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Experimental Study on Sensor based Technology to Improve Construction Safety Management

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ABSTRACT: In Construction sites, the movement and interaction of people, goods and every make safety management is difficult. The construction sites are dynamic and complicated. Nowadays, various sensor based technology have been adopted for construction safety management and information. It includes locating sensor based technology with sensing and wireless sensor networks. This paper provides a systematic and comprehensive review of previous studies in field to acknowledge useful findings identify the research directions. It is high efficiency, accuracy provides solid foundation and information. This paper provides a systematic and comprehensive review of previous studies in this field to acknowledge useful findings, identify the research gaps and points out future research directions.

KEYWORDS: construction; sensor technology ;sensors; safety management

I. INTRODUCTION

The development of sensor based Technology have improved information Collection data transmission and processing. In many aspects of building construction may very broad range of topics. Currently, sensor based Technology has been used fast developing area as well as engineering and academic communities. This paper aims at indepth investigation and providing and review of previous studies to help research and acknowledge useful finding and capture future trends.

The data analysis were then performed to identify research findings. The fourth section carries out comprehensive and overview based sensor technology from eight aspects. The direction of future work, offers potential opportunity improves more relevant and effective measure's, to ensure safety Construction sites.

The sensors in construction are specifically being looked into and applied to improve business operation. The statement and optimisation are use of sensors in construction techniques. The operation present and future of thidentification.

II. RELATED WORK

The application of Sensor based Technology covers the whole process of construction project, planning, design, construction. The systems, framework, models, and algorithms just not fully tested in real construction environment. In general, actively seeking the exploitation and exploration of various fields of Sensor based Technology applied is one of current development in Construction Safety Management.

The Construction sites are very complicated and difficult, by uses of additional setups to improve the Construction Environments.

III. METHODOLOGY

A Methodological approach to conduct a review of Sensor Based Technology has to explore findings and identify gaps for future research on previous studies. As per the selection of Sensor Based Technology which following steps are,

[1]. Based on review papers and some sensor based technology are preliminary identified



[2]. The Capability of improving construction safety Management without verification and text meseasures to provide supplement for Construction Safety Management.

Monitoring of civil infrastructure enhanced understanding of structural behaviour. Using the improved knowledge, aspects managers and engineers have possibility to decision making. Development in data storage and increased ability to transfer data and storage has mode infrastructure feasibility practice.

IV. EXPRIEMENTAL STUDIES

Sensors Based Technology are suitable for different workings conditions. GPS do not work well in door environment, because its accuracy and efficiency decreases and signal blocked. RFID, UWB, Zigbee are all based on radio frequency and arrangement of signals transmitter and receiver affects the effective range and accuracy.

By comparisons with RF location testing it is less expensive with satisfactory positioned accuracy. It is limited by spreading distance and signal strength has high enough to reduce blockages and interference.

Based on different site conditions and requirements to locate targets as personnels and machinery or identity dangerous zone like near edge openings areas. Taking a concrete mirror as the tracking and positioning target, the location systems should be within few metres consider vehicles size.

4.1 APPLICATIONS OF SENSOR BASED TECHNOLOGY

Accident Prevention: Smart sensors may also play key role in research to prevent the accidenta during construction.

Safety Management : Construction sites often various hazards. Smart sensors can continuous monitor the risk such as health of equipment and gas leakages to prevents the accident.

Wireless Sensor Networks ranked second followed by vision based sawing and UWB. The least usdd techniques are WLAN and Ultrasound with for papers. By percentage of RF locating sensor based technology account for 41.28%. RF location Sensor based technology which transitional stage from widespread techniques. This technique has applied to brand new fields. The application are based on new fields and helpful to enhance Construction Safety Management.

4.2 SCOPE AND OBJECTIVES

Smart sensor technologies have been used for monitoring and control mechanisms in a wide variety of environments, including smart grids, flood and water level monitoring systems, environmental monitoring, traffic monitoring and control, energy saving in artificial lighting, remote system monitoring and equipment fault.

A sensor is a device that detects and respond to some type of input from the physical environment. The input can be light, heat, motion, moisture, pressure.

Smart sensors also enable process control, such as monitoring a process, like manufacturing an item, and making any adjustments that might be required to meet quality or production goals. This was once a manual process, but smart sensors can be used to automate process control.

V. MATERIALS AND METHODS

The quality of construction materials and resources has an effect on construction safety in an indirect way. On one hand, based on the opinions of construction industry experts, the hidden troubles caused by quality defects and cheating on labor and materials may lead to serious safety accidents in the operation and maintenance stages; on the other hand, quality defects can bring about qualities issues such as rework and repair, leading to demolition, schedule pressure, extra working time an unstable work processes, which may all increase the risk of safety incidents.

