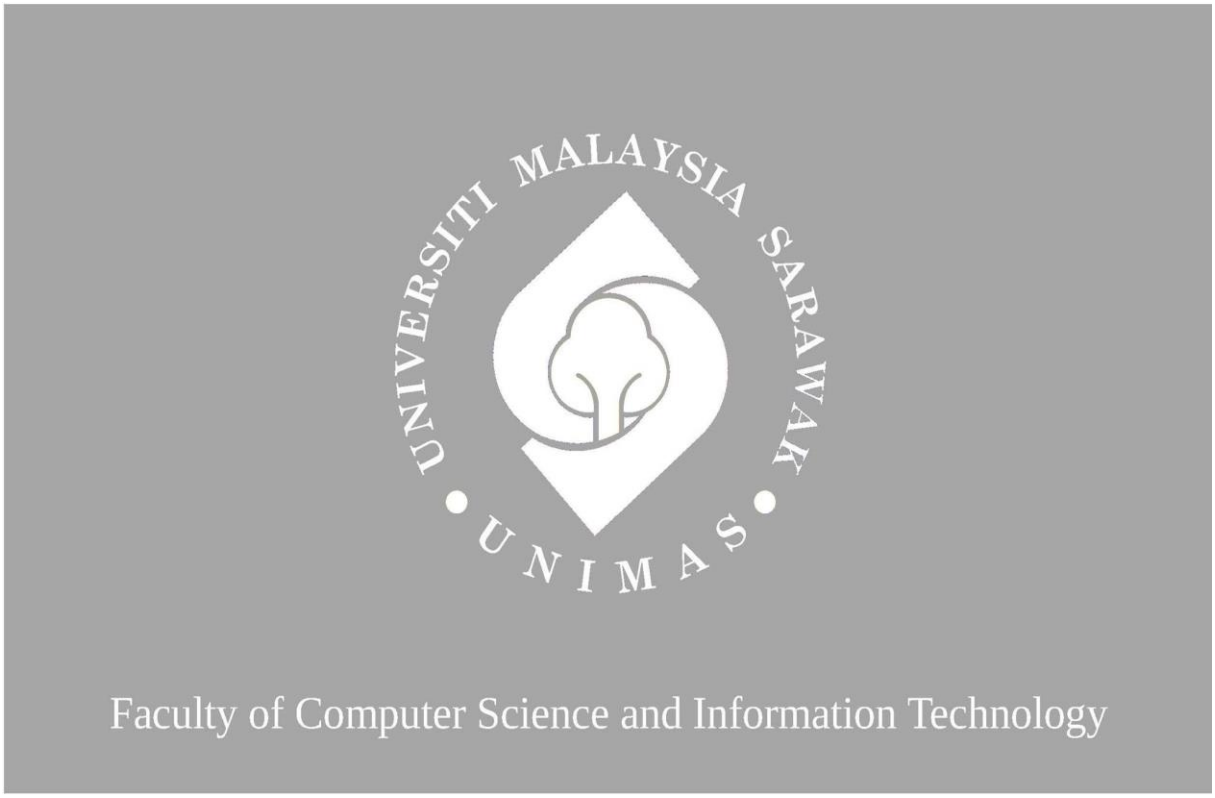

A Web-Based Intelligent Physics Tutor

Catherine Hii Seng Jing

(55620)

Bachelor of Computer Science with Honours

(Software Engineering)

2020

A WEB-BASED INTELLIGENT PHYSICS TUTOR

CATHERINE HII SENG JING

This project is submitted in partial fulfillment

of the requirements for the degree of

Bachelor of Computer Science with Honors

Faculty of Computer Science and Information Technology

UNIVERSITI MALAYSIA SARAWAK

2020

A WEB-BASED INTELLIGENT PHYSICS TUTOR

CATHERINE HII SENG JING

Projek ini merupakan salah satu keperluan untuk

Ijazah Sarjana Muda Sains Komputer dan Teknologi Maklumat

Fakulti Sains Komputer dan Teknologi Maklumat

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MATRIC NO: 55620

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Abstract

This study is concerned about the Question Answering (QA) system in the field of Physic science. QA system is a computational science discipline within the fields of natural language processing (NLP) and information retrieval, which is concerned with building a system that does not just automatically answer questions posed by humans in natural languages, but also adapt to the asking questions thus generating better result on every search. Without a doubt, QA system can help students to work at their own pace, while having the ability to impact education through the application of greater levels of individualized learning, not to mention that educational software can also be adapted to student needs. Besides, students may get additional support from online intelligent tutor. In comparison, human tutor can eliminate any language or communication barrier that is often seen in machine learning. Educational programs powered by online intelligent tutor may replace teachers for some extends, it can alter higher education level and offer unprecedented solutions in hoping to improve the learning capability. Hence, the aim of this paper is to describe and demonstrate the development of a web-based intelligent Physics tutor to help Malaysia secondary school's students in learning basic skills anywhere at any time. The methodology chosen to use in this study is the rapid prototyping methodology (RAD).

