AUTOMATED INSPECTION ROBOT

MOHD FADLY AIZAT BIN SAID

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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This report is submitted in partial fulfillment of requirement for the Bachelor of Electronic Engineering (Industrial Electronics) With Honours

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UNIVERSTI TEKNIKAL MALAYSIA MELAKA

FAKULTI KEJURUTERAAN ELEKTRONIK DAN KEJURUTERAAN KOMPUTER

BORANG PENGESAHAN STATUS LAPORAN

PROJEK SARJANA MUDA II

Tajuk Projek : AUTOMATED INSPECTION ROBOT

Sesi Pengajian : 1 3 / 1 4

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For my beloved mother and father

Haji Said Bin Sarkawi

Hajah Khalimaton Saadiah Binti Sahlan

Thanks for loves and supports

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ABSTRACT

This project is to design and build an autonomous inspection robot. The inspection robot is design to replace human intervention of doing some dangerous and hazardous working environment at the platform or inspection site. The benefit of this application is to create an efficiency of operational costs during the maintenance operation. Furthermore, it can increase the capacity of quality services because of the proficiency inspection in every detail inspection. On the other point of view, it also can save time and reliability of autonomous system whether to manufacture the product or maintaining the product. This unique feature of the robot makes it simpler to use and operate at any time anywhere and can record a video over an hour. The robot is programmed by using the interrupt technology that can change the priority of tasking if there is any obstacle. From that, the robot can freely move without the collision to the wall or any barrier. If the robot detects the defect area or a hole, it will automatically stop and the servo camera will record to the sensing area which the defect comes from. By using Arduino microcontroller (ATMEGA2560), it will control the whole operation from movement motor control, sensing input, output display, servo motor control and input voltage. Lastly, this report is to describe about the construction of robot in terms of mechanical design, design plan, electronic design and software design. All of the design above is the key factor for the robot to be successfully operated and do its task according to industrial specification.

ABSTRAK

Projek ini adalah untuk merekabentuk dan membina robot pemeriksa automasi. Robot pemeriksa direkabentuk untuk menggantikan campur tangan manusia untuk menjalankan pemeriksaan di persekitaran bahaya samaada bekerja di platform atau tapak pemeriksaan. Manfaat aplikasi ini adalah untuk mewujudkan kecekapan kos operasi penyelenggaraan. Tambahan pula, ia boleh meningkatkan kapasiti perkhidmatan berkualiti kerana pemeriksaan berperingkat dalam setiap terperincian pemeriksaan. Pada titik lain pandangan, ia juga boleh menjimatkan masa dan kebolehpercayaan sistem automasi sama ada untuk mengeluarkan produk atau mengekalkan produk. Ciri unik robot menjadikannya lebih mudah untuk digunakan dan beroperasi pada bila-bila masa mana-mana dan boleh merakam video lebih satu jam. Robot ini diprogramkan dengan menggunakan teknologi penukaran yang boleh menukar keutamaan tugas jika terdapat sebarang halangan. Daripada itu, robot yang bebas boleh bergerak tanpa berlanggar ke dinding atau mana-mana halangan. Jika robot mengesan kawasan kecacatan atau lubang, ia secara automatik akan berhenti dan kamera servo akan merekodkan ke kawasan yang terjejas teruk. Dengan menggunakan mikropengawal Arduino (ATMEGA2560), ia akan mengawal keseluruhan operasi daripada kawalan pergerakan motor, pengesan masukan, paparan keluaran, kawalan motor servo dan voltan masukan. Akhir sekali, laporan ini adalah untuk menerangkan tentang pembinaan robot dari segi reka bentuk mekanikal, pelan rekabentuk, reka bentuk elektronik dan reka bentuk perisian. Semua reka bentuk di atas adalah faktor utama untuk robot untuk berjaya dikendalikan dan melakukan tugas yang mengikut spesifikasi industri.

