Summary/Intro (Kate)

SafeBaby is the perfect device for busy parents who live in areas where the temperature can rapidly increase to fatal levels.

We understand that parents have a lot on their minds and that it can be easy to forget a child in a car. 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.

Design process

- Empathize (Kate)

The first stage of the design process is empathize. Our task is to better understand why our client wants this certain product created as well as to determine their wants and needs when it comes to this product. In our first client meeting, our client talked about the increasing amount of youth hot car deaths in his native United Arab Emirates and explained that he was looking for a product that would be able to help reduce the amount of youth hot car deaths internationally.

- Define (DelivB) (Belle)

In the define stage, we must identify our client's specific needs from the information that we gathered during the empathize stage. This will help us accurately define our goals, and establish possible designs later on. In our case, we identified our client's needs as the following:
product must compatible with all car models,
must be compact and able to fit in every car model while still leaving enough space for the passengers,
material for the product must be capable of withstanding extreme high and/or low temperatures,
power source cannot rely on car, in case of malfunctions,
should include an additional alarm system for the public (in case parent does not respond),
must be cost-efficient for families with varying incomes,
and the product must work for both pets and children of various ages.

From this list, we came up with the following problem statement:

Problem Statement: Our client wanted a device that would alert parents (or the public) of the presence of a young child in a hot car. This device's purpose was to minimize the amount of youth deaths caused by heat strokes, hypothermia, and/or carbon monoxide poisoning while a young child was locked in a hot car for a long period of time. Additionally, the client had the intent of selling this product globally so the design should have been compatible for installation in all types of car models as well as low cost so that it would be accessible to parents of all income levels.

- Ideate (DelivC) Ziad
    - Solution options & chosen concept (why/how)
    - Decisions made

For the design criteria step, we ranked our client's needs by priority, researched and benchmarked similar products on the market and identified the technical benchmarks and constraints that would be needed to know prior to creating our prototypes. Our device's functional requirements are its ability to sense a child's presence in a car and its ability to sense when a car is turned off or when the driver leaves. The

non-functional requirements would be a long product life, high reliability, nice aesthetics and its ability to be easily cleaned. Our constraints were the cost (because we want to use materials of the best quality however we also want to make the device accessible to all parents), the size of the device (so that parents with all car sizes can use it and so that it doesn't interfere with everyday car rides), the operating conditions (it should be able to function well in hot environments) and the weight (so that it doesn't interfere with everyday car rides).

We surveyed parents and pet owners to find out what they would look for and/or want in a device such as this. Some were concerned about the device's ability to be adjustable to different cars, a discrete design that wouldn't get in the way of everyday life and one that would be easily cleaned in case of messes. We did our best to incorporate these pointers into our design.

Additionally, we conducted research on existing products like ours. We found 3 similar existing products on the market; Cybex's SensorSafe, Kids and Cars's Waze app and Driver's Little Helper sensor system. We listed their specifications like cost, additional needs, compatibility with cars, its sensor capabilities and when alerts are sent. Based on our calculations, we found the Driver's Little Helper sensor system to be our strongest competitor on the market. However, this device was only made for young infants, and not for pets or older children. On top of that, the device costs $80.00 in comparison to ours which costs $40.00. With all this in mind, we planned to create a device that was versatile for both children and pets, compatible with all car types and more cost-efficient considering ours is half the price.

- Prototype (Evanna)
    - Trials and tribulations

In this step of the design process we are implementing the ideas and sketches we came up with in the ideate stage and creating prototypes. The importance of this stage is to reduce uncertainties, risks and receive feedback from the client.

There are different types of prototypes that could be constructed, your prototype can either be a focused or a comprehensive prototype,and the difference is that the comprehensive prototype contains most if not all of the aspects of the device and the focused prototype is concentrated on one aspect of the device.

A prototype can also be either physical or analytical and the difference between those is that the analytical is usually designed on a software website that is based on the mathematical aspect, this type is much cheaper to create in the earlier stages of prototyping as you can design and test the dimensions without using material.The physical prototype is when we construct a physical product that is used for testing purposes.