Abstrak

Kajian ini mementingkan sistem Soal Jawab (QA) dalam bidang sains Fizik. Sistem QA adalah disiplin ilmu komputasi dalam bidang pemprosesan bahasa semula jadi (NLP) dan pengambilan maklumat, yang berkaitan dengan pembinaan sistem yang tidak hanya secara automatik menjawab soalan yang diajukan oleh manusia dalam bahasa semula jadi, tetapi juga menyesuaikan diri dengan pertanyaan yang diajukan dengan demikian menghasilkan hasil yang lebih baik pada setiap carian. Tanpa keraguan, sistem QA dapat membantu para pelajar untuk bekerja pada kadar mereka sendiri, sambil memiliki kemampuan untuk mempengaruhi pendidikan melalui penerapan tahap pembelajaran individu yang lebih besar, apatah lagi bahawa perisian pendidikan juga dapat disesuaikan dengan keperluan pelajar. Selain itu, pelajar mungkin mendapat sokongan tambahan dari tutor pintar dalam talian. Sebagai perbandingan, tutor manusia dapat menghilangkan segala halangan bahasa atau komunikasi yang sering dilihat dalam pembelajaran mesin. Program pendidikan yang dikuasakan oleh tutor pintar dalam talian boleh menggantikan guru untuk beberapa lanjutan, ia dapat mengubah tahap pendidikan tinggi dan menawarkan penyelesaian yang belum pernah terjadi sebelumnya dengan harapan dapat meningkatkan kemampuan belajar. Oleh itu, tujuan makalah ini adalah untuk menerangkan dan menunjukkan perkembangan seorang tutor Fizik pintar berasaskan web untuk membantu pelajar sekolah menengah Malaysia dalam mempelajari kemahiran asas di mana sahaja pada bila-bila masa. Metodologi yang dipilih untuk digunakan dalam kajian ini adalah metodologi prototaip cepat (RAD).

Table of Contents

List of Tables

List of Figures

Chapter 1: Introduction

1.0 Background

Over the last few years, online tutoring sites have expanded in popularity. Technology is increasingly lending a helping hand though and now a Beijing-based online education start-up has developed an artificial intelligence-powered mathematics application which can check children's arithmetic problems through snapping of photo (Jing, 1969). More and more youngsters are using online tutoring with school and university. Many traditional schools started to share their lessons online. It represents a simple and convenient method to share knowledge with students. An online tutoring site is a great alternative to traditional schools, especially for students who cannot afford the time and money to take to tuition center. Online tutoring is a great idea, as it can be done at home on a laptop or mobile device with access to the Internet. The online tutors and students can choose their own comfort places to undergo online tutoring. Besides, online tutoring provides one-to-one tuition. This is a great way for the online tutor to work on a student's weak point in the subject, making the whole learning process more effective. These sites usually have a less formal approach than the school lessons. School lessons can often be inflexible in their learning style, as they are very dependent on the textbook. Hence, online tutoring free to be used regardless of the learning styles which the online tutor deems to be most useful for the students.

Question Answering (QA) System can be classified as text-based and knowledge-based QA systems. QA system also divided into two types which are open and closed domain QA system. Open domain QA systems are domain-independent and provided a short answer to a question, addressed in natural languages (Clementeena & Sripriya, 2018). The closed domain QA systems are precise, but they consist of limited repository of domain-specific questions (Clementeena & Sripriya, 2018).

1.1 Problem Statement

Schools in Malaysia are enforced by the rule which forbids student to bring laptop or mobile devices to class. For that reason, students may suffer a lack of knowledge to use any software or web application on the Internet. There are online tutoring system are complicated to understand and no instructor to teach and guide students to use the software. Hence, most of the students will give up using the online tutoring system after a while.

