# Bangladesh University of Professionals (BUP)
## Department of Information & Communication Technology (ICT)

# HEALTH MONITORING OF A PILOT USING IOT WRISTBAND

## System Requirements Specification (SRS)
## Ver. 1.2

Course: Software & Requirement Engineering Lab (ICE-3202)

Name: Md. Mahmudul Hasan
ID: 17511076
Sec: B

# Contents

# 1.   <u>Preface</u>

A good health and sound mind are the preliminary requisite of happiness. Good health is often referred as wealth. If our health is sound, we can do our daily activities properly and sincerely. Like every individual, it is of utmost important for an aircraft pilot as well. Whether a pilot flies his bird individually or with passengers, he needs to be in absolute health state to conduct his job. He needs to be stout physically and must get relieved from any kind of stress. It is to be mentioned that many aircraft crashes occur due to faulty management of aircraft pilots. Most of it is related with the sudden change of mental and physical condition of the pilot. Our project idea was basically initiated and aimed to reduce these losses. The project involves monitoring the physical and mental state of a pilot. A thorough medical check-up for a pilot is done before any flight. But during the flight a pilot may get sick physically or psychologically. We will be able to receive the updated health state of a pilot and give him support by taking medical professionals. We are to build an user friendly smart wrist band that is capable of examining the health condition of an aircraft pilot. We believe that the lives of the pilot as well as the aircraft will be saved after using our wrist band. It will be directly monitored by the Air traffic control room along with expert medical personnel. The paper will provide a complete idea about our health monitoring wrist band for pilots. We hope, this project will minimize the loss of lives and property to a great extent.

## 2.    <u>Introduction</u>.

**2.1    <u>Purpose</u>.**    The scheduled health checkup for a pilot before the commencement of his flight is a traditional process. But during the flight his health is not monitored. The pilots are well trained for the flights. Yet it might be a possibility, when a pilot may fall sick during a flight. Keeping this eventuality in mind, the main purposes of our project are as following:

a.    To monitor the health of a pilot as soon as possible.

b.    To monitor the blood pressure, heart rate, oxygen level and body temperature of the pilot.

c.    To provide mental support to the pilot.

d.    It is presumably be the first one of its kind as we could not trace any previous version.

e.    It will also find out the altitude and fire information of the cockpit.

f.    The unusual rise up or downfall of the health information of a pilot will be the benchmark of our project.

**2.2    <u>Intended Audience</u>.**    The users for our IOT wristband will be mainly the pilots during their time on the aircraft. Their health state will be monitored by the air traffic control room or the concerned authority. Therefore, they will also be our audiences. Most importantly, it must be understood by the physician in charge. This document contains all the necessary components and architecture model of the product and system. So apart from the mentioned, anyone who is interested in this project can get necessary information about this by reading this document.

**2.3**    **Product Scope**.    There are many types of smart watch but none of them are dedicated for health monitoring. Again, there are many equipment for health monitoring but none of them are dedicated for the pilot who are flying their aircrafts. Our product will provide necessary information regarding the medical condition of the pilot. The wrist band will have required number of sensors connected to an android device to provide records of the instance. It will help us to communicate, transfer data and generate information regarding a pilot's health. The personal information of the pilot will be recorded initially. The gadget will provide the information about heart rate, blood pressure, the altitude, oxygen level and body temperature of the pilot. The scope of the product is totally based on this. While building the wrist band, our focus will be mainly on the following:

    a.    Theoretical CS and Algorithm

    b.    Internet of Things (IoT)

    c.    Database Management

    d.    Information Security

    e.    App development

    f.    data transfer

    g.    communication

    h.    hardware wristwatch

## 3. **Glossary**.

**3.1. Heart Rate Sensor.** An optical blood flow sensor will be integrated from which heart rate can be checked.

**3.2. Ambient Temperature Sensor.** Ambient temperature could be compared to skin temperature in the service of determining exertion levels.

**3.3. Accelerometer.** Accelerometer measures body movement to track the pilot's movement pattern.

3.4. **Barometer.** Barometer can measure changes in altitude, which is relevant to sudden fall or crash of aircraft.

3.5. **Pulse Oximeter**. This sensor measures blood oxygen, a key data point for reporting accurate pulse rates and health status of pilot.

3.6. **Fire Sensor**. CO & CO2 level and air quality sensor determines their quantity in air and determines if there is any smoke or fire in cockpit.

3.7. **Health monitoring system**. In case of any abrupt changes in one's heart rate or body temperature alert is sent about the individual using IoT. Thus, health monitoring system based on IoT uses internet to effectively monitor one's health and helps the user monitoring their loved ones from work and saves lives.
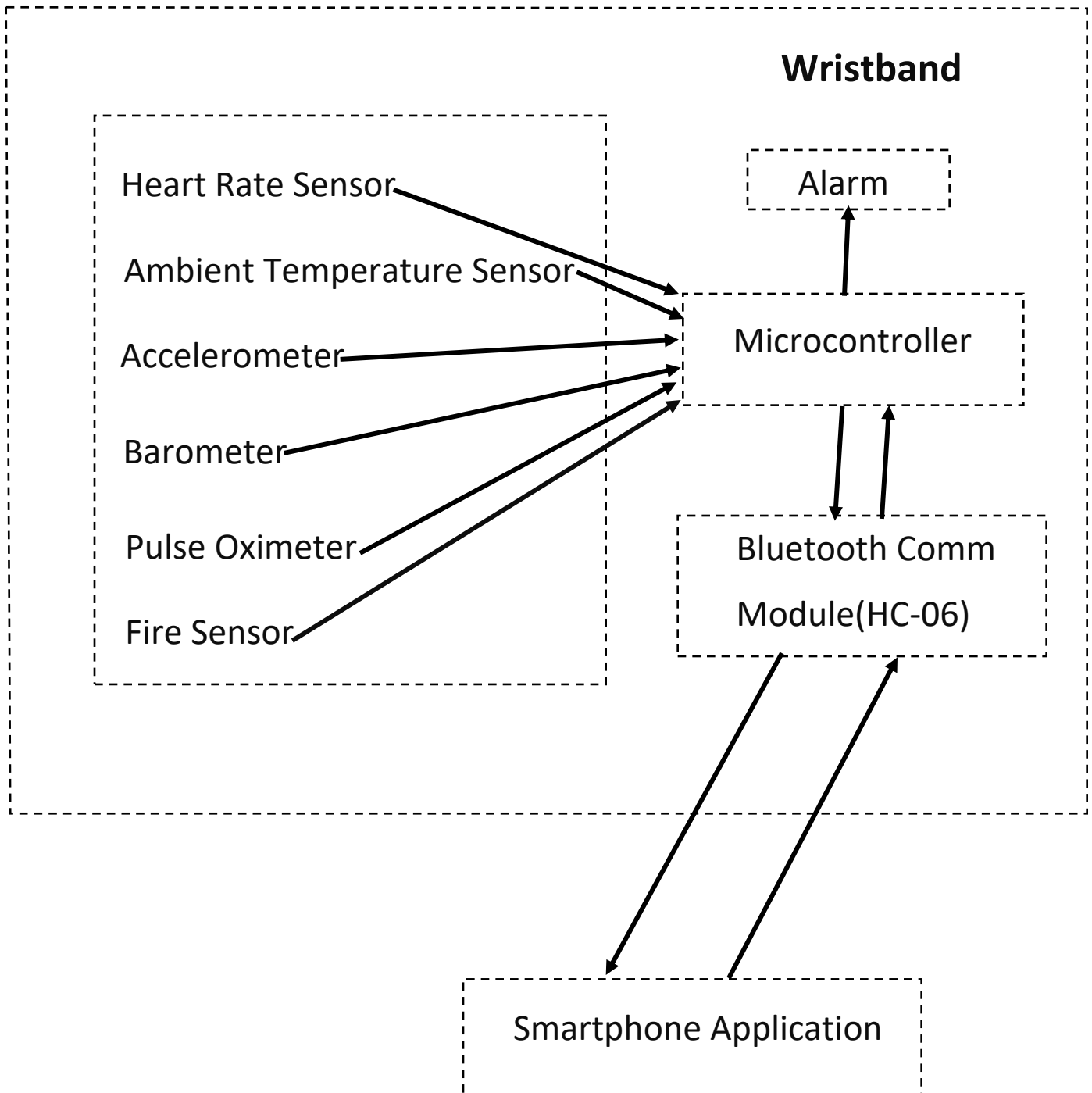
3.8. **IoT**. The *Internet of Things (IoT)* describes the network of physical objects, "things" that are embedded with sensors, software, and other technologies for the purpose of connecting and exchanging data with other devices and systems over the internet.

