CHAPTER I INTRODUCTION

I.1 Background

Indonesia is a country that has a *ring of fire* which means this country is surrounded by many active and non-active volcanoes, Indonesia has 127 volcanoes and this is the country with the highest number of mountains, of 127 volcanoes there are 64 active volcanoes (Magma Indonesia, 2021). The large number of mountains in Indonesia leads many mountain climbers who want to explore mountains in Indonesia, the climbers are variative, there are climbers come from within the country and there are also foreign tourists who come to Indonesia to climb and explore the mountains.

Climbing a mountain requires stamina and proper equipment to safely reach the top and avoid unwanted things. Unfortunately, many of the climbers do not have experience and lack of preparation for climbing, this includes physical preparation such as sufficient exercise and tools preparation for climbing, such as jackets, mountain shoes, flashlights and other necessities. This causes mountain climbers to often get involved in accidents and get lost from their path, and it could cause missing climbers, these missing climbers are also caused by several things, choosing the wrong path, and natural factors, according to statistical data 67% of climbers are missing. due to human error, 32% due to bad weather and 1% due to metaphysical events (Sony, 2021).



Figure I. 1 Accident and death statistic on the mountain

Based on data obtained from the Indonesian Mountain Guide Association (APGI), from the data on figure I.1 it can be seen that cases of climbers death on mountain are increasing year by year, and the peak is in 2019 with 19 climbers dying from 16 cases of climber accidents, the number of climbers death is more than cases of accidents that occur because in one case an accident can cause 1 or more climbers death. The total number of climbers who died from this data was 83 people.



Figure I. 2 Statistics on the causes of accident and deaths on the mountain

It can be seen from the figure I.2 that the causes of accidents and deaths of climbers on the mountain, the highest cause is hypothermia, hypothermia is a condition where the body experiences a drastic decrease in temperature, the intended temperature is below 35 degrees, where the normal human temperature is 37 degrees Celsius. The coldest temperature at the peak of Indonesia's mountains can be up to 5 degrees Celsius, plus strong winds will exacerbates hypothermia (Willy, 2019). Hypothermia sufferers are characterized by the victim feeling normal cold, body shivering, body shaking, hypothermia attacking the victim slowly so that often the victim does not realize that he has symptoms of hypothermia, the symptoms of hypothermia can also cause the victim to faint, and some also cause the victim to hallucinate to cause many dangerous things that the victim might do. The way to deal with climbers who are experiencing symptoms of hypothermia is to warm the victim using warm clothes, close the victim to a heat source (Makarim, 2022), therefore it is important that climbers

have a sufficient tools preparation to anticipate if the situation becomes more severe. colder than expected, such as rain and strong winds.

In addition to hypothermia, the second largest cause of accidents and deaths based on figure I.2 is getting lost, climbers are often not on the proper climbing route and cause the climber to get lost and disappear from the group. The search for missing climbers was carried out by the SAR team, the search took a long time, even days depending on the information and traces of the victims. One of the mountain that has history of lost climbers is Mount Gede.

Mount Gede is a tourist attraction with a high number of climbers due to its location in the Greater Jakarta area, and the relatively safe track is the reason many beginners start this hobby by climbing Mount Gede (Intan, 2021). The average number of climbers per day is 112 people with the highest number on the weekend period, and Poppy Oktadiyani as Public Relations of the Mount Gede Pangrango National Park said the number of online orders from Saturday (12/12/2020) to Sunday (12/27/2020) with 15 days there are approximately 1780 climbers (Nuri, 2020). The climbers can enter through 3 legal routes, namely, the Mount Putri route, the Cibodas route, and the Selabintana route.

Due to the large number of visitors to Mount Gede, and the absence of tools that can support climbing provided by Mount Gede Pangrango National Park, this is the cause of many cases of climbers who are lost due to getting lost died from hypothermia. In 2009 six students from the city of Sukabumi got lost since (30/06/09), until (03/07/09) they were lost for 3 days, and the Mount Gede search and rescue (SAR) team conducted a search for the victims on July 3, the sixth. The students can be found because the search and rescue team sounding the whistle and the victims responding by shouting to tell them their position.

