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CS 3201N – CS Thesis 1 (Design and Methodology)

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Parts of CS Thesis1

1. Title Page
2. Abstract
3. Chapter 1 Introduction
4. Chapter 2 Review of Related Literature
5. Chapter 3 Technical Background
6. Chapter 4 Design and Methodology
7. Bibliography
8. Appendices (Transmittal Letter, Interview Guide, Software Requirements Specifications)
9. Curriculum Vitae

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Parts of Chapter 4

- Chapter 4 Design and Methodology
  - 4.1 Research Environment and Respondents (if applicable)
  - 4.2 Research Instrument or Sources of Data (if applicable)
  - 4.3 Research Procedure (if applicable)
    - 4.3.1 Gathering of Data
    - 4.3.2 Treatment of Data
  - 4.4 Concept
  - 4.5 Analysis and Design
  - 4.6 Development Model
  - 4.7 Development Approaches
  - 4.8 Software Development Tools
  - 4. 9 Project Management
    - 4.9.1 Schedule and Timeline
    - 4.9.2 Responsibilities
    - 4.9.3 Budget and Cost Management
  - 4.10 Verification, Validation and Testing

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Design and Methodology

- The design is a **blueprint of the concept** of the proposed thesis project.
- It specifies the **conceptual structure** of what the project proponents will do.
- It provides an **outline of the phases and sub-phases** that will help the proponents be guided in their choice of techniques that are most appropriate at each stage of the project.
- It will also help the project proponent **plan**, **manage**, **control** and **evaluate** computing research project

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Design and Methodology

- The methodology is defined as **collection of procedures**, **techniques**, **tools**, and **documentation** aids which will help the proponents in their effort to solve computing problems.

Research Environment and Respondents

- Research Environment
  - It describes the **locale/venue** of research.

- Research Respondents
  - It is the study population and describes the type and characteristics of
  - the respondents/participants.
  - Describes the sampling technique used in selecting study subjects/participants and identifies possible limitations in the choice of respondents/participants.

Research Instruments or Sources of Data

- Describes the research instrument(s)/tools for gathering data and identify whether they are standardized or researcher-made.
- The description of the instrument(s) should describe the purpose of the instrument (what it is intend to measure), and available validity and reliability coefficients.
- Describes the content and preparation of each instrument.
- Describes other sources of data (e.g. records, documents). Identifies limitations of the research instruments and/or sources of data.

Research Procedure

- Gathering of Data
  - This section describes in detail the phases of data gathering employing the research tools described earlier.

- Treatment of Data
  - It explains the procedures for processing and analysis of data

Research Procedure: Gathering of Data

- Gathering of Data
  - It is description of procedures should describe in detail all steps which were executed in conducting the study.

  - Consider the following in composing this section:
    1. Did you use Qualitative or Quantitative data collection?
    2. Did you conduct interview? survey or questionnaire? document review?
    3. Respondents were interviewed several times?
    4. What other source of relevant documents do you have?

Research Procedure: Treatment of Data

- Treatment of Data
  - The steps necessary in processing your data and the statistical procedures to be used to answer each specific sub-problem of the study. Include a justification of the statistical procedures used and state your level of significance.
  - For qualitative data, include the methods on how data will be presented and analyzed.
  - Consider the following in composing this section:

    1. What tool will you use to analyze the data:

    Consider using Statistical Softwares like IBM SPSS Statistics 19 (analyze using descriptive statistics) see tutorials available

    2. How will you present the result of the analysis:

    Presentation of data : tabular form, graphs or charts

    SPSS can auto generate this

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Concept

- It is **narrative description** of the design to achieve your project objectives.

- Most of the concept is illustrated in a **graphical diagram** to visually present the structure of the concept of the project (conceptual framework).

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Example of Conceptual Framework

- Example 1: This research aims to develop a thyroid wellness system using Support Vector Machine (SVM) based on pathological attributes.

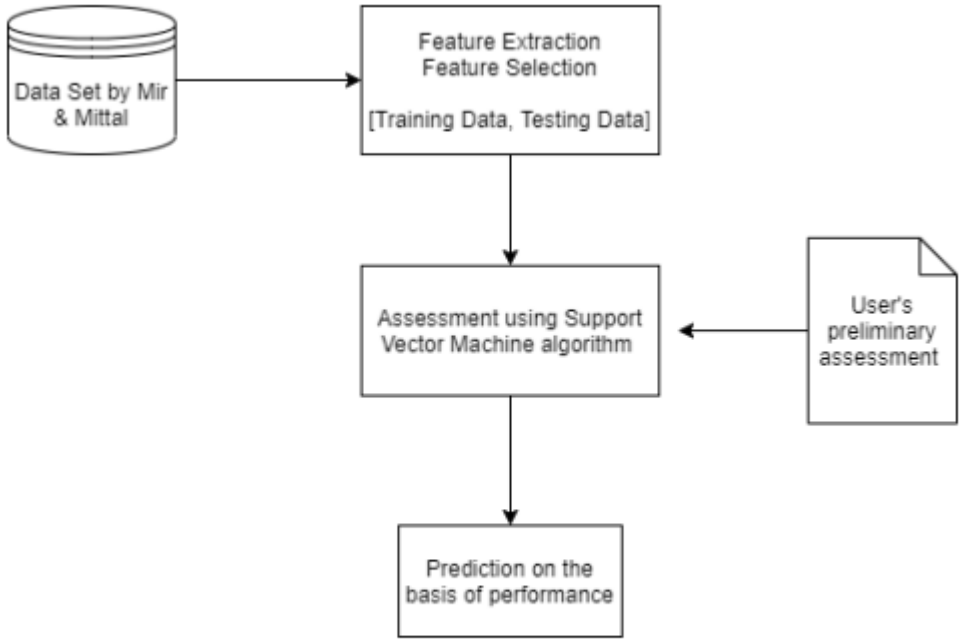

Figure 1: THY-SYS Conceptual Framework

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Example of Conceptual Framework

- Example 2: This study aims to provide an empirical analysis of using blockchain technology for e-voting systems based on the performance and security.