Not all the online tutors have the license or certificate in teaching and learning. This unlicensed tutor may mislead the students and use the improper teaching style. Some of tutor is lack of knowledge on the specific subject and always depend on the textbook in the school. Students will not be able to improve their knowledge of the subject and feeling that they are wasting their time on the study.

1.2 Aims and Objectives

The main objective of this project is to design and develop a Web-Based Intelligent Physics Tutor for Malaysia Upper Secondary School students using Python and web development skills such as HTML, CSS and JavaScript. Other objectives include:

- To propose an automated QA system which cover Physics learning units which include Thermodynamics, Electricity, Waves and Electromagnetism only.
- To demonstrate a QA system that able to handle different questions types.

1.3 Project Scopes

The Web-Based Intelligent Physics Tutor will be limited to web browser usage only. The user-targeted of this project is students from 16 – 17 years old. The students may improve their knowledge of Physics by using this proposed system. The proposed system may help the student to solve the Physics questions. The Physics learning units cover Thermodynamics, Electricity, Waves, and Electromagnetism only.

1.4 Brief Methodology

The purpose of this project is to implement an intelligent Physics tutor using web development languages such as HTML, PHP, JavaScript, and CSS using a web server.

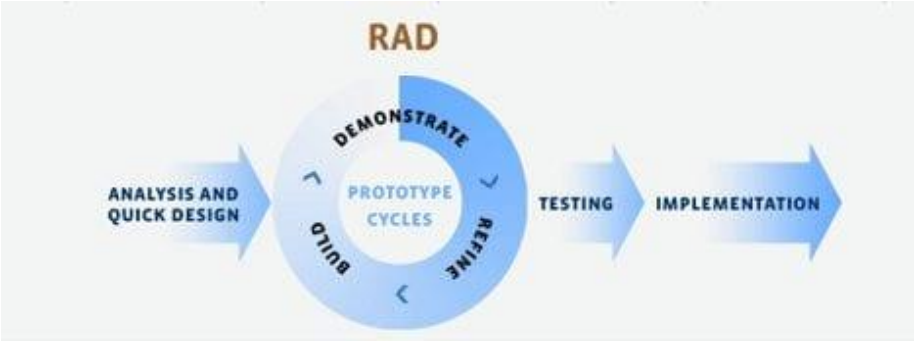

Figure 1.1: Rapid Application Development (RAD) (Biesemans, Hoesten, & Deroose, 2010)

There are four stages in the RAD Project Development Framework which are Analysis and Quick Design Phase, Prototype Cycle, System Testing, and System Implementation. Prototype Cycle involves Developing, Demonstrate, and Refining.

During the analysis and quick design phase, we identified the project problem statement, aims, and objectives to achieve the requirement in solving the project problems, project tasks, and project schedules, and documentation. We will study the details of the real-world issues and give solutions to the problem in this phase.

Next, in the prototype cycl**e**, we will analyse how the system will be designed and developed. The Use Case Diagram, Sequence Diagram, Activity Diagram and Entity-Relationship Diagram (ERD) will be used for system requirements and specifications. ERD will be shown on how the database of the QA system is designed. The graphical user interfaces will be reviewed in this phase. Also, the developed system will be examined by the client to check how the system achieves the requirements and proceed with refining if needed. This process will be completed when the system fulfils all the requirements and specifications from the client.

The validation of the system will be tested with the list of fulfilment requirements and specifications. In the testing phase, the bugs and errors will be fixed, the user interface of the system will be enhanced.

1.5 Significance of Project

This project will discuss the uses of Python to develop a website. This project will allow the students from age 16 to 17 years old to ask the question on the web and get the knowledge from the web. This project will also use the QA system to handle student's questions and answer the correct answer.

1.6 Project Schedule

The project schedule will be used as the guidelines for the project progressions of the methodologies of the development of a web-based intelligent Physics tutor.

