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Sprinkler Bed for Deaf

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Abstract:
This study was conducted to produce an on-the-bed fire safety system used by students with hearing-impaired in the hostel of Politeknik Ibrahim Sultan, Johor Malaysia. This study also aims to find the best approach in giving fire warnings to hearing-impaired students at the same time while fire warnings are given to the normal students. Thus, this system will be integrated with the main emergency systems available in hostel buildings. The fire safety system developed is using a sprinkler system that aims to wake and alert a hearing-impaired student during a fire. In this way, they will be instantaneously aware of the fire and can indirectly help reduce the risk of death for the aforementioned student during the fire. The safety system product was produced and tested in the workshop to ensure that this product can function in a proper manner.

Keywords: *sprinkler bed, fire safety system, student with hearing impairment*

1. Introduction

According to Bryan (1995), fire warnings are often marked by confusion, ambiguity or panic. The warning mechanism being produced to provide attention to the occupants in the hostel of Politeknik Ibrahim Sultan with the aim of conveying relevant information and allowing its occupants to commence the evacuation process is the main goal in the field of fire protection. However, the provision of warning mechanisms that can alert everyone regardless of their condition or level of awareness and vigilance is still difficult as the disabled (deaf) population possess a high risk of sustaining an injury or loss of life when a fire breaks out. This is due to the fact that they are not able to hear the warning issued by a typical emergency alarm device. According to the Fire Statistics Department Year 2018 by the Malaysian Fire and Rescue Department, for the sole month of January a total of 1794 fire calls were received, nationwide. Of that amount, a total of 410 were fire cases involving buildings and its assets with an estimated loss of RM 85 168 127.20. In addition, in the period of January 2018 alone, it claimed a total of 5 lives while 41 people were injured.

These statistics indicate that fires not only cost lives but also properties. Advances in technology have proven to produce a variety of equipment that can prevent fires and reduce incidents that can cost lives during a fire. "Out of about 10,000 schools nationwide, only over 1,000 are disabled-friendly (Deputy Minister of Education, Teo Nie Ching, 2018). The Centers for Disease Control (CDC) United States has identified six groups at risk for fire safety namely visual impairment, hearing-impaired and severe hearing loss, college students, children, the elderly, people with disabilities, dormitory workers, rural residents and the urban population [CDC Fact 5, 2006].

Thus, in order to address this problem, this study was conducted to find the best approach in providing fire warnings to the hearing-impaired students. Researchers have developed a security system being equipped to a bed. In order to ensure that deaf students receive fire warnings simultaneously with normal students, the above-mentioned system will be integrated with the main emergency system. Accordingly, they will be sensitive to warnings, instantaneously. Hence, this Sprinkler Bed for Deaf will help improve the safety of hearing-impaired students at Politeknik Ibrahim Sultan and able to indirectly help reduce the risk of death during a fire for the aforementioned group.

2. Problem Statement

Researchers have identified several problems faced by hearing-impaired students living in the Politeknik Ibrahim Sultan hostel, particularly in the Hi-Tech and Info-Tech blocks. Among the problems commonly faced is that they find it difficult to get information quickly because it is natural for those with hearing problems to require a different way of communication with normal students. Hearing impairment causes a person to become a stranger in this world. They become isolated due to what being said is not understood or misinterpreted. They may also involved in accidents or job losses (Myhealth Ministry of Health Malaysia, 2016). Even more depressing is when important information such as fire alarm bells cannot be heard by them. Speech problems will also be an obstacle in the process of delivering these fire warnings quickly to them. Hence, the above-mentioned circumstance will put the hearing-impaired students to be more at risk as casualties compared to normal students. Researchers are also aware of the issue that has caused casualties from the disabled, namely a woman with a mute and hearing-impaired disability who was caught in a fire at a restaurant in Jalan Gajah Mati Kota Bharu Kelantan in December 2020 (Berita Harian, 2018).

3. Objectives

i. To produce a security system to warn hearing-impaired students during fire emergencies.
ii. To reduce the risk of accidents during a fire to the hearing-impaired students.
iii. To increase the rate of safety for hearing-impaired students during fires.

4. Literature Review

According to the World Health Organization (WHO, 2011), students with disabilities can be defined as individuals with physical, mental, visual or hearing impairments. In addition, students with disabilities are also defined as individuals who are unable to determine some of their own needs or are unable to fully live in a society due to a physical or mental deficiency and require assistance from others in order to continue their lives. The Department of Social Welfare has categorized seven types of disabilities, namely hearing impairment, visual impairment, physical disability, speech impairment, learning disabilities, mental disability and various disabilities.

Among the disabled who inherited higher education at Politeknik Ibrahim Sultan, Pasir Gudang are the hearing and speech disabled. These students have problems interacting even with each other. They are only able to speak in sign language, hence the information they want to convey is slightly slower compared to normal students. The National Fire Protection Association (NFPA) reports that from previous studies it has found that strobe lights are less effective in waking and alerting most people including those with good hearing (Bowman SK, Jamieson DG, Ogilvie RD, 1995), hearing problems (Bruck D, Thomas I., 2009), and deaf or severe hearing problems (Du Bois J, Ashley E, Klassen M, Roby R, 2005). In June 2009, the NFPA mandated that tactile alarms such as pillows or vibrating beds should be installed in places for those with hearing problems or deafness (NFPA 72: National Fire Alarm and Signaling Code, 2010 edition).

Fire alarms - a common fire warning method for fire incidents - unfortunately do not evacuate immediately. More than 2/3 of those injured and half of those who were killed in non-residential buildings require injury and death prevention through evacuation but are still tied to activities that delay their own safety (Kuligowski, 2013; Proulx & Pineau, 1996 in Le, A. (2020). Although there are several fire detection tools or systems, this Sprinkler Bed for Deaf innovation product is expected to be one of the innovative products that can be utilized as an option in helping to reduce accidents due to fire.

5. Methodology

Sprinkler Bed will go through a process such as:

i. Coding / Programming

The programming for the Arduino we use is Arduino IDE software. IDE is the acronym for Integrated Development Environment.

ii. Circuit Installation

In the installation of this circuit, the components used must be new and undamaged. Researchers have connected wiring for the pump, Arduino and other components in one circuit. The next step, the researchers have tested the circuit to see if it functions or otherwise. Finally, upon testing, researchers found that the circuit worked well.

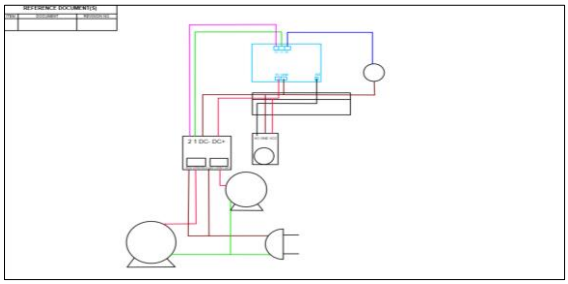

Figure 1: Sprinkler Bed for Deaf circuit diagram.

iii. Circuit installation on the bed

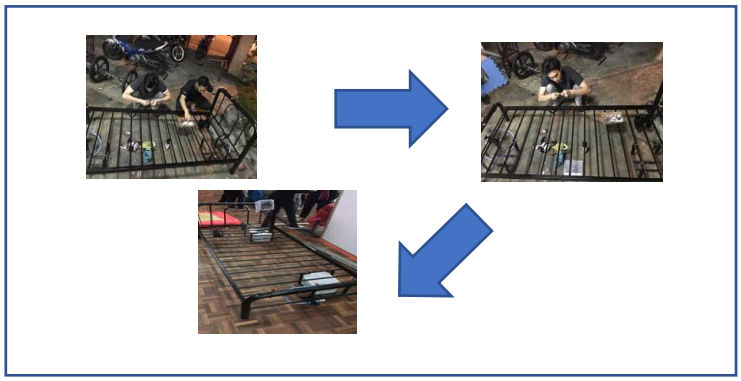

Figure 2: Diagram of the circuit assembly process for bed

6. Findings of the Study

Sprinkler Bed for Deaf is a product of security system innovation to warn hearing-impaired students during fire emergencies. In addition, to ensure the safety of hearing-impaired students during the fire is guaranteed. A good product is a product that utilizes low cost but has high value and quality.

6. Recommendation

There are several suggestions for improving the impact of vibrations on the bed. This is because this bed can also be used by normal people, those with hearing-impaired disabilities and the elderly. Furthermore, this Sprinkler Bed for Deaf can also be equipped with a lamp and in the event of a trace of smoke or fire, the lamp will lit. Indirectly, this situation can wake up the students more quickly. In addition, the research proposal for this Sprinkler Bed for Deaf could be improved in line with the technology in the future. Thus, this project can provide many benefits if given a place in technology development. Indirectly, the hearing-impaired can reap benefits while improving their quality of life.

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