



**Higher Nationals in Computing**

Project Title

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**ABSTRACT**

**Lời cảm ơn or sth similar**

**CHAPTER I: INTRODUCTION**

**1.1 Overview**

      In a modern world like today, many people are still indifferent to their health status. They still maintain unscientific lifestyles, eat unhealthy foods and even use alcohol and stimulants such as cigarettes. This indifference can stem from many reasons, such as the nature of work, living environment, or ignorance about common diseases, but all of the above reasons can also be summed up by self-subjectivity. Maintaining that lifestyle makes many people suffer from very serious diseases regardless of age, including a group of diseases that account for a very high mortality rate called Cardiovascular Diseases (CVDs).

      Cardiovascular Diseases (CVDs) are the name for a group of diseases related to the heart and blood vessels, the common diseases that belong to this group of diseases can be mentioned as cerebrovascular disease, coronary heart disease, and some other diseases. Cardiovascular disease is believed to be the leading cause of death worldwide, outstripping cancer and also in developed and developing countries. According to WHO data: “An estimated 17.9 million people died from cardiovascular disease in 2019, accounting for 32% of all deaths globally. Of these deaths, 85% were due to heart attacks and strokes. More than four out of five deaths from cardiovascular disease are due to heart attacks and strokes, and a third of these deaths occur prematurely in people under 70 years of age.” (Cardiovascular diseases (CVDs), 2021).

      Based on those parameters, we can see that cardiovascular disease is a fairly common disease, and there are many possible causes of cardiovascular disease in humans. Except for congenital factors, we can mention some high-impact causes such as eating unhealthy foods, unscientific living habits, using many alcoholic beverages, or excessive use of stimulants. Although this is a group of diseases with high prevalence and can cause many serious consequences, it is not too difficult to prevent.

      The old Vietnamese said: "Prevention is better than cure.", this saying has been proven through many different generations of Vietnamese people. Therefore, when realizing the danger of the current situation, especially the sudden stroke cases that happened in both young and older people, the project NAME PROJECT was established. The project was created to provide users with an efficient and convenient system for preventing and reducing the risk of cardiovascular problems. Furthermore, the system will aim to provide users with enough utilities and functions so that users can easily and conveniently monitor and protect their health.

**1.2 Purpose**

      - Realizing the urgency in monitoring the health of people today, especially the elderly, the project is trying to develops a simple system that makes it easy for users to make some preliminary diagnoses about their health status on a daily basis. According to the information and statistics released by the World Health Organization (WHO), cardiovascular problems are the leading cause of death globally. Unfortunately, this is still happening today due to human subjectivity and bad habits from daily life. Therefore, the system was created to provide users with the necessary solutions to this problem.

      - The system will both provide diagnostic capabilities based on the user's body parameters including some habits and also individual body parameters such as height, weight, daily blood pressure. The system wants to diversify the number of users to spread the system to as many people as possible. So the system will aim for simplicity in design as well as usage. In addition, the system also provides tracking of past diagnosis history, which makes it easy for users to monitor their health status over a period of time. In particular, this also helps family members to monitor the status of older people in the family. From there, it is possible to recognize and make timely actions or adjustment methods to ensure health is always in good condition.

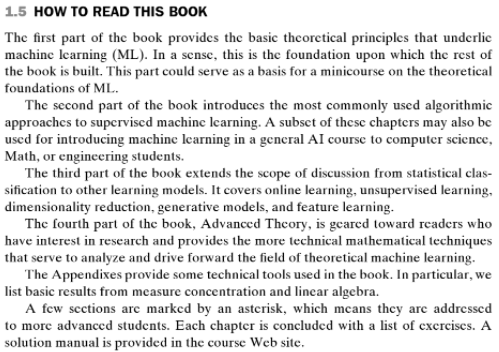
      - The system also provides an information system that specializes in providing health information, especially cardiovascular health. This information system was created to help users quickly find helpful information and necessary for the prevention or improvement of health problems in particular and cardiovascular-related diseases in general.

**1.3 Scope**

      - Mục tiêu mà dự án hướng tới cũng như là những điểm mà dự án chưa đạt được trong những lĩnh vực liên quan

**1.4 Organization**

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**CHAPTER II: LITERATURE REVIEW**

**2.1 Embedded System**

Embedded system is a term to talk about a system that is installed to perform a fixed task and this system will be fixed to an environment or a larger system. Embedded systems have very high automation and stability. The system will be set up to perform one or more fixed functions, so that they can be optimized in terms of size and production cost.

