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Design of Part Detection Sensor Robot

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Abstract: *We are working on sponsored project in "Badve Engineering Pvt.Ltd", the problem statement is the productivity and quality of product decreases mainly due to missing parts during assembly of different components on chassis, so we are analysing data and trying to reduce missing of certain parts on chassis in assembly line manufacturing process. Objectives of the project are to increase productivity and efficiency, to avoid dislocation and falling of objects during assembly, to manufacture optimistic product with less error. For this statement First we studied about different types of assembly line and how assembly line works. Then we observed how different parts are assembled to make the chassis. Then in a span of 1month we observed how many time parts get missed while assembly in a particular stage. Then we shortlisted top 10 parts which are Continuously being missed & studied on which stage maximum of the parts get missed. So, for this using try error method we implemented different methods like Sorting method, Barcode imposing method, lesser fixture cutting method but we came to know that these solutions are not fissible due to some limitations. So currently we are working on part detection sensing robot. Part detection Robot in chassis assembly is an automated robotic system that is used to detect and locate specific parts within an assembly process. This type of robot is typically used in manufacturing and assembly operations, where it can be programmed to identify specific parts and components within a larger assembly, such as bike chassis. The robot typically has a sensor or a camera mounted on its arm or body, which is used to detect and identify the parts. The sensor can be any type of sensor, such as a laser scanner, a vision system, or proximity sensor, depending on the type of parts being detected and the specific requirements of the application. Once the part has been detected, it givessignal to HMI and it moves to the next part. We have designed a3D virtual model of a system using Creo 7.O software as a tentative virtual prototype.*

Keywords: Robot.

I. INTRODUCTION

In Badve Engineering Pvt Ltd, the productivity and quality of product decreases mainly due to missing parts during assembly of different components on chassis, so we are analysing data and trying to reduce missing of certain parts on chassis in assembly line manufacturing process.The Part Detection Sensor Robot used in assembly lines is a highly specialized robotic system designed to automate and optimize the process of detecting and identifying parts during assembly operations. It combines advanced sensor technologies, robotics, and intelligent algorithms to enhance efficiency and accuracy in assembly line processes.In assembly lines, where numerous parts need to be precisely positioned and assembled, the part detection sensor robot plays a crucial role. It is equipped with a variety of sensors, such as cameras, laser scanners, or 3D vision systems, which enable it to accurately detect and identify different parts based on their shape, color, or other distinguishing features.The robot's sensors capture data about the parts and send it to the robot's control system. The control system, powered by sophisticated software algorithms, analyzes the sensor data and makes decisions based on predefined criteria or machine learning models. This enables the robot to precisely locate and identify the parts in real-time.Once a part is detected and identified, the robot can perform a range of tasks, such as picking up the part, positioning it correctly, and assembling it with other components. It can also perform quality checks, ensuring that the parts meet specific standards before being incorporated into the assembly.The part detection sensor robot offers several advantages in assembly line operations. It enhances efficiency by reducing human error and speeding up the part detection process. The robot can work continuously without fatigue or breaks, leading to

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increased productivity and throughput. Additionally, it improves accuracy and consistency, ensuring that parts are correctly identified and assembled every time.

The use of part detection sensor robots in assembly lines also provides flexibility. The robots can be programmed to handle various part types, allowing for quick changeovers and adaptability to different assembly processes. This makes them valuable in industries with high product variability or frequent design changes.Overall, the part detection sensor robot used in assembly lines revolutionizes the way parts are detected, identified, and assembled. Its integration into the assembly process enhances efficiency, accuracy, and flexibility, leading to improved productivity and quality in manufacturing operations.

II. PROBLEM STATEMENT

In Badve Engineering Pvt Ltd, the productivity and quality of product decreases mainly due to missing parts during assembly of different components on chassis, so we are analysing data and trying to reduce missing of certain parts on chassis in assembly line manufacturing process.

