# ROBOT CONTROLLED USING DTMF TECHNIQUE FOR CHEMICAL TRANSPORTATION PURPOSES

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To my beloved mother, brother, sisters and my friends that given me strength and spirit in completing this final year project‟s thesis.

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# ABSTRAK

Makmal bahan kimia sentiasa menghadapi isu tentang keselamatan menguruskan bahan kimia. Bahan kimia tersebut mempunyai ciri-ciri seperti menghakis, berbahaya, dan mudah terbakar dan mempunyai kesan yang merbahaya terutamanya terhadap manusia. Oleh itu, tujuan utama projek ini dibuat adalah untuk menggantikan tenaga kerja manusia yang membawa tabung uji daripada satu tempat ke tempat yang lain. Oleh itu, tahap keselamatan boleh ditingkatkan. Objektif projek ini adalah untuk megawal robot menggunakan telefon bimbit. Dalam melaksanakan projek ini, perisian dan perkakasan akan digunakan. Perisian yang digunakan ialah Proteus Professional 8 untuk mereka bentuk projek litar. Selain itu, PIC C Compiler akan digunakan untuk tujuan pengaturcaraan C. Komponen yang digunakan dalam projek ini ialah PIC Microcontoller iaitu PIC18F4550 sebagai komponen utama, dan IC MT8870 yang digunakan untuk mengaplikasikan teknik DTMF. Hasil kajian mendapati bahawa robot berjaya dikawal oleh telefon bimbit. Semasa panggilan dibuat, jika ada papan kekunci yang ditekan pada telefon yang membuat panggilan robot akan bergerak kiri, kanan, depan,belakang atau berhenti bergantung kepada butang yang ditekan dan bagaimana ia diprogramkan. Secara kesimpulannya, teknik DTMF dapat diaplikasi untuk pergerakkan robot ini supaya dapat membawa tabung uji tersebut dari satu tempat ke tempat yang lain di dalam makmal. Dengan ini, keselamatan akan dapat ditingkatkan dan mengurangkan risiko kemalangan yang melibatkan bahan kimia.

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## ABSTRACT

A chemical laboratory always has an issue regarding the safety of handling the chemical liquid. A chemical can be corrosive, harmful and flammable which is very dangerous, especially to the human. Therefore, the motivation of conducting this project is to replace the manpower that transfer a test tube contains liquid chemical from one station to another station for storage purposes. Hence, the safety measure at the working place can be increased. The main objective of this project is to construct a mobile robot that can be controlled by using a mobile phone. In completing this project both software and hardware are involved. The software that been used is Proteus Professional 8 for both circuit design and the circuit layout. Besides that, PIC C Compiler software is also used to create the C programming. The components involve in this project is PIC Microcontroller named PIC18F4550 as the main component and MT 8870 as the second main component so that DTMF technique can be applied. The result shows that the robot is successfully controlled by using a mobile phone. The user will call the embedded mobile phone that will attach to the robot. During the call, if any button is pressed at the transmitting mobile phone, the robot moves forward, backward, left, right or stop based on the programming. In conclusion, the movement of the robot can be controlled by applying DTMF technique to move a chemical filled test tube in a small laboratory. Hence, it will increase the safety measure in the laboratory and decrease the potential of occurring involved with chemical accidents.

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## LIST OF ABBREVIATIONS

| | | |
|---|---|---|
| 1. | DTMF | Dual Tone Multi-Frequency |
| 2. | DC | Direct Current |
| 3. | FFT | Fast Fourier Transform |
| 4. | GPRS | General Packet Radio Service |
| 5. | GSM | Global System for Mobile Communications |
| 6. | HID BOOTLOADER | Human Interface Device Bootloader |
| 7. | IC | Integrated Circuit |
| 8. | INH | Inhibit |
| 9. | IR SENSOR | InfraRed Sensor |
| 10. | ISDN | Integrated Services Digital Network |
| 11. | UMTS | Universal Mobile Telecommunications System |
| 12. | PCB | Printed Circuit Board |
| 13. | PIC | Peripheral Interface Controller |
| 14. | RC NETWORK | Resistor-Capacitor Circuit Network |
| 15. | RPM | Rotation Per Minute |
| 16. | SMS | Short Message Service |
| 17. | TOE | Three State Output Enable |
| 18. | USB | Universal Serial Bus |
| 19. | UV | Ultraviolet |

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| | | |
|---|---|---|
| 20. | www | world wide web |
| 21. | 2G, 3G, 4G | Second, Third, Fourth Generation |

