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Baby Car Seat with Warning System using IoT

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Abstract: In this advancement era, the bustling of daily schedule makes individuals particularly parents contribute to a lot of tragic cases that involve the death of children inside vehicle. This incident can happen because of parental carelessness therefore the ideas of this project are able to help by detecting and notify the parents regarding to the presence of a baby in car seat. The system designed will be having two separate boards consist of weight sensor with amplifier and two microcontrollers. By using this new transformation, it will send push notification to driver via mobile apps and guardian email. Thus, this project will become one of the new innovations of baby car seat according to our modern technology which are efficient, user friendly and conveniently used.

Keywords: Safety, Baby Car Seat, Warning

1. Introduction

Nowadays, people are too busy with their daily routine to support their family due to our country is rapidly developing into high technology. Apart from that work load also increasing until causes to pressure and at the end forget about everything even a simple task [1]. The entire mentioned above can be one of the reasons why a baby can be left unattended inside the car. In order to avoid this incident, "Baby Car Seat with Warning System using IoT" will be introduced in line with our current demands of technology.

This project will be an improvement from previous project and not being sold at the market yet. The differences are implementing a sensor that will be triggered then notification will be sending through mobile phone compared to the offline system via Bluetooth or alarm. So, this project will be slightly different in terms of system but the design of baby car seat remains the same.

1.1 Problem Statement

Lately, the top news story at television, radio and social media is about parent leaves a young child especially baby inside the car. This saddening incident can happened due to parent are careless, lack of attention and busy with their commitment [2]. Typical people always said "left them just for a

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minute and there is nothing can happened" but because of a minutes anything can happened in the blink of an eye [3]. Throughout research until now, there is still no baby car seat with warning system that are implementing by using sensor and IoT. This triggered the need to build and develop an innovation of baby car seat to fulfill the demand. Even a branded and high quality also still has a lacks in some way to satisfy the user.

1.2 Objectives

The purposes of this project are:

i. To develop a baby car seat warning system for a vehicle.

ii. To build a device that can detect the presence of child in a baby car seat.

iii. To design a device that can send messages to parents when their baby left unattended in the vehicle.

1.3 Scopes

To fulfill the stated objectives, the scopes of this project are:

i. This project will be using 10kg of load cell sensor, HX711 load cell amplifier, Arduino UNO, ESP32 microcontroller and the notification will be sending to the user and guardian too.

ii. For the experimental setup, the baby in a car seat and the driver had been setup by using 1.5kg of mineral bottle and 5kg of dumb bell. It had been scale down to 1:0.5 for baby while 1:0.1 for the driver.

iii. The notification will be sending continuously for every 60 seconds for 10 minute to the user through Blynk Apps and guardian through an email.

2. Methodology

2.1 Materials

One of the most recently used and top listed in communication system in the present universe of innovation is Internet of Thing (IoT). To build a warning system using IoT, there will have 3 parts consist of input, microcontroller and output called as user interface as below:

i. Input:

   a) Weight sensor: Trigger and detect the presence of driver and baby either inside or outside of the car

   b) HX711 Load Cell Amplifier: Calibrate and amplify to gain an exact value of human weight to avoid false error

ii. Microcontroller:

   a) Arduino UNO: Read the data and value from sensor then transfer it into ESP32

   b) ESP32: Receive the data from Arduino UNO and act as Wi-Fi module to send push notification to driver and guardian

iii. Output (User Interface):

   a) Smart phone: Driver get notification via Blynk apps and guardian will receive warning email.

