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Proposals on the Development of Life-saving Signals due to Disasters such as Mountain Accidents and Safety Accidents while Hiking

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Abstract

Purpose: Currently, the number of mountain accidents and safety accidents during hiking is increasing due to the quantitative expansion of the hiking population after the spread of the coronavirus (COVID-19), and the frequency of mountain accidents and safety accidents while hiking alone is increasing. Also, it is a situation that hiking is spreading in general like a trend among young people. The number of novice hikers visiting the mountain is increasing, and mountain accidents and safety accidents are increasing due to solo hiking. Therefore, the purpose of this paper is to reduce the increasing number of mountain safety accidents and to quickly locate and rescue valuable lives when mountain accidents and safety accidents occur during hiking. The research method is to provide a guide for safe hiking and to manufacture and activate a rescue device that enables rapid location by installing a rescue device in an environment where it is difficult to quickly rescue the injured due to difficulty in locating them. Therefore, the purpose of this study is to provide basic data that can help rescues by proposing a signal system method that allows rescuers to easily locate and save lives in the event of mountain accidents and safety accidents

Keywords : A mountain accident, mountain climbing, a distress accident, mountain activity, a mountainous terrain

JEL Classification Code : R40, H53, D74, Q50, I18

1. Introduction

The frequency and intensity of mountain accidents and safety accidents during hiking are gradually increasing due to the increase in the number of people and solo hiking due to quantitative expansion of the hiking population. In

addition, hiking, which used to be a hobby for middle-aged people in the past, is increasing like a trend among young people. The number of novice hikers visiting the mountain is increasing, and mountain accidents and safety accidents are increasing due to solo hiking and rapid changes in the environment. When mountain accidents and safety

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accidents occur during hiking, rescue is difficult and time-consuming, and in the worst case, it is directly linked to disappearances and death accidents. According to the National Fire Agency's Statistical Yearbook published in 2023, the number of mountain accidents in 2022 was 10,389, with 28 mountain accidents a day. When an accident occurs during hiking, the biggest problem is that it is difficult to accurately identify the location of the accident, and due to the nature of hiking, it is difficult to deliver characteristic buildings or signs to rescuers. This is because it is impossible to accurately explain my current location in words during hiking, and even if you explain the same path, the reporter and the rescuer who receive it may have different thoughts. In the event of mountain accidents and safety accidents while hiking, accurate location delivery and 119 reporting are of paramount importance. The purpose of this study is to provide basic data to minimize casualties by helping mountain rescuers to save lives by proposing a signal system and equipment that allows rescuers to easily locate and save lives in the event of mountain accidents and safety accidents.

2. Literature Review

2.1. Characteristics and Causes and Types of Mountain Safety Accidents

Mountain and sports also have a significant impact on people's mental and physical health, so in the end, safety management must be accompanied to improve their quality of life and lead a happy life. Mountain distress accidents frequently occur due to the increase in the mountainous population, and due to the nature of the mountainous terrain, mountain access by medical support teams is often impossible, leading to human damage. According to the National Fire Agency's annual report, among all types of accidents in 2022, mountain accidents ranked 8th in the order of fire, traffic, location, elevator, human life, suicide, and mountain.

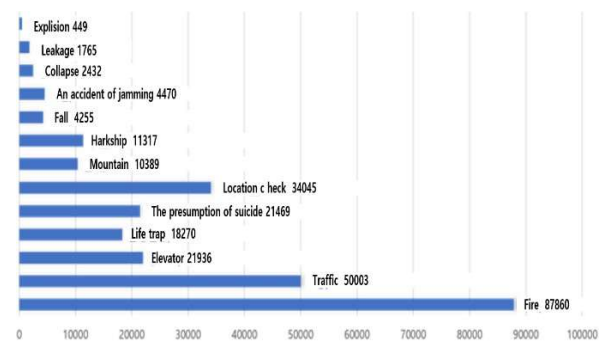


Figure 1: Number of rescues in 2022 (Type of accident)

2.1.1. Characteristics and Cause of Mountain Safety Accidents

According to the international news release and Infopower Mountain Accident Location Identification Method, the characteristics and causes of mountain safety accidents are as follows

