Zero Defect Assurance of Three-Wheeler Product Using IoT Systems

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Abstract. By considering quality improvement in three-wheeler vehicle, IOT based Zero Defect Assurance framework is created which can keep up basic discharge related processes and product parameters and parts alongside the vehicles. This includes various forms like IOT products and procedure parameters catching and child part capturing against the vehicle number and quality creation. The system will be created utilizing different IOT gadgets, sensors, PLC’s, programming’s and databases. This application will be conveyed in Engine Assembly, Vehicle Assembly and Sub Assembly lines. These frameworks will be utilized for maintaining a strategic distance from abandons going to the next stage and additionally to recover the information for dissecting field grumblings and emanation related grievances. It is likewise used to enhance the procedure and product characteristics in the system. The hard-ware utilized in this work are useful to peruse the information from the parts and to show the on-time capacity of the parts and guide against the Unique Vehicle Number (UVN).

1. Introduction
As the world is running under Industry 4.0, there are different advancements being utilized in many vehicle and manufacturing segments like Internet of Things (IoT), Artificial Intelligence, Vision System, Cloud Computing for ongoing screen physical procedure [1]. IoT that aides in capturing significant information advances observing the statuses of physical articles and sends IP systems to programming applications which is transferred through the data [2,3]. IoT is one of the quickest and trend setting innovation which is being utilized for both IT and Industrial Sector, which empowers information partaking in manufacturing administrations. Internet of Things with different segments like Scada Systems, Sensors and so forth helps in information sharing among various brilliant devices and objects which empowers the constant collaboration [4]. In manufacturing and coordination zones Radio Frequency Identification (RFID) is most usually used to track and follow the items or instruments for continuous status. The information gathered from Radio Frequency Identification peruses and Tags is stored and encourages the individual to know the subtleties of the part and its condition.

1.1. Difference between Machine to Machine and Internet of Things
The cloud platforms are analyzed through the data which is dependent on machine to machine in the first section. The way to communicate among each other is purely in a random way when it comes to Internet of Things. This is applicable in any industries under Industrial 4.0 which includes automation technology or any solar or energetic industries [5]. The transporter utilizes a flexible/hand held RFID...
reader to read product information [6]. The 5th generation wireless systems (5G) is a driver for the 5G-enabled IoT in the advent of faster wireless technologies as this helps to handle large number of IoT-enabled devices [7]. The difference between machine to machine and Internet of Things is shown in Table 1.

### Table 1. Difference between Machine to Machine and Internet of Things.

| Machine to Machine | Internet of Things |
|--------------------|--------------------|
| Point to Point communication usually embedded within hardware at the customer site | Devices communicate using IP Networks, incorporating with varying communication protocols. |
| Cellular or wired networks will be used in many devices. | A middle layer hosted in the cloud is relayed through data delivery. |
| Internet connections do not rely to any network | Devices require an active internet connection. |
| Limited integration options, as devices must have corresponding communication standards. | It requires a solution that can manage all communications by unlimited integration options. |

Any manufacturing industry means to have Zero Defect in their products which they assemble and focus on high consumer loyalty. In this paper a Three-Wheeler product is taken for Zero Defect Assurance by utilizing IoT frameworks. To accomplish Zero Defect in Three Wheeler product and procedure by considering different parts and parameters required for traceability in Engine Assembly, Vehicle Assembly and Sub Assembly lines.

This includes different methods like IOT products, products parameters capturing and child part capturing against the vehicle number and quality entryway creation. The need of this task incorporates the legitimate consistence to gather basic parameters through which, the need to include and keep up information for the duration of the existence cycle and to improve in quality of product by wiping out the imperfections moving to the following stage through quality gates. The principle object is to have frameworks for capturing procedure and product information through Child Part Mapping and actualizing the quality gate system for maintaining a strategic distance from abandons streaming to the following stage. Scarcely any tests like assistance contract for IoT unit can be tried and affirmed by Service Providers and Infrastructure Providers and data identified with agreement can be recorded and antiques are connected [8]. The quality elements for both inside condition, i.e. its parts, and outside condition guarantee the fulfillment utilizing an IoT stages [9].

### 2. Methodology

The goal of this undertaking is to decrease the deformities to zero, for this we have to diminish the imperfections at each phase of the procedure. So as to do so, every stage gear needs to get associated for information straight forwardness. Figure 2.1 shows the methodology. The technique utilized is to catch for the vehicle by capturing different parts and parameters information at various stages and partner them with vehicle identifier and check every one of the information accessibilities before pronouncing the vehicle OK through the quality entryways, to execute quality door framework for evading the deformity streaming the following stage. For "Zero Defect Assurance for Three-Wheeler Product Using IoT Systems" different contextual investigations were considered for utilizing Industrial IoT in executing Zero Defect. A detail study for the prerequisites of traceability are taken in Engine Assembly, Vehicle Assembly. LAN Connectivity and Power are required in this venture which is the principle hotspot for the correspondence between the machines and database. IoT hard-wares like RFID Reader, RFID Tag, Ethernet center points, RS232 connectors, DPM and SR Scanners are utilized in executing the venture and picking up the outcome. By observing the conveyor and plan of the rail an AIO PC structure must be intended to mount the PC for envisioning track and follow state of the part and its parameters. A LAN is the availability to get the IP Address.
in each station of traceability. By utilizing the IP Address Master Data Configuration is accomplished for Child Parts, Parent Parts with the part number and code. The detailed methodology of the work is shown in Figure 1.

