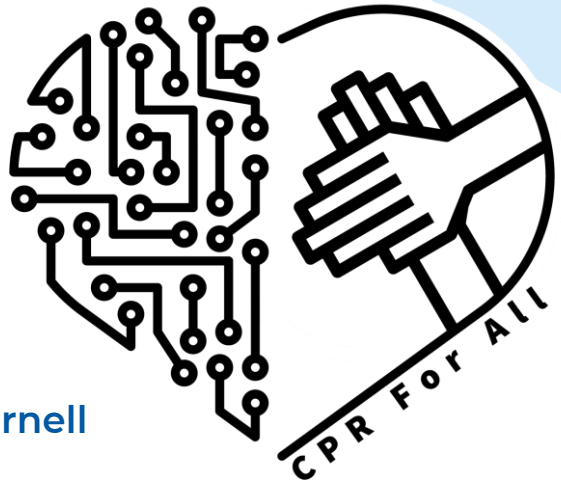
Cardiopulmonary Resuscitation

CPR For All



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The Challenge

CRP For All

How Might We create a **low-cost** version of a CPR model that appropriately simulates the **compression force** and **depth** required for high-quality CPR?

PAKISTAN LIFE SAVERS PROGRAMME

Join hands, save lives

User Groups & Needs

School Children

6-12th Grade.
Bystander CPR

College Students

Pre-Med Students.
Bystander CPR

Medical Students

Early year students.
Bystander & Clinical CPR

Organizations

Govt. workers, corporate employees.
Bystander CPR

PLS & Trainers

Running and administering bystander CPR trainings.

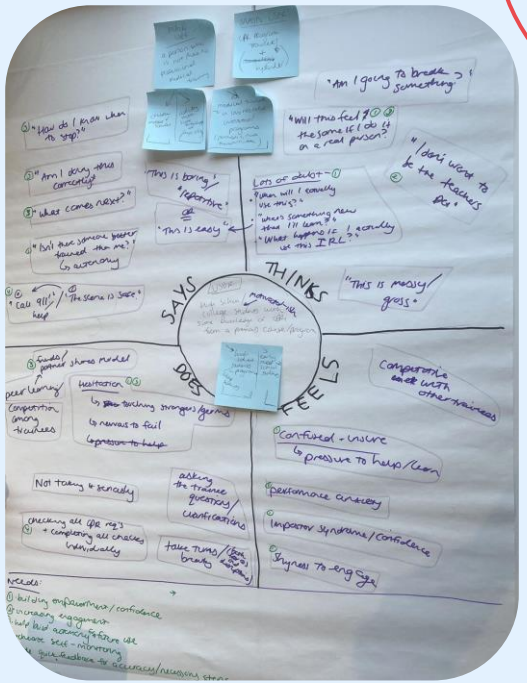
General Public

Any layperson trainee in PLS Bystander CPR programs

Design Challenge Framework

Components from empathy mapping:

Says: - How do I know when to stop? **- Am I doing this correctly?** - What comes next?	Thinks: - This is messy/gross! **- Will this feel the same if I do it on a real person?**
Does: - **Hesitation** to touch models or germs (Fear of failure). - Ask trainer more questions.	Feels: - Confused/unsure. **- Imposter Syndrome.** - Performance Anxiety.



Needs:

- ❑ Building empowerment/confidence
- ❑ Increase engagement
- ❑ Help build accuracy
- ❑ Enhance self-monitoring
- ❑ Quick feedback

Interview Takeaways

4 Emergency Medicine Physicians @ Weill Cornell

Pakistan Life Savers Program

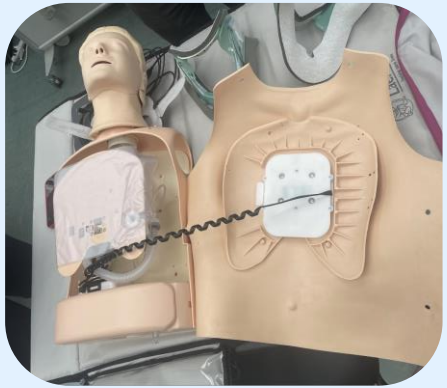
- Recent implementation of CPR into national education curriculum, ~10 million students 6th-12th grade
- Every trainee has one pillow and shares an expensive training mannequin
- Low resourced, high work output
- Need an affordable, portable, scalable, reproducible CPR model to deploy in their programs

