



BLOOD PRESSURE MONITOR TEARDOWN

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Background

Teardowns are a key activity in reverse engineering a product. There are many reasons why they are done, such as for competitive benchmarking, growing engineering knowledge, and developing new concepts



Assignment

In this assignment, we were tasked with doing a thorough teardown of a blood pressure monitor, 3D modeling all of the parts, and reassembling it in SolidWorks





PART 1: USER & USE OF PRODUCT

User Centered Design

What does the internet say about this product?

Resources

- [Quick-Start Guide](#)
- [Instructional Video](#)

Product Reviews

- “As an ER nurse for 30 years I would recommend this blood pressure machine to anyone who is able to use an upper arm cuff as I personally do not like the wrist cuffs due to potential accuracy issues.”
- “I got this for my grandfather whose vision isn't the best. The font on this BP monitor is nice and big and you can even turn on an option to have it read the BP out loud.”
- “Received the package in good time, looks ok, etc...but I seriously don't have the patience to fart around trying to reset the date, the time, and whatever else this thing is said to do.”

Intended Audience

Older adults, users with high blood pressure, users who need constant monitoring not intended to be used in a healthcare setting; to be used at home, alone

Packaging & Device

Packaging

- Small box with easy-open pull tab
- Fresh clean white font; not many warning labels
- Doesn't rattle when shaken
- Small illustration of the device lets users who may be expecting multiple packages/devices know what is inside the box
- Blue from inside the box is visible from the outside, makes the packaging look fancier than just plain cardboard
- Greeted with a "congratulations!" and a happy, calm blue upon opening

Device

- Short quickstart manual on top with large font on guide pages (easy to read)
- Protective plastic with logo containing device
- Protective film covering screen with a link for (instructional video)
- contact info is clear on product
- Peel-away informational stickers on body of device
- Light gray felt strap with sewn-in plastic graphic instructions
- Battery container is slide-away and easy to open

First Use

What was obvious?

- Assembly was obvious but how to use it was not.

Were instructions used?

- Even though there were instructions on the device not to put in on like a watch, we did it anyway because it is habitual to wear a device in that way
- It is tempting to not read instructions because the product doesn't look super complicated and reading instructions are often annoying and tedious

Wearing the device

- The wristband fits a wide range of wrist sizes comfortably

Using the device

- Three raised dots on battery section give grip and indicate sliding motion (also do not require screwdriver)
- Blue light up screen (can be used in the dark, though buttons do not light up)
- Larger numbers make it easy for patients with poor vision to read
- Color scale makes it easy and intuitive to understand what your pressure score means
- Mem button - goes back in memory to find old scores (here is a way to delete blood pressures from memory, but it isn't intuitive)

Knowledge Elicitation / Observation

Affordances:

- graphic on the side shows users how to put on the monitor and how high to hold it up
- buttons afford clicking
- screen/color spectrum affords visualizing data
- velcro affords fastening

Visual Cues:

- the large size and label of the “start” button indicates how to start
- the wrist shaped hole made by the strap indicates where to attach

Physical Interaction:

- The device is fastened to the wrist via the strap

Adjustments:

- The strap can be loosened or tightened

Off-Nominal Use

Examples:

- As a medical/diagnostic blood pressure monitor
- As a heart rate monitor

Successfulness of product:

- Not very well, it is prone to false high readings, which we noticed during our initial testing, and which were noted by several Amazon reviews

Product Toleration:

- Use as a diagnostic blood pressure monitor does not place excessive stress on the device
- Use as a heart rate monitor does not place excessive stress on the device, other than being used unnecessarily frequently

CONOPS Analysis

What is the intended use?

The Bluetooth Blood Pressure Monitor Wrist is an easy-to-use, portable blood pressure monitor built for home use. It is simple, intuitive, and high-functioning.

Who will use it?

The product is designed for home use as it is small and portable. It is not designed for people in the professional healthcare industry as doctors offices and other clinics would have access to bigger and better-quality devices

How will it be used?

This product can be used by wrapping the wrist strap around the wrist with the screen on the palm side of the hand. The strap can be adjusted for differently sized wrists. Press the start button to start the device operations. Hold the monitor at about chest level until the device stops calculating your blood pressure. The device will then display your systolic and diastolic blood pressure as well as your heart rate.

Under what conditions will it be used?

Doctors may recommend it to patients who may want to monitor their blood pressure every day. There is no need for them to come into the office to do this if they can just do it at home with this monitor.

