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A study on safety management in on-going construction projects with proactive system

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ABSTRACT

The construction industry is a vehicle through which a nation's physical developments are activated by initiating projects from the blue print stage to the implementation. The purpose of this paper is presenting a new advanced hardware/software system, with two features: first it performs real time tracking of workers' routes in construction sites; then it implements an algorithm for preventing workers to be involved in hazardous situations. This research step is part of a wider ongoing research concerning the development of a new generation of advanced construction management systems, allowing for real-time monitoring and coordination of tasks, automatic health and safety management, on-site delivering of technical information, capture of as-built documentation. Exploiting the high accuracy provided by the UWB system responsible for position tracking and successfully tested in previous research, our software interface is able to graphically reproduce (and store) the travel patterns of workers. Moreover, it constantly checks if they are accessing hazardous areas, using an algorithm based on a predictive approach: it is conceived to predict in advance whether any worker is approaching a forbidden area, in fact performing virtual fencing. This approach could be easily extended to other applications, too. Some preliminary tests simulated in the DACS laboratory are described and the obtained result discussed.

INTRODUCTION

In a high-hazard industry like construction, safety is an investment that provides real benefits. A safe work environment helps to keep skilled employees on the job and projects on track by reducing accidents that result in injuries and schedule delays, while also reducing the risks of litigation and regulatory action. A strong safety record enhances a company's reputation, makes it more competitive and helps to manage insurance costs over time. Fostering a successful safety culture, however, is a company-wide effort that requires commitment and participation from the chief executive to project managers, superintendents, foremen and individual workers on the job site. Delays resulting from accidents will also prove expensive. To be competitive, companies need to control all costs, including insurance. Safer companies tend to be more appealing to potential clients and to insurers. A proactive safety culture helps to save lives, retain workers, reduce claims and delays, and enhance productivity and profitability while strengthening the company's reputation phase. A real-time positioning system can be a useful tool as part of construction management. The commonly used position location systems that are applicable in construction sites are: Global Positioning Systems (GPS), Radio Frequency Identification Device (RFID), and Ultra Wide-Band (UWB). In order to ensure proper safety within an industry, various methods are adopted for measuring, monitoring

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and adopting suitable remedial measures for safety control. However, to reach world-class performance, proactive methods of safety management should also be adopted during the construction to take it into a better level.

AIMS AND OBJECTIVES

- To develop a comprehensive knowledge about the safety control within a construction industry.
- To identify the role of each and every individual in a construction project and their participation in safety control programs.
- To identify the different proactive safety control techniques implemented in a construction industry.
- To acquire a comprehensive knowledge about the proactive systems in construction safety control.
- To get an overall idea about the application of UWB systems in position tracking of workers and to prevent them from hazards

METHODOLODY

The methodology used for this research paper is by identifying the factor of safety in construction site both with the help of proactive systems and without the help of proactive systems in the present situation [1, 2]. A questionnaire survey based on identification factor. Next step is data collection. Here data analysis is done by spss and excel software's. Next chapter is about results and discussions. The last chapter is conclusion.

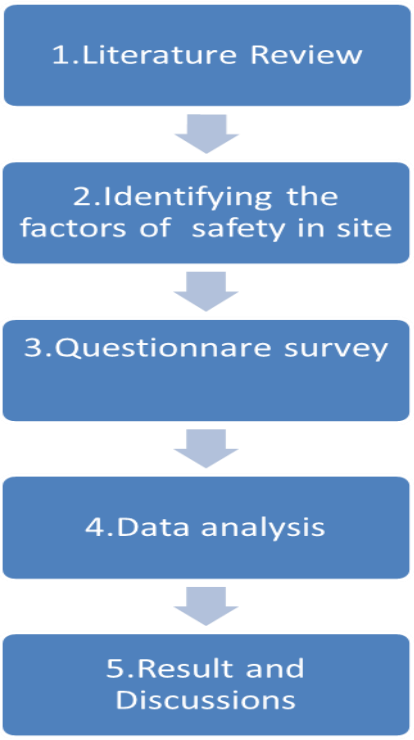

Fig1.Chart showing the methodology

DATA COLLECTION & ANALYSIS

Here data analysis is done by spss and excel software's.

