Automated CPR Device for Infants and Neonates: Prototype Production

Elevator Pitch:

Because it is difficult to administer continuous and consistent cardiopulmonary resuscitation (CPR), there are many existing market devices for automating CPR. However, none of these devices are compatible for infants, who have different requirements for chest compression depth.

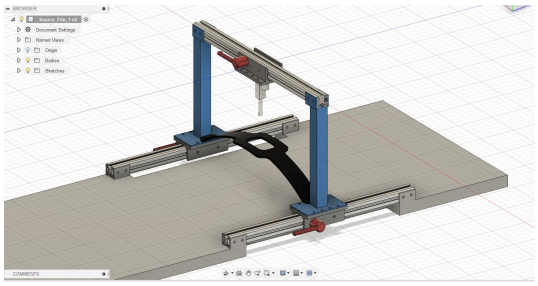
Introduction:

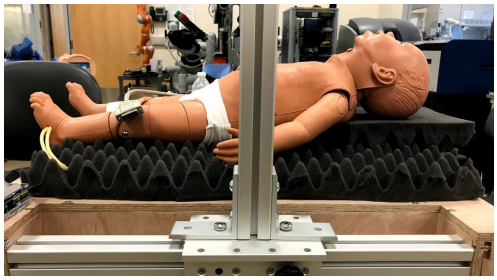
There are currently already automated CPR devices used in hospitals however they are strictly practiced on adults because of their “practicality” as well as stronger bone structure. Although SCA (cardiac arrest) is rare in the youth, it is still responsible for 10%-15% of sudden unexpected infant deaths. As an infant is placed onto the backboard of the device, an actuator extends and is aligned with a point where compression is needed. A plunger mechanism is dropped over the actuator so the position is kept still while the device is operating. The apparatus is made to compress at a rate of approx. 100 compressions per minute with the actuator extending 1.5 inches (⅓ the infants chest). If needed there is an available strap to assist in keeping the infant still while cardiologists are performing on the child. The t-slides along the border of the backboard are used to give cardiologists the ability to adjust the actuator as well as grant the option to add additional parts for the mechanism, essentially fabricating a modular device.

Method:

1. Created different iterations and sketches for a prototype while accessing pros and cons.
2. Met with mentors and decided upon the best iteration to start the MVP (Minimum Viable Prototype).
3. Measured infant beds and acquired the dimensions to create a suitable prototype.
4. Researched materials needed to create a working prototype.
5. Created a UI program for the Arduino UNO which paired with a TFT touch screen.
6. Learned to CAD and animate in Fusion 360 to create a visual prototype online.
7. Prepared a list of materials and quotes to analyze the price and confirm what is needed.
8. Cut and refined materials and attached to create a working prototype.

Results:





Conclusion:

We developed a working prototype to provide a possible iteration for an automated CPR device that can be used with infants. The bearings and T-slides are able to slide the motor freely allowing the administrator freedom to pinpoint a location and commence compressions. The Arduino is also optimized to display a UI screen in order to start compressions. The backboard features a foam in order to deliver back support to the patient. The interior of the device is also accessible by unscrewing the board. With that being said, the accessibility allows for an easy way to swap parts and make modifications to support your needs.

Limitations:

1. Doesn’t contain a battery of any sort and has to be near an outlet.
2. Not as lightweight as we would like it to be.

Next Steps:

1. To procure the motor/actuator for the frame.
2. Design straps to secure infant in place/identify location for compressions.
3. Test prototype on infant phantom.
4. Connect device to heart monitor and incorporate feedback controls based on readings.

References:

1. Children’s Hospital in Philadelphia. “Sudden Cardiac Arrest” (https://www.chop.edu/conditions-diseases/sudden-cardiac-arrest)