**Figure 1** Project Methodology
2.1. Materials Required

The materials used in this work is shown in Table 2.

Table 2. Materials.

| S.No | Materials                        |
|------|---------------------------------|
| 1    | RFID Readers                    |
| 2    | RFID Tags                       |
| 3    | All In One PC                   |
| 4    | Scanners                        |
| 5    | Ethernet Hub                    |
| 6    | Programmable Logic Controller (PLC) |
| 7    | IOT Gateways                    |

An Architecture is intended for capturing the data and the approval is done after all the required data is considered. The process flow is shown in Figure 2. By taking the data, program configuration is finished utilizing Node-Red pallets. This Node-Red shows the apparatus number, part number and whether the part is filtered or not examined with an indication. Once after all the ace information and pallets are effectively running in the Node-Red at that point trails are done in various stations with the 2D Matrix codes appended to the part in each station. Hardly any parts, for example, Camshaft, Piston head may accompany the Direct Part Mapping (DPM) for which DP Scanners are utilized. Scarcely any DP and Paper Scanners are set in introduction modes with immediate or circuitous light which can examine the part effectively with the base time. This is taken by considering the process duration of the administrator. When the path is effective then this will be the ceaseless procedure for the administrator and the information arrangement, Node-Red pallets will be checked through the IP Addresses. This knows the state of the parts and parameters where the information will be stored in the database in the form of a Vehicle Report.
3. Results
Traceability is being actualized to track and follow the right part being fixed with the individual engine and vehicle so as to improve the proficiency and productivity of the product. This shows the general report with each part filtered with alright or not alright outcome as for SKU/BOM number. The last report plainly portrays us about the zero deformity in each piece of the engine and vehicle parts. On the off chance that there is any part confound or deformity, at that point the engine or vehicle is taken into rework station and checks the imperfection which is again stacked and filtered to check in the event that it is right. Later the total zero deformity vehicle turns out and conveyed to client with the point by point report of the engine and vehicle. The sample report is appeared in table 3. by considering the defects from the three-wheeler such as

**Figure 2. Process Flow.**
- Part Mix up
- Leak Results
- Missed Parts
- Various Poka-Yoke

Table 3. Report.

| UVN      | xxxxxxxxxxxxxx | Model Number | xxxxxxxx |
|----------|----------------|--------------|----------|
| Engine Number | xxxxxxxx | Date and Time | xxxxxxxx |

| Test Type         | Part 1 | Part 2 | Part 3 | Part 4 | OK / Not Ok |
|-------------------|--------|--------|--------|--------|-------------|
| Sub-Assembly      | ✓      | ✓      | ✓      | ✓      | OK          |
| Engine Main Line  | ✓      | ✓      | ✓      | ✓      | OK          |
| Parts             | ✓      | ✓      | ✓      | ✓      | OK          |
| Parameters        | ✓      | ✓      | ✓      | ✓      | OK          |
| Leak Testing      | ✓      | ✓      | ✓      | ✓      | Ok          |
| Engine Test       | ✓      | ✓      | ✓      | ✓      | OK          |
| Vehicle           | ✓      | ✓      | ✓      | ✓      | Ok          |
| Parts             | ✓      | ✓      | ✓      | ✓      | Ok          |
| Parameters        | ✓      | ✓      | ✓      | ✓      | Ok          |
| Leak Testing      | ✓      | ✓      | ✓      | ✓      | OK          |
| Vehcile Test      | ✓      | ✓      | ✓      | ✓      | Ok          |
| Inspection        | ✓      | ✓      | ✓      | ✓      | Ok          |
| Overall           | ✓      | ✓      | ✓      | ✓      | Ok          |

Figure 3. Shows the line shrewd culmination pattern graph in Engine Assembly where X hub characterizes the week numbers in a month and Y hub characterizes the quantity of child parts and parameters captured and Figure 4. shows the line wise finishing pattern diagram in Vehicle Assembly where the X axis characterizes the week numbers in a month and Y axis characterizes the
quantity of child parts and parameters caught. The numbers referenced in the chart speaks to the day by day and week by week updates of the work finished according to the arrangement and genuine. Each point in figure 3. and figure 4. construes that the CPM and parameters plan coming to CPM and parameter real which encourages us to improve the recognizability execution.

4. Conclusion

Parts and Parameters are listed down for executing recognizability. Procedure Planning has been completed for the whole task. Movement acquisition and procedure study is thought about. Necessities and hard-wares arrangement of the venture is rattled off. Engineering configuration is set up for both the motor get together and vehicle gathering. Scanners that sweeps the 2D Matrix information from the part will be shown in the PC which is going through the Node-red program that stores the information in the database and finally gives the outcome as Vehicle report with every one
of the parts and parameters examined against the Stock Keeping Unit (SKU)/Bill of Materials (BOM) number.

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