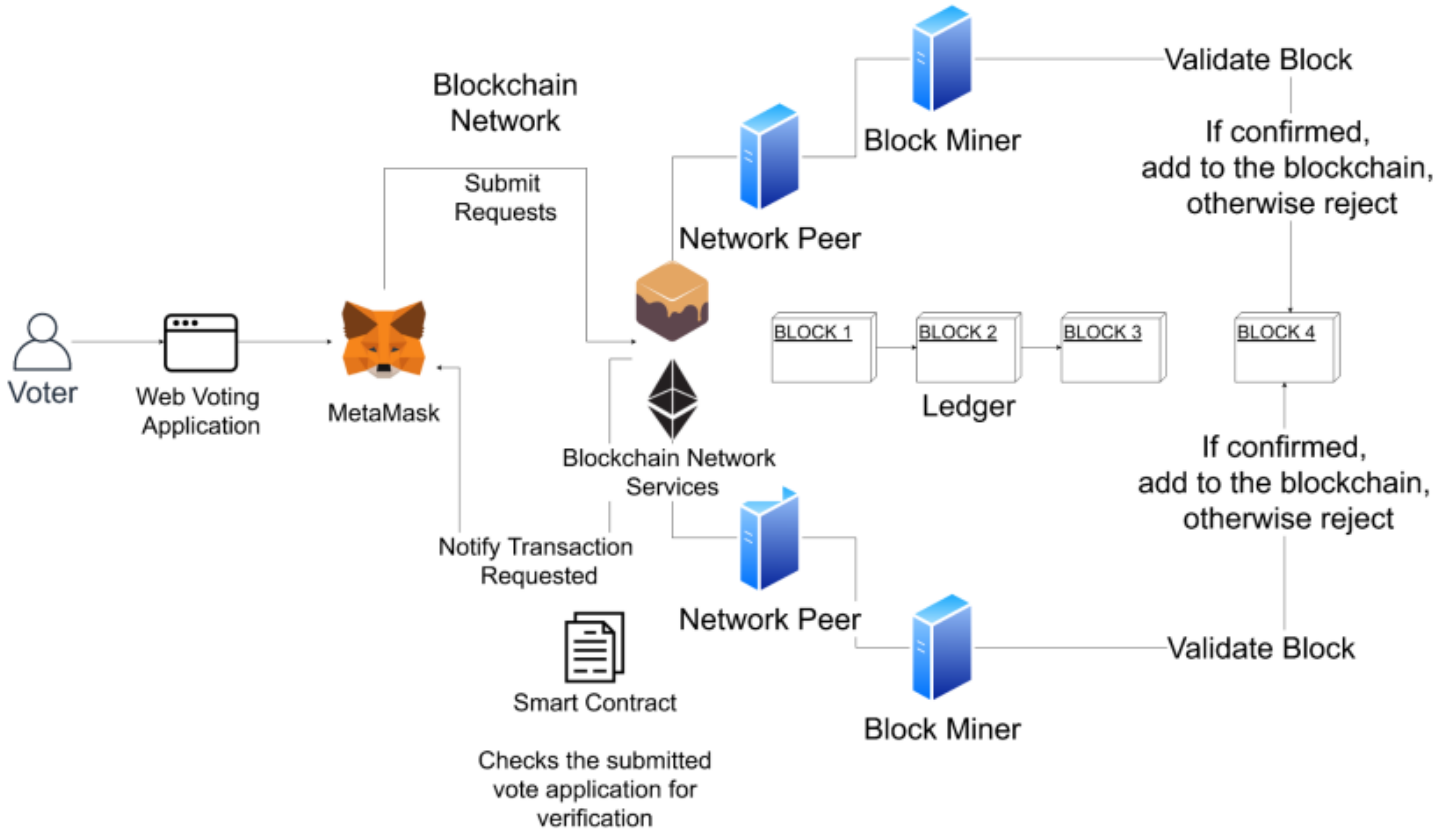

Figure 1. BEVS Conceptual Framework

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Example of Conceptual Framework

- Example 2: This study aims to provide an empirical analysis of using blockchain technology for e-voting systems based on the performance and security.

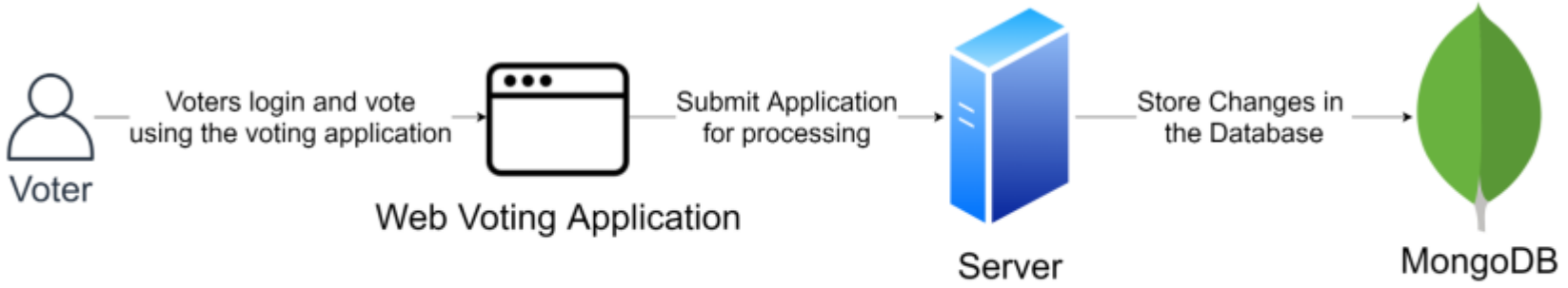

Figure 2. CEVS Vote Processing Conceptual Framework

Analysis and Design

- It is either **Structured or Object-oriented approach** (introduce UML, ERDs high-level only etc.).

Example of Analysis and Design

- Example 1: This research aims to develop a thyroid wellness system using Support Vector Machine (SVM) based on pathological attributes.