CPR Training

- Compressions (depth, rate, hand placement, length) is necessary to teach in bystander CPR over ventilation
- 2-2.5 inches deep at 100-120 cpm for 2 minutes
- Deliver high quality, intuitive feedback without increasing cost

Project Goals & Constraints

Expensive



Highly Accurate Feedback

No Feedback

Cheap

CPR For All

Project Goals & Constraints

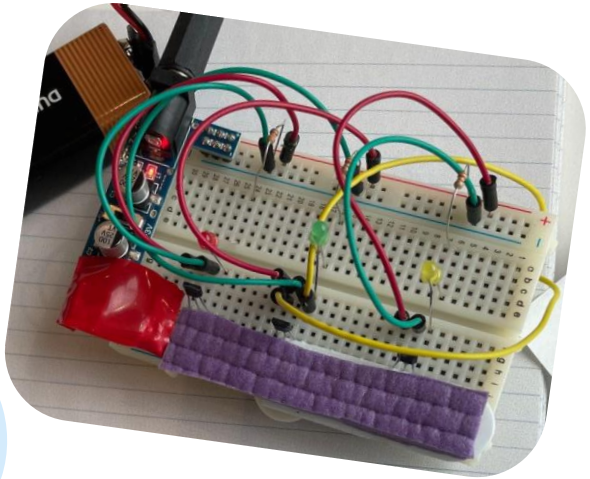
Goals

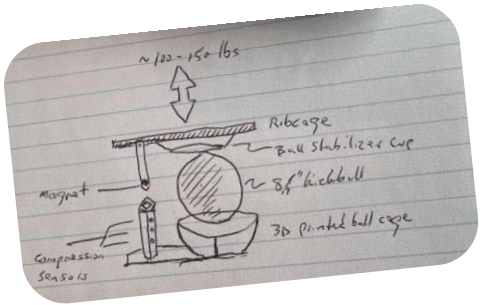
- ❑ Compression only
- ❑ Accurate depth and rate feedback
- ❑ Scalable and portable for schools

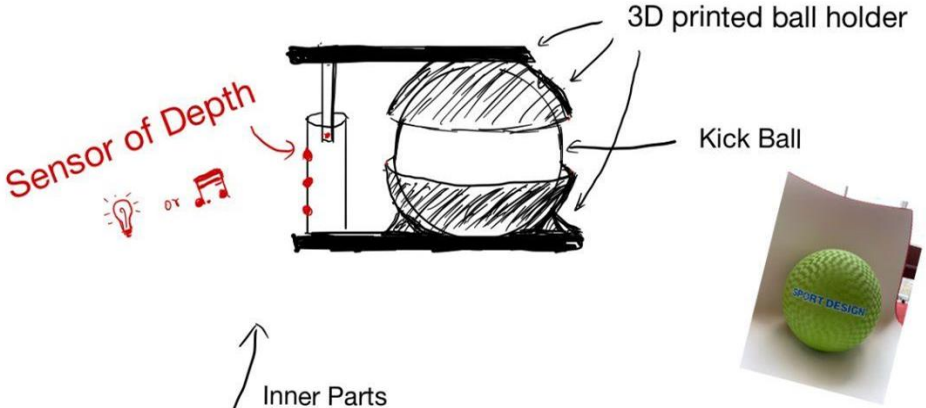
Constraints

- ❑ Low cost, affordable objects
- ❑ Reproducible
- ❑ Easy to assemble
- ❑ Repairable