3.9. **Air Traffic Control**. *Air traffic control* (ATC) is a service provided by ground-based *air traffic controllers* who direct aircraft on the ground and through *controlled* airspace and can provide advisory services to aircraft in non-*controlled* airspace.

## 4.    <u>**User Requirements**</u>.

5.1.    The wristband should be comfortable to use for the pilot.

5.2.    The app should have the data of the participating pilots recorded initially to monitor their health.

5.3.    Perfect reading and transfer of data without any distortion from wrist band to the android device needs to be done.

5.4.    The device should hold enough charge to minimize unnecessary shut down of the system.

5.5.    The application should be simple and user friendly.

5.6.    The data must be sent to the ATC room without any interruption to get monitored by the physician.

## 5. System Architecture.



**Wristband**

Heart Rate Sensor

Ambient Temperature Sensor

Accelerometer

Barometer

Pulse Oximeter

Fire Sensor

Alarm

Microcontroller

Bluetooth Comm Module(HC-06)

Smartphone Application

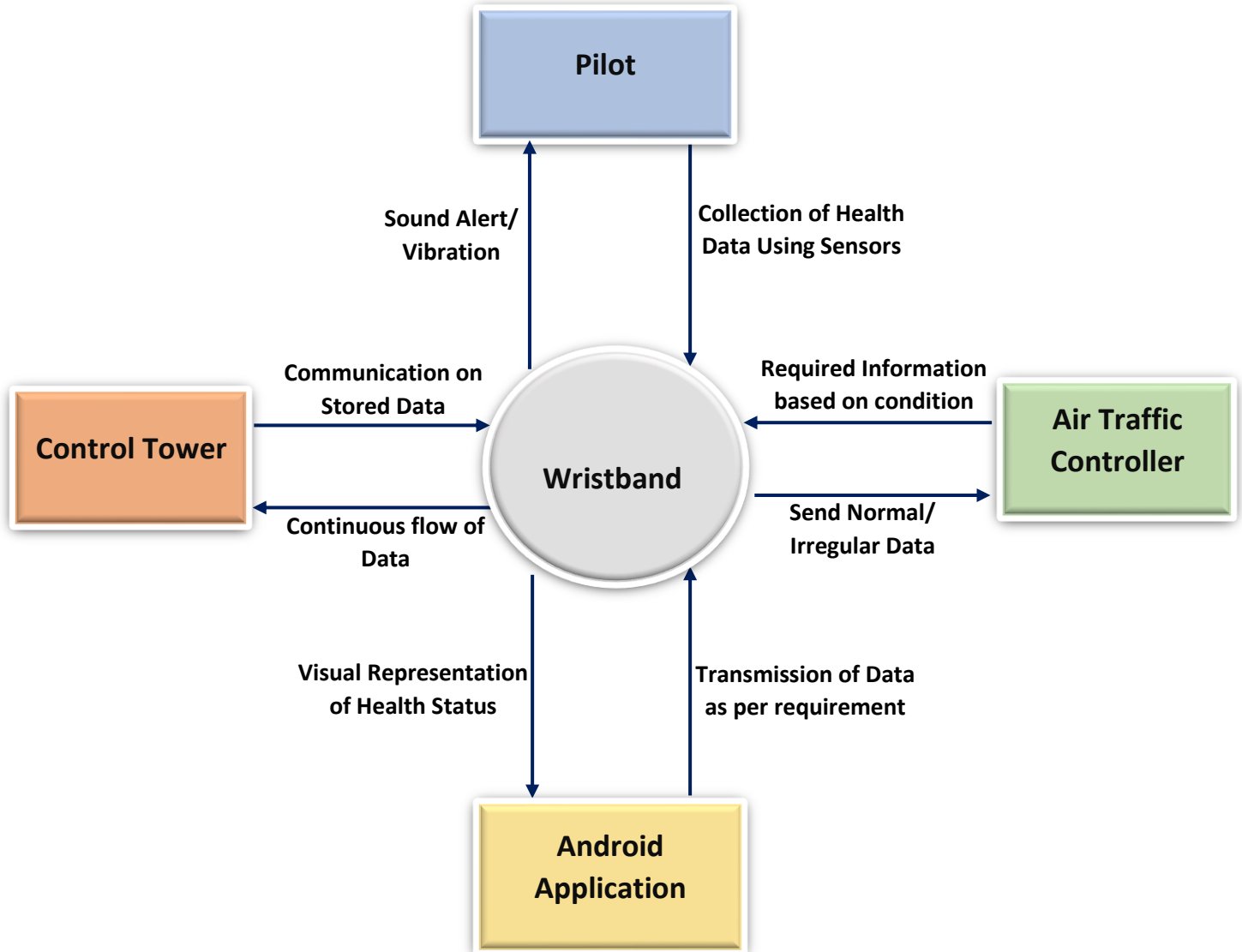## 6.    System Requirement Specifications.

### 6.1    System Requirements.

a.    The wristband will be light in weight and will be sweating free.

b.    The wristband will be having a unique ID no which will also be recorded in the app. That will help us to keep the track of the pilot needing attention.

c.    The whole system will have an android interface to keep track of the various data.

d.    High powered lithium rechargeable battery will be used so that it does not get shut down unnecessarily.

e.    The algorithms and the language of the app will be simple so that it can be modified as per future requirement.

f.    The data will be sent to ATC room by VHF. By proper frequency modulation we can reduce the data reduction.