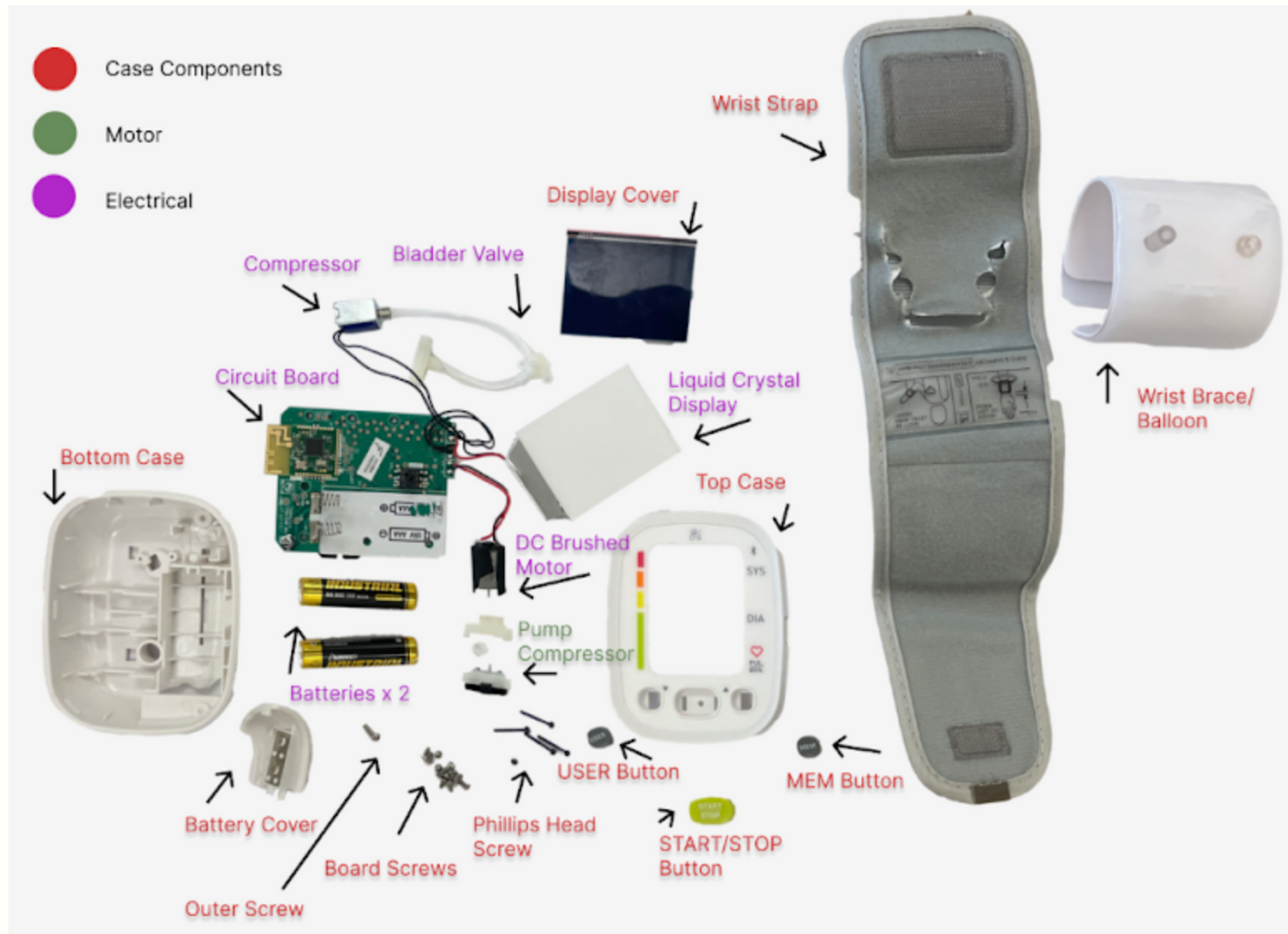
Blood pressure can be taken at multiple points throughout the body, including the wrist, arm, and head. Often, at the doctor's office blood pressure monitors squeeze around the arm cuff, as it is the most reliable read.

However, there are instances where people cannot use an arm monitor, such as iff their arm is too big or if they had lymph nodes removed. In these cases, wrist monitors can be good.



