Use of IOT in Mechanical Industry- A Perspective

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Abstract : In this paper, an explanation of what the Internet Of Things is and its applications are given. Secondly, the relevant IoT technologies in the car industry are introduced. In supply chains, a trade off exists between the manufacturing and transportation functions. For the smooth flow of materials through a traditional supply chain, deliveries have to be made every ordering period on an ''as required'' basis. However, this is likely to result in less than full truckload consignments, which does not optimize the utilization of the vehicle payload. Conversely, by running full vehicles, the demand for transport is minimized and transport costs are reduced. Batching exists in supply chains because each player makes a rational decision to minimize visible costs. This can be achieved in one of two ways. A product can either be routed through a consolidation centre or batching introduced into the ordering rule to only permit full vehicle loads. However, implementing the latter within a traditional supply chain structure will result in the batching or Burbidge effect.

IndexTerms **– IOT, Supply Chain .**

I. INTRODUCTION

II. LITERATURE SURVEY

S.M. Disney at al By investigating a generic two level supply chain model, in traditional serially linked or VMI mode, we have highlighted some very interesting emergent properties of VMI in relation to the transport operations and order batching activities. The purpose of using simulation is to provide a simplified environment into which a number of situations and ideas can be tested. Although the basis for the model here is generic, its components (both the manufacturing and VMI elements) have been found to be representative of current industrial practice. Therefore, the results that have been achieved here are repeatable (maybe to a lesser or greater extent) in most industrial settings.

Xiaohui Liu at al Both information flow management in VMI supply chain and the Internet of Things are focus on research in present-day society. This paper is carried out to make analysis of information flow management of VMI in Automobile Parts Inbound Logistics based on the environment of Internet of Things. This analysis aims to provide a new vision to research logistics and supply chain management.

S M Sohel Rana at al The management of inventory by the supplier continues to draw attention in many industries as VMI provides some compelling benefits to the involved parties. MI represents a business model in which the buyer of a service or good provides certain information to a supplier of that product regarding the quantity of goods
sold and liquid stocks. Based on information obtained supplier takes full responsibility for maintaining agreed inventory of the material, where buyer only has to inform about the increase or decrease of desired inventories. For implementing VMI, organizations have to invest in technology development and restructuring. However successful implementation largely depends on sound business processes and interpersonal relationships. A purely technical solution without regard for the people involved is unlikely to deliver the benefits described above. To be successful in VMI contract, it is necessary to ensure effective teamwork with strong participation by both manufactures and retailers. Moreover, trust between supply chain partners is critical. Both must experience and recognize vivid benefits or the relationship is doomed. Finally, organization enticements and metrics must be lined up with VMI goals. Undoubtedly VMI relationships will fail without needed relationships, metrics and organizational structure.

Yan Dong at al This study has focused on VMI's role as a strategy of integrated supply chain and evaluates its attractiveness to the two parties involved. It reveals that a VMI program will be effective in reducing the inventory-related costs for the system of buyer-supplier channel as a whole, even without changing any cost characteristics of the channel or demand level at the end market, a condition described as direct changeover or short-term. It achieves this through optimizing shipment quantities as observed in typical VMI practice (Hughes, 1996). The buyer will snatch most of these short-term cost savings, as its profit under VMI is always higher than that before VMI when both parties manage their respective inventory independently. Such cost savings are not always shared by the VMI supplier, because the supplier's extra burden of carrying the buyer's.

III. IOT TECHNOLOGY IN THE CAR INDUSTRY

According to (Ninan S et al. 2015), even since the early days of the Internet, manufacturers of cars have been looking to make their vehicles more connected to the outside world through it. Starting in the middle 60s, people have been thinking about combining instruments of navigation and situation reports within cars. In the first attempts the hardware to support this was to be put on the roads. The economic cost of these first ideas made them hard to follow up and realize, but the ideas of navigation and situation report instrument usage stayed.

The next step was embedded devices inside the cars that was to allow manufacturers help its customers remotely. An example of this are the OnStar devices integrated by manufacturers like BMW and Mercedes. After embedded devices, with mobile phones and other devices getting more popular, getting our own devices connected to our vehicles got more relevant than ever. This trend inspired "The infotainment era". Applications like Spotify and others got connected to our vehicles and we could all of a sudden, for example, move our media settings into our cars.