To verify this hypothesis on the basis of empirical data collected from 32 building construction projects tried to find out the relationship between quality performance and construction safety with empirical were used as predictor variables



and first aid and Occupational Safety and Health Administration (OSHA) recordable injury rates were used as response variables.

5.2 EQUIPMENT DIMENSIONS

Locating Sensor-Based Technologies	Accuracy from Publications
GPS	2.15 - 4.36m
RFID	0.86 - 2.6 m
WLAN	1.5 - 4.5 m

5.3 EQUIPMENT USED

Over-exposure to high temperature and high humidity working environments is the direct cause of some occupational diseases, which will directly affect the personal psychological state of workers and the behavioral effects of the work increasing the risk of construction safety accidents.

Therefore, the management for workers' health and safety is a crucial part of construction safety management. Similar to construction material and resources, various sensor-based technologies provide a new platform for worker health and safety management surveillance system based on radio frequency identification tags to track and identify workers on construction sites. It was energy-saving and could constantly work for more than 124 h as proved by field experiments.

The system could recognize workers' activity patterns and laid a foundation for worker health and safety management built a management system based on BIM and WSN to monitor construction environments in real time and conduct special management for high temperature and high humidity working conditions. The rescue and safety management of workers in emergency cases could be realized visually through this system.

5.4 EXPERIMENTAL SETUP

(1) Expansion in information dimensionality and data utilization :

At this stage, the application of sensor-based technology is subject to strong restrictions so that the collected information of construction environment has lower dimensionality. For example, the original data covers either the dimension of time or dimension of space, but the manager needs to make decisions based on data providing both temporal and spatial information; the original determine whether he or she is safe. The collected information typically covers only a few dimensions, which leads to the awkward situation that safety management cannot be reliably conducted due to incomplete information. At the same time, the capacity of processing the collected information not satisfying. Only a small part of data can be identified and utilized, remaining the most part ignored directly. How to expand information dimension.

(2) Exploration in various fields :

The application of sensor-based technology in construction safety management covers the whole process of construction projects, including planning, design, construction and operation. Until recently, most research focused on the project construction phase, mainly based on a simulated construction environments. The systems, frameworks, models and algorithms proposed have not been fully tested in real construction environments, therefore, the actual performance is unknown.

5.5 EXPERIMENTAL PROCEDURE

In general, single sensor-based technology is not directly applicable in construction safety management. Only the integration of multiple techniques is capable of meeting the ever-increasing requirements. Since the hardware and software are the essential parts of sensor-based technology, a balanced realization will achieve better and faster progress of sensor-based technology in construction safety management. As an integrated platform of multiple sensor-based technologies, in recent years, the price of smartphones have become attractive because of their substantial



popularity and price advantages resulting from large-scale production. In addition, due to the data processing ability and overall performance of smartphones, they have the potential to become an information management platform based on an open source system, which is beneficial in information collection and data processing. Generally, smartphones take both the hardware costs and the software compatibility into consideration and balances their relation in their evolution. Beyond that, compared with other sensor-based technologies, smartphones have some significant advantages, making them an optimal choice for both effective data acquisition solutions and portable data processing platforms.

Considering the environment of construction sites and the information requirements of safety management, in the foreseeable future, smartphones will have an increasing role to play in interactive construction safety management. In conclusion, there is still a long way to go for the development of sensor-based technology construction safety management from theoretical research to practical application. Nevertheless, without a doubt, this field of application has great potential and a bright future.

VI. RESULTS AND DISCUSSION

The annual publication dates of the 93 articles Before 2009, no more than four publications per year were related to construction safety management based on sensor technology. A sharply increasing number of related papers have been published since 2009. Though there are fluctuations in publication quantities, the annual number reaches an average of nine. During the same period of time, the RF locating sensor-based techniques (e.g., RFID, UWB) and the wireless sensor network became well developed and gradually applied to construction safety management.

The increased publication number indicates that the application of sensor-based technology is getting more and more attention from researchers in construction safety management and has become an important part of construction management practices no more than four publications per year were related to construction safety management based on sensor technology. A sharply increasing number of related papers have been published since 2009. There are fluctuations in publication quantities, the annual number reaches an average of nine. During the same period of time, the RF locating sensor-based techniques (e.g., RFID, UWB) and the wireless sensor network became well developed and gradually applied to construction safety management. The increased publication number indicates that the application of sensor-based technology.

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