III. OBJECTIVE

- To increase productivity and efficiency
- To avoid dislocation and falling of objects during assembly
- To manufacture optimistic product with less error

IV. EXPERIMENTALWORK AND ANALYSIS

Missing parts data of single month As per our observations first we studied about number of parts and their probability of missing in a month. We had taken a time span of one month. From the data which we extracted by 1 month of observation we plotted the graph in which X axis showing the name of part and Y-axis is giving number of times it gets missed in a month of observation. As per the observation the part which get missed maximum number of times is middle side cover bracket. And seat cowl bracket behind it.In Badve Industry nearly 127 parts get assembled on the chassis from analysing the data of parts missing over a month we analysed the top 10 parts which gets missed while assembling. Number of times a certain part gets missed is observed and we plotted the graph for the top 10 missing parts

Table 4.1:Top 10 missing parts data

Sr. No.	Missing parts	Stage	Quantity	Manual	Fix stage change	ECN	Auto retry detection at next stage	Auto retry prevention at stage	Action taken but revert
1	Middle side cover bracket LHS/RHS	F-130	184						
2	Seat cowl bracket	F-135	170				F-140		Auto retry bypass
3	Hook side stand harness	F-170M	101						
4	ABS kill bracket	F-1406	94				F-160		Auto retry bypass
5	Seat lock bracket	F-135	89				F-140		Auto retry bypass
6	Tank mtg bracket	F-130	87					F-130	Cycle time increases
7	Tank resting bracket	F-130	74					F-130	Cycle time increases
8	Rear side cover bracket	F-130	74					F-130	Cycle time increases

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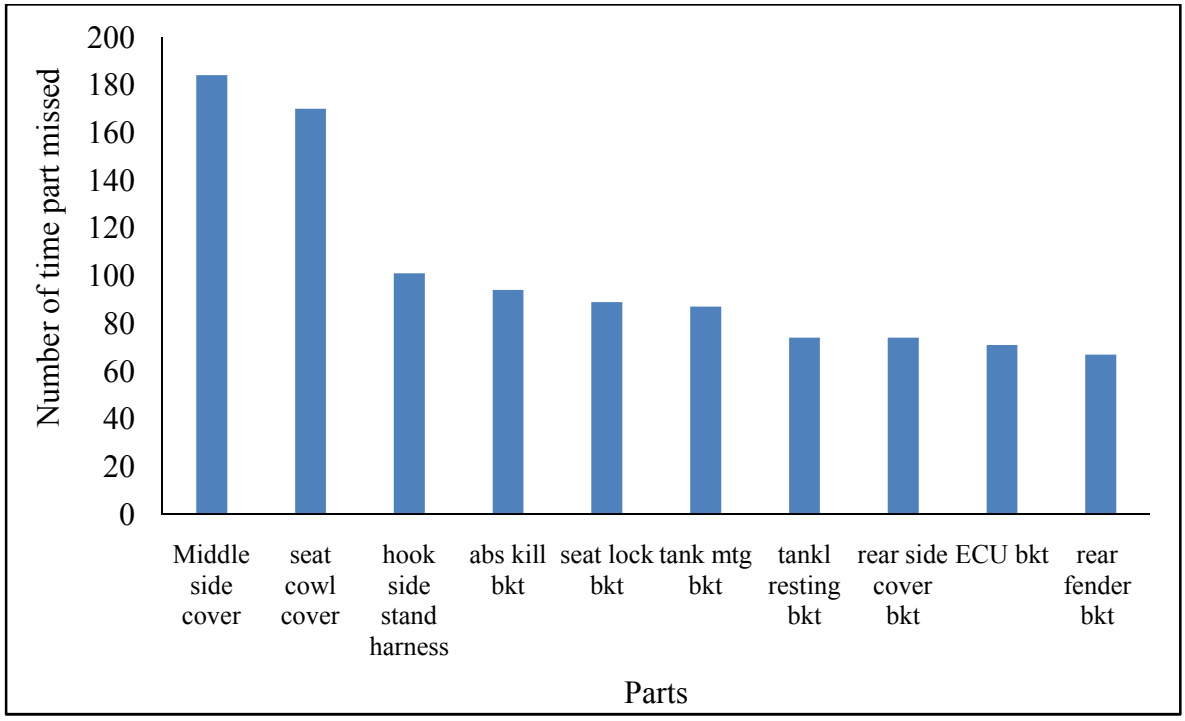
9	ECU bracket	F-160	71						
10	Rear fender bracket	F-135	67				F-140		Auto retry bypass



