UNIVERSITI TEKNIKAL MALAYSIA MELAKA

ALARM PILLOW SYSTEM USING BLUETOOTH SYSTEM AND ANDROID APPLICATION

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

by:

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DECLARATION

I hereby, declare that this thesis entitled "Alarm Pillow System Using Bluetooth System and Android Application" is the result of my own research except as cited in references.

Signature　：………………………………..……

Name　：………………………………..……

Date　：………………………………..……

APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as one of the requirements for the award of Bachelor's Degree of Electronic Engineering Technology (Telecommunications) with Honours. The following are the members of supervisory committee:

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Mr Abdul Halim Bin Dahalan

(Supervisor)

ABSTRAK

Pada masa kini, biasanya dalam hampir setiap isi rumah mempunyai beberapa peranti jam penggera. Ramai orang memilih rutin bangun pagi mereka dengan peranti semua-dalam-satu kerana kebebasan yang ditawarkan oleh teknologi pintar hari ini. Oleh kerana saiz yang kecil, mereka memilih untuk meletakkan telefon pintar di atas katil atau di bawah bantal. Namun, ini boleh meningkatkan risiko kerosakan telefon. Oleh itu, projek ini dipilih membantu masyarakat untuk mengatasi masalah bangun lambat mereka dengan hanya satu sentuhan menggunakan telefon pintar. Objektif utama projek ini adalah untuk membantu orang yang mempunyai masalah untuk bangun pada masa yang ditetapkan. Masalah ini berlaku kepada semua terutamanya kepada pelajar dan pekerja. Penggera bantal adalah ciptaan yang kami fikir boleh menyelesaikan masalah ini. Projek ini akan merangkumi penggera itu sendiri yang dihubungkan dengan penggetar di dalam bantal melalui sambungan Bluetooth. Sistem Bluetooth ini akan dikawal oleh aplikasi Android. Apabila masa yang ditetapkan di dalam aplikasi Android itu berbunyi, ia akan mencetuskan modul Bluetooth di bantal itu seterusnya menjanakan penggetar di dalam bantal. Getaran di dalam bantal itu akan menyebabkan perasaan tidak selesa kepada pengguna untuk terus tidur dan membuat mereka untuk bangun.

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ABSTRACT

Nowadays, commonly in almost every household is some alarm clock device. Many people choose to relegate their morning wake routine to all-in-one devices due to the freedom offered by today's smartphones. Due to their convenient size, they choose to place the smartphone on the bed or underneath the pillow. However, doing so may heighten the risk of damage of the phone. Therefore, this project is selected to help the societies to overcome their oversleep problem with just a touch in smartphone. The main idea of this project is to help people who have problem to wake up at the set timer. This problem occurs to all kinds of people especially students and workers. The alarm pillow is an invention that we think can solve the problem. This project will include the alarm itself, which connected to the vibrator in the pillow via Bluetooth. The Bluetooth system was controlled by the Android application. When the time set in the Android application goes off, it will trigger the Bluetooth module in the pillow thus powering the vibrator. The vibration in the pillow will give an uncomfortable feeling to the user to continue to sleep and makes them to wake up.

DEDICATION

To my beloved parents,

Nik Yusoff Bin Nik Ismail and Nik Rahimah Binti Nik Omar

For raising me become who I am today.

To my supervisor,

Mr Abdul Halim Bin Dahalan

ACKNOWLEDGEMENT

Alhamdulillah and gratitude to the Allah S.W.T. for giving me the strength and patience to complete this project.

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My sincere appreciation also goes to my family who has been so tolerant and supports me all these years. Thanks for their encouragement, love and emotional supports that they had given to me.

I would also like to thank all my friends who have directly or indirectly give me a favour at various occasions to complete my project and their support is such an encouragement for me throughout the project. Also not to forget all lecturers and FTK staff that provides help and support throughout this project development. Their views and tips are useful indeed. Unfortunately, it is not possible to list all of them in this limited space.

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LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

LED   --   Light Emitting Diode

PDA   --   Personal Digital Assistant

OS   --   Operating System

ISM   --   Industrial Science Medical

FHSS   --   Frequency Hopping Spread Spectrum

TCS   --   Telephony Control System

SDP   --   Service Discovery Protocol

RFCOMM   --   Radio Frequency Communication

L2CAP   --   Logical Link Control and Adaption Protocol

HCI   --   Host Controller Interface

Wi-Fi   --   Wireless Fidelity

DVM   --   Dalvik Virtual Machine

GSM   --   Global System for Mobile Communications

GPS   --   Global Positioning System

SDK   --   Software Development Kit

QEMU   --   Quick Emulator

HAL   --   Hardware Abstraction Layer

UI   --   User Interface

USB   --   Universal Serial Bus

PIR   --   Passive Infra-Red

CHAPTER 1

INTRODUCTION

1.0 Introduction

This chapter describes the introduction of research study such as background of the project, problem statement, project objective and scope of the research.