The recent development shows us that self-driving cars that take use of the IoT and Big Data may be the next step. Cars have now begun to interact with such things as road signs and other vehicles in a smart way. According to (BMW revamps R&D, 2016), BMW has plans to increase their effort into the research and development of self-driving cars. Many other companies also plan to do this research and development revamp.

Engine Control Unit

According to (Charette, R.N. 2009), what controls the internal devices in a modern car are many Engine Control Units (ECUs) connected through the CAN bus which is the central unit that the cars' ECUs connect to. An ECU is a microchip that takes input that control and regulate the internal device it is connected to so that it can act and function according to the current environment.

Some of these ECUs are connected to the IoT to access remote resources like audio and video streams or to communicate with other vehicles. One ECU controls the engine and other ECUs control things such as the battery, doors, power, steering and audio system to name a few.

Controller Area Network

According to (CAN in Automation, 2015), CAN is a protocol designed for the communication between the ECUs in cars. This is used to make ECUs work together in different ways to, for example, let them wait for each other before they go to the next action in the schedule.

On-board Diagnostics

The OBD system is the central control unit in the car. It controls the cars' ECUs through the CAN protocol/CAN bus. According to (Kerstetter, B. 2012), OBD is a diagnostic done either by the car itself or a person. This diagnostic reports the state of the ECUs in the car. If done by a person, an OBD is usually done by a hand held OBD scanner after the driver sees that a light is blinking in the car to signal him/her that something is wrong. The scanner can then be plugged in and report to a user what is wrong in the car with different codes and messages so the user then can look for a solution on the manufacturer's website and use it. OBD is also used by the car company's fleet management systems. The vehicle keeps track on its ECU status with OBD while running and this information is then uploaded to the IoT and can be viewed by those with access.

Supervisory Control And Data Acquisition

According to (Boyer, S.A. 2009), Supervisory Control And Data Acquisition(SCADA) is a system for monitoring and controlling factories used in the car industry and other industries. It is an Industrial Control System(ICS). SCADA differs from other ICSs by being custom-made for large scale operations. This system has come in many different generations, the latest being the IoT version. With larger operations, new challenges were presented to the SCADA system. It now had to deal with a lot more devices spread out over vast distances due to organizations growth. A concept deriving from Object Oriented Programming called Data Modeling solves parts of this. This data modeling creates virtualized models of the devices running in an SCADA system. These models

contain information about the devices to help the administrators get an overview of what are happening in the facility network. More ICSs are likely to adopt this concept due to the growing need to handle large-scale operations. The IoT enables the SCADA systems to use smart algorithms for the facilities it monitors and controls. This makes the facilities more cost and power efficient.

Automation of Car

One of the results of putting all the previous mentioned car technologies together is autonomous cars. According to (Ninan S et al. 2015) and (Petit et al. 2014), car brands like Nissan, Volvo, Mercedes and BMW are getting their cars autonomous, and many believe that 90% of all newly manufactured cars will be connected to the IoT by 2020 from the less than 10% of today. Autonomous cars have three main sorts of connectivity:

- Vehicle to Vehicle (V2V)
- Vehicle to Infrastructure (V2I)
- Vehicle to Device (V2D)

All these three types of connectivity are used to form the base of interactive autonomous cars. According to (Kerstetter, B. 2012) and (Appendix A, 2016), cars have become a bigger part of our lives as time has gone by. They affect the environment all around us in different ways in both our personal and professional life. Many businesses run by cars to increase their effectivity and value, and cars are of interest for many regular people. Parts of our society evolves around them. Autonomous cars have a lot of benefits. These cars remove the stress of drivers having to know what way to drive, how fast they can go and conduct themselves amongst other drivers. Automation would also help the cars to be more resource efficient, and how long drives take are calculable since the drive itself gets strictly planned. Making cars autonomous also give a new view on cars. Instead of something drivers use, it is seen as a vehicle that transports people and things as a service why have a driving license? Businesses

could use them for food delivery and many other things. Another thing about autonomous cars many people are excited about is the ability for many of these cars to run on electricity. Cars would not have to be filled by car gasoline and could also recharge given the correct instructions at a charging station.

