UNIVERSITI TEKNIKAL MALAYSIA MELAKA

"SMART BRACELET FOR CHILD TRACKING PURPOSE"

This report is submitted in accordance with the requirement of the Universiti

Teknikal Malaysia Melaka (UTeM) for the

Bachelor of Electrical Engineering Technology

(Electrical Engineering Technology (Industrial Automation & Robotic))

with Honours.

By

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SMART BRACELET FOR CHILD TRACKING PURPOSE

MUHAMMAD TAQWA BIN MOHD AZMY

A thesis submitted in fulfilment of the requirements for the degree of Bachelor of Electrical Engineering Technology (Industrial Automation & Robotic) With Honours

Faculty of Electrical and Electronic Engineering Technology

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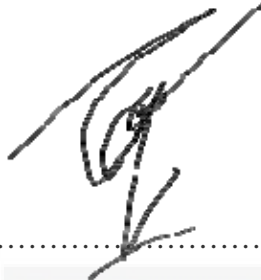Elektrik dan Elektronik,
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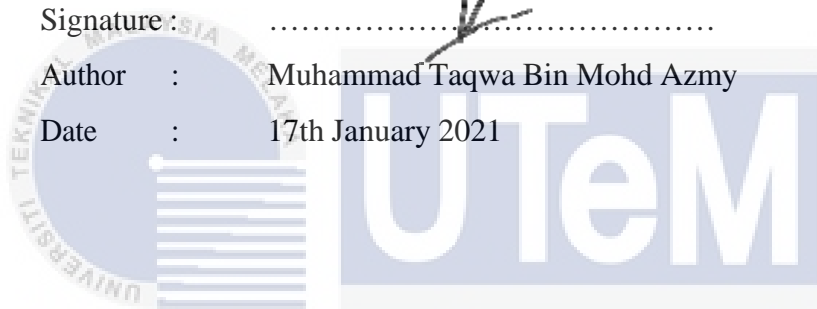
DECLARATION

I hereby, declared this thesis entitled "Smart Bracelet for Child Tracking Purpose" is the results of my own research except as cited in references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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Date : 17th January 2021

APPROVAL

This report is submitted to the Faculty of Electrical and Electronic Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Electrical Engineering Technology (Electrical Engineering Technology (Industrial Automation & Robotic)) with Honours. The member of the supervisory is as follow:

Signature   : ....

Supervisor   : Ts. Dr. Aliza Binti Che Amran

Date   : **18/1/2021**

DEDICATION

I acknowledge my sincere dedication, honors, and gratitude to both of my parents for their love, encouragement, supports, and sacrifices throughout whole of my life. Without their sacrifices and encouragement, I cannot possibly reach this stage. Special gratitude also dedicated to all my brothers and sisters who are always provide support and advise me in whatever I do in my life. Special thanks were given to all of lecturers who has taught and guided me throughout my studies. Not be forgotten, all of my friends who always been with me throughout this joyful journey. There are no words can express my sincere appreciation to all of you.

ABSTRACT

The title of this project is "Smart Bracelet for Child Tracking Purpose". Its main objective is to develop a smart bracelet to be worn by a child for tracking purposes by their guardian. For example, it is important for a guardian to monitor his or her child whenever they go for an outing. It can be while going to a supermarket, shopping malls or to an open area, such as playground and public park. The bracelet will use NodeMCU ESP32 as its microcontroller. To ensure the security of the child,real time relative distance monitoring between the child and guardian will be implemented. This will be the real spotlight of the project. Several equipment are needed to realize this project. They are Cytron Bluetooth Module, 5V Vibrating / Piezo Motor, and 3 different colors of 5v LED (Green, Yellow, Red) along with NodeMCU ESP32 Development Board microcontroller in order to monitor and control the real time relative distance between a guardian and the child at required parameters of detection range.

ABSTRAK

Tujuan utama bagi pembangunan projek ini yang bertajuk "*Smart Bracelet for child tracking purposes*" atau Gelang Pintar Sebagai Pengesan, menggunakan NodeMCU ESP32 sebagai peranti Mikropengawal untuk membantu penjaga menyelia anak mereka ketika berada di pasaraya atau di tempat terbuka, seperti taman permainan kanak-kanak dan taman rekreasi. Di samping itu, bagi memastikan keselamatan anak dari berlaku penculikan, dan meningkatkan kesedaran penjaga terhadap keadaan sekeliling, penyeliaan perbandingan jarak pada masa nyata antara anak dan penjaganya adalah tujuan utama bagi projek ini. Dengan mengenal pasti perbandingan jarak pada masa nyata bagi menyedarkan penjaga terhadap jarak anak mereka dalam persekitaran mereka, beberapa peralatan diperlukan untuk pembangunan projek ini. Modul *Bluetooth Cytron*, motor getaran/piezo 5V, serta 3 LED 5V yang mempunyai 3 warna yang berbeza (Hijau, Kuning, Merah) akan digunakan untuk projek ini, setereusnya menggunakan mikropengawal NodeMCU ESP32 Development Board untuk mengawal selia perbandinngan jarak pada masa nyata antara penjaga dan anak mereka mengikut kepada saiz jarak pengesanan yang ditetapkan.

