Internet Of Things (IOT) For Inventory And Container Position

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Abstract. Along with the rapid development of information technology, there is a change in every field, one of which is in the container depot (container storage). Smooth flow is part of the supporting aspects of the rapid transfer of products to consumers. Internet of Things (IoT) as technological development is a solution to support activities in container depots. The use of an IoT / RFID based system for transporting containers is an indispensable change in the interaction of the smooth flow of container transfers. The containers that are piled up will make the container search process longer and other processes hampered. The author tries to find out how to implement IoT in the depot container to achieve a container depot that is integrated with Information Technology (IT). This research was carried out using a qualitative method that wanted to be seen clearly and deeply what had been done.

1. Introduction
Export and import activities are important to support finance in Indonesia. Regarding its relatively large role, operational activities in export-import must also be optimal. Depo Container as a place to store containers both inside and outside the work environment is one aspect of supporting export-import activities.

According to Lasse "Container is a charge that has been tested for its strength, made of metal, can be used repeatedly in shipping or in non-ship vehicles, and is provided by carriers." [1]

The Container Depot is a complex system with very dynamic interactions between various handling, transportation and storage units. Container terminals are a meeting place between modes of transportation, containers transported by ships, trucks or trains will be temporarily stored in the stockpile to then be sent with the same or different transportation. Inside the container, terminals are appointed with equipment of different types and in container terminals grouped into three types, namely export / outbound containers, import / inbound containers, and transshipment containers.[2]

While the definition of depot according to Lasse is "Outside port area that provides warehousing services for transportation of export container loads and/or important transportation (overbrengen) from the port area."[1]

The container depot is one of the links in the supply chain, which is very important in order to complete the supply chain from producers to consumers. According to PP Governor No. 119 / 2011, container depots are an open area in or outside the port work environment (DLKr) as a place for storing and stacking (storage), cleaning or washing, maintenance and repair of containers, loading (
stuffing), stripping, and other activities that support the smooth handling of full containers and/or empty containers.\[2\]

And as discussed in the Minister of Transportation Regulation of the Republic of Indonesia PM 83 in 2016 concerning the operation and operation of container depots, the definition of the Container Depot is a place inside or outside the Work Environment Area (DLKr) Port that functions for storage activities, accumulation, cleaning/washing, maintenance, repairing containers, stuffing, stripping, and other activities that support the smooth handling of full container and/or empty containers.\[3\]

The problems in the depot are the efficiency of time and the incompatibility of laying containers in depots which refers to the length of the process in laying or finding containers during the loading and unloading process which causes a long queue in the depot. At present Indonesia needs to implement IoT (Internet of Things) in an effort to reduce the queue in the depot. IoT (Internet of Things) as one of the innovations to speed up the process in the depot.

IoT is a technology in which sensors and software are inserted in devices which surround us. These sensors and software collect and share information about the way the devices work, how they are used, and about the environment around them. All this information is stored on a secure hub called the internet of things platform. The internet of things platform is a very powerful gateway which applies analytics on the information received from these smart physical devices. This information can be used to detect possible problems before they occur and to offer a solution to them.\[4\]

Internet of Things (IoT) has provided a promising opportunity to build powerful industrial systems and applications by leveraging the growing ubiquity of radio-frequency identification (RFID), and wireless, mobile, and sensor devices. A wide range of industrial IoT applications has been developed and deployed in recent years.\[5\]

At present, the world is facing a digitalization era, the role of Information Technology (IT) in this era will shift activities that are usually done manually to technology or virtual based.\[6\]

The initial basis for industrial digitalization is the networking of devices. This is commonly known as the Internet of Things, a concept which the profession cannot define with unanimous agreement. It means IoT is a device equipped with chips, barcodes, RFID or sensors that are connected to each other and can connect data.\[7\]

Components of the IoT solutions are Device sensors on vehicles (speed, container lifting speed, moved containers), IoT Gateway server to connect sensors to the cloud, Fieldbus to ethernet converter to handle PLC communication with devices, SoftwareAG Cumulocity IoT platform, Web-based dashboard for easy monitoring.\[8\]

IoT tries to establish advanced connectivity (with the aid of internet) among these mentioned device or systems in order to little by little makes automation in all areas. The image that all things are connected to gather and all information would interact with each other over standard and different protocol domain and applications.\[9\]

The Internet of Things might be a hot topic in the industry but it’s not a new concept. In the early 2000s, Kevin Ashton laid the foundation for what would become the Internet of Things (IoT) in MIT’s AutoID laboratory. Ashton was one of the pioneers who understood this idea when he looked for ways to enable Proctor & Gamble to improve its business by connecting RFID information to the Internet. IoT describes a system where items in the physical world, and sensors inside or attached to these items, are connected to the Internet through wireless and wired internet connections. These sensors can use various types of local area connections such as RFID, NFC, Wi-Fi, Bluetooth, and Zigbee. Sensors can also have wide area connectivity such as GSM, GPRS, 3G, and LTE\[10\].

