



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**WIRELESS DOOR KEY SYSTEM USING BLUETOOTH AND
ARDUINO (WeDoKey)**

This report is submitted in accordance with the requirement of Universiti Teknikal
Malaysia Melaka (UTeM) for the Bachelor of Computer Engineering Technology
(Computer Systems) 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 Computer Engineering Technology (Computer Systems) with Honours. The member of the supervisory is as follow:

.....

(Project Supervisor)

ABSTRACT

The major goal of this project was to design and develop an alternative key called Wireless Door Key System using Bluetooth and Arduino (WeDoKey) based Android Smartphone. Due to the fastest development of sophisticated technologies it is gradually changing people's life. There were several factors that led to the project. First Smartphone, Wireless Door Key (WeDoKey) and Bluetooth technology were reviewed. Second, the hardware design and software development were implemented. Furthermore, the design of a Bluetooth will implement on the android for lock/unlock the door are set out. It was also based on Arduino platform both of which are free open source software. The hardware design for door-lock system was the combination of android smart phone as the task master, Bluetooth module as command agent, Arduino microcontroller as controller centre / data processing centre, and motor servo as door lock output. This WeDoKey are needed by people because it is useful for emergency case such as when the whole family is not in the house, and don't have the key to open the door during people absence at home. In another case, they can loss of key or drop out the key. It is shown that Wireless Door Key System using Bluetooth and Arduino (WeDoKey) is very useful for each home with invented low-priced, and scalable and user friendly. Using Android Smartphone Wireless Door Key System using Bluetooth and Arduino (WeDoKey) can be implemented as an alternative key.

ABSTRAK

Matlamat utama projek ini adalah untuk merekabentuk dan membangunkan kunci yang dipanggil Sistem Kunci Pintu tanpa Wayar menggunakan Bluetooth dan Arduino (WeDoKey) berasaskan talifon pintar Android. Dengan perkembangan teknologi yang pesat dan canggih, telah beransur-ansur mengubah hidup manusia. Terdapat beberapa faktor yang membawa kepada projek ini. Pertama, bagi menggunakan talifon pintar, Sistem Kunci Pintu Tanpa Wayar (WeDoKey) menggunakan teknologi Bluetooth dan Arduino telah dikaji semula. Kedua, reka bentuk perkakasan dan pembangunan perisian telah dilaksanakan. Tambahan pula, reka bentuk Bluetooth akan dilaksanakan pada android untuk mengunci / membuka kunci pintu. Ia juga berdasarkan platform Arduino kedua-duanya merupakan perisian sumber terbuka percuma. Reka bentuk perkakasan untuk sistem kunci pintu adalah gabungan telefon pintar Android sebagai tugas utama, modul Bluetooth sebagai ejen arahan, Arduino mikropengawal pusat pemprosesan data pusat pengawal, dan servo motor sebagai keluaran membuka pintu. WeDoKey ini diperlukan oleh semua lapisan masyarakat kerana ia adalah berguna untuk kes kecemasan seperti apabila seluruh ahli keluarga tidak berada di rumah, dan tidak mempunyai kunci untuk membuka pintu semasa tiada sesiapa di rumah yang boleh membuka pintu. Dalam kes lain, mereka boleh kehilangan kunci atau tercicir kunci. Dari sini; ia menunjukkan bahawa Sistem Kunci Pintu tanpa Wayar menggunakan Bluetooth dan Arduino (WeDoKey) adalah sangat berguna untuk setiap rumah dengan penggunaannya yang mesra pengguna, murah, dan boleh skala. Dengan menggunakan Sistem Kunci Pintu tanpa Wayar menggunakan Bluetooth dan Arduino (WeDoKey) boleh dilaksanakan sebagai kunci pilihan yang lain selain kunci besi.

DEDICATIONS

I want to dedicate this to my beloved parents who have supported me through the entire journey and have been a great source of motivation and inspiration.

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LIST OF SYMBOLS AND ABBREVIATIONS

SBM	=	Shape Based Matching
AC	-	Alternate Current
ADT	-	Abstract Data Type
AVR	-	Automatic Voltage Regulation
DC	-	Direct Current
DVD	-	Digital Versatile Disc or Digital Video Disc
GND	-	Ground
GCM	-	Google Cloud Messaging
GPS	-	Global Positioning System
GUI	-	Graphical User Interface
ICSP	-	In Circuit Serial Programming
ID	-	Identification
IDE	-	Integrated Development Environment
IEEE	-	Institute of Electrical and Electronic Engineers
IntelliJ IDEA	-	Java integrated development environment (IDE)
IOT	-	Internet of Things
I/O	-	Input / OUTPUT
MIT	-	Massachusetts Institute Technology
OS	-	Operating System
PAN	-	Personal Area Networks
PC	-	Personal Computer
PWM	-	Pulse Width Modulation
RF	-	Radio Frequency
RX	-	Receiver
SDK	-	System Development Kit
SD Card	-	Secure Digital Card
TV	-	Television
TX	-	Transmitter

