

Compression Assistor

CASPR (CARDIAC ASSISTANCE, SAFETY, AND PREVENTIVE RESEARCH) INC.

TEAM 2

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Items to Discuss

- 1) Mission Statement
- 2) Problem Overview
- 3) Project Objective
- 4) Technical Activity
- 5) Experimental Testing Results
- 6) Future Work
- 7) Questions
- 8) References

Mission Statement of the *Compression Assistor*

The *Compression Assistor* will increase the potential to **preserve life** through manual CPR, **improve the accuracy** of CPR chest compressions through real-time feedback during the procedure, and **minimize injury** imposed by CPR.

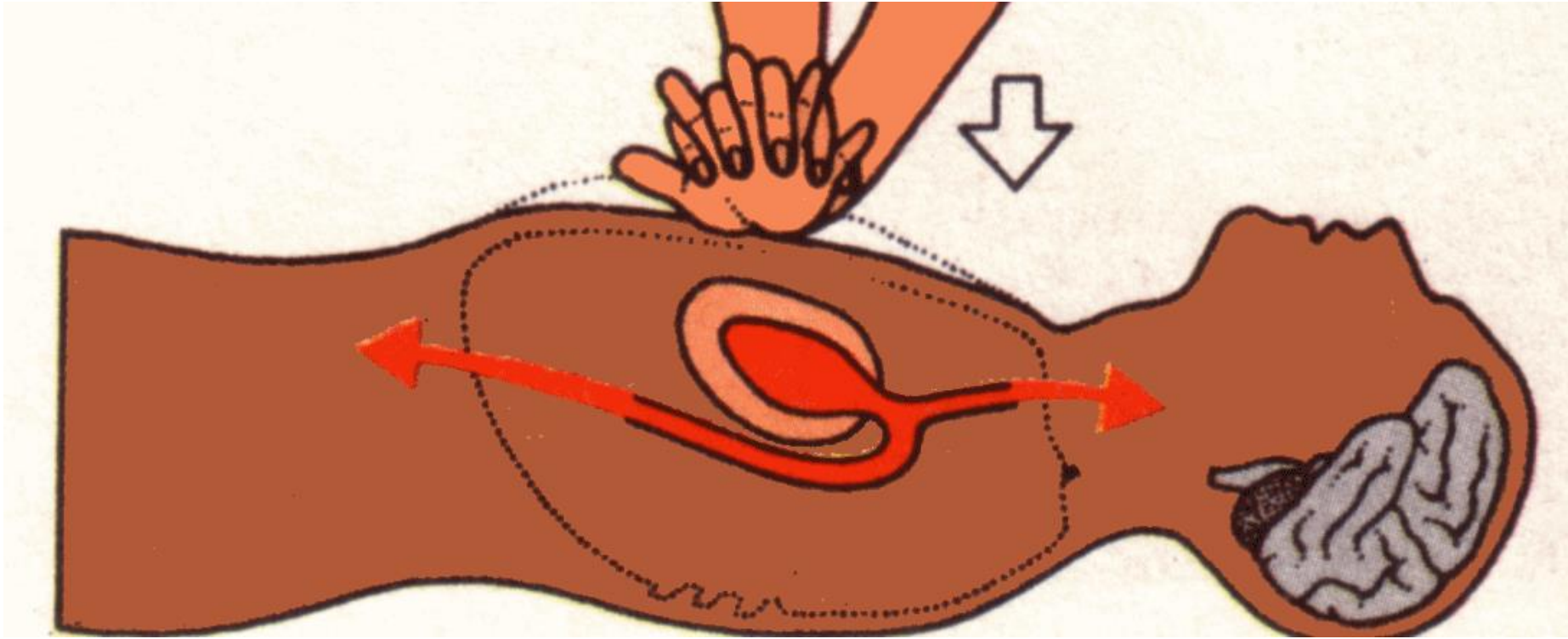


Figure 1. *Cardiopulmonary Resuscitation (CPR) diagram*

<http://www.arthursclipart.org/medical/respiratory/cpr%202.gif>

What Happens During CPR?