An embedded system usually consists of two main components, hardware, and software. The hardware of an embedded system usually consists of a microprocessor or microcontroller along with some additional components such as external memory, I/O, sensors, LCD screens, etc. Embedded system software is often referred to as firmware, firmware is usually uploaded to Flash, ROM, or EPROM, and once uploaded it is never changed unless it needs to be replaced. An embedded system before being put into production or use will be considered to optimize many different aspects such as processing time, power consumption, system size and also production cost. The optimization will help the system increase the level of performance and efficiency in the shortest amount of time as well as reduce a large number of the expenses for manufacturers.  
  
 An embedded system is a system that is designed to solve a certain problem, so the system will also need less connection requirements as well as other requirements on the parent system to operate. If there are requirements, they are also very easy to meet. Beside, the requirements are simple, the embedded system also requires very little operations in the installation and implementation process, so the system will be able to operate stably for a very long time before an accident occurs any error. In addition, the fact that the system only handles a certain job seems to be a huge disadvantage, but that property gives the system a very high processing speed and stability. The reason for this advantage is that all components in the system will be selected and configured for a single job and function, so there will be many good options to optimize cost and speed for the system. When necessary, performing component upgrades such as memory or replacing components is also very easy without causing unnecessary errors for the parent system.

However, embedded systems also have a lot of disadvantages. Because embedded systems are mostly hardware, when hardware problems occur, it will take a lot of time to determine where the error originates. And when an error occurs so that the system can return to normal, we will need to reset it manually, which can cause some data to be lost if not backed up in time. In worse cases the existing embedded system will have to be replaced by a completely different embedded system that performs the same function. This process will take a long time and cause the parent system to stall for a long time.

Embedded systems have very strong development potential. According to the world's statistics, in electronic devices, 99% of processors are in embedded systems. Due to the speed of processing, advantages of size, and cost, embedded systems are very popular all over the world. We can see embedded systems in electronic devices such as watches, phones, printers, and refrigerators; in air navigation systems, or industrial production lines.

**2.2 Internet of Things**

IoTs (Internet of Things) is a system of smart devices and technologies that can communicate with each other through the internet without human involvement. These devices through internet connections to carry out communication and data exchange with each other. As a result, devices can do more and more things faster, becoming smarter and more proactive. Today we have millions, billions of devices that can connect to the Internet. Everyday appliances such as toothbrushes, vacuum cleaners, cars and many machines can use sensors to collect feedback data for users through applications on personal mobile devices.

IoTs devices are mostly composed of four distinct stage components. The first is the process of collecting information through devices/sensors. These devices or sensors will be responsible for collecting data from the environment. This process can be as simple as collecting temperature, humidity, and pressure, or performing more difficult tasks like receiving data from another device or machine. Once the data collection is completed successfully, the data will be sent to other devices or stored in the cloud through various connection methods such as internet, LPWAN, cellular or countless other connection methods. The choice of connection method will be based on the range and bandwidth of the system and of that connection method. Regardless of the connection method chosen, the main task of this stage is to send the collected data to where it is needed. When the data is successfully sent, the data will be processed as checking whether the parameters match the requirements set out or not. Or will the data simply be stored waiting to be called out from another device. This stage is the stage where information will be processed to become information that users find useful when receiving. After completing the information will be sent to the user interface, the user will receive the information sent through personal applications, email or other devices. Based on the information sent, users will continue to make decisions or adjust accordingly.

With such communication and operational capabilities, IoTs bring many advantages to users. The biggest advantage that we can easily see is that it always works in real-time. We will always be updated with the latest information on the status of the devices or environments we care about with just one smart personal device that can connect to the internet. In addition, the use of IoTs in life can help us reduce a lot of resource costs and human resources when machines can receive and process jobs extremely quickly and, importantly, on time. The productivity problem is also one that IoTs can easily solve because the time it takes for machines to communicate and process with each other will take a lot less than the time to communicate and process between them. human to human. Work productivity will also improve because machines will not be affected by objective factors such as emotional, environmental or physical.

Besides, IoTs also have disadvantages that cannot be avoided. The biggest disadvantage is the connection problem, if the devices in the system are not connected to the internet, the whole system will stop working together. Although today the internet is popular in every home and corner of the world, there will still be times when internet problems are encountered. Then there will be very few ways to fix this problem. Another disadvantage is that the transmission through the internet will make the user's personal information likely to be leaked, leaking personal information can help bad guys take advantage of this information to commit illegal acts. The final disadvantage is probably compatibility between many manufacturers because the world has not yet had an international standard, so devices can still only be compatible with devices of the same manufacturer. Once a standard connection method is released, IoT devices will be able to combine with each other and create a much larger system that greatly improves people's lives.

Applications from IoTs have been bringing a lot of benefits and improvements to people's lives. In recent years, there has been the appearance of smart devices, voice control or even smart home systems. IoT is so popular that we can see it in almost every aspect and area of ​​our lives such as washing machines, refrigerators, televisions, etc. Or in the agricultural industry such as self-watering systems, fertilizer systems, drainage systems... Even in the medical industry such as personal wearable devices, these devices can continuously measure parameters in the body and store them so that they can give warnings when the parameters reach the alarm threshold or total. It is suitable for creating periodic statistics for users and many other uses.