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# CHAPTER 1

# INTRODUCTION

## 1.1 Project Introduction

DTMF (Dual Tone Multi Frequency) technique or also known as the tone dialing system has been widely used in a digital telephony method. DTMF signal is encoded as a pair of sinusoidal (sine wave) tones and mixed with each other. The examples of applications are PSTN (Public Switched Telephone Network) and Voice Response system for Telephone Banking. The system can also be applied in others different application such moving a mobile robot. It is known that mobile phone is an essential tool in everyday life and any application based on this device has wide acceptance [1]. Due to the wide coverage of mobile networks (GSM, GPRS, 3G, 4G, UMTS), to use them in

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the field of the remote or telematics control seems indispensable in engineering nowadays. The method is controlling other device by using the signals generated by the DTMF systems through a simple telephone call [1].

The remarkable development of robotics and communication field has led to combination of both technologies in producing sophisticated and yet helpful system and tools [2]. Therefore, application based on microcontroller has been implemented. The application is about the communication between the adapted mobile phone and the autonomous mobile robot. This microcontroller will cooperate with DTMF decoder receiver which recognizes the DTMF tones generated by the keyboard of a telephone in digital mode (being converted to 4-bit quantities). These binary data act as the inputs and the movement of the robot is the output.

The robot can be defined as Reprogrammable Multifunctional Automatic Manipulator. The robots undertake many tasks where accuracy is important such as robots in positioning a tube with hazardous substance to a certain place in a laboratory [3]. It can be said that the used of robot is purposely to minimize the factor of human error as the robot work more efficiently and effectively as they are programmed.

## 1.2 Objectives

The objectives of this project are as follows:

1. To construct a mobile robot using microcontroller PIC 18F4550.
2. To implement the DTMF technique using IC MT 8870 to the mobile robot.
3. To control the movement of the mobile robot using mobile phone in transporting chemical filled test tube.

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## 1.3 Problem Statements

There is always a safety issue concerning on human error in a small laboratory. Usually in a laboratory, the chemical that need to be stored at another station, needed to be carry by a person. This may be very dangerous as human error can sometimes lead to accidental drop of the test tube which leads to contamination to the environment. It is suspected that the used of mobile robot controlled by a mobile phone using DTMF technique increase the safety measure as its material is more durable to chemical hazardous compared to human.

## 1.4 Scope

The mobile robot is only limited to carry one test tube contains only liquid chemical at once. The test tube is limited to about 13 × 100 mm size. The size of the robot itself is about width 150 mm, length 200 mm and 120 mm height. Besides that, the robot only carries the test tube contains chemical (with a weight less than 200 grams) about distance of 1 meter. The function of the mobile robot is only to transport the chemical in a test tube which is not included how the test tube is carried out of the robot compartment. The mobile phone that used to control this robot must have network coverage and does not have to be a smartphone. The supply of the robot is from battery supply which is a DC power supply. Besides that, this project is only handled liquid form of non-flammable chemical. The characteristic of chemical liquid that will be handled by this mobile robot is that toxic, acidic, oxidize, and corrosive.

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## 1.5 Methodology Summary

The methodology of this research is briefly about how the project being conducted at the first step until the project is finished. The project is involving hardware and software. The hardware of this project is that the mobile robot itself and can be controlled using a mobile phone. The software of this project is a coding developed by using C programming. Further details will be discussed in Chapter 3 of this thesis.

## 1.6 Report Structure

Chapter 1 : Cover the overview of the project. It will include the introduction of the project, the project objective, problem statements of the project, scope of the project, methodology review and the report structure.

Chapter 2 : This part is the medium to get information in order to develop the project. In this chapter, the background of the project and the theory of each component are explained. The information is from the reference book, websites, articles and some related interview with the lecturer, including the differentiation of project of previous researchers. It is mostly about the Global System for Mobile Communication (GSM), Dual Tone Multi Frequency (DTMF) technique, PIC Microcontroller and finally about the DC Motors

Chapter 3 : It will cover all the methodology and the project implementation process. This chapter also explains the procedures that have been taken during the project implementation. The methodology of the work consists of the explanation on the project.

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Chapter 4 : This is the important chapter in this project report. This chapter contains the implementation of the whole project and its result. It also contains discussions on the result obtained.

Chapter 5 : This chapter is the final chapter of the report. In this chapter, it will include the conclusion and future recommendation for this project.

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