SPORTS INJURY AND ILLNESS RECORDING APPLICATION (SIRA)

แอปพลิเคชันบันทึกอาการบาดเจ็บและการเจ็บป่วยทางการกีฬา

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ABSTRACT

This project is an application project with the purpose of collecting data on illnesses and injuries which are important problems for athletes and recording staff data to record their data. Athletes can be timely by collecting data of athletes that will be saved in paper or google form where it is likely to be lost and compiled to be difficult to use. Our application is built to record and track injuries and illnesses through the Oslo Sports Trauma Research Center (OSTRC) Questionnaire and the International Olympic Committee (IOC) Injury and Illness Record that will be shown to the athletes as scores and messages. If the score exceeds the OSTRC star criteria, staff can see the case scores of the athletes who exceed the criteria, they can record and send messages to the athletes so that athletes can receive treatment, relieve injuries and prevent athletes from using their bodies during training or competition.

KEYWORDS: INJURY/ILLNESS/PSYCHOLOGY/ATHLETE/STAFF/
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74 P.

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บทคัดย่อ

การทำโครงงานครั้งนี้เป็นโครงงานทำแอพพลิเคชั่นโดยมีวัตถุประสงค์เพื่อใช้สำหรับการเก็บข้อมูลอาการเจ็บป่วยและอาการบาดเจ็บซึ่งเป็นปัญหาสำคัญต่อนักกีฬาและการบันทึกข้อมูลของบุคลากรเพื่อบันทึกข้อมูลของนักกีฬาได้ทันท่วงทีโดยการเก็บข้อมูลของนักกีฬานั้นจะถูกบันทึกไว้ในกระดาษหรือแบบฟอร์มกูเกิล (GOOGLE FORM) ซึ่งมีโอกาสสูญหายและเรียบเรียงนำมาใช้งานได้ยาก แอปพลิเคชันของเราสร้างเพื่อบันทึกและติดตามอาการบาดเจ็บรวมถึงอาการเจ็บป่วยโดยผ่านแบบสอบถามตาม Oslo Sports Trauma Research Center (OSTRC) และบันทึกข้อมูลอาการบาดเจ็บตาม International Olympic Committee (IOC) ซึ่งจะแสดงให้นักกีฬาได้เห็นเป็นคะแนนและข้อความโดยหากคะแนนนั้นเกินเกณฑ์ OSTRC บุคลากรจะสามารถเห็นเคสคะแนนของนักกีฬาที่คะแนนเกินเกณฑ์และสามารถบันทึกและส่งข้อความให้แก่นักกีฬาเพื่อให้นักกีฬาสามารถได้รับการรักษา, บรรเทาอาการบาดเจ็บและป้องกันการใช้ร่างกายของนักกีฬาในตอนฝึกซ้อมหรือการแข่งขัน

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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.

1.1 Motivation

Nowadays, injuries usually happen whether physical, mental or health, especially for athletes. Injury problems can affect athletes with their training, practice, as well as a competition. Athletes' performance would be decreased, resulting in their winning success in a competition or evenly lacking training. In addition, staff or medical teams (e.g., coaches, doctors, physical therapists, psychologists) would also be affected by athletes' injuries. Due to athlete's injury problems, staffs have to create or change a plan to suit the athlete's problem. Thus, it would be difficult to adjust if the athlete's problem information is sent late. In order to prevent those problems, keeping records of the athlete's problems as well as medical recordings from diagnostics are important. Collecting the record from both athletes and staff will assist the athletes' injury problems in order to decrease treatment time, so athletes can heal themselves with the correct method and also understand their injury status and what they need to do. Moreover, staff can plan whether healing, training, or competition for injured athletes. Therefore, building a platform for keeping those records will extremely be useful for both athletes and staff.

1.2 Problem Statement

Recording the athlete's problems actually happened in Thailand. However, there are two main problems with recording systems:

1.2.1 Recording with Paper

The paper-based recording has a number of drawbacks, including being hard to find, easily lost, difficult to retrieve, and requiring a large amount of labor. At the moment, we switch to different methods to avoid these issues.

1.2.2 Recording with Google Form

Google Form recordings are changed methodology from the paper-based. However, this method of recording injuries and illness has also had some problems whether scattered information, data integration, and difficult processing. Thus, this method has to be changed to a new one in order to improve the recording system.

1.3 Objectives of the Project

- Develop a SIRA system capable of managing data on physical injuries, health illnesses, and mental illnesses
- Make athletes know their injury status in order to heal themselves with the correct methodology
- Enable coaches and the medical staff to utilize athlete data to be useful and provide coaching and treatment input to specific athletes

1.4 Scope of the Project

- A mobile platform that can record both athlete's questionnaires and complaints as well as medical recordings from staff
- The operating systems provide both IOS and Android in order to collect for all athletes and staff data from all user devices
- Applied the Oslo Sports Trauma Research Center (OSTRC) questionnaires and International Olympic Committee (IOC) record form to the systems
- Sending weekly notifications for athletes in order to answer questionnaires every week

1.5 Expected Benefits

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

- Athlete
  - 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
- Staff
  - Filling out the medical record form as simple with clearly user interfaces
  - Planning for healing, training, competition for injured athletes
- 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.

1.6 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 background knowledge and earlier projects completed by other scholars that we applied some methodology to this project. We gave a summary of the project's content and an example of required knowledge in order to provide more understanding to this project.

2.1 Background Knowledge

2.1.1 The International Olympic Committee Surveillance Form

During the Olympic Games 2012 in London, the International Olympic Committee (IOC) provided a medical record form for all stakeholders whether common medical staff, physician team, physiotherapist, and so on. In order to prevent danger from injuries, all stakeholders could be finished the medical form and analysis a symptom of athletes. There are two types of report including injury and illness report that each type has a different required information. [1]

athlete's accreditation no. 123456789		sport and event 2 athletics, 100m (women)		round, heat or training 3 quarter final / 1st heat		date and time of injury 7.8.2012 - 14:35
injured body part, side wrist, left 4	code 15	type of injury sprain 5	code 8	cause of injury slipped and fell 6	code 21	absence in days 10 1

Figure 2.1: The example of IOC injury record form

athlete's accreditation no. 1564579587979		sport and event 2 football (men)		diagnosis tonsillitis, cold		occurred on (date) 02.08.2012
affected system respiratory 7	code 1	main symptom(s) fever, pain 8	code 1,2	cause of illness infection 9	code 2	absence in days 2 1

Figure 2.2: The example of IOC illness record form

2.1.2 The Oslo Sports Trauma Research Center Questionnaire Form

There are questionnaires from the Oslo Sports Trauma Research Center (OSTRC) that are separated into three parts including health, overuse, and sport psychology. The health questionnaire is about the illness of the athletes, for

instance, fatigue, fever, and so on. The overuse questionnaire is about the physical injury from any part of the body. The sport psychology questionnaire is about the athletes' mental illness, for instance, readiness to compete, training, and sleep quality. [2]

Table 2.1: Thai and English in OSTRC Health questionnaires

Thai version	**English version**
คุณมีปัญหาด้านอาการเจ็บป่วยหรือไม่ • ใช่ • ไม่มี	Do you have an illness problem? • Yes • No
1. ใน 7 วันที่ผ่านมาปัญหาการบาดเจ็บการเจ็บป่วย หรือปัญหาสุขภาพอื่น ๆ ของท่านทำให้การฝึกซ้อมหรือการแข่งขันกีฬามีปัญหาหรือไม่ • เข้าร่วมการฝึกซ้อมหรือแข่งขันกีฬาได้เต็มที่โดยไม่มีปัญหาการบาดเจ็บ ,เจ็บป่วย หรือปัญหาสุขภาพ • เข้าร่วมการฝึกซ้อมหรือแข่งขันกีฬาได้เต็มที่แต่มีปัญหาการบาดเจ็บ,เจ็บป่วย หรือปัญหาสุขภาพ • เข้าร่วมการฝึกซ้อมหรือแข่งขันกีฬาได้ไม่เต็มที่เพราะมีปัญหาการบาดเจ็บ ,เจ็บป่วย หรือปัญหาสุขภาพ • ไม่สามารถเข้า ร่วมการฝึกซ้อมหรือแข่งขนกีฬาได้ เพราะมีปัญหาการบาดเจ็บ ,เจ็บป่วย หรือปัญหาสุขภาพ	Have you had any difficulties participating in normal training and competition due to injury, illness, or other health problems during the past week? • Full participation without health problems. • Full participation, but with injury/illness. • Reduced participation due to injury/illness. • Cannot participate due to injury/illness.