On the same mountain in 2017, 17 students and students of Bina Nusantara University climbed Mount Gede via illegal routes, namely through the Mount Mas route, Puncak, Cisarua. With 13 male climbers and four female climbers, they have been climbing since (5/12/2016) and were reported missing on (6/12/2016), on the same day they were all evacuated by the SAR team with 1 victim died due to hypothermia and asthma.

The search for the location of the missing climbers is influenced by the amount of information obtained from the case, in the second case there were two climbers who were able to go down and ask residents for help to help their friends, that was one of the reasons why the evacuation could be done quickly.

Based on this case, this final project is developing a tool to support the climbers using a technology that can help to locate and monitor the climbers position, with the hope it can reduce victim death posibility. However, the conditions at Mount Gede is vary, some have flat tracks, some are uphill, based on temperature some are normal, and some are very extreme depending on the weather, for internet signal, many locations in Mount Gede do not have internet signal, therefore it is necessary to have a tracking device for climbers who do not use the internet and provided by the manager of tourist attractions so that the climbers can be safer. There needs to be a tool that can be used by climbers and has RFID technology with tracking feature that can locate the climbers position in order to speed up the evacuation process. RFID (Radio Frequency Identification) is a system that uses radio signals that can be used for various things, one of which is to track an object. Internet for tracking and the number of climbers that are difficult to identify, RFID has a unique serial number among other identical objects (Gondohanindijo, 2021). RFID could be used for tracking the climbers, with the system as figure I.3. Climbers quantity and position could be track by the reader that reveice the feedback from the tag, so there is history related climbers last position if there is emergency situation.



Figure I. 3 RFID system

In the case of missing climbers, efforts are needed from 2 parties, the climbers themselves to find the correct climbing route and outside parties or the SAR team to search and evacuate victims, climbers must own tools and abilities to read and determine their orientation to find and back to the main hiking trail. tool that can be used to determine the orientation of the direction is a compass, a compass will be very useful for climbers so that they can find out the orientation of their position so they can find a climbing route when they get lost, a watch also needed in mountain climbing activity, so the climbers could tell the time and could calculate their timin in reaching the check point. The existence of tools for observing the surrounding situation is very useful for climbers who are lost so they can determine which way to go looking for a hiking trail and it will be very helpful if climbers bring a map of the hiking trail so that they can always know the position and conditions around. The tool that can fulfill the demand is smart watch.

There are smart wathces that exist in the market with a lot of supporting features of mountain climbing activities such as watches, compasses, altimeters, barometers, health monitoring sensors, navigation systems. The watches with all the features that has been mentioned is having a expensive price starting from Rp. 4,800,000 to Rp. 11,599,000 depending on the brand and quality of the watch (pickybest, 2021). The price of the wathces is relatively expensive and not become priority specially for the beginner, and another product that is similar and become the reference in this research is RFID smart band in Mount Merbabu where the technology already implement and could work as its function in mount area, this product could help beginer climber because, many beginer climbers do not have appropriate climbing support equipment and only carry alternative tools and minimal preparation and it can cause climbers to get lost and get involved in accidents on the mountain. Therefore, there needs to be more attention from the managers of mountain tourist attractions so that they can prepare tools for climbers to use during climbing so that climbers also feel safe when climbing.

In this final project, researcher will focus on reducing posibility accident and death in mountain by improving mountain safety trough the development of RFID-based watches with additional features by adjusting to the important needs of mountain climbers in Mount Gede to become a suggestion for Mount Gede Pangrango National Park in providing watches to support the climbers and minimize the victim of accident and death happen in Mount Gede, the additional features are features that can support the mountain climbing activities, the RFID technology already developed in Mount Merbabu with their smart band, and it already proof that it could be used in the Mountain to locate climbers position, this technology will also be used in the proposed tool. Watches and compasses are important for climbers in order to know the time and orientation of their position in order to find a climbing route again when lost.