Internet of Things will:

1. Connect inanimate objects and living things. The initial testing and deployment of the Internet of Things network began with connecting industrial equipment. Today, the IoT vision has evolved to connect everything from industrial equipment to everyday objects. Cisco has expanded the definition of IoT to the Internet of Everything (IoE), which includes people, places, objects, and
Basic objects. Basically, anything you can attach sensors and connectivity to be able to participate in new connected ecosystems.

2. Use sensors for data collection. Physical objects that are currently connected will have one or more sensors. Each sensor will monitor certain conditions such as location, vibration, movement, and temperature. On IoT, these sensors will be connected to each other and to systems that can understand or present information from the sensor data feed. These sensors will provide new information to the company’s system and people.

3. Change what types of items communicate via the IP Network. IoT-activated objects will share information about their conditions and the surrounding environment with people, software systems, and other machines. This information can be shared in real-time or collected and shared at specified intervals. Going forward, all will have an identity and digital connectivity, which means you can identify, track and communicate with objects.[10]

3C from IoT:
Communication. IoT communicates information to people and systems, such as the state and health of the equipment (eg Life or death, filled, full or empty) and data from sensors that can monitor a person’s vital signs.

Control and Automation. In a connected world, businesses will have visibility into the condition of the device. In many cases, businesses or consumers will also be able to control the device remotely. For example, a business can turn on or turn off equipment remotely.

Cost savings. Many companies will adopt IoT to save money. Measurements provide data on actual performance and equipment health, not just estimates. Businesses, especially industrial companies, lose money when equipment fails. With new sensor information, IoT can help companies save money by minimizing equipment failures and allowing businesses to carry out planned maintenance [10].

2. Method
The research approach is qualitative to describe in how the inventory and position of containers. Data collection was conducted through structured interviews, semi-structured and in-depth interviews and focus group discussions. The data analysis technique used in this study uses an approach developed by Miles and Huberman which includes (after data collection) data reduction, data separation from unfocused, too detailed and so on so that the data will reveal patterns or themes. Next is displaying data (data display) which serves to help understand for further analysis of information or events. The final process is the researchers’ conclusions based on patterns and themes. Withdrawal of conclusions is carried out continuously, ie while doing when data reduction and data display is done [11].

![Figure 1. Data Processing Technique](source: Miles, Huberman, & Saldana (2014))

The data sources in this paper are informants who have the ability and effectiveness of information that is appropriate and in accordance with the needs of this research (purposive). Because this study aims to find out how inventory and positioning of containers for efficiency, effectiveness, and optimization of Container Depot, information that is not possible for professionals in terms of inventory, Container
Depo, and IoT is needed, but also those who every day in the inventory space, Container Depo, and IoT.

In this research, writers interviewed the following people, namely; 1) Senior Account Manager and Partnership of PT. Integrasi Logistik Cipta Solusi, 2) Credit Marketing Officer of PT. Gema Nawagraha Sejati (GNS), 3) Operational manager of PT. Gema Nawagraha Sejati (GNS), 4) Maintenance and Repair Head Division of PT. Gema Nawagraha Sejati (GNS), 5) Courtyard Head Division of PT. Gema Nawagraha Sejati (GNS), and 6) Marketing of PT. Gema Nawagraha Sejati (GNS).

3. Result and Discussion
PT. Gema Nawagraha Sejati is the target of implementing the Internet of Things (IoT) in this study. PT. GNS is a container depot company that was established in 1992 and is engaged in services, precisely storage containers located in the bonded area of Nusantara, cakung, North Jakarta. As a container depot company with more than 20 years of experience in the logistics industry. PT. GNS has a variety of obstacles in the depot activities such as infrastructure, heavy equipment that is inadequate, the depot plan is less effective, and also the soil texture is not good, causing heavy equipment difficult to move and lift process On / Off, the difficulty of the search process containers when they are needed so that it takes a long time in the search process.