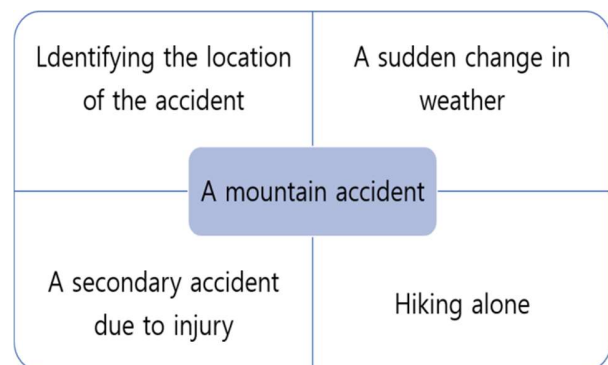


Figure 2: Characteristics of Mountain Accidents

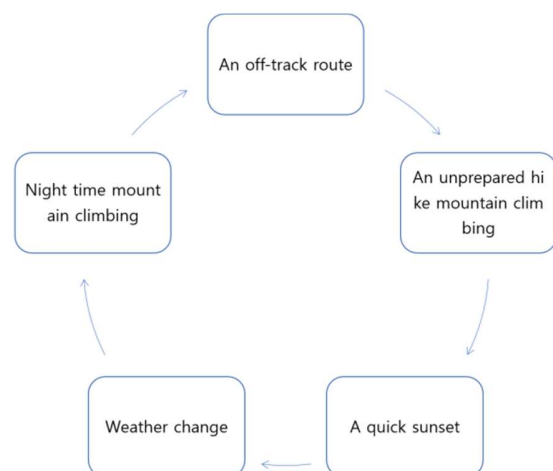


Figure 3: Cause of mountain accident

Looking at the characteristics and causes of mountain accidents, weather changes, which are environmental factors, are commonly investigated. It is necessary to prepare for hiking suitable for all four seasons according to weather conditions such as snowfall, rainfall, and temperature. Features and causes have a correlation, and special attention is required when hiking.

2.1.2. Types of personal (artificial) material (natural) safety accidents in safety accidents

Mountain safety accidents refer to accidents that occur due to carelessness or lack of safety education in the process of climbing a mountain, and accident factors appear as natural and artificial factors (Park Tae-won, 2015). In mountain activities, accidents are caused by natural and artificial factors of the climber. Natural factors are lightning (fallen lightning), sunstroke, heatstroke, darkness and fog, heavy rain, torrential flow, rain, wind, falling rocks, landslides, and avalanches. Artificial factors are said to be excessive hiking, lack of hiking and climbing skills, lack of experience knowledge, and lack of necessary equipment preparation and information due to carelessness (Korea Mountain Ak Federation, 2016).

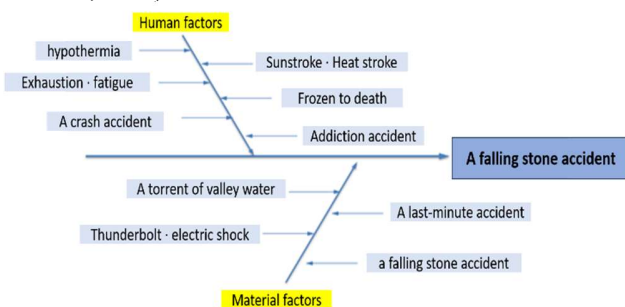


Figure 4: Human and Physical Characteristics of Mountain Safety Accidents

Safety Accident Human Safety Accident

The types of human accidents caused by human behavior in mountain safety accidents are shown in [Table 1] and can ultimately lead to death, so special significance is required when hiking.

Table 1: Types of human accidents

Types of human factors	Main cause	Safety measures
hypothermia	bad weather and exhaustion	Avoid getting too wet when hiking

exhaustion and fatigue	Walking too much or hiking with heavy loads	Measures for Hypothermia in Bad Weather under Exhaustion
a crash accident	A natural factor, an artificial factor	human and material measures
sunstroke and heatstroke	Exposure to long periods of sunlight in summer	Hiking slowly so that the body can adapt. Wear thin and loose clothes and a wide-brimmed hat, and drink plenty of salt and moisture from time to time.
Frozen to death	When winter clothes, shoes, gloves, etc. are wet and frozen	Tightening or tightening clothes, gloves, and shoes should be avoided because they interfere with blood circulation and are prone to frostbite.
Addiction accident	Distinguish between plants and mushrooms for food	You should never eat anything

Material Safety Accident of Safety Accident

[Table 2] shows physical disasters that can cause accidents due to environmental factors of mountain safety accidents, and caution is required when hiking.

