IMPLEMENTATION OF ONLINE MONITORING SYSTEM TO DETERMINE OVERALL EQUIPMENT EFFECTIVENESS

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A master project report submitted As a partial fulfillment of the requirements for the degree of Master of Manufacturing Engineering (System Engineering)

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DEDICATION

For my family, thank you for all the support and patience.



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ABSTRACT

Semiconductor manufacturing industries are faced with many challenges especially with more product complexity along with high expectation on quality with lower manufacturing cost. Engineers are working to improve the equipment's performances but always lack of efficient and accurate data to help them track the equipment performances. The Overall Equipment Effectiveness (OEE) metric is a very powerful tool that can be used to measure productivity at equipment level. Previous research has shown that OEE along with accurate and consistent real time equipment state data can help to estimate the equipment's performances and productivity. An online monitoring system with real time data will help manufacturing system to be more productivity and also path to determine and improve overall equipment effectiveness. Online monitoring system also will allow factory professionals to analyze the equipment's performance by automatically and also to detect the bottleneck elements in the system. The objective of this project is to implement online monitoring system at auto printed circuit board assembly tools. The main aim of this project is to develop and implement online monitoring dashboard to deliver real time equipment's condition and performances to determine overall equipment efficiency. The result of this project shows that online monitoring system demonstrates huge benefits and met the entire objectives. This online monitoring system paves way for further research on continuous improvement on equipment performances and also productivity development.

ABSTRAK

Kilang perindustrian elektrik menghadapi pelbagai cabaran terutama pengeluaran produk yang rumit dengan qualiti yang tinggi disamping harga pengeluaran yang rendah.Juruteramenghadapi kesukaran seperti memastikan, memperbaiki, mencipta iurutera atau mempertingkatkan mesin. Ini disebabkan oleh kekurangan peralatan yang sesuai untuk membantu jurutera-jurutera mencari dan mempertingkatkan penggunaan peralatan peralatan tersebut. 'The Overall Equipment Effectiveness Metric' (OEE) adalah satu pendekatan untuk mengukur daya pengeluaran sesuatu mesin. Hasil daripada kajian yang lepas, didapati OEE dengan data keadaan mesin dan proses yang depat dapat mentafsirkan daya pengeluaran sesebuah kilang. Kaedah 'online' sistem monitor dengan sistem tidak berfungsi secara automatik dapat membantu sistem pengeluaran dengan lebih produktif. Disamping itu, ia dapat membaiki peralatan secara keseluruhan dengan lebih berkesan. Sistem ini juga dapat membantu ahli-ahli kilang untuk menganalisa prestasi daya pengeluaran sesuatu mesin secara automatik. Ia dapat membantu dan menilai subsistem keseluruhan pretasi mesin dengan mengesan kelemahan dalam sistem perkilangan. Objektif kajian ini adalah untuk melaksankan 'online monitoring system' pada mesin 'auto printed board assembly tools'. Keputusan kajian ini amat bagus and mencapai objektif yang dikehendaki. Kajian ini juga dipercayai dapat membantu penyelidikan untuk menghasilkan kaedah peningkatan produktiviti pada masa akan datang.

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LIST OF ABBREVIATIONS

APCBA	Auto Printed Circuit Board Assembly
CIM	Computer Integrated Manufacturing
CPD	Cost Per Drives
DAQ	Data Acquisition
DOS	Disk Operating System
HMI	Human Machine Interfaces
IP	Internet Protocol
OCBM	Online Condition Based Monitoring
OEE	Overall Equipment Effectiveness
РСВ	Printed Circuit Board
PCBA	Printed Circuit Board Assembly
RCFA	Root Cause Failure Analysis
TPM	Total Productive Maintenance

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CHAPTER 1

INTRODUCTION

1.1 Background

Manufacturing industry is continuously growing and it comes more challenging to drives for minimization of manufacturing cost per product. In most manufacturing factory the general development of new manufacturing techniques has became an essential factor in maintaining the factory performances.

In an increasingly competitive environment, companies must understand how equipment utilization affected the profitability and work on its performance improvement. To accomplish these objectives, it is necessary to have a proper tool and method for real time monitoring, maximizing throughput, reduce cycle time and improve product quality and quality rate.

