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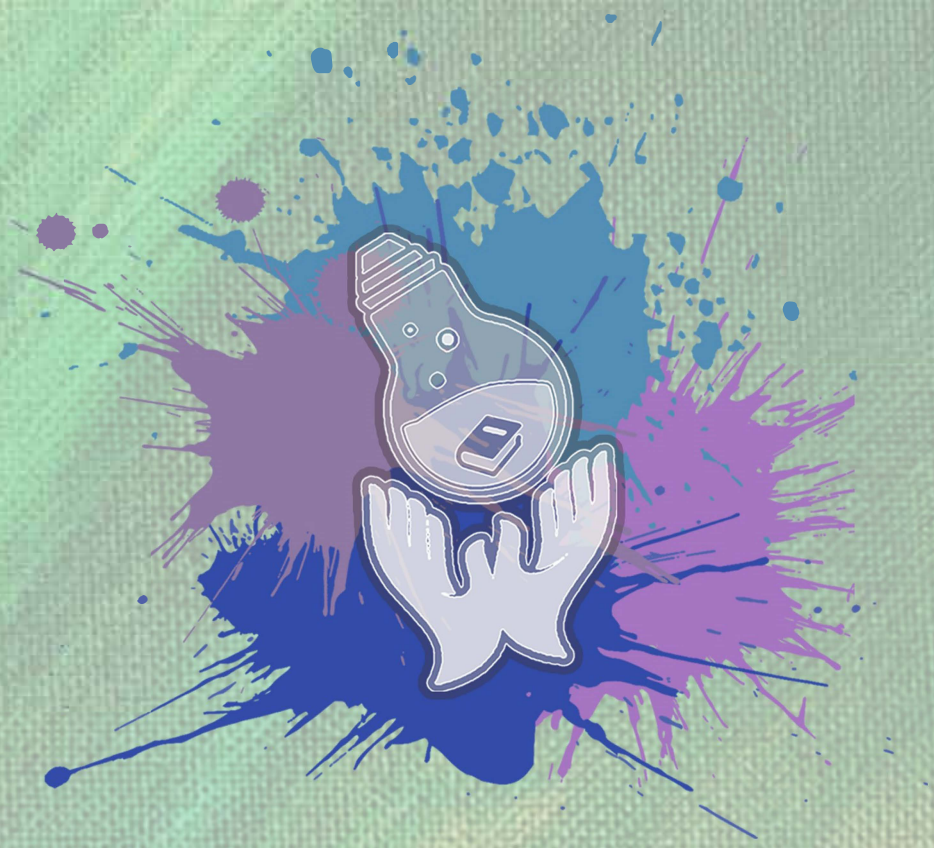
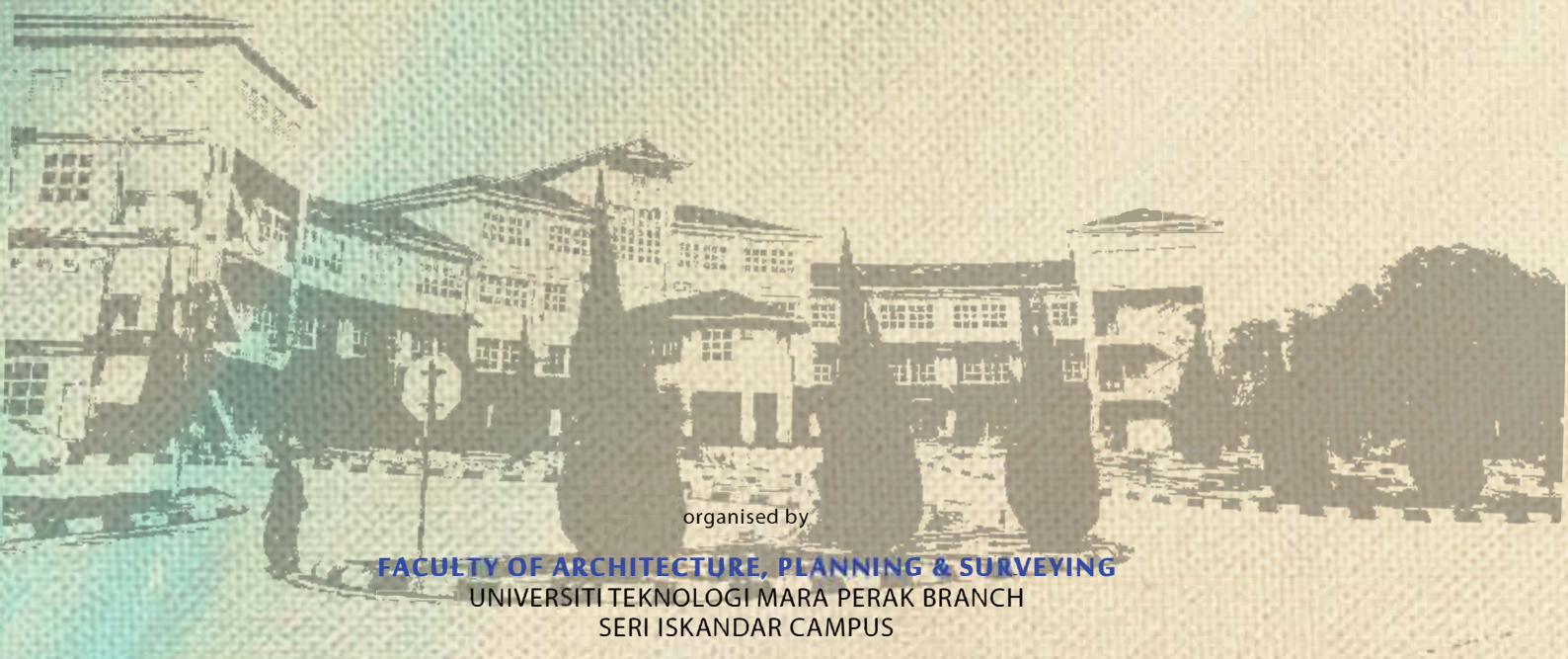
2019



