Smart Life Guard

UCS503 SOFTWARE ENGINEERING PROJECT REPORT

END SEMESTER EVALUATION

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BE THIRD YEAR, CoE-12

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1. PROJECT OVERVIEW

PROJECT OVERVIEW STATEMENT	**Project Name:** Smart Life Guard

Problem:

As per WHO ,Drowning is a serious and neglected public health threat claiming the lives of 372 000 people a year worldwide[1]. More than 90% of these deaths occur in low- and middle-income countries[1]. This death toll is almost two thirds that of malnutrition and well over half that of malaria but unlike these public health challenges, there are no broad prevention efforts that target drowning[1].

Goal:

An efficient and enhanced software tool for detecting well before the person is in danger of drowning by measure of person's heartbeat, blood pressure and oxygen concentration.

Objectives:

With the help of Machine Learning[2] and IoT, our objective is:

- To minimize time consumed
- To prevent drowning

Overview of Software:

- Our software consist of a model that takes certain values such as Heart beat , Systolic Blood pressure, Diastolic Blood pressure & SP02 values as input.
- On the basis of certain threshold values it evaluate, that a person has a higher probability of drowning.
- An alert is sent to the lifeguard along with the position of the drowning victim through the GPS.

Product Scope:

This application can be used at number of places (eg: swimming pool, beaches, etc.) to prevent drowning at crowded places and to help the lifeguard to reach the victim ASAP.

2. SOFTWARE REQUIREMENT SPECIFICATIONS (SRS)

SRS Revision History

Date	Reason For Changes	Version
04-09-2020	-	1.0 -Initial Release
21-10-2020	Updating our model for better outputs	2.0-Modified Release

Introduction

Purpose

The Software Requirement Specification document describes the functional, non-functional, software and hardware, security and execution requirements of the project. It also highlights the importance of project "SMART LIFE GUARD" with briefly presenting its input and output functionalities. The purpose for this SRS is to define user requirement and system necessities for the project before moving into the configuration of initial release. The requirements expressed in the document will be basic for scope, development, planning, and estimation. This would give an overview to the client and would give detailed specification for the developer.

Document Conventions

- Abbreviations Used :

S.No.	Mnemonic	Full Form
1.	FTP	File Transfer Protocol
2.	GPS	Global Positioning System
3.	ML	Machine Learning
4.	BP	Blood Pressure
5.	SPO2	Oxygen Saturation
6.	HTTP	Hyper Text Transfer Protocol
7.	HTML	Hyper Text Markup Language

Table 2.1 - Full forms of mnemonics used

- Font Style :
  - Major Headings : 16px, Arial, Black, Bold, Underlined
  - Sub Headings : 14px, Times New Roman, Black, Bold
  - Normal Text : 12px,Times New Roman, Black
  - Alignment : Justified

Intended Audience and Reading Suggestions

This document is intended to be a guide for developers, users and testers. Also, it has been planned to subject supervisor of UCS503-Software Engineering project and staff members from the Computer Science and Engineering Department. Supervisors and staff members of the project will discover this document helpful for assessments.

Document overview for reading suggestions: The remaining sections of this document provide a general description, including characteristics of the users of this project and the product's requirements. Overall general description of the project along with use case is discussed in section 2 of this document. Section 3 gives the external interface requirements. Section 4 tells about system features, (their functional requirements) and states constraints and assumptions made for each system feature. It also gives the user viewpoint of product use. Section 5 describes the performance, safety and security requirements.

Product Scope

Our software consist of a model that takes certain values such as Heart beat , Systolic Blood pressure, Diastolic Blood pressure & SP02 values as input. On the basis of certain threshold values it evaluate, that a person has a higher probability of drowning. An alert is sent to the lifeguard along with the position of the drowning victim through the GPS.

References

[1] WHO Drowning report. Link: https://www.who.int/water_sanitation_health/diseases-risks/risks/global-report-on-drowning/en/

[2] Jain, Ramesh, Rangachar Kasturi, and Brian G. Schunck (1995) McGraw-Hill, New York (ISBN0-07-032018-7).

[3] Schmidhuber, J. (2015). Deep Learning in Neural Networks: An Overview. Neural Networks 61:85-117.

Overall Description

Product Perspective

The main perspective of this product is to improve the person safety in swimming pool or more specifically in public swimming pool and also to reduce the mishappenings among children by developing a System that can detect the early symptom of drowning, so that the system can monitor whether a person is drowning through sensors.

The product offers the following feature

Send notification instantly if someone is found in drowned condition.

Product Functions

The product will be able to perform the following functions:

1. Heartbeat, systolic bp, diastolic bp and SPo2are detected of everyone.
2. The swimmers having irregular values of the above mentioned will be highlighted.
3. Then probability predication w.r.t threshold value.
4. After that result is generated and alert is sent to lifeguard.

User Classes and Characteristics

Our goal is to make a product which alerts if a person founds drowning. And there will only be two types of users who will be using this feature. There is a difference between the users on the basis of the authority and the product functions one will perform. The users and their characteristics are listed below:

1. **Life Guard**: The Life guard will be a person appointed by the organization with better supervision and management skills. He might also have some previous experiences in such type of jobs.

2. **Registered user**: The work of a registered user(swimmer) will only be limited to himself and can only view alerts from system. He has no access to any other user's data. Frequency of using the product by this person is much more than that of life guard.

Operating Environment

The software will operate in outdoor swimming pools. For such model to work in a proficient manner, we need good hardware platform to note heartbeat, systolic bp, diastolic bp and SPo2values and interpret the results every second. It would require high performance processors to work in real time. Can work on Windows or Linux machine.

General Constraints, Assumptions and Dependencies

The following list points out the constraints, assumptions, dependencies or guidelines to be imposed upon the implementation of our product:

- Good sensors required.
- Good bandwidth to transfer the data and alerts
- Challenges at an outdoor aquatic environment
- We have a device which records BP at real time.
- If we change the environment of functioning, then there would be a need to change the type of hardware required as well as the task specific changes required in our Model.
- Their may be some changes for different Operating system

User Documentation

Lifeguard's can be provided with specific trainings to act upon the different outputs as required. The software handling person can be made familiar to GUI of the software and connect it to alarm system.

