Sports injury and illness recording application

แอปพลิเคชันบันทึกอาการบาดเจ็บและการเจ็บป่วยทางการกีฬา

BY

Mr. Krissanapong Palakham 6288102

Mr. Pongsakorn Piboonpongpun 6288107

Mr. Rathakit sriprachayanun 6288134

ADVISOR

asst. prof. Dr. charnyote pluempitiwiriyawej

A Senior Project Submitted in Partial Fulfillment of

the Requirements for

THE DEGREE OF BACHELOR OF SCIENCE

(INFORMATION AND COMMUNICATION TECHNOLOGY)

Faculty of Information and Communication Technology

Mahidol University

2022

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ACKNOWLEDGEMENTS

We really would like to thank everyone who has taken part in our initiative and was relevant. This project could not be completed without the participation of all of the participants, including Mr. Krissanapong (Pun), Mr. Pongsakorn (Mark), and Mr. Rathakit Sriprachayanun (Art). We were also grateful to Asst. Prof. Dr. Charnyote Pluempitiwiriyawej, who served as our principal advisor, for his invaluable assistance and to all of the advisors for their support. We could learn a lot from this endeavor and put what we have learned into practice as we completed the final report. Finally, we expected that our project would be entirely useful and grateful as well as thanks to our parents encouraged us to enroll in this faculty.

Mr. Krissanapong Palakham

Mr. Pongsakorn Piboonpongpun

Mr. Rathakit Sriprachayanun

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Mr. Krissanapong Palakham 6288102 ITCS/B

Mr. Pongsakorn Piboonpongpun 6288107 ITCS/B

mr. rathakit sriphachayanun 6288134 ITCS/B

B.Sc. (INFORMATION AND COMMUNICATION TECHNOLOGY)

PROJECT ADVISOR: asst. prof. dr. charnyote pluempitiwiriyawej

ABSTRACT

<Abstract content as sentence case here>

KEYWORDS :

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แอปพลิเคชันบันทึกอาการบาดเจ็บและการเจ็บป่วยทางการกีฬา

กฤษณพงศ์ ปาลคำ 6288102 ITCS/B

ITCS/B

ITCS/B

วท.บ. (เทคโนโลยีสารสนเทศและการสื่อสาร)

อาจารย์ที่ปรึกษาโครงการ:

บทคัดย่อ

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CHAPTER 1

# Introduction

In this chapter, there are six parts of introduction which are Motivation, Problem Statement, Objectives of the Project, Scope of the Project, Expected Benefits of the Project, and Organization of the Document. Their focus will be on how the application was developed, why there is a need for the application, and what were the benefits of the application.

## Motivation

Whether it is a training, preparation, or competing, the common problems with athlete are injuries and the illnesses. These problems can affect the physical training, performance of the athletes at that time, and the success of winning competitive. Therefore, to prevent these things, it is important to keep track of athletes regularly and monitor their health and ailments. Collecting the data from athlete tracking help personnel in many fields such as the coaches of the athlete, the information can help them for planning about training and competition session, the medical teams (e.g., general practitioners, specialists, physical therapists), the information can help to know the predominant injury and illness type so that it can prevent and treat injury and illness in that time. Other information besides illness and injury also affects training and competition such as stressing level, athlete sleep time or else that effect to athletes meatal. So, these are very important to check for the athletes to have a more stable mind and better intentions.

## Problem Statement

Collecting data from the athletes through questionnaires form is difficult to manage in terms of sorting out between medical team and athletes. Making athletes feel comfortable to use our application is also hard to analyze since we need to get the feedback from athletes as much as possible.

## Objectives of the Project

In order to create the application, we provide

* Develop SIRA system capable of managing data on both sport injuries and sport psychology.
* Make it possible for athletes to monitor their present level of physical and mental wellness.
* Enable coaches and the medical staff to use athlete health data and provide coaching and treatment input to specific athletes

## Scope of the Project

A computing application that allows athletes to check their physical condition through online channels. The application is designed to facilitate both athletes and coaches and healthcare professionals with functionality that meets the needs of teams that care for athletes. Athletes and officials can view athlete statistics and check for ailments.