### 6.2    Requirements Classification.

| Ser | User Requirements | Type (Functional) | Type (Non-functional) | Remarks |
|-----|-------------------|-------------------|-----------------------|---------|
| 1. | System should be able to take the readings. | √ | X | |
| 2. | System should be able to calculate the anomalies with the standard readings | √ | X | |
| 3. | System should be able to communicate | √ | X | |
| 4. | System UI should be easy to understand | √ | X | |
| 5. | Time | X | √ | |

# 7. <u>System Model</u>.

## 7.1 <u>Context Diagram</u>.

**Pilot**

Sound Alert/
Vibration

Collection of Health
Data Using Sensors

Communication on
Stored Data

Required Information
based on condition

**Control Tower**

**Wristband**

**Air Traffic
Controller**

Continuous flow of
Data

Send Normal/
Irregular Data

Visual Representation
of Health Status

Transmission of Data
as per requirement

**Android
Application**

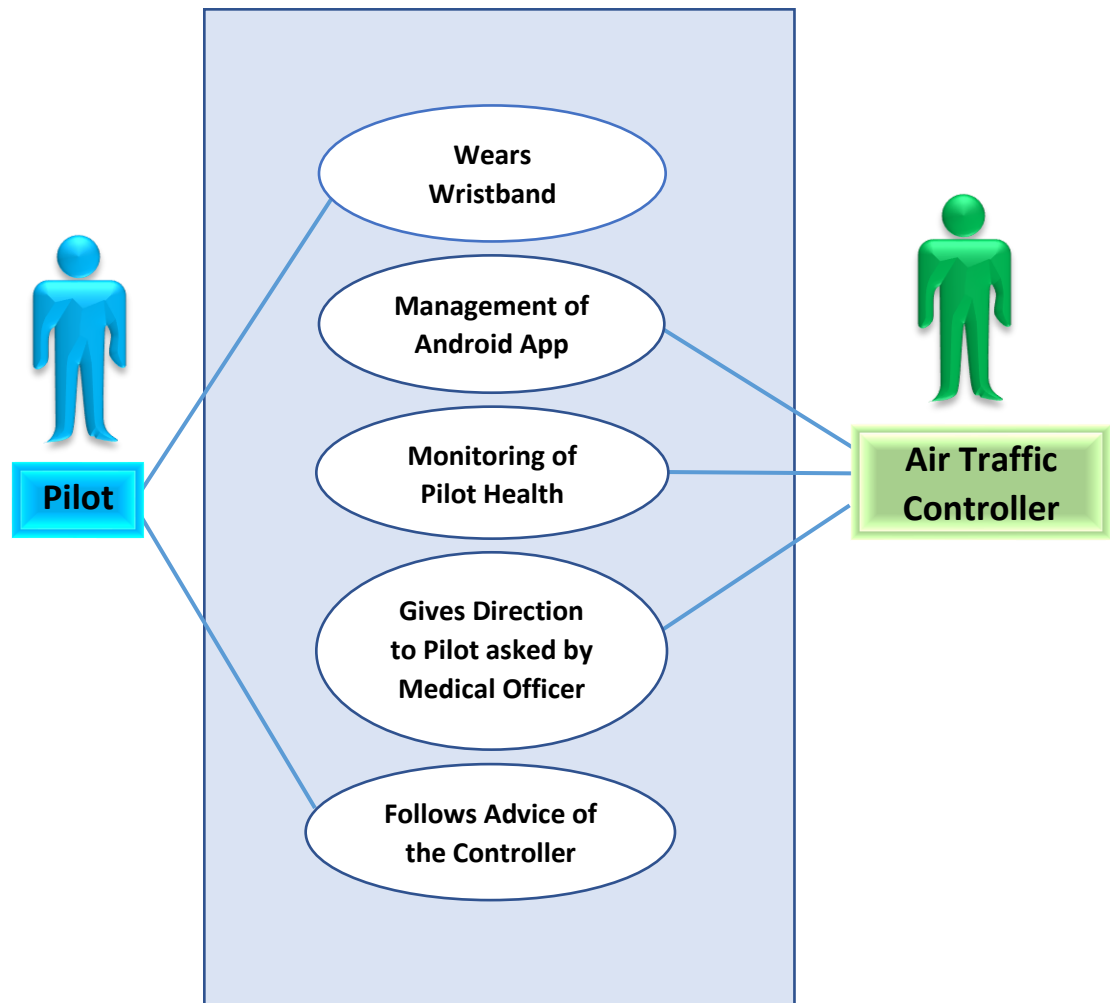## 7.2 Use Case Diagram.

