International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 06 Issue: 04 | Apr 2019 www.irjet.net p-ISSN: 2395-0072

Effective Safety Management in Construction

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Abstract - *Construction is one of the most dangerous industry sectors. Millions of construction industry accidents occur in the world causing damages and injuries to workers and consequently economical losses in every year. Construction sites are dynamic and complicated systems. The movement and interaction of people, goods, and energy make construction safety management extremely difficult. Due to the ever- increasing amount of information, traditional construction safety management has operated under difficult circumstances. As an effective way to collect, identify and process information, sensor based technology is deemed to provide new generation of methods for advancing construction safety management. The aim of this paper is to identify and evaluate the safety management in construction projects to minimise and control health and safety (H&S) of construction workers. In this paper described the various safety and control measures of accidents in building projects to minimise accidents by using sensor based technology.*

Key Words: Safety management , Hazards, Sensor based technology, Ultra-wide band

1.INTRODUCTION

Construction industry is considered as one of the most hazardous industries in the world. There has been an increase in the number of building which are built for commercial, residential and office purposes in every year. The construction market continues to expand due to the day by day increase in need of infrastructure facilities, home, office spaces ect,. The construction industry is very complex and hence it is prone to numerous health hazards. Therefore safety is a vital concern in the construction industry to result in a hazardous free environment. Safety professionals have analysed that the major workplace accidents are initiated by unsafe behaviours and that their control is one of the keys to successful accident prevention resulting in low accident rate in construction sites. The number of fatal accidents in construction site is not easy to quantify as information on this issue is not available for most countries. The main concern is completing projects at the required quality with minimum time and cost. Carelessness has been considered as the major reason for accidents and hazards happening in construction sites. With the changes in timings and schedules along with the change of men themselves combined with the nature of the construction jobs makes the construction industry as one with accident risks. Hence the major aim of this paper is to minimise the accidents occurring in construction sites. More than 3 million working days were lost due to hazards and accidents in the sites. Falls from elevated positions is the major cause of accidents and deaths in construction sites. Unexpected accidents which occur affect the overall plan of the projects which leads to production loss, lagging of works and interruption of production flow. Even through accidents cannot be completely erased, the affects of those accidents on workers can be controlled. Occupational health and safety issues have become a major concern in construction organisations. Due to lack of enforcement of applicable legislations, most of the construction organisations are forced to opt for implementation. Occupational health safety assessment series(OSHAS) to improve safety performance. It has been accepted that the construction workers have a high risk of work related illness and accidents than in any other public sector. Therefore there is an urgent need to reduce risk reduction by implementing a site safety management. Construction safety management is a method which is used to control safety activities in order to ensure a safe working environment in the construction site. Safety during the construction project is also influenced to a great part by decisions made during planning and design process. Construction safety can be branched into four groups which are planning for safety, employee training for safety, first aid and medical measures and safety policies by the management.

1.1 GENERAL

A safe jobsite can lead to lower insurance rates, completing jobs more efficiently, and most of all allow everyone to go home safe at the end of day. To help increase the safe monitoring capacity of a site, ultra- wide band(UWB) sensor networks are being explored as a method for offering continuous safety monitoring in ensuring construction workers are following safe working procedures for common tasks. UWB sensing is a promising new technology for tracking objects to remain within the field-of-view in order to be tracked; UWB signals propagate through walls and objects and allow non-line of –sight tracking.

To overcome the significant drawback of manual safety monitoring, several sensing technology have been proposed. The purpose of applying sensing technologies is to enable automated, continuous, and accurate observations of construction site conditions through real-time communication of contextual information. Unlike applying sensing technologies for outdoor applications, applying sensing technologies for indoor applications is more challenging.

1.2 OBJECTIVE

The objective of this paper is to create and demonstrate safety monitoring/ management process:

i. Recognition and registration of potential hazards
ii. Real-time detection of unsafe incidents through tracking construction resources.
iii. Storage and communication of such information to relevant stakeholders in real-time.

