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RFID - based supply chain control and management in basic and heavy industry

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Abstract: *Supply chain plays an important role in efficiency of basic and heavy industries. It mainly focus on enhancement of dynamic control management via sharing and analysis of information from involved participants of the projects to reduce manufacturing conflicts and project delay. Integrating promising information technologies such as radio frequency identification (RFID) technology, mobile device- PDA, and web portals can help improve the effectiveness and convenience of information flow in supply chain system. RFID technology has moved from obscurity into mainstream application and provides cost savings through speed and accuracy of data entry. This study propose a RFID - based supply chain management system to intensify the information flow among the environment. It is feasible to adopt proposed approach which concentrated largely on digitization and automation of pre-processing paper work.*
Key Word*: RFID , Supply chain management, Web- based, Tracking System*

I. Introduction

Metal industries like iron and steel industries are called the basic industry. These industries are extremely complex because product development comprises of several phase and various operations needed to be manage in an time constrain. The slightest mistake could lead to vast increase in costs. An effective monitoring strategy for various operation is essential to predict and prevent risk, thus requiring a diverse array of specialized service and involvement of numerous participants. On-site engineers generally handle various types of digital data, including process sheet, check lists daily report. They uses sheet of paper and/or field notes. Consequently a time and spacegap exist between on-site and the office, which reduce efficiency and creates a lack of data and data confusion. Information technology (IT) plays and important role in successfully controlling and managing of project through communication and coordination among participants. Furthermore, integrating promising information technology such as personal digital assistants (PDA), radio frequency identification (RFID) scanning and data entry mechanisms, can help improve the effectiveness and convenience of information flow in supply chain system.

Problem statements

Project management and control performance can be magnified by enabling participants to share information with each other. However, two major key aspects of information sharing are information acquisition and information communication. Information acquisition problems in a manufacturing project follow from most of the data and information being gathered from the working site, which is an extension of the chain. The effectiveness of information and data acquisition influences the information flow between the office and the job site. However, on- site engineers generally use written documents, drawings, process-sheet, specifications and daily report for job sites. Consequently, a time and space gap between the job site and the office causes duplication of data and information, lack of data and information, and associated confusion. Restated, existing means of processing information and accumulating data are not only time-consuming and expensive, but also compromise project management performance in information acquisition. Furthermore, on-site contractors normally depend on interactions via telephone or fax to communicate with suppliers, subcontractors and managers. Consequently, transactions are frequently lost or misunderstood. Such

means of communicating information between sites and offices, and among all participants, are ineffective and inconvenient.

Research objectives

This study develop RFID based tracking system for inventory management with the industry. The main purposes of this study include (1) applying such a system that integrates RFID technology with PDA technology to increase the efficiency of job site data collection; (2) designing a web-based portal for construction supply chain control, providing real-time information and wireless communication between offices and sites, subcontractors and suppliers;
(3) providing on-site engineers with updated information, accessed via the internal supply chain control system between the office and job site, and (4) supporting project managers of each shift in monitoring and controlling the production process dynamically. Fig. 1 illustrates solutions for problem statement by NALCO given in Smart India Hackathon (SIH-2020).