Thai version	English version
2. ใน 7 วันที่ผ่านมา ปัญหาการบาดเจ็บการเจ็บป่วย หรือปัญหาสุขภาพ ของท่านส่งผลกระทบต่อปริมาณการฝึกซ้อมหรือแข่งขันมากน้อยเท่าไหร่ • ไม่ลดลง • ลดลงเล็กน้อย • ลดลงปานกลาง • ลดลงอย่างมาก • ไม่สามารถเข้าร่วมได้เลย	To what extent have you reduced you training volume due to injury, illness, or other health problems during the past week? • No reduction • To a minor extent • To a moderate extent • To a major extent • Cannot participate at all
3. ใน 7 วันที่ผ่านมา ปัญหาการบาดเจ็บการเจ็บป่วย หรือปัญหาสุขภาพ ของท่านส่งผลกระทบต่อความสามารถ ในการเล่นกีฬามากน้อยเท่าไหร่ • ไม่ลดลง • ลดลงเล็กน้อย • ลดลงปานกลาง • ลดลงอย่างมาก • ไม่สามารถเข้าร่วมได้เลย	To what extent has injury, illness or other health problems affected your performance during the past week? • No effect • To a minor extent • To a moderate extent • To a major extent • Cannot participate at all
4. ใน 7 วันที่ผ่านมา ท่านมีปัญหาการบาดเจ็บ การเจ็บป่วยหรือปัญหาสุขภาพมากน้อยเพียงใด • ไม่สามารถเข้าร่วมได้เลย • มีอาการหรือปัญหาสุขภาพเล็กน้อย • มีอาการหรือปัญหาสุขภาพพอประมาณ • มีอาการหรือปัญหาสุขภาพอย่างมาก	To what extent have you experienced symptoms/health complaints during the past week? • No symptoms/health complaints • To a mild extent • To a moderate extent • To a severe extent

	• Cannot participate at all
Thai version	**English version**
5.อาการป่วย • ไข้ • อ่อนล้า • ต่อมอักเสบ • เจ็บคอ • คัดจมูก/น้ำ มูกไหล/จาม • ไอ • หายใจลำบาก • ปวดหัว • คลื่นไส้ • อาเจียน • ท้องเสีย • ท้องผูก • เป็นลม • ผื่นคัน • หัวใจเต้นผิดปกติ • เจ็บหน้าอก • ปวดเมื่อยกล้ามเนื้อเนื้อส่วนท้อง • ความเจ็บปวดอื่น ๆ • ชา • ความวิตกกังวล • หดหู่/เศร้า • หงุดหงิดง่าย • อาการบริเวณตา	Illness part • Fever • Fatigue/malaise • Swollen gland • Sore throat • Blocked nose, running nose, sneezing • Cough • Difficulty breathing • Headache • Nausea • Vomiting • Diarrhea • Constipation • Fainting • Rash/itchiness • Irregular pulse/arrhythmia • Chest pain/angina • Abdomen pain • Other pain • Numbness/pins and needles • Anxiety • Depression • Irritability • Eye symptoms • Ear symptoms • Symptoms form urinary tract and

• อาการบริเวณหู • อาการที่ทางเดินปัสสาวะและอวัยวะเพศ	genitals

Thai version	English version
9. คุณมีปัญหาอาการเจ็บป่วยอื่น ๆ หรือไม่ • มี • ไม่มี	Do you have another illness problem? • Yes • No

Table 2.2: Thai and English in OSTRC Overuse questionnaires

Thai version	English version
ท่านมีอาการบาดเจ็บหรือไม่ • มี • ไม่มี	Do you have an injury problem? • Yes • No
บริเวณที่บาดเจ็บ • หัวและหน้า • คอ • หัวไหล่/ไหปลาร้า • ต้นแขน • ข้อศอก • แขนท่อนล่าง • ข้อมือ • มือและนิ้ว • หน้าอก/ซี่โครง • หน้าท้อง • กระดูกันหลังทรวงอก • กระดูกสันหลังส่วนล่าง • เชิงกราน/ก้น • สะโพก/ขาหนีบ • ต้นขา • เข่า	Injury part • Head • Neck • Shoulder • Upper arm • Elbow • Lower arm • Wrist • Hand and finger • Chest and ribs • Abdomen • Thoracic spine • Lower spine • Pelvis and buttocks • Hip and groin • Thigh • Knee

• ขาท่อนล่าง • ข้อเท้า • เท้าและนิ้วเท้า	• Lower leg • Ankle • Feet and toes

Thai version	**English version**
1.ใน 7 วันที่ผ่านมา ปัญหา (Injury) ของท่านทำให้การเข้าร่วมฝึกซ้อมหรือการแข่งขันกีฬามีปัญหาหรือไม่ • เข้าร่วมการฝึกซ้อมหรือการแข่งขันได้เต็มที่โดยไม่มีปัญหา (Injury) • เข้าร่วมการฝึกซ้อมหรือการแข่งขันกีฬาได้เต็มที่แต่มีปัญหา (Injury) • เข้าร่วมการฝึกซ้อมหรือแข่งขันกีฬาได้ไม่เต็มที่เพราะมีปัญหา (Injury) • ไม่สามารถเข้าร่วมการฝึกซ้อมหรือแข่งขันกีฬาได้เลยเพราะมีปัญหา (Injury)	Have you had any difficulties participating in training and competition due to (Injury) problems during the past 7 days? • Full participation without (Injury) problems. • Full participation, but with (Injury) problems • Reduced participation due to (Injury) problems • Could not participate due to (Injury) problems.

2. ใน 7 วันที่ผ่านมา ปัญหา (Injury) ของท่านส่งผลกระทบต่อการฝึกซ้อมหรือแข่งขันมากน้อยเพียงใด • ไม่ส่งผลกระทบต่อการฝึกซ้อมหรือแข่งขันเลย • การฝึกซ้อมหรือแข่งขันลดลงเล็กน้อย • การฝึกซ้อมหรือแข่งขันลดลงปานกลาง • การฝึกซ้อมหรือแข่งขันลดลงอย่างมาก • ไม่สามารถเข้าร่วมการฝึกซ้อมหรือแข่งขันได้เลย	To what extent have you modified your training or competition due to (Injury) problems during the past 7 days? • No modification • To a minor extent • To a moderate extent • To a major extent • Cannot participate at all

Thai version	English version
3.ใน 7 วันที่ผ่านมา ปัญหา (Injury) ของคุณส่งผลกระทบต่อความสามารถในการเล่นกีฬามากน้อยเพียงใด • ไม่ส่งผลกระทบต่อความสามารถในการเล่นกีฬาเลย • ความสามารถในการเล่นกีฬาลดลงเล็กน้อย • ความสามารถในการเล่นกีฬาลดลงปานกลาง • ความสามารถในการเล่นกีฬาลดลงอย่างมาก	To what extent have (Injury) problems affected your performance during the past 7days? • No effect • To a minor extent • To a moderate extent • To a major extent • Cannot participate at all
4. ใน 7 วันที่ผ่านมา อาการเจ็บปวดของ (Injury) ของท่านซึ่งเป็นผลมาจากการเข้าร่วมการแข่งขัน/ฝึกซ้อมกีฬาอยู่ในระดับใด • ไม่เจ็บเลย • เจ็บเล็กน้อย • เจ็บพอประมาณ • เจ็บมาก	To what extent have you experienced Head pain related to your sport during the past 7 days? • No pain • Mild pain • Moderate pain • Severe pain

Table 2.3 Thai and English in Sport psychology questionnaires

Thai version	**English version**
นอนไม่หลับหลังจากเข้านอนไปแล้วนานกว่า 30 นาที • ไม่เคยเลยในช่วงระยะเวลา 1 เดือนที่ผ่านมา • น้อยกว่า 1 ครั้งต่อสัปดาห์ • 1 หรือ 2 ครั้งต่อสัปดาห์ • 3 ครั้งต่อสัปดาห์	Cannot get sleep within 30 minutes • Not during the past month • Less than once a week • Once or twice a week • Three or more times a week
รู้สึกตัว ตื่นขึ้นระหว่างนอนหลับกลางดึกหรือตื่นเช้ากว่าเวลาที่ตั้งใจไว้ • ไม่เคยเลยในช่วงระยะเวลา 1 เดือนที่ผ่านมา • น้อยกว่า 1 ครั้งต่อสัปดาห์ • 1 หรือ 2 ครั้งต่อสัปดาห์ • 3 ครั้งต่อสัปดาห์ขึ้นไป	Wake up in the middle of the night or early morning • Not during the past month • Less than once a week • Once or twice a week • Three or more times a week
ในช่วงระยะเวลา 1 เดือนที่ผ่านมา ท่านคิดว่าคุณภาพการนอนหลับโดยรวมของท่านเป็นอย่างไร • ดีมาก • ค่อนข้างดี • ค่อนข้างแย่ • แย่มาก	During the past month, how would you rate your sleep quality overall? • Very good • Fairly good • Fairly bad • Very bad

Thai version	English version
ในช่วงระยะเวลา 1 เดือนที่ผ่านมา ท่านใช้ยาเพื่อช่วยในการนอนหลับบ่อยเพียงใด (ไม่ว่าจะตามใบสั่งแพทย์หรือซื้อมาเอง) • ไม่เคยเลยในช่วงระยะเวลา 1 เดือนที่ผ่านมา • น้อยกว่า 1 ครั้งต่อสัปดาห์ • 1 หรือ 2 ครั้งต่อสัปดาห์ • 3 ครั้งต่อสัปดาห์ขึ้นไป	During the past month, how often have you take medicine (prescribe or "over the counter") to help you sleep? • Not during the past month • Less than once a week • Once or twice a week • Three or more times a week