It is important to present the client with a comprehensive physical prototype after rigorous testing, that explains how the product would look and function when finalized.
Following the clients feedback modifications will be made to the final prototype were possible

Applying the information mentioned above we created 3 prototypes in total. The first prototype was a focused physical cardboard box that mainly represented what the outer shell of the device would look like and its interior functioning like how the device would be displayed in the car and the dimensions of our product. As for the coding we took an analytical approach and started working on a website called tinker cad. By testing our first prototype we came to the conclusion that we needed more sensors on our

devices and that the length of the straps needed to be elongated in order for the device to cover more of the back seat. And with that we started working on our second prototype.

The next prototype involved the laser cutting of a material called acrylic which created our black box and we included the necessary modification we faced in the first prototype after rigorous testing and with that we were ready to present the prototype to the client for feedback.

Following our meeting with the client and the feedback we received such as material and colour of the box we managed to change those features for our third and final prototype. Which now consisted of a wooden material called medium density fiberboard (MDF) and built the circuit and uploaded the code for our sensors which we finally connected to the phone app.

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Test (Kymani)

In the design process, the testing stage is a vitally important step, as it helps show the positive and negative aspects of the prototype made in the last stage. We want to test the multiple different moving parts of our prototype by putting certain conditions that would mirror the conditions seen
to figure out what works, but more importantly to figure out what DOESN”T work and why it doesn't work. This will allow us to determine what issues we have to work on once we go through the design process again, to see what needs to be improved or worked on to ensure that our client gets the best version of our product.

So for our prototype, we decided to test the three major components of our design; the box that holds our components, the pir/motion sensors, and the temperature sensors. We would test them out individually and then later combine all the processes to determine what
When we started testing our prototype, one of the major aspects we tested out were the sensors. We wanted to check

Kate: To test those, we used a blow dryer to replicate heat and our own bodies to replicate movement. Additionally, we tested for conditions that were possible with a child or pet in the car but weren’t vital in our final device like the device’s ability to be cleaned easily in case of food or water spills or the straps durability with excessive movement. We replicated those conditions with water, apple sauce and by pulling on the straps when they were attached to the seat. Not all of our tests were successful with our first prototypes however by the end, they were all successful.

Final Product (Ziad)

Our device is an enclosed MDF box that contains a breadboard with an ESP8266 chip, 2 thermistors, 1 PIR sensor, a battery source and a couple of wires. We designed the box on a website called MakerCase, uploaded it on InkSpace and had it cut in the laser cutting machine in our campus’s MakerSpace workshop.

Why ours is better (Ziad)

We believe that our device is the best one on the market because it is the only one that is able to send push notifications to a parent’s phone immediately upon detecting a child’s presence in a hot car. Our detection and alert system has the fastest response rate and we know that quick responses are crucial during hot car emergencies because every second matters when saving a life. As a plus, an unlimited number of devices can be connected to SafeBaby, allowing multiple family members to be notified in case of an emergency.

Demonstration (Kymani):
Now, here is the part of the presentation that we've all been waiting for. Let's test our device out! To replicate the event of a child stuck in a hot car, I will be using my arm to replicate a child's motion in the car and using my blow dryer to replicate heat.

*Kymani moves arm in front of device and waves blow dryer in front of device
*Kymani receives phone notifications and shows it

Reflection/Conclusion (Kate & Belle)
As the semester comes to an end, here are some of the lessons that we learned throughout our whole design process (Kate)

- Teamwork
  - Relying on your teammates
  - Fostering a supporting and positive team dynamic
- Time management
  - Making sure that we complete all of our assigned subtasks on time so that the project can run smoothly and so that we are on time with the planned progress of our project
- Importance of truly understanding what the client wants
  - Because at the end of the day, even though we are the ones creating the product, the product is made for the client based on their wants and needs
- Importance of following a plan (design process)
  - We learned about the design process in our lectures and it has been really vital in keeping on track and organized because it helped break down the design process into smaller more specialized step
- All ideas are important
  - The more the better even though some might sound crazy
  - It's okay to look at competitors products and to use their favourable features to inspire our designing
- Importance of testing
  - To ensure that our final product will be able to withstand all possible conditions that it might face once the user buys it

Future work (Belle)

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.

- Keep up the good sense of teamwork & conflict management skills
- Prioritize our team meetings for organization and communication
- Ask questions all throughout the process when needed
  - we only asked for help later on when our prototypes weren't working
  - Guidance throughout all steps can be helpful
- Finish all of the deliverables ahead of time
  - Would have allowed more time for prototyping near the end
  - Allows editing and refining
- Utilize design process
  - Helpful guidelines when designing anything in life