Sr. No.	Part	Reason	Action Taken		Prevention
			Inspection Side	Cause side	
1.	Middle Side Cover	R1) Middle side cover miss R2) Bracket fallen down after welding R3) Bracket not rested properly	100% inspection at part missing inspection stage	Integral brackets are to be made	ECN released
2.	1)Seat cowl LHS/RHS 2) ABS kill bracket 3) Seat lock bracket 4) Rear fender bracket LHS/RHS	R1) Brackets missing R2) Operators forgot to place bracket	100% inspection at part missing inspection stage	Auto Retry command added for detection	Auto inspection by robot to be started.
3.	1)Tank mtg bracket 2) Tank resting bracket 3) Rear side cover	R1) Brackets missing R2) Operators forgot to place bracket	100% inspection at part missing inspection stage	Auto Retry command added for detection	Auto inspection by robot to be started.

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4.	1) ECU mtg bracket	R1) ECU Brackets missing R2) Gap between pipe and ECU bracket is more R3) ECU bracket trim edge foul with pipe R4) Welding block setting not done properly	100% inspection at part missing inspection stage	New welding fixture design and welding started	Auto inspection by robot to be started.

V. EXISTING METHOD

The existing process of part inspection in the manual manufacturing assembly line involves a series of steps to ensure the quality and precision of the assembled components. The process begins with a visual inspection, where operators carefully examine the parts for any visible defects such as scratches, dents, or deformities. They compare the physical appearance of the parts with the desired specifications and standards. Next, measurement tools and gauges, such as calipers, micrometers, and gauging fixtures, are utilized to check critical dimensions of the parts. Operators measure key features and compare the measurements with predetermined tolerances to ensure they meet the required specifications. Fit and alignment checks are also conducted, particularly for parts that require precise assembly. Operators verify that the parts fit together smoothly and align correctly.If applicable, functional tests are performed to verify the performance of the assembled parts. This may involve manually operating or activating the components to ensure they function as intended. Operators carefully examine the parts for any potential errors or deviations from the standard. They rely on their expertise and experience to detect anomalies that may affect the quality or functionality of the final product.Throughout the inspection process, documentation is essential. The inspection results, including any defects or deviations identified, are recorded on inspection reports or quality control sheets. These records provide a traceable history of the inspection process and serve as a reference for further analysis or improvement efforts.In case any parts fail to meet the required quality standards, they are either rejected and marked for rework or discarded altogether. Rework may involve repairing or modifying the non-conforming parts to bring them within acceptable limits. The inspection findings are communicated to the relevant stakeholders, such as production supervisors or quality control personnel. This feedback helps in identifying recurring issues, initiating corrective actions, and implementing process improvements to minimize future part defects or assembly errors.It is important to acknowledge that the manual inspection process heavily relies on human judgment and attention to detail. While it is a crucial quality control step, it can be time-consuming, subject to human error, and limited in terms of inspecting large volumes of parts efficiently. As a result, there is an increasing interest in implementing automated part inspection methods, such as robotics or computer vision systems, which offer advantages in terms of speed, accuracy, and scalability.

VI. PROPOSED METHOD

The project focuses on addressing a decrease in productivity and product quality caused by missing parts during the assembly of various components on the chassis. Our objective is to enhance productivity and efficiency, prevent dislocation and falling of objects during assembly, and manufacture high-quality products with minimal errors. To tackle this issue, we began by studying different types of assembly lines and their functioning. We closely observed the assembly process of chassis components and recorded instances of missing parts over a one-month period. From our analysis, we identified the top ten consistently missing parts and determined the assembly stage where the highest number of parts went missing. To find a solution, we initially experimented with various methods such as sorting, barcode imposition, and lesser fixture cutting. However, we encountered limitations that made these approaches unfeasible for implementation. Consequently, we have shifted our focus to developing a part detection sensing robot for the assembly of the chassis. A part detection robot is an automated system that utilizes sensors or cameras to identify and locate specific parts within an assembly process, such as a bike chassis. This robot is commonly employed in