## Expected Benefits

In order to build the application, we expected our solution would be assisted to any kinds of users that were classified into two groups including users and developers. Furthermore, users were more classified into three groups including athletes, medical team, and organization agents. The description as follows:

* Athletes
  + Receiving a recommendation from medical team for healing themselves
  + Regularly receiving health checks with professional medical team
  + Filling out the health questionnaire forms as simple with clearly user interfaces
* Medical Team
  + Filling out the medical record form as simple with clearly user interfaces
  + Examining the cases from athletes clearly and easily
* Organization Agents
  + Making a decision in order to send athletes to compete in each event
  + Athletes’ and Medical Teams’ data in order to archive and analysis
* Developers
  + Practicing mobile programming both coding and framework
  + Creating an assistant program for athletes and medical staff
  + Developing an application for both IOS and android operating systems with Dart language and Google Firebase Services
  + Evolving problem-solving, time management, prioritizing tasks, programming, database management, UX/UI, and presentation skill.

## Organization of the Document

This document consists of 6 chapters including:

1. Introduction – The motivation, problem statements, project objectives, project scopes, expected benefits for both users and developers, and document organization are all contained in the introduction's first chapter, which also introduces the project.
2. Background – Background knowledge, including a literature review, is included in the second chapter.
3. Analysis and Design – The project's analysis and design are presented in the third chapter. It includes details on the project's design, such as a system architecture overview, a system structure diagram, and a design for the web-based service.
4. Implementation – The fourth chapter discusses the implementation and includes information on hardware, system environment, implementation techniques, and implementation guide.
5. Testing and Evaluation – The testing and evaluation process, spread pattern results, and discussion are all found in the fifth chapter.
6. Conclusion – Conclusion, benefits, issues and limitations, and future work are all included in the sixth chapter.

CHAPTER 2

# Background

This chapter includes examples of earlier projects completed by other scholars. We give a summary of the project's content while highlighting its advantages and disadvantages in relation to other projects. In addition, we had the project reviewed so that we could improve it and change it to fit our preferences so that it would be a fantastic app.

## Literature Review

### The health problems survey from the Oslo Sports Trauma Research Center

Prior to recently, the majority of research on sports injury prevention consisted of observational studies that outlined injury risk in various activities as well as their incidence, pattern, and severity. Few studies, however, had been created to offer comprehensive data on injury processes and risk factors—data that was necessary in order to suggest appropriate preventative strategies. Based on this foundation, Oslo University Hospital and the Norwegian School of Sport Sciences collaborated to establish the Oslo Sports Trauma Research Center in May 2000. As a FIFA Medical Center of Excellence, the Oslo Sports Trauma Research Center was officially opened in 2009. The facility was also chosen to be one of the first four IOC Research Centers for Injury Prevention that year.

### Better reporting of sports-related overuse injuries and health issues

The OSTRC believed that these improvements would improve the respondents' experience and, as a result, maximized their adherence, and this paper offered updates to the OSTRC surveys. These impressions were influenced by environmental factors, including athlete experience, sport level, sports kind, and season. This implied that data gathered from various athletic cohorts would not necessarily be comparable. We supported additional studies on the psychometric characteristics of the OSTRC questionnaires in various contexts and groups.

### Development of an overuse injury questionnaire

According to the research, a new overuse injury questionnaire was developed during a series of group meetings at the facility involving sports physiotherapists, physicians, sports injury epidemiologists, athletes, and questionnaire design experts. The intention was to create a questionnaire that could be applied to the problem of overuse injuries on any area of ​​the body. However, for the purposes of this study, we chose to focus on the athlete's three common areas of overuse injury: his knees, hips, and shoulders. At the first meeting, a draft list of questions was developed that included items on the symptoms of the injury, the impact of undue injury on sport participation and performance, and the degree to which the injury affects physical functions such as jumping, lifting, and throwing.

CHAPTER 3

# Analysis and Design

This chapter has included the analysis and design of our system which is contained the system architecture and structure chart that explained the structure and process that happened in the system. Moreover, the system has included the database analysis consisting of ER diagram, Relational Schema, and File Structure which are explained the database on our system what data have to be kept in our system.