Metrics such as overall equipment effectiveness (OEE) have been used as a tool to measure the performances of the equipment and productivity but not much focus has been given for automated system to efficiently find the root cause of both equipment and product failure. Engineers tend to rely on subjective and delayed manual collected data. Dvorak and Kuiper (2000) highlighted that online monitoring matrix and data acquisition (DAQ) was a better alternative compared to manual data collection that will significantly improves the accuracy of OEE reports and delivers meaningful equipment performance information DAQ was a system designed to measure and log important data. DAQ system was electronic based and comprise of hardware and software. The hardware includes controller, sensors and interface components. The software is used to extract data from the hardware and process the signals to generate desired and meaningful information. Once data has been captured, it will store in web server for current and future reference.

1.2 Problem Statement

Manufacturing industries faced with many challenges especially with the increase in product process complexity along with tightened quality and yield. As engineers work on existing challenges such as maintaining, troubleshooting, design or improving equipment and processes. There was lack of information on the tool actual performances which will help them to improve the equipment performance.

In order to address the multitude of challenges, there need to be a methodology, a tool or a technique which would help factories to overcome and make full use of its equipment. This was the reason why an automated monitoring tool using data aquition (DAQ) should be introduced at the plant. Some of the issues arise on current equipment at manufacturing industry :

- i. Rely on manually gathered data which is subjective and delayed.
 - Reactive and not proactive approach because most of the information comes many hours or days after the defect is created.
- iii. Root-cause on equipment depends on real time monitoring and report but now no any system for support that.
- iv. Reduced yield due to inherent delay in discovering defects and cause of defects.

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1.3 Objectives

The main aim of this project is to develop and implement online monitoring dashboard to deliver real time equipment's condition and performances to determine overall equipment efficiency with these details:-

- i. Real time equipment quality rate or yields with the failures code and description.
- ii. Real time equipment status with colour coding and symbol to identify and differentiate the status of equipment on down, attended or running condition.
- Break down details on the down time and up time with the cause of failure descriptions
- iv. Product family name and model that running on the equipment.
- v. Determine the tool overall equipment efficiency

1.4 Scope

This project focussed on the implementation of online monitoring system at PCB install tool. The station chosen as a pilot area for this improvement project was production line#8A.

1.5 Outline of the Project

This report was organized such as Chapter 1 describes the problem statement with objectives and scope of this project. Chapter 2 is a summary of the literature review on online monitoring system, overall equipment effectiveness other related topic. Chapter 3 describes how the project was organized, planned and executed. Chapter 4 presents the detailed information about the method of developing a monitoring system and other information required for OEE metrics calculation. Chapter 5 is the interpretation of the result and discussion. Chapter 6 is the conclusions of this project and also include the recommendations for this project.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Hard disk drive industries are getting more competitive due to high competition with other suppliers. Cost effective manufacturing with quality product is top management goal.

Naguib and Schlueter (1994) highlighted that Overall Equipment Effectiveness (OEE) is a measurement for equipment performance as given specification and standard. OEE is a metric originally developed to measure the success of Total Productive Maintenance (TPM) programs.

Total Productive Maintenance (TPM) is a lean manufacturing philosophy designed to integrate equipment maintenance into the manufacturing system. The goal of TPM is to minimize equipment downtime and keep equipment produce good product as fast as possible with no unplanned downtime.

At most factories, OEE reports are generated using manual data acquisition and calculation. This has more often than not, resulted in inconsistency and delayed reports. Moreover the interpretation of the report can be subjective from person to person.

Use of the traditional maintenance concepts of fixed overhaul time, operate to failure maintenance, opportunity maintenance, etc. may not provide an optimum solution, both in terms of quality and cost. Liker and Jeffery (2004) highlighted online condition based monitoring (OCBM) has led to an improvement in the quality of maintenance and

also yields by having a tool shutdown system which will help to prevent the tool continuous producing bad parts.

2.2 Hard Disk Drives Manufacturing Process.

Hard disk drives manufacturing plant are assembly process which all the raw materials are sources from local and overseas. Figure 2.1 shows the raw material transport flow till manufacturing plant. Those raw materials are kept in hub and pulled to manufacturing plant by production planning based on customer demand. Those raw materials will go through multiple assembly process and quality criteria before finished product.



Figure 2.1: Incoming raw materials.