2. SAFETY

Construction sites are dynamic activities where workers engage in many activities that may expose them to a variety of safety hazards, such as falling objects, working from rooftops or scaffolding, exposure to heavy construction equipment, or the use of temporary electrical circuits while operating electrical equipment and machinery in damp locations. Through implementation of safe work practices, training, and compliance with federal, state, and local regulatory requirements, the Workplace Safety program aims to identify, control, or eliminate construction-related hazards

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2.1 IMPORTANCE OF SAFETY IN CONSTRUCTION

The construction industry has traditionally been considered as hazardous occupation due to the high incidence of occupational injuries and fatal accidents. The number of fatal occupational accidents in construction all users the world is not easy to quantify, as information on this issue is not available for most countries.

2.2 NEED FOR SAFETY MANAGEMENT

The construction industry has some special features which have a direct bearing on the accident potential. In this trade the pattern of work is ever changing. The operations and physical circumstances change constantly unlike in the factories where the process, method and operations are generally respective. Timings and schedules vary considerably from place to place. The most important changing factor the change of men themselves. The inherent nature of construction job combined with the above factors make this industry as one with accident risks.

2.4 SAFETY MANAGEMENT PROCESS

Process Safety is a disciplined framework for managing the integrity of operating systems and processes handling hazardous substances by applying good design principles, engineering, and operating practices. It deals with the prevention and control of incidents that have the potential to release hazardous materials or energy. Such incidents can cause toxic effects, fire, or explosion and could ultimately result in serious injuries, property damage, lost production, and environmental impact.

Fig 2.1 General safety management process

3.METHODOLOGY

The present study was conducted to establish to measure real time safety management performance on construction sites. This methodology adopted in this work is the collection of data by the method of survey. Surveying with a help of questionnaire was found to be most efficient based on the literature review conducted by the author and shown in Fig 3.1

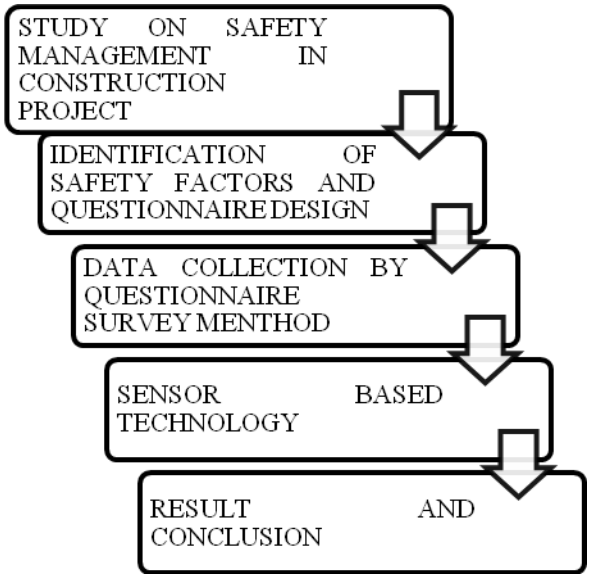

Fig 3.1 The methodology adopted in this work

3.1 METHODS OF ANALYSIS

SPSS statistics is a software package used for statistical analysis. It is now officially names "IBM SPSS Statistics". SPSS statistics (originally, statistical package for the social sciences, later modified to read statistical product and service solutions) was released in its first version in 1968 after being developed by Norman H. Nie, Dale H.Bent and C. Hadlai Hull. SPSS is among the most widely used programs for statistical analysis in social science. It is used by market researchers, health researchers, survey companies, government, education researchers, marketing organizations and other.

3.2 MAJOR ACCIDENT IN SITE

There are many causes of an accident on a construction site. The top causes of construction worker deaths on the job were falls, followed by struck by object, electrocution, and caught-in/between.