## System Architecture Overview

Diagram

Description automatically generated

Figure 3.1: SIRA Systems architecture

Figure 3.1 shows the overviews of our system architecture (Sport Injury and Illness Recording Application). There are two types of the users, they are athlete and medical team. The athletes can fill out a weekly injury or illness check questionnaire and submit data to firebase for storage and send to the medical team to track and view illnesses or injuries outside of athletes from training or competition. The medical team can not only track and view athlete symptoms, but also create a record to save diagnoses of athlete symptoms in the firebase for decision-making by the organization. The system includes application interface, do questionnaire, authentication, tracking, forgot password and database manager. The application interface can only be used in phones with IOS operating system at this time. Authentication is to manage user accounts which can be separated into two categories, athletes and medical teams that athletes are allowed to save and read their data. The medical team has the same rights as athletes but can be able to view illnesses and injuries data or weekly questionnaires of athletes taking. Doing questionnaire is accessible by athlete, which can be chosen from the application interface and the scores are calculated according to the Oslo Sports Trauma Research Center (OSTRC) and sent to firebase. Tracking will have access from medical team coming through the application interface to access athlete information. Forgot password can set the new password from the user send the email in the application interface. In order to connect to the database, the database manager serves as a controller. All statistical data can be stored in a database.

Diagram

Description automatically generated

Figure 3.2: The SIRA systems workflow

Figure 3.2 represents the workflow of all processes that specify whether athletes, staffs as well as the SIRA systems. The process starts from completion of questionnaire from athletes in order to save a result into the database (Firebase Firestore). After saved into the database, the system will send a notification of which questionnaire contains a total score over 25 points to staffs as a case. Then, staff will see the notification and receive whatever they want. Next, staffs have to complete a medical record regard to the received cases. After they finished the medical record, the system will notify the questionnaire status and advice messages for athlete from the staff who received. Then, athlete will receive the notification and they need to check the questionnaire status and react to advice messages for healing themselves. In addition, staffs can view the case and medical record history. Also , athletes can view the questionnaire history and advice messages.

## System Structure Chart

We produced the system structure chart, which illustrated the process all users would urge in terms of a diagram, in order to demonstrate how the SIRA system would be processed. The essential procedures for the recording system were analyzed and organized in the system structure chart. Additionally, a graphic and description have been used to explain the data that was needed to carry out the process.

|  |  |
| --- | --- |
| Diagram  Description automatically generated | |
| Project : Sport Injury and Illness Recording Application  System : Recording system | Major Advisor : Asst. Prof. Dr. Charnyote Pluempitiwiriyawej |
| Description : This diagram represents the structure chart of main processes that both athlete and staff have to work as a procedure. | |

*Figure 3.3: Structure chart of processes of the SIRA system*

The detailed description of each subsystem is shown below:

1. **Authentication process** – Users have to authenticate to our system both registration and log in in order to access the interactive interfaces
   1. Register to the system – Fill in the personal information, username, and updated password to register to the system
   2. Log on to the authentication – Fill in the email and password in order to verify the authentication part and access to the interfaces
2. **Complete the questionnaire** – Athletes choose the questionnaire type, then complete whether questionnaire and complain
   1. Choosing the questionnaire type – Athletes choose the questionnaire type including health questionnaire, physical complain, or mental questionnaire
   2. Fill in the chosen questionnaire – Fill in or choose an answer in order to complete the questionnaire
3. **Notify cases** – Notification for staff in order to notify the case from athlete’s questionnaire after it is finished
   1. Receiving cases – Staff receive the notification from the system
4. **Complete the medical record** – Staffs have to fill in the medical record from case diagnostic
   1. Diagnostic the cases from athlete – Diagnostic whether health, body injury, and mental problem from athletes’ cases
   2. Choosing the medical record type – Staffs choose the appropriately medical record type to received cases
   3. Fill in the chosen medical record – Staffs complete the chosen medical record from the diagnostic result
5. **Notify status and advice messages** – The system will send the notification of status and advice message from staff who received their case
   1. Receiving status and advice messages – Athletes will receive the notification from staff in order to verify their questionnaire status and know how to react to their injury or illness
6. **Retrieve result questionnaire history** – Athletes can view their questionnaire history to check the past cases
   1. Query the result questionnaire history – Athletes query the desired questionnaire by given options or default settings
7. **Retrieve result records and cases** – Staffs can view their medical record history as well as the cases they received
   1. Query the result records and cases – Staffs query the desired record or cases by given options or default settings