Table 2: Types of material thought

Types of material factors	main cause	safety measures
a torrent of valley water	It's prohibited to go to the valley when it rains	When the valley water rises and turns into a torrent, you should never cross it.
lightning and electric shock	Umbrellas, sticks, etc. are the role of attracting lightning if they are above the head	Evacuate quickly to low and safe places during thunderstorms
a last-minute accident	Predict risks such as avalanches, landslides, falls, and falls	Never use hot air balloons in sleeping spaces and hours
a falling stone accident	Be careful when passing under rock walls and areas where rocks occur	Always wear a safety helmet when climbing rock walls, and be careful of ropes when climbing and descending where there is a high risk of falling rocks

2.1.3. Status of Mountain Safety Accident Statistics

Statistics from the National Fire Agency have been operating the rescue life safety activity information system in the new system since March 22, and in the previous system, the number of rescue cases was included not only in the jurisdiction but also in the support dispatch, but in the current system, the ratio of rescue cases to the number of dispatches

is lower than usual.

The status of the number of rescue workers by year is Fig. 5, the status of rescue personnel by year is Fig. 6, and the National Fire Agency Statistical Yearbook (2023) is referred to.

Status of the number of rescues by year

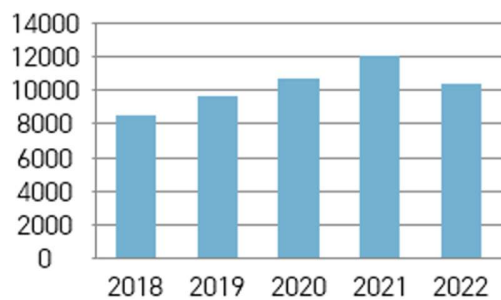


Figure 5: Status of the number of rescues by year

Status of rescuers by year

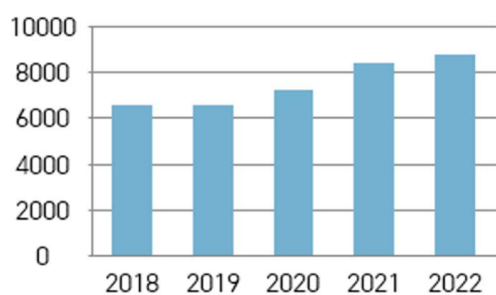


Figure 6: Status of rescuers by year

Analyzing the structure status by year, it gradually increased to 9,502 cases in 2018, rapidly increased to 12,040 cases in 2021, and decreased to 10,389 cases in 2022.

According to the analysis of the number of rescuers by year, it gradually increased to 6,559 in 2018 and was analyzed as 8,706 in 2022]

Number of mountain accidents and personnel status by region

The status of the number of rescue workers by year is Fig. 7, the status of rescue personnel by year is Fig. 8, and the National Fire Agency Statistical Yearbook (2023) is referred to.

Number of rescue workers from mountain accidents



Figure 7: Number of mountain accidents and number of rescuers

According to the analysis of the number of rescue cases and the number of rescue personnel by accident type in 2022, safety accidents were found in the order of Gyeonggi (South and North), Seoul, Gangwon, Gyeongnam, and Gyeongbuk.

3. Research Methods and Materials

3.1. Necessity of developing equipment for saving lives

In addition to the difficulty of identifying the exact location of the accident due to the nature of the mountainous terrain in the event of an emergency situation such as a safety accident or distress while hiking, and in some cases, it is impossible to report an accident or request rescue on its own due to an accident such as a fall, which leads to unnecessary life damage due to the inability to quickly perform rescue activities. To solve the problems of the existing emergency rescue systems and methods, it is designed to detect safety accidents or distress during various activities such as hiking and automatically transmit information on the current location along with rescue signals to the agency in charge. Therefore, the device is configured to perform a process of collecting user location information including the user's location, movement path, and duration without movement, including a global position system (GPS) module to check the user's current location. In addition, the detection sensor is configured to perform a process of collecting posture information including the occurrence of a sudden movement including a user's fall or fall, and the duration of the sudden movement, including a gyro sensor to detect the user's posture or condition. In addition, the rescue signal transmitter is configured to include a wireless

communication module to transmit the current location and rescue request to a predetermined contact when various accidents occur according to a predetermined setting. The light-emitting signal generator includes a light-emitting means that processes light-emitting signals that generate light of a specific shape or color or transmit a specific message through blinking, including a number of LEDs for emitting light to inform the user's current location. The audio signal generator is configured to perform a process of reproducing a preset sound source or voice or sound effect selected by the user, including a speaker to inform the user's current location through sound. It is configured to inform the exact location of the rescue target through other structural signal generators and location information collection.