4th UNDERGRADUATE SEMINAR 2019

BUILT ENVIRONMENT & TECHNOLOGY

e-PROCEEDING
eISBN-978-967-5741-97-5



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AUTOMATED SAFETY CUSHION FOR HIGH-RISE BUILDING

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Abstract:
The rapidly development of high-rise projects has leaded to the rise of fatalities and accidents. Most of the construction workers are frequently exposed to various types of injury such as falling from heights. As a result of uncertain and harmful nature, accidents on construction usually happen and cause lots of negative consequences, such as absenteeism and project delays. As a result, automated safety cushion is proposed to be applied in construction might significantly contribute to reduce the number of workers accidently falling from high. Safety cushion is used in emergency situations for rescue of people from high buildings. Safety cushion will absorb the shock of the fall with a comfortable and safe body response. With the help of technology, the automated safety cushion will be automatically function without human help. This paper aims to propose an innovation to reduce fall accident and to identify the significant of innovation to the problem. This innovation will help to prevent injury for the worker from falling from high and this will increase the worker safety at site.

Keywords:
Safety cushion; safety air cushion; high rise safety; falling from high; personal protective equipment

1.0 INTRODUCTION

Various infrastructure development programmes are being implementing in Malaysia such as The Exchange 106, Kuala Lumpur to Singapore High Speed Rail (KL-SG HSR), Pan-Borneo Highway and Bukit Jalil City. This development undoubtedly contribute to regional economic growth and prosperity. However, to guarantee the workers occupational safety and health during the construction period is very challenging. Most of the construction workers are frequently exposed to various types of injury such as falling from heights. As a result of uncertain and harmful nature, construction accidents usually cause lots of negative consequences, such as absenteeism, project delays, permanent disability (Fung et al., 2010; Hu et al., 2013). As shown on the Department of Occupational Safety and Health (DOSH) website (DOSH, 2019), over 81 construction workers died from building construction activities within the time frame of 2 month from 1 September 2018 till 31 October 2018. Due to significant increase in number of cases related to falling from high, the degree of awareness among the industry player is relatively low. As a result, automated safety cushion is proposed to be applied in construction might significantly contribute to reduce the number of workers accidently falling from high. This paper aims to propose an innovation to reduce fall accident and to identify the significant of innovation to the problem.