I.2 Alternative Solution

There are many factors that cause the problems in this final project to be complex, these problems can be described as the root of the problem so that each of these root problems can be found solutions and alternative solutions, so that the problems in this final project can be solved, writer using fishbone diagram in Figure I.4 to point the problem and causes of the problem, after that from all the causes there will be process to find alternative solution for each causes.



Figure I. 4 Fish bone diagram

Alternative solution is needed because there are more than one way to solve the problem, to find the most suitable solution for the problem writer need to compare each of alternative solutions. The alternative solution can be seen in Table I.1

No	Root of the Problem	Potential solution
1	Lack of existing product to support mountain climbing	New product design with additional features that can support mountain climbing activities
2	Mountain condition that are difficult to reach	The design of an information system to mark the location of the lost climber and make that information as an evaluation material
3	Extreme mountain nature condition	The design of an information system that inform current and forecast weather in the mountain.
4	Lack of physical preparation	Design of a website-based information system that is consist of information
5	Lack of mountain climbing knowledge	and ticket purchasing, the ticket will integrate with the product to support
6 7.	Unregistered climbers Rules are not clear	mountain climbing that are provided by mountain administrator

Table I. 1 Alternative solution

Based on the description of the root of the problem above and its alternative solutions, the chosen alternative solution is develop a new RFID based watch design with additional features that can support mountain climbing activities according to user needs, and not using internet signal. because with this alternative solution the author can apply the knowledge gained during lectures on product development in industrial engineering majority, also designing a product with features to support mountain climbing activities will help the people specially beginner to have a proper mountain climbing tools so it will reduce the potential of climber accidents that can result in death, because there are feature will help the evacuator to locate the position of the victim without using internet and heater to reduce the chance of hypothermia, also watch and compass to help the victim to orientate himself.

I.3 Problem Definition

Based on the background above, the following is the formulation of the problem related to the topic of this final project:

- 1. How to design RFID-based watches and other features based on customer needs using the QFD method?
- 2. Does the new product designs improve costumer satisfaction while climbing the mountain?

I.4 Research Objective

This final project aims to:

- a. Designing RFID-based watches and other according to the user's need statements using the QFD method
- **b.** Improve customer satisfaction on mountain climbing activities with new product design that comply the customer need statement

I.5 Benefit of Research

Benefit of this final project:

- 1. For users, this final project is useful for designing climbing support tools according to user needs
- 2. For researchers, this final project is useful in implementing methods in an effort to design a product
- 3. This final project is useful for other developments related to RFID technology and mountain climbing tool

I.6 Writing Systematics

The following is the Systematics of writing this research:

• Chapter I Introduction

This chapter contains background problems that causes accident and death in the mountain, especially for mountain climbing. This chapter also contains problem formulation, research objectives, research benefits, and writing systematics.

• Chapter II Literature Review

This chapter contains references to a literature review from previous studies relating to the problems that exist in this research, and the reasons for choosing the theory are also included in this chapter.

Chapter III Problem Solving Methodology

This chapter describes the research steps listed in detail as a guide for data collection and processing in this study.

Chapter IV Integrated System Design

This chapter explains how to collect data, namely by means of literature studies and field studies. The data in this study were divided into two groups, namely primary and secondary. After the data is obtained, then data processing is carried out according to the method used. In addition, all activities in the context of designing an integrated system for problemsolving are also written in this chapter. Activities carried out can be in the form of data collection and processing, data testing, and solution design.

• Chapter V Result Analysis and Evaluation

In this chapter, an analysis of the design data for the proposed tool design is carried out, especially in terms of ergonomics according to the method used.

• Chapter VI Conclusion and Suggestion

In this chapter, a comparison is made between the existing tools and the proposed tools so that a conclusion can be drawn as a form of advice to companies that are the object of study.