PART 2:
PRODUCT
DECOMPOSITION

Decomposition



Function Structure: Black Box

Legend:
Blue > Information
Red > Energy
Green > Materials

Inputs

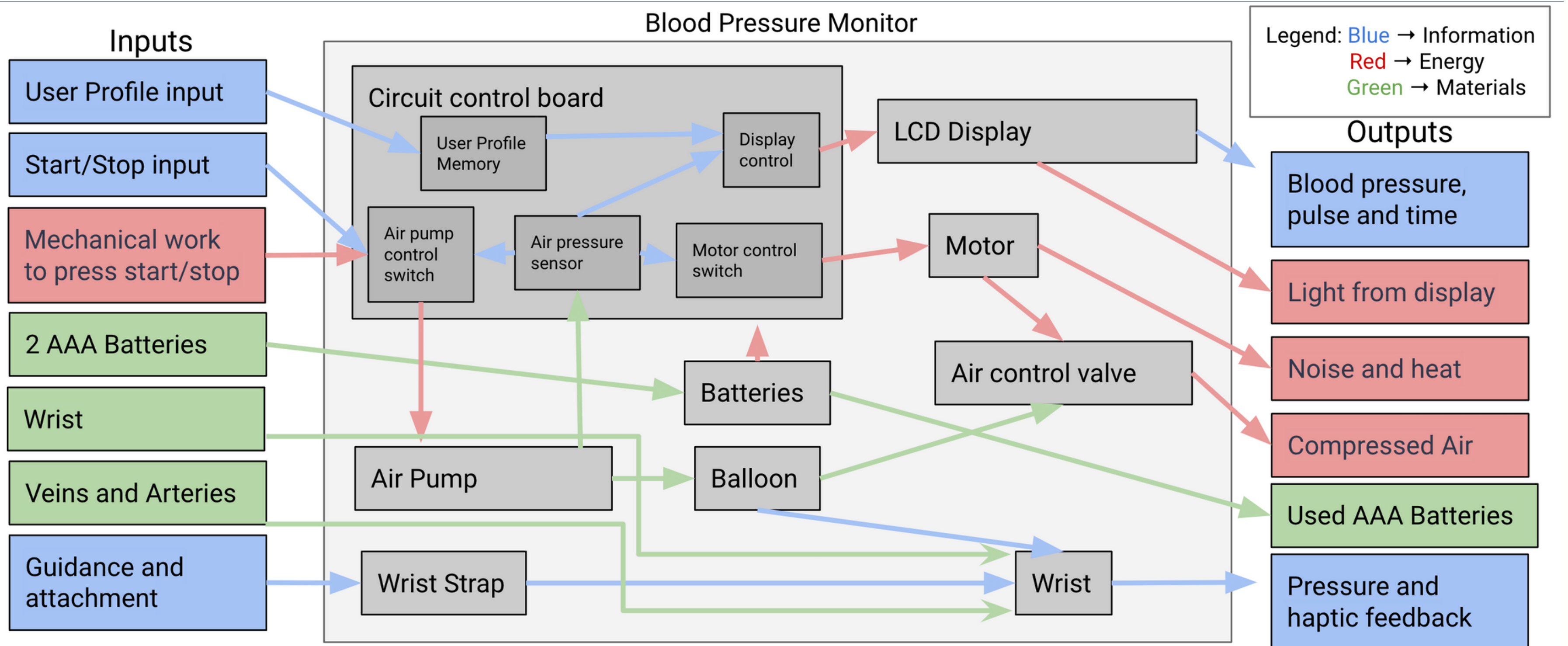
- Attachment to underside of wrist
- User selection
- Cardiovascular data
- Start stop button press
- Mechanical work to press start/stop
- Veins/arteries in wrist
- 2 AAA Batteries



Outputs

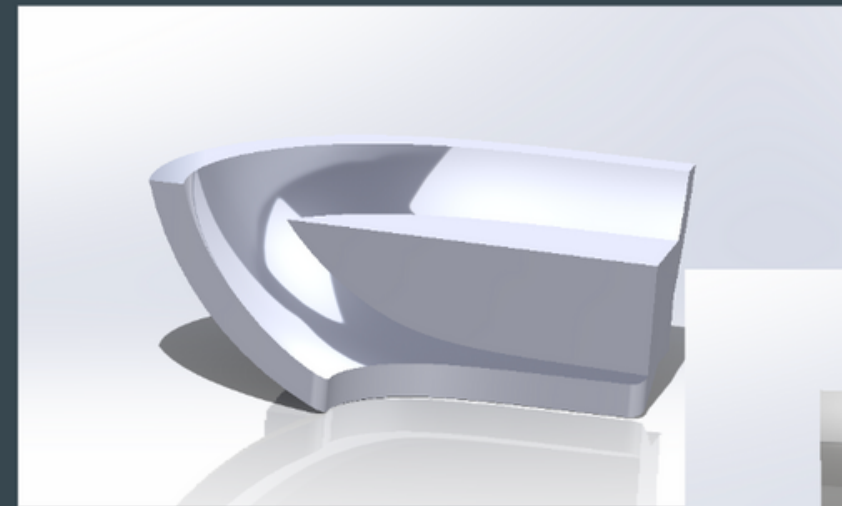
- Systolic and diastolic blood pressure
- Pressure on wrist
- Pulse
- Time
- Light from display
- Compressed air
- Noise and heat from the motor
- After several uses, used AAA batteries

