



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**DEVELOPMENT OF BABY STROLLER AUTOMATION
SYSTEM USING ARDUINO**

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

by

MOHAMAD FAKHRI BIN SHAMSUDDIN

B071310669

940602-06-5283

FACULTY OF ENGINEERING TECHNOLOGY

2016

BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

TAJUK: Development Of Baby Stroller Automation System Using Arduino

SESI PENGAJIAN: 2016/17 Semester 1

Saya **MOHAMAD FAKHRI BIN SHAMSUDDIN**

mengaku membenarkan Laporan PSM ini disimpan di Perpustakaan Universiti Teknikal Malaysia Melaka (UTeM) dengan syarat-syarat kegunaan seperti berikut:

1. Laporan PSM adalah hak milik Universiti Teknikal Malaysia Melaka dan penulis.
2. Perpustakaan Universiti Teknikal Malaysia Melaka dibenarkan membuat salinan untuk tujuan pengajian sahaja dengan izin penulis.
3. Perpustakaan dibenarkan membuat salinan laporan PSM ini sebagai bahan pertukaran antara institusi pengajian tinggi.
4. ****Sila tandakan (✓)**

SULIT

(Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia sebagaimana yang termaktub dalam AKTA RAHSIA RASMI 1972)

TERHAD

(Mengandungi maklumat TERHAD yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan)

TIDAK TERHAD

Disahkan oleh:

Cop Rasmi: _____

Alamat Tetap:

Kampung Relong,

27200 Kuala Lipis,

Pahang.

Tarikh: _____

Tarikh: _____

**** Jika Laporan PSM ini SULIT atau TERHAD, sila lampirkan surat daripada pihak berkuasa/organisasi berkenaan dengan menyatakan sekali sebab dan tempoh laporan PSM ini perlu dikelaskan sebagai SULIT atau TERHAD.**

DECLARATION

I hereby, declared this report entitled “Development of Baby Stroller Automation System using Arduino” is the result of my own research except as cited in references.

Signature : _____
Author's Name : MOHAMAD FAKHRI BIN SHAMSUDDIN
Date : 19 / 12 / 2016

APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfilment of the requirement for the degree of Bachelor of Electronic Engineering Technology (Industrial Electronic) with Honours. The member of the supervisory committee is as follow.

(Project Supervisor)

ABSTRAK

Pada masa kini, salah satu perkara yang penting bagi ibu bapa adalah kereta sorong bayi. Kereta sorong bayi akan digunakan apabila ibu bapa pergi ke pusat membeli-belah atau pasar raya, dan di mana sahaja asalkan di luar rumah. Kadang-kadang, ibu bapa juga perlukan kereta sorong bayi apabila ibu bapa mahu pergi ke taman permainan, mereka akan membawa anak-anak mereka bersama-sama dengan mereka. Jadi, bagaimana mereka boleh pergi ke taman permainan sambil menolak kereta sorong bayi secara manual? Untuk mengatasi masalah ini, penyelidik sedang mengkaji inovasi baru iaitu "Automation Baby Stroller" dan ia akan menggunakan teknologi terkini untuk menghasilkan automasi kereta sorong bayi yang berkualiti. Dalam usaha untuk menghasilkan automasi kereta sorong bayi yang berkualiti, ia memerlukan pengawal mikro yang akan berfungsi untuk menyambung perisian dan perkakasan. Automasi kereta sorong bayi yang dicadangkan akan menggunakan sensor ultrasonik sebagai alatan keselamatan. Selain itu, cara yang digunakan untuk menghasilkan automasi kereta sorong ialah dengan menggunakan kamera Pixy dan telefon pintar Android. Perisian yang akan digunakan untuk automasi kereta sorong bayi adalah Arduino IDE. Untuk bergerak kereta sorong bayi, motor harus disertakan untuk automasi kereta sorong bayi ini dan tanpa motor, projek ini tidak akan berjaya seperti yang diramalkan. Tambahan pula, automasi kereta sorong bayi boleh bergerak dengan baik untuk kedua-dua kaedah mahupun Sistem Automatik atau Kawalan. Akhir sekali, semua objektif untuk automasi kereta sorong bayi tercapai dengan berjaya and automasi kereta sorong bayi berfungsi dengan baik dan sama seperti apa yang diramalkan.