1.1 Project Background

Commonplace in almost every household is some form of an alarm clock device. Traditionally, alarm clocks were simple mechanical devices, but with the rapid pace of technological advances, we now have cellular telephones and smartphones with built-in alarm capabilities. These developments are beneficial to the general public in their everyday life. These developments can be divided into many aspects and one of the most important aspects is communication.

The main idea of this project is to help people who have problem to wake up at the set time. This problem occurs in all kinds of people in Malaysia who are students and workers. The alarm pillow is an invention that we think can solve the problem.

This project will include the alarm itself, which connected to the vibration motors in the pillow via Bluetooth. The Bluetooth system was controlled by the Android application. When the timer set in the Android application goes off, it will trigger the Bluetooth module in the pillow thus powering the vibrator. The vibration in the

pillow will gives an uncomfortable feeling to the user to continue to sleep and makes them to wake up.

Bluetooth is a global wireless communication standard that connects devices together over a certain distance. A Bluetooth device uses radio waves instead of wires or cables to connect to a phone or computer. A Bluetooth product, like a headset or watch, contains a tiny computer chip with a Bluetooth radio and software that makes it easy to connect. When two Bluetooth devices want to talk to each other, they need to pair.

Google‟s Android Operating System in Mobile phones are still relatively new, however, Android Operating System has been progressing quite rapidly. There is a lot of advantages of using Android application to connect the Bluetooth connection between the alarm including the multitasking system which you can browse, Facebook while turning on the Bluetooth and the diverse phone options. Talking Android phone, it will feel „different‟ than the iOS; if the iOS is limited to the iPhone from Apple, then Android is available on mobile phones from various manufacturers, from Sony Ericsson, Motorola, HTC to Samsung.

1.2 Problem Statement

This section explains on the problem statement relating with this project. Due to the configurability and freedom offered by today's cellular telephones and smartphones, many choose to relegate their morning wake routine to these all-in-one devices. Typically, these devices provide the user several different waking experiences including music, vibration and tones configurable over a range of volumes and intensities. Thus, based on a user's varying waking requirements, the cellular telephone or smartphone has become the alarm clock of choice.

In this regard, due to their convenient size, many choose to place the cellular telephone or smartphone on the bed or underneath the pillow. Unfortunately, doing so may alter the comfort of the bed or pillow and heightens the risk of damage to the phone.

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Thus the problem leads to the idea of this project is that the vibrating alarm is installed into the pillow without the phone clock. This may reduce the risk of damage of the phone itself. The vibrating alarm circuit is also including the Bluetooth module device to ensure the connection between the alarm and the phone clock. The alarm circuit inside the pillow is relatively small therefore it would not alter the comfort of the pillow.

1.3 Objective

The objectives of this project are:

1. To develop an effective alarm system to overcome oversleeping problem.
2. To study the Bluetooth system and Android application and how it affects human daily life.
3. To analyse the performance of the alarm system.

1.4 Scope

This section explains about the scope of work for this project. In order to achieve the project's objective, the Bluetooth connection between the vibrating alarm and phone clock must be live first. When two Bluetooth devices want to talk to each other, they need to pair. Bluetooth device uses radio waves instead of wires or cables to connect to a phone or computer. A Bluetooth product contains a tiny computer chip with a Bluetooth radio and software that makes it easy to connect. The Android application on the phone alarm must be build earlier with consist of Bluetooth button and clock LED display. Android application can be built by using Android Studio software.

1.5 Importance of the Project

This section explains on the importance of the project. There are no right or wrong in using the old alarm clock system. However, improving the technology might produce excellent and more productive waking system for the students and workers. This project can change the whole situation in clocking aspects. It makes it easier for the user to set the alarm which is through the phone and less annoying to wake up compare to the old ringing clock.

