UNIVERSITI TEKNIKAL MALAYSIA MELAKA

Remoted Operated Car Robot by Using Mobile Phone (Arduino)

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Electronic Engineering Technology
(Telecommunication) with Honours

by

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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 Electronic Engineering Technology (Telecommunication) with Honors. The member of the supervisory is as follow:

……

(PUAN IKA DEWI BINTI SAIFUL BAHRI)

DEDICATION

Alhamdullillah, praise to the Almighty ALLAH S.W.T.

This thesis is dedicated to

My beloved family,
My Friends,
and my lecturer
Thanks for their encouragement and support.

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ABSTRACT

Many of the wireless-controlled robots use RF modules. But for this project make use of Android mobile phone for robotic control. The control commands available are more than RF modules. For this android mobile user has to install an application on our mobile which is MIT apps inventor and also have to install the coding of Arduino module and connected with mobile phone. Then the user needs to make a connection between Arduino module in the robots and a mobile phone using Bluetooth. They have to turn on their Bluetooth and connected with the mobile phone. The wireless communication techniques used to control the robot is Bluetooth technology. User can use various commands like move forward, reverse, left or right using these commands which are sent from Android mobile. Robot has a Bluetooth receiver unit which receive the commands and give it to the microcontroller circuit to control the motors. The microcontroller then transmits the signal to the motor driver IC's to operate the motors.

ABSTRAK

Kebanyakkan pengawalan robot tanpa wayar adalah menggunakan modul RF. Akan tetapi, dengan projek ini, akan memanfaatkan telefon mudah alih Android anda untuk mengawal robot untuk bergerak. Segala arahan yang dikeluarkan sudah tersedia berbanding modul yang terdapat pada RF. Untuk pengguna telefon mudah alih Android hendaklah memuat turun aplikasi ke dalam telefon bimbit anda dengan menggunakan *MIT apps* dan juga haruslah memuat turun kod data perisian *Arduino modul* dan sambungkan pada telefon bimbit tersebut. Kemudian, pengguna hendaklah membuat penyambungan diantara perisian *Arduino modul* yang berada di litar robot dengan telefon bimbit menggunakan *Bluetooth*. Pengguna hendaklah mengaktifkan kawalan *Bluetooth* pada telefon pengguna dan menyambungkan isyarat pada robot. Teknologi yang digunakan pada projek ini untuk mengawal robot adalah *Bluetooth* teknologi. Dengan demikian, pengguna boleh memberi arahan pada robot untuk bergerak ke hadapan, belakang, kiri dan kanan yang dihantar daripada telefon bimbit Android pengguna kepada robot tersebut. Robot tersebut mempunyai unit penerima *Bluetooth* dimana akan menerima arahan dan memberi isyarat tersebut kepada litar mikropengawal untuk mengawal motor. Mikropengawal akan menghantar signal kepada micropengawal pemandu motor untuk mengaktifkan pergerakan motor tersebut.

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CHAPTER 1

INTRODUCTION

In today's technology that currently running with time, it actually occupied human lifestyle. Although, there is an interest thing about the technology in our routine lives even someone whose lifestyle is very far away for a well-known about technology nowadays. So that, this is one of our responsibility to design a new or upgrade a reliable systems which can be efficiently used by them whether for our daily life or safety in industry. This basic idea gave birth to the project Remote Operated Spy Robot Using Android Mobile Phone (Arduino Module) to control the moving of the robot.

1.0 Background Project

Remote Operated Spy Robot Using Android Mobile Phone is a model widely used especially by a military for the detection of ground bomb site. Besides that, this is also commonly used by the guardian of wild animals in the jungle. This project will defending their self from a danger situation such as for military, if this robot found the active bomb in the site, it can explode without dead causing. It also can be more safety than before. For wild animal guard, it will safer to the worker if the animal become aggressively to attack human as their food. This robot will take over their job by going through to the wild animal with a short distance. This project will be a useful robot for the dangerous activity doing by human without risking their lives. The system that used in this project is the robot will control by mobile phone with the long range. This is because, nowadays each of the people in this world uses the mobile phone and this can be said to be very important gadget. So, it will be easily

for user to use it and it will not be a weird thing that they have to do. In the previous project, they use a special remote control which has four switches to control the robot in four directions. But in this project, it will upgrade new things which use a mobile phone as a remote to control all of them. The example of the prototype for this project is shown in Figure 1.1 below.