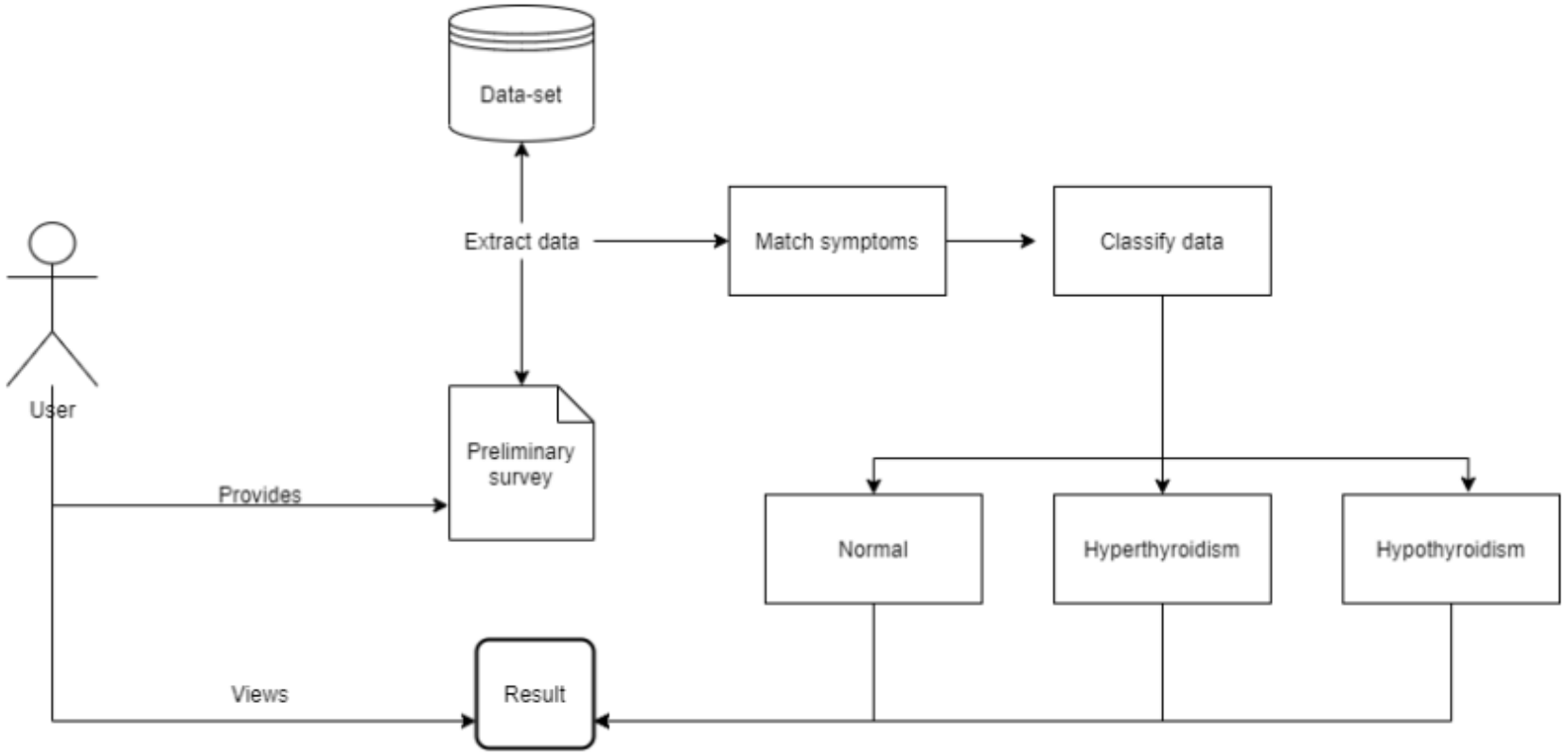

Figure 2: Use-Case Diagram

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Example of Analysis and Design

- Example 2: This study aims to provide an empirical analysis of using blockchain technology for e-voting systems based on the performance and security.

