Study Of Safety Management By Using Gis In Coimbatore

S. Kanchana, J. Faney

Abstract: The safety management is very important in the process of construction .The traditional methods of construction safety control cannot meet the construction of big project. To ensure the safety of construction and reduce accidents in the process of construction, the current situation and problems we face in construction safety management should be studied first. And then the project risk warning mechanism based on the GIS is constructed according to the problems we faced, to achieve visual monitoring and warning of construction safety risk management and to provide decision support for construction. This project aims to develop a web-based spatial decision support system model for proactive health and safety management in linear construction projects. [5] Currently, health and safety management is usually performed reactively instead of proactive management since hazard identification and risk assessment is mostly performed on paper based documents that are not effectively used at site. An information system relates to a chain of operations lead to planning the observation and collection of data, to storage and analysis of data, to the use of derived information in decision-making processes. To create a web-based, free and open sourced GIS that can work with different data formats by exchanging and presenting data as a real-time map on web.

Keywords: Project risk, visual monitoring, web-based models, real-time map.

1. Introduction

The construction industry is statistically one of the most hazardous industries in many countries. Besides causing fatalities, construction accidents also increase costs, cause delays and damages the reputation of the contractors. British Health and Safety Executive (HSE) has reported that cost of accidents in construction sector has become 3-6% of total project cost. The current day demand of construction industry requires a highly accurate planning, scheduling and management of the process of the project which can enable the overall optimization of the cost, time and resources. Planning and scheduling are the important aspects for the successful completion of a project. The proper planning and utilization of resources play important role in cost and time optimization. Construction planning is a fundamental and challenging activity in the management and execution of construction projects. It involves the choice of technology, the definition of work taskstasks, the estimation of the required resources and durations for individual tasks, and the identification of any interactions among the different work tasks. [1] Developments in local GIS applications have created a new avenue for managing traffic accident information system. One of the pioneering GIS researches in traffic safety was a study on linking the flexible Microcomputer Accident Analysis Package (MAAP) data to a DOS version of the MAPI FO [2]. GIS is a computer system for geographical data analysis. GIS is a special class of information system, which can be divided into four components involving a computer system, GIS software , human expert, and the data. GIS activity can be grouped into spatial data input, attribute data management, data display, data exploration, data analysis, and GIS modeling.

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2. GIS TECHNOLOGY:

A geographic information system or geographical information system (GIS) is a system designed to manipulate all types of spatial or geographical data. The acronym GIS is sometimes used for geographic information science (GIScience) to refer to the academic discipline that studies geographic information systems and is a large domain within the broader academic discipline of Geoinformatics. Geographic Information System is an organized collection of computer hardware and software designed to efficiently show all types of geographically or spatially referenced data .There are three elements in using spatial data:

- Input (encoding)
- Data Management(storage)
- Output(Maps) GIS can be an excellent tool for the emergency management community in hazards analysis and risk assessment and in making operational decision
- Digital Data – the geographical information that you will view and analyze using computer processing data.
- Computer Hardware – computers used for storing data , displaying graphics and processing data.
- Computer Software – computer programs that run on the computer hardware and allow you to work with digital data.

2.1. HISTORY OF GIS:

A GIS (geographic or geospatial information system) is a modern extension of traditional cartography with one fundamental similarity and two essential differences. The similarity lies in the fact that both a cartographic document and a GIS contain examples of a base map to which additional data can be added. The differences are that there is no limit to the amount of additional data that can be added to a GIS map and secondly the GIS uses analysis and statistics to present data in support of particular arguments which a cartographic map cannot do. Cartographic maps are often extremely simplified as there are limits to the amount of data that can be physically and meaningfully stored on a small map. There have been four distinct phases in the development of Geographic Information Systems. Phase one, between the early 1960s and the mid 1970s saw a new

discipline being dominated by a few key individuals who were to shape the direction of future research and development. The second phase, from the mod 1970s to early 1980s saw the adoption of technologies by national agencies that led to a focus on the development of best practice. Phase three, between 1982 until the late 1980s saw the development and exploitation of the commercial market place surrounding GIS whilst the final phase since the late 1980s has seen a focus on ways of improving the usability of technology by making facilities more user centric. [9]