Thai version	English version
อาการอื่นๆ ที่รบกวนขณะนอนหลับ โปรดระบุ • เติมลงในช่องว่าง	Other restlessness while you sleep • Fill the blank
ความมั่นใจโดยรวมในการหลับมาเล่นกีฬา • 0 1 2 3 4 5 6 7 8 9 10	My overall confidence to play is: • 0 1 2 3 4 5 6 7 8 9 10
ความมั่นใจในการกลับมาเล่นโดยไม่เจ็บ • 0 1 2 3 4 5 6 7 8 9 10	My confidence to play without pain is: • 0 1 2 3 4 5 6 7 8 9 10
ความมั่นใจที่จะทุ่มเท 100% • 0 1 2 3 4 5 6 7 8 9 10	My confidence to give 100% effort is: • 0 1 2 3 4 5 6 7 8 9 10
ความมั่นใจที่จะไม่กังวลกับส่วนที่เคยบาดเจ็บ • 0 1 2 3 4 5 6 7 8 9 10	My confidence to not concentrate on the injury is: • 0 1 2 3 4 5 6 7 8 9 10
ความมั่นใจว่าส่วนที่เคยบาดเจ็บจะกลับมาเล่นได้ไหว • 0 1 2 3 4 5 6 7 8 9 10	My confidence in the injured body part to handle demands of the situation is: • 0 1 2 3 4 5 6 7 8 9 10
ความมั่นใจในความสามารถของฉัน • 0 1 2 3 4 5 6 7 8 9 10	My confidence in my skill level/ability is: • 0 1 2 3 4 5 6 7 8 9 10

2.2 Literature Review

2.2.1 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. However, few studies 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, the Oslo University Hospital and the Norwegian School of Sport Sciences collaborated to establish the Oslo Sports Trauma Research Center (OSTRC) in May 2000. As a FIFA Medical Center of Excellence, the OSTRC was officially opened in 2009. The facility was also chosen to be one of the first four International Olympic Committee (IOC) Research Centers for injury prevention that year. [3]

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

The Oslo Sports Trauma Research Center (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. [4]

2.2.3 Overuse injury questionnaire methodology improvement

According to the research, a new overuse injury questionnaire has been improved in several sessions with many participants such as physiotherapists, doctors, athletes, questionnaire specialists, and others. This questionnaire was used for the management of injuries in overuse areas, especially the knee, lower back, and shoulder. The overuse injury questionnaire has evolved and has

changed, such as some specific physical questions not relevant to the sport in which one is playing. In order to replace the questionnaire, all inquiries pertaining to particular work duties were dropped, and the emphasis was placed on documenting the severity of illness, the effects of injury, and athletes' performance. The questions in the questionnaire were chosen as "problem" rather than "injury" because athletes interpret "injury" differently. [5]

2.2.4 Material and Method for Oslo Sports Trauma Research Center Questionnaire on health problem

The Oslo Sports Trauma Research Center (OSTRC) questionnaire on overuse injury and health problem developed by Clarsen Etal was translated and adapted to the Thai culture. These questionnaires are tools for injury and illness registration with four essential questions used to assess the severity. Scores in each symptom range from 0 to 100. The range of values in each question is from 0 to 25, with 0 representing no problem and 25 representing the maximum problem level in each question. As a result, questions 1 and 4 have a score of 0-8-17-25, and questions 2 and 3 have a score of 0-6-13-19-25. [6]

2.2.5 Translation and adaptation of Oslo Sports Trauma Research Center into Thai language

Based on the criteria for the process of cross-cultural adaptation of self-report measures, the questionnaire's translation and modification was carried out. This process consists of five stages consists of:

Stage 1 – Forward translation: Two independent translators consist of a knowledge-based translator (T1) and a general translator (T2). They performed a language with setting Thai as their native language, translated the Oslo Sports Trauma Research Center (OSTRC) English questionnaire into Thai language.

Stage 2 – Synthesis of the forward translation: The two translations (T1 and T2) and the researcher combined the results of both translations.

Stage 3 – Back translation: Two additional translators who were proficient in both English and Thai translated the Thai-translated version (T12) back into English (BT1 and BT2).

Stage 4 – Expert committee: The expert committee consisted of the researcher, health professionals, athletes, and the translators. (Forward and backward translators).

Stage 5 – Test of the pre-final version: In this stage, 15 athletes who had the same characteristics of the participants of the study were included to test the pre-final version of injury surveillance. [2]

2.2.6 Sports injuries and illnesses medical record form during Olympic Games 2012

The Olympic Movement Medical Code provided an importance for all athletes who joined the Olympic Games 2012 at London. They advocated all stakeholders to have practicing without any danger from injuries and illnesses especially to athletes. For analyzing the athletes' performance, they performed a medical record both injury and illness for all staff in order to record a symptom, diagnostic, as well as state of mind that could be affected the athletes. The National Olympic Committee (NOC) medical teams and London Organizing Committee of the Olympic and Paralympic Games' (LOCOG) medical staff were selected in order to test and evaluate this methodology. In the results, 10,568 athletes were participated which 11% and 7% of athletes were engaged at least one injury or illness respectively. However, an event of injury and illness could be occurred in variety of sports type that each sport type has a different of danger. Therefore, the medical record must be accompanied by a safe practice session in order to decrease both injuries and illness happening. [7]

CHAPTER 3
ANALYSIS AND DESIGN

This chapter 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.

3.1 System Architecture Overview

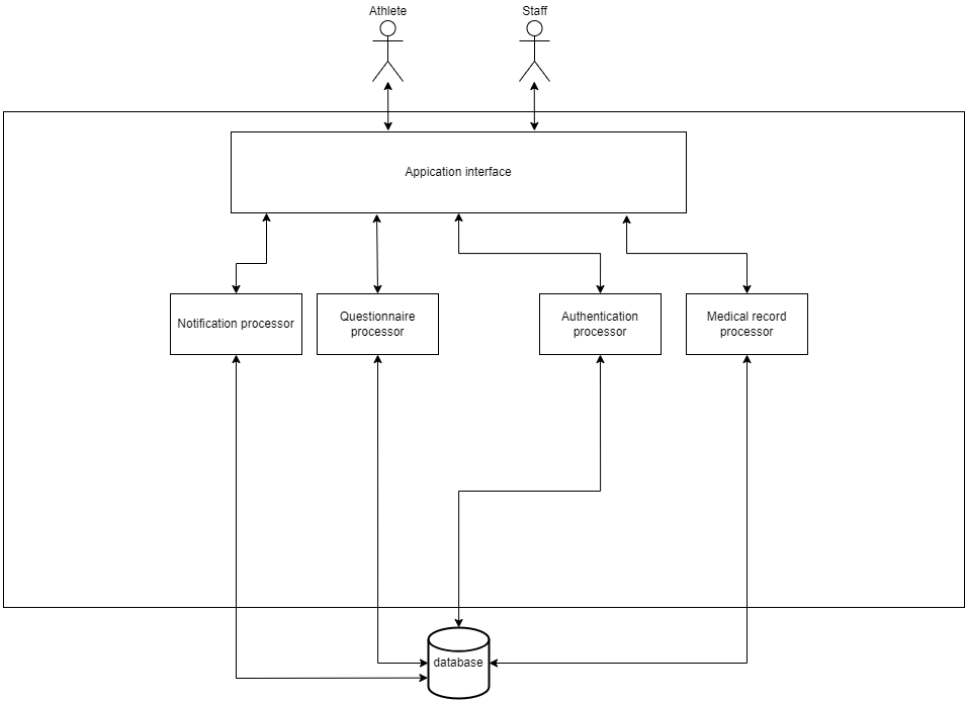


Figure 3.1: SIRA Systems architecture

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 staff (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

staff 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, questionnaire processor, authentication processor, medical record processor, and notification processor. 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 staff that athletes are allowed to save and read their data. The staff 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.

