Automatic Spatio-Temporal Analysis of Construction Site Equipment Operations

Continuous tracking is crucial for analyzing dynamic interactions among construction resources in any active construction site. The problem is that manual methods of operation analysis are expensive, potentially error prone and based on data sampling. Location tracking data, if available, are not used up to its optimum potential. The goal of this research is to automate the operation analysis process by developing algorithms that operate by merging location data from resources with site geography.

The research focuses on using GPS data for assessing productivity and safety conditions on site. The scope of this research is limited to outdoor construction sites and targets tracking workers and critical equipment in motion. The method of this research is to track equipment on site using GPS data logging devices and to develop a platform integrating algorithms for operation analysis. Site geography is incorporated into the platform by dividing the construction site into different geo-referenced or fenced zones. The results include detection and analysis of cycles, zone, speed, and proximity.

Cycles are classified into three types based on their starting and ending points. Cycle times like haul times, load times, return times etc. are automatically calculated along with the number of cycles. Zone and speed analysis provide better insight of working behavior of the resources and also act as a check for performance and safety. Proximity analysis helps in quantifying the cases when two or more resources work nearer to each other than allowed threshold. Congestion and crew interaction can also be analyzed. In conclusion, the results suggest that location data can be used in better understanding the site operations.

Repetitive tasks like cycles can be automatically detected and analyzed. Results to statistical analyses of cycle times are reported. Movement of resources in different zones and analysis of speed can act as pro-active measure for identifying unsafe behavior. It can assist decision makers in evaluating the site layout and making changes to Internal Traffic Control Plan. Proximity analysis can help to identify areas of potential collision on site and take preventive actions. Education and training tools are expected to result from this work that can greatly advance the field of site preparation, planning, and controlling, including pre-task work planning and job site safety analysis.

A major publication that is available to this topic to date is: