosing dementia, findings from a variety of sources and test must be pooled before a diagnosis can be made. [1]

Trail Making Test is a neuropsychological test which was originally used for assessing general intelligence. The Trail Making Test performance metrics have clinical utility in diagnostic classification of cognitively healthy older adults and patients with dementia.

As the performance of individual doing the test may vary due to age and other factors. We believe that the idea of individual assessment should be improved. Furthermore, this platform should be online for ease of access and view individual track record easily.

With the widespread of Machine Learning and big data, these data gathered could increase the accuracy of predicting dementia.

Objectives

This document proposes a comprehensive solution to the mentioned problem LarkDetect, an online trail making test that users need to complete once a year. LarkDetect will be available in the web to cater for individuals who are unable to visit a clinic to undergo the test.

The key features provided by the web platform are as follows:

(1) Cognitive Processing Speed (Test 1):

a. The user will connect a set of 25 dots in an increment manner as quickly as possible while simultaneously maintaining accuracy.
b. Each test is given a session period of 3mins for age 40 (increase of 30 sec every 10 years)

(2) Executive Functioning Test (Test 2):

c. Alternate between number and letters (1-A, 2-B, … L)
d. Each test is given a session period of 3mins for age 40 (increase of 30 sec every 10 years)

(3) View Report

e. Individual Time Taken
f. Individual Error rate
g. Average time taken and error rate to determine the user health risk
h. User information

Technical Approach

To make LarkDetect simple and straightforward for elderly to use, we have listed a set of guidelines to follow to ensure the smooth process of the test.

Following this section, we will be stating the customer needs, target specifications, and design consideration.

Customer Needs

As we move on to virtual consultation, patients that could not visit the doctor could use simple tests to determine their health state. We have decided that LarkDetect could serve as an important platform for all users. Customers need to be able to do the test at their own convenience, this would mean that they can do the test anytime anywhere. Customers need to be able to understand their health state and to do so, the test should also be conducted once a year. Our target audience, people of 40 years of age and above, may not be good at using technology and could have problems such as restricted movement, eye problems and slower thinking. All of these factors are of paramount importance and need to be carefully considered.

Target Specifications

From the user needs and requirements, we have deemed that a web application would be best for users to interact with. With LarkDetect the test will be convenient for all users and doctors. The centralized database system will store all information and records of the users, where doctors and users will be able to detect dementia symptom early.

Technology Consideration

LarkDetect will be a web application that utilizes Visual Studio for the application development and SQL as its database.

Technology	Summary
Visual Studio	Microsoft Visual Studio is an integrated development environment (IDE) that allows development of computer programs as well as games, web applications etc. [2]
MySQL	MySQL is an open-source relational database management system. [3]
Visual Paradigm	Visual Paradigm is a software tool designed for software development teams to model business information system and manage development processes. Visual Paradigm supports key industry modeling languages and standards such as Unified Modeling Language (UML), SoaML, BPMN, XMI, etc. [4]