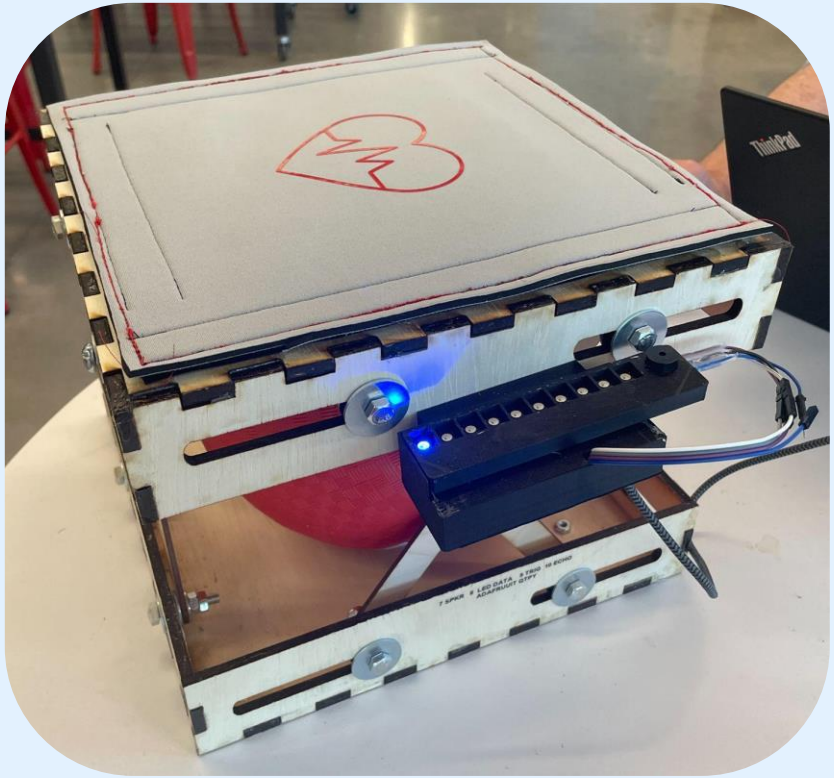
Prototype

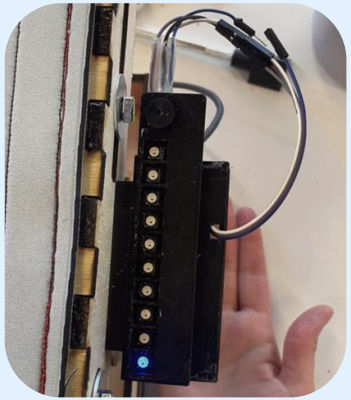


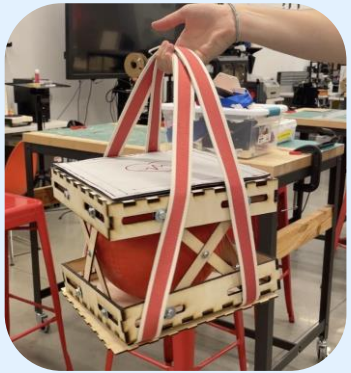

~ 120 - 150 lbs
Ribcage
Ball Stabilizer Cup
Magnet
3D Printed ball cage
Compression Sensors


3D printed ball holder
Sensor of Depth
or
Kick Ball
SPORT DESIGN
Inner Parts
CPR for All
Surface
Hand Placement