External Interface Requirements

User Interfaces

A graphical user interface for the admin to watch the fluctuating heartbeat systolic bp, diastolic bp and SPo2 values.
Options to set the threshold value for the model to determine whether the person is drowning or not because different environments may produce good results on different values.

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- **Entering Screen:** We tried to keep application easy to use(for proto-typing).

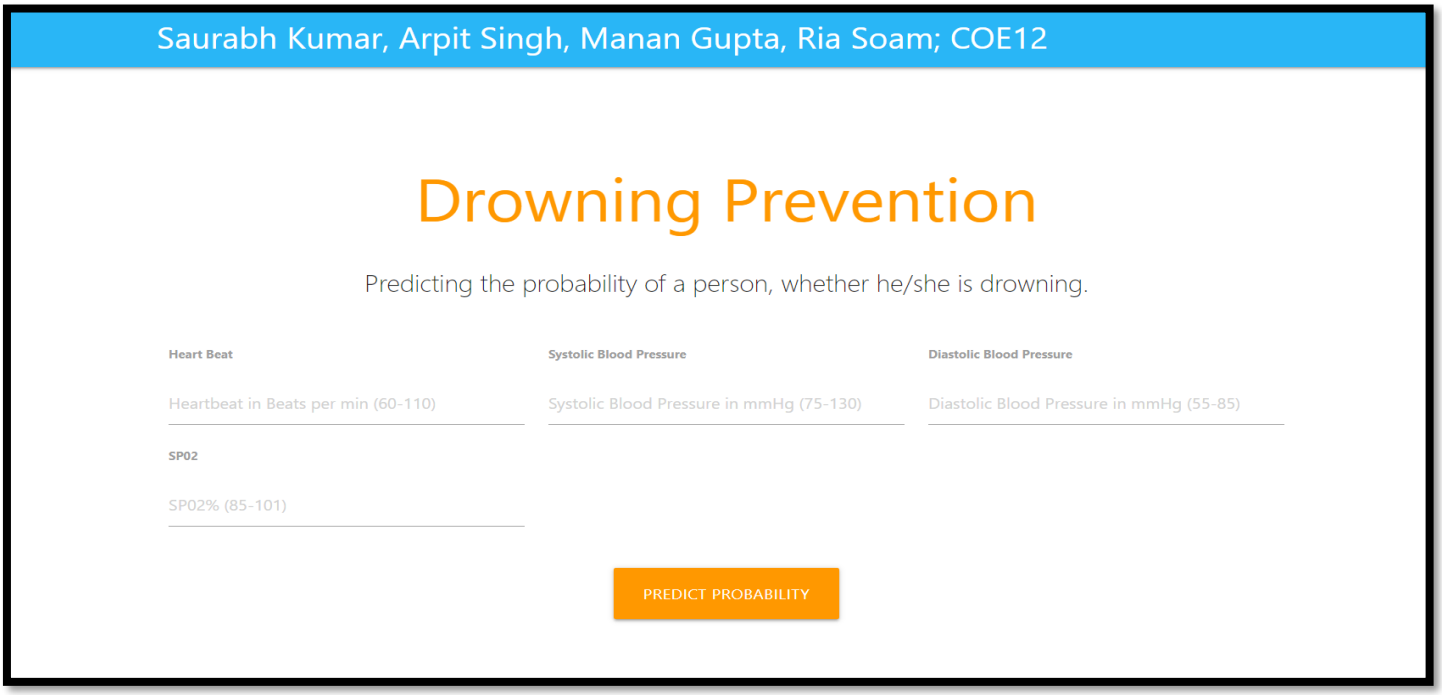

Figure 2.1 - Prototype of Entering Screen

Hardware Interfaces

Band – To note the heartbeat systolic bp, diastolic bp and SPo2 values.
Screen – for the Lifegaurd to see the fluctuating data and the swimmers who are in danger of drowning

Software Interfaces

A Databases would contain all the values obtained from the bands. Operating System can be Windows or Linux. Libraries used are, numpy, pandas, matplotlib, flask ,etc.

Communications Interfaces

File Transfer Protocol (FTP) is used for transferring heartbeat systolic bp, diastolic bp and SPo2 values to the Model and later to alarm system.
Data Transfer Rate needs to be quite high (around 1 Gbps).

System Features

Detection System

Used to detect people in danger of drowning through their heartbeats , systolic bp, diastolic bp and SPo2 values through a wristband which takes this live footage and transmits them to the database to be analyzed by our model. Live alerts are sent to the lifeguard for the people with irregular values and the ones who have high probability of drowning

Description and Priority

- It is of High priority. benefit, penalty, cost, and risk

Stimulus/Response Sequences

- Detects the heartbeat , systolic bp, diastolic bp and SPo2 values
- Alerts are sent to the lifeguard for the people with high drowning probability.

Other Nonfunctional Requirements

Performance Requirements

- The software is designed for web applications and can be accessed using any browser on any machine with minimum hardware and software requirements.
- The performance of software may vary from user to user on the basis of inputs provided by user.
- The software can handle multiple user accesses simultaneously.

Safety Requirements

- Data Transfer Rate should be good enough so as the live data could be processed without much transfer delays

Security Requirements

- Database only accessible to admin.
- Guard to be provided only with live footage

Software Quality Attributes

The software is available for everyone with all the requirements. It is available on large number of platforms. The performance of software increases as data increases the accuracy and performance increases. All the inadequate conditions are taken care so program doesn't crash.

The website is designed with beautiful textures and user friendly interface so new users won't face any difficulties.