ABSTRACT

Nowadays, one of the important things for parents is the baby stroller. The function of the baby stroller will be applied when parents go to shopping mall or supermarket, and anywhere as long as outside from home. Occasionally, the parents also need baby stroller whenever parents want go to playground, they will be bringing their children along together with them. So, how can they go to playground while manually push the baby stroller? To overcome this problem, the researchers are looking into new innovation which is “Automation Baby Stroller” and it will be use latest technology in order to produce the quality automation baby stroller. In order to produce the quality automation baby stroller, it needs microcontroller that will be functioning to connect the software and hardware. The proposed automation baby stroller will use ultrasonic sensor as safety tools. Besides, the method that already apply in order to produce this automation baby stroller by using Pixy camera and Android Smartphone. The software that will be applied for this automation baby stroller is Arduino IDE. In order to move the baby stroller, motor must be included for this automation baby stroller and without motor, this project will be not successful as well and prediction. In addition, this automation baby stroller can move as well for both method either Autonomous or Controlled System. Last but not least, all the objectives for this automation baby stroller is achieve with successful and the automation baby stroller function as well and same with the prediction.

DEDICATION

To my beloved mother and father who always there for me
Umi Kelsom Binti Usah and Shamsuddin Bin Kassim

To my siblings

Zulhasmirizal Bin Shamsuddin

Zulazrun Bin Shamsuddin

Mohamad Fairus Bin Shamsuddin

Zulhusni Bin Shamsuddin

Nor Syazwani Binti Shamsuddin

Zulhazwan Bin Shamsuddin

To my lecturer and supervisor, for their guidance and encouragement

IR Mohammad 'Afif Bin Kasno (Supervisor)

Noor Mohd Ariff Bin Brahin (Co-Supervisor)

To my friends, for their unconditionally support

ACKNOWLEDGMENT

Bismillahirrahmaanirrahim,

In the name of Allah S.W.T, the most compassionate and the most merciful.

Firstly, thanks to Allah S.W.T because giving me a good health and huge courage and strength to do this final year project.

Secondly, I would like to deeply express my gratitude and appreciation to my supervisor, IR Mohammad ‘Afif Bin Kasno and my Co-supervisor, Noor Mohd Ariff Bin Brahin for their guidance, support, encouragement and helping to finish my final year project.

I would like to extend my sincere to all my friends, who has assisted and share the ideas, indirectly easier for me to complete this project. I wish to extend to everyone who has helped directly or in completing this project. Finally, my deep gratitude goes to my beloved mother, father, and brother for their blessing and prays.

TABLE OF CONTENT

Abstrak	i
Abstract	ii
Dedication	iii
Acknowledgement	iv
Table of Content	v
List of Table	ix
List of Figures	x
CHAPTER 1: INTRODUCTION	1
1.0 Introduction	1
1.1 Background	1
1.2 Problem Statement	2
1.3 Objectives	2
1.4 Scope of Work	2
1.5 Report Structure	3
CHAPTER 2: LITERATURE REVIEW	5
2.0 Introduction	5
2.1 History of Baby Stroller	6
2.2 Current research on baby stroller control	9
2.2.1 Baby Stroller Movement Control by Android Application	9
2.2.2 Eye Movement Based Electronic Wheel Chair for Physically Person	10
2.3 Related research on automation concept	11
2.3.1 Autonomous Control of Eye Based Electric Wheel Chair with Obstacle Avoidance and Shortest Path Findings Based on Dijkstra Algorithm	11