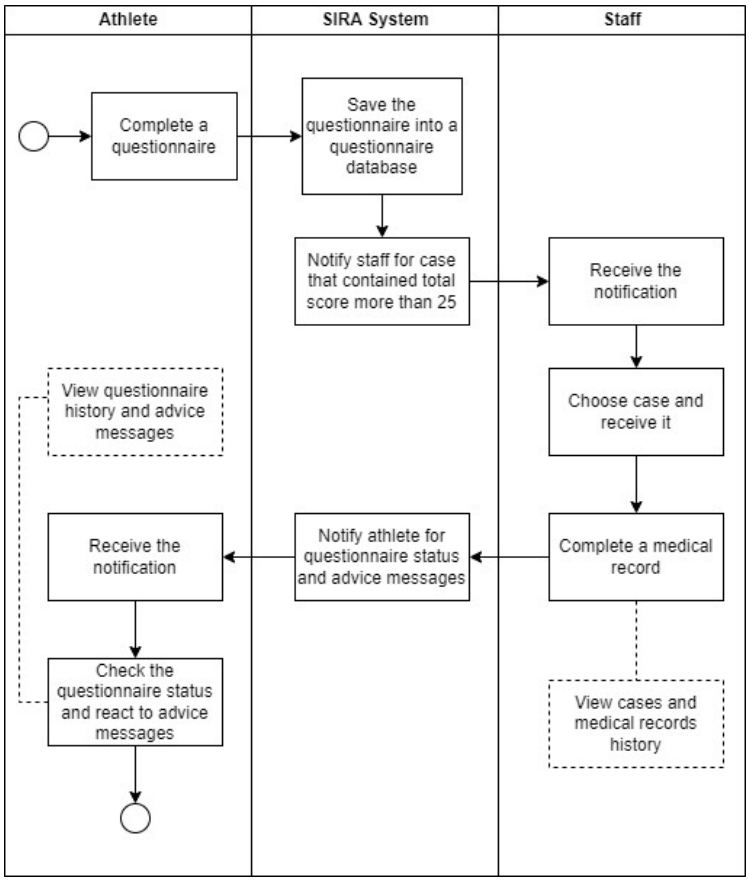
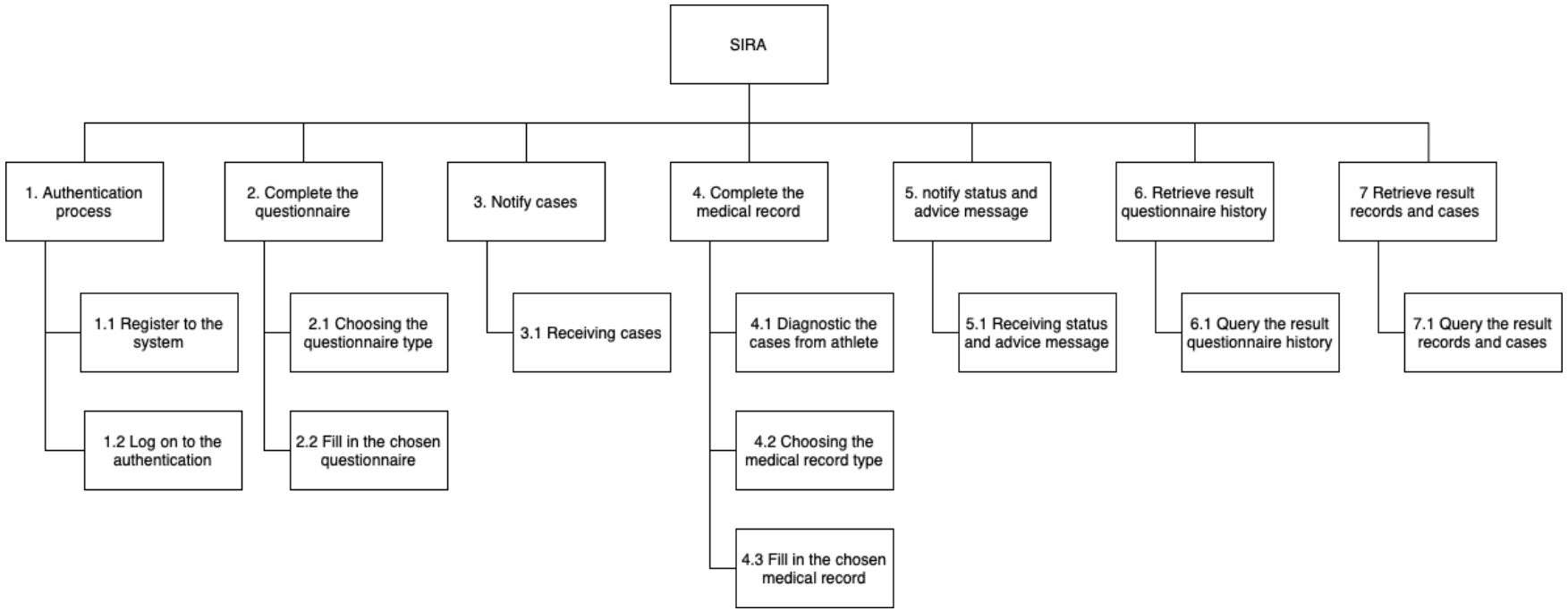


Figure 3.2: SIRA systems workflow

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.

3.2 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.



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 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

    1.1. Register to the system – Fill in the personal information, username, and updated password to register to the system

    1.2. 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

    2.1. Choosing the questionnaire type – Athletes choose the questionnaire type including health questionnaire, physical complain, or mental questionnaire

    2.2. 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

    3.1. 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

    4.1. Diagnostic the cases from athlete – Diagnostic whether health, body injury, and mental problem from athletes' cases

    4.2. Choosing the medical record type – Staffs choose the appropriately medical record type to received cases

    4.3. 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

5.1. 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

6.1. 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

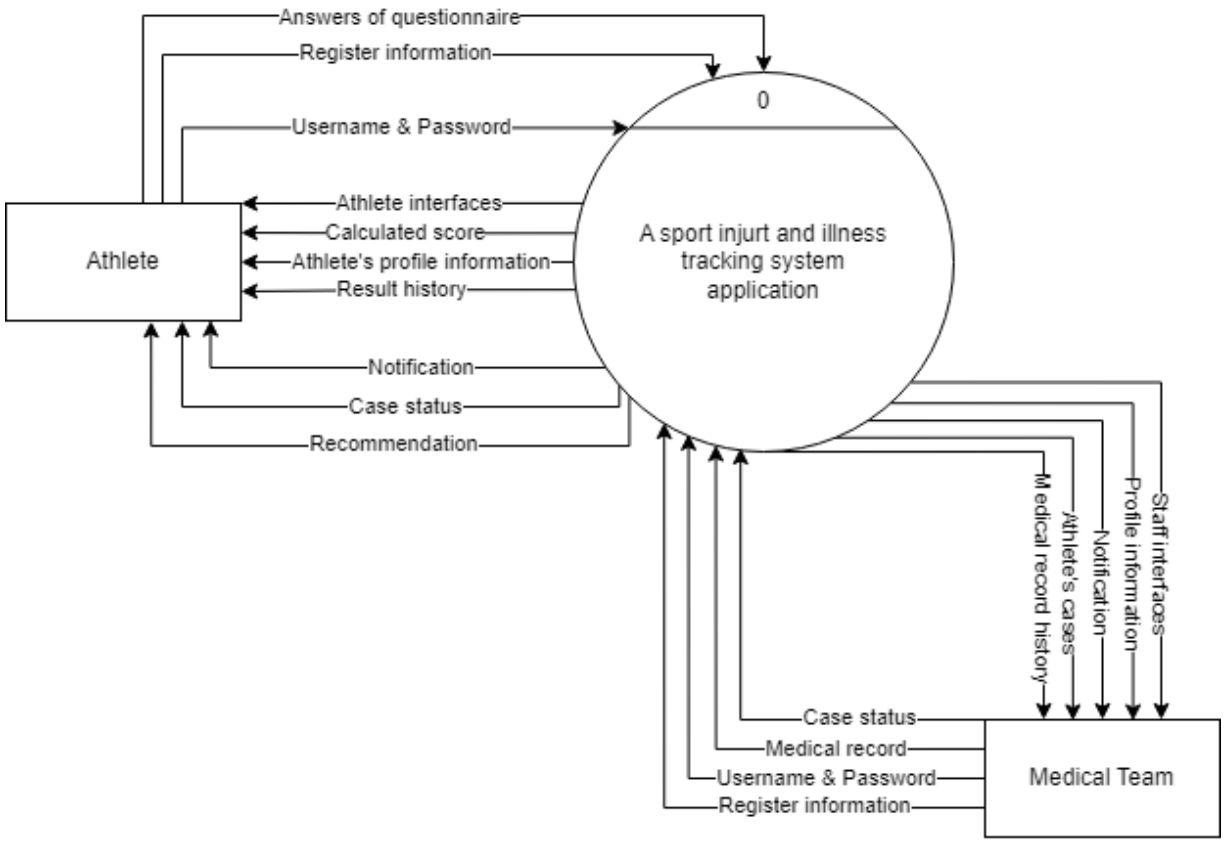
7.1. Query the result records and cases – Staffs query the desired record or cases by given options or default settings