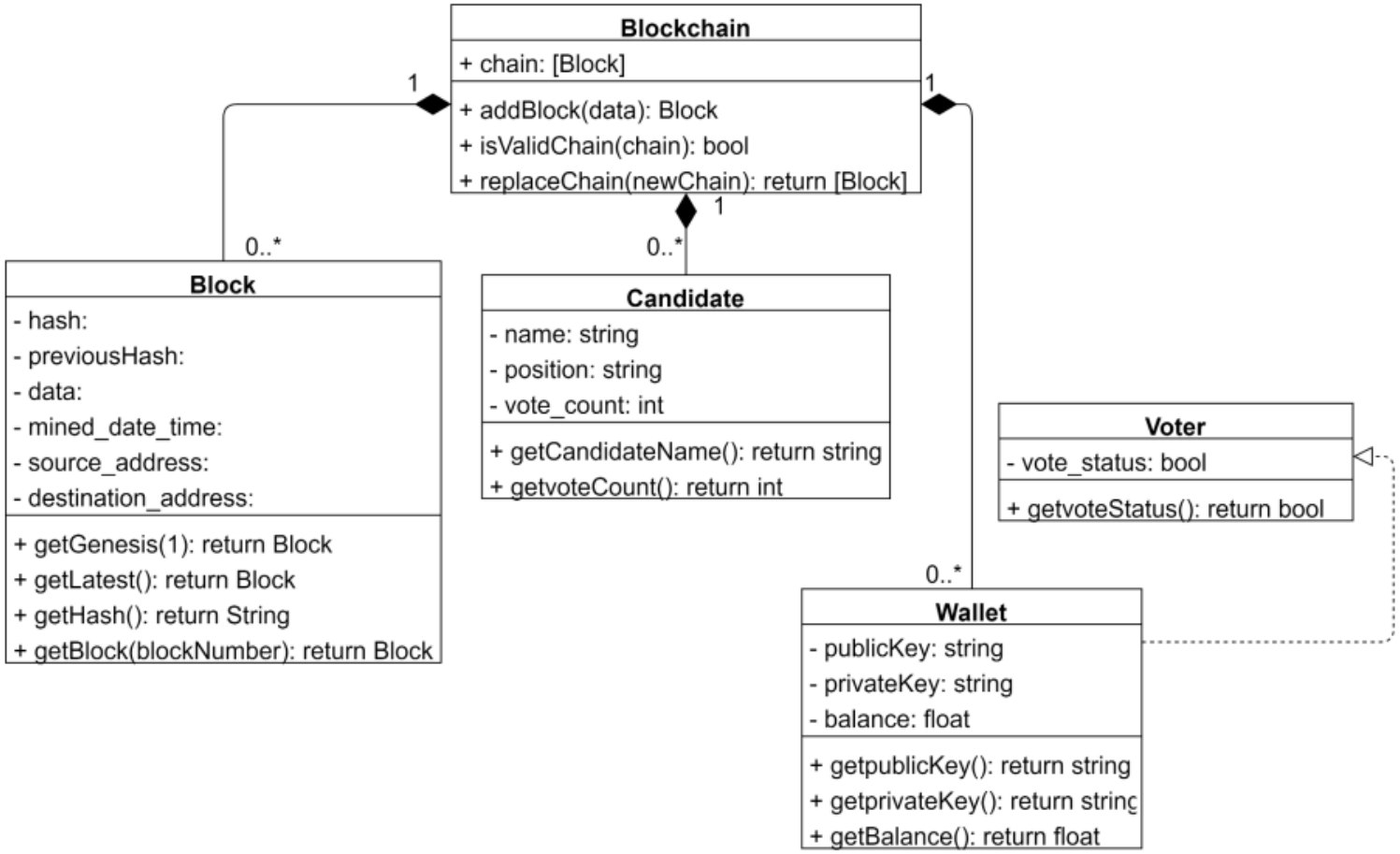

Figure 3. UML Diagram for BEVS

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Example of Analysis and Design

- Example 2: This study aims to provide an empirical analysis of using blockchain technology for e-voting systems based on the performance and security.

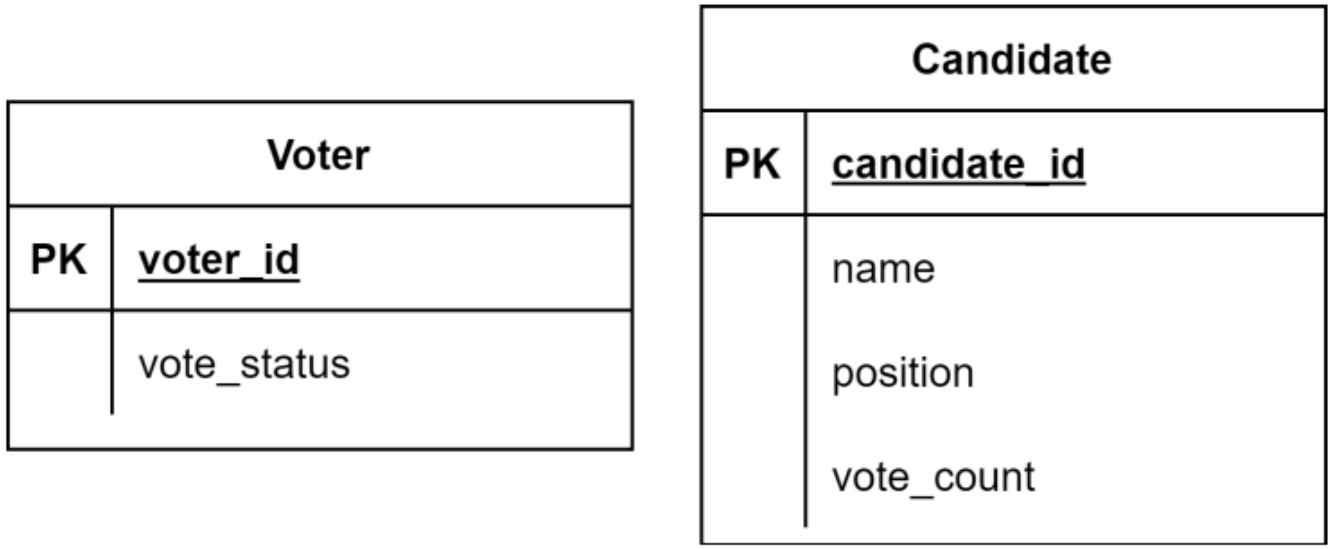

Figure 4. ERD for CEVS

Development Model

- It may include any of the following models:
  - Conventional waterfall-type
  - Incremental
  - Throw-away prototyping
  - Evolutionary prototyping

Example of Development Model

- Example 1: This research aims to develop a thyroid wellness system using Support Vector Machine (SVM) based on pathological attributes.

Figure 3: Visual Representation of Kanban framework

Example of Development Model

- Example 2: This study aims to provide an empirical analysis of using blockchain technology for e-voting systems based on the performance and security.

