

BABY CARE ALARM SYSTEM USING 1SHEELD WITH ARDUINO

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award of Bachelor of Electronic Engineering (Industrial Electronics) With
Honours**

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“I, hereby declare that this thesis entitled, **BABY CARE ALARM SYSTEM WITH 1SHEELD WITH ARDUINO** is a result of my own research idea concept for works that have been cited clearly in the references.”

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Specially dedicated to

My beloved family, lecturers, supervisor and friends who have guided and inspired me through my journey in education. Also thanks to their great support, beliefs and motivation.

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ABSTRACT

In this development era, the increasing work load contributes to stressfulness of people. The busy daily schedule makes people especially parents contribute to a lot of cases that involve the death of children inside the parked vehicle. The idea of the project is to alert parents about not forgetting their child by using the recent technology which is smartphone. Smartphone is the essential device that everyone in the world has at least one. So, the system designed is to make smartphone more useful besides people can save life. The project design consists of two main parts which are safety pad and keychain alarm device. For the first part, the safety pad consists of load sensor to sense the presence of child inside the child car seat and notify parents through smartphone. For the second part, the keychain alarm devices use Radio Frequency (RF) transceiver that will act as backup safety features for children in case when the parents' smartphone is missing or run out of battery. This device will activate the warning alarm when parents walking outside the RF signal range of the safety pad.

ABSTRAK

Era yang pesat membangun ini, peningkatan beban kerja telah menyumbang tekanan kepada seseorang individu. Jadual harian yang padat membuatkan individu terutamanya ibubapa menyumbang kepada banyak kes-kes yang melibatkan kematian kanak-kanak di dalam kenderaan. Projek ini bertujuan untuk memberi amaran kepada ibubapa supaya tidak cuai dan lupa anak mereka yang berada di dalam kenderaan dengan menggunakan teknologi masa kini iaitu telefon pintar. Telefon pintar adalah alat komunikasi yang penting kepada manusia pada masa kini. Oleh itu, sistem ini direka adalah untuk menambah fungsi telefon pintar supaya lebih berguna dengan menyelamatkan nyawa kanak-kanak. Projek ini terdiri daripada dua bahagian utama iaitu pad keselamatan dan alat penggera. Untuk bahagian pertama, pad keselamatan yang terdiri daripada sensor beban untuk mengesan kanak-kanak di dalam kereta dan telefon pintar berfungsi sebagai penghantar maklumat bahawa kanak-kanak berada di dalam kereta. Untuk bahagian kedua, alat penggera menggunakan '*Radio Frequency (RF) transceiver*' yang berfungsi sebagai alat keselamatan bagi kanak-kanak apabila telefon pintar ibu bapa hilang atau kehabisan bateri. Peranti ini akan mengaktifkan penggera amaran apabila ibu bapa berjalan di luar julat isyarat pad keselamatan.

TABLE OF CONTENTS

CHAPTER	TOPIC	PAGE
	PROJECT TITLE	i
	REPORT VERIFICATION STATUS FORM	ii
	STUDENT'S DECLARATION	iii
	LECTURER'S DECLARATION	iv
	DEDICATION	v
	ACKNOWLEDGEMENT	vi
	ABSTRACT	vii
	ABSTRAK	vii
	TABLE OF CONTENTS	ix
	LIST OF FIGURES	xii
	LIST OF TABLES	xv
I	INTRODUCTION	
	1.1 PROJECT BACKGROUND	1
	1.2 OBJECTIVES	3
	1.3 PROBLEM STATEMENT	4
	1.4 SCOPE OF PROJECT	5
	1.4.1 Hardware part	
	1.4.2 Software part	
	1.5 OUTLINE OF PROJECT	6

