

IoT-based Child-in-Car Safety Reminder

Muhammad Taufiq Dzulkifli¹, Roshayati Yahya^{1*}

¹Department of Electrical Engineering, Faculty of Electrical and Electronic Engineering,
Universiti Tun Hussein Onn Malaysia, Batu Pahat, 86400, MALAYSIA

*Corresponding Author Designation

DOI: <https://doi.org/10.30880/eeee.2021.02.02.043>

Received 04 July 2021; Accepted 19 September 2021; Available online 30 October 2021

Abstract: There are many cases related to the child being trapped inside a locked car with a window and engine closed, such as children being trapped inside the car due to the parents rushing to their workplace. In order to save the children from being trapped inside a car, a safety reminder is created by connecting the PIR motion sensor and microcontroller with the mobile phone through an application. This system used the Internet of Things (IoT) which occurs during connecting the system with the phone. Besides, the motion sensor that is included inside the system has the ability to detect human movement inside the car. This system is believed to be useful towards the safety of children efficiently so that the children will live a happy life. When the system detected the movement of a trapped child inside the car, the system will send a notification to the parents through mobile application.

Keywords: Movement Detection, Child Safety, Car Safety Reminder, IoT

1. Introduction

Recently, there are several death cases due to babies and children been trapped inside a car. The reason why this can happen is due to the parents that rushed to work and forgot to send their children to nursery nearby. For example, there is a case at Indera Mahkota, Pahang on 14th of August 2020 which the father forgot that his 9-month-old son, who should be sent to a nursery, was still on the car. The father only found out that his son was dead when he wanted to have a lunch [1]. Another similar cases occurred at Sungai Petani, Kedah two months ago which the father forgot that his 4-year-old son is trapped in his car with both car engine and window closed for 10 hours. His son suffered breathing difficulties and found dead around 6:30pm [2].

There is also a case occurs on last August at Andhra, India, which involved three 6-year-old children. They have been found dead due to suffocation after getting accidentally locked inside a car when they play with each other. These children are playing inside a car without their parents monitoring them, shows that this problem need a solution that can alert the parents that their children have been trapped inside a car [3].

This issue can be solved by using IoT Based Child-in-Car Safety Reminder, which can save children and babies' life. The system will alert their users or parents that their children is trapped inside the car

when movement from the human is detected inside the car. As the sensor detect human in certain range, it will send a notification to the user through an application to notify that their children is trapped inside their car and then they can pick their child to a safe situation.

There are several objectives that have been outlined in making this system. First, the system need to be developed with several circuit and IoT configuration. Other than that, this project objective is to test the functionality of the system after it is developed. Lastly, the objective for this system is to verify the performance of the developed system.

2. Materials and Methods

This section will present the methodology used to develop IoT Child-in-Car Safety Reminder. The first subsection will focus on materials used in this system, followed by block diagram of the system, flow chart and detail of each mechanism.

2.1 Materials

There are several materials that have been used in this system, which are:

- Microcontroller NodeMCU ESP8266
- HC-SR501 PIR Motion Sensor
- 3 resistors (220 Ω , 1k Ω and 2.2k Ω)

2.2 Block Diagram

The system of IoT Child-in-Car Safety Reminder is using several components such as ESP8266 microcontroller and HC-SR501 PIR Motion Sensor. These components are integrated with a phone application called Blynk, which can notify parents about their trapped children.

Figure 1 shows the block diagram for the system. There will only be five phases in this project, which is software development, hardware development, integration between hardware and IoT, system testing and the last phase is analysis and verification.

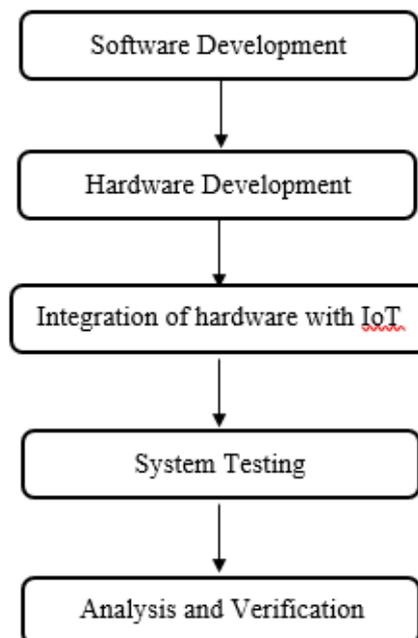


Figure 1: Block diagram of IoT Based Child-in-Car Safety Reminder.