3.3 Process Analysis and Design

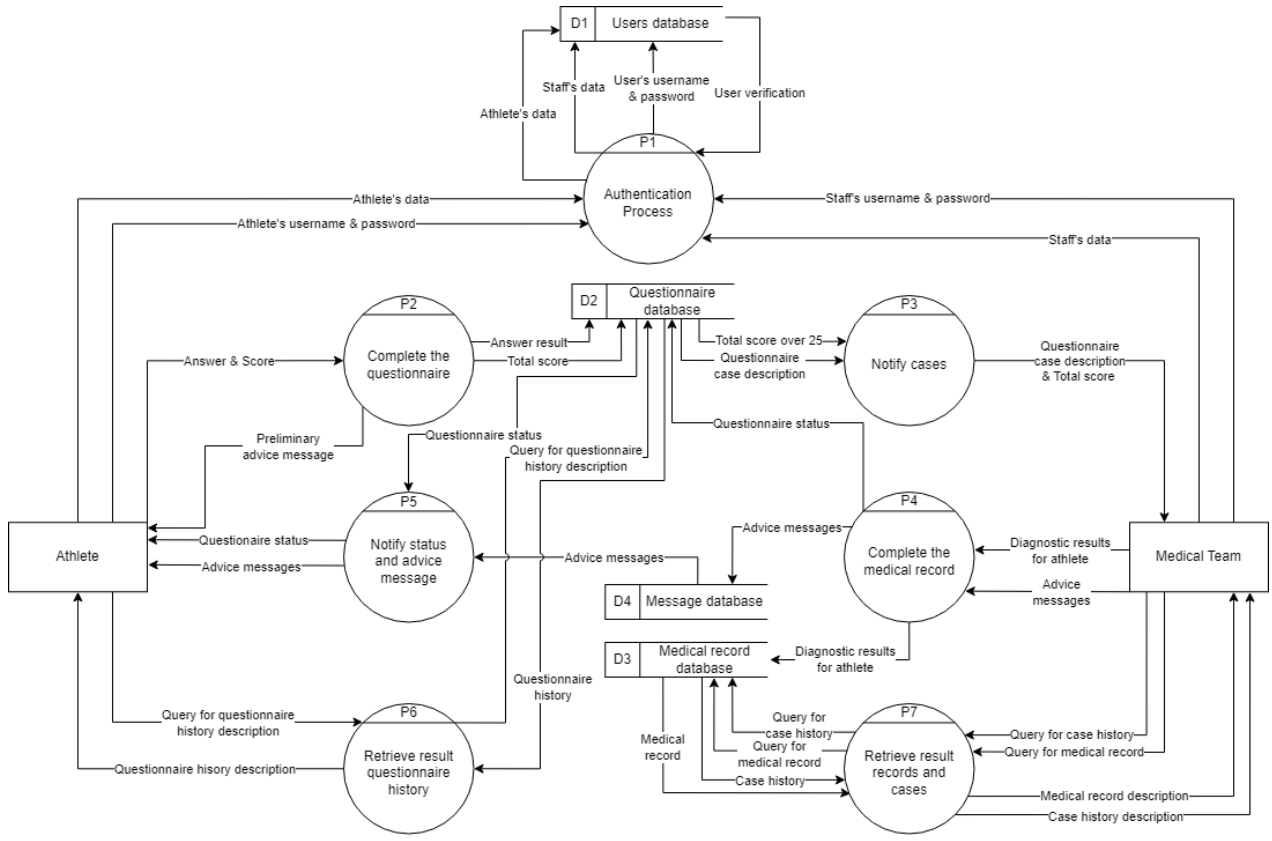
3.3.1 Data Flow Diagram

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.

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 represents how athletes and medical team are interacted with the SIRA application.	



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

3.3.2 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

3.3.2.1 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 3.1: 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

No.	Process	Name	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

3.3.2.2 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 3.9: 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 3.10: 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 3.11: 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 3.12: 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 3.13: 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

3.3.2.3 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 3.14: 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

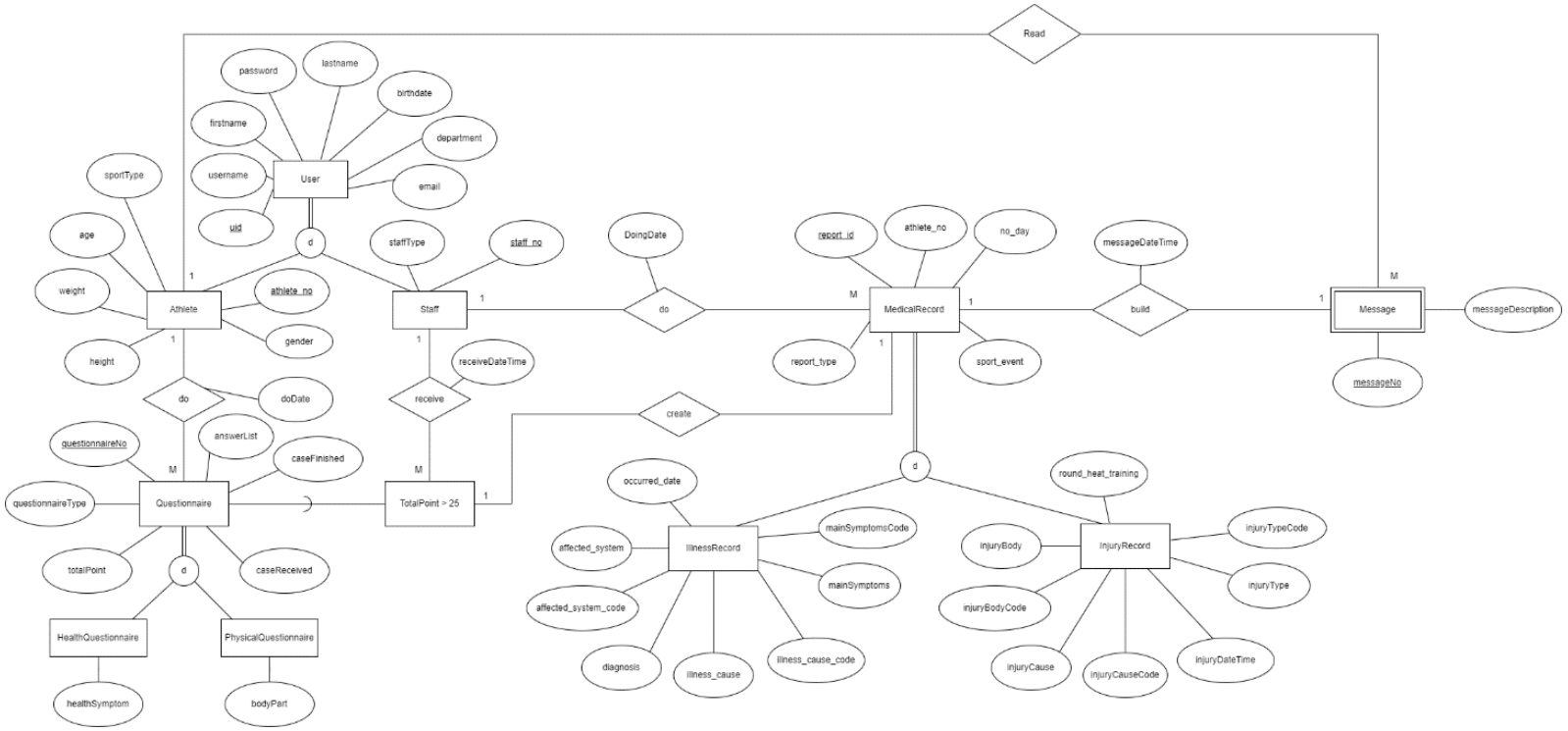
SEQ	Data Element Name	From Process/Source/Data Store	To Process/Source/Data Store
12	Total score	P2	D2
13	Total score over 25	D2	P3
14	Questionnaire case description	D2	P3
15	Questionnaire case description & Total score	P3	Medical Team
16	Diagnostic results for athlete	Medical Team	P4
17	Advice messages	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

SEQ	Data Element Name	From Process/Source/Data Store	To Process/Source/Data Store
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

3.4 **Database Analysis and Design**

The systems are created with interactive together which contain the entities, relationships, and attributes. Each entity will contain its data as attributes that represent the needed data as well as primary key and foreign key which can be used in SQL. The attribute contains the data that is relevant to them which some data can be null, and some data must fill in. However, this design and analysis are simply examples but cover all main users and data in our game system.

3.4.1 **ER-Diagram**



Project: Sport Injury and Illness Recording Application **System:** Recording system	**Major Advisor:** Asst. Prof. Dr. Charnyote Pluempitiwiriyawej
Description: This is ER-Diagram of SIRA including four entities that are superclass. User class has two subclasses including “Athlete” and “Staff”. Questionnaire class has two subclasses including “HealthQuestionnaire” and “PhysicalQuestionnaire”. MedicalRecord class has two subclasses including “IllnessRecord” and “InjuryRecord”. Message is weak entity from Medical Record.	

Figure 3.6: Conceptual ER-Diagram of SIRA Database

3.4.2 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 3.15: List of all Tables in Our System Database

Table#	Table Name	Table Type	Description
1	Athlete	Master	It is the subclass that collects the information of athlete.
2	Staff	Master	It is the subclass that collects the information of staff.
3	HealthQuestionnaire	Base	It is the subclass that collects all of health questionnaires that athletes do.
4	PhysicalQuestionnaire	Base	It is the subclass that collects all of physical questionnaires that athletes do.
5	IllnessRecord	Base	It is the subclass that collects all of illness records that staffs do.
6	InjuryRecord	Base	It is the subclass that collects all of injury records that staffs do.

Table#	Table Name	Table Type	Description
7	Message	Base	This table is the weak entity that collects the messages that occur when the staff makes a record for the athlete.

