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Least Cost Automation Based Wireless Sensor Networks in Multi Node with Multi Process Data Clustering for Vehicle Rim Manufacturing Industries

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Abstract: *The least cost automation is a highly challengeable in manufacturing industrial sectors because of several processes takes vital places in manufacturing industries. In present scenario most of the industries are followed by the wired communication between one machine to another for the sequential operation for the production unit. Some of the industries are switch over to wireless communication mode in partially, that also causes to more expensive to develop the automation in industries. This paper look into that the implement of least cost various process automation for industrial environment in machine to machine interfacing efficiently with collection of sensor nodes are communicate with wireless principle. The dynamic manufacturing industries are anticipated to increase their productivity and efficiency with zero defect and errors; this will lead by least cost automation with industrial wireless sensor networks. Wireless Sensor Networks make available information for data in different machines under sequential process in industrial ambience. The least cost wireless sensor nodes are capable of monitoring physical variants like pressure, temperature, force, vibration and luminosity. The lowest cost WSN based automation involved in industrial environment focus to increase the entire quality of services for the factory automation.*

Keywords: Least Cost Automation, Sensor, Nodes, Manufacturing, Factory Automation.

I. INTRODUCTION

The Industrial Wireless Sensor Network is a predominant role in several fields. A sensor based multiple field devices data are clustered with WSN mode. In existing many of the industries are functioning with semi level automation or completely connected with wired communication mode only, and also difficult of data logging embedded with the machine to machine control mechanism. By implementing of sensor nodes for machine to machine interfacing in the vehicle rim manufacturing industries become a industrial 4.0. The least cost sensor nodes are contributed in the vital role in working machines of the sequential operation systems. For IWSN technologies have constrained nodes are picking up the signals and transmitting of clustered node data from the source to destination. Closed loop control systems are most methodology for making higher efficiency of dynamic movements over wireless connectivity to sensor or actuators in the industrial location. The WSN architecture accept sensors, and other industrial instruments controllers embedded, using wireless and less maintenance

Communication protocols to lead an industrial automation. The various sensor nodes signals like temperature, pressure, strain and vibrations of the data from shop floor in industries are clustered of all sensor nodes and communicate to gateway. In Rim manufacturing unit of final product cross over the various processing unit step by step, all this process are isolated and more human intervention required to complete the final task. By enabling the sensor nodes in the entire processing unit and cluster the sensor nodes to communicate through gateway with minimum of human intervention.

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II. WSN IN WHEEL PRODUCTION MACHINE AND TOOLING

There are several machines involving to produce final stage of vehicle Rim for manufacturing process like Planishing Machine, Valve Hole punching Machine, Coiler machine, Flash Butt Welding machine, Trimming Machine, End cutting Machine, Flaring Machine, Roll forming Machine, Expanding Machine and press leak Testing Machine etc.