Many manufacturers are planning to get their cars into real-life testing to see how they hold up in the real world. An example of this is Volvo that has plans to give about 100 families chance to test their autonomous cars in their daily life in London , and the highway organization of England is looking to do their tests the same year ie 2017. Car companies have also looked into creating testing tracks. Jaguar Land Rover built their own 41-mile long test track in February 2016.

IoT Devices

The factories that create vehicles in the car industry are full of IoT devices. These devices are made to, for example, automate the process of putting car parts together, handle temperatures in the environment and notify administrators if something goes wrong. Many things around the factory are monitored and controlled by the power of these IoT devices administrated by the SCADA system.

IoT devices will also exist in the environments where autonomous cars move around. With cars getting more and more interactive, IoT devices get more usable than ever before by the car industry because of the value they bring through their ability to work as extra components to existing infrastructure. IoT devices can help autonomous cars make decisions and make them more efficient.

Computer Clouds

Many of the components of the cars connected to the outside world use computer clouds. These clouds get used for processing of complex data and also to store vehicle information. An example of how this is used is the fleet management systems car companies' have created to keep track of vehicles to service them remotely. Computer clouds are also used to process the data of the IoT devices around car industry environments.

The competition in supply chain management among vehicle manufacturers such as General Motors, Ford, Toyota and Volkswagen is as intense as that at race tracks or automobile shows. To sharpen their competitive advantage, vehicle manufacturers choose third-party logistics (3PL) specialists to reduce logistics costs and improve the satisfaction of their customers. The average new vehicle is assembled from more than 2,500 parts. In this sense, automobile parts inbound logistics is very important to automobile supply chain management.

The concept of VMI has received much research attention and evidence has shown that VMI can improve supply chain performance by decreasing inventory costs for the supplier and buyer and improving customer service levels, such as reduced order cycle times and higher fill rates. VMI is a collaborative commerce initiative where suppliers are authorized to manage the buyer's inventory of stock-keeping units. It integrates operations between suppliers and buyers through information sharing and business process reengineering. A number of research papers have studied information flow management through VMI or similar programs. Automation of information services could make members of the supply chain perceive, predict and respond timely to changing market conditions and accelerate the transfer of critical information among its members, which is necessary to improve the controllability, flexibility, performance and capabilities of abnormal events of supply chain. It is critical to control information flow in VMI supply chain.

In addition to information sharing structure and information flow management, it is equally important to define information flow in supply chain (parameters design). Description of the information flow process by information parameters and optimization of the process can help us identify and reduce information distortion and information transmission delay because of the unreasonable process of supply chain business. This paper will use United Modeling Language (UML) to model information flow of VMI system in automobile parts inbound logistics. The Internet of Things (IoT) is an emerging global Internet-based information architecture facilitating the exchange of goods and services in global supply chain networks. From a technical point of view, the architecture is based on data communication tools, primarily RFID tagged items (Radio-Frequency Identification). The IoT has the purpose of providing an IT-infrastructure facilitating the exchange of thing in a secure and reliable manner. This paper aims to study information flow management of VMI supply chain based on Internet of Things.

Information Flow Management of VMI Based on Internet of Things

The IoT is an emerging Internet-based information architecture facilitating the exchange of goods and services in global supply chain networks. The basic idea of the IoT is that virtually very physical thing in this world can also become a computer that is connected to the Internet. In VMI supply chain network, information flow is large and complex, usually in state of a high degree of uncertainty and multi-directional links between members. In this case, real-time information sharing is required soas to monitor the status of supply chain and exceptions in the supply chain broadcast. In order to increase transparency, visibility, availability and improving level of coordination of the supply chain, hub (center) type of information sharing structure should be used. Integrating promising information technologies such as RFID can help improve the effectiveness and convenience of information flow in VMI supply chain. The Internet of Things based on RFID provides an information sharing platform among all participants of the construction chain using web technology and RFID-enabled PDA