- **Manually contract ventricles of the heart**
- **Combination of rescue breathing and chest compressions**
- **Allow blood flow throughout the body**
- **Sustains oxygenation to the brain**

100 compressions/minute

American Red
Cross Standard
Guidelines

For

First Aid/CPR/AED
Response

30

Compressions

- \pm 2 inches
for an adult
- \pm 1.5 inches
for a child
- \pm 0.5 inches
for an infant

**2 Rescue
Breaths**

Problem Overview



It is likely that **conditions are not met on site** of cardiac emergency




Accuracy and efficiency of CPR is compromised due to lack of feedback during the procedure






With inaccurate CPR technique, **chances of survival fall 7-10% every minute** defibrillation is delayed

Project Objective

 Provide **real-time feedback** to the medical responder during the procedure

 Display—

-  **Number of compressions**
-  **Compression rate**
-  **Depth of compressions**

 **Cost efficient and accurate**

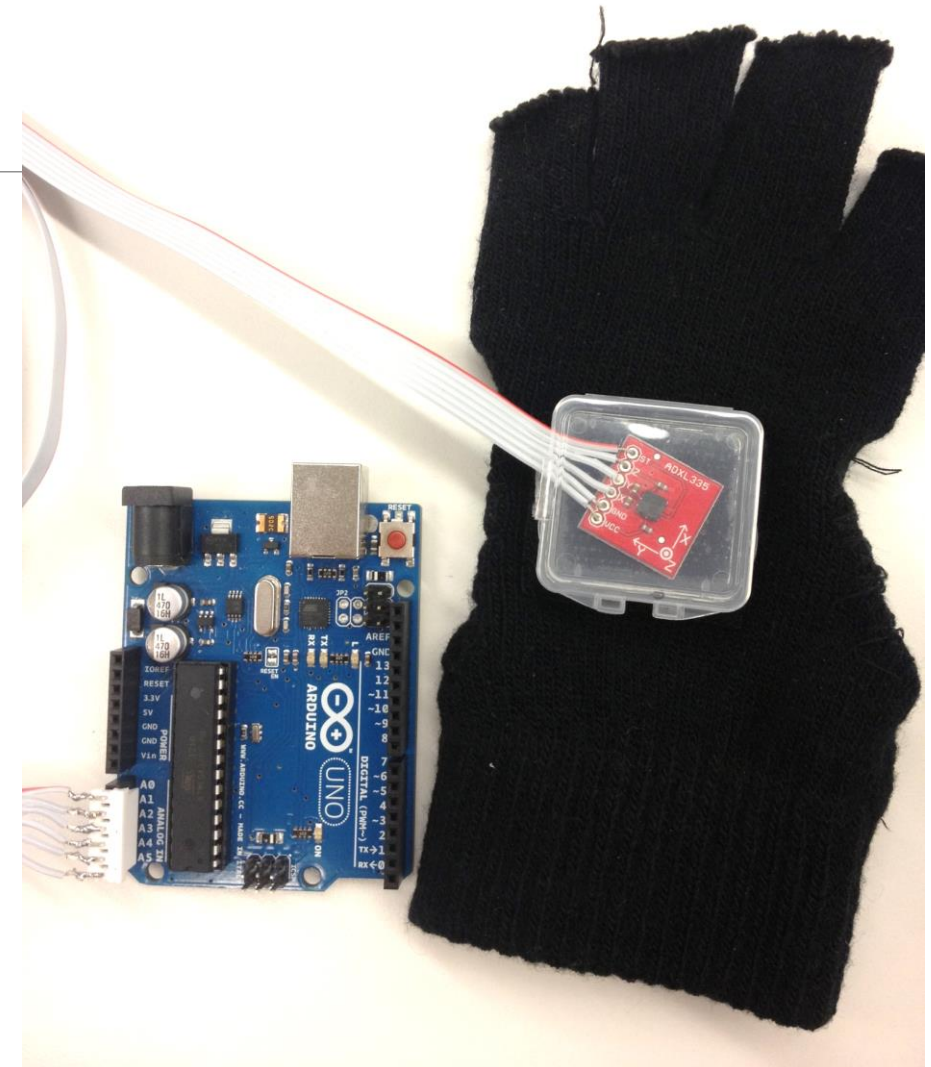


Figure 2. *Compression Assistor Prototype*

Important Features to Consider

Accurate

Stable

Calibrated

Durable

Weather
Resistant

Washable

Flexible

Adjustable for
each responder

Portable

Upgradable

Features of Focus for the *Compressions Assistor*

Adjust for each responder

- Glove design is **universal**
- **One size fits all**

Washable

- Glove is **machine washable**

Upgradable

- Entire device can be **easily taken apart**

Stable

- Fastener **covers entire surface area** of accelerometer case
- Allows for **optimal stability** of the accelerometer
- **Minimizes noisy signal**

Calibrated

- Includes **acceleration threshold** in code
- **Negates gravitational acceleration**

Technical Activities

- 1) Programming the Accelerometer
- 2) Designing the Glove
- 3) Implementing the Graphic User Interface (GUI)