USB	-	Universal Serial Bus
VCC	-	Voltage at the common collector
WIFI	-	Wireless Fidelity
3G	-	Third Generation
4G	-	Fourth Generation

CHAPTER 1

INTRODUCTION

1.0 Background

The reinforced processors, with the fast and larger storage capabilities, and richer entertainment functions had make the smartphone become more useful to everyone nowadays. Android has a complete software package that consists of an operating system, middleware and application layers of the core. Bluetooth used primarily for data exchanged, increase new features for smartphones. It has changed the way people use digital devices in the home or office, and has moved the traditional wired devices for several years. Bluetooth host device can communicate with up to seven Bluetooth modules at the same time through a link. Given the normal working area within eight meters, it is immensely useful in the home environment.

The use of Bluetooth technology in a smart phone today is not just for the transfer of data and files only. But it operates over unlicensed, available at a 2.4GHz frequency, it also may to connect digital devices in the range of 10m to 100m at speeds up to 3Mbps, depends on the Bluetooth classes of range. Bluetooth is operating over unlicensed; available at 2.4GHz frequency. With this Bluetooth qualification; the Wireless Door Key using Bluetooth based on Bluetooth technology is offered.

1.1 Problem Statement

The main problem to develop the proposed project of Wireless Door Key System using Bluetooth and Arduino (WeDoKey) is due to human error such as fail to remember to bring or take something important. Forget to bring and missing or lost their key are common problem among us due to rushing situation to do something into our daily life because key is in a small size. So, they cannot open the door because the door is locked. To get their key, they need to ask their family to bring the key to open the door. Otherwise, this can cause waste time because need to wait for their family to bring the key about a few hour. In case if their family went to any vacation, so they cannot to open the door. This kind of problem can be solved by developing a system which the better system used Bluetooth technology to control the door use smartphone. As the smartphone is a very important to our life, most of us are using smartphones every day or every minute, to surf the internet, manage calendar and even once, use smartphone for original purpose that is to make phone calls. Currently, these activities can be done through a device. Therefore, smart phones have changed the way we live quite drastically.

In other cases, at this time, the key is usually associated with one or more doors. Most individual users had to carry and manage a large number of mechanical keys. Lost keys may happen and such a wasting of time to search for the right key to open the door.

1.2 Objective

The motivation uses to implement a remote control to change the using of the alternative key:

- (a) To design and implement the application that enable to unlock their house door with smartphone instead of traditional key.
- (b) To identify an authorized person to login the apps.
- (c) To invent low cost, scalable new devices can be simply integrated into the system, and user friendly.

1.3 Project Scope

In order to achieve the objectives of this project, several scopes had been outlined. The hardware consists of hardware and software.

The hardware consists of:

- (a) Arduino Uno
- (b) Bluetooth module
- (c) Servo motor
- (d) Cylinder deadbolt lock
- (e) Mobile Phone with integrated Bluetooth

The software consists of:

- (a) Arduino IDE
- (b) MIT App Inventor

This project needs an Android smartphone and Arduino Uno to complete this system communication. The smartphone will communicate the Arduino board to open the door using Bluetooth. This system is only can be applied on the single door only for security mechanism. Arduino Uno will read the ID and password of each user for security.

1.4 Thesis Outline

This chapter is separated into five chapters described below:

- (a) Introduction

This chapter presents about the problem statement and objectives of the study together with as overview of the thesis.

- (b) Chapter 2: Literature Review

The relevant theories and concepts related to the project development will be reviewed in this chapter.

(c) Chapter 3: Methodology

This chapter is dedicated to the explanation on how the experiment was performed, how the Bluetooth door key will be designed and constructed and how it will be tested in the experiment. Details on the components and equipment needed for the experiment will be presented.

(d) Chapter 4: Result and Analysis

This chapter will present the results from the experiment conducted and its analysis.

(e) Chapter 5: Conclusion and Recommendations

This last chapter will conclude all the analysis and make recommendations for future work.

1.5 Project Limitation

This project had a limitation that can not to reach the limitation. This is due to some factors which are:

- (a) The system only can operate on an Android mobile operating system, because this system is implement for Android application only and not for another OS.
- (b) If appliances are disconnected from the main supply, they can no longer be controlled by the user and that part of the system would be rendered non-functional. Battery backup for controlling unit can be implemented in case of power disruption.

1.6 Scope of Research

The scope of this research is limited to the following items so that the research could be focused to achieve the stated objectives.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

This chapter will summarize the literature review on the Wireless Door Key System using Bluetooth and Arduino (WeDoKey). The literature reviews generally about the research information based on history of smart home technology and door key automation from other country.