Function Structure: Subsystems & Structure

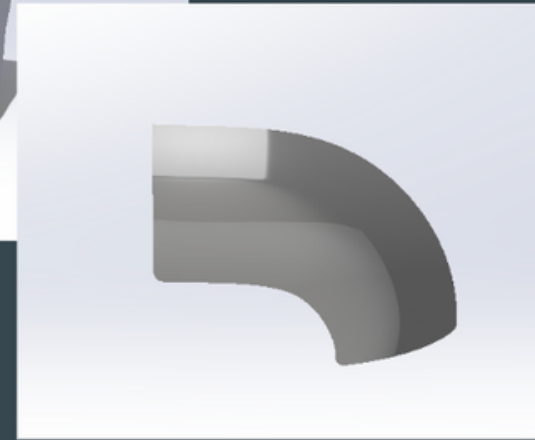


CAD - THE CASE

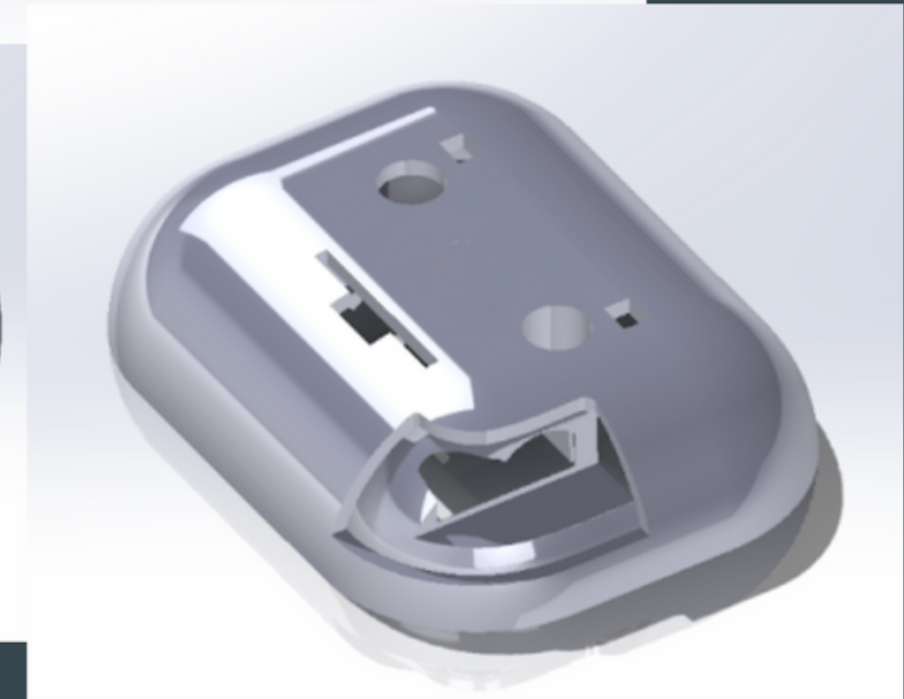
TOP PIECE



Battery Door



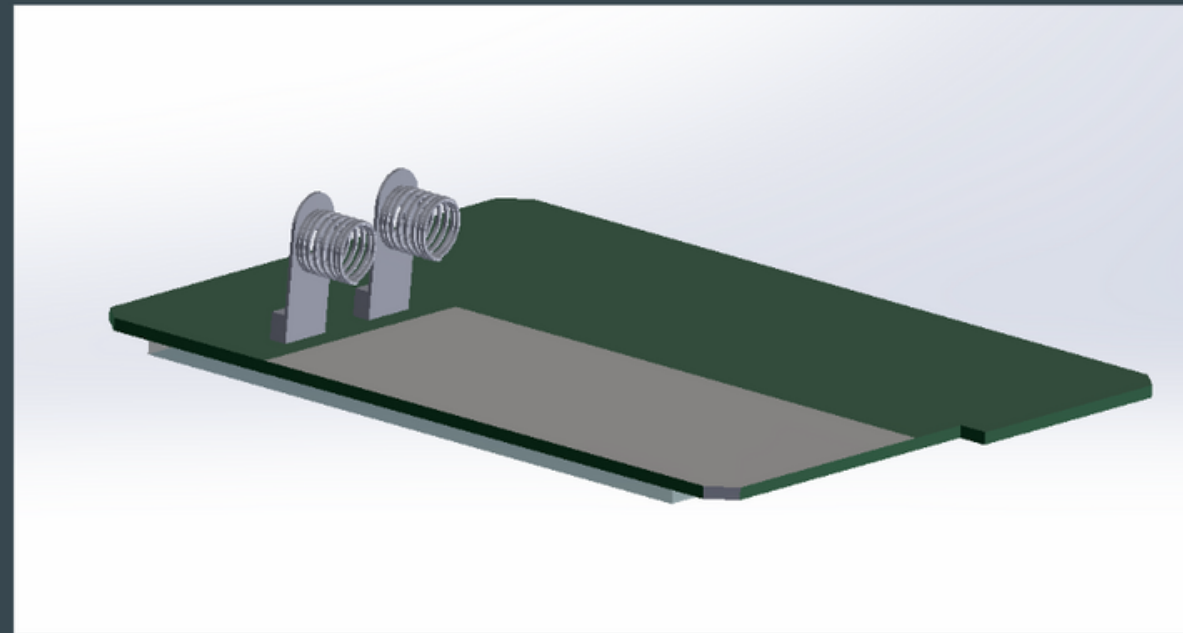