1. Relational Schema of Master File Tables

Athlete

uid	**athlete_no**	username	password	firstname	lastname	sportType	birthdate

department	weight	height	email	age	gender

Staff

uid	**staff_no**	username	password	firstname	lastname	stafftType	birthdate

department	email

2. Relational Schema of Base File Tables

HealthQuestionnaire

questionnaireNo	***athleteNo***	questionnaireType	totalPoint	caseFinished

caseRecieved	healthSymptom	doDate	***staff_no_received***	Q1	Q2	Q3	Q4

PhysicalQuestionnaire

questionnaireNo	*athleteNo*	questionnaireType	totalPoint	caseFinished

caseRecieved	bodypart	doDate	*staff_no_received*	Q1	Q2	Q3	Q4

IllnessRecord

report_id	*staff_uid*	*athlete_no*	report_type	sport_event	DoingDate	affected_system_code

affected_system	diagnosis	illness_cause	mainSymtoms	mainSymptomsCode	illness_cause_code

occurred_date	no_day

InjuryRecord

report_id	*staff_uid*	*athlete_no*	report_type	sport_event	DoingDate	round_heat_training

injuryBody	injuryBodyCode	injuryCause	injuryCauseCode	injuryDateTime	injuryTypeCode

injuryType	no_day

Message

messageNo	messageDescription	messageDateTime	*athleteNo*	*staffUID*

3.4.3 **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 3.16: File Structure of Athlete

Table Name :	Athlete				**Table#1**	
Table Type :	Master					
Description :	Storing the information of athletes.					
Field Name	**Type**	**Length**	**Description**	**Key**	**Reference**	**Null**
uid	varchar	28	User's ID	PK		NOT
athleteNo	varchar	11	Athlete's ID	PK		NOT
username	varchar	500	Athlete's username			NOT
password	varchar	500	Athlete's password			NOT
firstname	varchar	500	Athlete's firstname			NOT
lastname	varchar	500	Athlete's lastname			NOT
sportType	varchar	500	Athlete's sport type			NOT
birthdate	DATE	100	Athlete's birth date			NOT
department	varchar	500	User's department			NOT
weight	double	11	Athlete's weight			NOT

height	double	11	Athlete’s height			NOT
age	int	2	Athlete’s age			NOT
gender	varchar	6	Athlete’s gender			NOT
email	varchar	500	Athlete’s email			NOT
	Total	3669	Bytes			

Table 3.17: File Structure of Staff

Table Name :	Staff				**Table#2**	
Table Type :	Master					
Description :	Storing the information of staffs.					
Field Name	**Type**	**Length**	**Description**	**Key**	**Reference**	**Null**
uid	varchar	28	User's ID	PK		NOT
staffNo	varchar	11	Staff's ID	PK		NOT
username	varchar	500	Staff's username			NOT
password	varchar	500	Staff's password			NOT
firstname	varchar	500	Staff's firstname			NOT
lastname	varchar	500	Staff's lastname			NOT
staffType	varchar	500	Staff's type			NOT
birthdate	DATE	100	Staff's birth date			NOT
department	varchar	500	User's department			NOT
email	varchar	500	Staff's email			NOT
	Total	3639	Bytes			

Table 3.18: File Structure of Health questionnaire

Table Name :	HealthQuestionnaire				**Table#3**	
Table Type :	Base					
Description :	Storing the athlete's health questionnaire answers and calculate the score					
Field Name	**Type**	**Length**	**Description**	**Key**	**Reference**	**Null**
questionnaireNo	varchar	12	Questionnaire's ID	PK		NOT
athleteNo	varchar	28	Athlete's user ID	FK	Athlete	NOT
questionnaireType	varchar	500	Questionnaire's type			NOT
totalPoint	int	3	Total of points			NOT
caseFinished	varchar	500	Check this case finish or not			NOT
caseReceived	varchar	500	Check this case receive or not			NOT
healthSymptom	varchar	500	Athlete's health symptom			NOT
doDate	DATETIME	100	Questionnaire's do date and time			NOT
staff_no_received	varchar	500	Staff's user ID who receives the athlete's case	FK	Staff	NOT
Q1	int	11	Question 1 point			NOT

Q2	int	11	Question 2 point			NOT
Q3	int	11	Question 3 point			NOT
Q4	int	11	Question 4 point			NOT
	Total	2687	Bytes			

Table 3.19: File Structure of Physical questionnaire

Table Name :	PhysicalQuestionnaire				**Table#4**	
Table Type :	Base					
Description :	Storing the athlete's physical questionnaire answers and calculate the score					
Field Name	**Type**	**Length**	**Description**	**Key**	**Reference**	**Null**
questionnaireNo	varchar	12	Questionnaire's ID	PK		NOT
athleteNo	varchar	28	Athlete's user ID	FK	Athlete	NOT
questionnaireType	varchar	500	Questionnaire's type			NOT
totalPoint	int	3	Total of points			NOT
caseFinished	varchar	500	Check this case finish or not			NOT
caseReceived	varchar	500	Check this case receive or not			NOT
bodyPart	varchar	500	Athlete's body part			NOT
doDate	DATETIME	100	Questionnaire's do date and time			NOT
staff_no_received	varchar	500	Staff's user ID who receives the athlete's case	FK	Staff	NOT
Q1	int	11	Question 1 point			NOT

Q2	int	11	Question 2 point			NOT
Q3	int	11	Question 3 point			NOT
Q4	int	11	Question 4 point			NOT
	Total	2687	Bytes			

Table 3.20: File Structure of Illness record

Table Name :	IllnessRecord				**Table#5**	
Table Type :	Base					
Description :	Storing the illness record that staff do.					
Field Name	**Type**	**Length**	**Description**	**Key**	**Reference**	**Null**
report_id	varchar	12	Report's ID	PK		NOT
staff_uid	varchar	28	Staff's user ID	FK	Staff	NOT
athlete_no	varchar	11	Athlete's ID			NOT
report_type	varchar	500	Report's type			NOT
sport_event	varchar	500	Sport that causes illness in the event			NOT
DoingDate	varchar	500	Staff's do date			NOT
affected_system	varchar	500	Affected system that happen to athlete			NOT
affected_system_code	int	2	Affected system code			NOT
diagnosis	varchar	500	The identification of the nature of an illness or other problem by examination			NOT
illness_cause	varchar	500	The cause of illness			NOT

illness_cause_code	int	2	Illness's cause code			NOT
mainSymptoms	varchar	500	Main Symptoms diagnosed			NOT
mainSymptomsCode	int	2	Main Symptoms code			NOT
occurred_date	DATETIME	100	The date and time that occur illness			NOT
no_day	varchar	100	The day to rest or stop training			NOT
	Total	3757	Bytes			

Table 3.21: File Structure of Injury record

Table Name :	InjuryRecord				**Table#6**	
Table Type :	Base					
Description :	Storing the injury record that staff do.					
Field Name	**Type**	**Length**	**Description**	**Key**	**Reference**	**Null**
report_id	varchar	12	Report's ID	PK		NOT
staff_uid	varchar	28	Staff's user ID	FK	Staff	NOT
athlete_no	varchar	11	Athlete's ID			NOT
report_type	varchar	500	Report's type			NOT
sport_event	varchar	500	Sport that causes injury in the event			NOT
DoingDate	varchar	500	Staff's do date			NOT
injuryBody	varchar	500	The athlete's body part that injuries			NOT
injuryBodyCode	int	2	Injury Body code			NOT
round_heat_training	varchar	500	Round, heat or training during an injury			NOT
injuryCause	varchar	500	The cause of injury			NOT

injuryCauseCode	int	2	Injury’s cause code			NOT
injuryDateTime	DATETIME	100	Injury’s date and time			NOT
injuryType	varchar	500	Injury’s type			NOT
injuryTypeCode	int	2	Injury’s type code			NOT
no_day	varchar	100	The day to rest or stop training			NOT
	Total	3757	Bytes			

Table 3.22: File Structure of Illness record

Table Name :	IllnessRecord				**Table#5**	
Table Type :	Base					
Description :	Storing the illness record that staff do.					
Field Name	**Type**	**Length**	**Description**	**Key**	**Reference**	**Null**
report_id	varchar	12	Report's ID	PK		NOT
staff_uid	varchar	28	Staff's user ID	FK	Staff	NOT
athlete_no	varchar	11	Athlete's ID			NOT
report_type	varchar	500	Report's type			NOT
sport_event	varchar	500	Sport that causes illness in the event			NOT
DoingDate	varchar	500	Staff's do date			NOT
affected_system	varchar	500	Affected system that happen to athlete			NOT
affected_system_code	int	2	Affected system code			NOT
diagnosis	varchar	500	The identification of the nature of an illness or other problem by examination			NOT
illness_cause	varchar	500	The cause of illness			NOT

illness_cause_code	int	2	Illness's cause code			NOT
mainSymptoms	varchar	500	Main Symptoms diagnosed			NOT
mainSymptomsCode	int	2	Main Symptoms code			NOT
occurred_date	DATETIME	100	The date and time that occur illness			NOT
no_day	varchar	100	The day to rest or stop training			NOT
	Total	3757	Bytes			

Table 3.23: File Structure of Message

Table Name :	Message				**Table#7**	
Table Type :	Base					
Description :	Storing the message when staff do the record and want to give message to athlete.					
Field Name	**Type**	**Length**	**Description**	**Key**	**Reference**	**Null**
messageNo	varchar	11	Message's ID	PK		NOT
messageDescription	varchar	500	Message description			NOT
messageDateTime	DATETIME	100	Message's date and time			NOT
athleteNo	varchar	11	Athlete's ID	FK	Athlete	NOT
staffUID	varchar	28	Sport that causes illness in the event	FK	Staff	NOT
	Total	650	Bytes			

3.5 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.