### a. Normal Scenario.
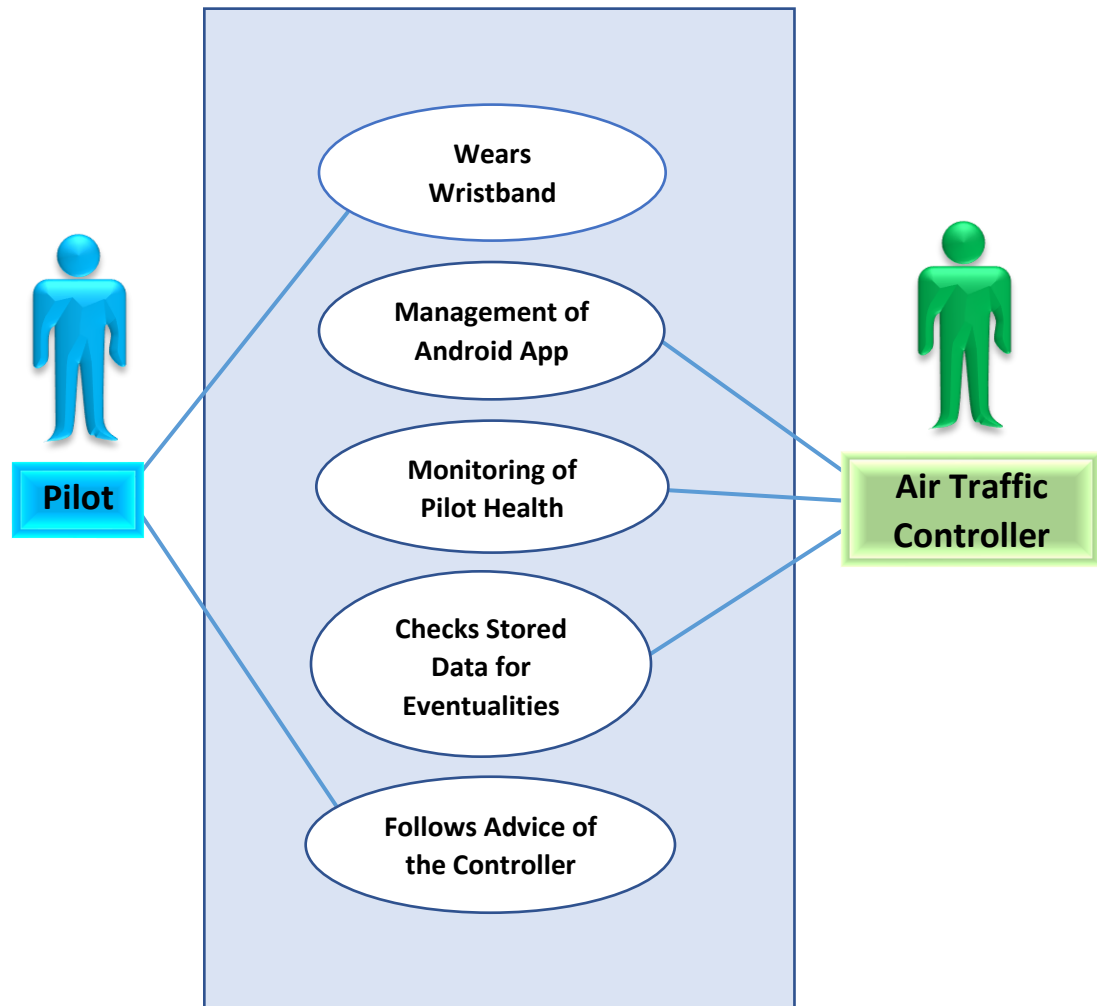


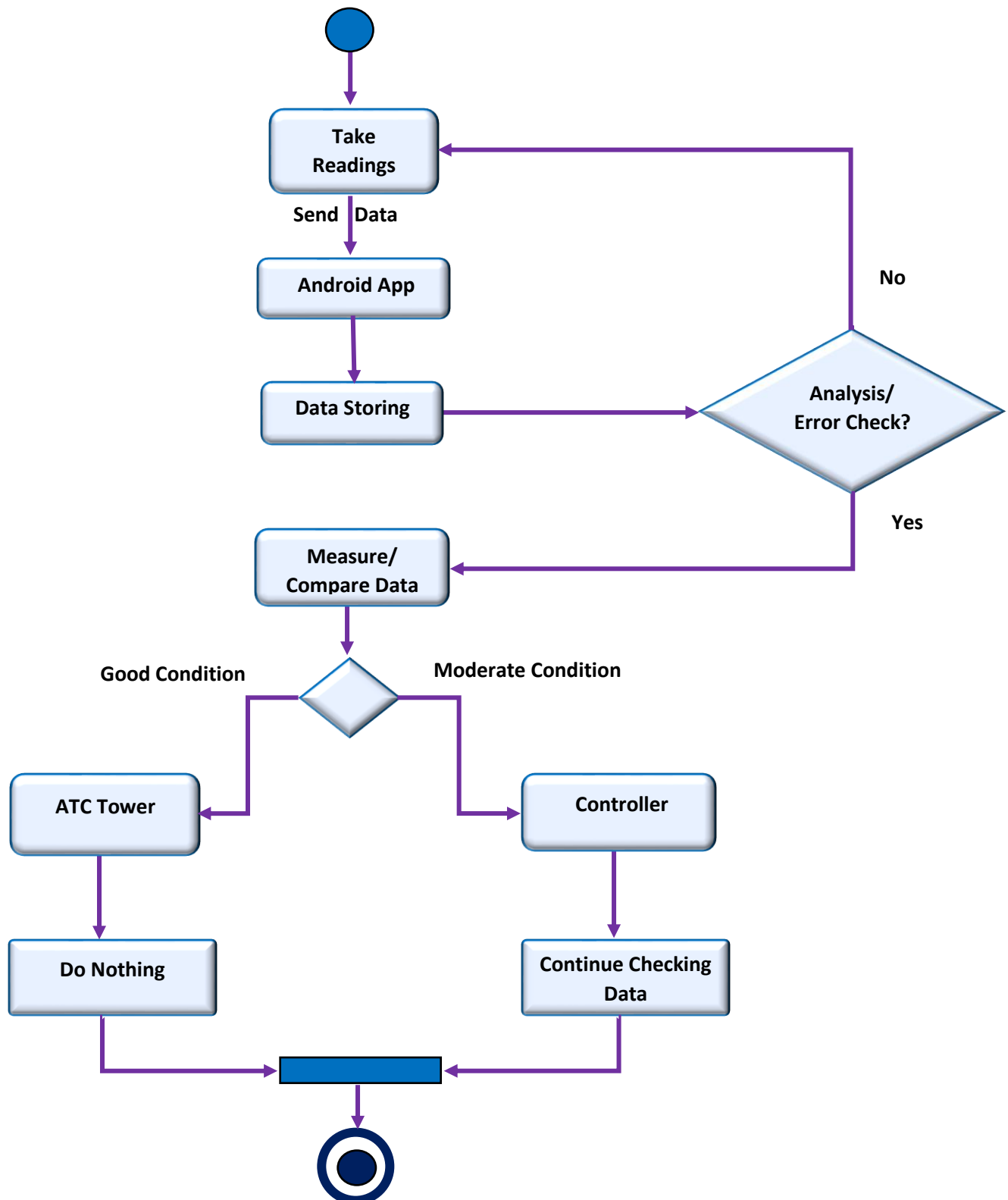| Use Case | Normal Scenario |
|---|---|
| Actors | Pilot, Air Traffic Controller |
| Description | A pilot wears the wristband and the readings of the sensors are seen in the android app by the air traffic controller. From the standard readings, controller can tell whether the condition of the pilot is fit for flying or not. The controller gives necessary advice by monitoring pilot's health. |
| Data | Readings from the sensors |
| Stimulus | Data collection, command issued by Controller |
| Response | Do nothing |
| Comments | i.    The ATC tower should have a good communication with pilot.<br>ii.   The android app should have accurate data. |