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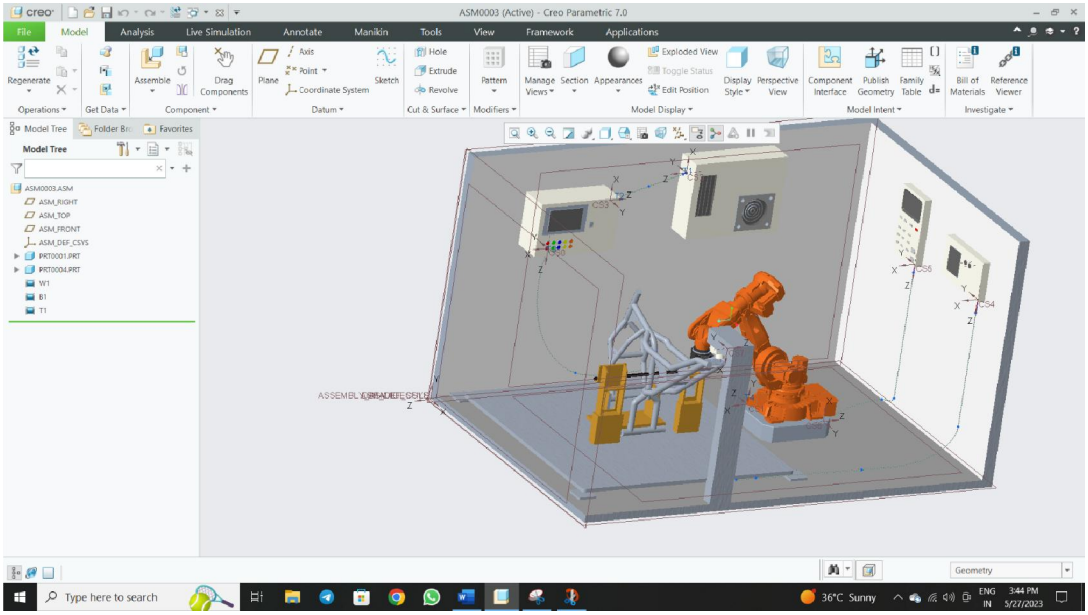
manufacturing and assembly operations, enabling programmed identification of desired components within larger assemblies. The robot's sensor may include laser scanners, vision systems, or proximity sensors, depending on the nature of the parts and the application's specific requirements. Once a part is detected, the robot sends a signal to the Human-Machine Interface (HMI) and proceeds to the next part. As part of our progress, we have created a tentative virtual prototype of the system using Creo 7.0 software, visualizing the 3D model of our proposed solution.

Design



Final layout

VII. FUTURE SCOPE

The future scope of robotic arms for part detection includes advancements in sensing technologies, artificial intelligence and machine learning integration, collaborative capabilities, IoT connectivity, improved flexibility and adaptability, enhanced safety features, and the utilization of data analytics and predictive maintenance. These developments will lead to more accurate and efficient part detection, increased productivity, improved quality control, and streamlined assembly line operations in various industries.

VIII. CONCLUSION

In “Badve Engineering Pvt.Ltd.” the missing parts on chassis are identified manually by workers so this method is time consuming and less efficient so we analysed data of different missing parts at different stages of assembly line, according to our research we noticed that there are few parts which are frequently getting missed, so we tried some solutions to resolve this problem but they are not fissible due to some limitations, so currently we have proposed part detection sensor robot idea which includes robotic arm, PLC, HMI, programming pendent, robotic arm controller. We made tentative 3D model of this system in Creo 7,O software as virtual prototype. Implementation of this system will lead to increase the productivity, efficiency, accuracy.It will also manufacture optimistic product with less error .this will fulfills the objectives of “Badve Engineering Pvt.Ltd.”

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