**2.4 Machine Learning**

Machine Learning (ML) is a technology that is said to be causing a fever around the world today. ML is a technology platform invested in and developed by many big companies in the world such as Facebook, Google, and Microsoft. ML is an application of Artificial Intelligence (AI). ML gives systems the ability to automatically learn and improve without explicitly coding like others. The learning process is done starting by reading or observing the data, the computer can use algorithms to perform the analysis of the acquired data. From that result, the computer will make appropriate corresponding decisions based on the cases given in the data. The difference is that instead of requiring an exact model or solution like conventional research methods, ML uses problem specification information, training models, and optimization techniques.

      ML có thể chia thành bốn loại khác nhau bao gồm: Supervised learning, Unsupervised learning, Semi-supervised Learning and Reinforcement Learning:

        + **Supervised Learning:** Supervised learning is an algorithm that relies on specifically labeled values in the examples provided in the data. The algorithm will perform data analysis and compare methods to find the method that has the highest accuracy. After the analysis is completed, the algorithm can proceed to give results based on completely new values that do not coincide with the analyzed examples, but the results still have high accuracy. Supervised learning can be divided into two categories, classification and regression. Classification is an algorithm that will analyze pre-classified input values instead of specific input values like Regression.

        + **Unsupervised learning**: Unsupervised learning is an algorithm that relies on specific unlabeled values. The algorithm will have to rely on data structures to be able to cluster, dimensionality reduction, feature extraction, or representation learning without human help. Unsupervised learning cannot derive results from the data but can provide a function to describe the structures and hidden information in the data.

**+ Semi-supervised Learning**: Semi-supervised learning is a useful algorithm for data that have both labeled and unlabeled values. Usually, the data used will have a small portion of the data labeled, and the majority of the rest will be unlabeled data. The algorithm will then prioritize using labeled data to support classification or feature the rest of the unlabeled data. Semi-supervised learning solves the problem of collecting labeled data because the process is usually very expensive.

        + **Reinforcement Learning**: Reinforcement learning is an algorithm that will perform the analysis to make the most optimal decisions based on the conditions that will be gained or lost when performing an action. The system will determine behavior based on circumstances to achieve the best benefit. This model learns by trial and error method, the model will be based on the provided situation to test the possible cases and come up with the most feasible case with the most beneficial results. Reinforcement learning is therefore neither supervised because the learner is not provided with optimal actions from which to choose, nor is it completely unsupervised.

The biggest advantage of machine learning is the ability to self-learn, with a certain amount of data, systems using machine learning can learn and analyze themselves to come up with the most accurate diagnostic algorithm. Moreover, with that original algorithm, every time the analysis is performed, the accuracy is improved and higher. At the same time, machine learning also contributes to reducing the time to access, data and give more accurate results than humans.

Applying machine learning will help the system know the results in a very short time from which it can give the most appropriate responses. This advantage is most evident in specific cases such as the discovery of potentially harmful software in the technology industry or find out where the virus is likely to appear based on infection parameters around the world. Finding out the factors that can cause danger will help us prevent many bad situations.

The downside of machine learning is the initial amount of data. To be able to perform diagnostic algorithms, machine learning will need a large amount of data to perform analytical methods to come up with the most accurate diagnostic algorithm. Besides, the input data needs to have high accuracy because the accuracy of the algorithm is greatly affected by the accuracy of the data used for analysis. Besides, machine learning only learns and analyzes data with clear statistics.

**2.5 Flask**

Flask is one of the popular micro-framework used in Python for building a web application. Flask is considered a micro-framework because Flask requires little or is dependent on external libraries or tools. Instead, Flask contains tools, libraries, and functions that are suitable for developing and maintaining a web application using a fast and efficient approach. This framework is designed with ease of use and extensibility in mind to create a solid foundation framework for web applications of various levels of complexity.

Besides, Flask also gives developers more control over the development process, which gives developers the option to decide how the project will be developed. Flask is one of the most feature-rich micro-frameworks of the moment, especially with its first-class extensions and elegant API. Flask comes with the benefits of fast templates, strong WSGI features and the ability to thoroughly unit test at the web application and library level.

Flask is composed of 4 main components: Jinja, Werkzeug, ItsDangerous, MarkupSafe:

+ **Jinja**: Jinja is a popular template engine in python. Jinja is an extension that supports displaying data from app to HTML. Jinja2 is used to create HTML, XML, or other file formats based on the principle of combining data into marked locations in the text.

+ **Werkzeug**: Werkzeug is a tool library that provides tools to support the development of WSGI-compliant applications. These utilities do things like parse headers, send and receive cookies, provide access to data, create redirects, or generate error pages in the event of exceptions.