Programming the Accelerometer

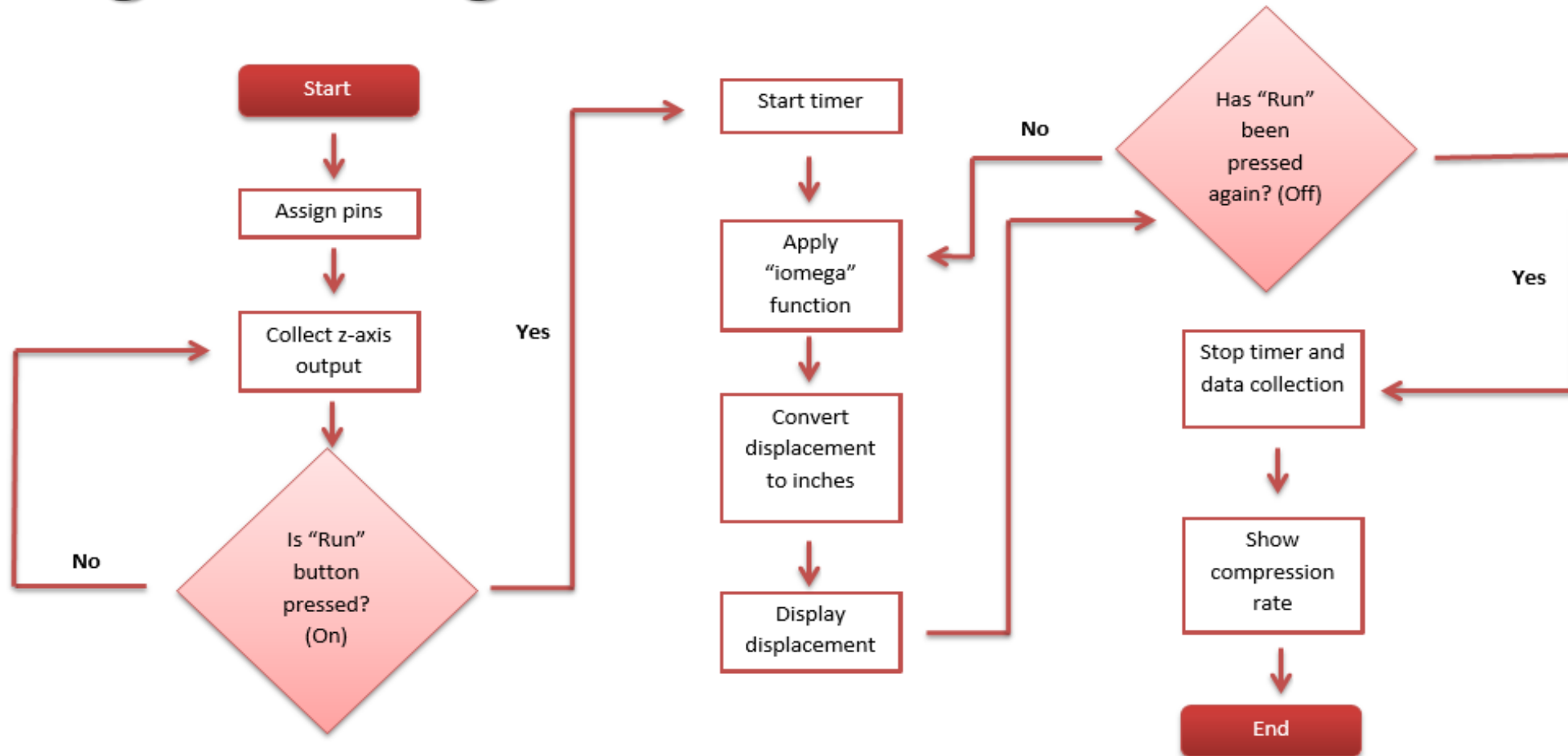


Figure #. Signal flow of *Compression Assistor*

Programming the Accelerometer

```
% Transform datain into frequency domain via FFT and shift output (A)
% so that zero-frequency amplitude is in the middle of the array
% (instead of the beginning)
A = fft(datain);
A = fftshift(A);
% Convert datain of type datain_type to type dataout_type
for j = 1 : N
    if iomega_array(j) ~= 0
        A(j) = A(j) * (iomega_array(j) ^ iomega_exp);
    else
        A(j) = complex(0.0,0.0);
    end
end
% Shift new frequency-amplitude array back to MATLAB format and
% transform back into the time domain via the inverse FFT.
A = ifftshift(A);
datain = ifft(A);
% Remove zeros that were added to datain in order to pad to next
% biggerst power of 2 and return dataout.
if size1 > size2
    dataout = real(datain(1:size1,size2));
else
    dataout = real(datain(size1,1:size2));
end
return
```