Appendix A: Glossary for SRS

SNo	Term	Definition
1.	Data-flow diagram	A data-flow diagram is a way of representing a flow of data through a process or a system (usually an information system). The DFD also provides information about the outputs and inputs of each entity and the processitself.
2.	Github	Github is a web-based platform used for version control. Git simplifies the process of working with other people and makes it easy to collaborate on projects. Team members can work on files and easily merge their changes in with the master branch of the project.
3.	FTP	The File Transfer Protocol is a standard network protocol used for the transfer of computer files between a client and server on a computer network. FTP is built on a client-server model architecture using separate control and data connections between the client and the server.
4.	GPS	The Global Positioning System (GPS) has been developed in order to allow accurate determination of geographical locations by military and civil users. It is based on the use of satellites in Earth orbit that transmit information which allow to measure the distance between the satellites and the user.
5.	Deep Learning	an AI function that mimics the workings of the human brain in processing data for use in detecting objects, recognizing speech, translating languages, and making decisions.
6.	Computer Vision	an interdisciplinary scientific field that deals with how computers can gain high-level understanding from digital images or videos.
7.	Machine Learning	an application of artificial intelligence (AI) that provides systems the ability to automatically learn and improve from experience without being explicitly programmed.

Table 2.2 - Glossary

Appendix B: Issues List

The product is to be delivered in the form of a web app in its initial release but if time permits, we would like to integrate it to wrist band for more smoother and faster conduction.

3. STRUCTURED ANALYSIS

Data Flow Diagrams:

DFD Level 0:

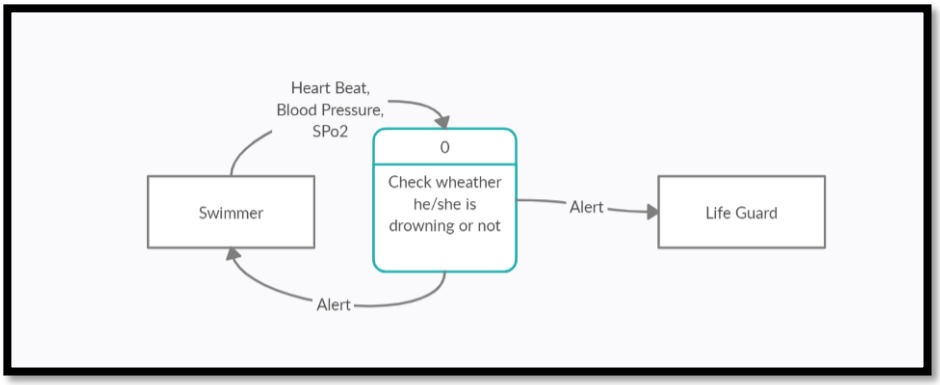

Figure 3.1 DFD level 0

DFD Level 1:

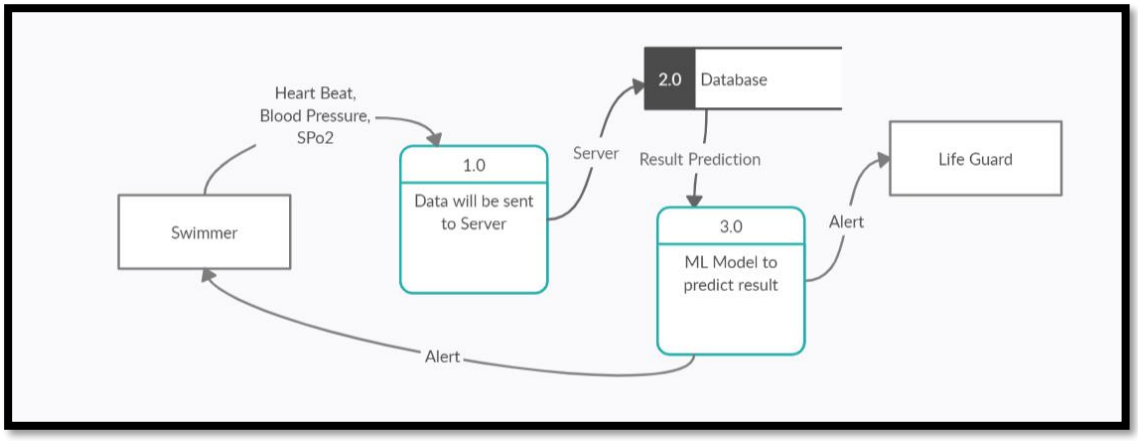

Figure 3.2 DFD level 1

DFD Level 2:

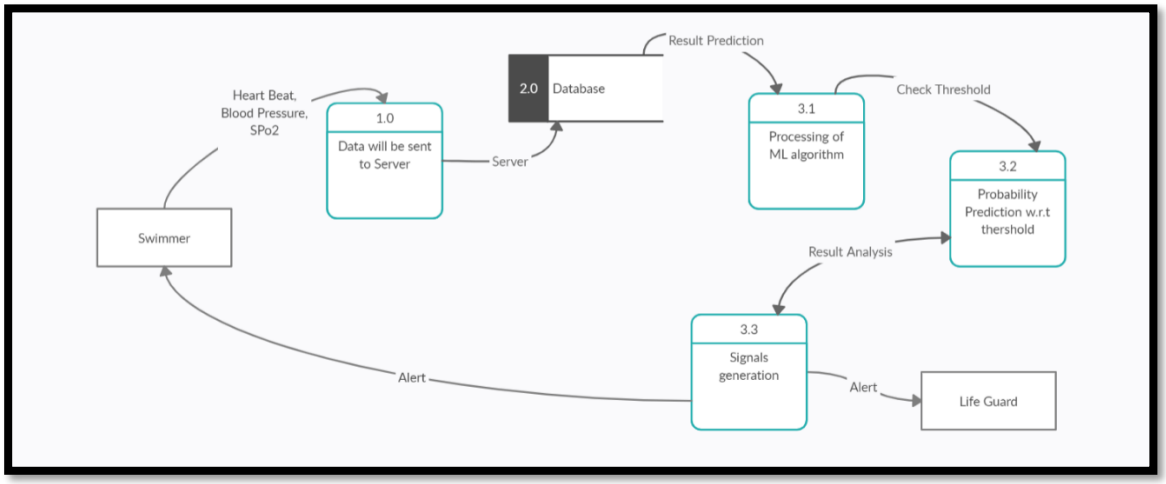

Figure 3.3 DFD level 2

4. OBJECT ORIENTEDANALYSIS

Use Case Diagram:

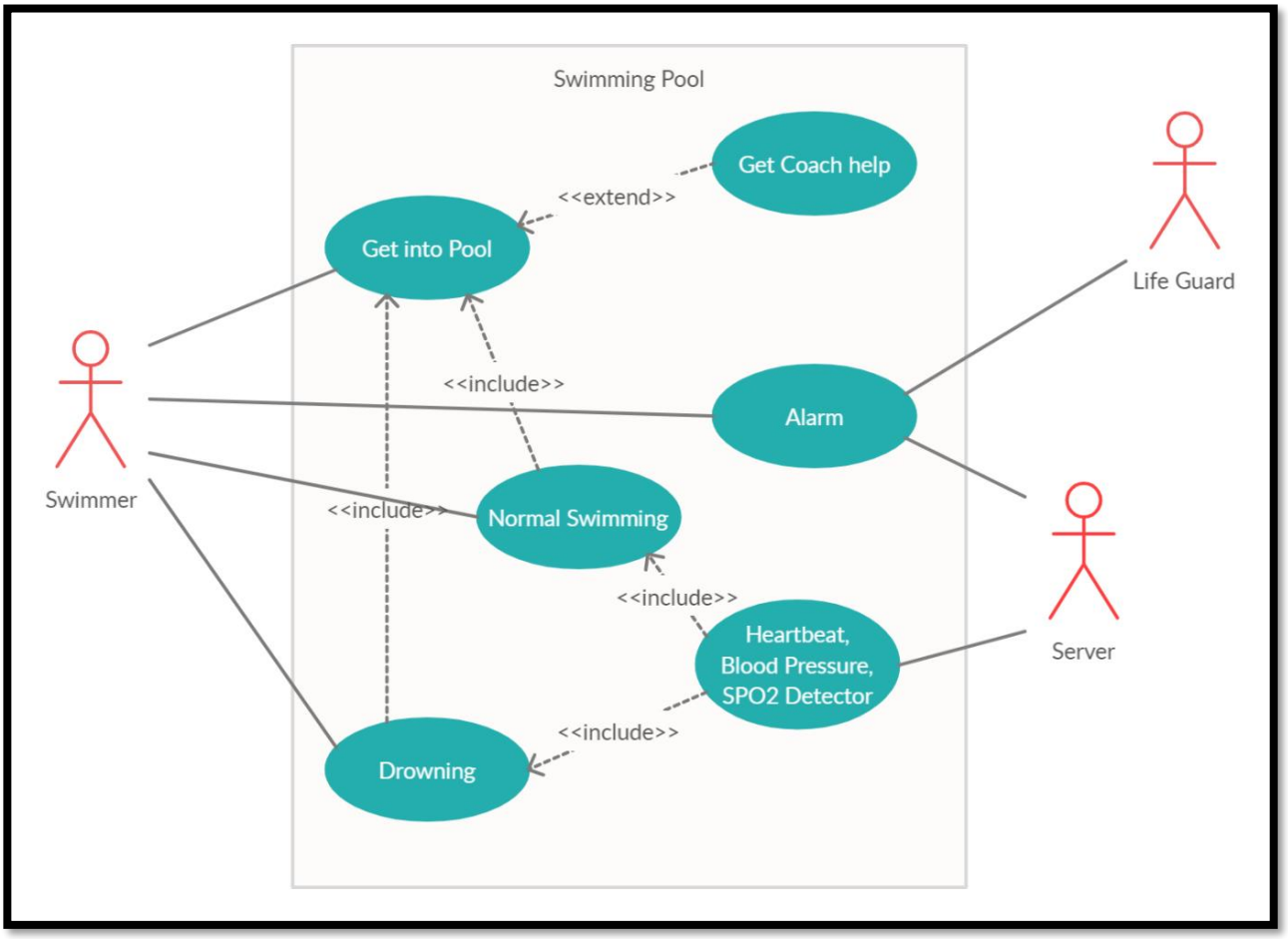

Figure 4.1 Use Case Diagram for Smart Life Guard

Use Case Templates:

1. Use Case Title	Swimmer Features
2. Abbreviated Title	Band
3. Use Case Id	1
4. Actors:	Swimmer
5. Description: Whenever a swimmer arrives in the pool, he/she must be provided with a band. Band captures the swimmer's features/readings and send them to server.	
5.1 Pre conditions: User must be registered if not already for band allotment.	
5.2 Task Sequence: 1. Band is provided to the user 2. After wearing the band, he/she may enter the pool and the readings will get captured.	
5.3 Post Conditions: 1. User will be put on alert if he/she is in a state of drowning.	
6. Exceptional flow of events: 1. If user provides wrong user id, he/she will get corresponding alert message on his/her mobile phone and user can be verified by OTP.	

1. Use Case Title	Alarm
2. Abbreviated Title	Alarm
3. Use Case Id	2
4. Actors:	Lifeguard
5. Description: Lifeguard will remain attentive towards the virtual pool and alarm, so that Lifeguard could take action as soon as possible.	
5.1 Pre conditions: Lifeguard must be well trained and healthy.	
5.2 Task Sequence: Lifeguard will act swiftly as soon as he/she notices the virtual pool displaying the drowning location after the alarm went off.	
5.3 Post Conditions: 1. Both Swimmer and Lifeguard will be alerted well before drowning, so that the swimmer can be rescued.	
6. Author: 404: Drowning Not Found	

Activity Diagram:

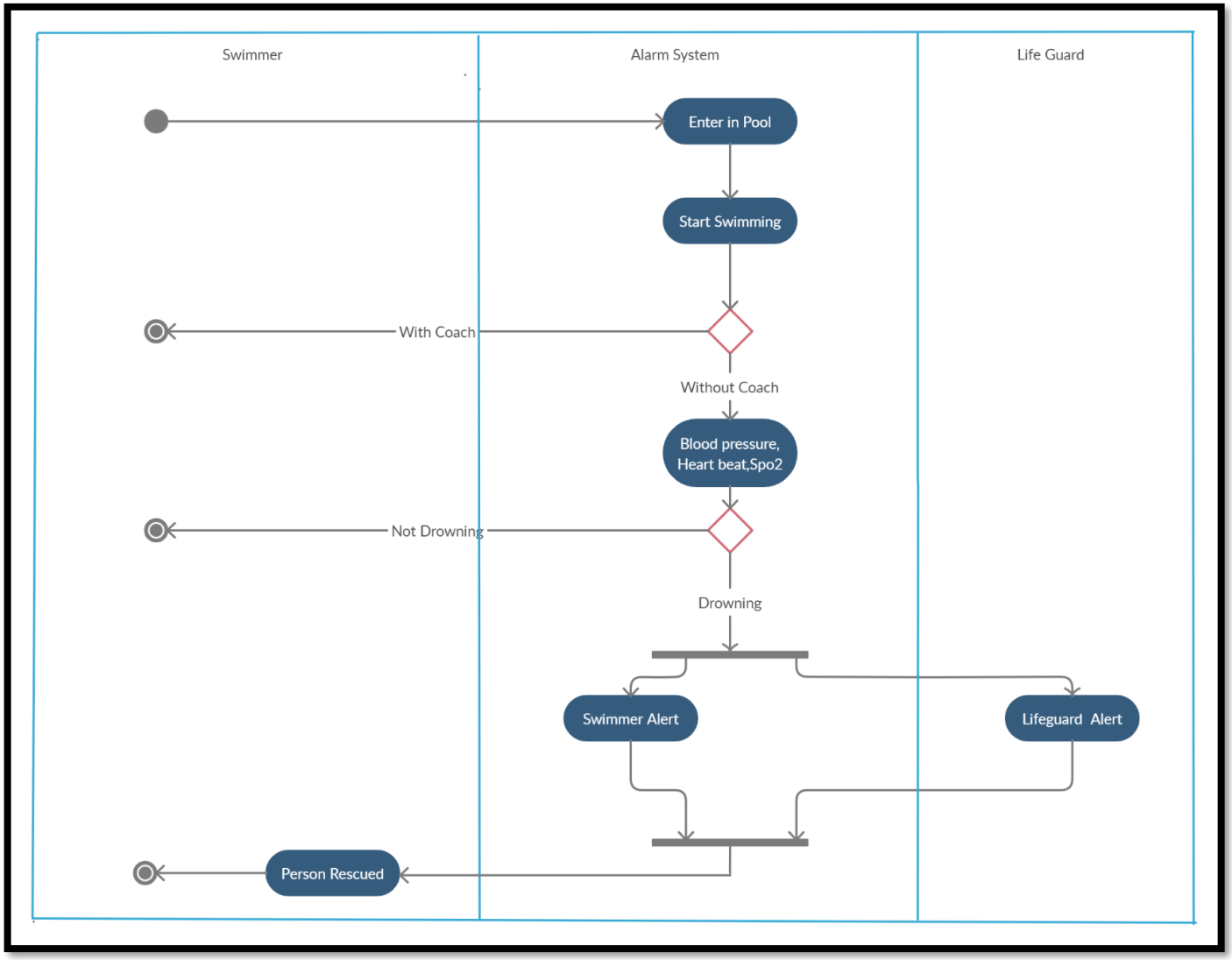

Figure 4.2 Activity Diagram for Smart Life Guard

Class Diagram:

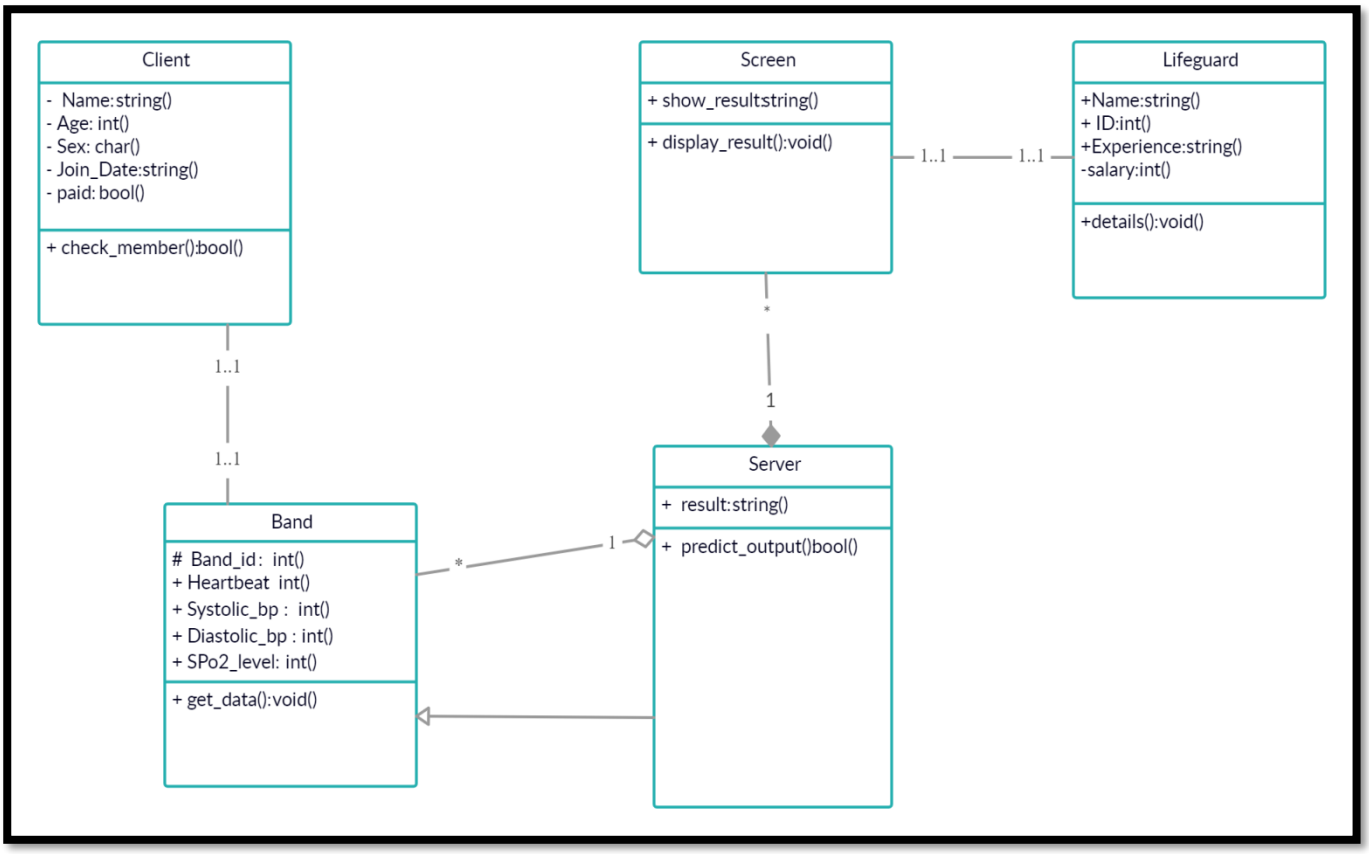

Figure 4.3 Class Diagram for Smart Life Guard

Sequence Diagram:

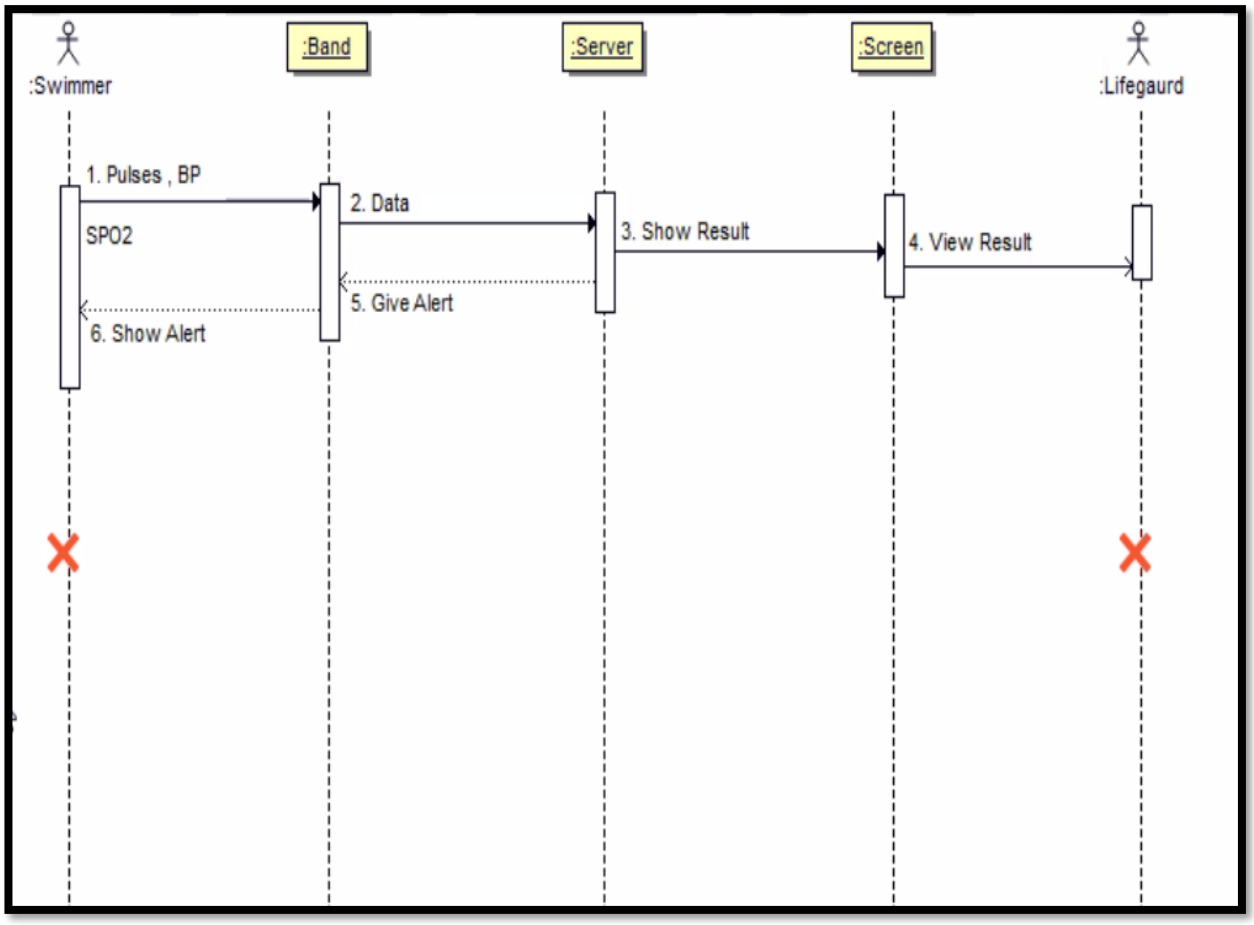

Figure 4.4 Sequence Diagram for Smart Life Guard

Collaboration Diagram:

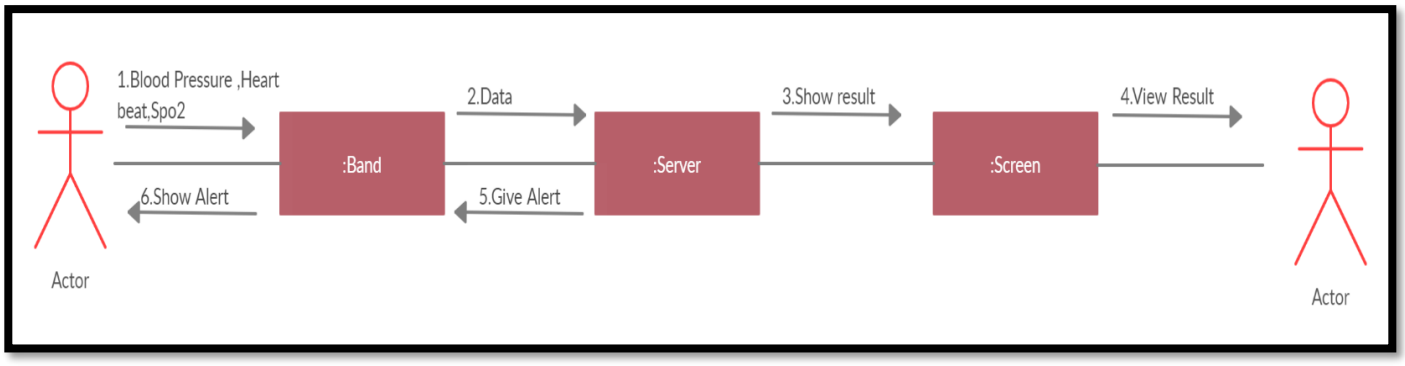

Figure 4.5 Collaboration Diagram for Smart Life Guard

State Chart Diagram:

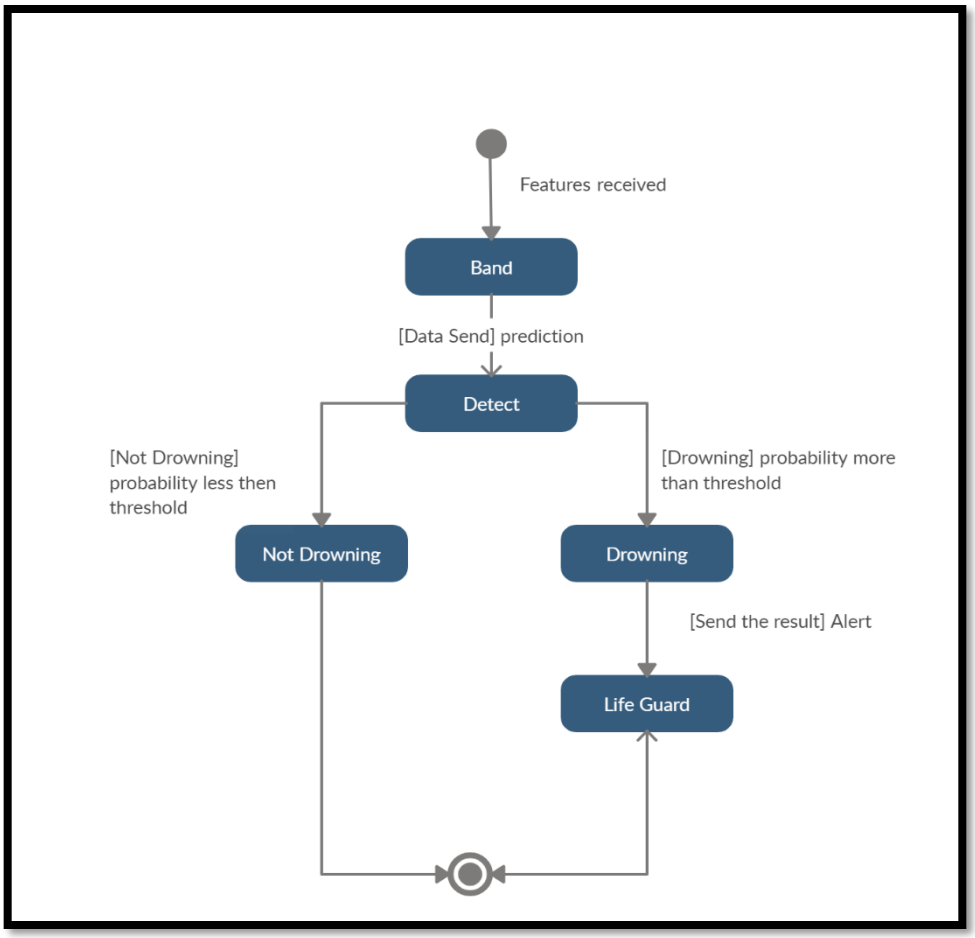

Figure 4.6 State Chart Diagram for Smart Life Guard

Component Diagram:

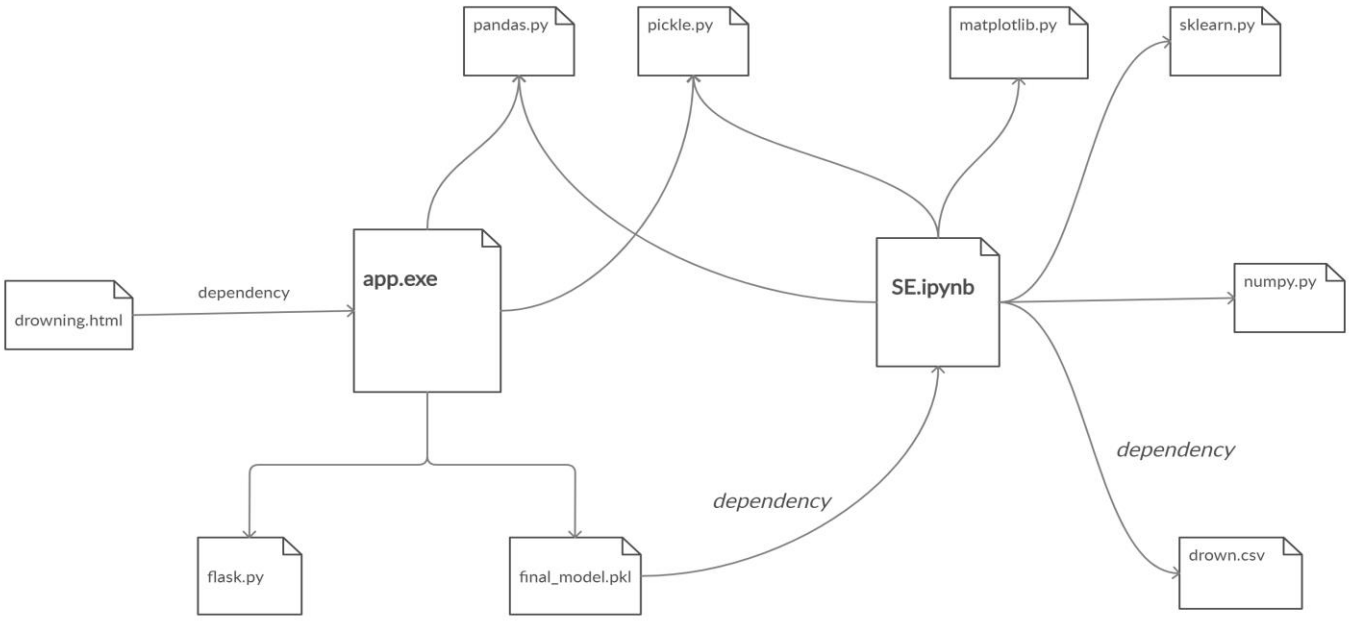

Figure 4.7 Component Diagram for Smart Life Guard

Deployment Diagram:

- A deployment diagram serves to model the physical deployment of artifacts on deployment targets. Deployment diagrams show the allocation of artifacts to nodes according to the diagram.