2.1 Smart Home Technology

Smart home technologies have been widely used in homes with various apparatus converse over a local network. According to the Smart Homes Association the best definition of smart home technology is: “the combination of technology and services through home networking for a better value of living” (John, 2010). This technology can be used to monitor, alert and execute, according to the desired functions. Smart homes technology makes automatic connection with environment via Internet, telephone or regular fixed phones. This smart home technologies will aware us to what's going on to our homes, is the electrical items is in good conditions and security system can be built to offer some help in emergency situations whether during work or on holiday.

2.1.1 Smart Home System Using X10

The smart home are those connected to a PC and leaves the PC to implement the home control duties on a stand-alone basis. It will allows the PC to communicate with another devices through the home controller, thus enabling single button and

voice control simultaneously in reprogrammed scenarios or operating modes. X10 is used in this system to remotely controlling any devices plugged into any electrical power link. Short radio frequency (RF) burst is involved to represent digital information to enable communication between transmitter and receiver. All the appliances and devices are receivers and remote control or keypads or the means of devices of controlling the system are transmitter. Limitations of X10 is communicating over electrical lines is not always reliable because the lines get noisy from powering other devices. X10 device might not able to interpret or receive the command electronic interference as a command and react at all (John, 2010).

2.1.2 Smart Home System Using Zigbee

This project proposed the system used Zigbee. Zigbee module is act as a central main controller of the overall home embedded in digital door lock. Zigbee is developing for wireless sensor networks based on IEEE 802.15.4 specification, has become the most attraction technique in research and commercial domain because of open standard, low cost and low power characteristic (Devi, 2012). Smart digital door lock exploits the full capacity of ZigBee sensor network by integrating home security with home automation. Although the Zigbee based home automation system is in the early development phase and it only works on the limited distance, most of the project using Zigbee only focuses primarily on home automation within in the house only.

The other method is sensor nodes the network of sensor nodes with digital door lock as base station. Sensor nodes are deployed at appropriate places at home. Sensor node will monitor the environmental condition around the home. Another task for sensor node is switch power status of home devices. To monitor the environmental condition, the sensor nodes are attached with Zigbee module. The sensor nodes also upload their current status and relevant data to the digital door. Also sensor nodes send response messages including operation results, as there are commands from digital door lock. Figure 2.1 shows how the Zigbee module connected to home appliance.

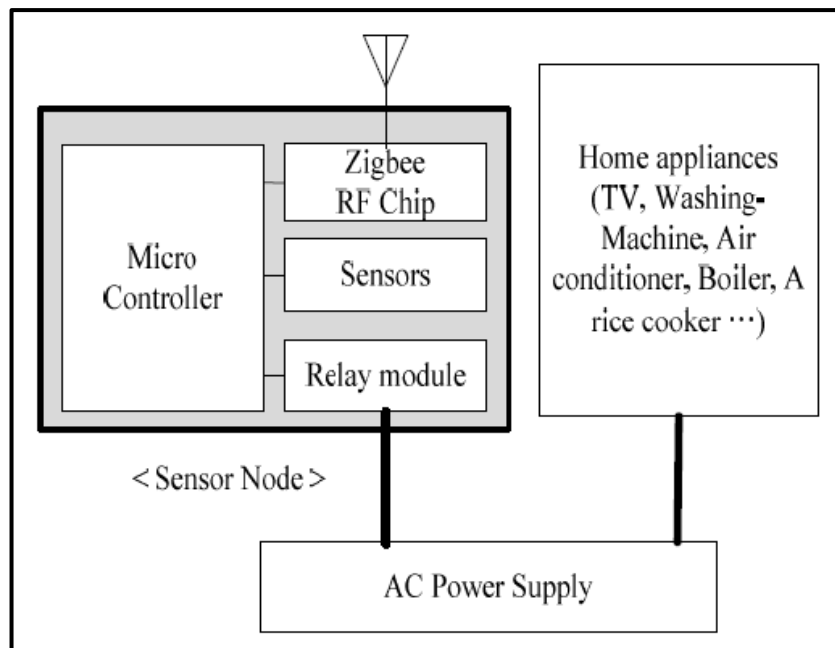


Figure 2.1: ZigBee module connected to home appliances.

2.1.3 Smart Home System Using Bluetooth

One of the methods is using Bluetooth. This smart living proposed home lighting control system, where a small “piconet” is established using a microchip and several Bluetooth modules. Bluetooth communication is much better than Zigbee in term of the communication distance with the range of 10 m (Sriskanthan, et al., 2002). Bluetooth can be used in term of the communication distance with the range of 8m to 10m between the smartphone to the equipment’s controlling depends on types of Bluetooth modules. Bluetooth also capable to communicate with up to seven Bluetooth modules at the same time through one link in a host is proving that Bluetooth technology is much better. In other word, each home device is physically connected to a local Bluetooth sub-controller. Bluetooth has a medium bandwidth, and it is used on the IEEE 802.15.1. Bluetooth technology has the disadvantage of incurring an access delay due to the sharing of a single Bluetooth module between numerous devices.