Figure #. Sample code of the *Compression Assistor*

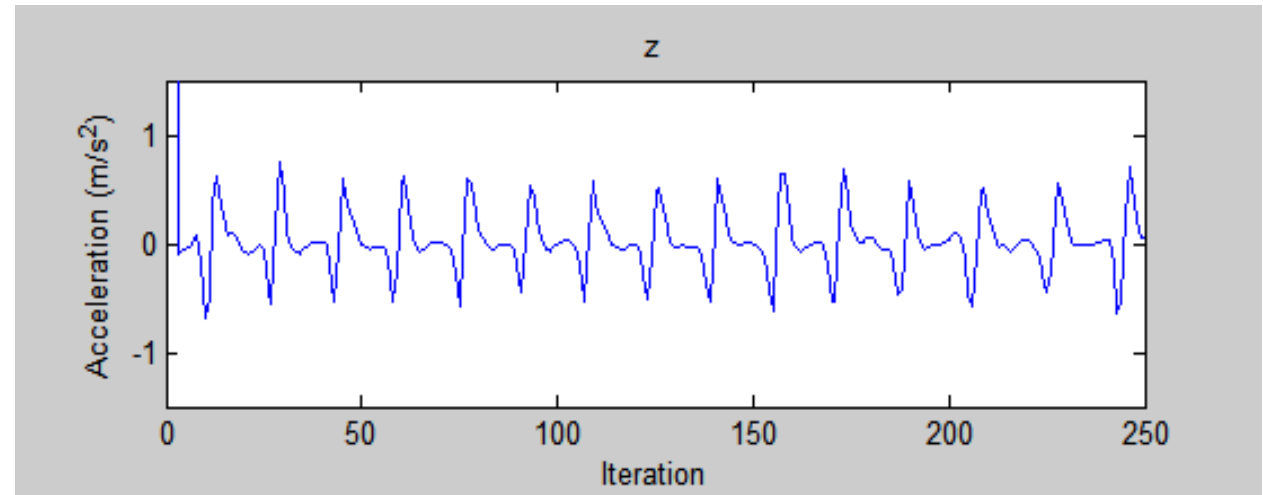


Figure #. Graph of acceleration from the *Compression Assistor* MATLAB program

Designing the Glove



Figure 3. Left and right handed capabilities for glove design



Universal Design



Left-handedness



Right-handedness



One Size Fits All



Fabric is **stretchable**
and **flexible**

Implementing the Graphic User Interface (GUI)

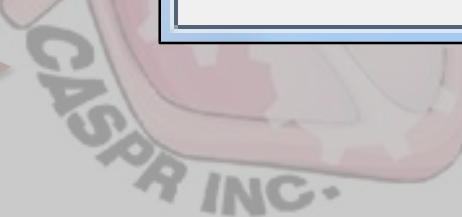
Name of device

Compression Assistor

Depth of compressions

Your compression rate was 96 compressions per minute.