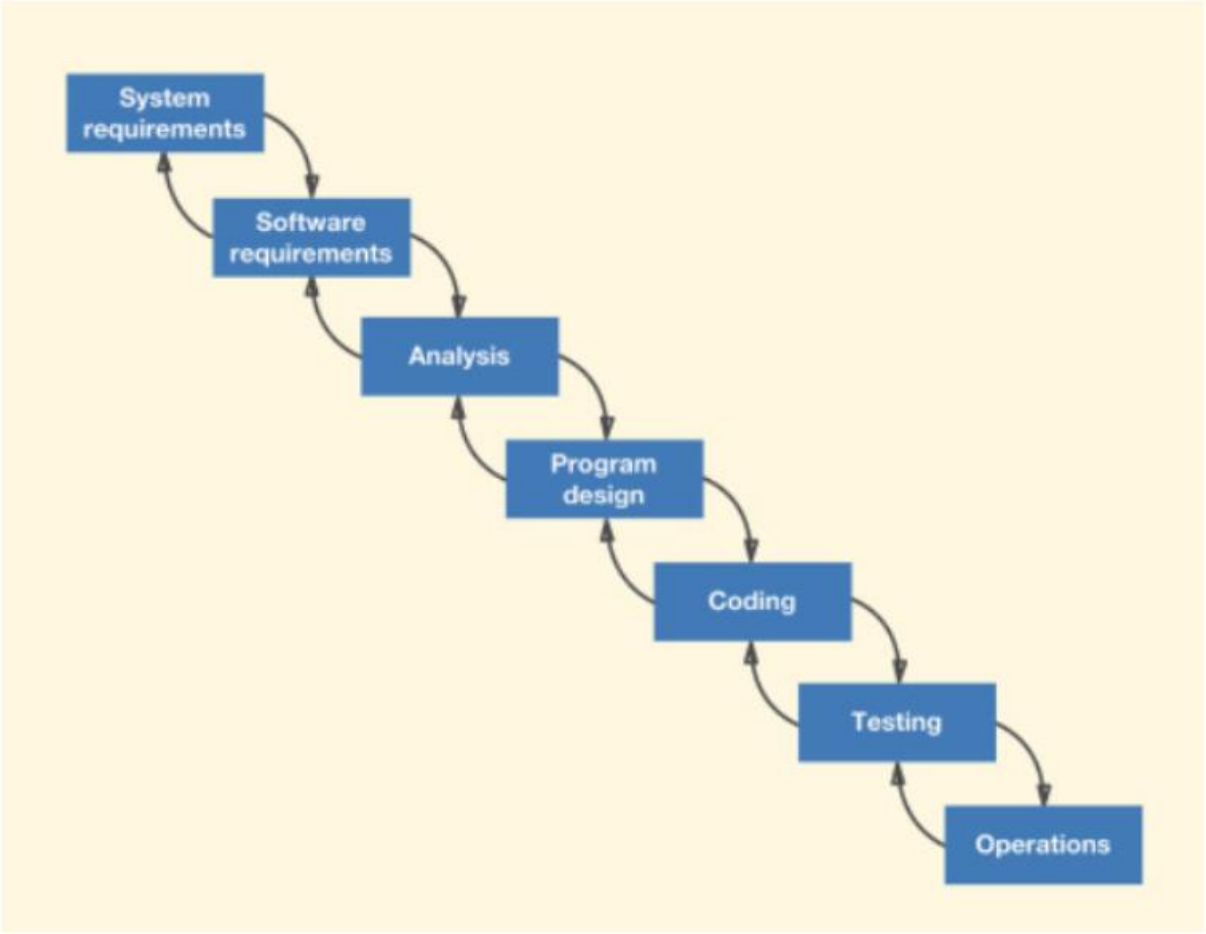

Figure 5. Modified Waterfall Model

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Development Approach

- It may include either **Top down or Bottom-up** approach of development.

Example of Development Approach

- Example 1: This research aims to develop a thyroid wellness system using Support Vector Machine (SVM) based on pathological attributes.

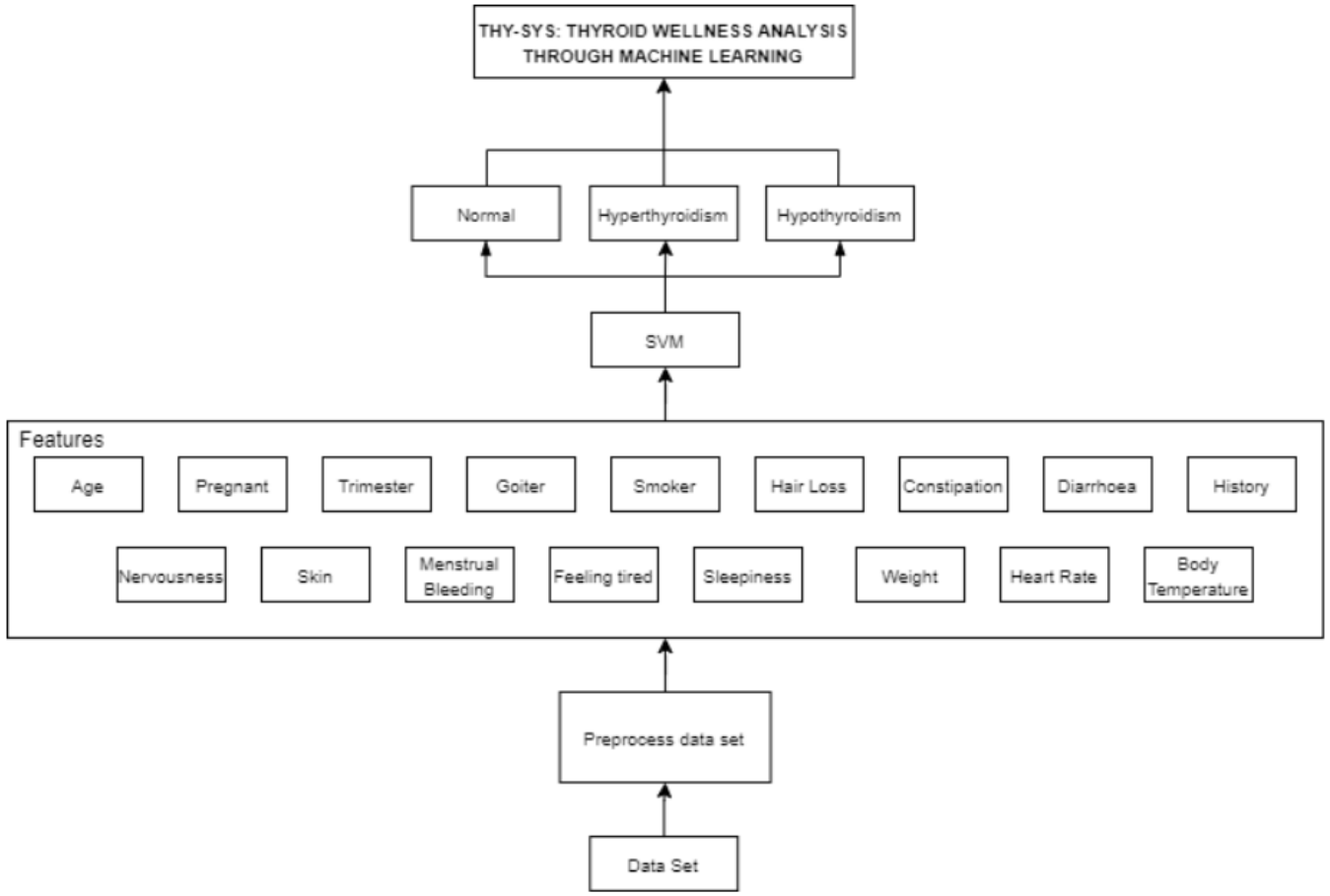

Figure 4: Bottom-Up Approach of THY-SYS

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Example of Development Approach

- Example 2: This study aims to provide an empirical analysis of using blockchain technology for e-voting systems based on the performance and security.

