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# Study and Analysis of Various Automated Construction Materials Tracking Technology

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**ABSTRACT:** Materials management is a critical factor in construction project performance, particularly in the industrial sector. Inadequate amount of inventory will result in job stoppage due to materials required for conducting the work could not be specified at time they are needed, waste of labour working hours, and schedule delays. Construction materials constitute a large portion of the total cost in construction projects. It may account for 50-60% of the total project cost. Research projects conducted during the last decade to automate the identification and tracking of materials have concluded that such automation can increase productivity and cost efficiency as well as improve schedule performance, reduce the number of lost items, improve route and site optimization, and improve data entry. Use of RFID to tracking the materials and improve the material management. Thus, this paper provides a review of the existing issues in material tracking of inventory management process in huge construction projects. The findings reveal that there is a need for more proper technology to be implemented in construction project in order to facilitate materials tracking process and at the same time, reduce dependency on paper work reports in inventory management.

**KEYWORDS:** material tracking, Inventory management, construction projects.

### I. INTRODUCTION

The Construction Industry Institute (CII) (CII 1986) has defined materials management as “the planning and controlling of all necessary efforts to insure that the correct quality and quantity of materials and equipment are appropriately specified in a timely manner, are obtained at a reasonable cost, and are available when needed.” Materials management is a system, not the organization responsible for performing these tasks. It is an indispensable part of the project management which can be integrated with engineering to provide an end product that meets the client's requirements and is cost effective (Saurabh 2016). Accurate and timely information of the progress in a regular repeated basis is needed for a well maintained and efficient project control that will ensure cost and time efficiency of the project. Hence, an efficient on site data collection, a timely data analysis and a communication of the results in a well interpreted way are major concerns for construction companies (Ioannidis 2015).

Recently, there have been efforts on automating project monitoring which have shown the potential for effective construction project control. One of the automations applied to the construction industry is the adoption of Building Information Modelling (BIM). Commercial inspection software packages that use BIM model to facilitate inspection process such as LATISTA, Autodesk BIM 360 Field, Field 3D, bim, etc. Offer to the inspector the ability to use a mobile device (Tablet PC) instead of paper documents. These software packages are very effective at issues regarding document management, but the inspection process itself has not been automated since the inspector still has to manually navigate around the BIM model while visually inspecting the building.

The lack and incomplete of up-to-date information regarding on-site stock is caused by the poor tracking and locating of materials in construction sites. Thus, there is a need for a proper inventory management in order for the materials to be tracked and located easily; and without employing additional costs. Tracking of materials and components in construction project is not an easy task (Saurabh 2016) agreed that materials tracking still remain as a big problem in construction jobsites. (Sang 2018) in their research examined three case studies of subcontractor-fabricator relations. In two of the cases, there were work stoppages due to lack of materials. They calculated baseline productivity

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and the loss of labour efficiency in each case. Their research concluded that inefficient materials management could lead to an increase in the field labour hours of 50% or more.

This can eliminate paperwork, lower product and operational costs, and reduce cycle times. However, there is not much use of modern ict tools (e.g. Wireless communication, bar-coding and radio frequency identification (RFID)). To the facilitate materials management processes for tracking materials quickly, accurately and easily (narimah2015)

## II. VARIOUS AUTOMATION MATERIAL TRACKING TECHNOLOGY

**Barcode:** A typical bar coding system consists of some hardware, software and certain infrastructure which may be wired or wireless to connect the hardware to the database that stores and analyses the data collected by the system. The hardware system basically consists of the bar code scanner and the computer



Fig:- Barcode

**GPS:-** The Global Positioning System (GPS) is a satellite-based navigation system formed by a network of 24 satellites placed into the orbit by the U.S. Department of Defence ). GPS is used in the air industry for navigation by general aviation and commercial aircraft; at sea it is mostly used for navigation by recreational boaters. The land-based applications of GPS are more diverse. Surveyors use GPS for much of their work, because it provides excellent accuracy and radical cost savings by reducing the setup time at the survey site GPS technology also provides a wide range of positioning solutions for the construction industry. Navigation (guidance from one location to another), tracking, mapping, and timing (precise timing) are some of the applications of GPS in the construction industry.



Fig: GPS

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**GIS:-** Successful implementation of GIS has been found in areas such as civil engineering, transportation facilities management, urban planning, waste management, natural resources management, environmental impact assessment and business analysis. GIS can be easily integrated with other automated data collection technologies and software.

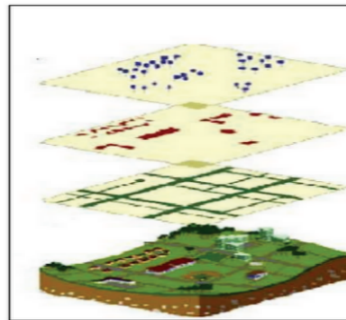


Fig:-GIS

**RFID:-** Stand-alone radio frequency identification (RFID), like bar coding, is also an automated data collection (ADC) technology. An RFID tag is a portable memory device located on a chip that is encapsulated in a protective shell and can be embedded in any object which stores dynamic information about the object. Tags consist of a small integrated circuit chip, coupled with an antenna, to enable them to receive and respond to radio frequency queries from a reader. Reading and writing ranges depend on operation frequency (low, high, ultra high, and microwave). Low frequency systems generally operate at 124 kHz, 125 kHz or 135 kHz. High frequency systems operate at 13.56 MHz and ultra-high frequency (UHF), and use a band anywhere from 400 MHz to 960 MHz. Tags operating at Ultra High Frequency



Fig:-RFID Reader and Tags

## III. CASE STUDY

Field trials were conducted on one construction site. The author of this thesis was located on one of these sites. The field trials were intended to further prototype and assess the performance of the RFID technology. One construction site where the system was prototyped and where field trials were conducted on number of sub-contractors each specialized in a particular area such as piping, electrical, and structures

### ➤ Existing Material Management

The facility needed materials varying in different sizes and specifications. These included engineered materials, prefabricated materials and bulk materials. The materials used in the facility construction were supplied from different

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vendors The current or existing materials management process consisted of managing materials received at site mostly through manual operations

## ➤ Automated Materials Tracking Process Based on RFID/GPS Technology

Field trial was being conducted. When the list of critical items was received from the main contractor, it was compared with the shipment order and the materials were identified. When the materials were identified, an active rfid tag was attached to them through zip ties. Of rfid tags attached to 4 pipes. Each rfid tag has a distinct number. The unique identification number of the item from the shipment list and the corresponding tag number were recorded in datasheets and then entered into the electronic format in excel spreadsheets in the office

## IV. RESULTS

summary of the times spent on locating the Pipes of (Specific Size ) by workers of the contractors without using the automated materials locating system and time spent on locating pipes using automated system

Sr. No.	Time spent on locating components without using automated system	Time spent on locating components using automated system
1	180 mins	18 mins
2	260 mins	15 mins
3	125 mins	12 mins
4	75 mins	3 mins

## V. ANALYSIS & INFERENCES

1. The automated materials tracking system is feasible and can be successfully applied on future construction projects.
2. The integrated, automated materials tracking system consisting RFID tags, reader, Handheld PC is able to collect data about the materials with reasonable accuracy, identify and track materials, and locate materials in the supply chain.
3. The automated system can be integrated with the project information technology systems and materials management processes.
4. Use of RFID reduces the time to locate the materials and thus increase the productivity of engineers, Reduces construction delay and overall cost of the project.

RFID is can be used as an effective antitheft system and is cost effective in long term for large residential or commercial project.

## VI. CONCLUSION

- 1) The automated materials tracking system is feasible and can be successfully applied on future construction projects
- 2) The productive time of engineers is wasted in searching the materials
- 3) It increases the productivity of the engineers, helps them to focus on their core work instead of wasting the time on searching the material.
- 4) Improves material Management.
- 5) Material theft is reduced to zero