b.    **Moderate Scenario.**
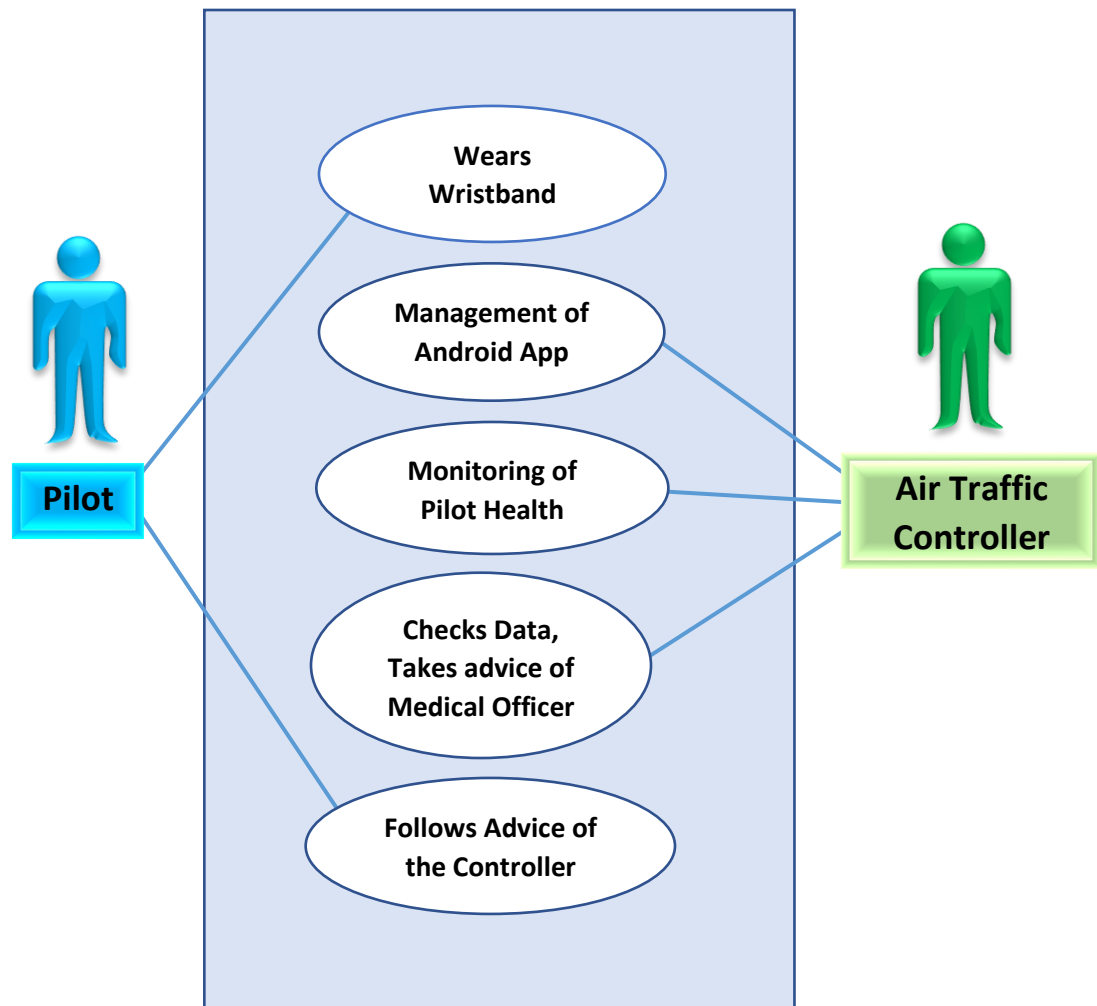


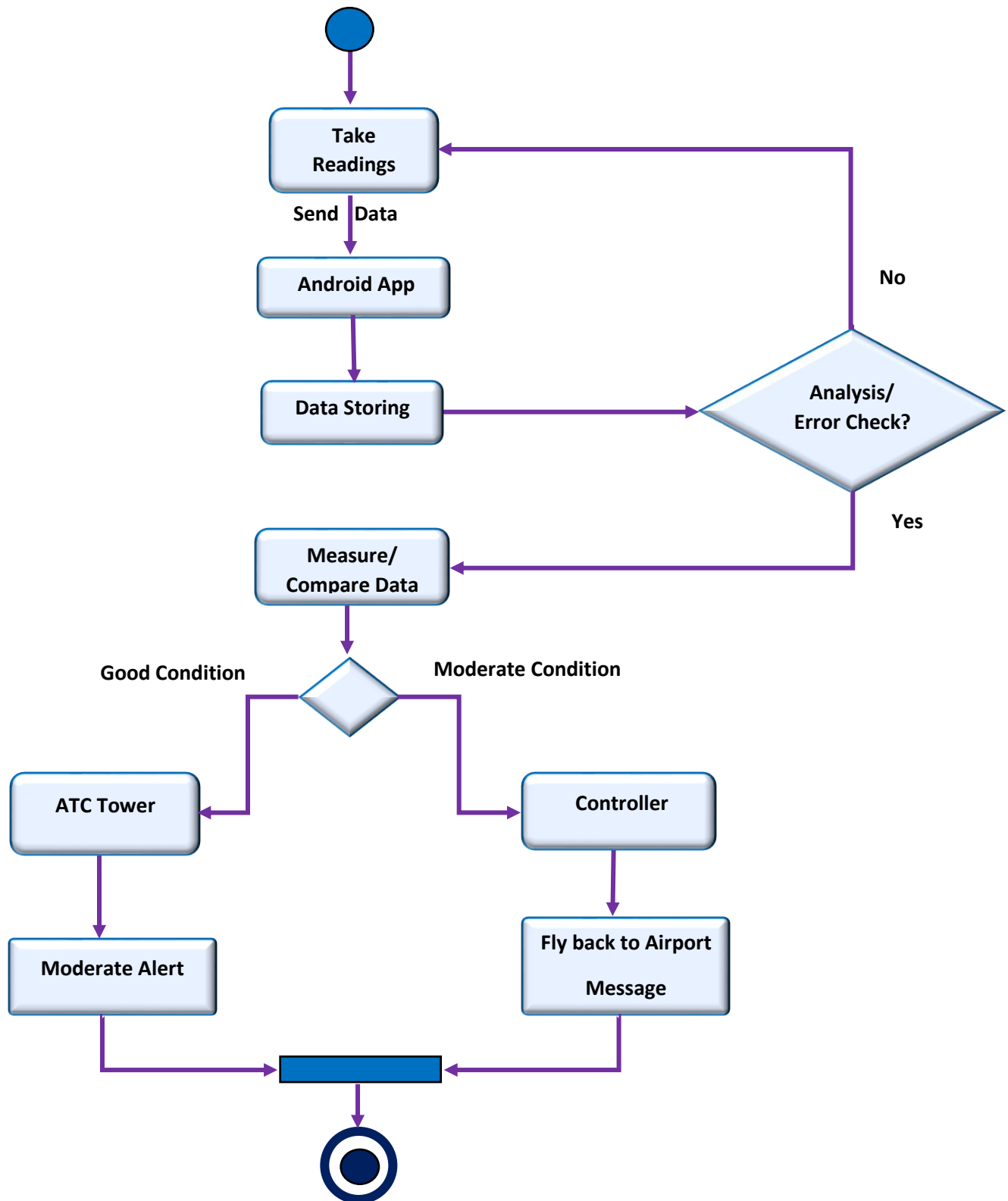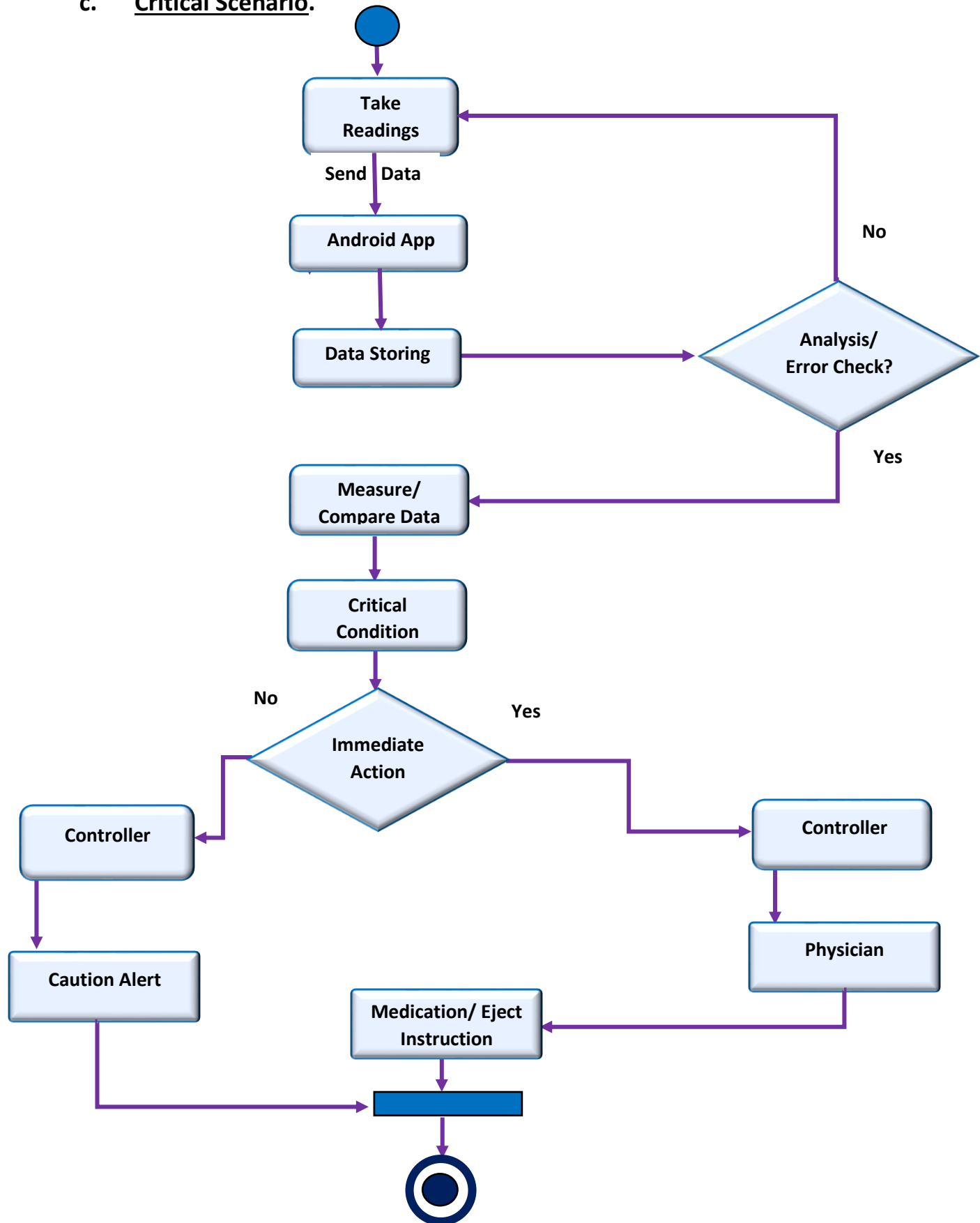| Use Case | Moderate Scenario |
|---|---|
| Actors | Pilot, Air Traffic Controller |
| Description | A pilot wears the wristband and the readings of the sensors are seen in the android app by the air traffic controller. From the standard readings, controller can tell whether the condition of the pilot is fit for flying or not. The controller gives necessary advice by monitoring pilot's health. |
| Data | Readings from the sensors |
| Stimulus | Data collection, command issued by Controller |
| Response | Alert, Return to airport |
| Comments | i.    The ATC tower should have a good communication with pilot. <br> ii.    The android app should have accurate data. |

