Production output real time data monitoring based on internet of things (IOT) at automotive part machining line

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Abstract. DRB HICOM Berhad is currently facing challenge which is lack of accuracy and real time information on their machining output data. With a new era of the Internet of Things (IoT), it may reduce hassle for better productivity and quality. This paper proposes on Internet of Things (IoT) based real-time monitoring data production output at machining line in which the output parts will be monitored over a webserver using internet and will notify workers when a breakdown occurs through hand phone notification. The system is designed to collect data automatically such as plan vs actual goods, reject output and breakdown time and display them on OLED board as well as on webpage for the workers and management to see and monitor it easily without being in the working line area. The data from this should be transmitted to the management without human intervention. Moreover, it also offers a better solution to the workers and management to know the condition of the machining line and can take immediate preventive measures. The efficiency of the machining line can be improved gradually as a result of better system. Hence, the real-time monitoring data production output at machining line will help the company to generate higher revenue, obtain faster and accurate production data.

1. Introduction

The Internet of Things (IoT) is defined as an ecosystem of smart object, network and processing technologies working together in providing services to the end user.[1,2] This ecosystem allow industry to gain several benefits for their own businesses.[3] The manufacturing industry in Malaysia is undergoing a dramatic shift centered on new technologies that offer the promise of greater efficiency, speed and higher quality.[4] A central component of this shift toward Industry 4.0 is the Internet of Things (IoT), which serves as the frontline of data capture in the modern factory. The Internet of Things (IoT) intelligent systems enable rapid manufacturing of new products, dynamic response to product demands, and real-time optimization of manufacturing production and supply chain networks, by networking machinery, sensors and control systems together [5].

Company A is one of DRB HICOM subsidiaries that venture in the business of aluminum casting. Most of the part made in Company A are automotive part such as cylinder head, steering housing, pan oil and many more. It involves five (5) major processes which are melting, casting, fettling (secondary), machining and logistics. There has been some issue at this machining line whereby there is only one worker that need to do inspection and record the machining output data. Due to the high workload, most of the time the worker is unable to report the data on time, error in counting the finished products and sometimes error in classifying good and out of standard products. This causes delay in obtaining current output of the machining line especially if there is any quality issue that need immediate attention. A
possible cause of this problem is due to the availability of only one operator involves in recording and monitoring goods and reject outputs and that person is also involves in inspection area. An Internet of Things (IoT) based real time data production output monitoring could be used as an alternative to resolve the situation. The objective of this study is; to design and develop IoT output data collection, and to validate the fabricated prototype.

2. Methodology
The methodology follows the Deming Cycle Plan-Do-Check-Act (PDCA) to breakdown the project into a more systematic flow. Table below shows the PDCA methodology for this project.

| Activities | Progress |
|------------|----------|
| **PLAN** | |
| **STEP 1: TOPIC SELECTION** | i. Topic chosen: IoT Based Real Time Monitoring Data Production Output at Machining Line |
| i. Meeting with UiTM supervisor and DRB-Hicom supervisor | |
| **STEP 2: UNDERSTAND PROCESS AND SITUATION** | i. Searched for previous study real time monitoring data |
| i. Study and understand about the topic chosen. | ii. Site Visit |
| ii. Define problem, literature review and information and data gathering. | iii. Do observation at die casting area |
| **STEP 3: PLAN ACTIVITIES** | i. Draft milestone in completing the project. |
| i. Develop milestone of project | |
| **STEP 4: PROBLEM IDENTIFICATION AND IDEA GENERATION** | |
| i. Identify problem and analyze data to generate idea in developing the system | |
| **STEP 5: CONSIDER AND IMPLEMENT COUNTERMEASURE** | OBJECTIVE 1 |
| CHECK RESULT | Level 0: Sensors |
| i. Proposed countermeasure action | Level 1: Microcontroller |
| ii. Design and Develop | Level 2: Communication Protocol |
| iii. Propose Changes | Level 3: Cloud |
| iv. Fabricate the prototype. | Level 4: Software Analytics |
| | Level 5: Software Interface |
| **STEP 6: CHECK RESULT** | |
| i. Install the Andon system in machining line | i. Review feedback from management |
| ii. Ensure the system workability | ii. Results Evaluation |
| iii. Identify any problems occur to the system. | iii. Improve Prototype |
| iv. Compare the OEE analysis | iv. Performance analysis |
| **STEP 7: DOCUMENTATION AND REPORT** | |
| i. Compile all information as a result of project. | i. Documentation and report on this study. |

3. Results and Discussion
The schematic diagram for the prototype is shown as in Figure 1. The system collects data and display it on the website as illustrated in Figure 2. The Overall Equipment Efficiency (OEE) have shown increase in its percentage after implementation. The comparison could be seen in the Figure 3. The
The application of this system has reduced the paper usage in daily data collection. It also helps in notifying the technicians in the case of breakdown.

**Figure 1.** Internet of Things (IoT) system prototype

**Figure 2.** IoT System Website Data Display
4. Conclusions and Recommendation
This project has successfully met the goals of developing a real time monitoring data production output system in line with the integration of Internet of Things (IoT) devices, improving the response time of the technician reacting to anomalies in the machining line and obtaining an operating status in real time.

The Internet of Things (IoT) system help in assessing the OEE performance of the machining line. The OEE performance can help the technician and management to identify which machining line needs better attention. Some recommendations that need to be done to improve this projects are:

- Use a faster processor microcontroller to reduce the delay in transferring data to the cloud.
- Use long-range proximity sensor suitable for industrial applications.
- A procedure standard (SOP) should be established to provide the worker with information on how to operate this system.
- The system should be installed for a certain period of time to ensure that it can withstand the industrial environment in order to guarantee the efficiency of this system.
- The digital height should be readable from up to 50 m for simple counter version or tachometer version.

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