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Design Project User and Product Manual

Safe Baby™

Submitted by:

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Table of Contents

List of Tables

List of Acronyms and Glossary

Table 1. Acronyms

Acronym	Definition
SB	The Safe Baby™ device.

Table 2. Glossary

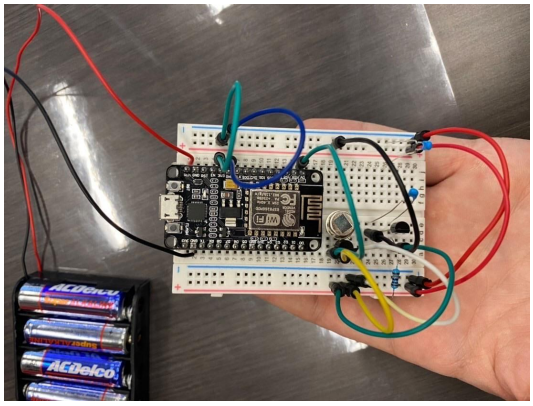
Term	Acronym	Definition
Medium Density Fiberboard	MDF	Material similar to plywood, can be used in a laser cutter

Introduction

This User and Product Manual (UPM) provides the information necessary for users, clients or anyone who wishes to modify the product to effectively use and understand our Hot Car Emergency product, Safe Baby™ (SB), and for prototype documentation. This document contains everything we did throughout the term and shows how we did it, from the design, prototyping, coding, building, costs… Its purpose is to help you understand and figure out how to use our product in case you want to use, maintain, modify or reproduce our product.

Overview

We understand that parents have a lot on their minds and that it can be easy to forget a child in a car. This device's purpose is to minimize the amount of youth deaths caused by heat strokes, hypothermia, and/or carbon monoxide poisoning while a young child is locked in a hot car for a long period of time. Our affordable device is easy to install and has 2 sensors, a motion detector and a thermal detector, which are able to detect a child's presence in a hot car and send a notification to the parent when concerning levels have been detected.



Cautions & Warnings

The device has been designed to be waterproof and stain-resistant with clumsy kids and their snacks in mind. However, the inside circuitry is not waterproof hence parents are advised not to open the outer case if there is food, drinks or kids in the vicinity. Additionally, we know that

our device was created with materials that can withstand high temperatures of heat that are fatal to humans however we have not tested the maximum temperature it can withstand.

Set-up

SafeBaby's simplistic design was created with busy parents who aren't fancy engineers or builders. We wanted to make sure that all parents would be able to install this in their cars and that the installation would be quick.

Before installing the device in the car, you need to check the battery. Our devices come with a rechargeable battery source so you will need to double check that the batteries are completely charged or else you will need to charge them. To install the device in the car, connect the velcro rings at the end of the straps to the rods of the head rest of the driver or passenger seat (depending on the child's position). Make sure that the device's opening (the cut-out rectangular section where the sensors are visible) is facing the child or dog.

To be able to receive notifications, you need to download the *Pushbullet* application on any devices you plan to receive your notifications on. You will need to create an account by following their instructions and then you will be able to connect your devices.

User Access Considerations

This product is compatible with all car models around the world. It only requires attachment to a simple headrest. Buyers may include pet owners, parents, or other caregivers. The device is very simple to install, any of the listed buyers will be able to complete this. Users also consist of children and pets, as this product's goal is to detect their presence in a car. However, if one has very limited fine motor skills, they may struggle with the velcro attachments. In this case, we recommend having someone else help with installation.

Our device is always turned 'on' so parents don't need to remember to turn the device 'on' and 'off' every single time they are going for a ride.

Our device is made with affordable materials because we wanted to make sure that the device would be accessible for parents of all income levels all around the World.

Using the System

Our system operates in a straightforward path. Since the device is always turned ‘on’, the sensors are always able to detect their specification. If concerning levels are detected by both the temperature sensors and the PIR motion sensor, an output is sent to the Arduino chip in the SafeBaby device which is coded to send an output to the Pushbullet app which sends a notification to all of the devices that have been connected to the app.

Troubleshooting & Support

We acknowledge that our company doesn’t have much experience in creating devices however we believe that our multiple prototyping and testing stages until successful are proof that our device is up to safety and user standards. However, in case of a malfunction, users can contact us for advice on how to proceed.