1.6 Report Organization

a) Chapter 1: Introduction

This chapter contains project background, problem statement, and objectives of project, project''s scope and the importance of this project.

b) Chapter 2: Literature Review

This chapter covered the literature review and citation about any information that related to this project from any references. In this chapter, the citation about analysis of equipment also is included.

c) Chapter 3: Methodology

This chapter covered more detailed explanation of this project. In addition, this chapter gives information of process flow in this project. Flow chart and table of data is included in this chapter.

d) Chapter 4: Result Expectation

This chapter discuss about the result about the project.

e) Chapter 5: Conclusion

This chapter covered the conclusion based on overall process that happened in this project from start until end of this project.

CHAPTER 2

LITERATURE REVIEW

2.0   Chapter Overview

This chapter discusses projects and paper works related to this project. These related works have been reviewed carefully in order to improve the quality and reliability of this project. By analysing the projects did by other researchers, there is a possibility to know what features are lacking in their projects. They also will recommend some future works that could be done to improve the same project. Moreover, there are some useful ideas that can be implemented in this project from other similar projects. Therefore, literature review process extended right from the start until the end of the project.

In this literature review there were source of information for this alarm clock system with Bluetooth technology and Android application. Furthermore they contain information on the in depth understanding of the Bluetooth technology and also explained how each of various peripherals communicates through Bluetooth communication with various levels of protocols. Whereas Google's Android Operating System in Mobile phones are still relatively new, however, Android Operating System has been progressing quite rapidly. There is a lot of advantages of using Android application to connect the Bluetooth between the vibrating alarm and the phone clock.

2.1   What Is Alarm Clock?

A wake up timer is a clock that is intended to make a sound, or some other sign, at a particular time. The primary utility of these clocks is to awaken people

from their night's sleep or short naps; they are sometimes used for other reminders as well. Most utilize sound; some utilization light or vibration. Some have sensors to recognize when a man is in a light phase of rest, keeping in mind the end goal to abstain from waking somebody who is profoundly snoozing, which causes tiredness, regardless of the possibility that the individual has had sufficient rest. To stop the sound or light, a catch or handle on the clock is pressed; most tickers consequently stop the caution if left unattended sufficiently long. An exemplary simple wake up timer has an additional hand or inset dial that is utilized to indicate the time at which to initiate the alert (Norway, 2001). Wake up timers are likewise found on cell telephones and watches. There is a lot of alarm clock available nowadays such as:

1. Traditional mechanical alarm clock.

   It have one or two bells that ring by means of a mainspring that powers a gear to propel a hammer back and forth between the two bells or between the interior sides of a single bell.

2. Digital alarm clocks.

   This type of alarm can make other noises. Simple battery-powered alarm clocks make a loud buzzing or beeping sound to wake a sleeper, while novelty alarm clocks can speak, laugh, sing, or play sounds from nature.

### 2.1.1 Basic Circuit Operation of Alarm Clock
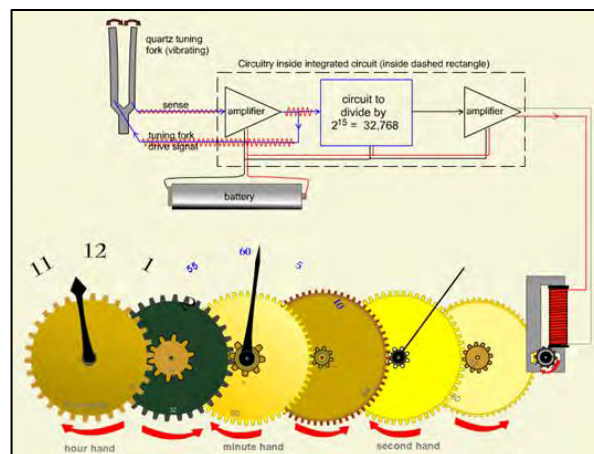
Figure 2.1.1.1: Circuit Operation of Alarm Clock (Norway, 2001).

The quartz tuning fork, the resonator driver circuit which amplifies electrical signals from the tuning fork and also keeps the tuning fork oscillating. The piezo-electric property of quartz provides a coupling between

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its mechanical motion and electric charge on electrodes printed on the tuning fork's surface. This property means that oscillations of the tuning fork will create small electrical signals in the "sense" electrode on the tuning fork. It also means that more powerful drive oscillating signals apply to the "drive" electrode can sustain the oscillations. (Friedt, 2007)

This circuit serves a similar function as a gear train, precisely reducing the frequency of the resonator to a usable frequency. In a digital watch, additional circuits of this type would reduce the frequency further and also drive the digital displays. In the clock as shown, the gear train reduces the frequency further and drives the analog clock hands. (Friedt, 2007)

