Faster cargo processing at container terminals

By PolyU's real-time tracking technology for smart co-ordination in terminal logistics

A ship waiting to be unloaded is an opportunity cost for the port. Therefore, faster truck turn times, vessel turn times and throughput is crucial for busy port terminals like Kwai Tsing Container Terminals. Recently, PolyU has unveiled its latest monitoring and tracking system, Intelligent Context-aware Decision Support System (ICADSS), in speeding up the cargo processing in container terminals. To clear up the shipyard for the next arriving ship, thousands of cargos can be moved between the ship area and the storage yard with a fleet of port vehicles. ICADSS offers real-time tracking of moving truck and terminal equipment, allowing smart co-ordination that eliminates long queue and truck waiting time in the process of discharging or loading cargo.

Moving giant shipping cargos through a port terminal is a daunting task, which takes a concerted effort involving massive equipments like crane, trailer truck and mobile handling equipment. These logistic activities, often in slow motion, become time-sensitive in today's competitive marketplace. On arrival at the port, a ship is expected to unload and depart as soon as possible, in order to allow the terminal to handle as many ships as it can. Therefore, Department of Management and Marketing together with Department of Logistics and Maritime Studies from PolyU have recently developed a novel tracking system that promises smart management of terminal logistics for faster cargo flow and speedier service for the ships.

The tracking system, Intelligent Context-aware Decision Support System (“ICADSS” in short), is an integrated suite of modern wireless technologies built around a knowledge-based computer system. With a differential global positioning system (DGPS) and ZeeBee technology rolling into one wireless sensor network, ICADSS monitors truck queue at key hand-off points such as quay crane (QC) and rubber-tired gantry crane (RTGC), where cargos are moved between the ship and the cargo storage yard with a fleet of port vehicles.

As a truck will move throughout the yard and stop at a work queue, its location and load status can be tracked in real-time. Load status indicates if a truck is empty, loaded or half loaded. Port terminal can now track hundreds of trailer-trucks space across acres and acres of yard area,
by simply viewing from a graphical display in a control room. A full visual over every work queue allows empty trucks to be quickly located and assigned to idle queue or even new jobs. This will result in reduction of waits and optimal allocation of terminal resources serving the ships.

ZeeBee sensor offers excellent signal reception over a short distance, resulting in a monitoring system that can accurately pinpoint a truck to below 5m, way better and costs much less than GPS. Offering incredible accuracy and reliability, ICADSS overcomes the line-of-sight problem brought by thousands of stakes of cargos, an advantage which is extremely useful for contain terminal. Kissing good-bye to manual checking for possible data discrepancy from obstruction of view, ICADSS minimises the labour in managing the cargo flow. The principal investigator Professor Eric Ngai said, “it’s very time-consuming to do manual yard check and to try locating trucks when there are hundreds of them in the yard.”

Being the largest container port serving southern China and one of the busiest in the world, Hong Kong handled a total of 21 million TEU* in 2009**. With thousands of cargo, terminal truck, crane and mobile handling equipment to co-ordinate in a busy container terminal, job scheduling and dispatch is an exercise in complexity and scale. By using ICADSS, a full picture showing movements of vital truck and equipment; without blind spot and delay becomes possible. Jobs can be dispatched in a way to eliminate long queue and waiting time. As trucks perform more moves, the operator can move as many cargos as they can.

The real-time system also encourages dynamic job dispatch that is situation responsive. In keeping abreast of new queue and repositioning of truck, the traffic controller can see the effect of change in real time. Furthermore, being “context-aware”, ICADSS operates on a knowledge-based management system which will formulate on its own a job dispatching decision based on real-time information and even generate alert for overcrowded queue.

As a simple, reliable and cost-effective tool to achieve efficient co-ordination of cargo and truck movements, this tracking system enjoys enormous attention with a couple of international awards including the Bronze Award at the 38th International Exhibition of Inventions of Geneva, Switzerland. Although the new technology is some years away, terminal operators that have taken part in the trials are excited about the benefits it can bring, as early result has shown that truck waiting time at the queue was cut drastically by 50%. Showing enormous potential in improving truck turn times, vessel turn times and throughput, ICADSS can help to boost the annual capacity without increasing the size of terminal.

* TEU (20-foot Equivalent Unit) is a unit of cargo capacity to describe the capacity of container ships and container terminals