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LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURES

RSSI   -   Received Signal Strength Indicator

BLE   -   Bluetooth Low Energy

NISMART -   National Incidence Studies of Missing, Abducted, Runaway and Throwaway

IDE   -   Integrated Development Environment

IoT   -   Internet of Things

GPS   -   Global Positioning System

LCD   -   liquid crystal display

LED   -   Light Emitting Diode

GSM   -   Global System for Mobile Communications

I/O   -   Input / Output

RF   -   Radio frequency

Wi – Fi -   Wireless Fidelity

ISM   -   Industrial, Scientific and Medical

PDS   -   Proteus Design Suite

PCB   -   Printed Circuit Board

LED   -   Light Emitting Diode

FTDI   -   Future Technology Devices International Limited

GPIO   -   General Purpose Input Output

DC   -   Direct Current

CHAPTER 1

INTRODUCTION

1.1   Introduction

This chapter will discuss about the background of the project, problem statement, objectives, scope of the project, and the report outline.

1.2   Project Background

Children's security has always been a priority. It is so important that its solution must constantly be improved. Children safety is important especially to their guardian. Therefore, guardians play an essential role in keeping their child's safety. Child protection and security will always be an issue due to their lack of ability to protect themselves.

In modern times, child security has been declining, as their safety would have been in risky condition, while the child kidnapping and smuggling cases increases at times all over the world. In order to increase the potential of child safety, an idea of a project has been proposed which to help providing children the ability to fend themselves from unknown harm.

In this project, an arm bracelet will be designed to be equipped with a tracker system to monitor the locality of the child, who is wearing the bracelet. The tracking system will be consist of a Bluetooth module used as device tracker which detects the range of the worn device. When the device detects an unsafe condition, the device itself will trigger and give alarm for guardian.

The main purpose of this bracelet is to keep track of the kid when they are playing or doing some activities at an open area. This small, lightweight device will be designed to be a simple, user - friendly for both children and their guardians.

1.3 Problem Statement

Kidnapping or abduction is a wrongful, intentional act aimed at secret or open, or by fraud, withdrawal of a person from the natural micro social environment and residential area with subsequent retention elsewhere against his will. The crime is mostly committed for mercenary motives and aims ransom from relatives or loved ones of the kidnapped person.

Criminal act involving children, happen frequently in our community. Child kidnapping commonly occurs due to the kids likely to be inattentive on public area, such as public park, playground, shopping mall & supermarkets, which they can be too vulnerable to be abducted by the kidnapper. Therefore, the authorized personnel of the area could not guard the all the kids in the area at the same time which may lead to this criminal occurred. One of the examples that show the kidnapping case occurred on school kid shown in Figure 1.0.
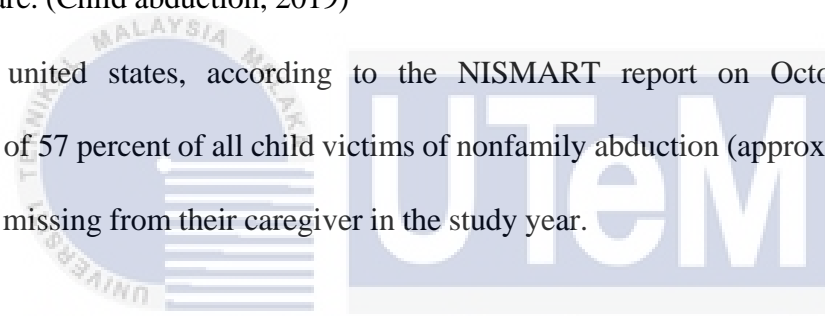

Figure 1.0 One of the abduction cases from newspaper

In Malaysia, from 2013 to 2016, over 5,000 missing teenagers and children cases were reported. 65 cases involved with children between 6 and below, between 7 and 12 years of age (297 cases), between 13 and 15 years of age (3,959 cases), and 16 and 18 years of age (3,345 cases) were covered by cases from 2013 to 2016. With respect to the ethnic composition, 5,123 cases involved by Malays, Chinese at 528 cases, and Indians at 758 cases, and other races are at 1.245 cases that were reported. (BERNAMA,2017)

The stereotypical version of child abduction by a stranger is the classic form of "kidnapping," exemplified by the Lindbergh kidnapping, in which the child is detained, transported some distance, held for ransom or with intent to keep the child permanently. These instances are rare. (Child abduction, 2019)

As in united states, according to the NISMART report on October 2002, an approximation of 57 percent of all child victims of nonfamily abduction (approximately 33,000 children) were missing from their caregiver in the study year.