The result of the study are:
This is the container process flow in PT. GNS depot
A. Process Container in
1. Security Check
Check documents when containers enter the Depo, where drivers carry the Import DO from shipping and Interchange along with the EIR from the Port.
2. Survey In
The next step is to check the IN Depo Surveyor Team to check container numbers, conditions Damage (DM) or Available (AV), size and type and criteria for Washing (Water / Detergent / Chemical). The condition of the container is recorded in the IN Survey form and signed by the Management / EMKL / Depot Driver and Surveyor. Based on the condition of the container, the container is affixed with a Green AV sticker or a Red DM. If Damage conditions, the Surveyor takes photos of the Damage section, as additional evidence for the Estimate of Repair (EOR).[12]
3. Washing
Cleaning the container depends on the type of cargo it carries. There are 3 types of container washing methods, namely:
   a. Water Wash (Steam Wash), if container conditions are still normal.
   b. Detergent Wash, if the condition of the container is dirty and it is necessary to do the washing using detergent so that the container is clean and can be used for further export activities.
   c. Chemical Wash, if the container conditions are dirty and can not be cleaned only with water and detergent. For example Container ex-cargo of chicken food.

The container is damaged (damage) from the survey carried out when the container enters the depot, the stack is carried out separately from the container in good condition (available). This is done to simplify the repair process and when stacking containers. This is also included in the regulations issued by each shipping lane or container owner so that the container damage separation is carried out [2].

4. Cashier
When the container is washed in the washing area, the driver / EMKL hands over the EIR and Interchange from the TPS, along with the Survey Form for administrative completion or payment of Lift OFF and washing / Detention / M & R collection if there is damage caused by the user (user) with cost <Usd 20.00, - at the cashier [12].

5. Stacking
Then the cashier hands over the UnLoading Card, the color red for DM conditions, white for AV conditions. UnLoading cards are given to Stacker for reduction and each stack according to the conditions.

Containerization (Container Yard (CY) stacking depends on the container handling system used because each container handling system depends on each type of container equipment used in the system[2].

B. Process Container Out
1. Security Check
   An empty truck goes to the depot. The EMKL takes the queue (queue number) at the ACC / DO counter and sends Export DO (from the cruise) to the ACC / DO counter.
2. Cashier
   At the ACC / DO counter, shipping data from shipping is sent to the depot via email / check on the shipping system and cross-checked with DO carried by the EMKL management. If appropriate, DO / SI is approved to continue the payment process, Lift ON is carried out by the Management / EMKL.
3. Stacking
   Then the management / EMKL accepts the Loading Card / Load Card to select the stacking area and then the container is loaded onto the truck (lift on).
4. Survey Out
   Inspect all containers that will exit the depot above the chassis before making a travel document in accordance with the information and criteria written on the load card. And verify the physical and container numbers, verify the physical and trailer numbers, check container eligibility, then write container numbers and signatures on the loading bill.

This is a real time of container process in Depo

| Process       | Container | Time      |
|---------------|-----------|-----------|
| Security Check| CGMU 5286435 | 109"     |
|               | APHU 6410225 | 50'       |
|               | TCLU 9358729 | 60'       |
| Survey In     | CMAU 5459527 | 5'28"     |
|               | BSVU 2201264 | 15'23"    |
|               | GESU 6460796 | 2'44"     |
| Washing       | TGHU 6407705 | 19'44"    |
|               | CMAU 7258990 | 19'57"    |
|               | SEGU 7304010 | 10'50"    |
| Staking       | SEGU 7304010 | 16'02"    |
|               | SEGU 6435653 | 18'24"    |
|               | INKU 6466683 | 17'10"    |
| Survey Out    | BMOU 671266  | 1'41"     |
|               | CMAU 472269  | 2'56"     |
|               | GESU 111453  | 7'15"     |
Can be quoted from the data above is the real time of the container process in the depot of PT. GNS starts from security checks, In-Survey, Washing, Stacking, and Survey Out. And it is expected that using IoT in the depot can reduce time usage from the data above.

Referring to the obstacles that exist in the depot of PT. Our GNS recommends implementing IoT as a solution. As we discussed earlier, IoT has a variety of advantages because the system is integrated quickly. Implementing IoT by providing barcodes or RFID will facilitate container work. Facilitate the process of searching, laying and retrieving containers so that the process is more effective and efficient. As well as implementing IoT can minimize the occurrence of errors because the data needed by stacker has been determined by the system.

4. Conclusion
Container Depot PT. GNS has active activity in and out of containers every day. Facing progress in the digitalization era, developing is an important aspect for every industry. Internet of Things (IoT) as part of the advancement of information technology (IT) becomes a digitalization solution in container depots with integrated systems. The benefit of implementing the IoT is to facilitate the storage and placement of containers in container depots. So that storage and placement of containers become effective and efficient.

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