## Process Analysis and Design

### Data Flow Diagram

Our data flow diagram represents the structure and analysis of the processes that can take place in our system and describes the system's flow. The graphic illustrates the processes that our users can carry out and how they create a process in order to produce an output, such as registration, login, completing a questionnaire, and other procedures. The diagram also shows the users who might be the main users, the data that is collected into the database, and the database that is needed for our systems.

|  |  |
| --- | --- |
|  | |
| Project : Sport Injury and Illness Recording Application  System : Recording system | Major Advisor : Asst. Prof. Dr. Charnyote Pluempitiwiriyawej |
| Description : This diagram represents how athletes and medical team are interacted with the SIRA application. | |

*Figure 3.4: SIRA Data Flow Diagram Level 0*

|  |  |
| --- | --- |
|  | |
| Project : Sport Injury and Illness Recording Application  System : Recording system | Major Advisor : Asst. Prof. Dr. Charnyote Pluempitiwiriyawej |
| Description : This diagram deep dives into level 1 of the data flow diagram which makes more clearly in each process through the SIRA application. | |

*Figure 3.5: SIRA Data Flow Diagram Level 1*

### Data Dictionary

A data dictionary is a way to document and describe Processes, Data Stores, and Data Elements (Data Flow) that occur in a Data Flow Diagram (DFD). It is composed of 3 parts as shown below.

* Process Descriptions
* Data Stores
* Data Elements

#### Process Description

This section will provide the detailed description of each process that exists in this system. It includes Inbound Data, Outbound Data, and Logic Summary.

Table .: List of all Processes

| No. | Process | Name | Description |
| --- | --- | --- | --- |
| 1 | P1 | Authentication process | The process of authentication both register and log in to the system |
| 2 | P2 | Complete the questionnaire | Fill in the questionnaire in the system |
| 3 | P3 | Notify cases | Notification for medical team to examine the cases |
| 4 | P4 | Complete the medical record | Fill in the medical record from a diagnostic result |
| 5 | P5 | Notify status and advice messages | Notification for athlete to receive the questionnaire status and advice messages |
| 6 | P6 | Retrieve result questionnaire history | Query for retrieving the questionnaire result history description |
| 7 | P7 | Retrieve result records and cases | Query for retrieving the medical result history description and cases history description |

Table 3.2: Process Description of Log on to the application authentication

|  |  |
| --- | --- |
| Process Name | P1 – Authentication process |
| Description | The process of authentication both register and log in to the system |
| Inbound data | * Athlete’s username and password * Staff’s username and password * Athlete’s data * Staff’s data |
| Outbound Data | * User’s username and password * Athlete’s data * Staff’s data |
| Logic Summary | No subsystem |

Table 3.3: Process Description of Complete the questionnaire

|  |  |
| --- | --- |
| Process Name | P2- Complete the questionnaire |
| Description | Fill in the questionnaire in the system |
| Inbound data | * Answer & Score |
| Outbound Data | * Answer result * Total score * Preliminary advice message |
| Logic Summary | No subsystem |

Table 3.4: Process Description of Notify cases

|  |  |
| --- | --- |
| Process Name | P3- Notify cases |
| Description | Notification for medical team to examine the cases |
| Inbound data | * Total score over 25 * Questionnaire case description |
| Outbound Data | * Questionnaire case description and total score |
| Logic Summary | No subsystem |

Table 3.5: Process Description of Complete the medical record

|  |  |
| --- | --- |
| Process Name | P4- Complete the medical record |
| Description | Fill in the medical record from a diagnostic result |
| Inbound data | * Diagnostic result for athlete * Advice messages |
| Outbound Data | * Questionnaire status * Diagnostic results for athlete * Advice messages |
| Logic Summary | No subsystem |

Table 3.6: Process Description of Notify status and advice messages

|  |  |
| --- | --- |
| Process Name | P5- Notify status and advice messages |
| Description | Notification for athlete to receive the questionnaire status and advice messages |
| Inbound data | * Questionnaire status * Advice messages |
| Outbound Data | * Questionnaire status * Advice messages |
| Logic Summary | No subsystem |

Table 3.7: Process Description of Retrieve result questionnaire history

|  |  |
| --- | --- |
| Process Name | P6- Retrieve result questionnaire history |
| Description | Query for retrieving the questionnaire result history description |
| Inbound data | * Questionnaire history * Query for questionnaire history description |
| Outbound Data | * Questionnaire history description * Query for questionnaire history description |
| Logic Summary | No subsystem |

Table 3.8: Process Description of Retrieve result records and cases

|  |  |
| --- | --- |
| Process Name | P7- Retrieve result records and cases |
| Description | Query for retrieving the medical result history description and cases history description |
| Inbound data | * Query for case history * Query for medical record * Case history * Diagnostic record |
| Outbound Data | * Medical record description * Case history description * Query for case history * Query for medical record |
| Logic Summary | No subsystem |

#### Data Stores

This section describes the data stores that exist in the data flow diagram and consists of the Data Store Name, Description, Inbound Data, and Outbound Data.

Table 3.11: List of all Data Stores

| No. | Data Store | Name | Description |
| --- | --- | --- | --- |
| 1 | D1 | Users database | Keeping the staff and athlete data |
| 2 | D2 | Questionnaire database | Keeping the result of questionnaire from athletes |
| 3 | D3 | Medical record database | Keeping the result of diagnostic from medical team |
| 4 | D4 | Message database | Keeping the messages between athletes and staffs |

Table 3.12: Data Store Description of Users database

|  |  |
| --- | --- |
| Data Store Name | D1- Users database |
| Description | Keeping the staff and athlete data |
| Inbound data | * Athlete’s data * Staff’s data * User’s username and password |
| Outbound Data | * User verification |

Table 3.13: Data Store Description of Questionnaire database

|  |  |
| --- | --- |
| Data Store Name | D2- Questionnaire database |
| Description | Keeping the result of questionnaire from athletes |
| Inbound data | * Answer result * Total score * Questionnaire status * Query for questionnaire history description |
| Outbound Data | * Total score over 25 * Questionnaire case description * Questionnaire history * Questionnaire status |

Table 3.14: Data Store Description of Medical record database

|  |  |
| --- | --- |
| Data Store Name | D3- Medical record database |
| Description | Keeping the result of diagnostic from medical team |
| Inbound data | * Diagnostic results for athlete * Query for case history * Query for diagnostic record |
| Outbound Data | * Medical record * Case history |

Table 3.15: Data Store Description of Medical record database

|  |  |
| --- | --- |
| Data Store Name | D4- Message database |
| Description | Keeping the messages between athletes and staffs |
| Inbound data | * Advice messages |
| Outbound Data | * Advice messages |

#### Data Element

This section describes the data elements or data flows that exist in this system. The table below contains the list of all data elements belonging to their data element name, starting process/source/data store, and ending process/source/data store.

Table 3.16: List of All Data Elements

| SEQ | Data Element Name | From Process/Source/Data Store | To Process/Source/Data Store |
| --- | --- | --- | --- |
| 1 | Athlete’s data | Athlete | P1 |
| 2 | Athlete’s data | P1 | D1 |
| 3 | Staff’s data | Medical Team | P1 |
| 4 | Staff’s data | P1 | D1 |
| 5 | Athlete’s username & password | Athlete | P1 |
| 6 | Staff’s username & password | Medical Team | P1 |
| 7 | User’s username & password | P1 | D1 |
| 8 | User verification | D1 | P1 |
| 9 | Answer & Score | Athlete | P2 |
| 10 | Preliminary advice message | P2 | Athlete |
| 11 | Answer result | P2 | D2 |
| 12 | Total score | P2 | D2 |
| 13 | Total score over 25 | D2 | P3 |
| 14 | Questionnaire case description | D2 | P3 |
| 15 | Questionnaire case description & Total score | P3 | Medical Team |
| 16 | Diagnostic results for athlete | Medical Team | P4 |
| 17 | Advice messages | Medical Team | P4 |
| 18 | Questionnaire status | P4 | D2 |
| 19 | Advice messages | P4 | D4 |
| 20 | Diagnostic results for athlete | P4 | D3 |
| 21 | Questionnaire status | D2 | P5 |
| 22 | Advice messages | D4 | P5 |
| 23 | Questionnaire status | P5 | Athlete |
| 24 | Advice messages | P5 | Athlete |
| 25 | Query for questionnaire history description | Athlete | P6 |
| 26 | Query for questionnaire history description | P6 | D2 |
| 27 | Questionnaire history | D2 | P6 |
| 28 | Questionnaire history description | P6 | Athlete |
| 29 | Query for case history | Medical Team | P7 |
| 30 | Query for diagnostic record | Medical Team | P7 |
| 31 | Query for case history | P7 | D3 |
| 32 | Query for diagnostic record | P7 | D3 |
| 33 | Case history | D3 | P7 |
| 34 | Diagnostic record | D3 | P7 |
| 35 | Case history description | P7 | Medical Team |
| 36 | Diagnostic record description | P7 | Medical Team |