Figure 1.1: The example of the prototype

The robot senses the surroundings through the CCD camera and sends to the receiver through the Radio Frequency wireless communication (mobile phone). The wireless CCD camera can be observed the surroundings in the computer or the phone itself. Android is a software stack for mobile devices that includes an operating system, middleware and key applications. Android boasts a healthy array of connectivity options, including Wi-Fi, Bluetooth and wireless data over a cellular connection. The controlling device of the whole system is a Microcontroller. Bluetooth module, DC motors are interfaced to the Microcontroller. The data received by the Bluetooth module from Android smart phone is fed as input to the controller. The controller acts accordingly on the DC motors of the robot. The robot in the project can be made to move in all the four directions using the Android phone.

1.1 Problem Statement

In this project, Remote Operated Spy Robot has a limitation in some aspects that have to be improved. First of all, the projects that already have before had to be

upgrade follow the technology era nowadays. The limitation is this system does not work for longer distance which the maximum controllable range is 125 meters. So that, the robot have exceed the limit to do the dangerous thing such as observed the behaviour of wild animals where human beings cannot reach. Besides that, this system also can use in army applications to detect the bombs. With this robot, it can avoid human lives threatened. In military, when the situation out of control, we can use this robot to identify the enemy and also the possibilities in the bomb site from the soldier not die in vain. After that, this system also can use in industries. For example, in the chemical industry, there are so many type of chemical can cause the workers to be in danger in life or can get health problem.

1.2 Project Objectives

In this project, discuss about the Remote Operated Spy Robot using Mobile Phone and the main objectives of this project are ;

1) To understand and develop the Remote Operated Spy Robot using Mobile Phone.
2) To implement the application of Arduino module in the mobile phone for Remote Operated Spy Robot.
3) To improve the Remote Operated Spy Robot by control using Arduino module

1.3 Work Scope

The main scope of this project is to easily transport by using mobile phone for the long range and it also can use for military activity such as to check the grounded bomb at the bomb site and this project can avoid human from get injury because of the explosive damage. This Remote Operated Spy Robot will be used as a prototype and it will set to operates for a few actions such as transmit and receive the command between robot and controller (mobile phone) and it also can display the video and audio that been captured directly to the mobile phone. Other than that, we use the

Arduino module for the controller and do an installation until it can use as the objective of this project.

1.4 Report Organizations

In this part will explain all the process and the flow for completing this report and project. This report will be conducted in few chapters and each stated as below:

Chapter 1: Introduction

This chapter will simply introduce about the project. This chapter contains background of project, objectives, problem statements, work scope and report organizations.

Chapter 2: Literature Reviews

This chapter explain about research of related or previous project. The literature about the previous project is stated in this report. The summarisation about the previous project will be included.

Chapter 3: Methodology

This chapter shows about the project methodology. The methodology based on System Development Life Cycle (SDLC) to evaluate this project. The simulation and analyse about this project will be discuss in this circuit.

Chapter 4: Expectation Results

In this chapter, it will state out the expectation result that will be obtained when some simulation is done by using the software.

Chapter 5: Conclusion

This chapter will discuss about the summarization of the project and the major conclusion of the project by referring the objectives.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

This chapter will discuss on previous projects and some journals that related to this project. This journal and reports have been analysed carefully to improve the effectiveness and quality of this project. By analysing the previous, the possibilities that affect the quality in their projects can be analysed and reviewed. From the previous project, idea can be implemented and to improve the project. Therefore, literatures review process start from beginning of project until the end of the project. Besides analysing the previous project, reviews from internet and books which are very effective to this project is done. Throughout the analysis at the beginning of the project, the special feature in this project is determined and the components used in this project are decided. Lastly the concept of the system of this project is well understood.