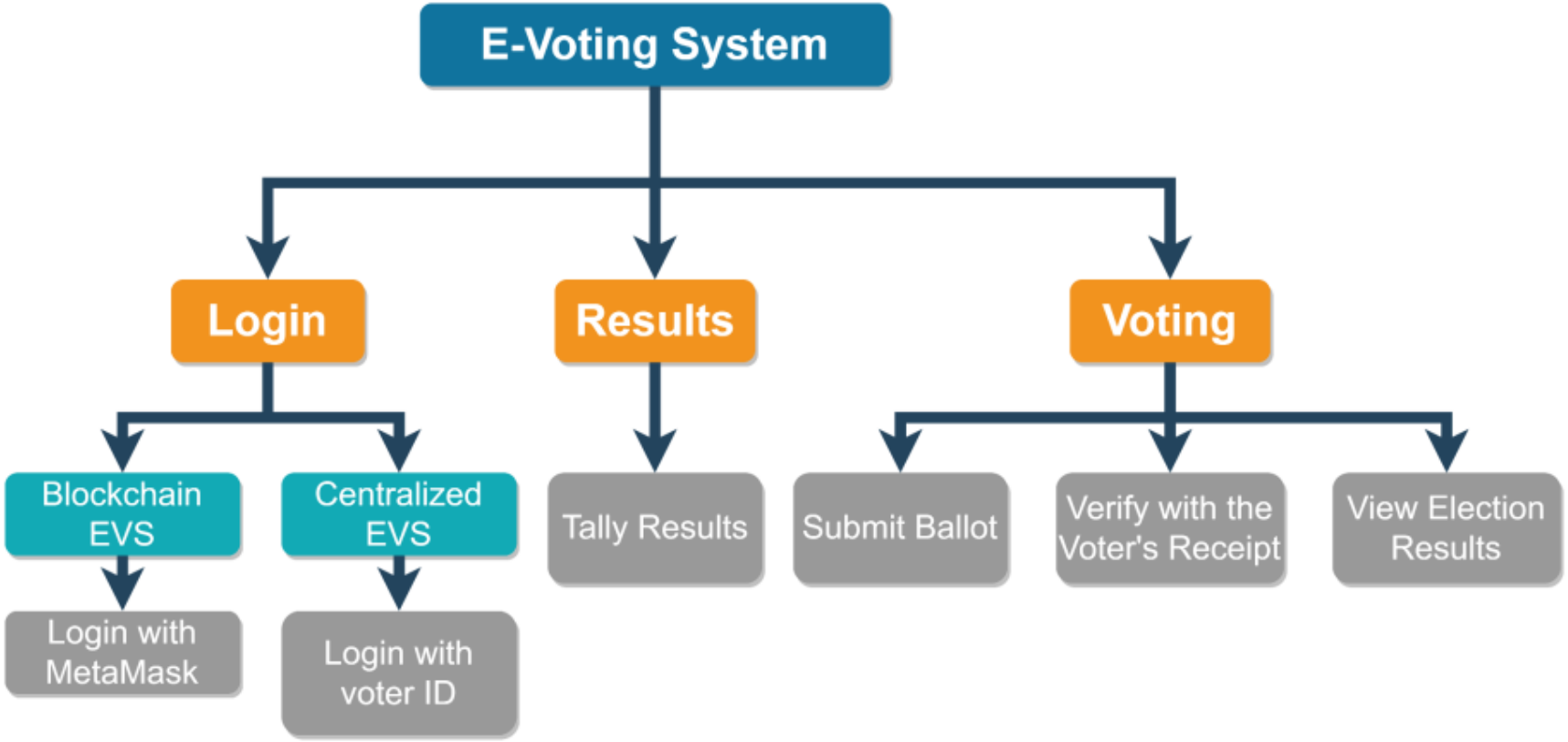

Figure 6. Top-Down Development Approach of E-Voting System

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Software Development Tools

- It should contain the discussion about the programming language tools to be used specifically on:
  - Front and Back-end; Reuse or not;
  - Open vs. licensed software;
  - Criteria of selecting it such as
    - maintainability,
    - support,
    - HCI capability,
    - database connectivity,
    - simplicity,
    - learning.

Example of Software Development Tools

- Example 1: This research aims to develop a thyroid wellness system using Support Vector Machine (SVM) based on pathological attributes.

Table 1

Software Development Tools

Software	Version	Use
Google Chrome	83.0.4103.122	A software used to access sites and use Google Colab
Visual Studio Code	1.56.0	A code editor used in creating systems and software
Google Colab		A free and public, interactive and collaborative environment intended for writing code used in data science
Github	2.28.0	A code-hosting platform intended for collaboration in software and system development
Jira	8.13	A project management software that is used in organizing and tracking of tasks within a team
IBM SPSS Statistics 25	25.0.0.0	A software, that stores and displays data through a spreadsheet and is used for doing statistical analysis
Sci-kit learn package	0.24.1	A Python package for data mining
NumPy	1.20.2	A Python package used when handling arrays
Tkinter	0.1.0	A Python package used in providing graphical user interface.

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Example of Software Development Tools

- Example 2: This study aims to provide an empirical analysis of using blockchain technology for e-voting systems based on the performance and security.

Table 2

List of Software Tools

Software	Version	Use
Node.js	14.16.0	Server development
Node Package Manager (npm)	7.6.3	Package manager for Node.js codes
Truffle	5.2.5	Development environment for Ethereum
Ganache	6.12.2	Local blockchain for Ethereum distributed application development
MetaMask	9.2.0	Browser extension for accessing Ethereum DApps
Vue.js	3.0.7	Development framework
MongoDB	4.4.5	Non-relational database management system
Visual Studio Code	1.54	Text editor for web development
Google Chrome	89.0.4389.90	Browser to run the application on
Apache JMeter	5.4.1	Performance testing tool
OWASP ZAP	2.10.0	Security scanner

Project Management

- Schedule and Timeline
  - It may contain **Gantt Chart, Activity Graph, Critical Path Analysis** and other **scheduling techniques** that will list the activities to be done in order to achieve the objective.
  - Usually it includes the phases an its **sub-phases of the systems development life cycle**.