II

LITERATURE REVIEW

2.1	PREVIOUS RESEARCHES ON CHILD'S SAFETY SYSTEM	7
2.1.1	Warning System for Child Left Unattended in Vehicle by James Morningstar	7
2.1.2	System and Method for a Child Safety Seat Having Sensing and Notification Abilities by Chelsea Owens	9
2.1.3	Baby Seat Occupant Detection System by Davisson, Sally Trimmer, Lisa A. Sheehy, Angela Caporelli, David Ratz, and Kamill R. Hilberth	11
2.1.4	Child Car Seat Alarm System By Watson, Greg device	12
2.1.5	Proximity detection using an electronic device by Varoglu, Devrim, and Gencer Cili	14
2.1.6	Master Table (Summarization of Previous Project Finding)	16
2.2	RESEARCH ON HARDWARE PARTS	
2.2.1	Load sensor	18
2.2.2	INA125P Instrumentation Amplifier	20
2.2.3	Microcontroller	22
	2.2.3.1 Arduino Uno	22
	2.2.3.2 Arduino Pro Mini	23
2.2.4	UART to USB Converter for Arduino Pro Mini	25
2.2.5	1SHEELD	26
2.2.6	RF Transceiver	29
2.3	RESEARCH ON SOFTWARE PARTS	31
	2.3.1 The Arduino software	
	2.3.2 1SHEELD software	33

III	METHODOLOGY	
	3.1 PROJECT IMPLEMENTATION	35
	3.1.1 Flow chart of the project	35
	3.1.2 Gantt chart	39
	3.2 BLOCK DIAGRAM OF PROJECT	40
	3.2.1 Safety pad	40
	3.2.2 Keychain Alarm Device	41
	3.3 SYSTEM OVERVIEW DIAGRAM	42
IV	RESULT AND DISCUSSION	
	4.1 ILLUSTRATION OF THE SYSTEM	44
	4.1.1 Safety Pad	45
	4.1.1.1 Hardware Part	45
	4.1.1.2 Software Part	47
	4.1.1.3 Result	
	4.1.2 Keychain alarm device	50
	4.1.2.1 Hardware Part	50
	4.1.2.2 Software Part	51
	4.1.2.3 Result	53
V	CONCLUSION AND FUTURE WORK	
	5.1 CONCLUSION	56
	5.2 FUTURE WORKS	57
	REFERENCES	
	APPENDIX	58-60 61-65

LIST OF FIGURES

NO	TITLE	PAGE
1.1	Reading of thermometer in a car for less than an hour	1
1.2	Pressure pad was shifted laterally and forward the back of the child restraint	4
2.1	100- A child warning system block diagram proposed By James Morningstar	8
2.2	100- Child safety seat system having sensing and notification abilities proposed by Chelsea Owens	10
2.3	Block diagram of the baby seat occupant detection System consist of one remote unit and one base unit	12
2.4	100- Child car seat	13
2.5	200- A receiver: may be key fob	13
2.6	100- Block diagram of an electronic device	14
2.7	Illustrates a transmitter with a target distance	15
2.8	Load sensor	18
2.9	Load sensors built using resistive bonded foil strain gauges	19
2.10	Wheatstone bridge Network	19
2.11	INA125P	20
2.12	INA125P pin configuration	20
2.13	Arduino Uno pin out board	22

2.14	Arduino Uno schematic	23
2.15	Arduino Pro Mini pin out	24
2.16	UART to USB converter	25
2.17	1Sheeld connected to Arduino board and software platform on Android smartphone	26
2.18	Adjust 1Sheeld to either 3.3V or 5V depends on type of Arduino	27
2.19	Place your 1Sheeld on your Arduino board	28
2.20	Connecting Arduino with 1Sheeld to computer	28
2.21	NRF24LO1 transceiver	29
2.22	NRF24LO1 transceiver pin out diagram	30
2.23	Arduino symbol	31
2.24	Arduino IDE	31
2.25	Serial port on Arduino IDE	32
2.26	Type of board on Arduino IDE	32
2.27	1Sheeld apps on the Google play store	33
2.28	1Sheeld library	33
2.29	Include 1Sheeld libraries inside Arduino libraries	33
2.30	Write Sketch	34
3.1	Project flowchart	36
3.2	Project Gantt chart	39
3.3	Block diagram of the Safety Pad	40
3.4	Block diagram of Keychain alarm device	41
3.5	Design Overview	42
4.1	Components for the Safety pad circuit	45
4.2	(a) Equivalent circuit	45
	(b) Schematic circuit design for the Safety pad	
4.3	The constructed Safety pad circuit using breadboard	46