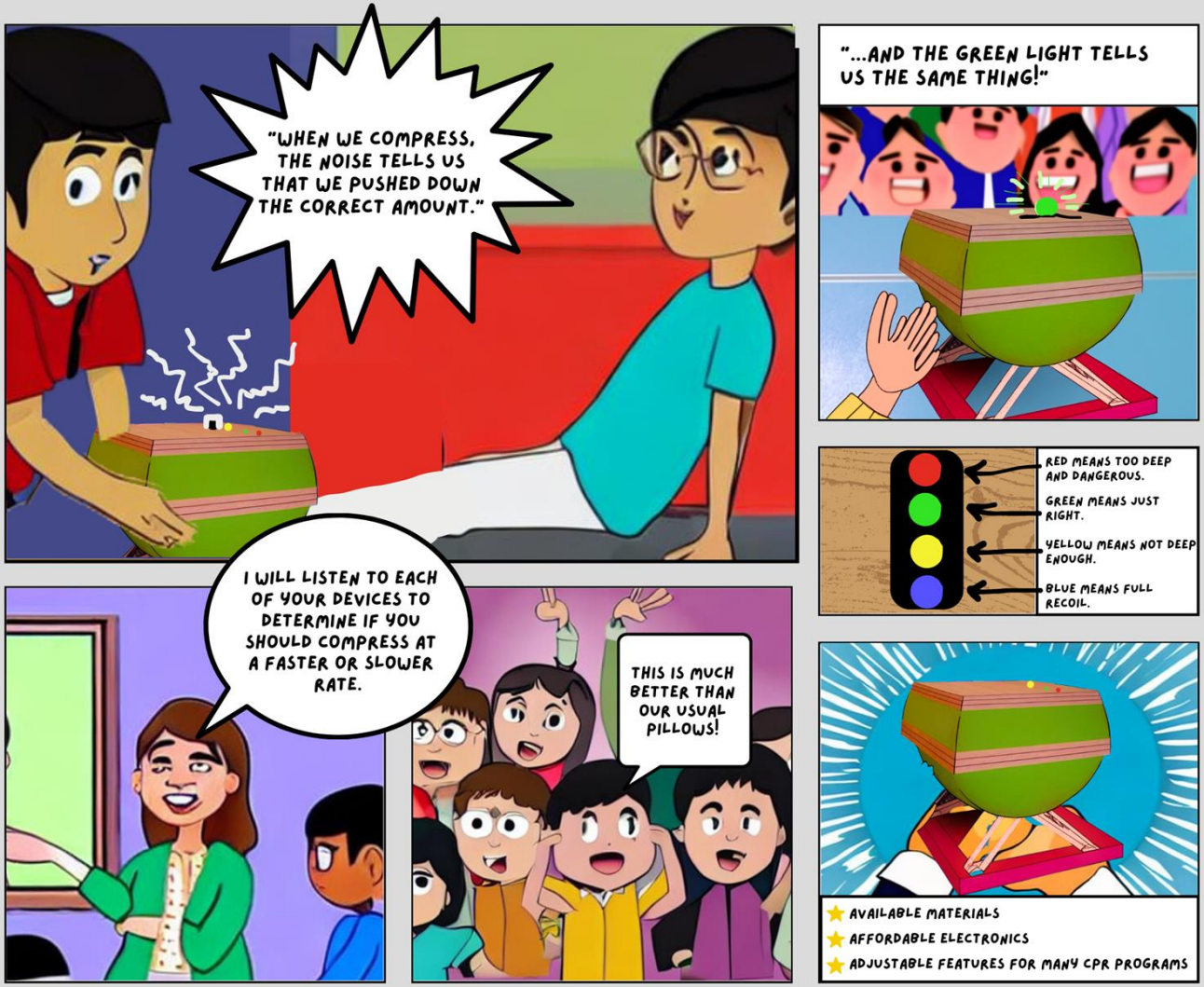
Final CPR Compression Trainer



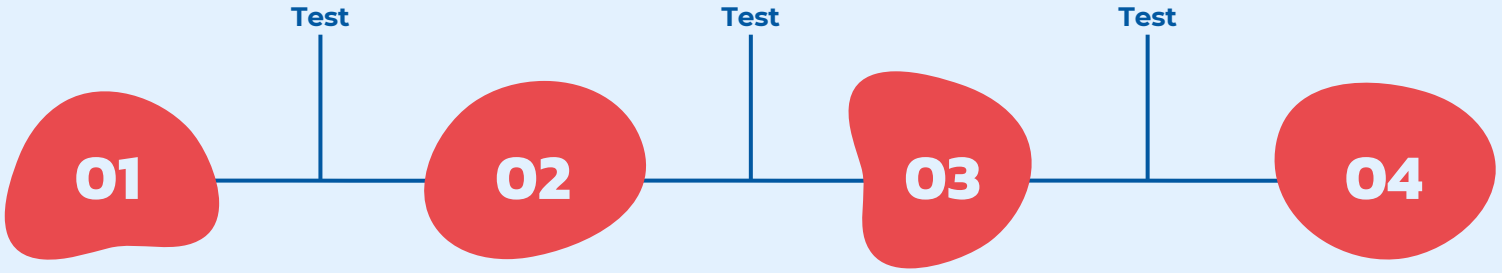





MONDAY
8:45AM
CPR
TODAY IS CPR DAY! WE WILL NOT BE USING PILLOWS TODAY...
HUH??? WHAT DOES SHE MEAN?
"WE HAVE A SPECIAL GUEST TODAY. OUR KICKBALL IS GOING TO TEACH US HOW TO DO CPR."
HOW DOES IT WORK?
"LET'S DEMONSTRATE."