CASPR Inc.
Logo



Toggle button that initiates the program

Duration of procedure

OK

Acceleration from VideoPoint

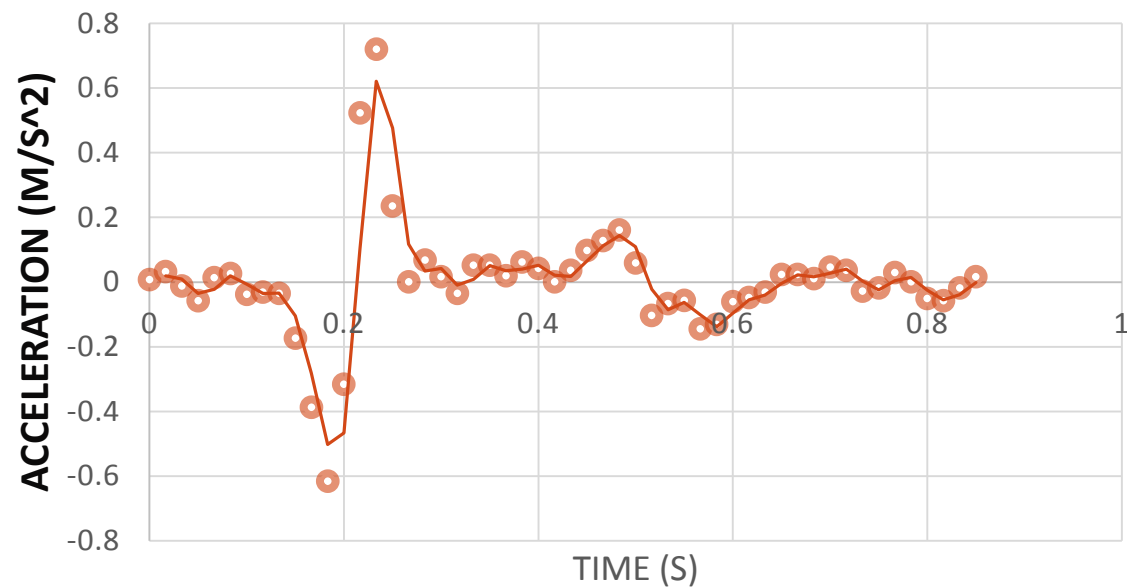


Figure #. Actual acceleration imposed on ADXL335 Accelerometer during Trial 1

Acceleration Comparison Table			
Trial	Acceleration (VideoPoint)	Acceleration (MATLAB)	Percent Error / 100
1	0.72144	0.729	0.01037037
2	0.632072	0.6535	0.032789594
3	0.69039	0.6947	0.006204117
4	0.721442	0.7238	0.003257806
5	0.62937	0.5901	0.066548043
6	0.554042	0.5866	0.055502898
Average Percent Error / 100			0.029112138