2.2 System Flowchart

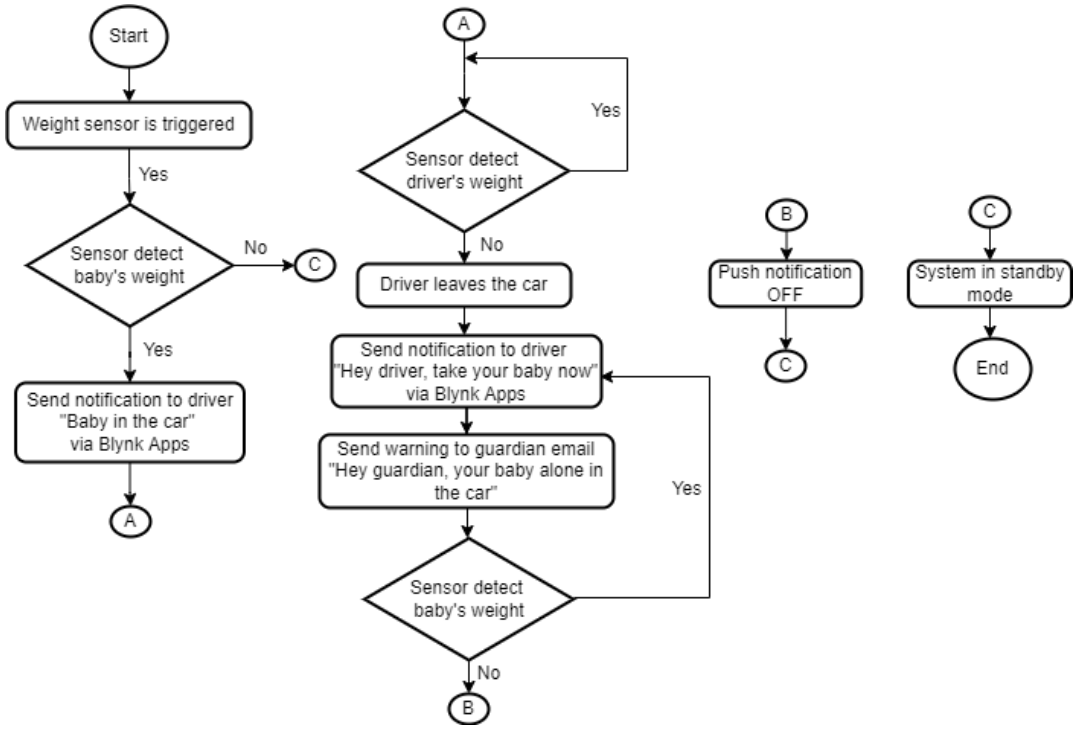

Figure 1: Flowchart for overall system

Based on Figure 1, the system starts automatically after driver start the engine and followed by baby being detected on the seat when weight sensor is triggered. Meanwhile the driver car seat will be only triggered and functioned when driver is on and outside of the car seat. But in this project, the driver is assuming as 5.0 kg of dumb bell and baby is 1.5 kg of mineral bottle respectively. Firstly, the weight sensor will sense the presence of baby in car seat. When the baby is detected, it will directly send one-off push notification to driver “Baby in the car” via Blynk Apps as a soft reminder to driver that he/she is brings a baby along together. If not, the system will be in standby mode.

Then when driver out of from the car, it will send notification to driver “Hey driver, take your baby now” via Blynk Apps and guardian will receive warning email shows “Hey guardian, your baby alone in the car. Call driver now!” Both notification will always pop-up every one minutes with the maximum of time is 10. When driver has saved the baby successfully, the system will stop sending any notifications to driver and guardian too. Then, the system will be in standby mode which is the system always in get ready condition according to the presence of human weight. Lastly, this project will be using USB cable port attached to the car where it is supplied by car engine and when the engine is stop, battery will take over their turn to run the overall systems.

