



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

GUI CONTROLLED MOBILE ROBOT

This report is submitted in accordance with requirement of the University Technical Malaysia Melaka (UTeM) for the Bachelor Degree of Electrical Engineering Technology (Industrial Automation and Robotics) (Hons.)

by

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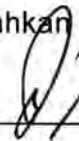
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DECLARATION

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APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Electrical Engineering Technology (Industrial Automation and Robotics) (Hons.). The member of the supervisory is as follow:



.....

(Project Supervisor)

ABSTRAK

Projek ini adalah untuk mereka bentuk dan membangunkan model robot mudah alih yang boleh dikawal dengan menggunakan pengantara muka pengguna grafik (GUI) dengan menggunakan protokol tanpa wayar. Projek ini memberi tumpuan kepada kawalan dengan menggunakan GUI sebagai pusat kawalan navigator dan pengendali boleh mendapat gambaran imej dan video masa nyata pada perisian iaitu visual basic yang bertindak sebagai GUI untuk model robot mudah alih. Robot ini direka untuk mengikuti arahan daripada komputer melalui komunikasi tanpa wayar XBee untuk mengatasi had kawalan apabila menggunakan wayar. Bahagian utama robot terdiri daripada casis, pengantara muka pengguna grafik (GUI), modul XBee, DC motor gear, trek roda, telefon pintar dan pengawal mikro (PIC18F4550). Kaedah yang digunakan untuk memandu ialah menggunakan L298 untuk mengawal ke hadapan, ke belakang, ke kanan dan pergerakan kiri robot. Dalam reka bentuk mekanikal, roda trek telah digunakan dan bukannya roda konvensional bagi membolehkan robot untuk melakukan pergerakan melalui permukaan yang tidak rata atau rupa permukaan yang kasar. Selain itu, kamera telah digunakan dan diletakkan kamera tanpa wayar pada robot sebagai sistem pemantauan yang berfungsi seperti kamera CCTV kerana beberapa masalah. Akhir sekali, reka bentuk robot akan menjadi reka bentuk dengan kawalan tanpa wayar supaya pengendali dapat mengawal robot dengan jauh. Kawalan tanpa wayar membolehkan pengendali mengelak dari persekitaran yang tidak selamat atau peranti berbahaya dan mengelakkan wayar atau kabel yang boleh mengganggu pergerakan robot.

ABSTRACT

This project is about designing and developing mobile robot model that can be controlled using graphical user interface (GUI) by using wireless protocol. This project focuses on the control by using GUI as navigation control centre and operator can get a view an image and real time video on visual basic software that act as GUI for model of mobile robot. This mobile robot is designed to follow instruction from the computer via Xbee wireless communication to overcome limitation of wired based control. The main part of the robot consists of chassis, graphic user interface (GUI), Xbee module, DC gear motor, wheel track, camera and microcontroller (PIC18F4550). The differential drive method using the L298 is used to control the forward, backward, turn right and turn left movement of the robot. In the mechanical design, track wheels have been used rather than conventional wheels to enable the robot to travel through different type surface or rough terrain. Additionally, a camera is use by attached a wireless camera to the robot as a monitoring system by function as CCTV camera due to some problem. Last but not least, the robot will be design by wireless control so that the operator able to remote controls the robot. The wireless control allows the operator away from the unsafe environment or harmful device and evades the wire or cable interferes the robot movement.

DEDICATION

Specially dedicated to my family

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LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

GUI	=	Graphical User Interface
VB	=	Visual Basic

CHAPTER 1

INTRODUCTION

Nowadays, robotics is not a new field. It has been all over the place for a decades. For example the car maker use automated machine to position a car frame, joint a part with spot-weld robot, bolt piece together, painting and priming. This project is to develop a mobile robot which is remotely controlled by mean of wireless application. The control is to be done through a graphical user interface (GUI). The robot must also be capable providing feedback through the use of electronic device. This project involves hardware and software part. This project has several applications in surveillance.

In this way, human can tell the robot to change directions, take measurements and so on. For example, mobile robot can let security personal stay in a central office and still check out unsupervised areas in a warehouse or other site. This is a new venture that is focused on intelligent mobile robot that are used in flexible environment and not as automated tool set in fixed location.

The hardware part have electronic component and mechanical component. Electronic parts is use to develop this robot are printed circuit board (PCB), microcontroller, dc motor and x-bee. While, the mechanical parts is wheel track, gear box and chassis of the robot.

The software that use in software part in this project are visual basic as a GUI, MPLAB X to program a microcontroller, XCTU to pairing Xbee frequency and proteus to design a circuit as well as do a simulation.

1.1 Problem Statement

The problem statement in this project is the use of user graphical interface in controlling robot via wireless application and the ability of robot for providing a feedback. The robot

movement on a hard surface and not flat by using a suitable wheel types to do a surveillance. The information of environments and monitor conditions to give information to the user also problem when the vision of control area when outside eye view. The limitation surveillance area when using cable.