Example of Schedule and Timeline

- Example 1: This research aims to develop a thyroid wellness system using Support Vector Machine (SVM) based on pathological attributes.

Table 2

Gantt Chart of Activities, Second Semester, A.Y. 2020 - 2021

	To-Dos	Details	Q1 FEB 1 2 3 4	Q1 MAR 1 2 3 4	Q2 APR 1 2 3 4	Q2 MAY 1 2 3 4
1	Research Topic Ideation	Reasearch Title and Themes				
2	Thesis Definition and Planning	- Chapter 2: Review of Related Literature - Chapter 3: Technical Background - Statement of the Problem - Chatper 4: Design and Methodology				
3	Thesis Development	- Chapter 1: Rationale of the Study, Significance of the Study, Scope & Limitation and Abstract - Transmittal Letter, Bibliography, Questionaire, Survey and Curriculum Vitae				
4	Thesis Revision	- Submission of Draft Thesis Paper - Initial Thesis Revision				
5	Thesis Defense	- Submission of Thesis Paper (Chapter 1-4) - Thesis Proposal Defense - Thesis Paper Revision (Panelist Feedback) - Submission of Final Revised Thesis Paper				

Table 3

Gantt Chart of Activities, First Semester, A.Y. 2021 - 2022

	To-Dos	Details	A.Y. 2021 - 2022 (1st Semester) Q3 AUG 1 2 3 4	Q3 SEPT 1 2 3 4	Q3 OCT 1 2 3 4	Q4 NOV 1 2 3 4	Q4 DEC 1 2 3 4	Q4 DEC 1 2 3 4
1	Data Training	Training the algorithm using the obtained data samples						
2	System Testing and Verification	- Model Accuracy Testing and reinforcement						
3	System Development	- System Interface Design - Integration of the model to the system - System Validation - Fixing of Errors						
4	Thesis Documentation	- Chapter 5: Results and Discussion - Chapter 6: Conclusion						
5	Thesis Defense	- Document Revisions - Submission of Documents and Thesis Defense Preparation - Thesis Defense - Thesis Paper Revision (Panelist Feedback) - Submission of Final Revised Thesis Paper						

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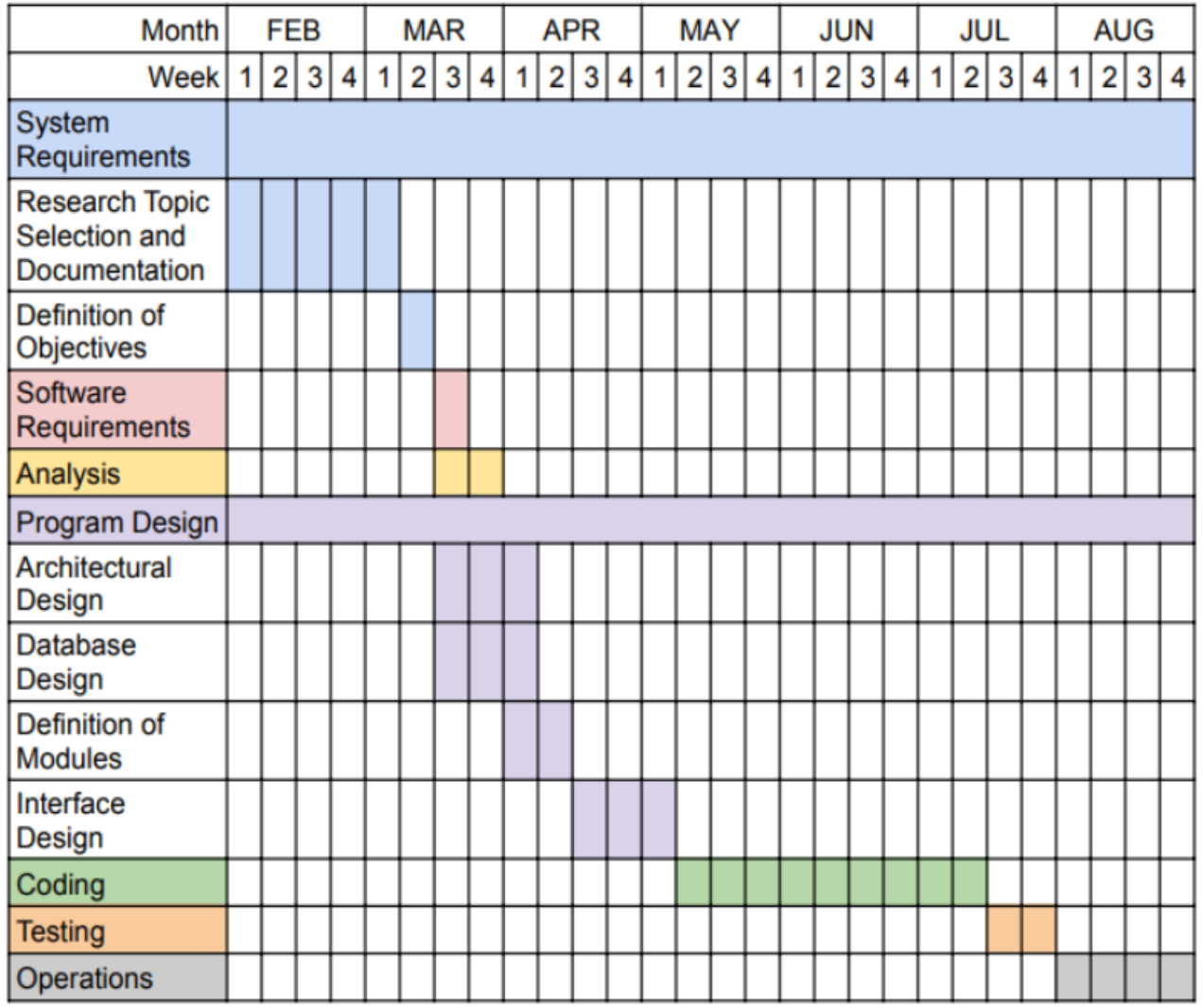
Example of Schedule and Timeline

Table 3

Gantt Chart of Activities



- Example 2: This study aims to provide an empirical analysis of using blockchain technology for e-voting systems based on the performance and security.