Proactive Systems

The good aspect of tracking technologies is that some of them are very accurate, and are able to track workers by just equipping them with such small embedded tags, that they do not interfere

with ongoing activities. A pro-active system for health and safety management in construction sites mainly composed by two parts: the first performing real-time position tracking, while the second providing real-time prediction of risky events. Information about the location of construction resources, such as workforce, equipment, and materials is highly beneficial to a manager in order to conduct different construction phases on time, safer, and within the allocated budget. A real-time positioning system can be a useful tool as part of construction management. The commonly used position location systems that are applicable in construction sites are: Global Positioning Systems (GPS), Radio Frequency Identification Device (RFID), and Ultra Wide-Band (UWB).

MODEL DEVELOPMENT

Ranking Relative Importance Index (RII) is a method used to determine the weight age of a particular variable when there are multiple responses under that variable. RII helps in determining the contribution of a particular variable that makes to the prediction of a criterion variable both by itself and in combination with other predictor variables. Relative Importance Index can be computed by using the formula

Formula: RII= Σ W / H*N

Where Σ W is the summation of all the response of the variable, H is the highest value of the variable and N is the number response in a variable. The Tables shows that the list of number of responses given for the each factor and finding the relative importance index value for factors and from that find ranking for each factor in that ID-F8 (Are construction lifecycle concerned with green policies) Factor get the 1st ranking and the RII value (70.33333) then followed

DEVELOPMENT OF REGRESSION MODEL

The main objective of study is to develop models to predict cost performance, schedule performance, quality performance and satisfaction level. Four models were developed for each of the performance metrics. Multiple Linear Regression (MLR) and Artificial Neural Network (ANN) technique were used to construct the models to predict project performance, and these models are then compared and validated.

BUILDING REGRESSION MODEL

The SPSS Software has been used to build all the regression models. The statistical terms can be used to check the model's statistical competence. In order to examine how the obtained linear regression equation represents the data, two sets of parameters, R and R^2 are calculated. Firstly, the linear correlation coefficient, R, measures the strength and the direction of a linear relationship between two variables. The value of R ranges between -1 and +1.R value close to +1 indicates that two variables have strong positive linear correlation. The value of R^2 lies between 0 and 1 (both values inclusive). The closer the value of R^2 to one, the better is the goodness of fit. 5.1.2 Data analysis using SPSS Regression is a data oriented technique because it deals directly with the collected data without considering the process behind these data. Regression is a mature technique that has been used in many scientific applications. Regression models can be linear or nonlinear, which represent a relation between dependent variables and independent variables. The regression methodology models the distribution of a dependent variable with the help of one or more independent variable. Simple regression analysis involves only one predictor when investigating its relationship with the dependent variable. For simple linear regression, only two variables, independent and dependent the fitted linear equation is written as

$Y = a + bx.$

The coefficient of determination, R^2, is a statistic that is widely used to determine how well a regression fits the data. R^2 represents the fraction of variability in the dependent variable, Y, that can be explained by the variability in the independent variable, X. In other words, R^2 explains how much of the variability in the dependent variable can be explained by the fact that they are related to the independent variable. Regression models for the project performance consider one dependent variable cost growth, schedule growth, quality

performance, and satisfaction level against several independent variables.

UWB SYSTEMS

Previous experimental tests led in the construction site shown in Figure 2-b and 2-c, let us conclude that UWB tracking systems can perform very accurate location tracking at least until reinforced concrete structure's erection. Using just four receivers and equipping every resource with 1 W tags, it was possible to monitor a 500 m2 large construction area. Hence UWB overcomes the limits of GPS, which was not able to track indoor. Instead, a different and more intense configuration for UWB receivers will be necessary to perform monitoring when masonry buildings are monitored. In any case, it came out that UWB tracking is very good for tracking from the beginning of the construction progress, until structure frame is built. Hence it would be able to support several automated features.

RESULTS & CONCLUSION

Construction industry remains a dangerous business, accounting for the second most fatal work injuries of any sector after transportation and warehousing. In order to acquire an accident free construction project, some proactive measures are to be adopted properly. In this study proactive methods normally resorted for reducing accidents are identified and discussed. It includes the participation of top level management in safety control, safety in the planning stage, pre-qualifying sub-contractors for safety, training for workers, fall management etc. various proactive safety control, it is very difficult to create a zero injury project. The top level managers will be not able to concentrate on safety control because of their management works. Some software/hardware systems were proposed that can track the path of the workers approaching hazardous areas and thus accidents can be prevented.

The companies using proactive system area

- Kristal group construction (P) LTD Edappally Ernakulam
- Coral group (P) LTD Thrissur
- EV group KALOOR
- SM Tech group (P) LTD Thrissur
- Olive builders Ernakulam.

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