2.3 System Block Diagram

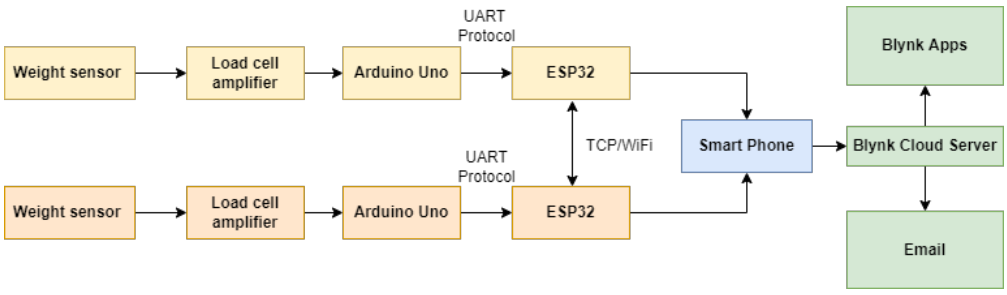

Figure 2: Full block diagram

Figure 2 shows that there have two separate of boards and how the system worked after the weight of baby and driver are detected. But in this project for prototype purpose only where the baby is replaced with 1.5 kg of mineral bottle and the driver is replaced with 5.0 kg of dumb bell. Basically, the boards will be placed under driver and baby car seat separately but they are connected to the USB port in the car as power supplied when the engine is ON and battery 9V is used when car engine turn to OFF condition. For input, weight sensor (up to 10.0 kg) is used to detect how heavy of the human and able to identify of weight changes over time beside it is compatible with all the component used. For calibration, HX711 load cell amplifier is required to amplify the value into an appropriate value. Next, the output from sensor will be achieved through Arduino UNO then directly transfer the data into ESP32 by using UART protocol which is multi-cross function of Tx and Rx. So, ESP32 will act as Wi-Fi module where becomes an interpreter of the signal received to the driver and guardian smart phone. To communicate between both boards, TCP/Wi-Fi is used where baby board as TCP client and driver board as TCP server.

After they successfully connected, push notification will be sent to driver through Blynk Apps and warning to guardian email according to the condition that has been setup. All of the data will store into Blynk Cloud Server. Lastly, the condition mentioned are when baby is sitting on the car seat, it will send one-off notification only to driver. When driver left the car, push notification through Blynk Apps to driver and guardian email will be sent every 60 seconds within maximum of time is 10 minutes.

3. Results and Discussion

3.1 Results

Figure 3: Full prototype of hardware connections

Figure 3 above shows the overall of experimental setup consist of two board where baby board and driver board. The component used for both boards are same that contains 10.0 kg load cell sensor, HX711 load cell amplifier, Arduino UNO and ESP32 microcontroller. As for experimental setup only, 10.0 kg load cell is chosen due to their availability of stock in market with the affordable price, suitable for prototype purpose and compatible with the chosen microcontroller. Then, 1.5 kg mineral bottle and 5.0 kg dumb bell as baby and driver in the car seat as well. For baby, 1.5 kg of mineral bottle is used due to the scale down to 1:0.5 meanwhile 5.0 kg of dumb bell for driver is 1:0.1. Besides, their calibration factor used also has high accuracy where able to avoid any false error detection. Lastly, this project can be applied and set up under baby and driver car seat as well as load cell sensor will be triggered then notification will be sending through Blynk Apps for driver and warning email to guardian every 60 seconds with the maximum of time is 10 minutes.