"WHEN WE COMPRESS, THE NOISE TELLS US THAT WE PUSHED DOWN THE CORRECT AMOUNT."
"...AND THE GREEN LIGHT TELLS US THE SAME THING!"
RED MEANS TOO DEEP AND DANGEROUS.
GREEN MEANS JUST RIGHT.
YELLOW MEANS NOT DEEP ENOUGH.
BLUE MEANS FULL RECOIL.
I WILL LISTEN TO EACH OF YOUR DEVICES TO DETERMINE IF YOU SHOULD COMPRESS AT A FASTER OR SLOWER RATE.
THIS IS MUCH BETTER THAN OUR USUAL PILLOWS!
AVAILABLE MATERIALS
AFFORDABLE ELECTRONICS
ADJUSTABLE FEATURES FOR MANY CPR PROGRAMS

Our Design Process



Build Compression Box

- Kickball holder out of cardboard

Add Electronics

- Set-up sensor code and LED + audio feedback on compression depth

Build Sturdier Model

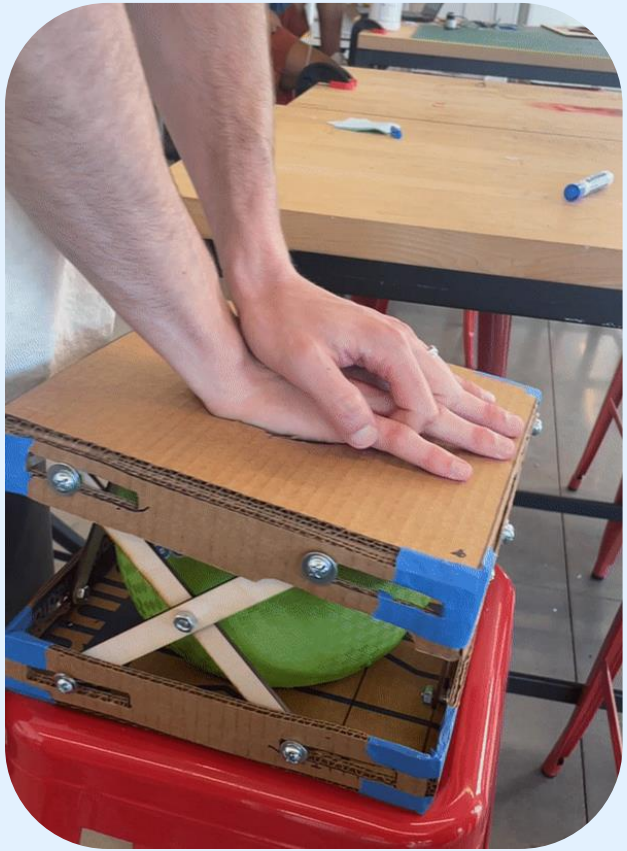
- Laser cut wood for compression box
- 3D-printed pieces to hold electronics