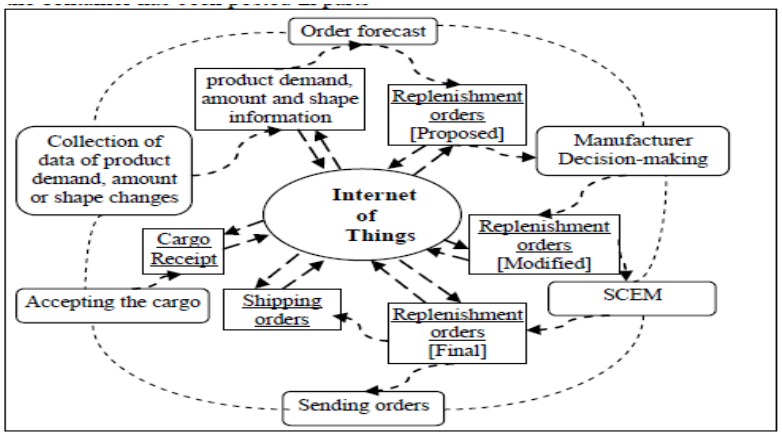

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Fig.3.1 Modeling Information Flow Management of VMI in Automobile Parts Inbound Logistics Based on Internet of Things

The use of IoT is still in its early stage. Information flow management of VMI based on Internet of Things includes two ways. First, label the parts itself, known as hard links. A typical example is the RFID tire tracking and management. According to Figure 2, the most appropriate is those medium-sized, high-value auto parts. Such parts are generally high value, safety requirements and characteristics of components and RFID can be used to effectively identify and track parts. This kind of auto parts affixed with RFID tags will be better monitored when shipped to the local warehouse or parts factory in packages by Kanban instruction and collection and placed in storage areas in department by the line side. Second, the label affixed to the packaging or shipping rack parts can reduce the cost of RFID use. But the need for RFID in the container and the container has been posted in parts of the link between the database, which is known as soft links or soft tracking. IBM shows that Global Automobile Industry has focused on RFID application for container management.

How VMI Works

VMI is inventory which is managed by the vendor or supplier and it means that the vendor determines when to replenish and how much to replenish. Vendor-managed inventory (VMI) is a coordination program between a vendor, often a manufacturer or supplier and a buyer, often a retailer, in which the supplying organization takes full control of inventory management and replenishment decisions for retailers. The supplier in the relationship owns everything as far as planning and shipping. The customer provides a snapshot of what stock is in the warehouse and how much it is used before. The supplier inputs that stock and usage data into the VMI tool and creates a forecast and replenishment plans accordingly. In a VMI partnership, the supplier, usually the manufacturer but sometimes a reseller or distributor, makes the main inventory replenishment decisions for the consuming organization. This means that the vendor monitors the buyer's inventory levels (physically or via electronic messaging) and makes periodic resupply decisions regarding order quantities, shipping, and timing. Transactions customarily initiated by the buyer (such as purchase orders) are initiated by the supplier. Under VMI, the buyer provides the vendor with inventory information and the vendor uses this information to monitoring inventory or placing orders. Hence passing retailer's inventory management duty and responsibility of inventory replenishment decisions from buyer to vendor is the cornerstone of VMI The retailer's role in a VMI arrangement shifts from managing inventory to simply renting retailing space to the vendor.

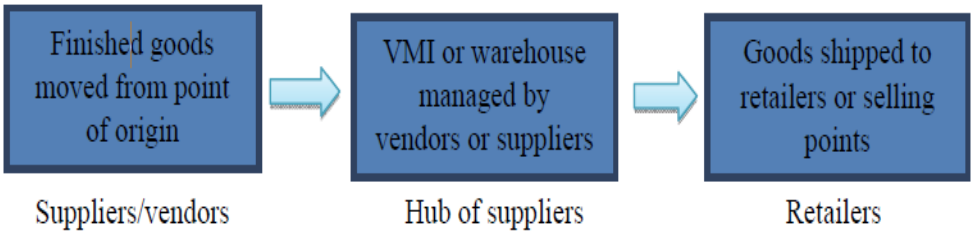

Fig.3.2 VMI Work Flow Chart

IV. CONCLUSION

An overview of the developments and trends of Industrial IoT systems point out related challenges while implementing IOT in different fields. In the near future the Internet and wireless technologies will connect different sources of information such as sensors, mobile phones and cars in an ever tighter manner. The number of devices which connect to the Internet is – seemingly exponentially – increasing. These billions of components produce consume and process information in different environments such as logistic applications, factories and airports as well as in the work and everyday lives of people. The society need new, scalable, and compatible and secure solutions for both the management of the ever broader, complexly-networked Internet of Things, and also for the support of various business models. .

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