3.1.1 Case 1: When driver and baby is sitting on car seat

Figure 4: Baby and driver are sitting on their car seat

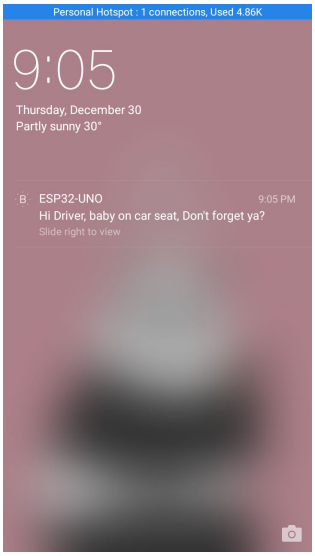

Figure 5: Pop-up one-off notification to driver only

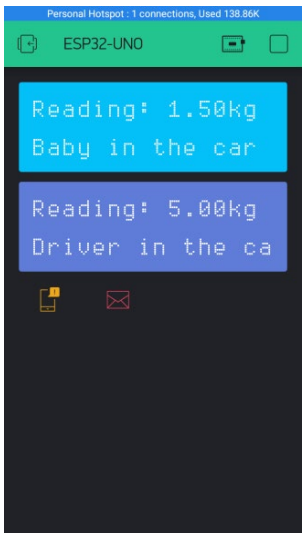

Figure 6: Interface inside Blynk Apps

3.1.2 Case 2: When baby was left alone inside the car

Figure 7: Driver not in the car and baby left alone inside the car

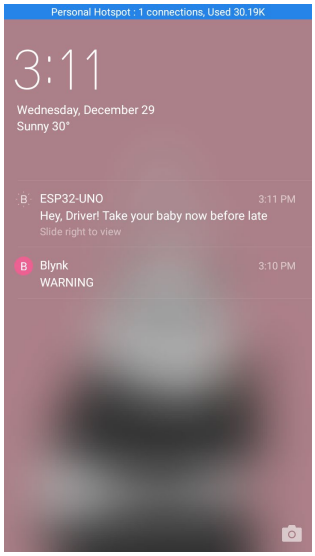

Figure 8: Pop-up push notification to driver phone and warning email to guardian

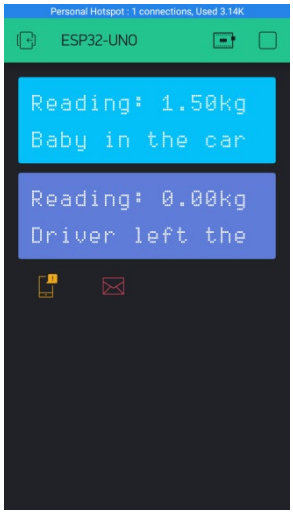

Figure 9: Interface inside Blynk Apps

3.2 Discussions

Based on all figure above for two cases shows that warning system was successfully built because able to send notification not only to driver but other guardian too. For case 1 (refer Figure 4 & Figure 5), the condition is starting by driver ON the engine and weight sensor under baby car seat is triggered so driver will receive one-off push notification as soon as possible through Blynk Apps. At GUI interface inside Blynk Apps will appeared as shown in Figure 6 where weight of baby and driver is detected.

Then for Case 2 (refer Figure 7 & Figure 8), the weight sensor under driver is not triggered but at baby car seat the sensor still triggered so the system will automatically send notification to driver through Blynk Apps and at the same time guardian will receive warning email too. At GUI interface inside Blynk Apps will appeared refer to Figure 9 which is weight baby is detected but the driver is not. Both of these notifications will be repeated every 60 seconds within a time maximum is 10 minutes. Then, it will stop sending when the driver has saved the baby from car seat successfully. Lastly, the overall system for this prototype is in standby mode as well as always in a state of get ready condition and once the presence of human weight is detected it will be triggered.

3.3 Data Analysis

Table 1: Table of data analysis

Case	Condition 1	Condition 2	Outcome
1	Driver (YES)	Baby (YES)	Only driver got notification
2	Driver (NO)	Baby (YES)	Driver got notification Guardian got email

Table 1 is about two conditions for two cases in form of table to summarize and easy to analyze the comparison among them based on the result obtained. Thus, the analysis is achieved the main objectives and scopes of this project because of the prototype is working and function well.

4. Conclusion

In short, this project known as “Baby Car Seat with Warning System using IoT” is relevant to be designed because it can give a big impact and huge contribution to society especially driver, parent and baby itself. Plus, this project has achieved main objectives and scopes of the project which are to warn that a baby has been left unattended in the vehicle, build a device that can be installed easily in any types of baby car seat and design a wireless device that will triggered by weight sensor and send message to notify driver and guardian too.

For future recommendation, this project surely can become greater project by adding some sensors and collaboration between mechanical and electronic working principle. By addition of mechatronic system, the project can achieve a maximum level of safety and more details. Plus, the car can be equipped with something that will have more functions and benefits either to driver or others.

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