## ABSTRACT

Andoh, Abdul Rahman. M.S.E., Purdue University, May 2012. Tracking construction site dynamics using RFID and GPS. Major Professor: Dr. Hubo Cai.

Construction site is rugged, dynamic, and complex, involving a large number of resources that intensively interact with each other under varying site activities. Being able to accurately locate, and track the construction site dynamics and continuously transferring the information from the field to the office in a timely manner, is critical to project control and management. A few studies have explored the potential of the Radio Frequency Identification (RFID) technology in estimating the two-dimensional (2D) and three-dimensional (3D) locations of construction site objects at discrete time points. However, the biggest challenge in applying the RFID technology is that the received signal strength (RSS) varies over time and location, and there is no direct relationship between the signal strength and the detection range, leading to low positional accuracies in the estimated object locations. For the purpose of tracking the construction site dynamics, both capabilities of estimating 3D locations of site objects at discrete time points and tracking the real-time movement of site objects must be incorporated in the tracking system.

This research presents a conceptual framework of a 4D tracking system to track the status of construction site dynamics using RFID, GPS, wireless sensor networks and a Geographical Information System (GIS). In this study, a prototype system was implemented based on the 4D framework and tested in a field experiment. The newly created framework was supported by an innovative algorithm that integrates a "boundary condition method" and the trilateration concept to estimate tag locations in 3D real world coordinates from four or more RFID readers equipped with GPS. A comprehensive assessment of the positional accuracy was applied to field experiment results and a high accuracy of the algorithm was observed. This study also investigated a number of potential quality indicators (e.g. factors that might have a direct relationship with the resulting accuracy). The measure of the spatial dilution of reader distribution was discovered to have a linear relationship with the resulting accuracy of the estimated tag location. This finding could help in estimating the accuracy and quality control of RFID-based locating and tracking systems in construction.