Faculty of Electrical and Electronic Engineering Technology

DEVELOPMENT OF A VISUAL INFORMATION SYSTEM USING VB.NET (AUTOMOTIVE INDUSTRIAL AUTOMATION)

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

MOHAMAD AIMAN ZAFIR BIN ABDULLAH

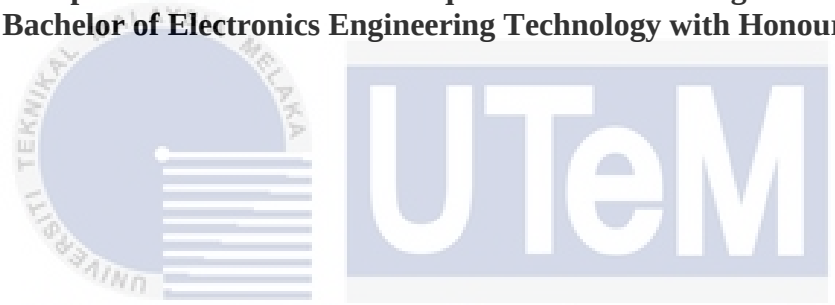
Bachelor of Electronics Engineering Technology with Honours

2023

DEVELOPMENT OF A VISUAL INFORMATION SYSTEM USING VB.NET (AUTOMOTIVE INDUSTRIAL AUTOMATION)

MOHAMAD AIMAN ZAFIR BIN ABDULLAH

A project report submitted
in partial fulfillment of the requirements for the degree of
Bachelor of Electronics Engineering Technology with Honours



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I declare that this project report entitled “Development Of A Visual Information System Using VB.Net (Automotive Industrial Automation)” is the result of my own research except as cited in the references. The project report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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I hereby declare that I have checked this project report and in my opinion, this project report is adequate in terms of scope and quality for the award of the degree of Bachelor of Electrical Engineering Technology with Honours..

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DEDICATION

Specially dedicated to:

My belove mother and father, my loved ones, family, friends, supervisor, and all my lecturers for their support, encouragement and inspiration throughout my journey of studies in University Teknikal Malaysia Melaka.

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May Allah Bless All Of Us.

ABSTRACT

This project focuses on the development of simulation and monitoring system by using Visual Basic software to develop a .Net framework. The purpose of the system is as a visual aid to monitor the information about the process of a certain plant process which involves heavy and dangerous task where human interference should be minimized. The system would be able to be used with the aid of monitoring hardware like sensors to mimic the real-life process while being connected to the actuator such as motors and cylinders. The software will have the plant layout simulate the process of the workpiece moving along the conveyor belt and observe whether the workpiece is in an acceptable condition or not. The sensor unit in the simulated system would indicate if the object passed the simulated inspection or not. The system could also be implemented as a real-time monitoring aid by using sensor modules that is usually incorporated into the process' system through Arduino interface.

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ABSTRAK

Projek ini adalah berkisarkan tentang pembangunan sistem pemantauan dengan menggunakan perisian Visual Basic untuk membangunkan rangka kerja .Net. Tujuan sistem ini adalah untuk memantau informasi tentang sesuatu proses tertentu di kilang yang melibatkan tugasan-tugasan berat dan berbahaya di mana penglibatan operator manusia sebaiknya diminimumkan. Sistem ini akan dapat digunakan dengan bantuan perkakasan pemantauan seperti sensor berdasarkan proses kerja sebenar, di samping boleh disambungkan kepada penggerak seperti motor dan silinder. Perisian ini akan mempunyai susun atur kilang untuk mensimulasikan proses sesuatu bahan kerja yang bergerak di sepanjang penghantar dan memerhati sama ada bahan kerja berada dalam keadaan yang boleh diterima atau tidak. Unit penderia dalam sistem simulasi akan menunjukkan sama ada objek melepasi pemeriksaan simulasi atau tidak. Sistem ini juga boleh diaplikasikan sebagai sebuah sistem pemantauan masa nyata dengan menggunakan sensor yang biasanya digunakan ke dalam sesebuah proses perkilangan melalui antaramuka pemproses Arduino.

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CHAPTER 1

INTRODUCTION

1.1 Background

The development of the visual information system will be done using Visual Basic .Net environment where the language used is an object-oriented programming method supported by C# language. The visual representation of the plant layout can be made using various variable to control the action done in that software, such as image box, button, label, list box and more. The coding for the system is written and arranged solely through Visual Studio software, using NET framework. From the software, the layout for the simulated plant is arranged and designed in the 'Design' tab, while the coding for each of the objects' action is done in the code-writing window. To simulate the sensor in the design tab, object such as image box can be used where the result of the simulated workpiece passing proportionally to the makeshift sensor can be identified as a sensor signal. The system will also have the function to identify a USB camera connected to the PC to simulate a real-life detection of a monitoring peripherals through the use of visual processing library for .Net framework in the Visual Basic IDE.