Conservatively, the RF circuits use in wireless-controlled robots, which have the disadvantages of limited working range, limited frequency range, and limited control. The input from user is communicated serially over an RF link to the Robot, where it is received, identified and relayed to the proper module.

- The response to the system is from the user.
- This response is first processed at the control application, serially communicated over a radio link.

After that this input is received at the robot and processed again. Although the presence and abilities of robots contrast massively, all robots share the features of a mechanical, portable structure under certain form of control. The control of robot consist of three distant phases: perception, processing and action. Generally, the preceptors attached on the robot, handing out is done by the on-board microcontroller or processor, and the task is implemented using motors.

1.2 Objective

There are four main objective that reason in studying and developing this model of robot. The motive of this project is to develop graphical user interface (GUI) to monitor and control the robot remotely through GUI which is named Navigation Control Centre. The Navigation Control centre is centre control station that operator to control and monitor the robot movement.

The additional aim of this project is to apply a skill dealing with electronic component and circuit to control the system. This project also gives the opportunity to apply programming skill and to understand the operation of each block diagram that contains in the circuit. The objective for this project:

- i. To develop a mobile robot.
- ii. To create a control through a graphical user interface (GUI).
- iii. To design a robot of providing image feedback to computer.
- iv. To study a wireless application to control a robot.

1.3 Scope

Development of GUI controlled mobile robot focuses on the theory of making the existence feature by the use of remote control, monitoring and navigation, as well as information sharing in joint communities of living and non-living entities. The project is dividing into two parts: hardware and software. This project will transmit the data remotely by using Xbee to communicate. For the robot base have two block of interfacing. First block is robot navigation control that is use to control robot action and monitor robot status such as image. Second block is live video transmission that is use to send live video signal to give Operator see what robot see and operator also can capture the footage for analysis by using GUI that is named Navigation Control Centre.

This model of this robot is controlling and monitoring system using visual basic and PIC microcontroller. The previous researchers have been implemented in this project especially the robot mechanism and the control system of the robot. Visual Basic is the type of software that is used in control movement and was implemented with the Visual Basic so- as the control system of the robot. Programmable Interface Controllers (PIC) as microcontroller to monitoring system and it will provide the serial data that has use to transmit and receive data in monitoring control robot. DC motor is use to make the robot can move from one place to another places. To make the DC motor moving according to instruction giver from operator, L298 as motor driver chip is used. The project will focusing on a few guidelines which define the scope to ensure that the project achieves its objectives.

- i. To develop a mobile robot control by using GUI.
- ii. To develop a mobile robot control by wireless application.
- iii. Using a wheel track base for make a robot to move around from one location to another location.
- iv. The robot can give a feedback to the GUI.
- v. The main brain is use a programmable integrated circuit (PIC).
- vi. The range robot can communicate within 50m

CHAPTER 2

LITERATURE REVIEW

This chapter is to consider about the article that are linked to this project. This chapter covers the theory and applications of the project hardware, software, equipment and programming language that used in previous project that already done.

2.1 Related Previous Works

Mobile robot design is about art and skill development to create the useful robot for human application. Each part of mechanical, electrical and software should be studied to make sure that all mobile robot application can run smoothly and can complete the task given. In mechanical part, each measurement of the mobile robot design must be details and fixed which it is important factor to stability and functionality of robot. In electrical and software part also need research in order to develop a mobile robot that low price, robust and good performance.

2.1.1 A Vision-Based Course plotting Control System for a Mobile Service Robot

Mohamed Abdellatif (2007) introduce a Mobile service robot with a class of robot and the tools to understand in order to allow its motion or object conduct in such spaces like the environment at home as well as office. The development of autonomous mobile robots is give the effect of the decreasing prices of sensors and computer. Other while to autonomous mobile robots is in advance much interest of it. Also, to increase the quality of live with the ascending need for their application in human friendly surroundings.

Using the Fuzzy logic approach in robotics give many positive applications and considered as an intelligent computational method. Fuzzy Logic Control, FLC, allows the system to hedge the hesitation from disturbing the control actions. In other method, they propose a

method by via potential field philosophy to integrate the behaviour decisions. It proved be very well-organized specifically for fast robots. The prototypical of imaging and measurements of aim position from the colour image, it stated the Tone, Saturation and Intensity, HSI colour space is used from the time when it is found previously and perceptually constant. Other advantage is concerning the recognition of object from colour presence in the image is to get better results. They refer to the design of fuzzy logic controller in authority and the goal is allow the mobile robot to fulfil two objectives specifically; aim tracking behaviour, obstacle evading behaviour and else merging both behaviours.

The testing of robot control are use the system structures. In safe and sound controlling the robot to perceive the object by its colour, it was lead to discover the success of the control system. Moreover, were lead for separate self-determining behaviours and then for joined behaviours. A vision-based control system was applied and can enables a mobile robot to footpath and trail a moving object. Addition, using the potential field theory in the fusion of behaviour commands was successful in line for to the smooth resolutions from the specific behaviours.