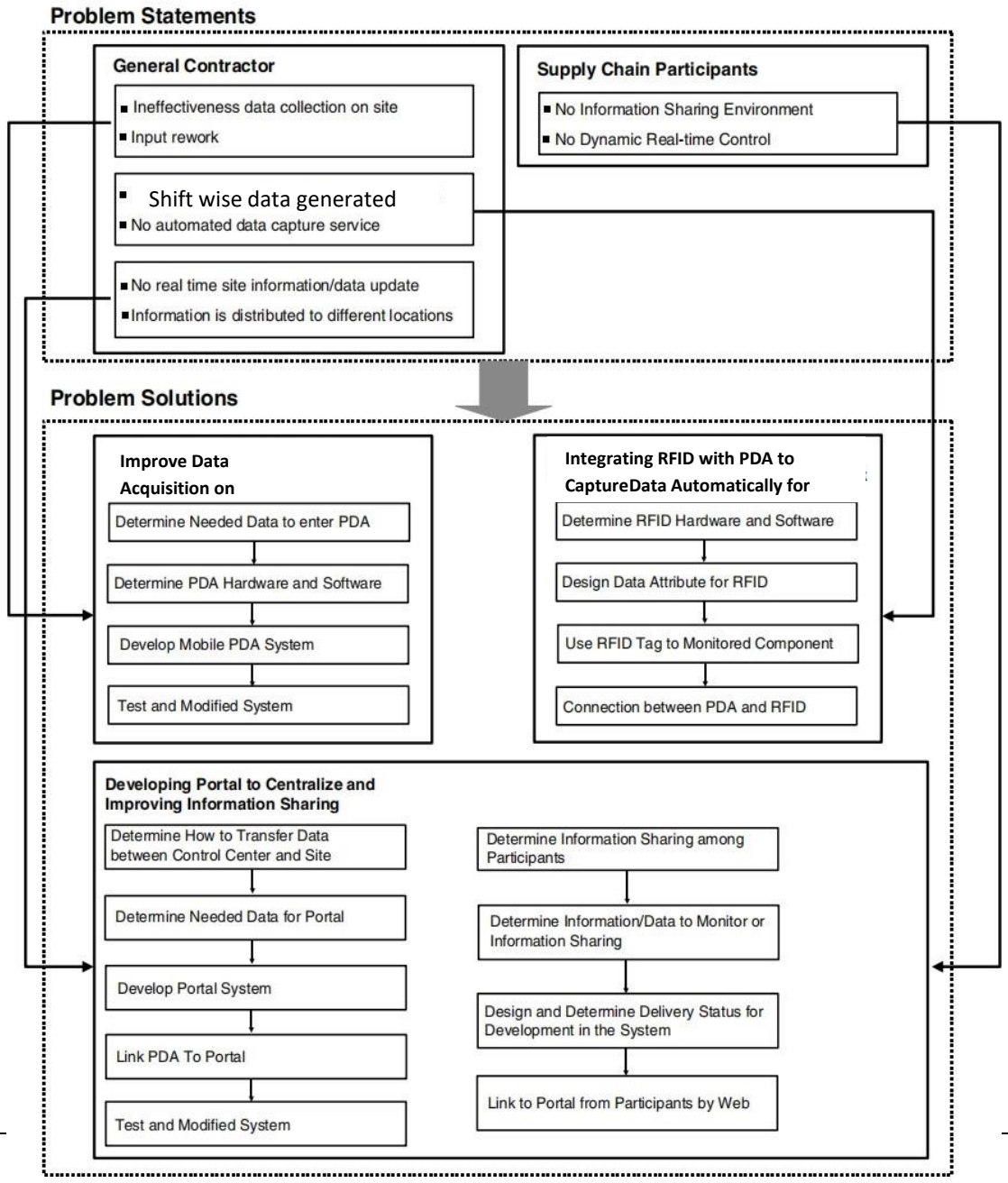


Fig. 1. Problem statement in information sharing among participants

II. Material and Methodology

RFID tracking system

The network structure of RFID system is depicted in Fig. 2. S can be seen, a RFID tracking network consists of three main components: active/passive RFID tags, RFID reader and a tracking server. The tracking server process measurements from all readers via Wireless Local Area Network (WLAN) to determine positioning of tag. As focus of this work is positioning in large and complex industrial areas, so in our approach we attach tags to moving object while readers are fixed at different locations.