The motor-drive amplifier that amplifies these pulses so that they are sufficiently strong to drive a small electric motor.
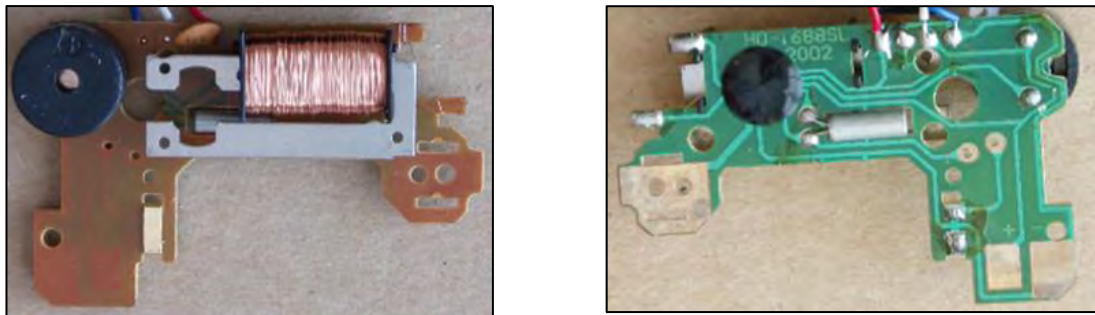
Figure 2.1.1.2: Small circuit board from a modern quartz clock (Friedt, 2007).

In the left photo, show a black alarm buzzer, the shiny magnetic flux guide, and the solenoid (with its many turns of copper wire). The right photo shows the back side of the same circuit board. There show the black circular integrated circuit and the tuning fork canister, along with "printed on" copper traces (pathways) to take electrical power and signals from one location to the next such as the alarm or motor. (Gmbh, 2005)
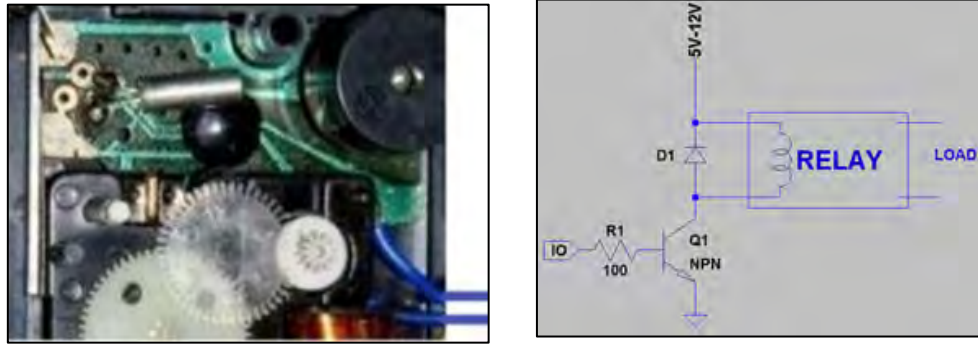
Figure 2.1.1.3: Contacts of the relay used to switch on the vibrator (Gmbh, 2005).

A relay is a switch that is turned on and off by an electromagnet. When a small current flows through the coil it produces a magnetic field, which magnetises an iron core. This attracts the armature, which forces the switch contacts to touch. When the current is turned off, the switch contacts open again. A relay is a very useful type of switch because it can be turned on and off in all sorts of ways. (Fong, 2010)

A relay is an electromagnetic switch. It can be connected in two ways: Normally Open (N/O) or Normally Closed (N/C).

2.2   What Is Bluetooth?

Bluetooth is a low cost, low power, short-range radio technologies intended to replace the cable connections between hand phones, PDAs and other portable devices. It can clean up your desk considerably, making wires between your workstation, mouse, laptop computer and many other devices. This technology allows to the users instantaneous connections of voice and information between several devices in real time. (Yasri, 1999)


Figure 2.2.1: Bluetooth Official Icon.

One of the biggest attractions of the implementation of this technology is the creation of networks, with the Bluetooth technology is possible to form different networks in the same geographical point, with relatively high speed of transmission. Anyway the

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Bluetooth technology has a limited scope, this characteristic of limited scope presents a great disadvantage if we try to implement a net in one extensive geographical area (Djonin, 2001).