System Architecture/Platform

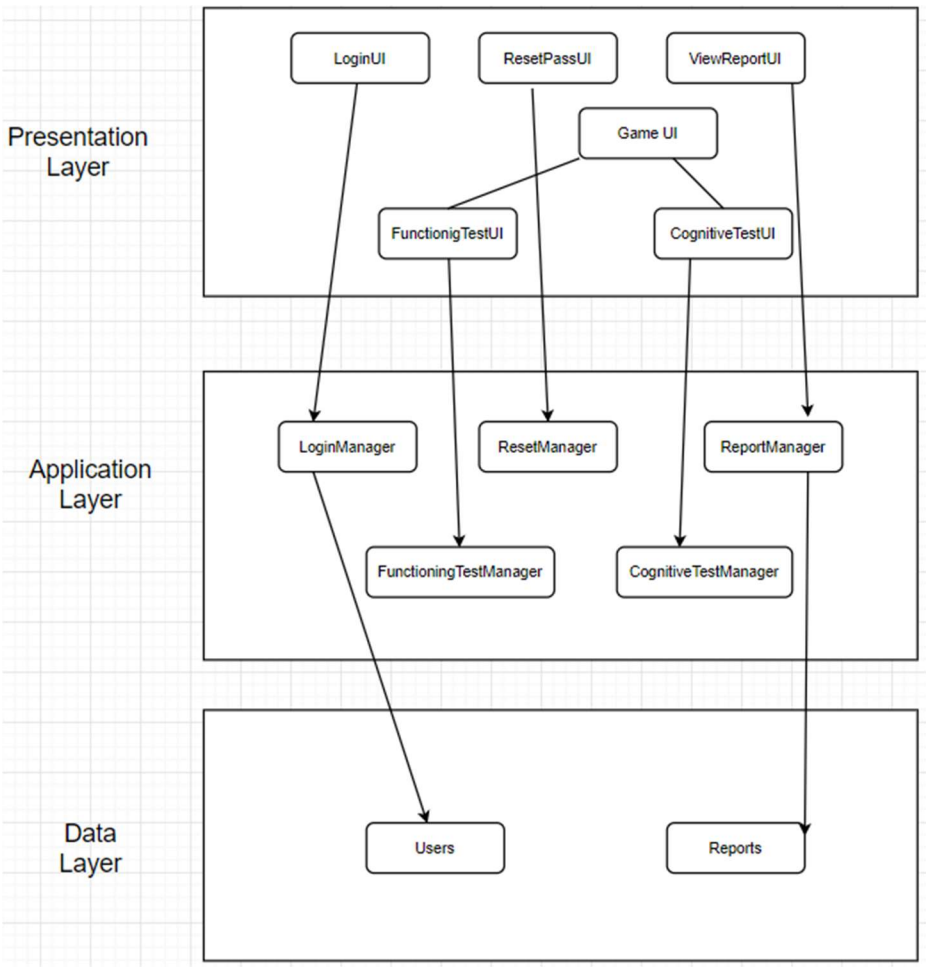
LarkDetect is designed based on 3-layered architecture.

The first layer is the Presentation layer. It contains all the classes that are responsible for presenting the UI to the end user or sending response back to the user. User Interface such as LoginUI, ViewReportUI and RegisterUI are included in presentation layer.

The second layer is the Application layer. It contains all the business logic that is required by the application to meet its functional requirements. This layer includes logic classes such as LoginManager, ResetManager and the ReportManager.

The third layer is the data layer. It consists of a database and a program for managing read and write access to the database. MySQL will be use as a database to store all the user details and report. This layer will include entity such as Users and Reports.

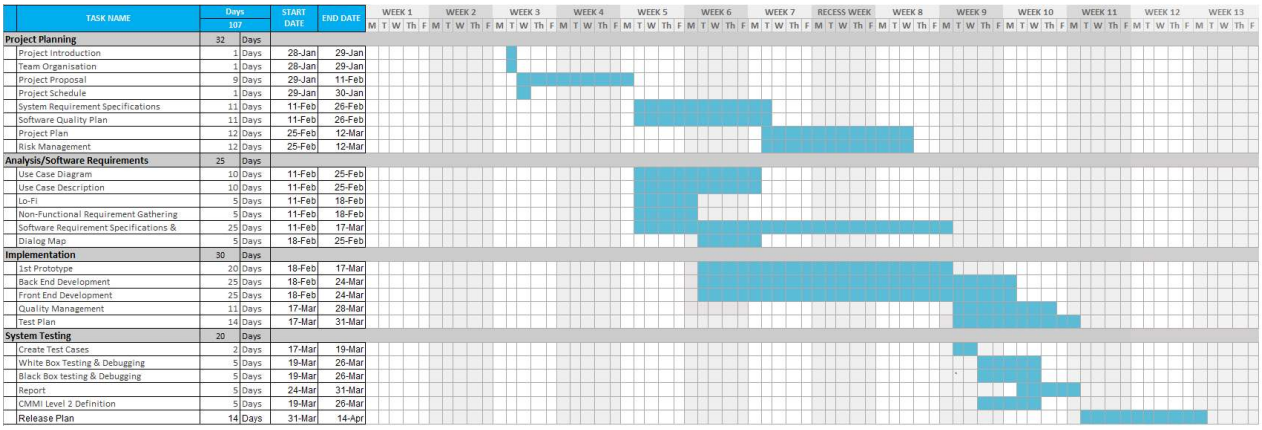
Architecture Design:



Project Management

The following Gantt Chart features a detailed breakdown of the planning and execution of our project over the span of 9 weeks (28 January 2020 – 31 March 2020).