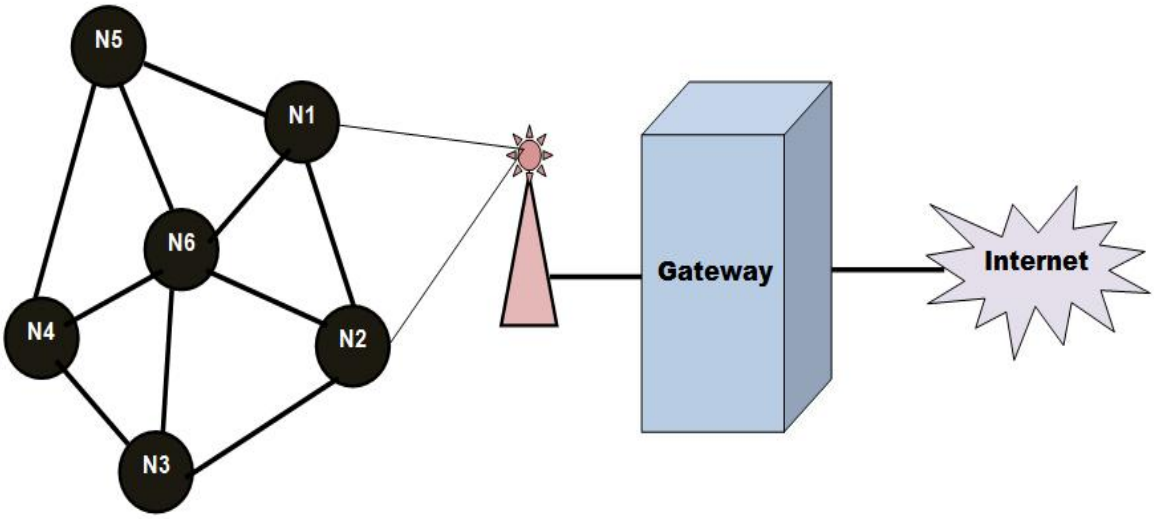

Figure 1: Multi Node Sensor Architecture

Above machines are working in isolated mode of operation in industries, the WSN system is connect the entire machines sequential manner according to the Rim manufacturing process. With the help of suitable sensor nodes are able to peer to peer communicate in the entire machine unit. The industries anticipate the least cost automation which selects the sensor nodes communication tool as Zigbee, IEEE802.15.4, LoWPAN etc, this tools are easily to communicate with rim manufacturing unit and the signals transmitting from the source to destination via gateway.

III. WSN IN PRODUCTION AREA

Especially in wheel production area the four major machines are highly important role with specific operation with the help of multi sensors and actuators effect. These four machines are integrated with WSN and data transmissions between peer to peer machines have autonomous operation with low cost of sensor node protocols.

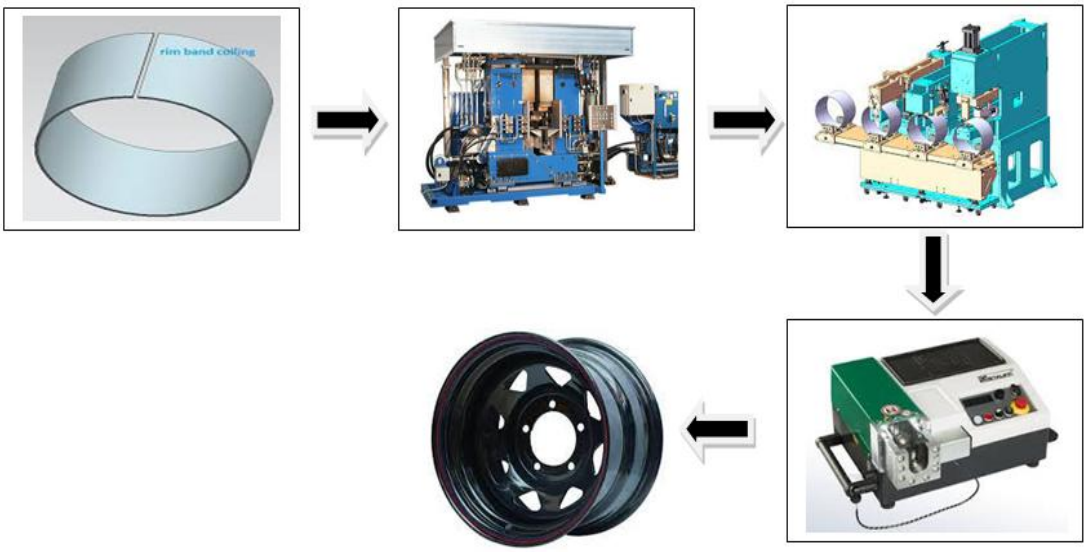

Figure 2: WSN in Production

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3.1 Coiler Machine Embedded with Sensor Node

This machine consists of the feeder, deburrer, stamper and coiler. The conveyor used to feed a single piece of a rim band and the conveyor controlled with closed loop system and monitoring the piece by counter operations. The deburrer is equipped to remove burrs at both edges of the rim band, protecting molds and operators from scratches during the next processing steps this evaluated by proximity sensors. The stamper presses the needed marks on the rim band, including specification, model, manufacturer production date and other information everything monitored and pre scaled by image processing. The wheel rim forming machine of coiler is used to automatically cut the coil rim bands of the prescribed length. The next step of conductive to welding process carried out of coiler both the edges flattening by weld joints. All Conveyor, Proximity sensor and Scanning are collaborating among self with various sensor nodes connection.