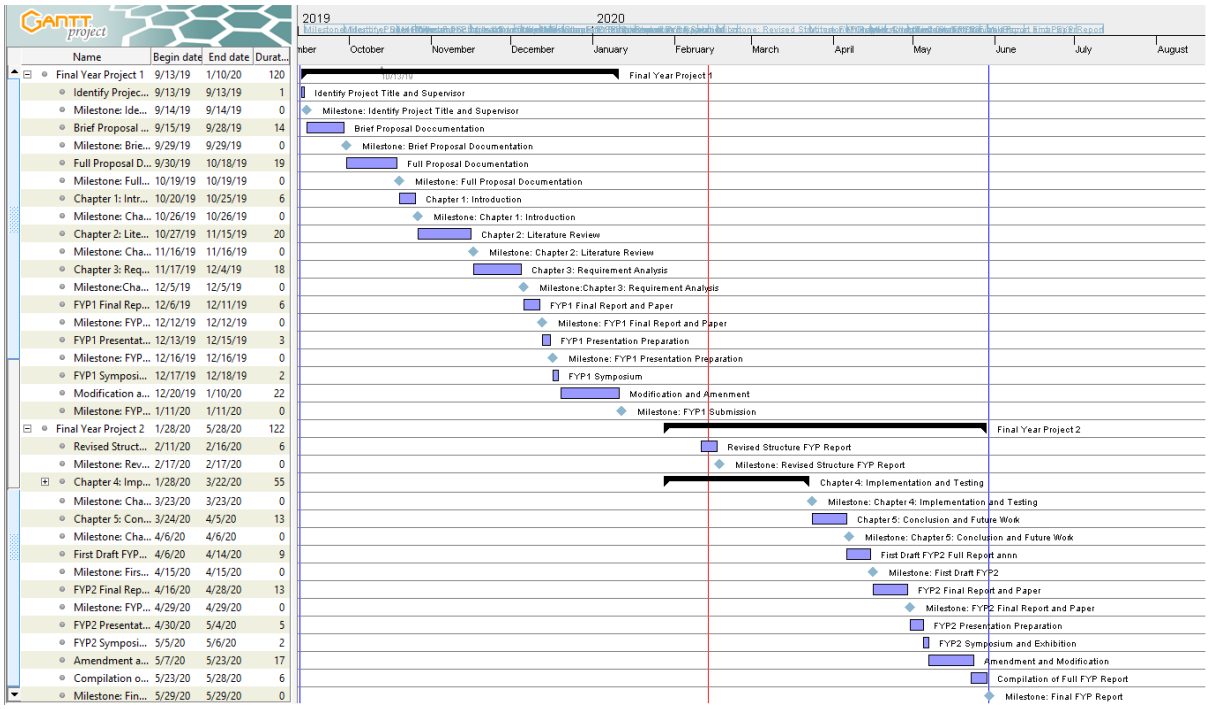

Figure 1.2: Project Schedule in Gantt Chart for FYP

1.7 Expected Outcome

The expected outcome of the project is to provide a website for students to ask Physics questions and the proposed system will generate the answer. The QA system that is implemented in the website is able to understand and find the keywords related to the questions. In summary, the system will search for the answer through the offline Physics database.

1.8 Project Outline

1.8.1 Chapter 1: Introduction

Chapter 1 is to highlight the introduction and objectives of the project goals. Chapter 1 includes the project background, problem statement, the aim and objectives, project scopes, the brief methodology, significance project, project schedule and the expected outcome of the project. The problem statement shows the problems with the issues of the online Physics Tutor from the Internet. The project aims and objectives highlight how the project outcomes are achieved to solve the problems that stated in the problem statement. The methodology of the project describing the process of the project to achieve the aims and objectives, and the ideology of the project's concept.

1.8.2 Chapter 2: Literature Review

In Chapter 2, we review the existing system, which relate to the project, we study and acquire knowledge from related official websites, conference papers, and journal articles. We determine and study the strength and limitations of the existing system. The techniques and ideas on the implementation of the project will be discussed in this chapter, such as the methods to carry out the project.

1.8.3 Chapter 3: Requirement Analysis and Design

The methodology used and system requirement specifications will be reviewed and discussed in this chapter. The Rapid Application Development (RAD) methodology is chosen to be used as a model to develop the proposed system in this project. This chapter also involves the requirement analysis by using the questionnaire to gather information. In addition, the use case diagram, sequence diagram, activity diagram, class diagram, and database design of this proposed system is also incorporated in last segment of this chapter.

1.8.4 Chapter 4: Implementation

This chapter will discuss the details of the system implementations and the user interface of the system.

1.9.5 Chapter 5: System Testing

This chapter will discuss the detail of the system testing based on the requirement and specification.

1.8.5 Chapter 6: Conclusion and Future Works

This chapter reviewing the summary of the project. The future work or any enhancement of the project will be discussed in this chapter too.

1.9 Summary

This chapter discussed the introduction and background of the project. The aims and objectives of the project to solve the problem also stated in the project.