3.5.1 Interface Design

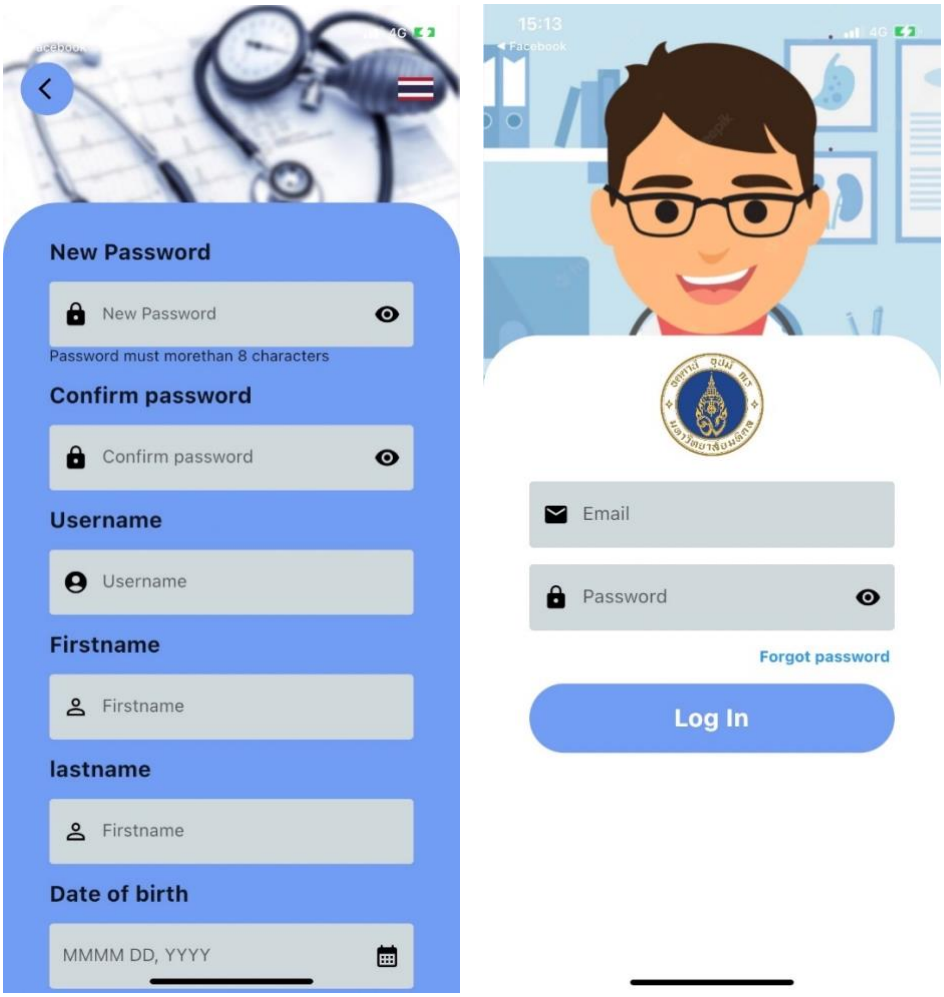


Figure 3.7: Register and Login

According to Figure 3.7, users must sign in in login page and sign up in register page to create an account.

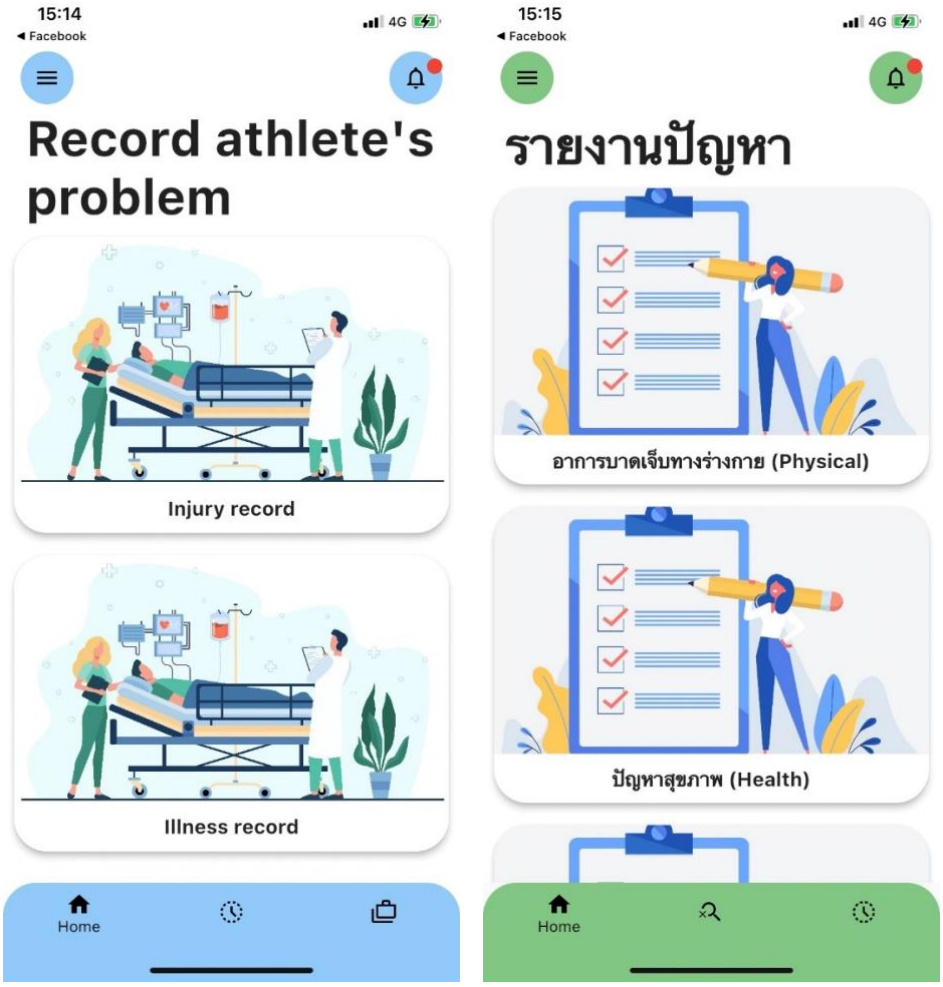


Figure 3.8 Staff/Athlete Homepage

According to Figure 3.8, both interfaces contain staff homepage (left picture) and athlete homepage (right picture). When user's login successfully, user can go to homepage first. If you are athlete, your homepage has the green bottom bar that has home, search, and history button. If you are staff, your homepage has the blue bottom bar that has home, history, and cases button

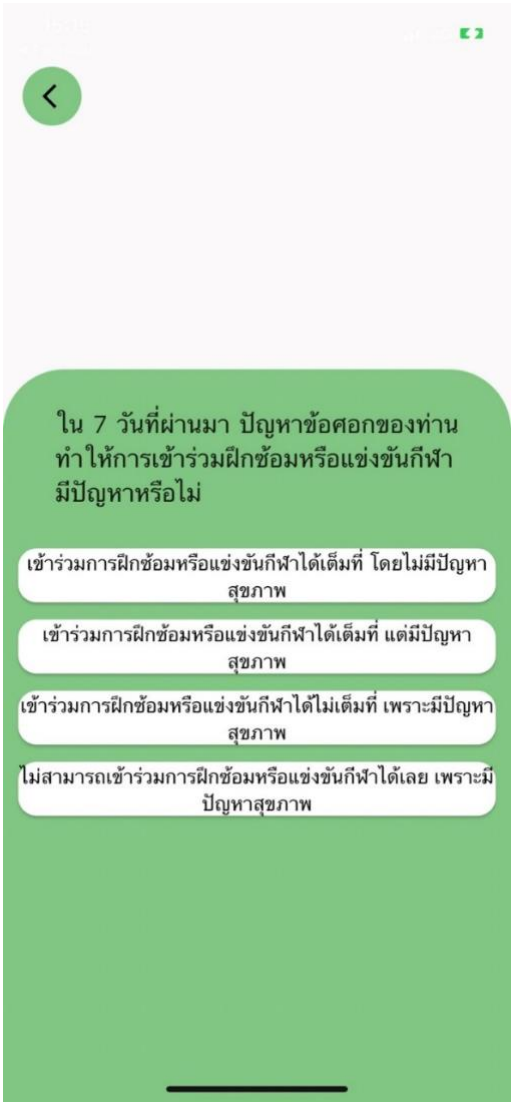


Figure 3.9: Questionnaire page

According to Figure 3.9, athletes have the three questionnaire buttons in their homepage that are health questionnaire, physical complain, and mental questionnaire.