2.1 Previous Project

2.1.0 Design and Implementation of Remote Operated Spy Robot Control System

According to (Mo, Khaing, & Thiha, 2014), they are design and implementation of Remote Operated Spy Robot Control System. The Spy Robot is remotely controlled robots, equipped with a camera, transmitting video data to the intervention troop. They are made to small and compact enough to easily transport. This project supposes a movable spy robot with a

remote controller by using PIC 16F628A and PIC 16F877. The spy robot is made up of the wireless camera, an antenna, batteries and four movable wheels. CCD camera is used to capture information surrounding the robot. A 4 bits LCD display is mounted on remote controller to view user command. To use the spy robot in the dark area as night, the CCD is set up with LED that connected by lighting circuit. Radio Frequency modules signals are used in wireless remote control system for transmitting and receiving wireless logic signals to control the motors of the Spy robot control system. The three Brush DC motors and the two L298N are used to drive the Brush DC motors respectively.

2.1.1 Using the Android Platform to Control Robots

Based on the (Göbel & Jubeh, 2011), the Android Mobile Phone Platform by Google becomes more and more popular among software developers because of its powerful capabilities and open architecture. As it's based on the java programming language, its ideal lecture content of specialized computer science courses or applicable to student projects. They think the project is a great platform for a robotic system control, as it provides plenty of resources and already integrates a lot of sensors. The java language makes the system very attractive to apply state of the art software engineering techniques, which is their main research topic. The unsolved issue is to make the android device interoperate with the remaining parts of the robot: actuators, specialized sensors and maybe co-processors. So that, they have discussed the various connection methods and present a first approach to connect Android with the LEGO Mind storms NXT robotics system, which they successfully used in their robotics / software engineering courses so far.

2.1.2 Remote Control Robot Using Android Mobile Device

By referring from (Nádvorník & Smutný, 2014), they was designed and realization of the mobile application for the Android operating system which is focused on manual control of mobile robot using wireless Bluetooth

technology. The application allows the robot control interaction with the display or voice. When they use a graphical interface, they can monitor the current distance of the robot from obstacles. The measurement of distance is carried out by ultrasonic sensor placed in front of the robot. It was necessary to build a prototype of a mobile robot for the development of the application. The prototype of the mobile robot is based on the differential gear.

2.2 Hardware

2.2.1 Wireless CCD Camera

The operating voltage of CCD camera is 12V DC. The supply for this camera is taken from the motors battery. The output signals of this camera are in the form of audio and video. These types of cameras are commonly available in the market (Electronicshub, 2015). The Figure 2.1 shows the example of wireless CCD Camera.

Figure 2.1: Wireless CCD Camera

2.2.2 HT 12D and HT 12E

HT12E is an encoder integrated circuit of 2^{12} series of encoders. They are paired with 2^{12} series of decoders for use in remote control system applications. It is mainly used in interfacing RF and infrared circuits. The chosen pair of encoder/decoder should have same number of addresses and data format.

Simply put, HT12E converts the parallel inputs into serial output. It encodes the 12 bit parallel data into serial for transmission through an RF transmitter. These 12 bits are divided into 8 address bits and 4 data bits.

HT12E has a transmission enable pin which is active low. When a trigger signal is received on TE pin, the programmed addresses/data are transmitted together with the header bits via an RF or an infrared transmission medium. HT12E begins a 4-word transmission cycle upon receipt of a transmission enable. This cycle is repeated as long as TE is kept low. As soon as TE returns to high, the encoder output completes its final cycle and then stops (EngineerGarage, 2012). The Figure 2.2 shows the example of Microcontroller HT12E and Table 2.1 shows the pin description for HT12E.