2.2. GIS USED IN CONSTRUCTION PROJECTS:

In 2003 the Department of Transportation (DOT) found that 365 of Oregon's bridges had problems. This meant that a bridge repair plan had to be established. The Oregon DOT used GIS in this big project, which included infrastructure and integration of comprehensive environmental data for around 400 of its bridge sites. DOT staff draw a box around the bridge site and indentify all the resources inside the box. After collecting all the data for the site, engineers design work for the project. In Malaysia, studied how the GIS, based on a decision support system, can be used to select a suitable new forest road. He considered three things in his research: (a) assigned to each area, and then the Raster Calculator function was used to find the best route with less timber harvesting impact. [5] An application system that used GIS to report a Bill of Quantities(BOQ) for construction projects. The researchers noted that the information provided in this tradional way, is not enough. For example, start and end time, duration, date, and next tasks are the Tradional way, and more advanced tools are needed. The researches developed a system called PMS-GIS (Progress Monitoring System with GIS). They stated that this system "allows projects planners and managers to see in detail the spatial characteristics of a projects by showing on the same screen a bar-chart schedule and a 3D rendering of the project marked". Tere are three parts in this software:

- AutoCAD
- Primavera Project Planner(P3)
- GIS(Arc View GIS)

With these elements, every update will provide 3D progress tasks. This can help engineers and managers to see the work in detail with the 3D picture. Similar to this work, the Arc software application was developed to assist engineers in controlling and monitoring the construction process.

- Gravity sewer installation
- Force main installation
- Acceptance testing
- Compaction tests
- Soil and erosion control issues

2.3. GIS BASED CONSTRUCTION SAFETY MONITORING:

In geotechnical construction , accident control and hazard minimization is a big challenge .For deep excavation monitoring is essential specifically at the sites where neighbouring structure exists and the soil condition is poor .With the help of GIS fuzzy model for identifying adverse situation .In the study they used automatic data transmission technology which collected from sites. Different layers in GIS showed the site layout attributes charecteristics and instruments position , then the data integrated and analysis to qualify the risk foor protecting accidents in geotechnical construction .

3. RESEARCH PROCEDURE:

The general methodology of this study relies largely on the method which was collected from the building contractors, project managers, project engineers, construction managers. This project shows the general information about the land .key risks associated with the construction projects and the level of impact on each project objective that would result in as high ,medium or low .

METHODOLOGY IMPLEMENTED IN THE PROJECT:

There is an increasing need for a modern method for planning and scheduling of a project, with real-time monitoring. Taking the traditional methods as a platform, new methodologies are being developed. The utility of GIS in creation of time enabled data has become a great advantage for planners. The spatial analysis of an area using its remotely sensed data has a greater advantage in site selection of large projects. [1] [12]

- Study of literature review.
- Data collection
- Analyzing the Data Collected
- Using the Arc GIS Software to find the areas affected.
- Suggestions to manage the safety in construction projects by using GIS

The Below Maps are used for Decision Making System in Construction Management

1) Water Quality Map (check the water level for construction)
2) Road Map (Used to analyse the shortest path and accident management)
3) Drainage Map (Used to fine the drainage area)
4) Watershed Map (find water dumping Area)
5) Soil Map (Find the Soil Level in the area)
6) Settlement Map (Used to Analyse nearest Buildings)
7) Tank Map

5. APPLICATIONS OF USING GIS:

The construction industry is highly labour-intensive, unskilled and semi-skilled labours are cheap, unorganised, being unaware of their rights, builders find it convenient and profitable to use such manpower. While implementing safety regulations and laws many construction companies do not adhere to the safety codes. In such situations, it is very important to introduce virtual environment or IT advancements for the demonstration of construction process, hazards identifications, and safety planning. [8] explored a prototype integrated with critical path method for safety and health knowledge-intensive system. It identifies safety and health concerns for those who modify the design and construction methods to make a project less hazardous to construct.[13] developed an integrated planning and control model for production safety. An automated model of monitoring fall hazards in building construction. It identifies locations in building where fall-from-height hazards appear and proposes protective activities to be integrated into the schedule. It monitors the existence of guardrails and warns when something goes wrong. Innovative simulation-based model that assesses the hazards for each activity in the

construction schedule. The model is an approach to manage safety and schedule simultaneously. [8]

A. Web-Based

A web-based safety and health monitoring system for construction management. Safety performance on site was measured through integration with database, web, and expert systems. Online database was created to evaluate the impact of various hazards at workplace. An online prototype system [8] helps in capacity assessment of various construction professionals. Web-based tool using artificial intelligence (AI) support professionals in their decision-making process on competence basis and perform hazard identification and safety regulation checking [13].