4.4	Main coding for Safety pad system	46
4.5	Notification on the smartphone	49
4.6	Connection of keychain alarm device (client)	50
4.7	Connection of Safety pad (server)	50
4.8	Main coding for client	51
4.9	Main coding for server	52
4.10	Wireless communication between keychain alarm device and Safety pad module	53
4.11	(a) No communication between two devices	54
	(b) No baby is detected	54
	(c) Baby is detected	55
	(d) Baby is detected and alarm in the keychain alarm device is triggered	55

LIST OF TABLES

NO	TITLE	PAGE
2.1	Master table	17
2.2	Gains and RG resistor values	21
2.3	Arduino Pro Mini details	24
4.1	The result of load sensor	49

Based on figure 1.1, the transparent windows of a car were struck by the sun's shortwave radiation (yellow colour wave) and the objects inside the car such as dashboard, steering wheel and child seat heat the adjacent air by conduction and convection thus give off long wave radiation (red colour wave also known as infrared). This situation contributed to the air trapped inside a vehicle to warm quickly [5]. Leaving the vehicle's windows slightly open does not basically can reduce the warming rate of inside the vehicle because children's bodies warm at a faster rate than adults [4].

Based on the statistics in the US, only about 10% of child heat stroke-related deaths involve neglect or substance abuse by the caretaker. A majority of the cases occur when parents get distracted from their daily schedule and they don't realize that the child was in a dangerous position. Parents busy schedules, combined with the tendency for them to seat their sleeping children in the rear of cars (because that's where the child seat is usually mounted), and could cause them to forget that they are carrying precious cargo in car cabins. They could potentially go about their routine and leave kids locked in the car. A recent study assessed the effects of stress and cortisol on a variety of memory tasks in male human subjects and demonstrated that there is stress-induced working memory impairment [1]. This statement explains person's daily life could affect their behaviour and contribute someone to leave unattended, his child in the vehicle due to stressful and work load.

To avoid these tragic incidents happens; the vehicle that had used must be equipped or provided with a device or system that can be used to warn them if they were negligent in their child when leaving the vehicle. That's how Baby Care Alarm System was born. The system consists of two main modules; one is the Safety pad to be installed in the child car seat and the Keychain alarm devices to be hooked on the parent car key. The safety pad will detect whether the child is seated in the car seat or not.

Once the system is awake, it will immediately start to check the presence of a child in the car seat. If the Safety pad detects the weight of the baby, it will notify the parent's smartphone that baby is in the car. As long as the Safety pad senses the baby, it will continuously give notification to the parent's smartphone. When the parent turns off the engine and leave the car, the Safety seat will constantly read and

notify parents if the device still senses the presence of the child in the child car seat. Once the parent move outside the radio frequency range provided between the Safety pad and Keychain alarm device, it will trigger the alarm that indicates the parent have forgotten to take out their child in the car. The alarm will keep beeping until the child is removed. This project takes advantage of technology to bring a solution for this problem and help to prevent parents from making a mistake that may end the life of an innocent child.

1.2 Objectives

The objectives of this project are:

- i. To design and implement a device to be installed in the child car seat to detect if a child is seated on that seat.
- ii. To design and implement a wireless device that will trigger an alarm or send message to notify parents when they have left their children in the vehicle.
- iii. To implement the safety alarm system for children that can be installed easily in any types of vehicle.