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1.2 Problem Statement

3D (dangerous, demanding, demeaning) jobs have been a staple in the industrial work scene since the first age of Industrial Revolution. As one of the many industries that prioritizes on manufacturing a product, the automotive engineering is not excluded from

having its own dangers and risks toward the human worker, especially those who in vicinity to the manufacturing plant. Thus, it is important to minimize human intervention during the manufacturing process as accidents might happens, which could also lead to other subsequent damages.

With the use of sensors, alarms and other indicator could be used to signify an error that occurs during the process. But without a proper monitoring system, it might take some time to troubleshoot and figure out what went wrong. This will lead to an increased downtime for the process. Thus, output rate would also be reduced.

Other than that, for education purpose, explanation through verbal communication would be less effective to get a grasp of what the process in automobile manufacturing is supposed to be. Through visual simulation, user could understand the process easier as the order of the process is presented in a sequential manner, with colour markers and labels.

1.3 Project Objective

This visual information system would help the user to simulate a conveyor or process line in an automotive process plant where the hazard and accident risk is high, such as during the paint coating process or heavy parts transportation is done. The detailed objective of this project is stated such as below:To develop a set of generic representative feeder (RF) model of the Malaysian MV distribution network for effective system wide energy flow and TL analysis.

a) To provide a visual information system for the dangerous section of the automation industry's process.

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b) To develop develop the simulation of the process through the use of GUI software with moving workpiece and suitable process activity.

c) To develop and integrate the software with a model prorotype for real-time process monitoring.

1.4 Scope of Project

This project will be erected based on a certain scope that is the limit to what the finished system will consists of. The requirements that the system will comply are:

a) The simulated process designed for the system will only display the simplified version of an assembly conveyor of from one of the dangerous process in the automation plant (stamping process).

b) The hardware that is being used for the prototype only involves a simplified version of the process which is using sensors and electric conveyor.

c) The animation for the conveyor would have a different delay to the actual prototype.

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CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The visual representation system is designed for providing visual guide in a dangerous and risky process in some part of the automation industry's factory. The purpose of this chapter is to identify what made those process dangerous where human intervention is too risky and not recommended. This chapter will also discuss about the system chosen for the project and how it could help to achieve the objective provided.

2.2 Automotive Industry

According to John Bell Rae (2020), automotive industry is the factories, companies and their activity involving the manufacturing process of motorized transportation, which includes parts fabrication and product assembly, which excludes tires, batteries, and fuels. The main products of the industry, to name a few, are vehicles such as automobile and light trucks. Commercial vehicles such as vans, lorries and other large transport trucks, on the other hand, are the industry's secondary products.

The processes of manufacturing automotive products were done in a wide factory plant. Most of the modern factory nowadays do not fabricate most of their products' parts such as car accessories, window glass, and sensors, they instead commissioned it from other companies. Most modern automotive companies only fabricate small amount of their product's part and most of the works done in their factories are process such as assembling and painting.

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NRTC Automation (2020) explains that a process of manufacturing a car involves the establishing and acquirement of raw materials for car production. Then, there is product design process, which involves engineering application to design a car which fulfils public needs, modelling and simulations of the car model through software and calculations while identifying safety needs for the products' design. After approval is obtained, the process moves on to the next step, which is manufacturing. During this process, the car model is produced physically. Sheet metal is used to produce car chassis, frames, doors and more through stamping process by robots. Once these parts are made, they'll be sent to travel along a moving assembly production line where smaller parts of the car are attached and assembled along the way. Processes are done using robotic work cells and human operators. There is also the painting process, which includes cleaning the exterior area of the car where paint will be applied, chemical layering to the car body and painting, where multiple layers of paint such as the primer, main colour, top-coat and other protective layer will be applied to the car. The next process of the manufacturing section would be assembling more parts of the car body such as the engines, transmission, accessories, and tires to complete the product. Lastly, the product will undergo Quality Assurance & Safety testing to find out any manufacturing flaws, and incompliances of the finished products as opposed to its function design.

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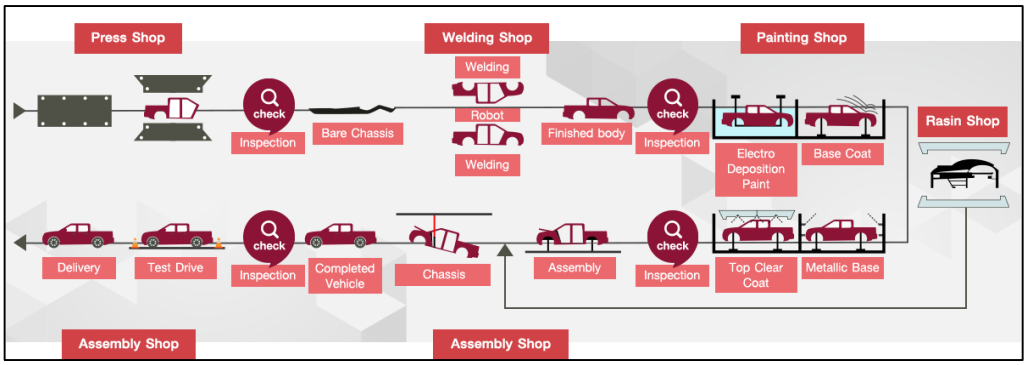

Figure 2.1 Vehicle manufacturing process according to Toyota Daihatsu Engineering & Manufacturing Co., Ltd.