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## REFERENCES

1. Sang Young Lee, "RFID Materials for the logistic Information.", International Journal of Applied Engineering Research ISSN 0973-4562 Volume 13, Number 1 (2018)
2. Piotr Nowotarskia Jerzy Pasławskia Maciej Skrzypczakb Radosław Krygier, "RTLS systems as a Lean Management tool for productivity improvement." 34th International Symposium on Automation and Robotics in Construction (ISARC 2017)
3. Mingyuan Zhang, Tianzhuo Cao and Xuefeng Zhao, "Applying Sensor-Based Technology to Improve Construction Safety Management, Department of Construction Management, Dalian University of Technology, Dalian 116000, China(2017)
4. Saurabh Badjate, Prof. Pranay Khare "Survey and Analysis of Automated Civil Construction Material Tracking." International Engineering Research Journal (IERJ) Volume 1 Issue 11 Page 1517-1520, 2015, ISSN 2395-1621(2016)
5. Saurabh Badjate1, Pranay Khare, "Study of Various Automated Construction Materials Tracking Technology."(2016)
6. Saurabh Badjat, Prof. Pranay Khare, "A Model On Automated Construction Material Tracking." International Journal on Recent and Innovation Trends in Computing and Communication, Volume: 4 Issue: 6, ISSN: 2321-8169, page 445 – 446, 2016
7. Pradip D. Nimbalkar, S. S. Valunjkar, Amarsinh B. Landage "A Review of Automated Monitoring System in Construction of Road Project, Proc. of the 32nd CIB W78 Conference 2015, 27th-29th 2015, Eindhoven, The Netherlands, 2015
8. Narimah Kasim, "Intelligent Materials Tracking System for Construction Projects Management, International Journal of Engineering Research Volume No.5, ISSN:2319-6890(online),2347-5013, Issue Special 1 pp : 197-199 & 9 Jan 2016
9. Marianna Kopsida, oannis Brilakis, Patricio Antonio Vela "A Review of Automated Construction Progress Monitoring and Inspection Methods, Copyright ©2015 Published by ITB Journal Publisher, ISSN: 2337-5779, The 2nd International Conference on Sustainable Infrastructure & Built Environment (SIBE), 19-20 November 2013, Bandung, Indonesia.
10. Akinci, B., Patton, M., and Ergen, E. (2002). "Utilizing radio frequency identification on precast concrete components – supplier's perspective." Proceedings of 19th ISARC, Washington, DC, 381-386.
11. Aziz, Z., Anumba, C., Ruikar, D., Carrillo, P. And Bouchlaghem, D. "Intelligent wireless web services for construction—a review of the enabling technologies", Autom. Constr., 15(2), pp. 113–123 (2006)
12. Caron, F., Navabzadeh Razavi, S., Song, J., Vanheeghe, P., Duflos, E., Caldas, C.H., Haas, C.T. (2006). "Models for locating RFID nodes." Joint International Conference on Computing and Decision Making in Civil and Building Engineering (ICCCBE), Montreal, Canada.
13. Caldas, C.H., Torrent, D.J. and Haas, C.T. "Using global positioning system to improve materials-processing on industrial projects", J. Constr. Eng. Manage., ASCE, 132(7), pp. 741–749 (2006).
14. Construction Industry Institute (CII). (1988). "Project materials management primer." Publication 7-2, November 1988
15. Javad Majrouhi Sardroud, "Influence of RFID technology on automated management of construction materials and components", Scientia Iranica, Open Access funded by Sharif University of Technology, 30 April 2012, pages 381-392.
16. Narimah Kasim, Aryani Ahmad Latiffi, Mohamad Syazli Fathi, "RFID Technology for Materials Management in Construction Projects – A Review", international Journal of Construction Engineering and Management, Dated 2nd September 2013, Pages 7-12
17. Narimah Kasim, Rozlin Zaina, Alina Shamsuddin, Naadira Che Kamarudin, "Implementation of RFID Technology for Real-Time Materials Tracking Process in Construction Projects", 2012 IEEE Colloquium on Humanities, Science & Engineering Research (CHUSER 2012), December 3-4, 2012, Kota Kinabalu, Sabah, Malaysia, Pages 472-476
18. Kasim, N. B. (2008). Improving Materials Management on Construction Projects. Loughborough University: phd Thesis. Kasim, N. B. (2010). Towards a Framework for ICT-Enabled Materials Management in Complex Projects. Journal of Techno-Social.
19. Saeed, G., Brown, A., Knight, M. And Winchester, M. "Delivery of pedestrian real-time location and routing information to mobile architectural guide", Autom. Constr., 19(4), pp. 502–517 (2010).
20. Song, J. (2005). Tracking the Location of Materials on Construction Projects. University of Texas: phd Thesis.
21. Song, J., Haas, C. T., & Caldas, C. H. (2006). Tracking the Location of Materials on Construction Job Sites. Journal of Construction Engineering and Management, 132(9), pp. 911-918.
22. T. Phani Madhavi, Steve Varghese Mathew, Roy Sasidharan, "Material Management in Construction – A Case Study", IJRET: International Journal of Research in Engineering and Technology, November-2013, pages-401 to 403.
23. Patel, K. V. & Vyas, C. M. (2011). Construction Materials Management on Project Sites. National Conference on Recent Trends in Engineering & Technology, Gujarat.
24. [Http://www.corerfid.com/](http://www.corerfid.com/)