2.3.2 Implementation of Head and Finger Movement Based Automatic Wheel Chair	12
2.4 Sensor	12
2.4.1 Ultrasonic Sensor	12
2.4.2 Passive Infrared (PIR) Sensor	13
2.4.3 Infrared Sensor	14
2.5 Microcontrollers	16
2.5.1 Raspberry Pi	16
2.5.2 Arduino Uno	16
2.6 Electrical Motor	17
2.6.1 Alternating Current (AC) Motor	17
2.6.1.1 Stepper Motor	18
2.6.2 Direct Current (DC) Motor	19
2.6.2.1 Brushed DC Motor	20
2.6.2.1.1 Servo Motor	21
2.6.2.2 Brushless (BL) DC Motor	22
2.7 Motor Driver	23
2.7.1 L293D Motor Driver	23
2.7.2 L298 Motor Driver	24
2.8 Relay	25
2.8.1 Relay Module (Active High)	26
2.8.2 Relay Module (Active Low)	26
2.9 Pixy Camera	27
2.10 Bluetooth	27
2.10.1 Bluetooth History	27
2.10.2 Type of Bluetooth	28
2.10.2.1 HC-05	28
2.10.2.2 HC-06	28
2.11 Comparison Table	29

CHAPTER 3: METHODOLOGY	34
3.0 Introduction	34
3.1 Block Diagram	35
3.2 Project Flowchart	36
3.3 Algorithm for Project Flowchart	37
3.4 Flowchart for Programming Parts	38
3.5 Explanation for Programming Flowchart	39
3.6 Current Progress	39
3.7 Simulation from Proteus Software	40
3.8 Proposed Method	41
3.9 The Main Hardware	42
3.9.1 Relay Module	44
3.9.2 DC Power Window Motor	45
3.9.3 Modification Baby Stroller	46
3.10 Hardware Implementation	47
3.11 Mechanical Implementation	47
CHAPTER 4: RESULT & DISCUSSION	49
4.0 Introduction	49
4.1 Results	49
4.2 Analysis	53
4.3 Discussion	57
CHAPTER 5: CONCLUSION AND FUTURE WORK	60
5.0 Introduction	60
5.1 Conclusion	60
5.2 Recommendation	61
5.3 Project Potential	62
REFERENCES	63

APPENDICES	66
A Gantt chart for PSM1	66
B Gantt chart for PSM2	67

LIST OF TABLES

2.1 Comparison between DC Motor and AC Motor	29
2.2 Comparison between Arduino Uno and Raspberry Pi Model B	29
2.3 Advantages and Disadvantages of the DC Motor and AC Motor	30
2.4 Advantages and Disadvantages of the Ultrasonic Sensor, Passive Infrared Sensor and Infrared Sensor	31
2.5 Comparison the existing project	32
3.1 Main components for Automation Baby Stroller	42
3.2 5V Active High relay module	44
3.3 Specification of the DC Power Window motor	45
4.1 Reading for several Weight and Time taken	49
4.2 Reading of the Distance and Value of X by using Serial Monitor	50
4.3 Reading for minimum and maximum for Ultrasonic (HC-SR04) sensor	51
4.4 Delay for the motor to move	52
4.5 Detections of the Ultrasonic (HC-SR04) sensor at certain distance	52
4.6 Detections of the Bluetooth module at certain distance	52
4.7 Reading for the value of X and Width for Pixy camera	53

LIST OF FIGURES

2.1 Pram Baby Stroller	7
2.2 Umbrella Baby Stroller	8
2.3 The Jogging Baby Stroller	8
2.4 Connection pins of Ultrasonic Sensor	13
2.5 Connection pins of PIR sensor	14
2.6 Infrared (IR) sensor	15
2.7 Raspberry Pi	16
2.8 Arduino Uno	17
2.9 AC Motor	18
2.10 Stepper Motor	19
2.11 DC Motor	20
2.12 Brushed DC Motor	21
2.13 Servo Motor	22
2.14 Brushless DC Motor	23
2.15 L293 Motor Driver	24
2.16 L298 Motor Driver	25
2.17 12V relay	25
2.18 5V relay	25
2.19 Example of relay module for Active High	26
2.20 Example of relay module for Active Low	26
2.21 Example of Pixy Camera (CMUcam5)	27
2.22 HC-05 Bluetooth module	28
2.23 HC-06 Bluetooth module	29
3.1 General Block Diagram for Automation Baby Stroller	35
3.2 Project Flowchart for Automation Baby Stroller	36
3.3 Flowchart for Programming parts	38