A more detailed view of the Gantt Chart can be accessed on **Appendix B**.



TASK NAME	Days		START DATE	END DATE
	107			
Project Planning	32	Days		
Project Introduction	1	Days	28-Jan	29-Jan
Team Organisation	1	Days	28-Jan	29-Jan
Project Proposal	9	Days	29-Jan	11-Feb
Project Schedule	1	Days	29-Jan	30-Jan
System Requirement Specifications	11	Days	11-Feb	26-Feb
Software Quality Plan	11	Days	11-Feb	26-Feb
Project Plan	12	Days	25-Feb	12-Mar
Risk Management	12	Days	25-Feb	12-Mar
Analysis/Software Requirements	25	Days		
Use Case Diagram	10	Days	11-Feb	25-Feb
Use Case Description	10	Days	11-Feb	25-Feb
Lo-Fi	5	Days	11-Feb	18-Feb
Non-Functional Requirement Gathering	5	Days	11-Feb	18-Feb
Software Requirement Specifications &	25	Days	11-Feb	17-Mar
Dialog Map	5	Days	18-Feb	25-Feb
Implementation	30	Days		
1st Prototype	20	Days	18-Feb	17-Mar
Back End Development	25	Days	18-Feb	24-Mar
Front End Development	25	Days	18-Feb	24-Mar
Quality Management	11	Days	17-Mar	28-Mar
Test Plan	14	Days	17-Mar	31-Mar
System Testing	20	Days		
Create Test Cases	2	Days	17-Mar	19-Mar
White Box Testing & Debugging	5	Days	19-Mar	26-Mar
Black Box testing & Debugging	5	Days	19-Mar	26-Mar
Report	5	Days	24-Mar	31-Mar
CMMI Level 2 Definition	5	Days	19-Mar	26-Mar
Release Plan	14	Days	31-Mar	14-Apr

Figure 01: Gantt chart for the project. The solid bars indicate the portions of the tasks that we have accomplished.

Deliverables

The project deliverables will include a detailed documentation on the system architecture and requirements specifications. It will also include both high-level testing procedures, and low-level automated test codes. A website application, source code, flowcharts, and documentations will be created.

A more detailed breakdown and delivery dates of the project deliverables are shown in Table.

Deliverable	Description	Delivery Date
Project Proposal	Technical proposal for the project, containing technical approaches, management plans and costs for the project.	11 February 2020
Use Case Model	Visual representation of the application's functionalities, along with use case tables which contain information of each functionality.	
System Requirements Specification	Complete description of the functional and non-functional requirements and behaviour of the application.	24 February 2020

Quality Plan	For different stages of the development cycle, quality practices to be executed are documented.	
Project Plan	Detailed plan on work breakdown structure, resource management, project schedule and time estimation.	16 March 2020
Risk Management	Identifies possible risks during project development and provides risk management strategies.	
Prototype (For Demo)	Prototype for simple demonstration. Prototype related documents, such as code, documents, slides etc will also be delivered.	
Software Release (Final Presentation)	Final revelation and presentation of project and application.	31 March 2020
Test Plan	Documentation of different tests, such as functional and non-functional tests, user acceptance test and system test to be conducted.	
Test Cases and Requirements Test Coverage Report	Black Box techniques are used to design test cases, then testing is conducted, and results are recorded.	
CMMI Level 2 Definition	Review and definition of requirement analysis, quality assurance, project planning and configuration management.	
Production Software	Initial release of the software to production. Operation ready.	10 April 2020

Budget

The right amount of manpower with the right expertise, and access to various resources is crucial to the success of the project. Therefore, the team have compiled a budget breakdown of all the items required in the following table. The team will communicate closely with the sponsors over the course of the project to ensure that all provided items and funds has been used wisely according to the project's needs.

Table 1: Requested items and funds for initial design.