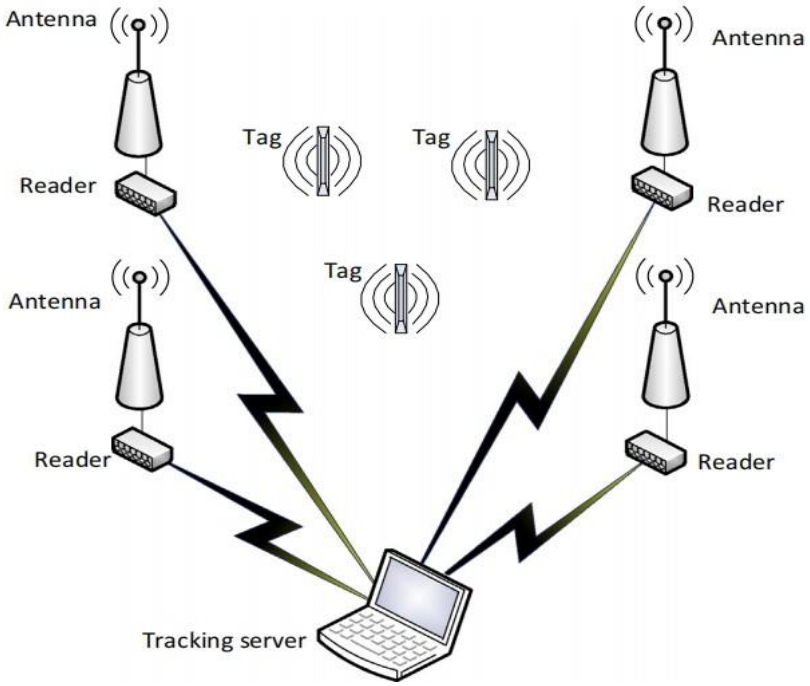


Fig. 2. Network of RFID tag tracking

Personal Data Acquisition- PDA

Various mobile devices have been adapted to field work in manufacturing industry. The application of mobile devices has been applied in numerous areas in the industry, including the following (1) providing wearable field inspection systems; (2) supporting digital data acquisition for recording work flow and daily report; (3) supporting collaborative and information sharing platform; (4) utilizing mobile computer to capture data for pilling work.

Using a portal in supply chain

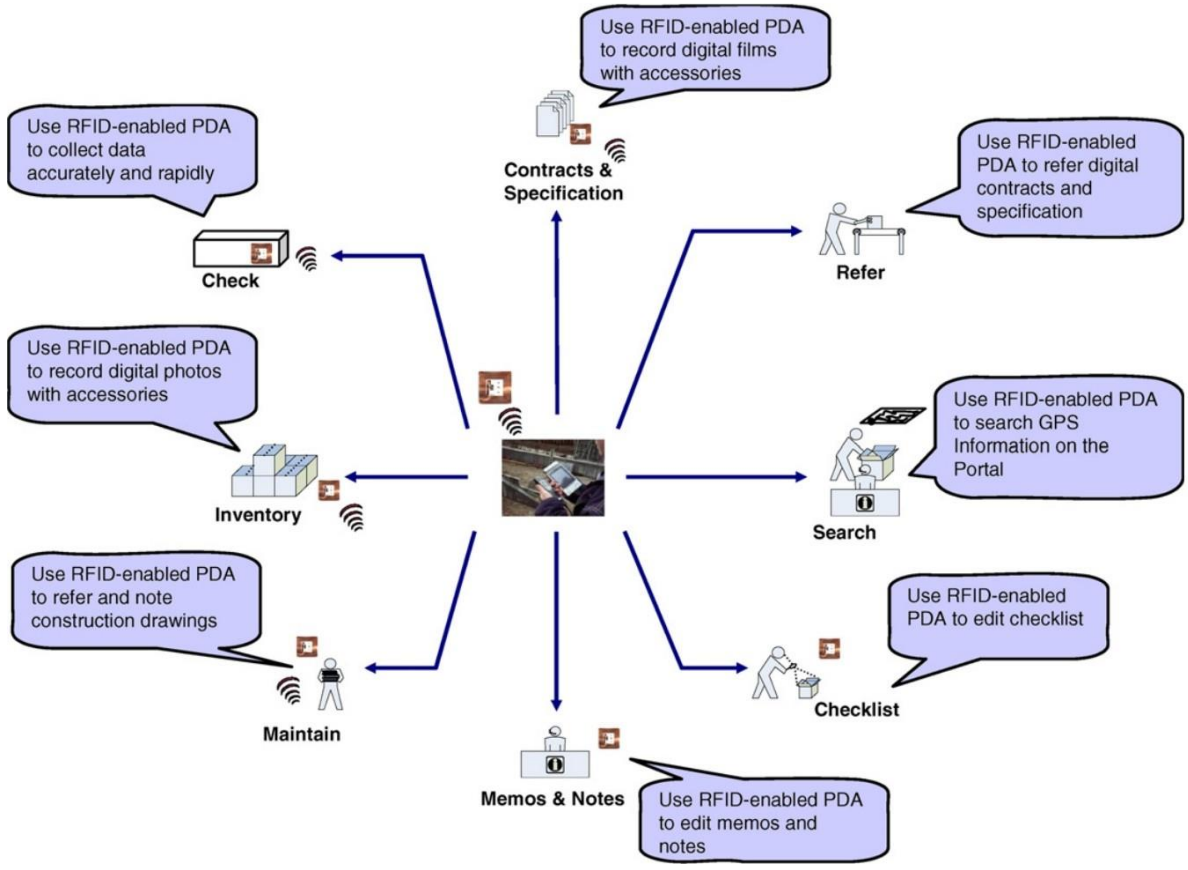
A portal is an ideal platform for sharing information in supply chain. When a portal is used all project related information that is centralized in a project database can be accessed via web interface. Standardized interaction with single portal are easier to manage than numerous peer- to- peer relationship. Electronically exchanging information reduces errors and increases work efficiency.