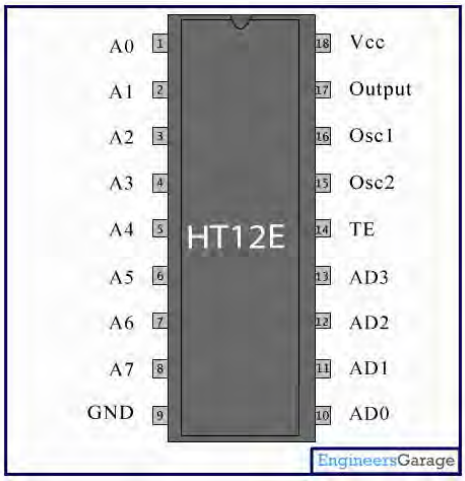

Figure 2.2: Microcontroller HT12E

Table 2.1: Pin description for HT12E

Pin No	Function	Name
1	8 bit Address pins for input	A0
2		A1
3		A2
4		A3
5		A4
6		A5
7		A6
8		A7
9	Ground (0V)	Ground
10	4 bit Data/Address pins for input	AD0
11		AD1
12		AD2
13		AD3
14	Transmission enable; active low	TE
15	Oscillator input	Osc2
16	Oscillator output	Osc1
17	Serial data output	Output
18	Supply voltage; 5V (2.4V-12V)	Vcc

HT12D is a decoder integrated circuit that belongs to 2^{12} series of decoders. This series of decoders are mainly used for remote control system applications, like burglar alarm, car door controller, security system etc. It is mainly provided to interface RF and infrared circuits. They are paired with 2^{12} series of encoders. The chosen pair of encoder/decoder should have same number of addresses and data format.

In simple terms, HT12D converts the serial input into parallel outputs. It decodes the serial addresses and data received by, say, an RF receiver, into parallel data and sends them to output data pins. The serial input data is compared with the local addresses three times continuously. The input data code is decoded when no error or unmatched codes are found. A valid transmission in indicated by a high signal at VT pin.

HT12D is capable of decoding 12 bits, of which 8 are address bits and 4 are data bits. The data on 4 bit latch type output pins remain unchanged until new

is received (EngineersGarage, 2012). The Figure 2.3 shows the example of Microcontroller HT12D and Table 2.2 shows the pin description of HT12D.

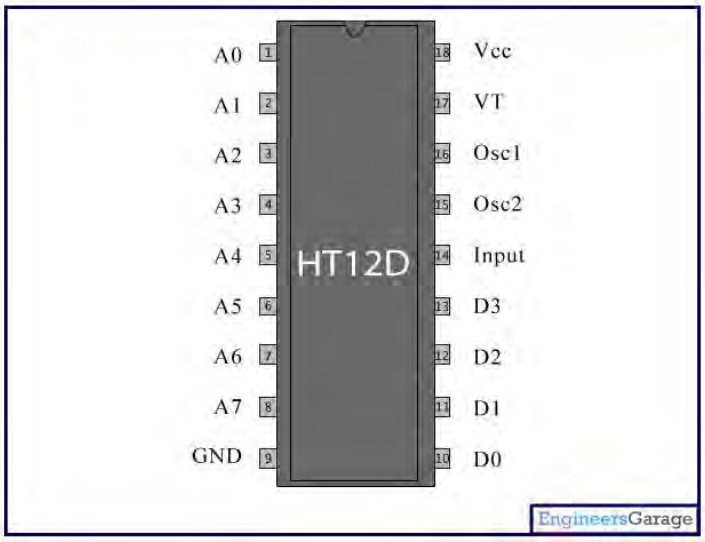

Figure 2.3: Microcontroller HT12D

Table 2.2: Pin description of HT12D

Pin No	Function	Name
1	8 bit Address pins for input	A0
2		A1
3		A2
4		A3
5		A4
6		A5
7		A6
8		A7
9	Ground (0V)	Ground
10	4 bit Data/Address pins for output	D0
11		D1
12		D2
13		D3
14	Serial data input	Input
15	Oscillator output	Osc2
16	Oscillator input	Osc1
17	Valid transmission; active high	VT
18	Supply voltage; 5V (2.4V-12V)	Vcc

2.2.3 L293D Motor Driver

L293D is a dual H-bridge motor driver integrated circuit (IC). Motor drivers act as current amplifiers since they take a low-current control signal and provide a higher-current signal. This higher current signal is used to drive the motors.

