

**REAL TIME PRODUCTION MONITORING SYSTEM**

**SIVA KUMAR S/O SUBRAMANIAM**

**A thesis submitted in fulfillment of the requirements for the award of the degree of  
Master of Science in Electronics Engineering**

**Faculty of Electronic & Computer Engineering  
UNIVERSITI TEKNIKAL MALAYSIA MELAKA**


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**” I declare that this thesis entitled Real Time Production Monitoring System is a result of my own works except as cited in the references “**


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**Date** : 16 February 2009

**We hereby declare that we have read this thesis and our opinion this thesis is sufficient in terms of scope and quality for the award of the degree of Master of Science in Electronics Engineering**

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## ACKNOWLEDGMENTS

As usual when a piece of work this size comes to an end there are many people to thank than is practically possible. To those I have forgotten to mention, thank you first of all. There are however a few people I remember in particular.

I am deeply thankful to my supervisor Professor Abdul Hamid bin Hamidon. He has been enthusiastically inspiring and encouraging me since I started my research. Without his excellent guidance and tremendous support, this research work would not have been possible.

My heartfelt gratitude also goes to my co-supervisor Madam Siti Huzaimah binti Husin for her great enthusiasm, interaction, friendship and valuable advice over the years.

My deepest gratitude goes to my mother and father who supported me mentally. I'm also grateful to my wife Miss Kavitha d/o Krishnan who showed infinite patience and understanding during my study and gave tremendous moral support and loving encouragement.

Writing a thesis is an extremely time consuming task I therefore would like to thank my friends for persistently asking me the killer question "How is your Master's?"

## ABSTRACT

A production monitoring system is a system that is used in real time to record production line problems. It is constructed using programmable logic controller and sensors to collect data from production lines. The real time production monitoring system is designed to collect data automatically and display the data on display boards for the workers to see. Devices in the real time production monitoring system are capable of working as individual units or working together with multiple terminal links such as automated machineries, robotic systems and manual process line. The data will also be relayed to the management for prompt action.

Data on production time, non-production time, targets, rejection rates, planned stops, and cycle times will be displayed as well as relayed to the management. Unadulterated data collected from the real time production monitoring system should be relayed to the management without human intervention. Such data would then be interpreted accordingly in order to identify the faults at production level and to spur corrective measures from the management. With the help of this real time production monitoring system the management will be able to monitor both the workers and machine performance. Display of data can also prompt instant action from both workers and line supervisors.

The data collected is in line with the requirements of overall equipment effectiveness. Overall equipment effectiveness is the tool for improving efficiency. Efficiency of production lines enables better yield and utilization of the available resources. The real time production monitoring system together with overall equipment effectiveness will help companies to generate higher revenue.



## ABSTRAK

Sistem pengawasan pengeluaran merupakan sistem yang digunakan di dalam masa nyata bagi merekodkan sebarang permasalahan yang berkaitan dengan talian pengeluaran. Ia dibina menggunakan sistem kawalan logik boleh aturcara (PLC) dan beberapa pengesan bagi mendapatkan data daripada talian pengeluaran. Sistem pengawasan pengeluaran masa nyata adalah direka untuk memperolehi data secara automatik dan memaparkan data pada paparan bagi membolehkan ianya dilihat oleh para pekerja. Alat peranti di dalam sistem ini adalah berkebolehan untuk berkerja sama ada secara persendirian mahupun bekerjasama dengan beberapa rangkaian pangkalan seperti mesin berautomatik, sistem robot dan talian pengeluaran secara manual. Data-data juga akan dialirkan kepada pihak pengurusan bagi tindakan lanjut.

Data-data yang terlibat di dalam masa pengeluaran, masa bukan pengeluaran, sasaran pengeluaran, kadar tolak, pemberhentian berjadual, dan masa kitaran akan dipaparkan dan dihantar kepada pihak pengurusan. Data-data asli yang dikumpulkan melalui sistem pengeluaran masa nyata ini akan diagihkan kepada pihak pengurusan tanpa campurtangan manusia. Data-data tersebut kemudiannya akan ditafsir bagi mengenalpasti kelemahan di peringkat pengeluaran dan membolehkan pihak pengurusan mendapatkan pengukuran yang sepatutnya. Adalah difikirkan sesuai sekiranya data-data ini disambungkan terus ke dalam sistem komputer. Dengan adanya bantuan dari sistem pengawasan pengeluaran masa nyata ini, pihak pengurusan mampu mengawasi kedua-dua pihak, samada pekerja mahupun kemampuan mesin. Melalui paparan data ini, tindakan segera dari pekerja dan penyelia talian mampu diperolehi.