3.4 Simulation of DC motor, Arduino and Ultrasonic sensor using Proteus software	40
3.5 5V Active High relay module	44
3.6 DC Power Window Motor	45
3.7 Condition of back wheel after mounting with 12V DC Power Window Motor	46
3.8 The location of electronic devices after mounting	47
3.9 Condition of Baby Stroller after wiring is finish	48
3.10 The Automation Baby Stroller Apps	48
3.11 Automation Baby Stroller ready for testing	48
4.1 Relationship between Time taken and Weight	50
4.2 Relationship between Value of X and Distance	51

CHAPTER 1

INTRODUCTION

1.0 Introduction

This chapter will be given a brief explanation about the project. Furthermore, this chapter also provides the user some contents such as the background of this project, problem statements, objectives, scope of work and report structure.

1.1 Background

In order to carry a baby and young children is a difficult task for parents during they go to shop, go to a playground and much more. Furthermore, critical problem that will be faced by parents when they have three or more kids. Moreover, several baby stroller already has a special designed in order to help parents. Other than that, their child will be comfortable and feel safe during they spent time together on a travel or vacation. Expected for this project is to add some innovation to the existed baby stroller. Furthermore, this project also eases the user when they use it. This because, the movement of the existed baby stroller is controlled by manually. So, this project will be changing the movement of baby stroller from manual to automatically.

1.2 Problem Statement

Problem statement for this project is movement of parents will become a limitation because parents need to push the baby stroller when parents not in the home. Other than that, another problem is there are no automation baby stroller that available at the market.

1.3 Objectives

- To study the current research and issues regarding automation baby stroller
- To develop the automation baby stroller system using Arduino, Ultrasonic sensor and Pixy Camera.
- To analyze the performance of the automation baby stroller when this automation baby stroller in moving condition.

1.4 Scope of Work

Limitation for this automation baby stroller are the role of the baby stroller only follow the people as a corresponding user (baby stroller will be follow the people that have same colour Pixy's signature. Other than that, the maximum test value of load for this automation baby stroller is 10 kg. Furthermore, as safety, this automation baby stroller can stop when approaching the desired distance in the range of 0.40 meters (0.40 meters is already write as a coding in Arduino IDE but when apply to the automation baby stroller, it can stop at the distance 0.40 meters. Moreover, this automation baby stroller have two mode but need change the mode manually (use two Arduino microcontroller or upload the right coding when want use the selected mode). For first mode, this automation baby stroller use Autonomous system that can move in forward, stop, right and left direction. For second mode, this automation baby stroller use Controlled system that can move in

various direction such as forward, backward, right, left and stop. Last but not least, the testing range for Bluetooth module, HC-06 is 0 meter until 12 meter only.

1.5 Report Structure

In order to give clear detail about this whole project, the study already divide into five chapters. Furthermore, all of the five chapter shows that the logical step in order to understanding this whole project and to gain the appreciation and evidence of the methodology is used to produce the prototype of the project.

Chapter 1: Firstly, this chapter will be introduced the brief idea of the project and it also covers the overview of the whole project. Moreover, this chapter also including the synopsis of this project, objectives, work scopes of this project, problem statement and outcomes of this project.

Chapter 2: Secondly, this chapter is about how to gain the information about this project. All information about this project will be classified into several articles such as journal, book and some related interview.

Chapter 3: After that, for this chapter, it will cover all of the methodology and project implementation in order to achieve the goal of this project. Other than that, the software and hardware technical details also explained in this chapter.