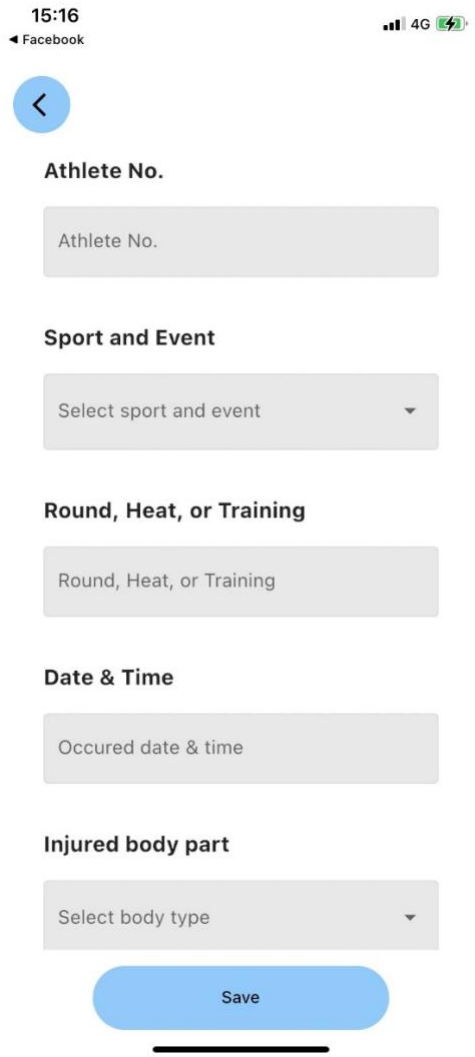


Figure 3.10: Recording page

According to Figure 3.10, athletes have the two recording buttons in their homepage that are illness and injury record.

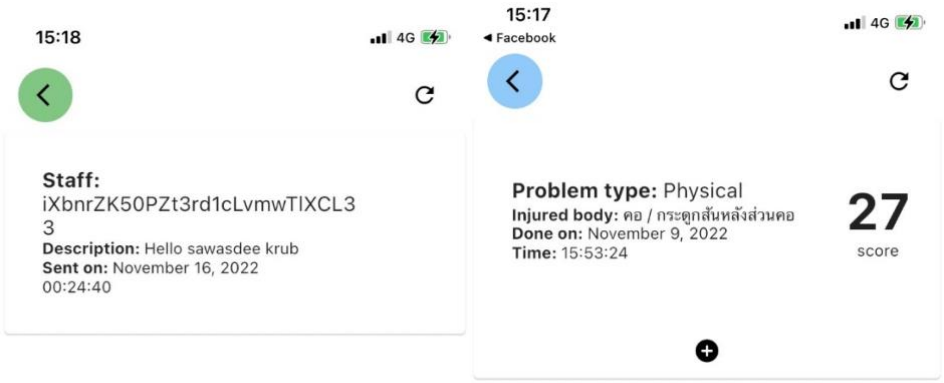


Figure 3.11: Notification page

According to Figure 3.11, both interfaces represent the athlete notification page (left picture) and the staff notification page (right page). For notification page, Athletes and staffs can see the top right button in homepage that have bell button, it is notification button. The alarm button properties of both parties are different as follows:

- **Athlete's notification (Left picture)**
  It notifies the message that the staff or medical team sent to that athlete.
- **Staff's notification (Right picture)**
  It notifies the cases that the athlete has completed the questionnaire and the points are due to be recorded by the medical team which the medical team can accept cases by pressing the plus button and reading the description above the button.

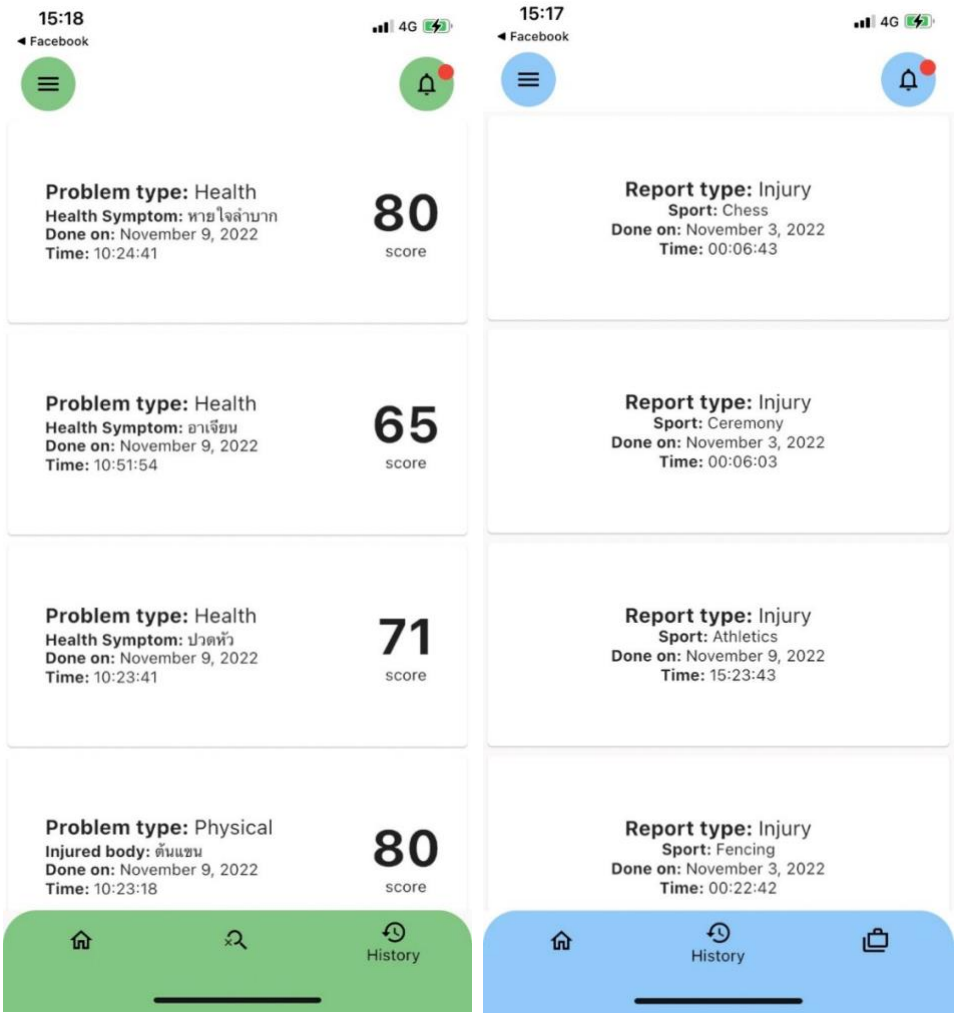


Figure 3.12: History page

According to Figure 3.12, both interfaces represent the athlete history page (left picture) and the staff history page (right picture). Athlete and staff have the history button that each position when pressing the history data button is different as follows:

- **Athlete's history (Left picture)**

  It shows the history of the questionnaires that athletes do it. It shows the questionnaire score, questionnaire type, health symptom or injured body, and date and time of the questionnaire.

- **Staff's history (Right picture)**

  It shows report completed by staff which shows data card with report type, sport, and date and time of the finished report.

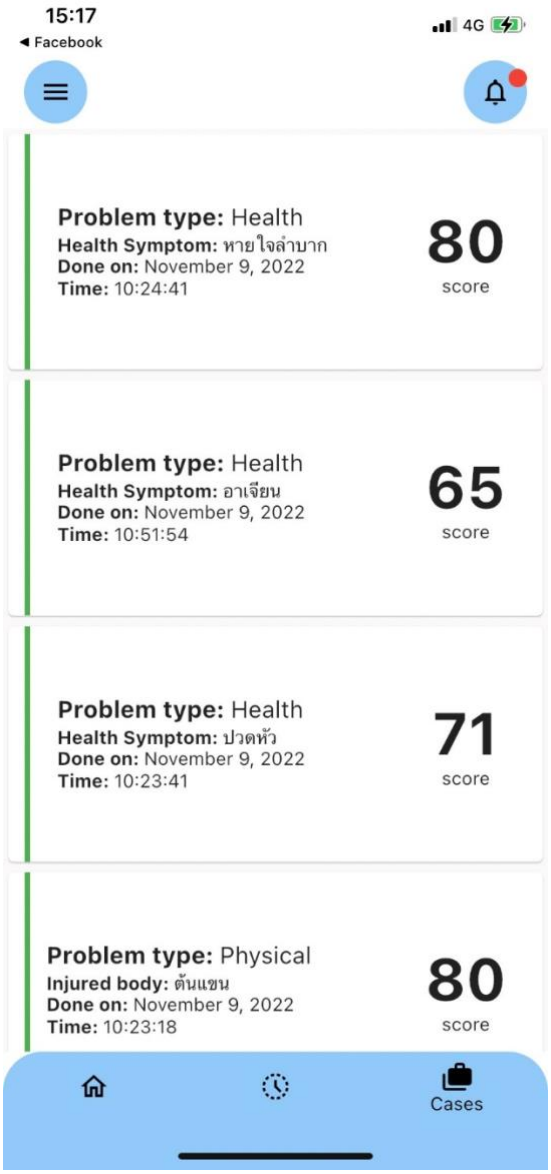


Figure 3.13: Staff's case page

Figure 3.13 shows the cases that staff receive in the notification. When staff click plus button in notification, the received case will show in the case page with red line tag. If staffs finish the received case, the case will change the red line tag to green line tag. Cards in the case page show several information, for instance, the received case history, case's score, problem type, and others.

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