Data-data yang terkumpul seharusnya setara dengan syarat-syarat keberkesanan keseluruhan peralatan. Keberkesanan keseluruhan peralatan merupakan alat atau medium penambahbaikan kecekapan. Kecekapan satu-satu talian pengeluaran membolehkan hasil yang baik diperolehi dan penggunaan sumber-sumber yang sedia ada dipertingkatkan. Sistem pengawasan pengeluaran masa nyata digandingkan bersama dengan keberkesanan keseluruhan peralatan mampu membantu sesebuah syarikat dalam memacu keuntungan yang lebih tinggi.

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## LIST OF ABBREVIATION

SHORT FORM	DESCRIPTION
PMS	Production Monitoring System
PLC	Programmable Logic Control
OEE	Overall Equipment Effectiveness
TQM	Total Quality Management
PPC	Production Planning and Control
TPM	Total Productive Maintenance
RCA	Root Cause Analysis
FTA	Fault Tree Analysis
SR	Super relay
LCD	Liquid crystal display
LED	Light emitting diode
PCB	Printed circuit board
CMOS	Complementary metal-oxide semiconductor
IC	Integrated circuit
BCD	Binary coded decimal
VDC	Direct current (voltage)
VAC	Alternative current (voltage)
SOP	Standard operating procedure
LAN	Local area network
WiFi	Wireless fidelity
SMS	Short messaging system
ZLSR	Zelio logic super relay

<b>SHORT FORM</b>	<b>DESCRIPTION</b>
GSM	Globe system for mobile
PCU	Primary control unit
SCU	Secondary control unit

## CHAPTER 1

### INTRODUCTION

Production line inefficiencies are the main factors that contribute to less yield and hence less profit to any industry. The aim of this study is to design a real time production monitoring system for use on these production lines. Such a monitoring system will be used to automatically gather production line data and distribute/send it to the industry management or anyone on the shop floor for instant action (Kumar et. al., 2007b). The availability of these data can help the industry in improving their production yield and hence profit.

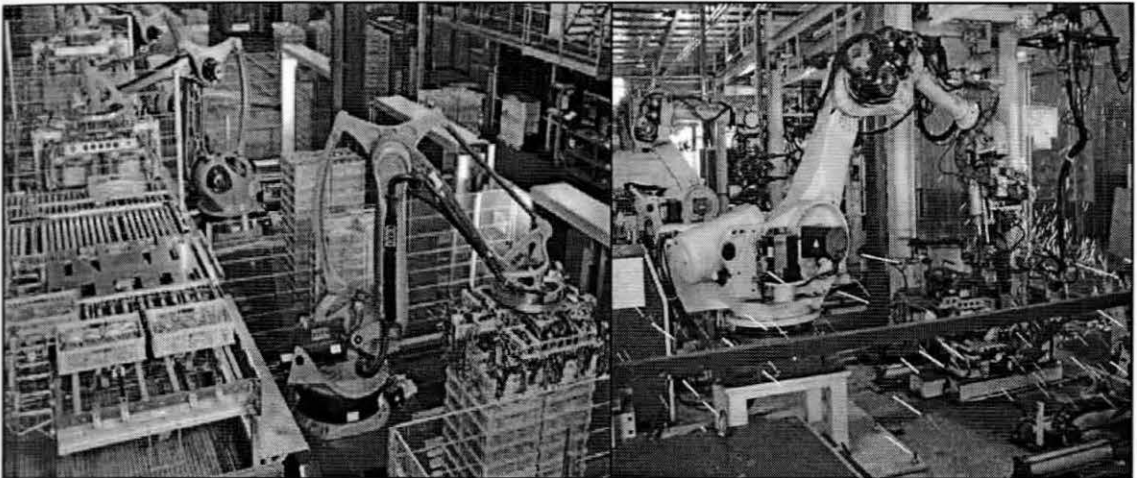
#### 1.1 The production line

A production line is a set of sequential operations established on a factory shop floor whereby materials are put through a refining process to produce an end product that is suitable for onward consumption or components are assembled to make finished goods. In general a production process involves a moving platform or conveyor to move partially completed products to workers who perform simple repetitive tasks designed to permit very high rates of production per worker.