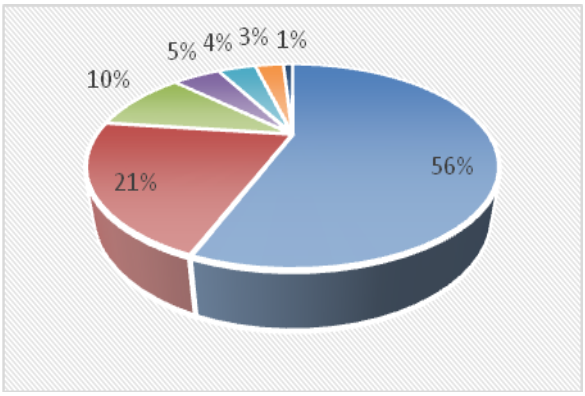

Fig 3.2 Accident rate

56%- Falls from height

21%-Trapped by something collapsing or overturning

10%-Struck by a moving vehicle

5%- Contact with electricity or electrical discharge

4%-Struck by a flying/falling object during machine lifting of materials

3%Contact with moving machinery or material being machined

1%- exposure to a hot or harmful substance

3.3 QUESTIONNAIRE SURVEY DESIGN

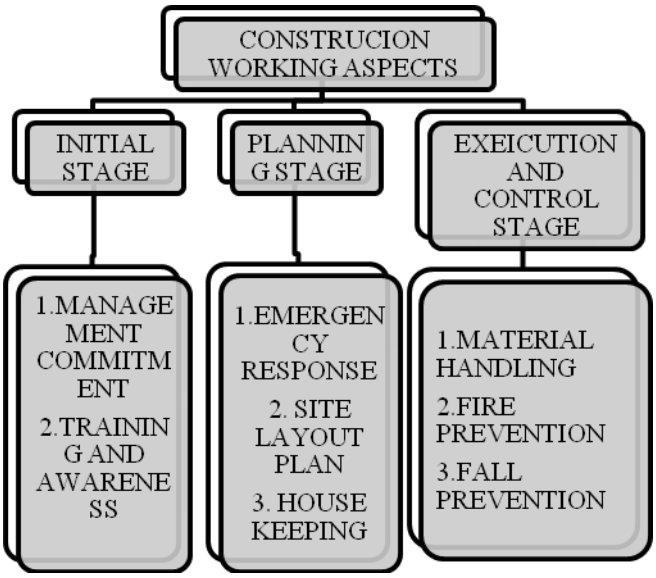

Fig 3.3 questionnaire survey

3.4 SENSOR BASED TECHNOLOGY

Ultra-wideband (UWB) is a wireless positioning technique newly-developed in recent years. It has a good application potential in the field of wireless indoor positioning. UWB takes advantage of ultra-wide band signals that are suitable for high-speed and short-range wireless transition due to their wide spectrum range. Compared to other narrow-band transition systems, it is less susceptible to multipath interference, thus it has the capability of real-time tracking for multiple targets with high sampling speed, high accuracy and low energy consumption.

UWB has been well accepted by scholars and construction managers and gradually popularized in related experiments and practices. So far, it has been utilized in fields including AP, SD, HI and ST&E. In general, the average positioning error is about 0.5m and the accuracy can reach the centimeter level in indoor environment. The 2D

positioning accuracy was 20 cm and 40 cm for 3D positioning in open area with 70% credibility level for both. The UWB was much less accurate in a large area (65,000 m2) affected by the frequency of positioning labels. A set of tests shows the positioning accuracy of UWB was 1.26 m with 1-Hz label and 1.63 m with 60-Hz label. In addition, the obstacles in work environment and metal interference will have a significantly negative impact on UWB's positioning accuracy.

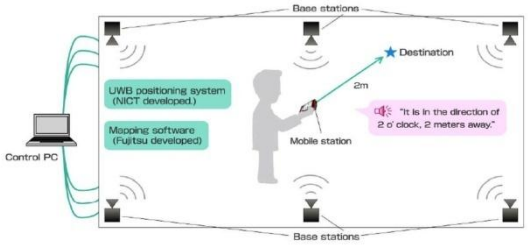

Fig 3.4 UWB sensor process

4. RESULT AND DISCUSSION

The questionnaire was distributed among fifteen companies mostly around Coimbatore. Dichotomous question are prepared for the survey. These questions ask the respondents only a yes or no answer. Hence, it makes it difficult to analyze beyond the yes and no answer.