## Database Analysis and Design

### ER-Diagram

|  |  |
| --- | --- |
|  | |
| Project :  System : | Major Advisor : |
| Description : | |

Figure .: <Description of the Figure Above>

### Relational Schema

This section describes the attributes of the tables in the database. The attribute notation is shown below.

* **Attributes** – which are bold and underlined are the Primary Keys
* *Attributes* – which are Italic are the Foreign Keys
* ***Attributes*** – which are bold, italic and underlined are both Primary Keys and Foreign Keys

Tables in this system can be divided into 3 groups as follows:

* Master File Table
* Base File Table
* Transaction File Table

Table .: List of all Tables in Our System Database

| Table# | Table Name | Table Type | Description |
| --- | --- | --- | --- |
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1. Relational Schema of Master File Tables

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |

1. Relational Schema of Base File Tables

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
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| --- | --- | --- | --- | --- |
|  |  |  |  |  |

1. Relational Schema of Transaction File Tables

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |

### File Structure

This section shows the details of each file component including field name, field description, field data type, field length, null value, primary key and foreign key.

Table 3.9: File Structure of <Data Store Name>

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Table Name : |  | | | | | | Table# | |
| Table Type : |  | | | | | | | |
| Description : |  | | | | | | | |
| Field Name | | Type | Length | Description | Key | Reference | | Null |
|  | |  |  |  |  |  | |  |
|  | |  |  |  |  |  | |  |
|  | |  |  |  |  |  | |  |
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|  | |  |  |  |  |  | |  |
|  | | Total |  | Bytes |  |  | |  |

## I/O Design

This section explains the design of the Input and Output User Interface. The section consists of two parts, the interface design and the transition diagram showing transition through the system.

### Interface Design

### Transition Diagram

CHAPTER 4

# Implementation

## Hardware and System Environment

* Operating System and Utilities Applications
* Web Server Software
* Editor
* Database Management System (DBMS)
* Programming and Scripting Tools
* Components

## Implementation Guide and Techniques

### <Guide/Technique/Know-how>

### < Guide/Technique/Know-how>

CHAPTER 5

# Testing and Evaluation

## Unit Tests

For the unit tests, we selected some important and critical processes for formal unit testing. The selected processes include:



### Test Performed on <Process Number> <Process Name>

Table 5.1: <Test Name>

|  |  |  |
| --- | --- | --- |
| Operation Performed | Condition Tested | Actual Result |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

### Test Performed on <Process Number> <Process Name>

Table 5.2: <Test Name>

|  |  |  |
| --- | --- | --- |
| Operation Performed | Condition Tested | Actual Result |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

## System Integration Test

This activity is performed after the system is completely integrated. The purpose of this testing is to check whether the system can operate correctly according to the required functions or not.

### Test Scenario

In order to test all functional aspects of the system thoroughly, we had set up a test scenario which consisted of phases as shown below.

Moreover, the test scenario can be used as a user guideline because it covers all the steps necessary in order to use our system. The details of each phase are shown in the next section.

#### 

#### 

#### 

#### 

#### 

CHAPTER 6

# Conclusions

## Benefits

### Benefits to Project Developers

### Benefits to Users

## Problems and Limitations

## Future Work

REFERENCES

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APPENDIX A

# <INSERT YOUR TOPIC>

BIOGRAPHIES

|  |  |
| --- | --- |
| NAME |  |
| INSTITUTIONS ATTENDED | , :  High School Diploma  Mahidol University, :  Bachelor of Science (ICT) |
|  |  |
| NAME |  |
| INSTITUTIONS ATTENDED | , :  High School Diploma  Mahidol University, :  Bachelor of Science (ICT) |
|  |  |
| NAME |  |
| INSTITUTIONS ATTENDED | , :  High School Diploma  Mahidol University, :  Bachelor of Science (ICT) |