BOTTOM PIECE



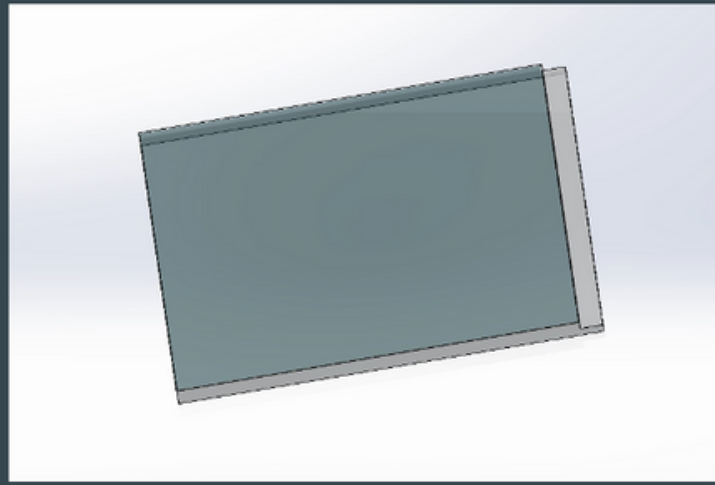
Buttons



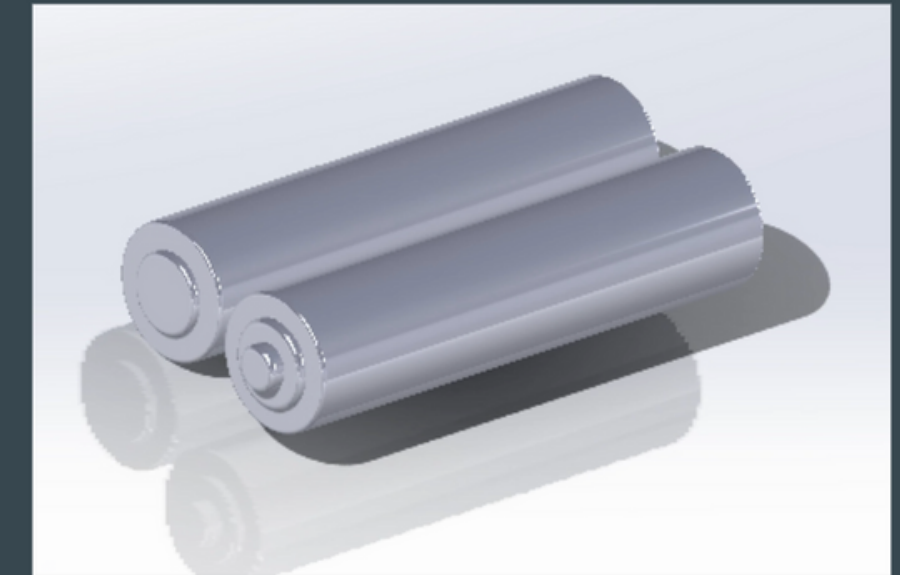
CAD - INNER PARTS 1



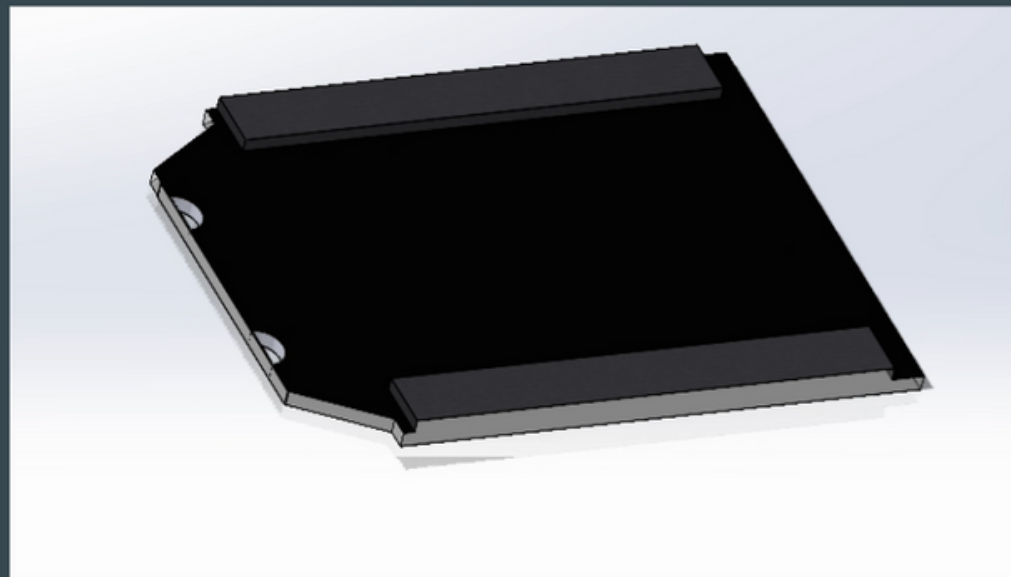
Motherboard