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Project Management

- Responsibilities
  - It should contain **the assignment modules and activities** to be done by each team member.

Example of Responsibilities

Table 4

Table of Roles and Responsibilities

Member	Roles	Assignment
Mary Bernadette Ferolin	Researcher and Developer	Collect the data to be used in the study
		Learn the basics concepts of Support Vector Machines and how it is implemented
		Train the model using the datasets, and afterwards test the model.
		Develop the system interface, and verify the survey questions used in the system and the generated response.
Ismael Francisco	Researcher and Developer	Learn the basics concepts of Support Vector Machines and how it is implemented
		Pre-process the data to be used in the testing and training of the model
		Train the model using the datasets, and afterwards test the model.
		Evaluate the performance of the model on the basis of its accuracy, and develop the system interface

- Example 1: This research aims to develop a thyroid wellness system using Support Vector Machine (SVM) based on pathological attributes.

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Example of Responsibilities

Table 4

Roles and Responsibilities

Member	Role	Responsibility
Jayson V. Cadiz	Researcher	Gather data from respondents
	Developer	Research on software tools and applications
		Develop both systems
		Test the developed systems
Nicole Amber M. Mariscal	Researcher	Gather data from respondents
	Developer	Research on software tools and applications
		Develop both systems
		Test the developed systems

- Example 2: This study aims to provide an empirical analysis of using blockchain technology for e-voting systems based on the performance and security.

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Project Management

- Budget and Cost Management
  - It should contain a **detailed budget proposal** and how each cost is to be managed effectively in the conduct of research or study.

Example of Budget and Cost Management

- Example 1: This research aims to develop a thyroid wellness system using Support Vector Machine (SVM) based on pathological attributes.

Table 5

Table of Expenses

Items	Cost
Laptop (Acer Aspire E5-575G & Acer Aspire E5-576G)	68,000.00
Conference Fees (includes the Conference Registration Fee, Airfare, Accommodation, etc.)	85,000.00
Miscellaneous	10,000.00
Total	**163,000.00**

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Example of Budget and Cost Management

- Example 2: This study aims to provide an empirical analysis of using blockchain technology for e-voting systems based on the performance and security.

Table 5

Proposed Budget and Cost Management

Items	Cost
Personal Desktops	Php 80,000.00
Transportation Fees	Php 1,000.00
Conference Fees	Php 5,000.00
Miscellaneous Fees	Php 5,000.00
Total	**Php 91,000.00**

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Verification, Validation and Testing

- These includes:
  - verify if you are developing the system right,
  - validate if you are developing the right system, and
  - test the system if it works correctly without any bugs or errors.

- Most importantly, use of any quantitative and qualitative measures should be planned in order to achieve the research projects specific objectives

Verification, Validation and Testing

- Computing Science researchers use several methodologies to tackle questions within the discipline.
- The idea is not to classify researchers or projects in each of these methodologies or to be exhaustive.
- Tasks performed by a single researcher fall within different methodologies.
- Even the activities required to tackle a single research question may include several of these methodologies.

Verification, Validation and Testing (Scientific Methods of Computer Science)

- Formal Method
  - Mostly used to prove facts about algorithms and system.
  - Develop mathematical techniques to address questions.
  - Discovery of more efficient algorithms in many areas including combinatorial problems, computational geometry, cryptography, parallel and distributed computing.
  - They also answer fundamental questions about computability and complexity.

Verification, Validation and Testing (Scientific Methods of Computer Science)

- Experimental Method
  - Broadly used in CS to evaluate new solutions for problems.
  - Experimental evaluation is often divided into two phases.
    - **Exploratory phase** the researcher is taking measurements that will help identify what are the questions that should be asked about the system under evaluation.
    - **Evaluation phase** will attempt to answer these questions.
  - A well-designed experiment will start with a list of the questions that the experiment is expected to answer.

Verification, Validation and Testing (Scientific Methods of Computer Science)

- Build Method
  - It consists of building an artifact either a physical artifact or a software system to demonstrate that it is possible.
  - Design the software system, Reuse components, Choose an adequate programming language.
  - Consider testing all the time.

Verification, Validation and Testing (Scientific Methods of Computer Science)

- Process Method
  - It is used to understand the processes used to accomplish tasks in Computing Science.
  - This methodology is mostly used in the areas of **Software Engineering and Man-Machine Interface** which deal with the way humans build and use computer systems.
  - The study of processes may also be used to understand cognition in the field of Artificial Intelligence.

Verification, Validation and Testing (Scientific Methods of Computer Science)

- Model Method
  - It is centered on defining an abstract model for a real system.
  - This model will be much less complex than the system that it models, and therefore will allow the researcher to better understand the system and to use the model to perform experiments that could not be performed in the system itself because of cost or accessibility.
  - The model methodology is often used in combination with the other four methodologies.

Sources:

- Thesis Projects

  A Guide for Students in Computer Science and Information Systems

  Authors: Mikael Berndtsson, Jörgen Hansson, Björn Olsson, Björn Lundell

  ISBN: 978-1-84800-008-7 (Print) 978-1-84800-009-4

- PSITE Undergraduate Research and Capstone Project Manual

  Authors: Cherry Lyn Sta. Romana, Randy Gamboa, Dave Marcial, Gregg Victor Gabbison, Allan Sioson

  ISBN: 978-971-95389-0-5

- IJCCSE journal of Computer Science How to do Research Step by Step Guide
- Presentation of Jaderick from UPLB

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Sources:

- Thesis Projects

  A Guide for Students in Computer Science and Information Systems Authors: Mikael Berndtsson, Jörgen Hansson, Björn Olsson, Björn Lundell

- ISBN: **Book**

  Gray, D. (2009). Doing Research in the Real World 2nd edition. British Library

- Online

  Presentation of Danilo B. Largo, Ph. D.

  Presentation of Shamanthakamani Narendan, Ph. D.

  Presentation of Bobby Gerardo, Ph.D.

  University of Michigan Proposal Writer's Guide by Don Thackrey

  Department of Computer Science, Ryerson University

  Jason Eisner of University of Pennsylvania

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Thank you for listening. ☺

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