Chapter 4: Next, for this chapter, it is very important for this project because it contains the development and implementation of this project. Furthermore, this chapter also gives many analysis in order to determine whether the objectives for this project is achieved or not. Last but not least, this chapter also cover the result of this project, theoretical and actual findings and the simulation of the software.

Chapter 5: Lastly, this chapter is a whole contents of this thesis. This because it consists all references, discussion, and all attachments also will be included for the future references and the most important part is concluded.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

In order to finish this chapter with successful, many sources of references that already has been refer such as journal, articles and many more. Furthermore, all related information will include in this chapter. All the useful information will be used as a guide to finish this chapter. Some studies of information from references are about some major components and topic that related to this project and it will be used in the project in order to make the software and hardware.

2.1 History of Baby Stroller

The primary perambulator, otherwise called a "pram," was created 1733 by well-known architect William Kent as an approach to entertain the offspring of the Duke of Devonshire. The pram comprised of a wicker basket set on a luxuriously enriched wooden casing with four wheels and harness, so it could be pulled by a horse, goat, or dog. The new vehicle got on with the English world class, who dispatched comparative models from neighborhood skilled workers who put their own twist on the configuration. One of the main changes was supplanting the harness with two handles, so the pram can pull by adult. Later, after excessively numerous kids dropped out of prams, a bar was put between the handles, permitting guardians to push the pram in order to watch out their children. One configuration change was made to skirt the law. It was illicit to operate four-wheeled vehicles pedestrians on the trail, so after numerous moms and babysitters got references for pushing a pram, makers release a few wheeled prams to keep their customers out of inconvenience. Prams turned out to be more famous after World War I on account of a post-war time of increased birth rates, and also successful in plastic generation. Replacing costly wood and wicker bassinets with plastic shells, and metal fittings with chrome plated metal, meant the cost of a pram descended impressively. More changes were made to the configuration as well, including more profound wicker bin, thicker wheels, lower clearance to the ground and foot brakes.



Figure 2.1: Pram Baby Stroller

In the 1940s, strollers, or pushchairs intended for little children were presented. Kids in strollers confronted forward, instead of the more basic guardian confronting seats of prams. Early plans were minimal more than wheeled seats with a metal circle around the youngster. Be that as it may, a noteworthy update happened in 1965 when Owen Maclaren, an English aeronautical engineer, heard his little girl complaining about the struggles of taking a pram on a plane. Utilizing his knowledge in flying machine fabricating, Maclaren planned a stroller from lightweight aluminum that could be collapsed when not being used. His "umbrella stroller" turned into a tremendous hit is still famous today.



Figure 2.2: Umbrella Baby Stroller

Another real plan shift came in 1984, when Phil Baechler had running with his baby child close behind. Soon, Baechler understood that strollers were "horrendous for running and they arrive at a complete stop on grass or sand." So he started exploring different avenues regarding aluminum tubing and bike wheels, in the end, the three-wheeled Baby Jogger, which he at first sold out of the back of running magazines for \$200 per piece.



Figure 2.3: The Jogging Baby Stroller

2.2 Current research on controller baby stroller / wheel chair

2.2.1 Baby Stroller Movement Control by Android Application

This project is to design a system by using combination of software and hardware which have the ability to control and operate the movement of the baby stroller in wirelessly by using Android technology. Through it, knowledge in design and using programming in Arduino software for interfacing purpose can be learns and improves. The selection of Basic4Android (B4A) software is for better fundamental understanding on computer program application in the computer interfacing. This project will be separate to three parts. The first part is designing the software for interfacing, data key in and timing. The second part is finding and designing the hardware for the project. The third part is joining the entire component that had been design. In this project, the main component will be used is DC motor, Arduino Board and Android based devices. The system use Bluetooth technology as the platform of the connectivity and interface to the Android device. The system consist of five movement control which is can moving forward, moving backward, turn left, turn right and also stop. The advantages of this design are the cost is quite low. Interfacing takes advantages of low cost, high speed input or output port and compatible with high level languages (Hassan 2015).