‘Under Pressure’: a Project for the Prevention of Crowd Crush

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1. The Seriousness of the Problem

Crowd crush is an accident that occurs when many people are concentrated on a narrow terrain and can cause a large-scale catastrophe that can lead to many. Recently, the Itaewon crowd crush occurred in Korea, and many other crowd crushes occurred worldwide. Representatively, there is a case in which many people gather up in large numbers for religious events in India or the Middle East.

2. The Cause of the Problem

According to foreign media and overseas experts during the 2022 Itaewon Crowd Crush, the lack of control and monitoring of the crowd was cited as the biggest cause of the disaster. According to the construction law, the road should be 4m wide, which is the appropriate width for pedestrians and cars, but the width of the street where the accident occurred was less than 4m, and the unauthorized extension of the structure hindered people's movements. Also, the main cause of death in the accident was cardiac arrest caused by traumatic asphyxia.

3. Considerable Solution

The "Under Pressure" living lab experiment is a comprehensive solution to prevent crowd crushes, pressure sensors, space analysis, and anti-choking airbags are all composed of one package. This integrated package provides a way to analyze narrow spaces that are likely to cause crowd crushes in advance, monitor them in real time, and respond immediately in the event of an accident.

expected effects

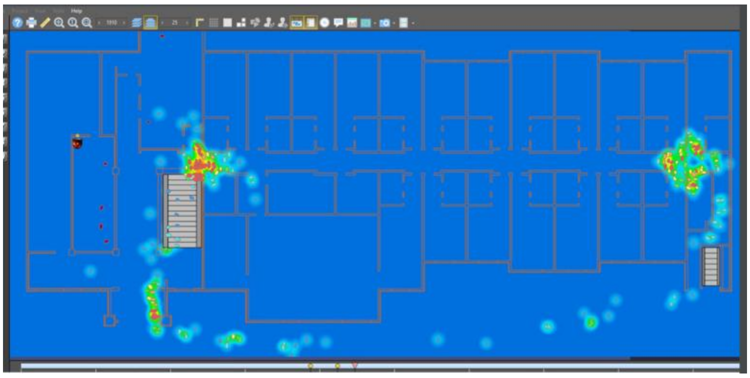
This integrated crowd crush prevention package can significantly reduce the likelihood of accidents in crowded situations such as large-scale events, performances, and festivals. Dangerous areas can be identified in advance through spatial analysis. Immediate response and damage minimization are possible through real-time monitoring and asphyxiation prevention airbags. This will create a safer environment and contribute to reducing casualties caused by crowd crushes.

3-1. Accident Prevention using Spatial Analysis

Several characteristics are observed at the site of the crowd crush. Typical examples are lopsided terrain, narrow width, and bottleneck phenomenon. Intensive observation of areas where crowd events are scheduled to appear can detect and respond to signs of the occurrence of a crowd crush beforehand.

Predicting accident risk and sharing risk maps

Through 3D scanning, the topography throughout the place where the event is scheduled to is converted into data. This data includes 3D modeling of each zone, the slope width of the



digitized passageway, and the size of the expected crowd. By evaluating the risk of accidents by zone based on the corresponding figure, a 'risk map' colored on the map is sent to the administrator so that the crowd can recognize the risk. In addition, an accident response system is established by selecting and intensively monitoring the areas with the highest accident risks.

Establishment of live monitoring and response system

An accident response system is established by installing pressure sensors on the wall and the ground preferentially in the high-risk area selected in the above process. The pressure sensor detects the magnitude and area of the pressure applied to the

wall and the ground which notifies dangerous situations such as a pedestrian who is about to trip over, or an excessive pressure applied to a certain area. In the event of a dangerous situation, an alarm is transmitted to nearby fire stations, police stations, and emergency rooms to alert them for immediate response.