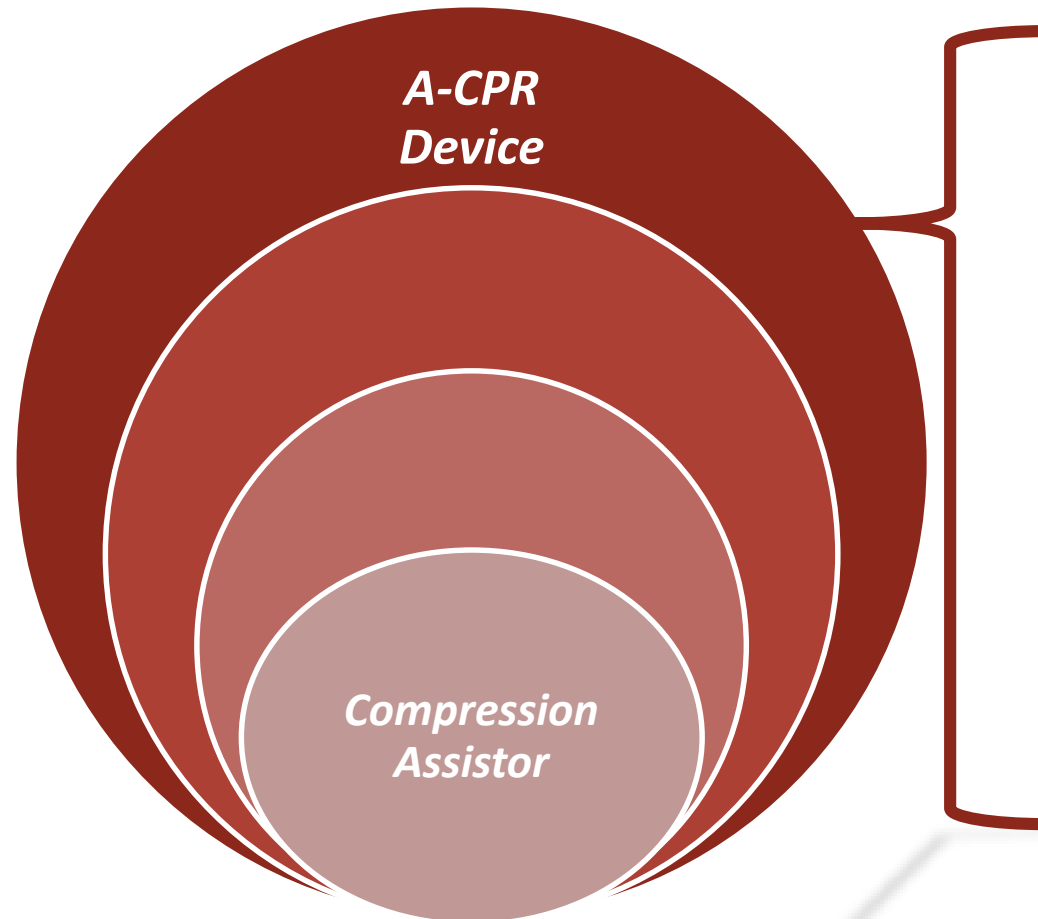
Figure #. Actual acceleration imposed on ADXL335 Accelerometer

Experimental Testing Results

- Compression Assistor* can accurately detect acceleration with a 2.91% error.