2.3 Flow chart

To operate the system, a set of hardware components are combined in a circuit and soldered. After that, the code is constructed with integration to a phone application, and later uploaded to a microcontroller by using a software on computer. Lastly, the system need to be tested and troubleshoot if there is a fault in the system. The systems' whole process is explained in the flow chart as seen on Figure 2 below.

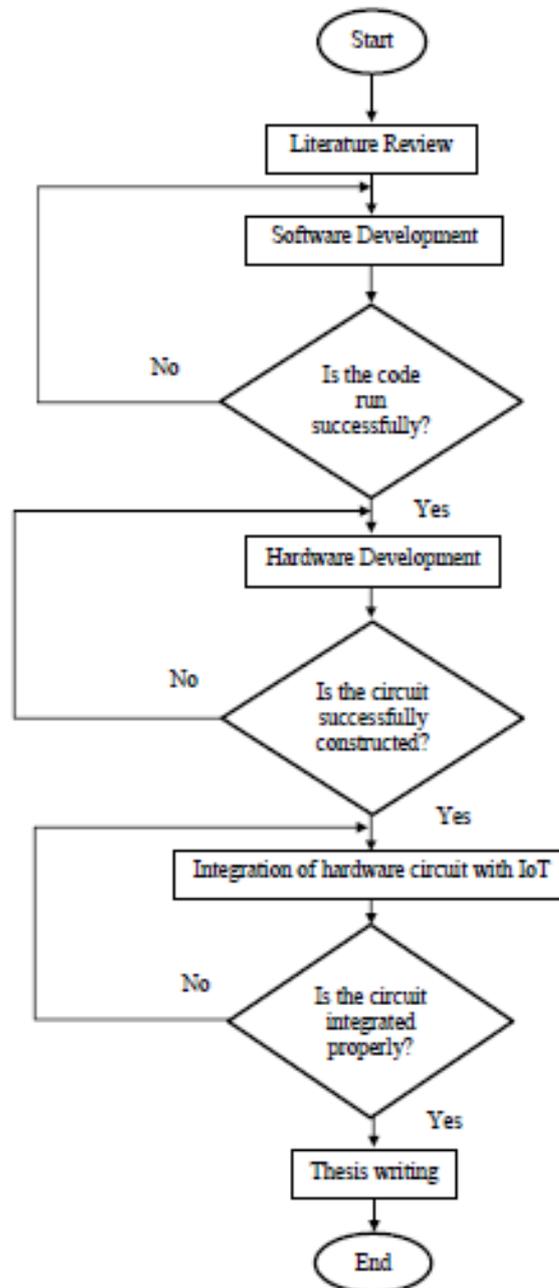


Figure 2: Flow chart of the system

2.3 Circuit Connection

Figure 3 shows the circuit connection of IoT Based Child-in-Car Safety Reminder. The connection will revolve around the microcontroller of the system, which is NodeMCU ESP8266.