1.3 Problem Statement

In this fast developing era, most of the people's daily life is constantly in a rush and under pressure. They are used to follow their fixed schedule every day. A change in routine, a distraction or accidents are some of the main reasons of why parents forget their child inside of a vehicle [6]. To prevent from this tragic incident still occur, one system for preventing children from this case need to be created. This system will address this matter by alerting the parents when they leave the baby in the vehicle and walk away from the vehicle.

Another concern is the misuse scenarios on the products such as for the pressure pad technologies that may be inappropriate positioning of the device within the child restraint, from either incorrect installation or shifting over time as shown in

figure 1.2. In this case, the safety pad will be installed under the cushion of the child car seat, so the pad will not shift or moving to the inappropriate positions.

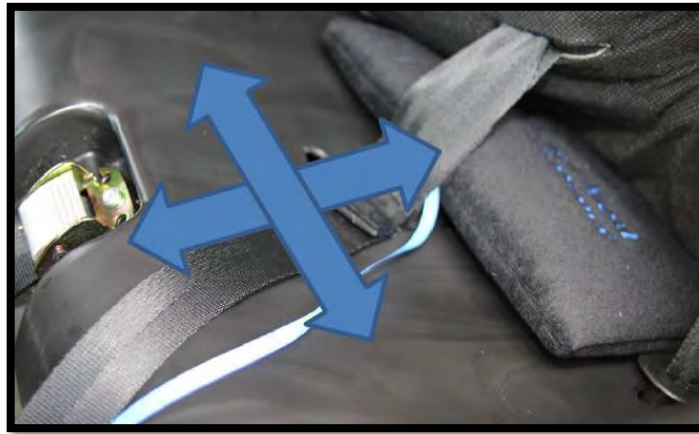


Figure 1.2: Pressure pad was shifted laterally and forward the back of the child restraint [17]

Lastly, there are many existing product use key chains as an alarm to notify parents about their children in the vehicle. Since every alert will be made from a small device attached to the key chain, and often the keys of the vehicle can be missing, it can be a major problem with this the system since the system can't notify the parents. To avoid unwanted event from happening to the child, the proposed system can help to solve the problem of existing products by sending an alarm to parent's smartphone since the smartphone is an essential tool for our lifestyle nowadays. If the parents couldn't respond within the predetermined time, an alert will be sent to key chain as a back up to warn that a child still inside the vehicle.

1.4 Scope of project

The aim of this project is to design and implement the system that can help to detect children and help parents avoid forgetting their children inside the vehicles. This section is important to know the limitation and boundary of this project. The project scope consists of two main parts which are hardware and software part.

1.4.1 Hardware part

Firstly, the circuit will be constructed and testing on the breadboard. This makes it easy to use for creating temporary prototypes and experimenting with circuit design. After the circuit is working well, all of components will be installed on the strip board and then go to soldering process. The hardware part consists of safety pad module and keychain alarm device.

- i. The safety pad module contains of load sensor, NRF24L01 transceiver, Arduino UNO, 1Sheeld and battery for its major components.

Load sensor: This sensor has task to detect when a child is placed on the child car seat. Since this project covered the child from birth until 5 years old, the range of this sensor is from 2kg to 20kg. (Average weight of normal growing children in Malaysia: boys- 3.3kg to 18.7kg and girls-3.2kg to 17.7kg)

NRF24L01 transceiver: This wireless chip will act as proximity sensor that will communicate with NRF24L01 transceiver on the Keychain alarm devices. When both of transceiver loss their communication (means that parent moves outside the radio frequency range), Keychain alarm devices will trigger some action.

Arduino UNO: As a microcontroller to execute a certain command that has been coded.

1Sheeld: Wireless shield to piping data from Arduino to Smartphone and activate the notification on the smartphone.

- ii. The key chain module contains of the Arduino Pro Mini, NRF24L01 transceiver, buzzer alarm and battery as its major components.

Arduino Pro Mini: Act as a microcontroller to execute a certain command that have been coded.