Item	Supplier	Quantity	Unit Price	Total
Hardware				
Webserver	Dell Pte Ltd	1	$15	**$15**
Laptop	Asus Pte Ltd	6	$2.500.00	**$12,500.00**
Office Rental	NTU	1	$6,000.00	**$6,000.00**
Human Resource				
Project manager		1	$42,000.00	**$42,000.00**
Project team members		5	$27,000.00	**$135,000.00**
Software				
SQL Management Tool (Developer)	Microsoft	6	$0	**$0**
Visual Paradigm License (Standard)	Visual Paradigm International Ltd	6	$349.00	**$2,094.00**
Visual Studio 19	Microsoft	6	$0	**$0**
			TOTAL	**$197,609.00**

Communication and Coordination with Sponsor

There would be multiple rounds of feedback sessions between the two parties to reduce the possibility of any friction between the sponsor and the developer team. During sessions, the team would propose a reasonable schedule for the completion of the project and the sponsors would make their demands known at the very start of the project. The developers could then assess the demands on its feasibility and convey them to the sponsors. This helps to resolve any miscommunication as every aspect of the project is thoroughly discussed among the stakeholders.

During the development of the project, a weekly email will be sent out to update the sponsors with regards to the progress report of the project. A monthly face-to-face meeting would be scheduled between the two parties for the sponsors to have a clearer understanding of the project advancement and for the developers to answer any doubts and queries of the sponsors. By employing transparency throughout the entire project implementation, it would help to facilitate better communication and coordination with the sponsors.

Team Communication

The team will conduct weekly meeting on every Tuesday. We update each other on our individual progress and cross-checking of will be done to ensure there is no compromise on the quality of deliverables produced. We also discuss further on the changes needed in the system and get feedback on the difficulty of the tasks assigned.

Team Qualifications

Team CoronaSG is bonded with various soft and technical skill sets. All team members are current undergraduate students of Nanyang Technological University's School of Computer Science and Engineering. Resumes of teach each team members are located in Appendix A.

Ang Zhan Phung (Edmund) have been exposed to various projects which is involve multilevel coordination. He ensures that the project to be completed in time and within the given budget.

As the QA Manager and QA Engineer of this project, Emmanuelle Vania has past work experience that has helped her gain proficiency in the related field. From her experience as a tester, she was familiar with the use of rigorous test cases and issue documentation. Her time in the Content Quality Team and Customer Service Team has taught her to uphold the importance of maintaining product and/or service performance levels.

How Mo Xuan is highly experienced in software development. Having dealt with both popular backend and frontend development framework, along with his extensive knowledge of coding makes him fit for the role of backend developer.

Sam Jian Shen has the relevant skills for his roles in front-end developer such as JavaScript, CSS and HTML. Such skills suit our goals in the project. Such as established an online webpage. He has relevant skills in web development experiences as shown in his involvement in his co-curriculum activities WSC. As such, he is surely qualified for the role front-end developer under the right supervision of the lead developer.

Brenda Ng Xin En has great experience in the software development process such as in Android Studio, Visual Studio and Unity. She has worked with many teams and knows how to manage the workload and properly integrate codes. With the ability to access software performance and plan release schedules, she will certainly fit the role of a Release Engineer.

Ang Yong Xin is highly skilled in a lot of programming languages such as Python, Java, C++ and etc. With his great understanding of coding, working experience, and his eagerness to tackle algorithmic problems, hiring him as a tech lead would ensure a reliable and efficient application.

Conclusion

LarkDetect is an essential web application for neuropsychological test to change the way people approach towards medical screening. With early detection for dementia, it could greatly prepare families for necessary medical care and planning. With more data, we could probability slow the process of dementia with the right medical treatment.

References

[1] Dementia.org.au. (2020). *Dementia Australia | Early diagnosis of dementia*. [online] Available at: https://www.dementia.org.au/information/diagnosing-dementia/early-diagnosis-of-dementia [Accessed 4 Feb. 2020].

[2]"Microsoft Visual Studio", En.wikipedia.org, 2020. [Online]. Available: https://en.wikipedia.org/wiki/Microsoft_Visual_Studio. [Accessed: 04- Feb- 2020].

[3]"MySQL", *En.wikipedia.org*, 2020. [Online]. Available: https://en.wikipedia.org/wiki/MySQL. [Accessed: 04- Feb- 2020].

[4]"Visual Paradigm Frequently Asked Questions", Visual-paradigm.com, 2020. [Online]. Available: https://www.visual-paradigm.com/support/faq.jsp. [Accessed: 04- Feb- 2020].

Appendix B
Gantt Chart

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