Development of the system

The proposed system comprises three components: PDA, RFID and portal. Notably, both the PDA and the RFID components are on the client side, while the portal component is on the server side (see Fig. 3). Similar to project scheduling management, all data are stored and classified using activity-based units in the system.

Additionally, the services described in this study are made available to all project participants via a specially designed portal, which also serves as a real-time and mail communication channel for projects. Within the system, all project-related information acquired by on-site engineers is centralized in a supply chain system database (portal model database). Project participants (subcontractors and suppliers) in the supply chain may be able to access all or

some of this information via the portal, depending on their access privileges. All the authorized participants can run quality controls, schedule controls and inventory management, based on the data shared through the portal service.



System implementation

This section illustrates the implementation and module of the RFID - enabled PDAs system.

• Inventory management module

The Inventory management module is an easy-access and portable environment in which on-site engineers can trace and record all information on the status of materials in the warehouse or on the scheduled delivery list. This module enables on-site engineers to improve inventory management on construction sites.

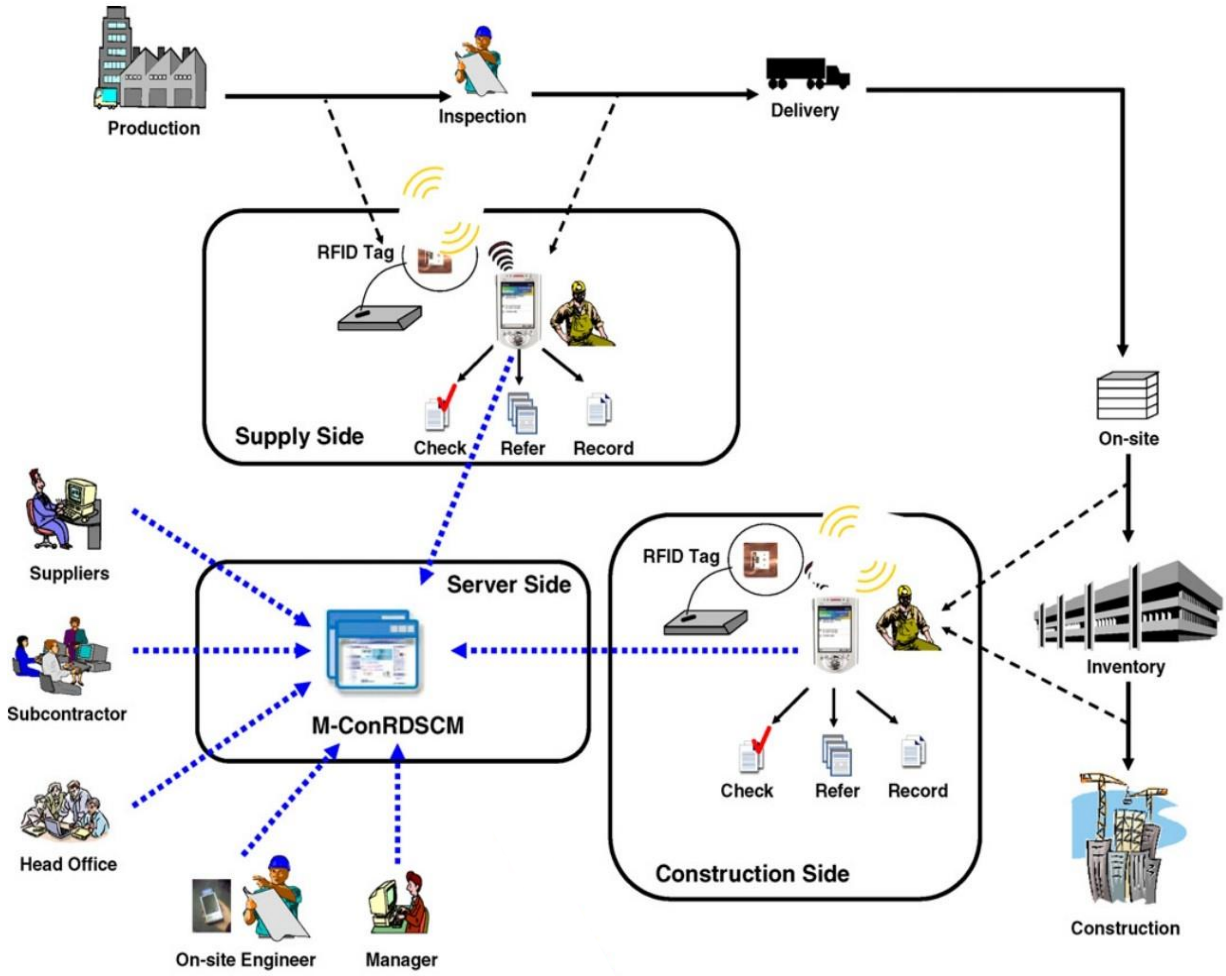
• Quality and inspection module

On-site engineers can download the most up-to-date quality tests from the Internet, and can enter test results directly via PDA. Additionally, PDAs display the code and/or checklist for each important component and work. On-site engineers also can plot unacceptable positions on a drawing and choose relevant items from the lists in the PDA. The module has the advantage that on-site engineers can enter/edit quality and inspection test result on the construction site and all test records can be communicated between the PDA and the portal via real-time synchronization, eliminating the need to repeatedly enter the same data.

• Progress monitor module

This module is designed to help managers and on-site engineers monitor the progress of the key components. Furthermore, managers, on-site engineers and project related participants can share the current progress or delivery condition of these critical works and components. The schedule management module provides an easy-access and

portable environment in which on-site.