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LIST OF ABBREVIATIONS

NGV	-	Natural Gas Vehicle
BP	-	British Petroleum
CCTV	-	Closed Camera Television
PIG	-	Pipeline inspection gauge
PWM	-	Pulse Width Modulation
UART	-	Universal Asynchronous Receiver Transmitter
AC	-	Alternate Current
DC	-	Direct Current
ICSP	-	In circuit serial programming
USB	-	Universal serial bus
VIN	-	Voltage Input
FTDI	-	Future technology device universal
GND	-	Ground
KB	-	Kilobyte
DDRAM	-	Double data random access memory
SRAM	-	Synchronous random access memory
EEPROM	-	Electrically Erasable Programmable Read-Only Memory
RX	-	Receiver
TX	-	Transmitter
TTL	-	Transistor-transistor logic
SPI	-	Serial peripherals interface
MISO	-	Multiple input single output
MOSI	-	Master Out Slave In
SCK	-	System communication key point
SS	-	Slave select
LED	-	Light emitting diode

SDA	-	System data line
SCL	-	System clock line
TWI	-	Inter Integrated Circuit
AREF	-	Analog reference
LCD	-	Liquid crystal display
IR	-	Instruction register
DR	-	Data register
RS	-	Register selector
MPU	-	Micro processing Unit
RC	-	Remote control
IR	-	Infrared
NPN	-	Negative positive negative
HEX	-	Hexadecimals
CPP	-	Code plus²
COM	-	Common
PCB	-	Printed circuit board
SMD	-	Surface mount soldering
IN	-	Input
OUT	-	Output
GUI	-	Graphical User Interface

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CHAPTER I

INTRODUCTION

In this chapter, the introduction of the Automated Inspection Robot will be explained. This chapter will be explaining the objective, problem statement and lastly the scope of work.

1.1 Introduction

In this report, we present the developments of automated inspection robot specifically design for the inspector to do a maintenance and surveillance work at the surface target automatically. The design of the robot must be sophisticated so the robot can adept in the hazardous and hostile environment. The robot which employing the mechanism of independent rubber track units which can grip to the surfaces and move horizontally at the target structure. [1] The aim of this automated robot crawler is to assist the inspector to do some monitoring work by using CCTV camera with sufficiently detect the cracks, clogs or deformation. Therefore with the low cost equipment that available, we can install them into the robot so the robot can do the multitasking job. This robot is basically an autonomous robot. This type of robots is usually replacing the human inspector job to check the subjected area, where the inspector cannot reach because the robot has the ability to monitor and evaluate the tight area [2]. The human inspector can place the robot anywhere, and the control signals for the robot are usually sent through a programming code in a microcontroller. The ultrasonic sensor determines the conditions of the subjected

area by examining the output from the sensor data measurement, which is usually the video from the camera recorded.

1.2 Problem Statement

Nowadays there are many cases involving pipeline leaking in several areas in Malaysia. Recently there is an incident leaking gas pipeline (NGV) at Kawasan Perindustrian Ayer Keroh. It happens because the pipe is hit by the excavator during excavation work and evacuation procedure has been implemented. [3] In 2010, the disaster occurs in the Mexican Gulf which is killing 11 people and spilled a large amount of crude oil across the sea. This tragedy was the most unprecedented tragic accident in the human history. British Petroleum is the company who are taking all the responsibility of this disaster [4]. The company had loss a billion of dollars in single moment which is the price of not taking the maintenance into a serious business. With poor maintaining and surveillance work the chance of disaster is estimated about 70% to occur. There are paths that human cannot reach in the certain pipeline area because it is hazardous and narrow make impossible for a human to intervene. Robotic deployment is also desirable to avoid dangers to manual operatives and the costs of using manual operatives in such dangerous activities [5].

1.3 Project Objective

There are two objective of this project:

a) To develop surveillance robot work in the pipeline

b) To create a controller that can operates the inspection robot

1.4 Project Scope

The scope of this project is:

a) Designing and prototyping of a robot that traverses horizontally through pipes for inspection.

b) The robots are frequently used to deploy and monitors pipeline system condition and to analyze the enough information to assist repairing and maintenance work.

c) To study and design the controller that can control the movement of the robot.

d) Install the robot with the low cost equipment that available, so the robot can do the multitasking job.