2.1.2 Identifying and Observing Time-Related Abnormal Events via Wireless Sensor Network as well as Mobile Robot

Yuan Yuan Li et al. (2008) use Wireless Sensor Networks (WSNs) to sense alterations in the surroundings. Low cost can be expend to large area can be monitored by this network. They have investigated by “unknown environment” that are intruder detection in a previously, it mean that the previously unknown to the WSN are the device signatures as well as forms of anomalies. To confirm if there is an invader in the zone the robot use the camera as an extra sensors. The important things they try to determine a systematic procedure on this network, so that it can sensitive only to real anomalies. They must have integrated a machine knowledge system into the WSN, so the network study to identify usual and unusual approaches of action automatically. Furthermore, the network can keeps learn from the past and the future of events without forgetting anything.

They have objectives to achieve in this network as to plan an accessible, well-organized and tough abnormality recognition system via WSN and other movable robots that will be positioned in an unidentified surroundings. The features to culture algorithm are first:

capable to notice abnormalities in an unidentified surroundings with least human supervision, second: capable to straightforwardly scale to enormous numbers of motes, third: capable to care a hierarchical construction, fourth: computationally inexpensive, fifth: memory efficient, sixth: capable to identify time-related abnormalities online, seventh: modular, eighth: capable to endlessly monitor the surroundings, ninth: robust and tenth: able to adopt feedback. Nevertheless, several clustering systems more appropriate for some precise categories of data or applications.

In this network, they used architecture for the sensor networks, the fuzzy ART link, and Markov prototypical extension. On the hardware stages, wireless sensor network contains of two that are fixed sensors (Crossbow motes) and movable robots (Pioneer 3 robots). The results are from many experiment such as intruder detection system, performance metrics, temporal change detection experiment and intruder detection experiment. This is the new approach system from that an invader recognition system by via a wireless sensor network and movable robots it able in the direction of detect time-related abnormalities.

2.1.3 Wireless Underwater Movable Robot System Created on ZigBee

Mofeed Turky Rashid et al. (2012) indicate *Artemia Salina* is a crustacean tiny than insects in size as well as mass. Cause of motivation for multi-agent control tactics created on decentralized algorithms is too considerate and modelling the relation mechanisms and operational philosophies of shared behaviour of animals. It's planning for evolving development control, scattered accommodating control and direction of multiple movable independent agents/robots. Moreover, the collective behaviour of *Artemia* is worthy exemplary for robot applications to the improvement of beneficial distributed control systems (DCS). The underwater mobile robot system moved which the function of wireless control grounded on promotion of light to be achieve in order to populate *Artemia*. The idea for underwater movable robot system is include two fragments, first is the underwater mechanical robot as well as another is ZigBee wireless.

In the wireless control, they have been achieve of three type wireless control. The first type of wireless control is the *Artemia* gesture control by light, second wireless control via magnetic field for underwater mechanical robot in addition the last is wireless sensor (ZigBee standard). The mainly targeted requirement of ZigBee are battery-powered

applications everywhere small data rate, small cost and extended battery life. In command to control the gesture of Artemia populace to arrange three types of gesture patterns that are lining, round as well as zigzag that used in the wireless underwater robot system. That are proved Artemia group centred on identifying to transportable light spot and Artemia group be able to be controlled to change in any direction.

The wireless robot control system is easy to create, small cost and be able to control minor organism in minor area with execute some patterns like a group of Artemia and which is used as a instrument to execute a wireless control to citation behaviour of these organisms.

2.1.4 Area Admission Monitoring System using VB

Sahbudin et al. (2003) state security is the main issue similar to doors are the central entrance to our house, company or else whichever sort of building, it suggested a dependable door safety system be specifically designed. They want to achieve the improvement of a safety system with linkage capability via microcontroller MOTOROLA MC68HC11A8. Also, to planned on a market reasonable with a least cost. Moreover, the software part is established segment by segment because it includes a lot of analysis and correcting. It involve of three part such as a gathering program, server sideways program and client on the side program. They used the Eyewatch is primarily to connect with the microcontroller and accomplish database log on purpose. Winsock programming with Eyewatch that the client side program would communicate to notify the user about the door situation whether the door is obstructed or not. The mainly is the analysis actions are concentrated on communication in the middle of computer as well as the microcontroller. Also, this system uses keypad as an input method.

The experimental design of management program crossing point with microcontroller MC68HC11A8 as well as extra peripherals such as LCD display, private card magnetic device, photo device as well as keypad. These peripherals are positioned close to the door. VB are the core management program contains the subroutines that crossing point with other important peripherals and the management program will as well act as a server.

Besides that, the management system is planned to observer persons go in or go out from whichever rooms in a building. In this project it is planned for 4 rooms and supposing consume only one door. Through GUI interface it also allow user to observer the status of