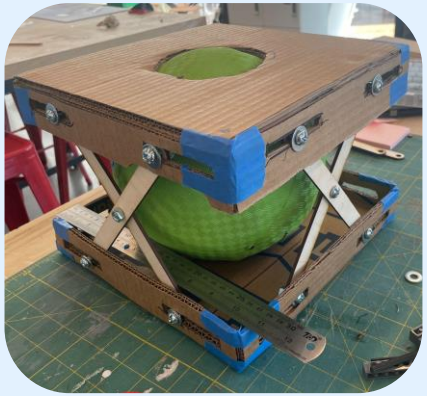
Add Final Electronics

- Reposition and fasten electronics and all parts

Cardboard Model →

Scissors + cardboard
Laser cut wood
Nuts + bolts
Fabric cover



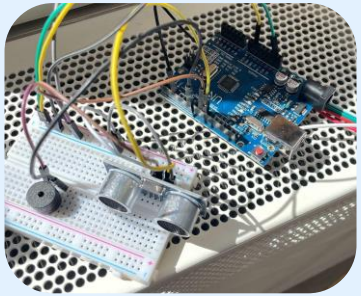


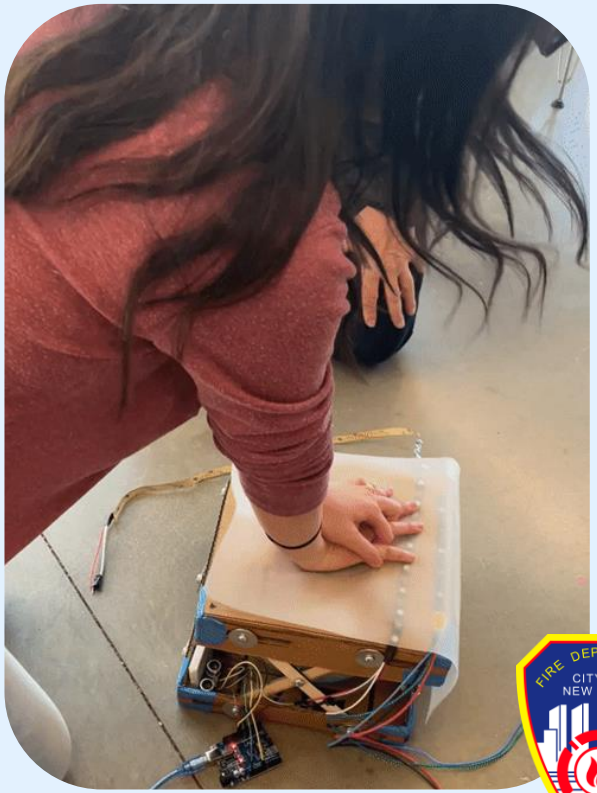
Learnings:

- Realistic compressions
- Withstands force
- Considering electronics placement

Cardboard Model + Electronics

Scissors + cardboard
Laser cut wood
Nuts + bolts
Fabric cover
Arduino + depth sensor + LED



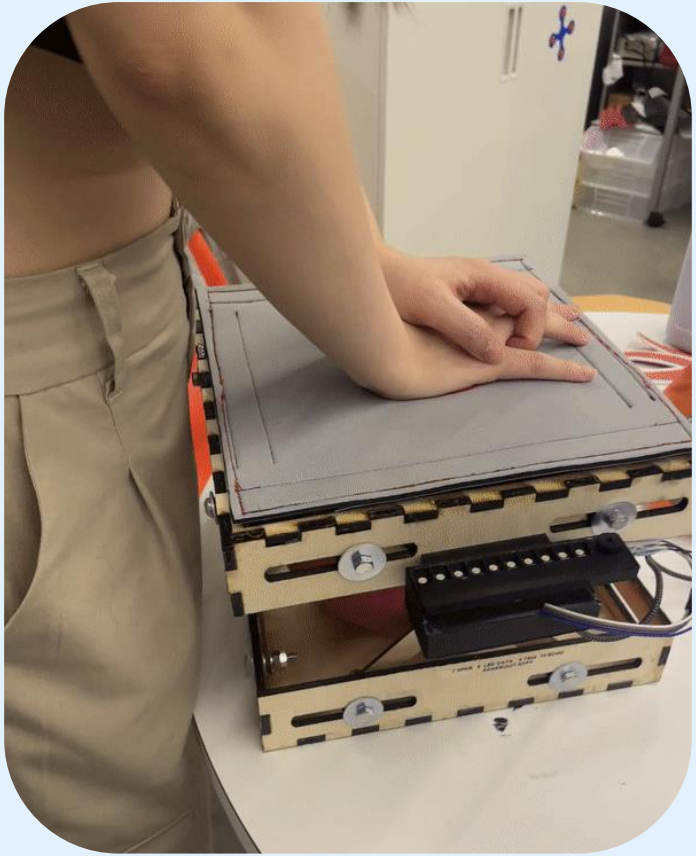


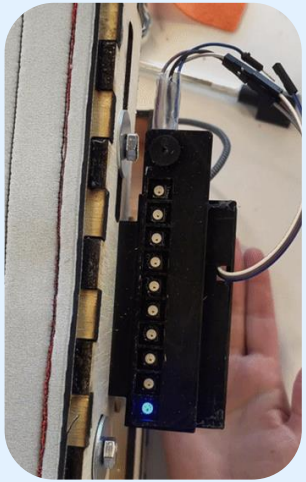
Learnings:

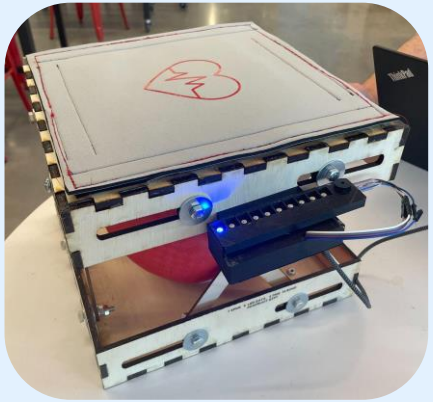
- Tune light and audio feedback to be less jerky
- Finalize sensor placement
- Consider portability & durability

Final CPR Model

Scissors + cardboard
Laser cut wood + wood glue
Nuts + bolts
Fabric cover
Arduino + depth sensor + LED
3D-printed electronics holders
Sewn fabric + velcro straps







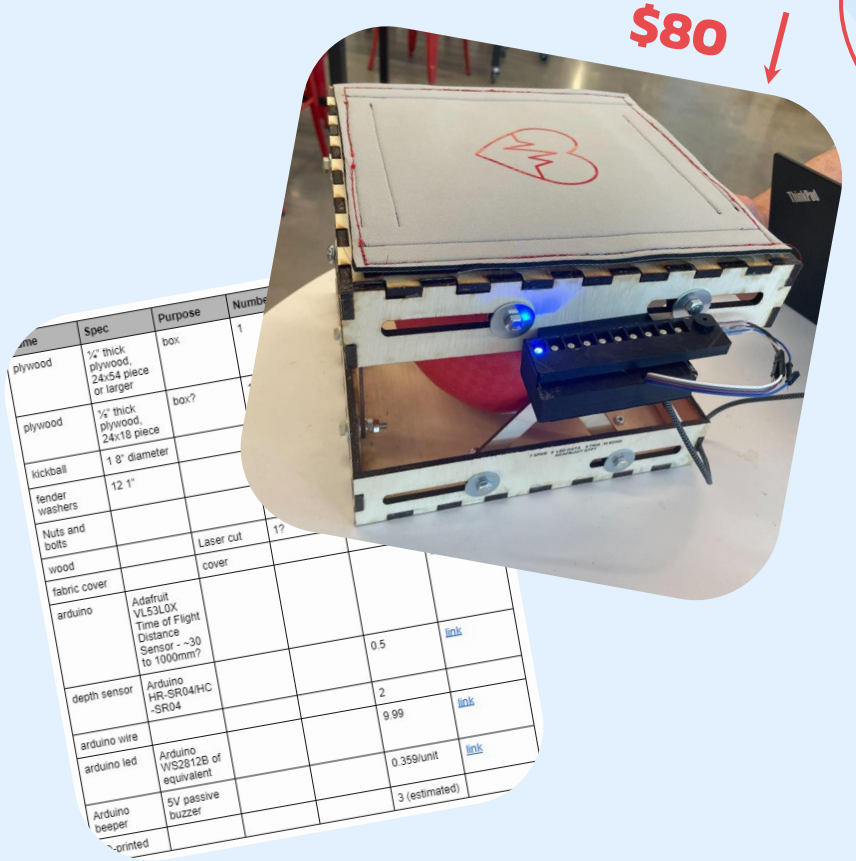
Learnings:

- Relocate electronics
- Position light feedback away from a user's hand

User Manual and Costs

- **User manual (link)**
  - **Supplies**
  - **DIY instructions**
  - **Building process**
  - **Arduino code**
  - **Laser cut wood file**
  - **Estimated costs (below $80)**

- **Keep improving our model for**
  - **May 19: Spring 2023 Open Studio**
  - **July 17: International Symposium on Academic Makerspaces 2023**



Thanks!

Feedbacks and questions?