AED HELPER- MODULAR AUTOMATIC EXTERNAL DEFIBRILLATOR & CARDIOPULMONARY RESUSCITATION DEVICE

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ABSTRACT

In the United States alone, more than 350,000 people suffer an out-of-hospital cardiac arrest out of which almost 90% result in death. About 70% of these out-of-hospital cardiac arrests occur in the home. [1] This design proposal is for the myAED, a more user-friendly AED intended to be kept in the home. The main goal of this project is to illustrate the importance of our vision, a world of modular, affordable, and intuitive/user-friendly medical devices to engineers, medical professionals, and medical device companies.

Keywords – Modular, Intuitive, Emergency Medical Devices, ECG/EKG, CPR, AED, IMU

INTRODUCTION

- Create a modular and user-friendly approach to emergency medical devices.
  - Use of tethered and wireless connections to connect differing functions to an AED and smartphone device.
  - Smartphone connection is made to have a user-friendly and recognizable experience
- Current AEDs are only for delivering shocks without easily guiding users through CPR
  - The compression meter will be integrated to a glove to force proper CPR form
- The module will include an electrocardiography sensor to attached to AED Device and a compression meter
  - The compression meter will make use of a displacement meter and gyroscope to model the compression of the user
  - The compression meter will make use of a pressure sensor to indicate a full decompress, a common error in laymen rescuers [2]

RESULTS: END-PRODUCT DESIGN

Hardware Set-Up

- The main idea behind our vision is having a main hub to which the differing modules will connect to via a universal USB-C Connection or a wireless connection depending upon the baud rate necessary
- The AED will be the hub to which the module (AED Helper Glove) will connect to via a bluetooth connection initiated by an Near-Field Communication for a quick set-up

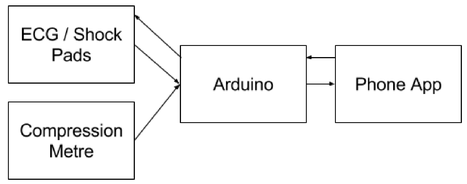

Fig 2: Hardware Block Diagramme

- Fig 2 shows the general communication scheme we have in place:
  - The *ECG* and *Shock Pads* will be a tethered connection; a shock will be delivered once the data analysis deems it to be being necessary.
  - The *Compression Metre glove* comprises a slave bluetooth module which will send to the analysed IMU (Inertia Measurement Unit) data and pressure sensor data, as compared to raw data, to help with network congestion.
  - The *Arduino* will act as the AED device which will be in charge of decision making and immediate feedback; it will have a master bluetooth module to connect with the glove and a slave module to connect to the phone.
- The main difficulty will be take the 7 inputs from the compression meter glove and outputting an intuitive qualitative value for users to use

Software Design

- Our first implementation for the app will be via android
- The app will have two portions: a database for further knowledge and the guide, which will show the input values from the system and guide the rescuer
- In Fig 3, one can see the current state of the guiding portion of the app reading the ECG value and pressure value via bluetooth

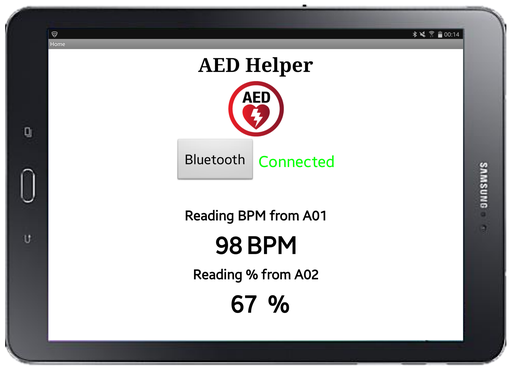

Fig 3: AED Helper App V1.7 (03/04/17)

- The app will only be go through more user testing to implement the most intuitive design possible
- The user will be prompted to contact the emergency services in their area via the app which will send the user's location for quick deployment
- The gyroscope and displacement data will use an algorithm to output a value/color to indicate to the user the quality of their compression

CONCLUSION

The idea of myAED originated from the team's desire to work on a project related to *healthcare* and one that would make a *difference* in people's lives. The four members in the group were eager to implement their experience gained thus far in creating something that would give those at risk a peace of mind and a sense of security. We are trying to bring to life our vision of a modular and intuitive world of medical devices. Upon meeting and discussing our idea with our mentor, Dr. Ou Bai, we determined that *AED Helper*, the modular wireless compression meter glove would be the most feasible and impactful way to go about it. The idea is aimed to making CPR, an essential step in saving someone, an easy and guided experience for the rescuer that is often times a layperson

Our main goals for AED Helper is to keep it lightweight and convenient for the users. It should also provide the user feedback of the victim's heart activity. Additionally, our top priority is to keep the all users, victims and rescuers alike, safe and out of harm's way. Implementing the analysis of the the responses of interviews we conducted, we came up with a secure and intuitive design. We are also attempting to keep the production cost low so that it may be easily adopted by medical companies. We hope to bring about a revolution in stagnant sector of technology.

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METHODOLOGY

- The Arduino Micro will affixed onto the glove for use with the ECG and MPU9250 modules
- To provide live feedback from the module inputs, a custom serial port communication scheme was designed and implemented
- Android SDK will be used to design the app and algorithms to analyze the module inputs
- Our team conducted a survey concerning how comfortable laymen were with AED devices or CPR techniques early November 2016 to various university students and professors around the globe

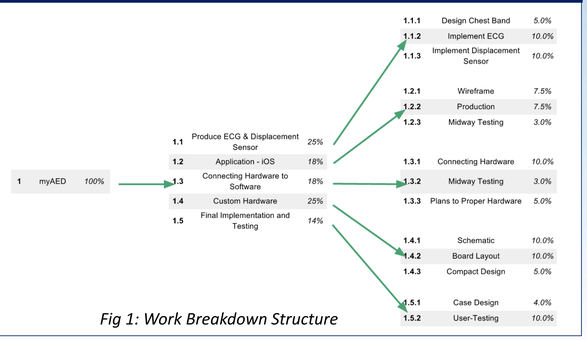
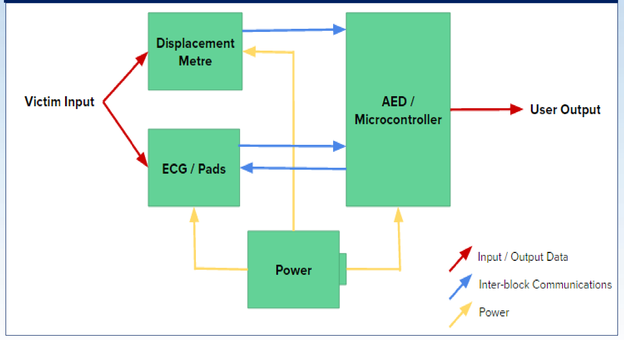


Fig 1: Work Breakdown Structure

BLOCK DIAGRAM - LEVEL 1



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