Glass Display



Batteries



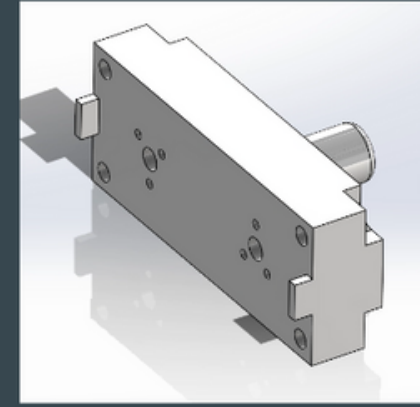
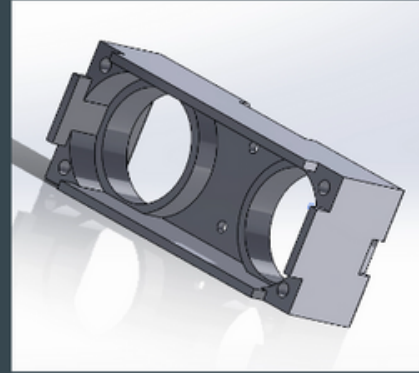
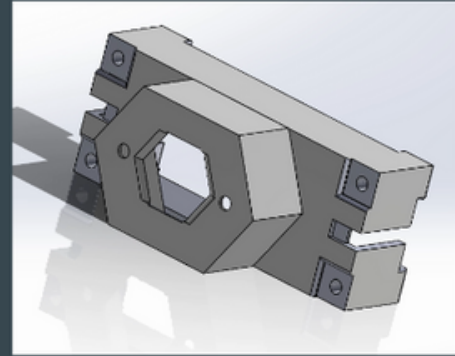
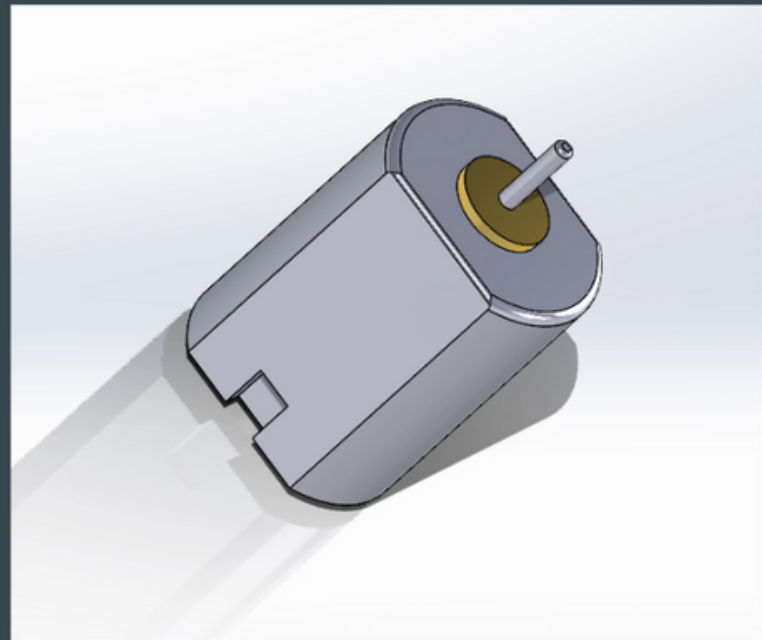
LCD Screen



