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Project Guardian

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In memory of ECE Professor David Daut

Introduction

A **heart attack** occurs when the blood flow to the heart is blocked. Symptoms include intense discomfort to the chest or areas near the heart. Unlike cardiac arrest, the heart does not usually stop beating during a heart attack; therefore, with quick proper treatment there may be less damage to the arteries and heart.

Cardiac Arrest occurs when the heart malfunctions and stops beating unexpectedly. Within seconds, the victim becomes unresponsive and is no longer breathing. Death occurs within minutes if the victim does not receive treatment.

The premise of Project Guardian is to alert and allow for quick response and action during a heart attack or cardiac arrest by utilizing radio frequency technology in order to capture and identify common gestures victims make during a heart attack and continuously monitor heart rate to detect unusually high or low heart rate.

Motivations and Objectives

❑ **Motivations/Statistics**

- Heart disease is the number one cause of death in the United States, claiming over 610,000 lives annually
- Every year about 735,000 Americans have a heart attack
- Chest pain is a major warning sign and the gesture of a victim's hand-to-chest is a key indicator of a heart attack
- Over 350,000 out-of-hospital sudden cardiac arrests occur annually and 70% of cardiac arrests occur at home
- A heart that suddenly stops beating is an indication of cardiac arrest

❑ **Objectives**

- Reduce the number of heart-related deaths due to heart attacks and cardiac arrests annually through gesture-based detection and continuous heart rate monitoring

Future Work

- Implement 3G/4G technology into device to remove necessity of mobile device
- HA/Cardiac Arrest victim's location sent to EMS/Paramedics

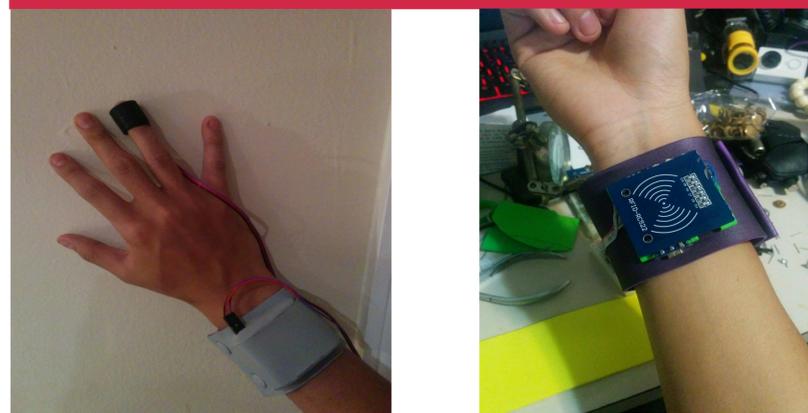## Methodology

Gesture Detection

It is human instinct to place their hand on the pain point in order to lessen the pain. With chest pains as the major sign of a heart attack, capturing the hand-to-chest gesture through Project Guardian's radio frequency technology allows:

1) An alert to be sent to user's mobile device prompting a yes/no message "Are you experiencing any unusual pain near the heart?"
2) If user selects "yes", ICE contacts will be sent a text of the user's location
3) If user selects "no", alert will disappear
4) If user does not respond in 20 seconds, ICE contacts will be notified of user's location

Heart Rate Monitoring

Project Guardian has the feature of detecting when a user's heart rate reaches a certain threshold, such as 0, to indicate that the user may be experiencing cardiac arrest or unusually high heart rate.

Through the use of a wearable finger pulse sensor, Project Guardian allows:

1) Constant monitoring of heart rate
2) If user's heart rate drops < 10 BPM, ICE contacts will be sent a text of user's location
3) If user's heart rate rises > 200 BPM, ICE contacts will be sent a text of user's location
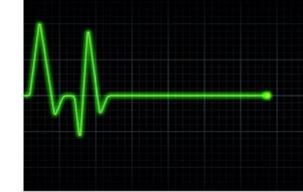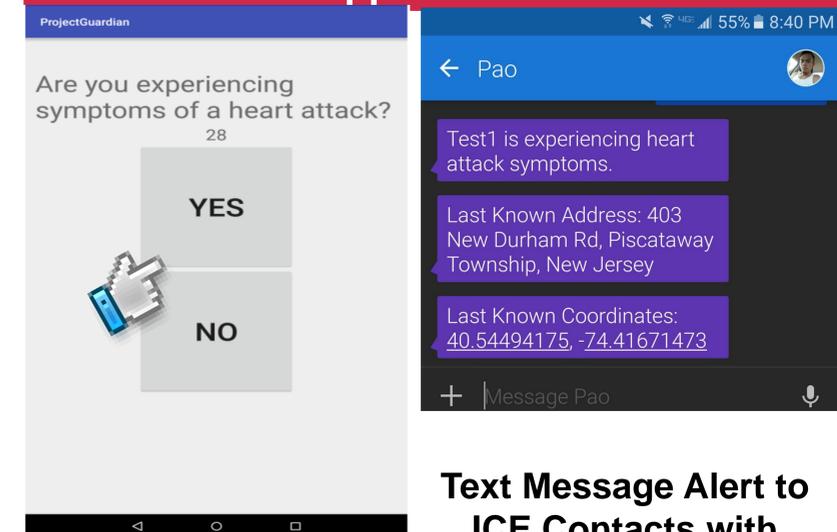4) User is advised to sit down and breathe while help arrives

Final Product

Hardware Components of Project Guardian Device:
- RFID Reader & Wearable RFID Tag
- RedBearLab BTLE Nano Module
- Heart Rate Sensor
- Arduino Nano

Mobile Application Results

User prompted alert from Gesture Detection

Text Message Alert to ICE Contacts with Victim's Location

References

[1] **American Heart Association:** www.heart.org/HEARTORG
[2] **Center for Disease Control and Prevention:** http://www.cdc.gov/heartdisease/facts.htm
[3] **Sudden Cardiac Arrest Foundation:** http://www.sca-aware.org/sca-news/aha-releases-2015-heart-and-stroke-statistics