Sl. no	Types of organization	Percentage of response received
1.	Developers& promoters	20
2	Contractors	13
3	Sub Contractors	10
4	Consultants	4

Table 4.1 Distribution of questionnaire

The cause for accidents as stated by respondents is shown in figure 4.1. There is no fatality in the surveyed companies. The damages that are reported after an accident are worker injury, loss of man days, wastage of material, breakage o form materials, financial claims, etc. the financial loss in terms of claim for medical treatment to injured worker, insurance claims and material costs vary from rupees ten thousand for minor injuries to one lakhs forty thousand rupees.

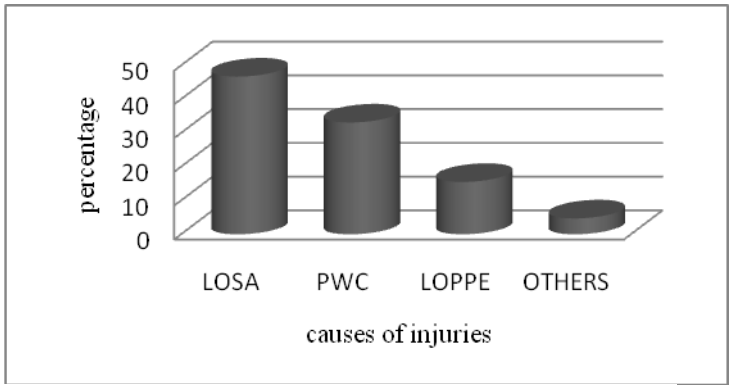

Fig 4.1 Causes of Injuries

46.7%- Lack of safety Awareness

33.1%- Poor working Condition

15.5%- Lack of Personal protective equipment

4.7%- Others

4.1 1PLANNING FOR SAFETY:

Every construction organization should develop a performance oriented safety program. A safety management procedure is including information about personnel protection equipments (PPE), hazardous substances in site, use of power equipments, safety practices, safety policies, emergency procedures in site, responsibilities of workers etc should be made. This safety document should be made available to all the workers in the construction site.

4.2TRAINING FOR SAFETY:

In Sites Proper training about safety should be provided for workers. It is a major component of safety management. Workers should be made aware about different hazards that can occur in sites and control of those hazards. By this training the workers should be able to handle any emergency situation of safety in sites without panic and also they should understand the relevance of safety practices in sites.

4.3MEDICAL SERVICES AND FIRST AIDS:

First aid and medical facilities should be made readily available in sites according to the size of site and number of workers in the site. The employer must be responsible for this and should ensure the availability of medicines and first aids in the sites.

4.4 SAFETY POLICY BY MANAGEMENT:

The safety policy of the management is very relevant in maintaining workplace safety. Apart from the safety plans and training program, the management must ensure that the workers are following the safety standards in the site. Regular safety inspections must be conducted by the management in the sites.

4.5 THE BASIC ACCIDENT PREVENTION MEASURE OUTLINED BY OCCUPATIONAL SAFEETY AND HEALTH ADMINISTRATION (OSHA) ARE:

- Safety helmets for head protection
- Hearing aids for ear protection
- Safety shoes with steel toe for foot protection
- Safety glasses or goggles for eye protection especially for welding works and in sunlight.
- Clothes should be worn according to the climatic conditions.
- Use of high visibility clothing should be ensured especially for works during night shifts.
- Safety training program should be conducted occasionally by the safety department.
- Medical services and first aids should be ensured in site always.

5. CONCLUSION

In this paper helps to reduce the construction accidents and injuries by using the sensor based technology. It has been identified that safety management is the most important area in a construction work which ensures sound health of the workers in the construction site and also prevents occurrence of different types of hazards and accidents in a construction site. In this project, the major parameters which are considered in the safety management were discussed. The different stages of safety management have been observed and analyzed. Various accidents which are occurring in a construction site were observed and remedies that are to be taken in order to prevent these accidents were sorted out. The study shows that implementation of safety measures is more important than safety planning and training. In order to ensure safety, a safety engineer or officer should always be present at the construction site to inspect the implementation of safety in the sites. The management should make safety equipment's mandatory. All the workers should be provided with personnel protection equipment's to ensure their own safety. Proper remedies and measures should be taken in every construction site to prevent any chance of occurrence of any kind of accidents.

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