Typically a production line system in industries can be classified into three which are robot and automated machines, semi automated machines (human & machines) and manual/work bench (human).

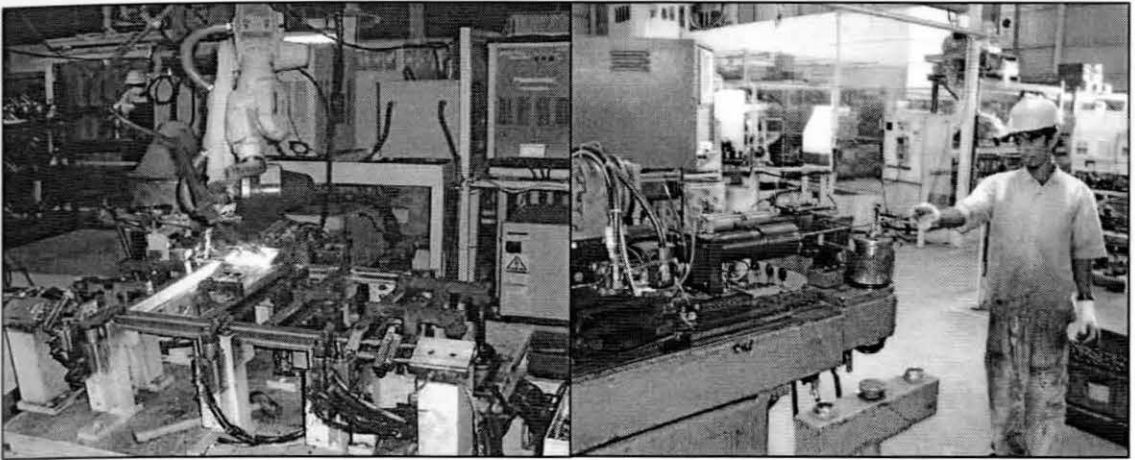


Production process using automated machineries or robots as shown in Figure 1.1 are capital intensive as it uses a high proportion of machinery in relation to workers. Capital is increased with fewer workers and faster rate of production. Machineries for automated production process such as robots have high installation costs. Thus, mass production is ideally suited to serve large, relatively homogeneous populations of consumers, whose demand would satisfy the long production runs required by this method of manufacturing.



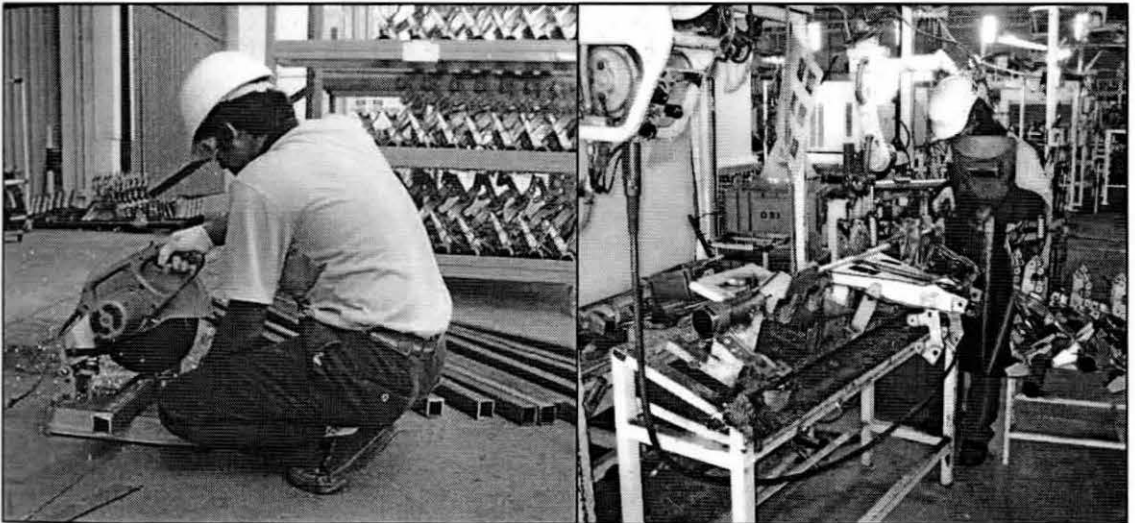
**Figure 1.1:** Automated production lines

Semi-automated production lines as shown in Figure 1.2 consist of human and machineries working together to accomplish certain task. Such production lines are practiced for moderate production output. The production process involves repetitive task for both the humans and machineries to establish products within definite standards.