Category	Estimate	95% Confidence Interval*	Percent
All nonfamily abduction victims	58,200	(24,100–92,400)	100
Caretaker missing[†]	33,000	(2,000–64,000)	57
Reported missing[‡]	12,100[§]	(<100–31,000)	21
Stereotypical kidnapping victims	115	(60–170)	100
Caretaker/reported missing[¶]	90	(35–140)	78

Figure 1.1: Estimation of Nonfamily Abducted Children

In this study, the number of stereotypically abducted children was significantly higher and reported as missing than those without families, with 78 percent of victims of stereotypical abductions. Since estimates are based entirely on cases reported by law enforcement, there are no children kidnapped or reported to police on the number of stereotypically kidnapped children missing from their caregiver. Such kids may exist; however, they are presumed to be extremely rare given the seriousness of stereotypical kidnappings.

Characteristic of Child	All Nonfamily Abduction Victims (n = 58,200)		Stereotypical Kidnapping Victims (n = 115)		Percent of U.S. Child Population* (N = 70,172,700)
	Percent	Estimate	Percent	Estimate	
Age (years)					
0–5	7†	4,300†	19	20	33
6–11	12†	6,800†	24	25	34
12–14	22†	13,000†	38	45	17
15–17	59	34,100	20	20	17
Gender					
Male	35†	20,300†	31	35	51
Female	65	37,900	69	80	49
Race/ethnicity					
White, non-Hispanic	35	20,500	72	80	65
Black, non-Hispanic	42†	24,500†	19	20	15
Hispanic	23†	13,200†	8†	10†	16
Other	<1†	<100†	2‡	<5†	5
Region					
Northeast	<1†	<100†	n/a‡	n/a	18
Midwest	33	19,300	n/a	n/a	23
South	38†	21,900†	n/a	n/a	35
West	29†	16,900†	n/a	n/a	24
No information	<1†	100†	100	115	—

Figure 1.2: Characteristics of Nonfamily Abducted Children

Percentage of child victims in total for nonfamily abduction (up to 14 years) are at 41 percent in total, which to be approximated around 31,100 victims that were involved in nonfamily abduction cases.

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Characteristic of Episode	Percent of All Nonfamily Abduction Victims (*n* = 58,200)	Percent of Stereotypical Kidnapping Victims (*n* = 115)
Child's location prior to episode		
Own home or yard	5*	16
Other home or yard	18*	3*
Street, car, or other vehicle	32*	40
Park or wooded area	25*	14*
Other public area	14*	n/a†
School or daycare	5*	2*
Store, restaurant, or mall	<1*	8*
Other location	<1*	9*
No information	<1*	8*
Other episode characteristics		
Child was taken or moved	70	95
Child was detained	35*	83

Figure 1.3: Characteristics of Nonfamily Abducted Children

Based on Figure 1.3, kidnapping or abduction occurs mainly in public and open area. Highest percentage of cases occur in streets and in car. second highest is at public park or wooded area. This statistic proves that open and public area provides the highest risk of kidnapping activity which must be taken precautions by guardians with their children.

In order to provide solution to this issue, an idea of a project was proposed to help reducing future risks of kidnapping and abduction, mainly among children. To go hand in hand with industrial revolution 4.0 needs, this project to be built with wireless connectivity, which helps users to alert with their surroundings, while doing their outdoor activities.

1.2   Objectives

The objectives of this project are:

1. To design and build a smart bracelet for tracking purposes using NodeMCU ESP32 microcontroller.

2. To integrate an IoT system for the tracking device.

3. To verify the functionality of the developed prototype.

1.3   Work Scope

As for the project, the prototype will use an NodeMCU ESP32 Development Board as the brain of the project. While built - in Bluetooth module as the transmitting and receiving features. With this module, smart bracelet can detect child range up to ±30 m radius in free, open space. To power up the device, a battery model of LiPo Rechargeable 3.7V 1300mAH Battery as its Supply so that the battery can supply up to 3 days of battery life at its maximum potential, with recharging capability. And then, NodeMCU ESP32 Development Board as microcontroller of the project is making a connection with the Bluetooth module between the master (worn by guardian) and slave (worn by child) smart bracelet.

The real time relative distance of the child can was monitored by the Bluetooth module. The guardian will be notified as soon as there are changes in the level of the child's relative distance on slave device, which is the child's bracelet. There will be multiple level of notification, i.e. safe, moderate, and danger range respectively. Not safe range will notify the guardian by triggering an alarm to both master and slave device, according to the level of range specified.

1.4 Thesis Statement & Outlines

This report consists of five main chapters. Chapter 1 is about introduction of the project that includes the project briefing, problem statement, objectives of the project and also work scope of the project. The next chapter, Chapter 2 describes about the theoretical research and literature review conducted to support and justify the feasibility of this project. Chapter 3 discusses about project methodology. In this chapter, the methods that will be used to achieve all project objectives will be explained in detail. Chapter 4 is the chapter where the preliminary results of the project will be reported.

Chapter 5 is about the conclusion about this project. This chapter will also explain how the project will be carried out for next semester to be completed.