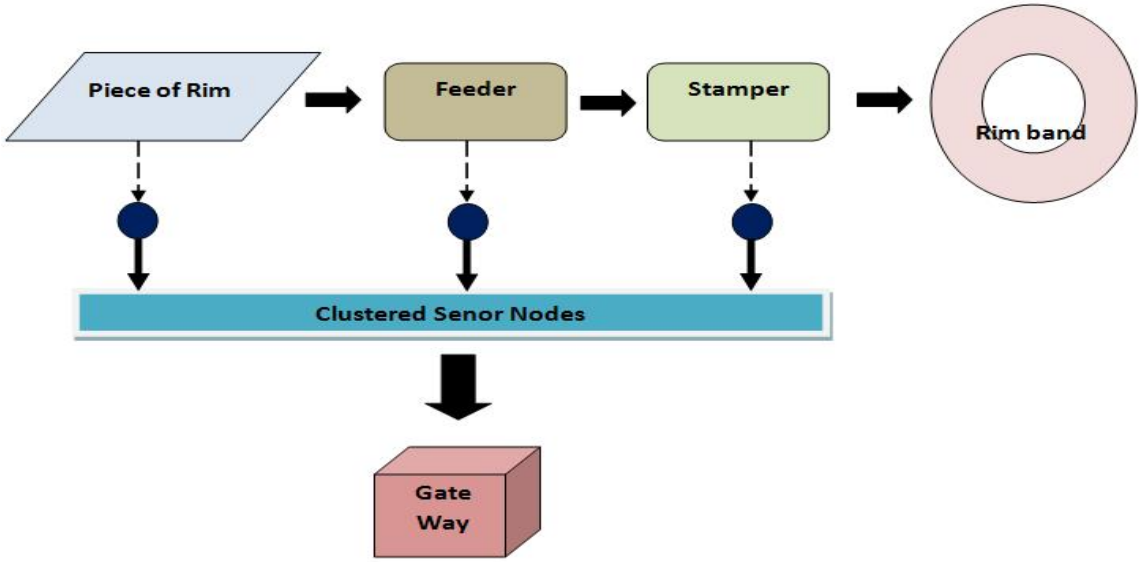

Figure 3: WSN based Sequential Operation

3.2 Trimming Machine and Power Sources

The trimmer can remove weld slag on internal and external surfaces of the weld joint for the purpose of flatten it. By utilization of trimming machine is consume high range of power from the source, this will lead uncontrolled mode of operation in the trimming process. So inter connect power converters with suitable sensors used to control and monitor the trimming operations automatically.

3.3 Automatic Flaring Machine

The flaring processes incorporate with high strength and stable operation of structured step by step operation of wheel rim controlled by flaring equipment. This operation automatic load and unload by the machine. The designing of wheel rim structure leads to control the flaring process with quick adjustment. The rim flaring tool is designed with more number of pyramids. Rim edges are flared using passive sliding friction instead of forward extrusion, which reduces stress on the molds and increases their service lives up to 10 times longer and measure the stress by load cell and automatically adjust to integrate to the next process though the wireless mode.

3.4 Wireless based Press Leak Testing Machine

The leak testing machine has three major parts associate with wireless mode of operations: they are, master machine unit, hydraulic based transmission controller and electrical control elements. The main machines consist of machine outer yoke, work podium minor mold, higher mold, oil container. The hydraulic transmission controllers consist of an oil reservoir, oil pump with motor control unit, control valve, etc. And the electrical control elements are integrated both electrical control and electrical operation box. The entire internal operation of flaring step by step processes are interlinked with various sensor nodes and communicate to the next process with the help of wireless technology.

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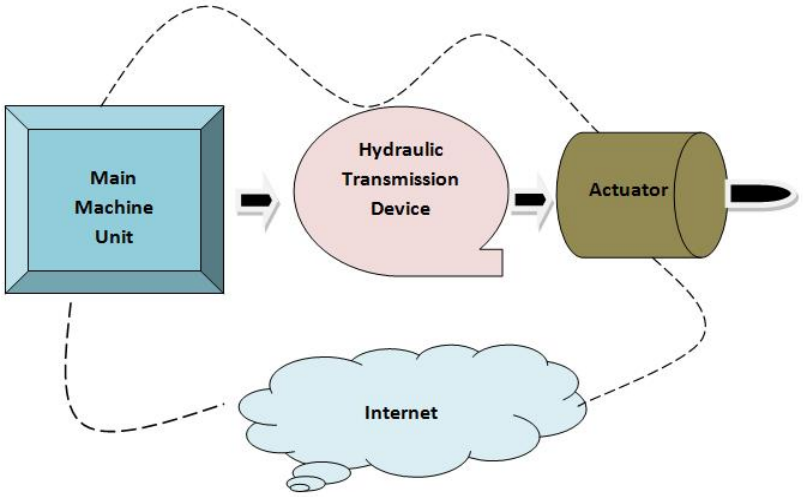

Figure 4: Data Clustering

IV. CONCLUSION

This paper has developed wireless sensor networks in vehicle rim manufacturing industries with least cost automation. A fast operation and zero flawed operations in the product of manufacturing industries assigned with multi sensor node setting and low cost with high efficiency of fast data transmission and reception systems in the entire industry environment. The wireless communication mode has enhanced the industrial growth in various aspects with higher efficiency of the industrial automation.

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