**Figure 1.2:** Semi automated production lines

Most of the work stations have their craftsman in the workbench. Skilled workers are required to follow procedures in producing parts. Such production lines are practiced for small scale production and manual assembly process. A manual production line is shown in Figure 1.3.

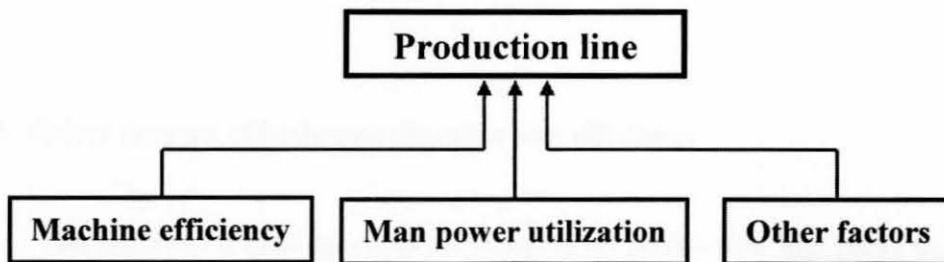


**Figure 1.3:** Manual/work bench production lines



## 1.2 Factors contributing to inefficiency of production lines

Analysis are carried out by the management on production line problems almost daily and counter measures are brought to light to further strengthen the performance of this production line. Analysis is made easy when data is translated into various categories base on critical factors which affects the production lines. The factors affecting production lines can be categorized into three as shown in Figure 1.4. Each of these factors will results in various consequences towards the production lines.



**Figure 1.4:** Factors affecting production lines

### 1.2.1 Machine efficiency

Machine efficiency is one of the factors that are overlooked by the management and this can lead towards losses which reduces the yield (Werner, 2004). Improper maintenance of machines will result in low standards of production output and will increase the maintenance of machineries (Liker & Jeffrey, 2004). Machines are meant to work efficiently but in some circumstances, machines can be less productive due to improper preventive maintenance. Preventive maintenance is a key factor which keeps the machine running efficiently. The maintenance activity on machineries needs extra attention by the management to ensure the optimum usage of machineries and to eliminate unwanted wastages due to machine stoppages.

### **1.2.2 Man power utilization**

Human performance varies from time to time depending on their capability and duration of work. When the performance of a worker drops, the production output also drops. Improper monitoring of workers will result in low standards of production output and will increase the maintenance of machineries. A major factor contributing to this is the attitude of the workers themselves. Most of the workers tend to perform in an average manner and for most of the time they will be less productive and resulting towards wastage of the production time. The only solution for this problem is to have better supervision on them during working hours.

### **1.2.3 Other factors affecting production line efficiency**

The amount of time taken to solve faults on production line plays an important role in maximizing the production output. On the race to meet the targets there will be unwanted breaks caused by machines that will delay the production. In addition, time is also wasted in the calling process and due to the department's unavailability to correct faults.

In general, manpower capitalize most of the process on industries from the management to the layman (operators). An industrial environment is one in which there are a large number of people from various departments working together to meet set goals. When it comes to unmet goals, fingers also should be pointed to the supporting department which will be discussed in Chapter 3. The support department plays a role in maintaining the consistent pace of work on the industrial shop floor.

There are three basic departments in industries which are the Total Quality Management (TQM), Production Planning and Control (PPC) and maintenance. The TQM involves all the quality matters of the parts produced. The PPC involves in planning the production process and supplies based on orders. The maintenance department is responsible on all the technical matters on the industrial shop floor. Most of the industries face problem due to unforeseen damages that the company will face if a task is not done on scheduled basis.