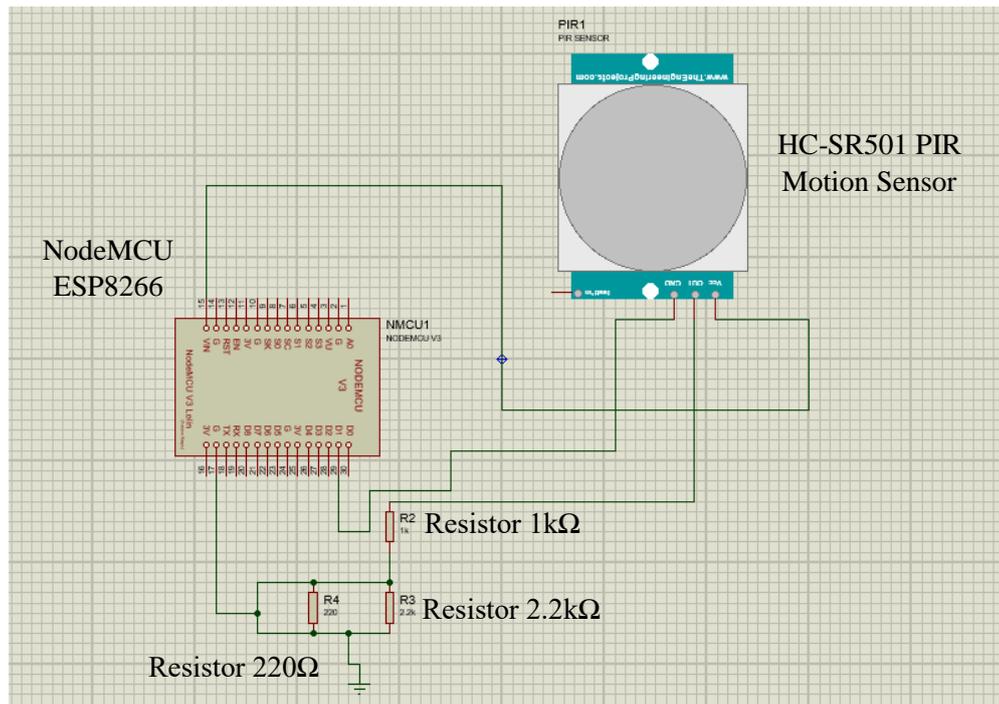


Figure 3: The Connection for IoT Based Child-in-Car Safety Reminder

In this figure, the connection of the system that have been constructed via Proteus software. This system consists of resistors, NodeMCU ESP8266 microcontroller and HC-SR501 PIR Motion Sensor.

3. Results and Discussion

This safety reminder system is a very useful system to ensure the safety of the child who is trapped inside the car. Parents can alert the presence of their children inside the car. By using this system, it can avoid death cases due to this situation. This system created and developed by used simple components that can be found in current market, making the troubleshooting process easier when there is fault in the system.

3.1 Software Result

Arduino IDE is the software that is used to construct, verify and upload program to the microcontroller. The program will need to be verified first, before uploaded to the system microcontroller. After all the program have no error, the program can be uploaded to the microcontroller. The system will work when there is a source applied to it and all the codes were uploaded successfully.

One more sign that indicated a successfully transferred program is that there is a flashed blue light from the microcontroller. The flashed blue light from the microcontroller indicated that the code is inserted successfully to the microcontroller.

Figure 4 shows the partial code used for this system. This code can set the condition of the system when there is movement in front of motion sensor, and instruct the mobile application to send notification towards parents. On this code, user can set the wi-fi that need to be connected towards the system by naming the wi-fi name and password on the code.

```

FMVQOHTV085PDY | Arduino 1.8.13
File Edit Sketch Tools Help

FMVQOHTV085PDY

#include <ESP8266WiFi.h>
#define BLYNK_PRINT Serial // Comment this out to disable prints and save space
#include <BlynkSimpleEsp8266.h>

char auth[] = "f_Ge1k_45nWV_gk7LX0S1JThpdBmlcc0";

/* WiFi credentials */
char ssid[] = "Dial-1188888888";
char pass[] = "1188888888";

/* HC-SR501 Motion Detector */
#define ledPin D7
#define pirPin D1 // Input for HC-SR501
int pirValue; // Place to store read PIR Value
int motionDetected = 0;

void setup()
{
  Serial.begin(115200);
  delay(10);
  Blynk.begin(auth, ssid, pass);
  pinMode(ledPin, OUTPUT);
  pinMode(pirPin, INPUT);
  digitalWrite(ledPin, LOW);
}

void loop()
{
  getFirmware();
  getFirmware();
}
    
```

Figure 4: Partial of code inserted to Arduino IDE have been successfully compiled

3.2 Hardware Results

Figure 5 and Figure 6 show the soldered circuit and system casing, respectively. The microcontroller, which is NodeMCU ESP8266 [4] is connected to other parts of the circuit such as resistor and HC-SR501 PIR Motion Sensor [5]. The system can be turned on by powering source towards the microcontroller. After the circuit powered by a source, the system will turn on and operate by referring to the code that have been uploaded.