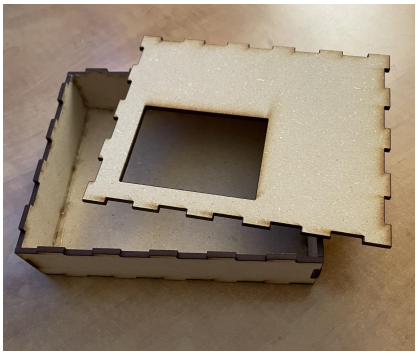
Maintenance

As previously mentioned, our device operates on batteries, in order for the sensors to continuously function correctly and pick up any movement/extreme temperature change the batteries should always be charged. Of course, if the circuit malfunctions it should be fixed and tested again to make sure it is functioning correctly. The code should not require daily change but in case the range of motion requires changing or the maximum temperature these can be modified.

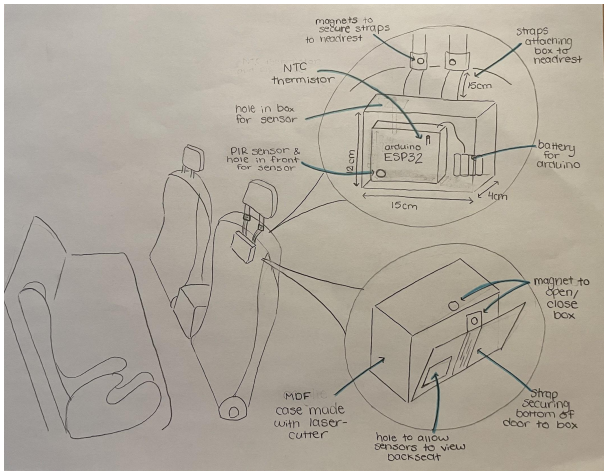
Support

In the need for emergency assistance, the authorities should be contacted such as the police station or the fire department. Or else, users can contact us through safebaby-help@sb.ca or visit our website www.safebaby.ca.

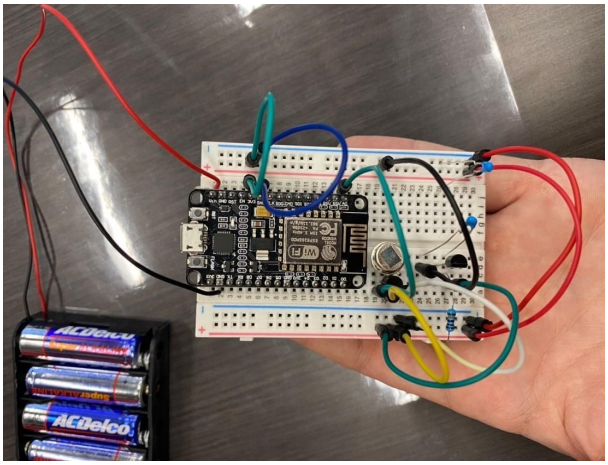
Product Documentation



We laser cut an MDF box in our university's lab for the case which held our components based on a device we created virtually on the website Maker's Case. The box measured 15cm x 12cm x 4cm and used finger edge joints. This material worked well when attaching our straps and velcro, as it held hot glue well. Our other prototype was made of black acrylic, however this did not hold glue well and the colour allowed it to absorb too much heat. We used black felt for the straps attaching the case to the car headrest, and the latches to open and close the box. This material is not strong enough for a final product. We would recommend using sturdy straps that are the same, or similar, material to a car's seat belt. To latch the felt together, we used velcro. We found this material to be effective and strong enough to hold the case up and together. In past prototypes, we considered using metal clasps, however they were less cost-efficient, and more difficult to glue onto our felt straps.



This is the circuit that we created to be put inside the SafeBaby case. It contains an Arduino ESP8266 chip, 2 thermistors, a PIR motion sensor, a battery source and many wires.



