AUTOMATION & HUMANS WORKING TOGETHER

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Kuenz has a long history when it comes to automation. We have been delivering special purpose handling cranes for the mining industry and machines for the hydropower sector – with a very high level of automation – since the nineties. It may surprise some of you that hydropower plants have been fully automated, without any workers on site, since this time.

Given our experience in this area, it meant we could transfer our expertise to the first automation project in an intermodal yard, which was completed in 2005 when one sole crane was delivered to the Warsteiner Brewery. The crane had been built without a cabin and the crane operated semi-automatically, handling the stack fully automatically, with the loading/unloading of trains done remotely via remote operating station (ROS). This was built in a very similar way to a ROS from a traditional automated stacking crane (ASC) operation. Once this project was done, between 2005 and 2016 we executed several more automation projects in ports. Over the decade we've seen the sensor, camera, laser and crane become optimized, heralding the fully- and semi-automated terminal.

AUTOMATION CHALLENGES

When conceptualizing automation in the maritime sector, it should be understood that there are some major differences between an intermodal yard and a port. First of all, there are trains in an intermodal yard, and another big difference is the presence of workers. The safety concept from ports is always to fence an automated area to have zero people where cranes operate. This is doable in ports, however it is not an option for intermodal yards. This is because every incoming and outgoing train in an intermodal yard needs human influence. For example, trains need to be moved in by a train operator. In North America all trains are double stack and twistlocks are used to interlock the containers. Unlocking and locking of the twistlocks is done by workers driving on a platform, known as 'grunts'. Also, different safety checks need to be made on the rail cars, this is also done by human workers, and the workers will access the area around trains with vehicles.

Given the above, it is obvious that a safety concept used in ports will not work for intermodal yards. The challenge then is to craft an automated system that works together with human workers on the ground. We developed a solution for projects in Canada and the United States where the customer requested us to supply cranes with a very high level of automation and no operator on the crane.

AUTOMATION SOLUTIONS

Several different systems, such as laser systems and thermal imaging cameras, had been tried to solve the above issue, but in the end they did not meet the safety requirements. The solution was a system that consisted of DGPS and RFID technology. These components and the attendant software had been specifically developed for the needs of an intermodal terminal.

The safety concept was also based on a multilayer system, and it was created in this way in case one system (layer) is not working, allowing another system to take over. This assures maximum safety and high availability for the end customer. All vehicles were also equipped with a DGPS system and one RFID tag. The workers' helmets were also equipped with an RFID tag, with the battery of the tag lasting as long as one year. The RFID tags are also personalized. RFID receiving antennas were attached at the light posts of the terminal and also on the cranes. The RFID and DGPS systems could then constantly transmit the positioning data to the yard controller. The challenge was to never lose the position of a vehicle or a worker, even if a line of sight

is not available. The accuracy of the system at any given time is never less than 1 metre.

The cranes have also been equipped with the latest version of cameras and laser systems to detect containers, and find pins on rail cars and trucks. A yard controller is used to connect the TOS system and the cranes. The yard controller is also constantly fed the position data of the RFID and DGPS system, as well as the cranes. The TOS then sends the work orders to the yard controller and the yard controller then optimizes the path from the crane, considering all vehicles and workers on the ground. The crane is now driving around vehicles and workers, picking up containers from rail cars and trucks, and placing them at the desired destination.

The crane system is equipped with ROS for exceptional moves and to supervise the loading and unloading of trucks. In ports, it is common for the end loaded concept with 'kiosks' to be used. In this instance, the truck driver needs to step out of the truck cabin and wait at the kiosk. Once the truck driver is in a safe position, the crane unloads or loads the container from/to the trailer. This concept was not possible in intermodal terminals because kiosks were needed along the entire length of the rail track, which is usually a minimum of 700 metres long. Therefore, we needed to find a new solution.

Truck drivers are trained before they enter an area where they are told where to drive and where and how they need to park. The terminal layout is designed in such a way that the trucks are located underneath one cantilever, separating the stack and the rail cars from the trucks. Once they have parked, the truck driver needs to step out of the cabin, and release the pins, then wait next to the truck cabin for the crane. The crane will stop before approaching the truck and the operator at the ROS will then take over, ensuring that he sees the truck driver, then press a button to execute the job. Once the worker releases the button, the crane stops immediately. That means that the crane system is automatically loading and unloading containers, but supervised by an operator. Thus, the entire stack is operated fully automatically, and the loading and unloading of rail cars is done fully automatically too. Now, an operator at the ROS only need take over in exceptional circumstances. The cranes are handling ISO and WTP containers only.

OUTLOOK

Increasingly, terminals are converting intermodal operations into semi-automated terminal designs. Therefore, terminals we've worked with are now working with less labour costs, with the time taken to change operators on the cranes at zero, and the predictability of the performance of cranes dramatically improved (when compared to manual cranes). Further still, the operating hours on cranes can now be evenly split. The Kuenz Automation Package can be implemented on existing cranes as well as on new cranes.

ABOUT THE AUTHOR

David Moosbrugger is Managing Director of Kuenz. David is in charge of Sales and Engineering at Kuenz. Before becoming Managing Director of Kuenz, Moosbrugger worked in engineering, project management and sales. He lived in the US for several years working for Kuenz America.

ABOUT THE AUTHOR

Kuenz was founded in 1932 by Hans Kuenz who succeeded in creating a significant and successful mechanical engineering company in a very short period of time. The company started out manufacturing tower construction cranes. The focus later shifted towards manufacturing container cranes, followed by hydro power equipment. Kuenz is one of the oldest and most prestigious mechanical engineering companies in Austria.

ENQUIRIES

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