2.0 LITERATURE REVIEW

Construction workers are frequently exposed to various types of injury-inducing hazards, especially falling from heights (Hsiao, 2010). In general, lack of the safety measure at the construction sites is one of the causes the occurrence of fall accidents. The nature of the construction industry's rapidly changing conditions, associated work hazards, and the characteristics of construction organizations further aggravate the situation (Choudhry, 2008). Therefore, there are necessary to implement the appropriate prevention action to prevent the occurrence accidents effectively. For automated function, pyroelectric detection will be used as it is promising technology since they are thermal, operate over a huge range area (Suen et al., 2017). Also the use of personal protective equipment does not eliminate hazards but gives only limited in case of accidents (Norkus, 2012)

3.0 METHODOLOGY

The method employed were desk studies. Desk studies were derived from relevant books and articles. The studies is meant to get a clear picture about the aims and objectives of the economic perspective on the safety awareness regarding human falling from high rise building. Some readings on DOSH website show the number of accidents happen until October 2018. The desk studies were carried out to identify the possible problem of the chance for future innovation to invent. The desk studies were carried out by reviewing articles to find out the problems and solution will be proposed in the form of new innovation.

4.0 ANALYSIS AND FINDINGS

Sensor is a device with the purpose to detect changes in the environment and send the data to other electronics such as computer processor. There are several type of sensor such as temperature sensor, light sensor, gas sensor, humidity sensor, heartbeat sensor and etc. There are several criteria need to be seen before choosing a sensor. First need to know the accuracy and precision that the sensor can managed. Accuracy has to do with how close the sensor reading is to the true value while precision refers to the ability of the sensor to detect small changes. Too high of precision can give a false impression that the reading is also accurate or can result in the system detecting noise rather than the actual desired data. Secondly need to select proper sensor which suitable with the environment of the instrument will be operated. Many sensor can be affected by the non-ideal conditions of a production floor such as the temperature variation, vibration, humidity or chemical presence. Next is need to consider the flexibility of it technology conversion. The usual mistakes in sensor applications include fail to select the appropriate features for the task and fail to consider the full range of expected operating conditions. Also, in modern systems it is mostly preferred that the instrumentation system provides digital data rather than analogue gauges or chart recorders.

For this innovation project, the human identification using laser scanners and image sensor will be included. Pyroelectric infrared (PIR) is a sensors function as a sensing systems to detect human body movement. PIR sensors are well known and have been widely use as powerful presence trigger for alarms, such as surveillance systems and automatic lighting control. PIR sensor can detect the direction and speed of a moving object, the distance of the body from the PIR sensor, the body shape and the presence of multiple people. PIR is small in size which is 700mm x 250mm. Eventhough the size is small it can detect for 6m distance. Its fields of view are 120^{o} x 106^{o} wide. The PIR sensor price is inexpensive and affordable for everyone to own it.

Personal protective equipment is any equipment designed to be worn by the labourer to protect themselves against hazards that likely to endanger their safety and health at work. The most common accident cause of worker injuries is falling from height place. A personal fall protection system is an assembly of components functional to protect the user against falls. The function of the fall protection system is to prevent free fall while enabling the user to work at height in suspension.

Fall arrest systems should be used whenever a worker is working at a height of six feet or more. This system included lanyards, anchor point, full body harness, energy absorber and connector. They come into use only when a fall occurs. A full body harness with a shock absorbing lanyard or retractable lifeline is the best type of fall arrest system because it distributes the fall force throughout the whole body. The benefits of wearing full body harness are it is designed to restrain a person working in hazardous position and reduce the chance of falling. It also help to stop the falling and at the same time reduce the impact force exerted upon the user's body. But it also has several disadvantages which is possibility in a non-feet first fall of an impact across the waist, with potentially serious injury to the spleen, liver and spine. Fall arrest system also have a limited maximum arresting force which is 1,800 pounds and can only free fall more than 6 feet nor contact any lower level.

5.0 CONCLUSION

Building construction activities experience high fatal accident rate due to inherently hazardous nature. As for this, technology innovation is needed to help in reducing accidents and enhancing safety. Despite all the innovation there is no technology have been incorporated in the safety innovation for the construction industry. This is important for innovation to add technology to be done so that the amount

of cases regarding the number of falling from height can be reduced. The safety features that have been invented in this product is human recognition and thermographic camera which can detect human presence. When human presence is detected, the safety cushion will be automatically inflated to receive the individual that accidently fallen from the building. This innovation will help to prevent injury for the worker from falling from high and this will increase the worker safety at site. The material for the safety cushion will be save enough to withstand the amount of impact falling from high. The material of the safety cushion also can receive impact falling from 60m high. The automated safety cushion will be fully function with help of sensor.

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