+ **ItsDangerous**: ItsDangerous is a tool created to sign data. So when data is sent to dangerous or unreliable environments, the recipient can not only view the data but have no authority to change or overwrite the data. In some cases, the data can still be edited if the recipient obtains the secret key. So in most cases, the data will be safe as long as the secret key is not exposed and the level of complexity is guaranteed.

+ **MarkupSafe**: MarkupSafe is a string processing tool for Python. MarkupSafe will process input strings to avoid the data being displayed in its original form as the user enters it. Then the strings can be displayed on the website but still ensure information security.

**2.6 ReactJs**

ReactJs is an open source developed by Facebook, ReactJs was launched in 2013. It is itself a JavaScript library used to build interactions with elements on the website. This library is used to create responsive, fast, and simple web applications. The reason why a high-speed website can be achieved is that React allows users to break down and break down complex interfaces into smaller and simpler ones. This makes the rendering not need to be done on the server like others, but can also be done on the client.

The potential and benefits that React brings are great, instead of using JS and HTML separately, React uses a different special syntax, JSX. JSX makes it possible for users to write code that mixes JS and HTML. In addition, we can bring the code into the render function without having to implement the string concatenation methods. React is also said to be a potential library due to a large number of development tools. In addition to the built-in development tools, React also has other development tools thanks to the installation of Chrome browser extensions that are made available for React. Finally, it's SEO-friendly. SEO is considered one of the big problems that JS frameworks are facing. However, React is not one of the JS libraries that have this problem thanks to the support of rendering and returning the browser as a webpage when running React on the server and virtual doms.

React provides a component-based structure, and you create larger components that include those smaller components. And then you write higher-level wrapper components. And, it goes on like that until you have this root component and that component is your application. Each component decides for itself how it should be rendered. Each component has its logic inside it. You can reuse these components wherever you need them. As a result, your application will have a consistent look and feel, code reuse will make it easier to maintain and develop your base code, and your application development will also be simpler.

React also has a very popular library that provides a store for storing and retrieving information, which is Redux. Any changes to the stores will trigger rendering for the components involved, keeping the view in sync with the system's data. Redux is used for logging, exception handling, and asynchronous API calls but we can also easily write a middleware through Redux to solve all kinds of other problems.

**III. Software Product Requirements**

* 1. Review/overview of other similar products
  2. Use Case Diagrams/User Stories
  3. Use Case Specifications/Activity Diagrams & Context Diagrams/Sequence Diagrams
  4. ERD
  5. Sitemap

**VI. Review of Software Development Methodologies**

**5.1 Waterfall**

Mô hình waterfall là mô hình phát triển phần mềm được chia thành các giai đoạn khác nhai và được thực hiện tuần tự,  đầu ra của giai đoạn này là đầu vào của giai đoạn tiếp theo và không có sự chồng chéo.

Mô hình waterfall bao gồm 6 giai đoạn:

* Phân tích yêu cầu: Đây là giai đoạn đầu tiên trong mô hình, giai đoạn này nhằm xác định và phân tích tất cả các nhu cầu kinh doanh, yêu cầu về sản phẩm từ người dùng, các ràng buộc và rủi ro đi kèm
* Thiết kế hệ thống: Thiết kế hệ thống là giai đoạn sử dụng các thông tin thu thập từ giai đoạn trước nhằm tạo ra bản thiết kế cho sản phẩm nhằm đáp ứng được tất cả các yêu cầu mà người dùng đưa ra. Quá trình thiết kế này bao gồm quá trình thiết kế phần cứng, thiết kế phần mềm, lựa chọn ngôn ngữ lập trình và cả lựa chọn cách thức lưu trữ dữ liệu.
* Xây dựng: Khi quá trình thiết kế đã hoàn thành, giai đoạn này sẽ tập trung vào việc phát triển các chức năng cho sản phẩm.
* Kiểm thử hệ thống: Đây là giai đoạn mà đội ngũ QA và tester nhằm tìm kiếm và báo cáo các lỗi trong hệ thống cần được xử lý. Việc này bao gồm tất cả các hoạt động kiểm thử tính năng và phi tính năng. Đây là giai đoạn cực kỳ quan trọng mà nhóm không được phép mắc sai lầm nhằm đảm bảo hệ thống được kiểm tra kỹ lưỡng, đầy đủ chức năng và đáp ứng được các yêu cầu của người dùng.
* Triển khai hệ thống: Đây là giai đoạn khởi chạy đầu tiên của hệ thống. Trong quá trình này mọi thứ cần được đảm bảo hoạt động trơn tru và
* Bảo trì hệ thống

**5.2 Spiral**

**5.3 Rad**

**5.4 Agile**

**5.5**

**VI. Design and Implementation**

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