L293D contains two inbuilt H-bridge driver circuits. In its common mode of operation, two DC motors can be driven simultaneously, both in forward and reverse direction. The motor operations of two motors can be controlled by input logic at pins 2 & 7 and 10 & 15. Input logic 00 or 11 will stop the corresponding motor. Logic 01 and 10 will rotate it in clockwise and anticlockwise directions, respectively.

Enable pins 1 and 9 (corresponding to the two motors) must be high for motors to start operating. When an enable input is high, the associated driver gets enabled. As a result, the outputs become active and work in phase with their inputs. Similarly, when the enable input is low, that driver is disabled, and their outputs are off and in the high-impedance state. The Figure 2.4 shows the example of Microcontroller L293D and Table 2.3 shows the pin description of L293D.

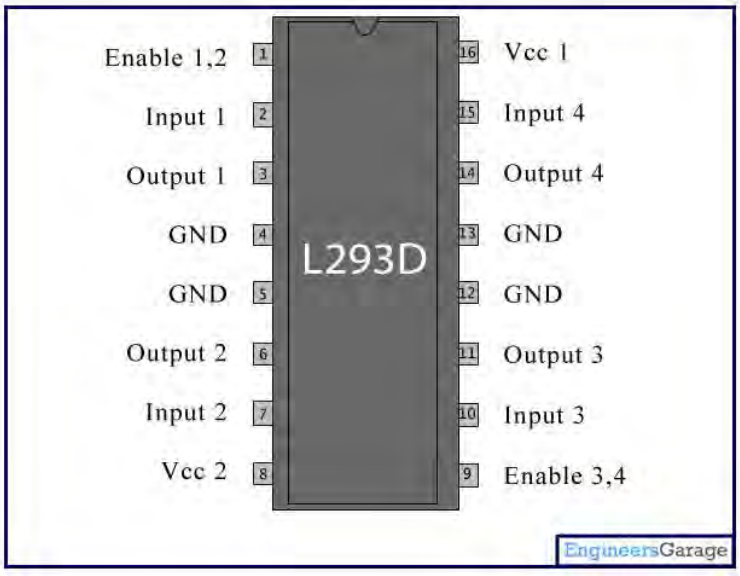

Figure 2.4: Microcontroller L293D

Table 2.3: Pin description of L293D

Pin No	Function	Name
1	Enable pin for Motor 1; active high	Enable 1,2
2	Input 1 for Motor 1	Input 1
3	Output 1 for Motor 1	Output 1
4	Ground (0V)	Ground
5	Ground (0V)	Ground
6	Output 2 for Motor 1	Output 2
7	Input 2 for Motor 1	Input 2
8	Supply voltage for Motors; 9-12V (up to 36V)	Vcc_2
9	Enable pin for Motor 2; active high	Enable 3,4
10	Input 1 for Motor 1	Input 3
11	Output 1 for Motor 1	Output 3
12	Ground (0V)	Ground
13	Ground (0V)	Ground
14	Output 2 for Motor 1	Output 4
15	Input2 for Motor 1	Input 4
16	Supply voltage; 5V (up to 36V)	Vcc_1

2.2.4 Resistor

In this project, the resistors that needed are 33 kΩ and 750 kΩ. Resistors are the most commonly used component in electronics and create specified values of current and voltage in a circuit. A resistor is a passive two-terminal electrical component that implements electrical resistance as a circuit element. There are ten internationally recognized standard colors used for identifying the value of a range of electronic components. Each is assigned a numerical value between 0 to 9 in the following order which is black, brown, red, orange, yellow, green, blue, purple, grey and white. On top of that, the function of resistor is to reduce the electric current. So that, resistor can prevents circuit from damaged if the flow through resistor is too high and causes the heat and temperature increase to critical value. The Figure 2.5 shows the color code of resistor.