**C.** **Critical Scenario.**



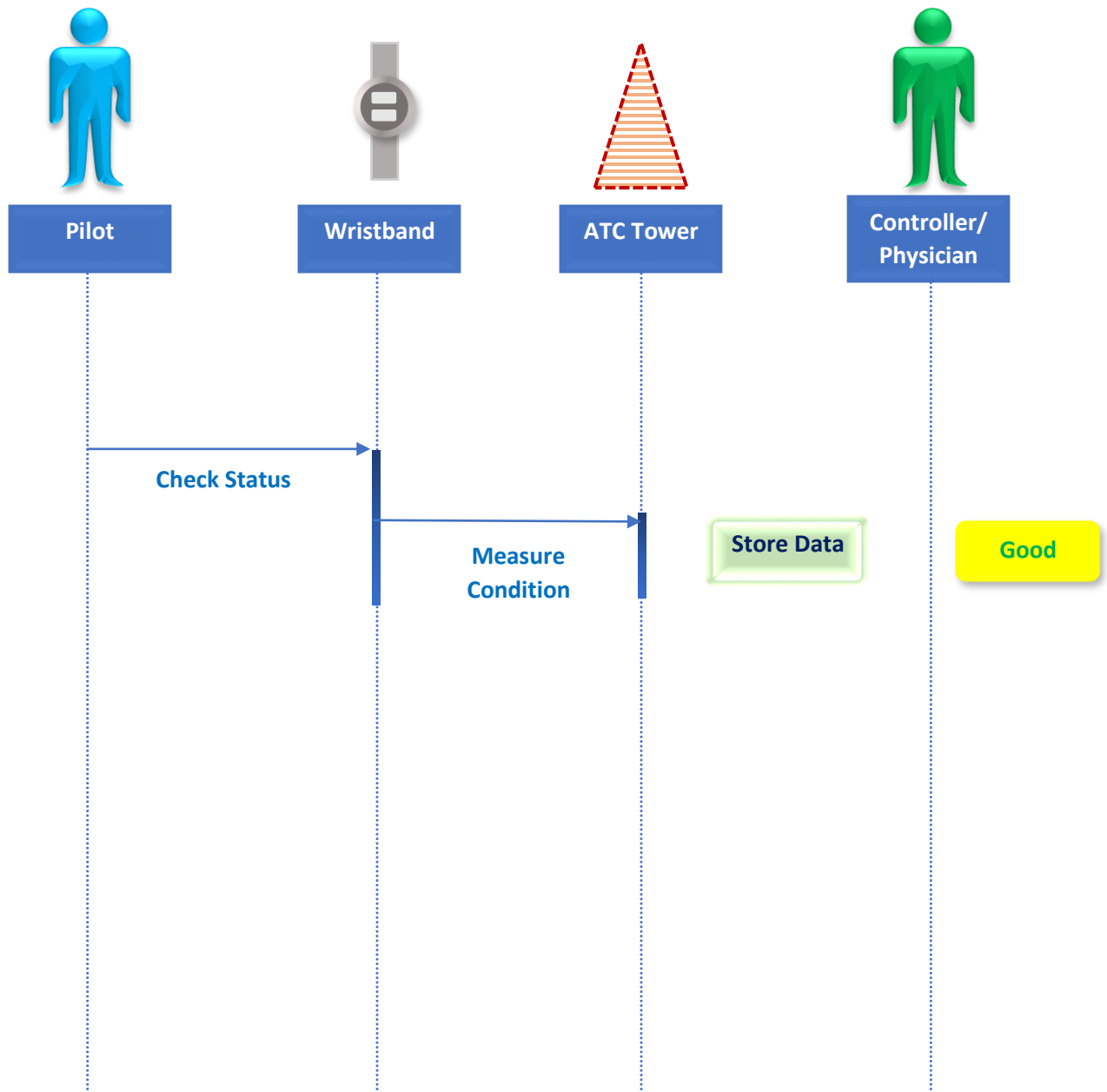| Use Case | Critical Scenario |
|---|---|
| Actors | Pilot, Air Traffic Controller |
| Description | A pilot wears the wristband and the readings of the sensors are seen in the android app by the air traffic controller. From the standard readings, controller can tell whether the condition of the pilot is fit for flying or not. The controller gives necessary advice by monitoring pilot's health. |
| Data | Readings from the sensors |
| Stimulus | Data collection, command issued by Controller |
| Response | Alert, Eject/ Medication advice |
| Comments | i.    The ATC tower should have a good communication with pilot.<br>ii.    The android app should have accurate data. |