NRF24L01 transceiver: Operable to receive and transmit a wireless signal of NRF24L01 transceiver (at the child car seat) when the signal outside their predefined range and trigger an alarm.

Buzzer alarm: Sound projected from speaker on the key chain that caused by NRF24L01 transceiver with an instruction to alert the parents that child still inside the vehicle.

1.4.2 Software part

For the programming part, the Arduino IDE will be used to do the coding for Arduino, 1Sheeld and NRF24L01 transceiver. 1Sheeld libraries for 1Sheeld and Mirf libraries for NRF24L01 transceiver will be downloading and paste to Arduino libraries to make it easier to do the coding for this whole system.

1.5 Outline of Project

The Baby Care Alarm System's report is covered by five main chapters which as follows:

Chapter I: The aim of this chapter is to describe about the overview of the project, including the project background, objectives of project, problem statement scope of the project and outline of the project.

Chapter II: Summarize all the reviews about the previous study and researches that related to this project. There are many sources for this finding includes journals, reference books, internet and research papers. The research on the components and circuit related to this project will also help in understanding of the project.

Chapter III: Explains the methodology of the project, which includes the development of the design system and how the project was organized. This chapter includes all the project part from the beginning, developing until the project is finished.

Chapter IV: This chapter focus on the presenting result of the project. The testing of the hardware and software parts will also be included in this chapter. Lastly, the result was analysed and discussed in this chapter.

Chapter V: The last chapter is about to conclude the overall analysis from the first chapter until chapter four. Discussion on the problem encountered, future work and suggestions for the project improvement will also be included.

CHAPTER II

LITERATURE REVIEW

This chapter discusses about previous researches, project and journal that can be applied in this project. In this chapter covered the theoretical concept, features, components and useful ideas to carry out this project. Therefore, this chapter is very contributed to make sure a proper plan to implement this project.

2.1 Previous researches on child's safety system

2.1.1 Warning System for Child Left Unattended in Vehicle by James Morningstar [7]

According to this journal, this invention is about a system to notify parents that they have left their children in the vehicle. A pressure pad or a secured child seat, lap belt is used to detect the child's presence in a child safety seat. When the driver releases the seat belt, it will wake the system up. When still a child remains in the seat when the driver's seat belt is disengaged, the system alarms notifying the driver. The alarm would include a calm audio output such as a lullaby, a song, or a story. The system can be integrated into the OEM features to provide an alert escalation process using a local alert, a vehicle alert, a Wireless alert and ultimately a 911 alert.

Based on the block diagram in figure 2.1 below:

102- Child seat detection sensor

104- A securing driver's seat belt sensor and turning on the ignition switch to the on position

106- An ignition switch status sensor

108- Portable power source such as a rechargeable battery

110- Such as lullaby, a song, a story

112- Does not provide undue stress to the child

114- Provide remote notification to another party, such as driver or parents.

116- Remote notification device such as text message, voice message or email.

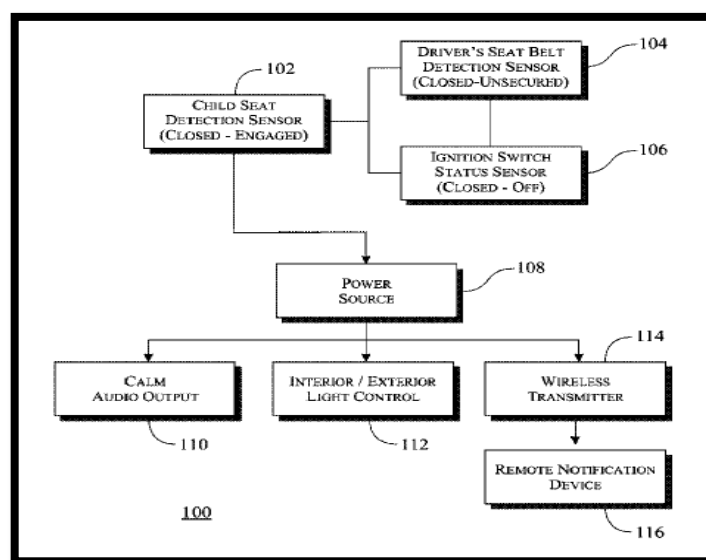


Figure 2.1: 100- a child warning system block diagram proposed By James Morningstar [7]