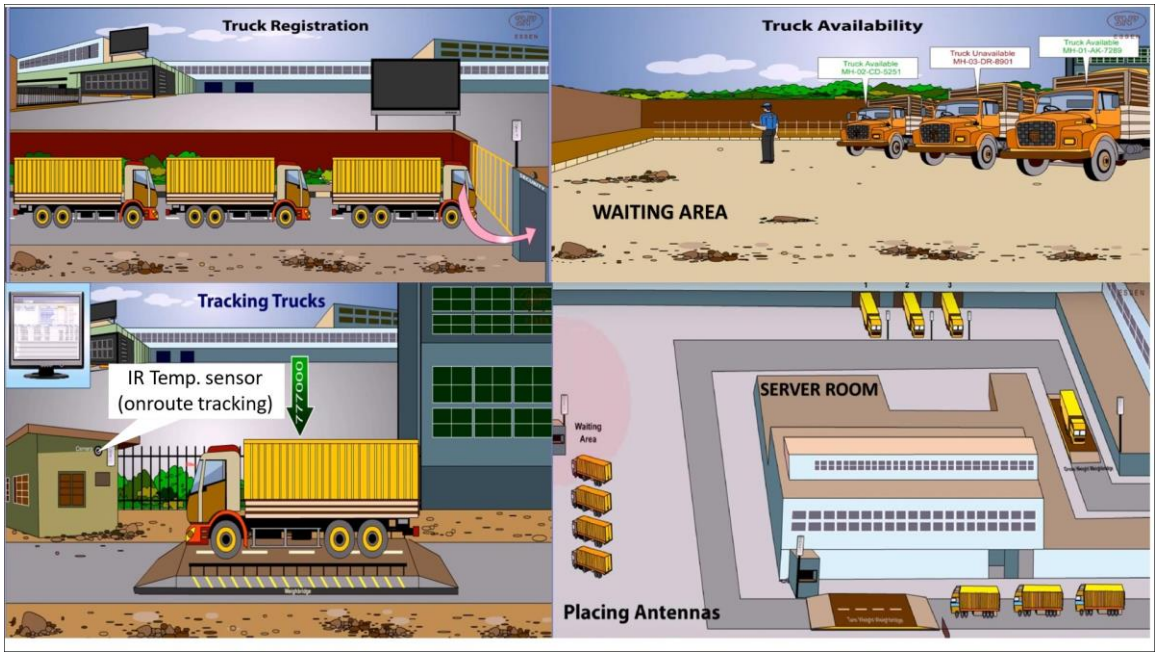
III. Case Study

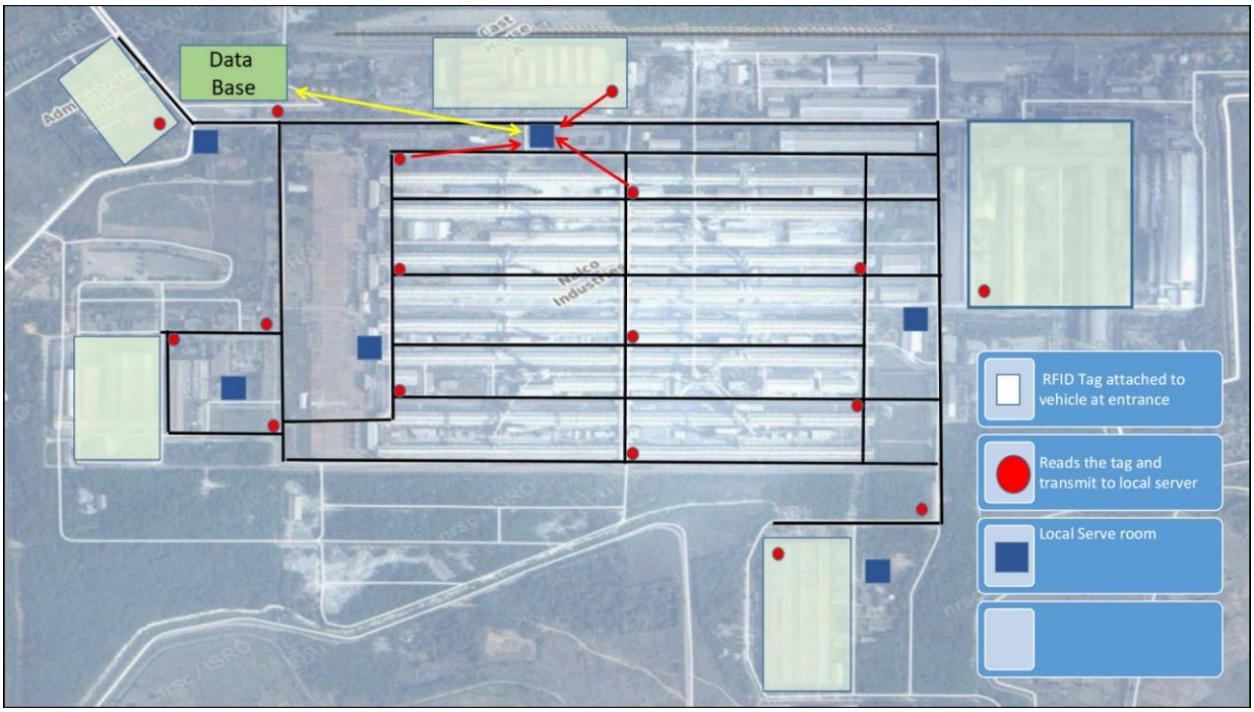
Proposed system can be applied for problem statement from NALCO. Following are the requirements of the industry.

- To devise an IOT based vehicle mounted pilot project which shall ensure real time data connectivity on: Vehicle location tracking through LPS. (UWB / RTLS / Indoor-Locating / LPS)
- Information on availability of vehicle.
- Vehicle call request with location.
- Driver acknowledgement for call request.
- Vehicle identification through code broadcast.

The proposed project will enable to achieve the following:

1. Reduced Metal Transporting Trucks turnaround time leading to lower haulage losses.
2. Reduced occurrences of ladle hot metal temperature drop due to smaller and faster haulage time.
3. More efficient control of vehicle logistics reducing chaos due to vehicle unavailability/in traceability.
4. Reduction of possibility of metal outage at either of Cast Houses, Rolling Plant.
5. Reduction in consumption of fuel oil required for reheating of liquid metal.





IV. Conclusion

This study presents a web-based portal system that incorporates RFID technology and mobile devices to improve the efficiency and effectiveness of on site data acquisition and information sharing among participants to assist managers in controlling and monitoring progress in supply chains within firm. The proposed system not only improves the acquisition of data on site efficiency using RFID - enabled PDA, but also provides a monitor to control the production progress. On the client side, on site engineers use RFID - enabled PDAs to overcome time and space

constraints, enabling them to seamlessly integrate work processes at job sites, owing to its accuracy and ability to

capture data effectively. Meanwhile, on the server side, the system offers a Hub center to provide suppliers and subcontractors with real-time updated project-related information and to monitor the construction progress. In a case study, the application of the system helps to improve the monitoring of operation progress for NALCO industry. As a process tracking technology, this study demonstrated that passive RFID technology has significant potential to enhance supply chain control and management in project. The integration of production and delivery real-time information from precast supplier helps the GC manager to monitor and control the whole

V. Recommendation of Future

Based on the findings of the case study, RFID technology and mobile devices appear to be useful solutions for monitoring progress on job sites. As the next step in the implementation process for further research, the following suggestions are presented:

- A working prototype can be made for small organization and then can be up-scaled.
- System can be further integrated to measure product quality
- This study found that passive RFID devices were more robust than the use of barcodes, but they also noted a disadvantage in the requirement that the reader be within a certain distance from the tag to be read. Furthermore, reading ranges are commonly less than 16 cm when using RFID-enable PDA during the study.

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