BOM (Bill of Materials)

Below you can find a list of all the items we used in making our device:

Cost Estimation and Bill of Materials:				
Component	Description	Amount	Unit Cost($)	Total Cost($)
Wires	Always in need of wires.	4	0.10	0.40
The Arduino case- laser- cut MDF	Plastic casing that covers the arduino, outer case will be laser-cut	1	2.50	2.50
ESP32 - Arduino+	Containing the arduino board, breadboard,some wires and transistors.	1	10.94	10.94
NTC Thermistor	Probes used to measure changes in temperature.	2	0.83	1.66
Batteries	Used to power the system.	4	1.00	4.00
PIR motion sensor	Inside case, to detect motion of child	1	4.86	4.86
Magnets (pack of 6)	To secure straps to headrest, and close / open box	1	1.25	1.41
Fabric for straps	Glued to outer casing to attach to headrest	1	Free (using recycled material)	0
			Overall Cost :	$37.73
			Allocated Budget:	$50.00
			Money left (in case of emergency):	$12.27

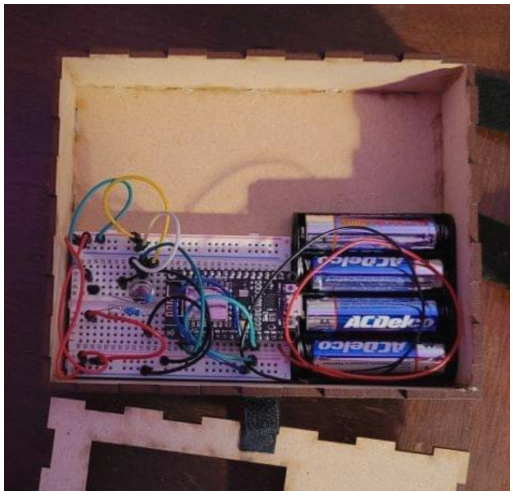
Equipment list

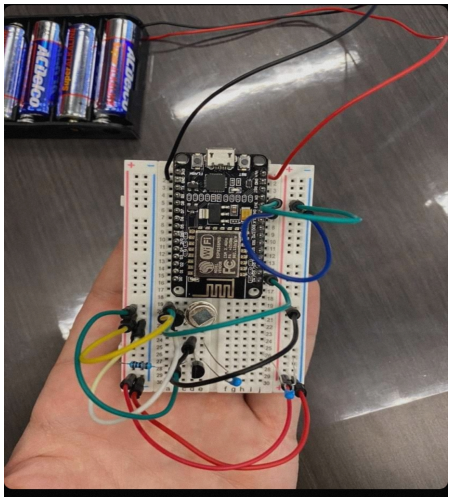
1. Esp32 - Arduino board with wifi/bluetooth capabilities.
   https://edu-makerlab2021.odoo.com/shop/product/esp32-111?search=esp#attr=233
2. Ntc Thermistor - Probes that are used to measure surrounding temperatures
   https://edu-makerlab2021.odoo.com/shop/product/ntc-thermistor-138#attr=
3. Batteries - Used to battery.
   https://edu-makerlab2021.odoo.com/shop/product/battery-90?category=5#attr=167
4. Magnets https://canada.michaels.com/en/default/10307908.html
5. Strap fabric
   https://canada.michaels.com/en/solid-cotton-fabric-by-loops-and-threads/M10411660.html?dwvar_M10411660_size=18%22%20x%2021%22&dwvar_M10411660_color=Pink
6. PIR sensor - sense the presence of a child to activate the system
   https://edu-makerlab2021.odoo.com/shop/product/pir-sensor-46#attr=

- We also used a laser cutting machine

Instructions

As shown above, almost all the websites that were mentioned were used, like the tinkercad for the coding and the makercase for the box. when it comes to the coding, it is preferred to follow the build up shown in the photo below:





Conclusions and Recommendations for Future Work

It is important we carry all the lessons we learned throughout this project with us into all future endeavors, both in engineering and everyday collaboration. Firstly, we must maintain a strong sense of teamwork & conflict management skills. We also learned to prioritize our team meetings for organization and effective communication. In the future, we would also recommend asking more questions all throughout the process when needed. We only asked for help later on when our prototypes weren't working, however guidance throughout all steps would have been helpful, and led to better success earlier on. In the future, we will also finish all deliverables ahead of time. In doing so, we would have allowed more time for editing, refining, and prototyping near the end of the project.

If we had a few more months to work on this project, we would have added a carbon monoxide sensor. This would protect pets and children from this factor along with the extreme temperatures. We would have also incorporated parts of the car into our design. For example, our client expressed that having the car windows roll down in the case of extreme heat would have been desirable. However, we did not have the time to incorporate this into our design for this project.