Battery Springs

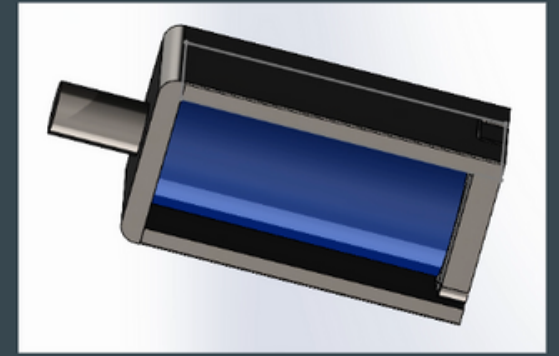
CAD - INNER PARTS 2

Motor

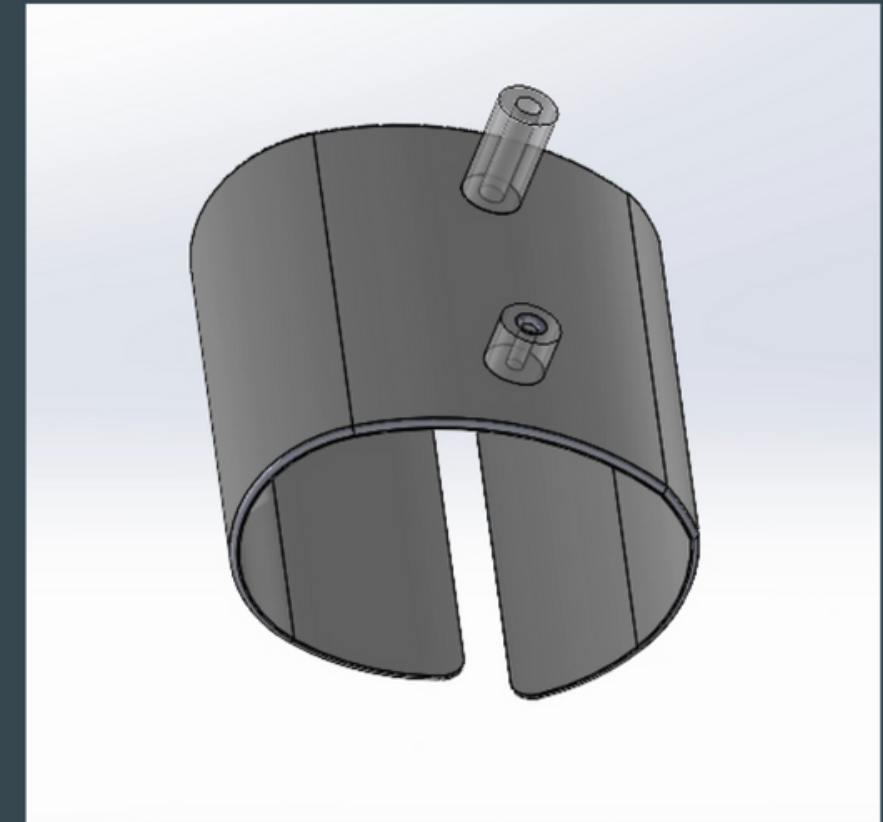


Air Control Valve

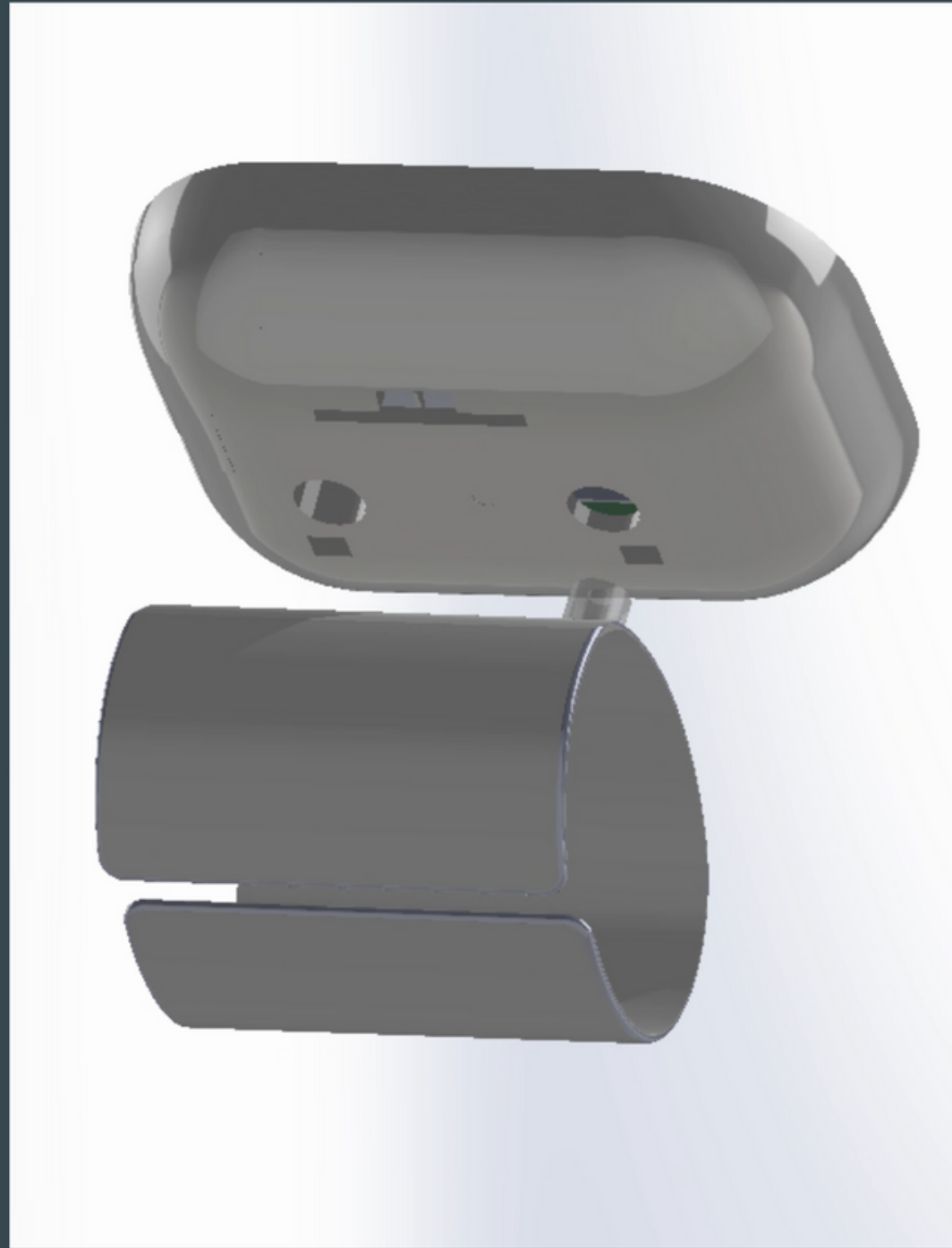
Air Pump



Balloon



CAD ASSEMBLED PRODUCT



THANK YOU!

Feel free to reach out with any questions,
comments, or concerns

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