7.3    **Activity Diagram**.
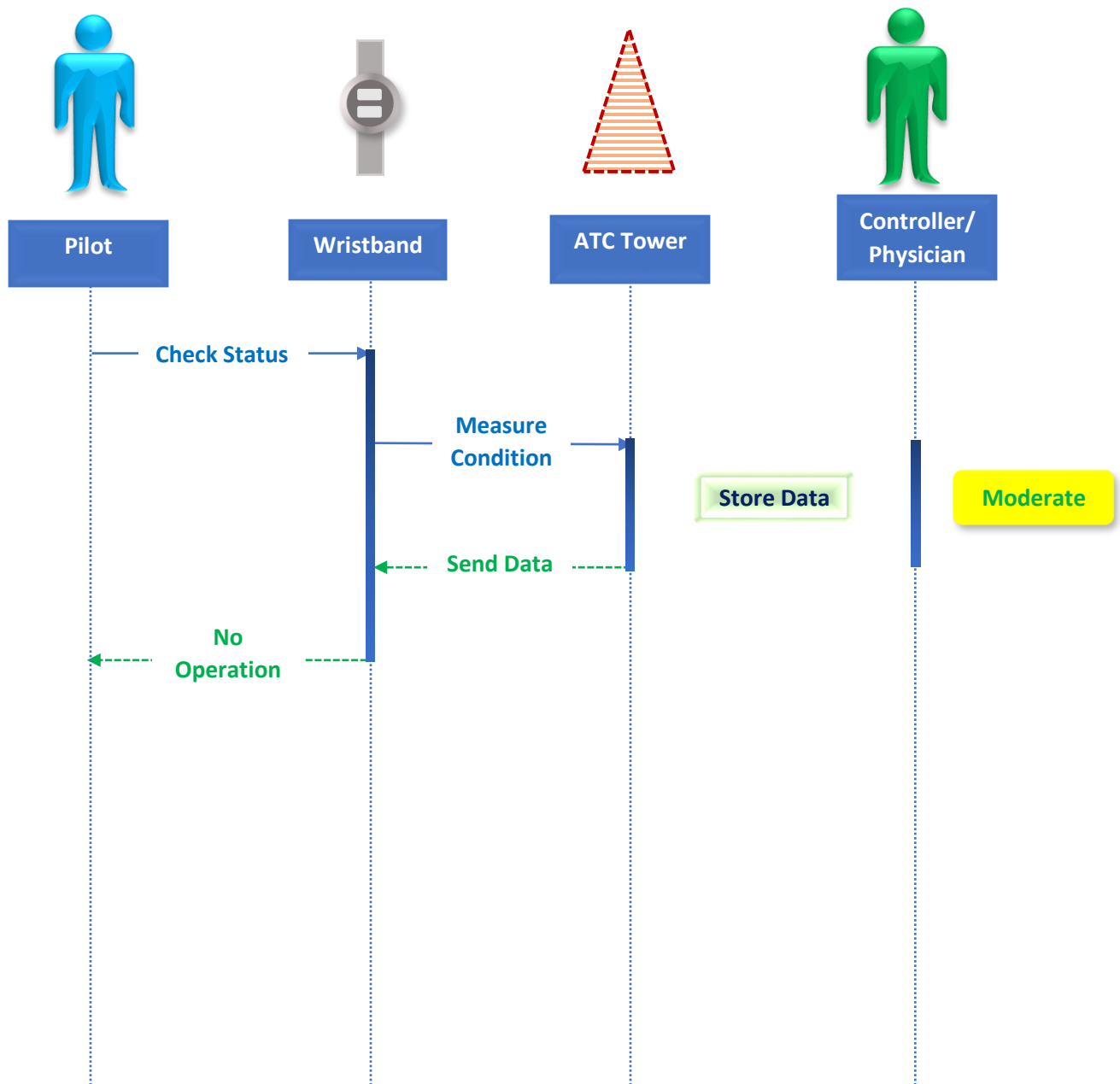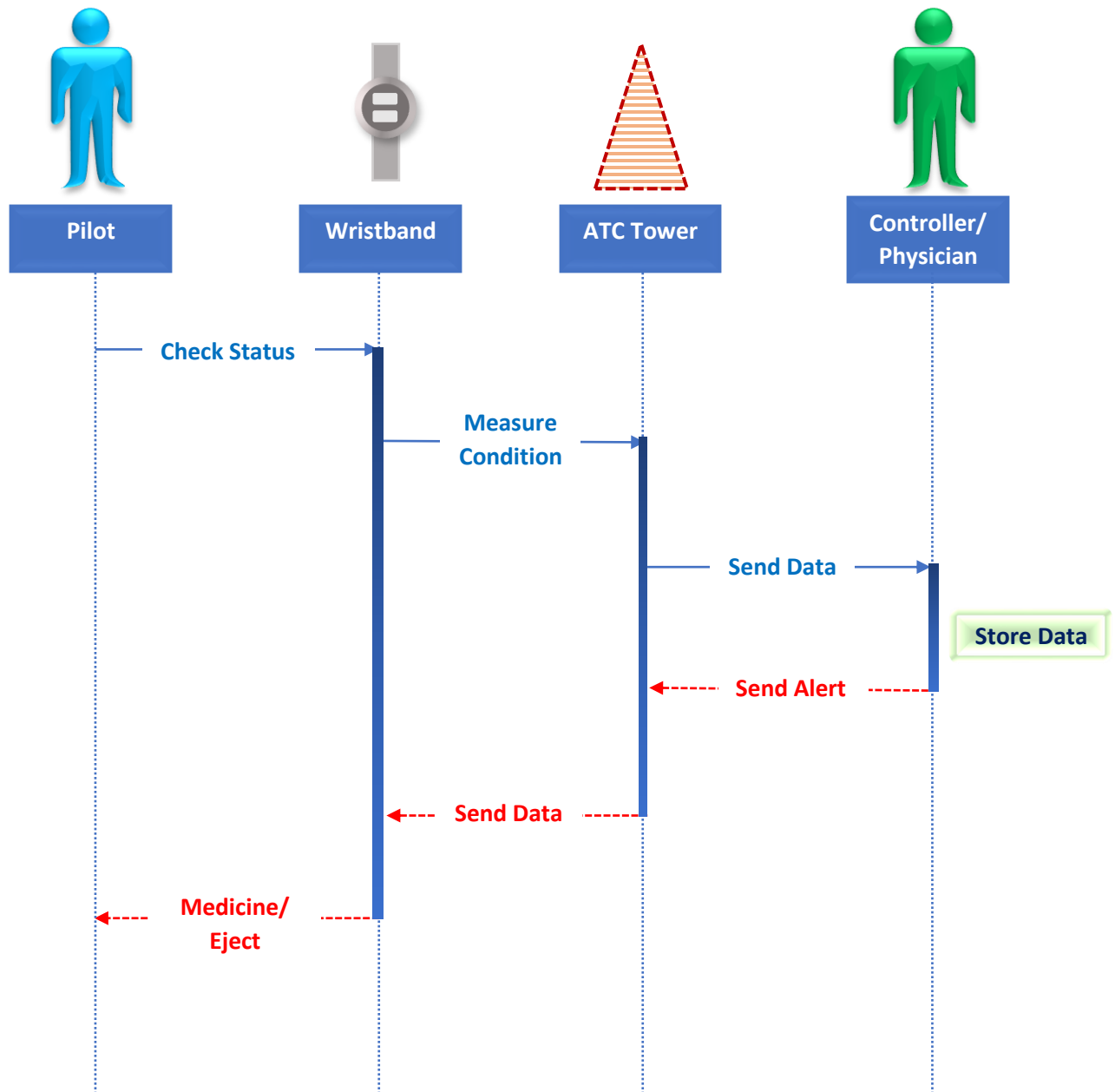
a.      **Normal Scenario**.