2.2.1 Automation Manufacturing Station

The figure below displayed an example of a process cell in an automation plant. Below is a palletiser section in a press shop process of the plant where blank cutouts are made to be pressed as chassis or other parts such as doors and roofs of a vehicle.

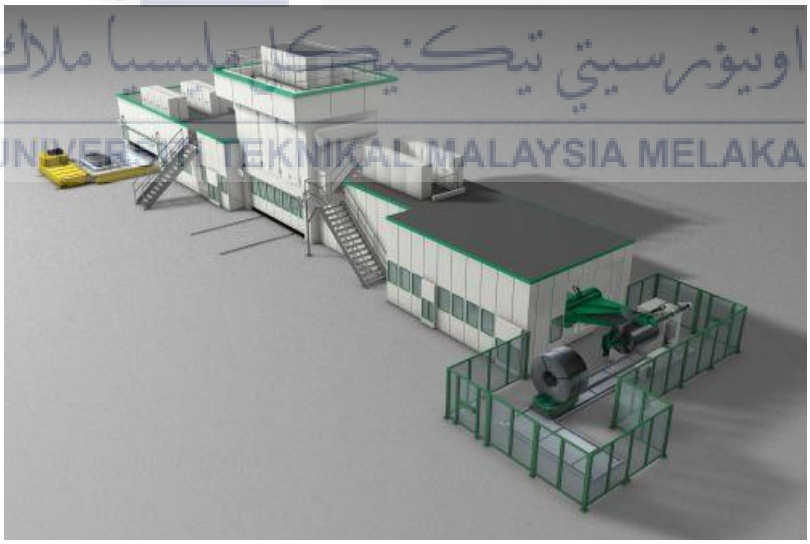

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Figure 2.2 Press shop palletiser layout.

Through the press shop's palletiser, the metal sheets are trimmed to the size necessary for the transfer press in the blanking lines. The precision with which the dimensions are measured during cutting is critical to the process's reliability and the quality of the subsequent pressing activities. Cut-outs should be made now, if at all possible. The automated processes maintain a high level of consistency. The cell works by decoiling the blank roll of metal sheet through the coil feed section. The metal sheet is then moved to the working process to cut, drill and later, being arranged as finished blanks.

Here is another example of high-risk process cell in an automotive factory, which is the paint shop.

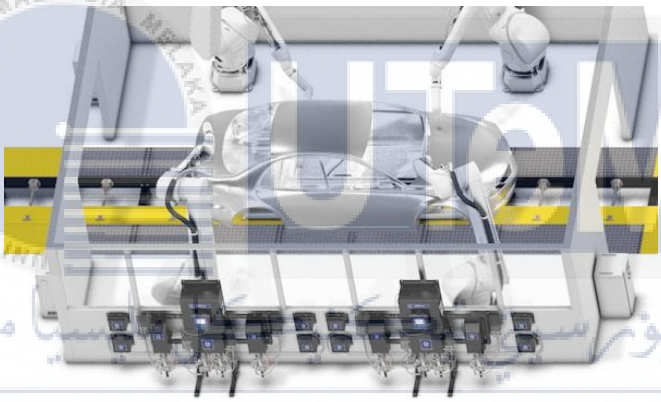

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Figure 2.3 The painting process layout in car factory.

The station shown above is the top coating station for the painting process in the car manufacturing factory. The topcoat paint protects the car body, especially the base coat from being affected by sunlight, rain, and dust. The car body is painted by multiple robot arms while moving on a conveyor belt. The robot arms will have their movement in a loop while the chassis of the car moves across the robot arms' painting perimeter.

2.2.2 Risks and Dangers Of Automotive Industry.

Heigl (2018), stated that the manufacturing process does come with a lot of hazards. Like most manufacturing industry, the automotive industry is not excluded of having their own risks and hazards towards any human in vicinity of the running machine and heavy workpiece. Cameron (2022) listed down 6 major hazards that are present in the workplace as below:

i. Safety hazards
   - Slipping.
   - Tripping.
   - Falling.
   - Handling of dangerous machine etc

ii. Biological hazard
   - Exposure to substances in many forms (liquid, fumes etc.).
   - Exposure to disease linked to work.

iii. Physical hazard
   - Exposure to hazardous condition of the working environment.
   - Brings damage to employees' physical condition such as hearing damage, radiation damage towards skin and internal organs.

iv. Ergonomic hazard
   - Would damage workers' physical condition through the strain put on their body due to abnormal body position and bad posture while working or through continuous heavy-lifting works.

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