B. Virtual Reality

Virtual reality (VR) is an advanced human-computer interface to simulate a realistic environment . A VR model for integrating design and construction processes during pre-construction planning stage for improved constructability. The model proposes user-interactive virtual construction sessions that allow designers or builders to construct and criticize the proposed facility using a 3D virtual environment to capture the safety knowledge in terms of experience in safety hazards at workplace and accident precautions. By performing virtual construction during the project's pre-construction planning stage, the designers or builders are able to undertake rehearsals of the construction process, allowing them to analyse and criticize designs as well as performing what-if scenarios for the selection of a safe construction method . A knowledge-based VR enables planners to perform virtual experiments on the construction processes, dynamically visualize the site environment, and identify all possible health and safety problems.

C. Four-Dimensional Computer Aided Design

Four-dimensional computer aided design (4D CAD) model is an innovative integration tool which combines two separated information sources, a construction schedule and a 3D CAD model [1]. The construction schedule and 3D model integration allows users to run a visualization of the planned construction process of a project. 4D CAD-safety research integrates 4D CAD and site safety for assisting the designers or builders in analysing and utilizing safety plans in terms of what, when, where, and why a safety measure is needed. [1] removed variations in sequence interpretation in safety planning by using 4D CAD and VR for hazards identifications. 4D CAD facilitates 3D visualisation of construction process on a computer screen and safety engineers to interpret construction sequence. 4D CAD application that analyses the design information to detect construction hazards and recommend necessary safety requirements. These measures are then inserted into the construction schedule and visualized in 4D CAD together with construction sequences. It helps in creating explicit visual perceptions of the construction process and making it an effective collaboration media for construction team [11]. Safety integration into construction process using 4D CAD is useful in conceptualizing and comprehending the sequence and spatial constraints in a construction schedule. It is a proactive approach to improve construction safety and to relate safety with plans. Safety activities and requirements are identified earlier during the planning phase and inserted in the construction sequence. Safety awareness can be achieved through the visualisation of developed 4D model.

6. SAFETY ENGINEERING:

Safety engineering is an engineering discipline which assures that engineered systems provide acceptable levels of safety. It is strongly related to systems engineering, industrial engineering and the subset system safetyengineering. Safety engineering assures that a life-critical system behaves as needed, even when components fail.

Construction site accidents happen all too often. In fact, according to the Bureau of Labor Statistics, one in every 25 construction workers is injured on the job every year. In 2010, 774 workers lost their lives on construction sites. In order to prevent these dangerous and life-threatening accidents, it's important to take the proper safety precautions while working on construction sites. [3]

San Antonio personal injury lawyer Pat Maloney shares a few ways you or your loved one can work to avoid construction site accidents:

- **Be aware of the risks around you**. Common hazards on construction sites include falling debris and materials, live electrical wiring, and falls from high heights.
- **Keep it clean**. Put up tools and materials when you're done using them and ensure your workspace is free of hazards. Keep all walkways clear and free of debris to prevent unnecessary falls and slips.
- **Take part in any training provided**. Additionally, don't operate any equipment you're not qualified or trained to use.
- **Report any dangerous working conditions**. If you spot hazards in your work environment, report it to your employer. If necessary, go to your union representative or file a complaint with the Occupational Safety and Health Administration.
- **Maintain your tools.** Before using a piece of equipment or machinery, ensure it is in proper working order. Keep all tools and machinery on a regular inspection schedule.
- **Wear safety gear.** Always wear the recommended safety equipment for your job. Whether it's a hard hat, goggles, gloves, or protective suit, these items could save your life. [13]

7. Conclusion

The costs of construction injuries including both human suffering and construction losses may affect the companies working strata. Companies that implement these key safety management practices realize savings for both human and management peoples. Employers can improve the industry's safety image and positively impact their bottom lines by implementing GIS safety management practices. By using these GIS software we can use shape file diagrams for identifying the most complicated areas thus we can avoid the accidents. Therefore GIS can safe the people from danger before the construction work through some safety measures. The construction companies make use of the software for the benefit of people .[14]

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