**b.** **Moderate Scenario.**

c. **Critical Scenario.**

## 7.4    Sequence Diagram.
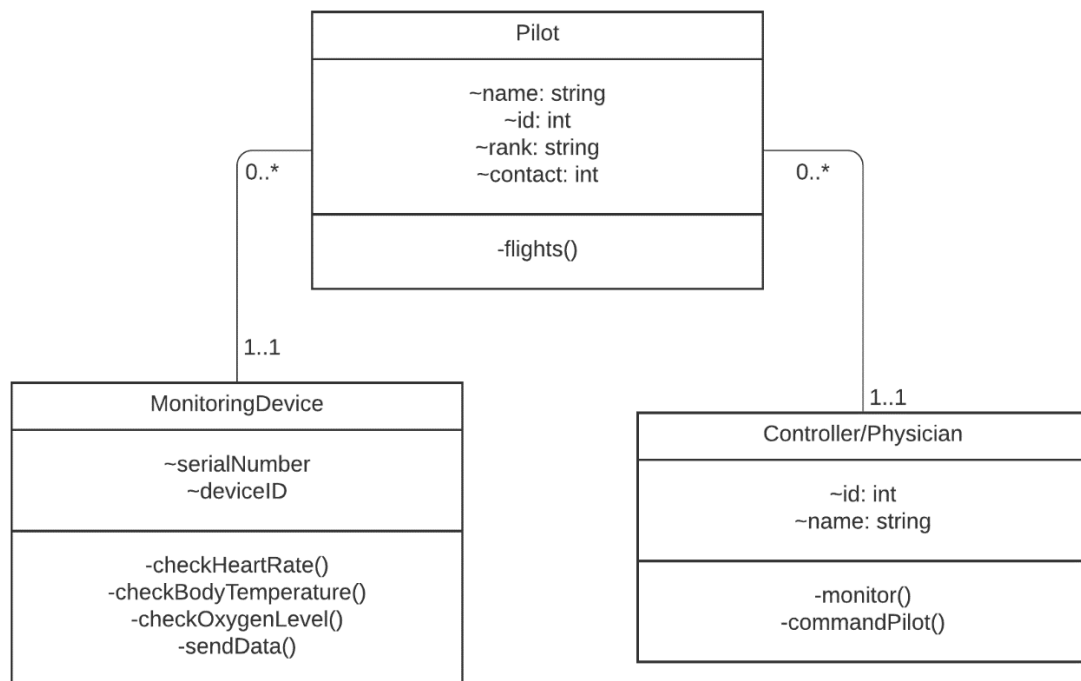
### a.    Normal Scenario.

b. <u>**Moderate Scenario**</u>.

## c.   Critical Scenerio.

## 7.5     Entity Relationship (ER) Diagram.

**Pilot**

| PK | Pilot ID |
|---|---|
| Key | First Name |
| Key | Last Name |
| Key | Rank |
| Key | Contact |

**Flight Schedule**

| PK | Pilot ID |
|---|---|
| PK | Flight ID |
| Key | Aircraft ID |
| Key | Flight TIme |
| Key | Flight Duration |
| Key | Flight Route |

**Health Record**

| PK | Pilot ID |
|---|---|
| PK | Flight ID |
| Key | Condition Type |
| Key | Heart Rate |
| Key | Oxygen Level |
| Key | Body Temperature |

## 7.6     Class Diagram.

**Pilot**

~name: string
~id: int
~rank: string
~contact: int

-flights()

0..*     0..*

1..1

**MonitoringDevice**

~serialNumber
~deviceID

-checkHeartRate()
-checkBodyTemperature()
-checkOxygenLevel()
-sendData()

1..1

**Controller/Physician**

~id: int
~name: string

-monitor()
-commandPilot()

## 08. <u>System Evolution</u>.

**8.1.** With the span of time more new dimensions will be added to our project. More sensors will be added to check the health state of the pilot more accurately.

**8.2.** The gadget will become smaller and lighter in size and weight.

**8.3.** It will work by invoice command.

**8.4.** If aircraft communication system fails, it will take over the air communication system as an alternative.

**8.5.** For aircraft system failure, it will show the way point towards the destination.

**8.6.** It will notify about the bad weather condition.

**8.7.** If pilot is puzzled, it will give direction to control the aircraft.

**8.8.** If pilot is senseless, control room will be able to execute emergency ejection through the gadget.

**8.9.** Now-a-days robots are replacing human jobs. So, in future battles will be fought by drones and aircraft will be controlled by the control room directly. No more requirement of the pilot and so no more requirement of the gadget.