2.2.1 How It Works?
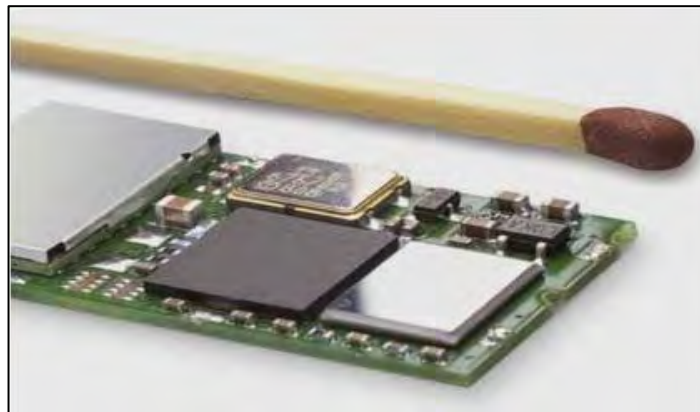
**Figure 2.2.1.1:** Bluetooth module circuit

Based on **Figure 2.2.1.1,** every Bluetooth device will have to be equipped with a microchip (transceiver) that transmits and receives in the frequency of 2.4 GHz Industrial, Science, Medical (ISM) band that is available in the whole world with some variations of bandwidth in different countries as shown in **Table 2.2.1.1** (Puy, 2008).

Table 2.2.1.1: The frequency range and channels of different countries. (Puy, 2008)

Country	Frequency Range	RF Channels	
Europe* & USA	2400 - 2483.5 MHz	f = 2402 + k MHz	k = 0,...,78
Japan	2471 - 2497 MHz	f = 2473 + k MHz	k = 0,...,22
Spain	2445 - 2475 MHz	f = 2449 + k MHz	k = 0,...,22
France	2446.5 - 2483.5 MHz	f = 2454 + k MHz	k = 0,...,22

The ISM band ranges between 2.400 GHz and 2.483 GHz. Bluetooth devices use seventy-nine 1-megahertz frequencies (from 2.402 to 2.480 GHz) in the ISM band as shown in **Figure 2.2.1.2**. These devices use a technique called frequency hopping to minimize eavesdropping and interference from other networks that use the ISM band. With frequency hopping, the data is

divided into small pieces called packets. The transmitter and receiver exchange a data packet at one frequency, and then they hopped to another frequency to exchange another packet. They repeat this process until all the data is transmitted (Ramachandran, 2004).
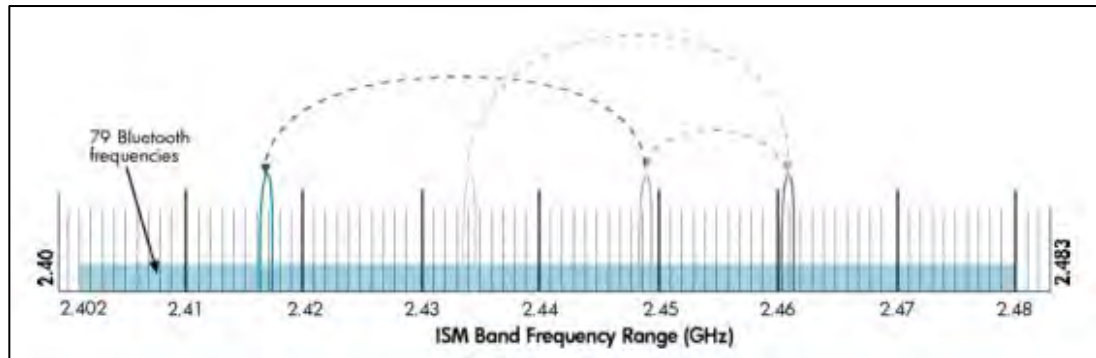
Figure 2.2.1.2: Bluetooth devices hop between frequencies up to 1600 times per second (Ramachandran, 2004).

The Bluetooth radio utilizes a signalling technique called Frequency Hopping Spread Spectrum (FHSS). The radio band is divided into 79 sub-channels. The Bluetooth radio uses one of these frequency channels at a given time. The radio jumps from channel to channel spending 625 microseconds on each channel. There are 1600 frequency hops per second. Frequency hopping is used to reduce interference caused by nearby Bluetooth devices and other devices that using the same frequency band (Yasri, 1999).

The equipment of transmission are qualified in three classes according to the level of power of emission, as we can see in the **Table 2.2.1.2** below. The recipient equipment must possess a sensibility of at least 70 dBm, and the rate of admissible mistake must be a minor or equal to 0.1 %.

Table 2.2.1.2: The classes of Bluetooth according to maximum range (Puy, 2008).

Device Power Class	Maximum Permitted Power	Range (approximate)
Class 1	100 mW (20 dBm)	~100 meter
Class 2	2.5 mW (4 dBm)	~10 meter
Class 3	1 mW (0 dBm)	~1 meter