Demonstration

Future Work



Performs necessary compressions for CPR without rescue breaths



Functions



Detect electrical activity of the heart



Give cardiopulmonary compressions



Display number of compressions

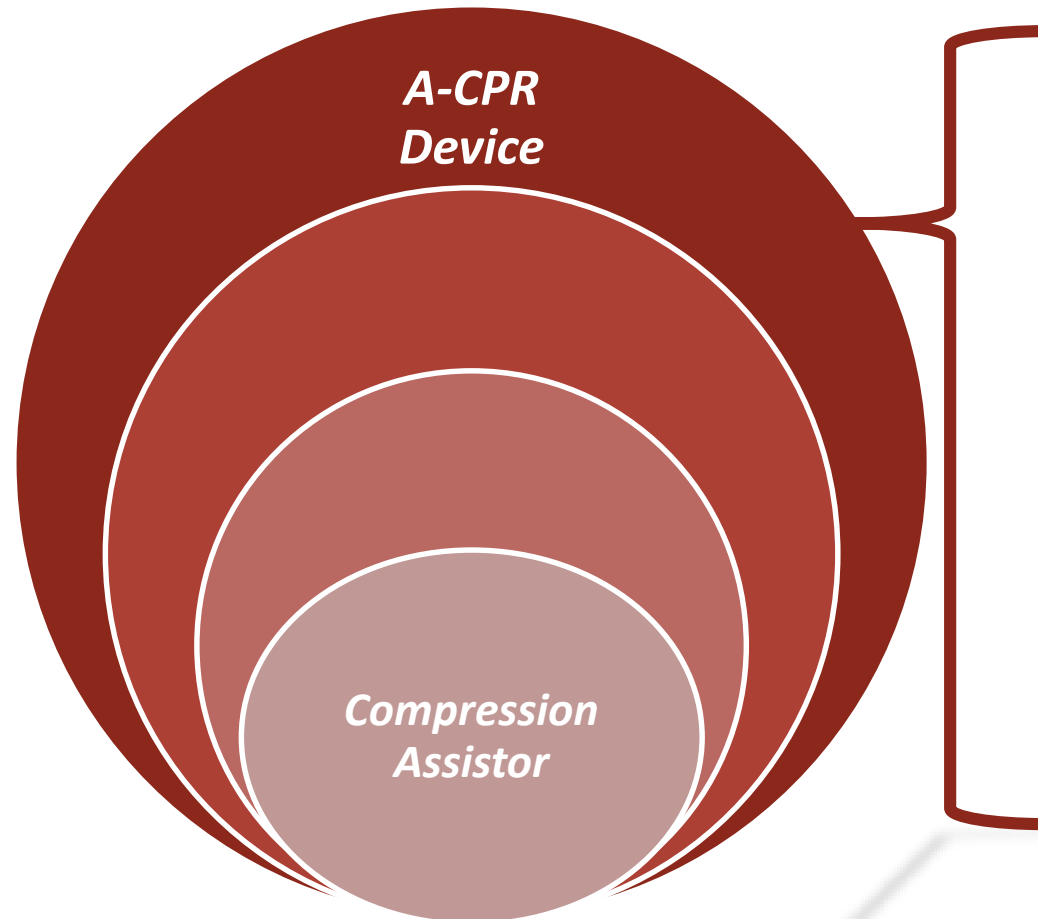


Display duration of procedure



Perform 3 types of CPR: (1) infant, (2), child, (3) adult

Future Work



Similar benefits to
Compression Assistor—



Consistent compression performance



Improve accuracy of CPR



Minimize injury to the patient during the procedure

References

[1] "American Red Cross First Aid/CPR/AED Participant's Manual," [Online]. Available: <https://www.naz.edu/campus-safety/documents/CPR-AED-First%20Aid-Participants Manual.pdf>

[2] "CPR Statistics," [Online]. Available: <http://www.heart.org/HEARTORG/CPRAndECC/WhatisCPR/CPRFactsandStats/CPR-Statistics UCM 307542 Article.jsp>

Questions?

THANK YOU FOR ATTENDING OUR PRESENTATION

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