3-2. Wearable airbags

We propose a 'wearable airbag' as an innovative solution to minimize death due to traumatic asphyxiation in a crowd crush, which is the main cause of death in a crowd crush. If you fall or are under pressure in a large crowd, it may become difficult to breathe, leading to asphyxiation. To prevent this, we will take inspiration from the 'wearable airbag' developed to prevent asphyxiation of infants and toddlers during sleep and apply it to situations of crowd crushes.

Advanced functions of the airbag for Adults: Designed to reflect the physical characteristics of adults and requirements in crowded situations while maintaining the advantages of existing functions of the airbag for infants and toddlers

1. Size and Adaptability Adjustment: Considering the various body sizes and body types of adults, adjustable straps and fasteners can be used to fit various body types. The size and volume of the airbag are also enlarged to sufficiently protect the chest of an adult.

2. Durability and material improvements: Same for infants and toddlers, it maintains light weight and ventilation so that it does not feel uncomfortable even when worn for a long time. It is made of a material that does not get torn or ripped easily.

principle of operation

1. Pressure detection and air injection: The worn airbag detects when pressure is applied to the abdomen and injects air into the airbag on the chest. Through this, it is possible to prevent suffocation by securing the user's breathing space.

2. Smart Connections: The airbag system connects to the user's smartphone via Bluetooth. When an emergency is detected, it automatically calls safety control agencies such as police stations and fire departments for immediate help.

expected effects

The wearable airbag is a device that can greatly increase an individual's chances of survival in a crowded situation. It is expected to play an important role in reducing the number of deaths in the event of a crowd crush by detecting and responding quickly to the risk of suffocation. In addition, it enables rapid emergency response by automatically sending out rescue requests in emergency situations. The device can be used in a variety of crowded situations such as large-scale events, performances, and festivals, and will contribute to minimizing damage in the event of an accident. The experimental introduction and testing of wearable airbags will open new possibilities for the prevention of crowd crushes, thereby creating a safer society.

4. Experimental plan

Place selection

The solution is presented above can be utilized in many crowded situations regardless of specific locations. There are places such as concert halls, public transportations such as buses and subways

The place that is expected to attract most people in the Wonju is the Wonju Sports Complex.

The experiment will be conducted at the Psy Heumbpeok(Soaking) Show, which will be held on June 29 at Wonju Sports

Complex. It will be conducted to 100 people who are in front of the fence at the concert.

Budget

- Program license fee: 7.63 million won (5.100 EU)
- Airbag Price: 15 million won (150,000 won x 100)
- Pressure sensor price: 12.5 million won
- Total: 35.13 million won:

Experiment content

1. Geographic Analysis: A 3D map will be drawn by taking a full shot with a drone and specify the hazard level for each section. Making the risk interval predictable proceeds in the form of guessing from statistical data and data from existing events. It is expected to gradually become complete by the statistics.
2. Sensor Installation: The sensor will be installed in a specific section and airbags will be distributed to the people in the section.
3. Monitoring: Experiments will allow concert crews to immediately contact the police and fire departments in case of excessive crowds or dangerous conditions.

5. Expected Experimental Results

It is expected that the rate of safety accidents will be greatly reduced by preventing a certain degree of density and preventing crowd crush. In addition to concert halls, high effects can be expected in various places where unexpected situations can occur, such as buses, subways, and downtown areas. In addition, the airbags will be used as a safety device to minimize damage in case of similar situations.

6. Conclusion

The "Under Pressure" Living Lab experiment is expected to achieve the goal of “Sustainable Cities and Communities" among SDGs by introducing various innovative approaches to prevent crowd crushes. If this experiment plan is successfully carried out, these systems will be applicable not only to various large-scale events but also to all sorts of crowded situations. It can greatly contribute to the prevention of crowd crushes not only in Korea but also around the world and will ultimately play an important role in building a safe and resilient city. Therefore, the 'Under Pressure' Living Lab experiment plan is an innovative approach that can greatly contribute to the achievement of the SDGs goal, and it is expected that it will be able to solve the problem of building a safe and resilient city at the global level.