3.2. Proposals of signals and equipment for saving lives

When there is a hiking plan, it is important to inform the surroundings of the hiking plan and to secure an emergency contact network to contact them in case of an emergency. The most important thing when requesting rescue is an accurate description of the accident location. It is also important to be familiar with the rescue request signal in case of an emergency in a place where there is no cell phone or the phone does not go off. In the signal method, there are rescue signal methods by sound, light, and smoke, but in this paper, there is a risk such as fire, so the smoke signal method should be ignored.

When it is difficult to send a rescue signal due to an accident such as a fall when climbing a mountain, we propose a device that can automatically notify and transmit light after a certain period of time.

It is also possible to install a mobile phone application, but it is not suitable because the mobile phone battery is consumed early in mountainous areas. The patent application for this product was completed on August 29, 2024, and it was named a personal portable multifunctional structural signal generator.

3.2.1. Usability of the device

It can be easily operated so that not only mountain climbers but also the general public can use it. In particular, the device, which is expected to be highly utilized by elderly people such as dementia, operates the device, setting the hiking time in the timer when hiking, and automatically operating the device after a certain period of time. Also, after hiking, you should stop operating the device.

3.2.2. Durability of equipment

It should be made of a solid and light material to withstand shocks caused by accidents during hiking, and the battery should be operated for at least seven weeks.

3.2.3. Configuration of the device

Compass, timer, speaker, light emitting lamp, battery charging button, check remaining battery capacity button, etc. are required.

3.2.4. Example model of the instrument

As shown in the figure on the right, each operating key can be distinguished by color, and it must be manufactured and configured so that anyone can operate easily.



Figure 7: Model diagram of rescue equipment

4. Results and Discussion

4.1. Measures to Prevent General Mountain Safety Accidents

4.1.1. 119 tips for reporting mountain safety accidents

- Kakao Maps delivers GPS information text using Naver Maps
- Install an application dedicated to hiking, such as the mountain trail spring, to deliver latitude and longitude information
- Check the sign of the mountain location near the hiking trail and deliver it
- You don't move around carelessly after reporting, and you build up your physical strength

4.1.2. preparation for mountain accidents

- Climb more than two people as much as possible
- travel by hiking trail
- Get weather information before hiking starts
- Bring emergency snacks and auxiliary batteries
- Installation of the necessary application for hiking (GPS on)
- Let your family know your destination in advance
- Preparation of thermal protection measures
- Emergency Preparedness

5. Conclusions

As a result of the COVID-19 pandemic, mountain climbing, which used to be the exclusive property of the middle-aged, has become a hobby of various age groups that the MZ generation enjoys together, and related mountain safety accidents are gradually increasing. Therefore, as part of the countermeasures to reduce mountain safety accidents, I would like to propose the following.

First, it is difficult to identify the location of the person in distress, so it is difficult to be rescued and gradually reduces the situation that leads to death due to hypothermia or a lot of bleeding,

Second, we manufacture rescue devices to make life-saving easier and prevent mountain safety accidents,

Third, anyone, regardless of age group, should be able to operate easily,

Fourth, it is inexpensive and easy for anyone to install, so it must be utilized, simple, and not high in price,

Sixth, it is difficult to determine the weather and the location of the person in distress for several days after the distress, so the battery maintenance period should be at least 7 days.

Therefore, if this product has been put to practical use and is inevitably in distress during hiking, it is hoped that it will be institutionalized so that each team can install it to facilitate location and structure. Most importantly, as mentioned in the text, the information necessary for hiking and thorough preparation for safety accidents cannot be overemphasized. Therefore, the priority is to prevent safety accidents from occurring by thorough preparation for safety accidents and reporting guidelines. Nevertheless, mountain safety accidents are expected to occur due to natural disasters or abnormal climates. Therefore, we hope that you will be able to live an accident-free hobby by always making every effort to mountain safety for your health with thorough preparation and posture.

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Acknowledgements

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