2.1.2 System and Method for a Child Safety Seat Having Sensing and Notification Abilities by Chelsea Owens [8]

The authors in [8] developed a safety system for child that consists of:

- i. Proximity sensor
Any component of hardware/software/both that can detect when a wireless receiver is outside a range distance of the child's seat.
- ii. Presence sensor
Any component of hardware/software/both to sense the presence of child in the child's seat
- iii. Transmitter
Any component of hardware/software/both that can communicate with wireless receiver via a wireless signal

This operation for this is the presence sensor will always check for the presence of children in the safety and the proximity sensor will check on the range distance between wireless receiver and child's seat. If proximity sensor sense distance outside the range and child still in the child's seat, a wireless signal will alert wireless receiver to produce an alarm to notify parents or the driver.

Advantages of this project may be its provides system for child safety seat that comprising of a temperature control unit and a thermoplastic that can detect the temperature of child whether the temperature is safe or not. This advantage can reduce the risk of heatstroke among child in the child safety seat inside a vehicle.

Based on figure 2.2 below:

110- child safety seat

112- a child

114- presence sensor

116- proximity sensor

118- a transmitter

120- wireless signal such as radio frequency, micro wave or infrared wave signal

124- a restraint

134- seat belt of vehicle

150- wireless receiver

154- proximity sensor

156-an alert

158-a speaker

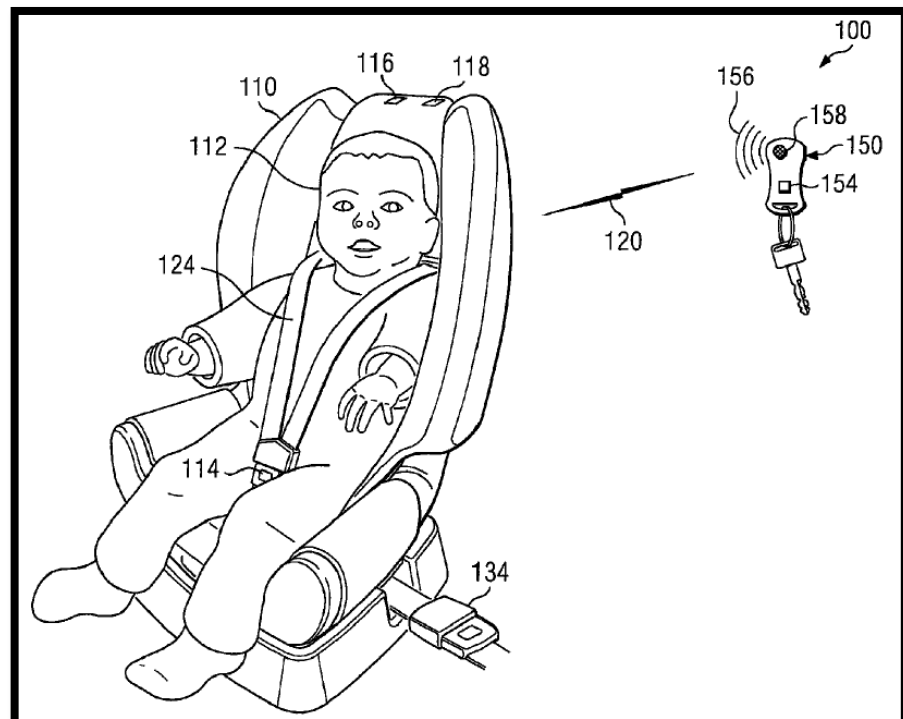


Figure 2.2: 100- child safety seat system having sensing and notification abilities proposed by Chelsea Owens [8].