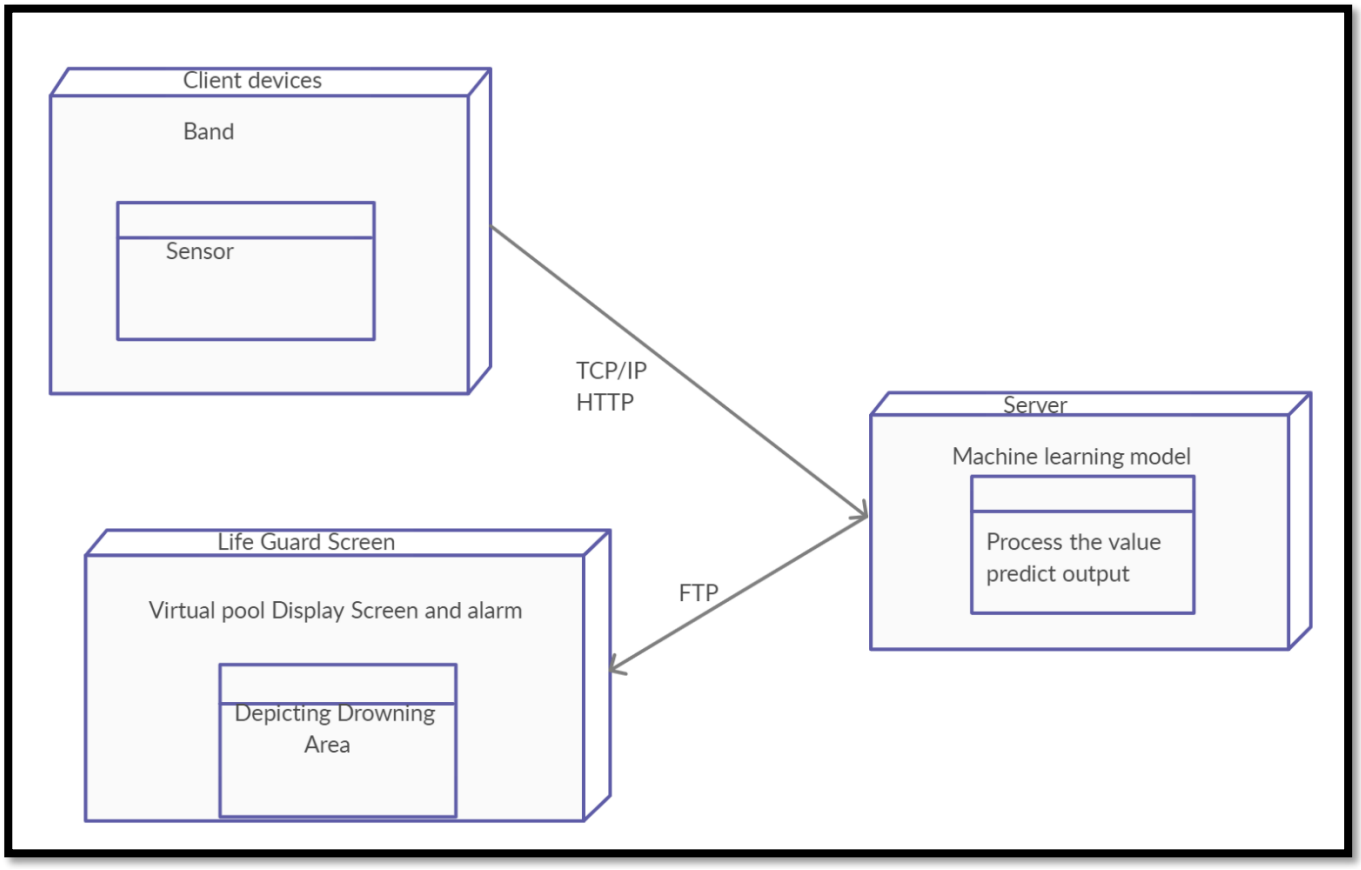

Figure 4.8 Deployment Diagram for Smart Life Guard

5. TEST REPORT

Test Case #:1.1

Test Case Name: Notify Drowning

System: Smart Life Gurad

Subsystem: Drowning

Designed by: Team Ria Soam

Design Date: 21/11/2020

Executed by: Team Ria Soam

Execution Date:25/11/2020

Short Description: Test the alarm system to notify drowning.

Pre-conditions

The swimmer should be inside pool.
The swimmer should have a valid swimming band
Band should properly send(Heart rate, Blood pressure & SPO2 levels) and receive(alerts)
Lifeguard's screen should be working
Band and Lifeguard's screen should be properly synched

Step	Action	Expected System Response	Pass/ Fail	Comment
1	Person is doing swimming	Band measures the value of features corresponding to system.	Pass	
2	**Check post-condition 1**			
3	If feature values are in range, such that no drowning occurs, repeat steps 1, 2 , otherwise move to step 4	The system displays a message of person not drowning The system again gets the value from band	Pass	
4	**Check post-condition 2**			
5	The lifeguard quickly runs to the drowning person as per the location sent on screen. and SAVES him/her.	The system prompts the message that the person is drowning and blinks the location of swimmer on lifeguard's screen.	Pass	
6	**Check post-condition 3**			

Post-conditions

1. Check the threshold level of features.
2. Give alert to lifeguards screen and band of swimmer.
3. The person is saved.