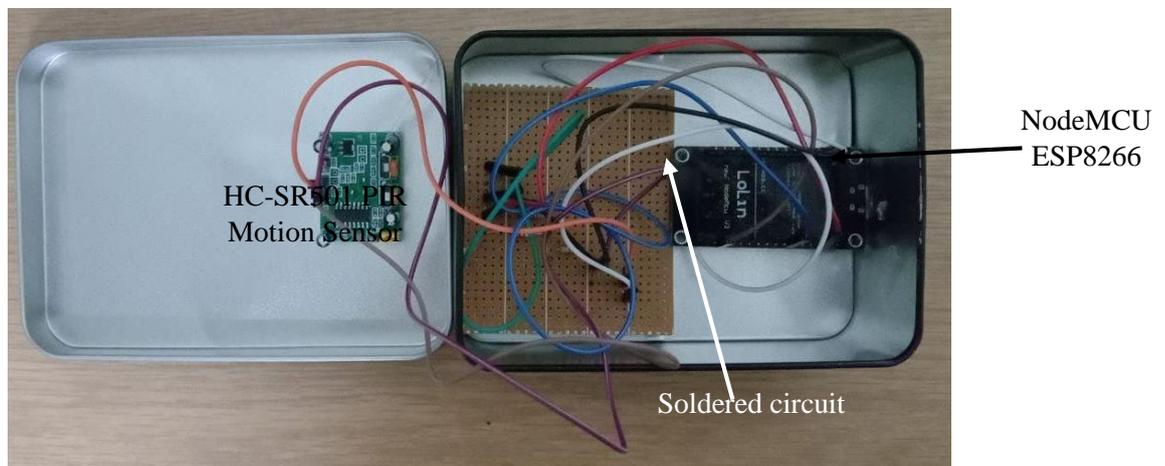


Figure 5: Circuit of the system that had been soldered



Figure 6: System casing

3.3 IoT Implementation

There is an IoT-based application that were used in this system, which is Blynk application. Blynk is a widely used IoT-based mobile application and can connect between phone and system through Wi-fi connection. It also will notify the user when there is a presence or movement from a child inside the car, that is detected by the motion sensor. Figure 7 shows the notification that will be send to user after the motion sensor detected any movement inside the car.

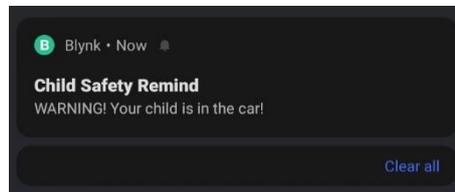


Figure 7: Notification that will appear on parents' mobile phone when the system detected the presence of the child.

3.4 Discussions

This IoT Based Child-in-Car Safety Reminder system consist of components such as resistors, NodeMCU ESP8266 microcontroller and HC-SR501 PIR Motion Sensor, which all the components had been combined in a small circuit. Then, this circuit combined with an IoT based mobile application called Blynk so that the application can notify parents when a movement of a child is detected on the camera of PIR motion sensor. Overall, this is a low-cost, family friendly system that implement modern IoT application and can be used as a safety measure.

4. Conclusion

Overall, the whole system of IoT Child-in-Car Safety Reminder was able to detect the movement of children inside a closed car. Besides, this system can notify the availability of children inside car by sending data to Blynk application on mobile phone and notify users. However, there is some limitation of the system, which is the motion sensor will not detect human movement who is far from the sensor. The positioning of the system will be very important in order to ensure that the system run properly. Other than that, the system itself can provide a secured system for the safety of children.

Acknowledgement

The authors would like to thank the Faculty of Electrical and Electronic Engineering, Universiti Tun Hussein Onn Malaysia for its support.

References

- [1] Harian Metro. 17 Feb, 2020. "Bapa terlupa, bayi tertinggal dalam kereta". Last accessed 14th Jan 2021. < <https://www.hmetro.com.my/utama/2020/02/545587/bapa-terlupa-bayi-tertinggal-dalam-kereta>>
- [2] Utusan Malaysia. 14 Aug 2020. "Kanak-kanak mati tertinggal dalam kereta". Last accessed 14th Jan 2021. < <https://www.utusan.com.my/berita/2020/08/kanak-kanak-mati-tertinggal-dalam-kereta/>>
- [3] ANI. 7 Aug 2020. "3 children trapped inside car suffocate to death in Andhra". Last accessed 14th Jan 2021. < <https://www.aninews.in/news/national/general-news/3-children-trapped-inside-car-suffocate-to-death-in-andhra20200807023257/>>