SmartChart

By: Wilson Dhalwani, Andrea Kim, & Giacomo Pugliese

MISSION STATEMENT

EMT workers are often put under high pressure, where providing the right diagnosis and treatment can mean life or death for the patient. Our mission is to create an app and hard case with integrated artificial intelligence and computer vision for EMTs, that enhances their ability to provide timely and effective care to patients. With this, we seek to minimize the time EMTs spend on documentation or looking up protocols, allowing them to maximize their time spent on patient care and call planning. We believe that our app has the potential to revolutionize the way EMTs deliver emergency medical care, enabling them to make more informed decisions and provide faster, more effective treatment to patients.

OUR INNOVATION

We created an artificial intelligence integrated web application, SmartChart, designed for the efficient and consistent delivery of EMS care. An interface was created for EMTs to record vitals and patient care summaries while continuously updating the patient care suggestions tab, a separate page that includes a patient care overview recommended by the algorithm. In addition, a machine learning model was created to take in images and return possible patient complications. Other features included are on-demand translations for language barriers and transport directions to recommended medical facilities. This app is paired with our DMAC, or Deployable Medical Assistance Case. This is an entire environment for recording and storing data, taken by inbuilt sensors or human interface. It is capable of taking real time vitals and sending them to SmartChart, for AI related processing.

PRACTITIONERS & TRAINING REQUIREMENTS

This app and case are created for EMTs to use on-duty. Users must be certified EMTs in order to ensure that they have the background knowledge and training necessary, to correctly carry-out actions. The case and website are easy to use and maintain.
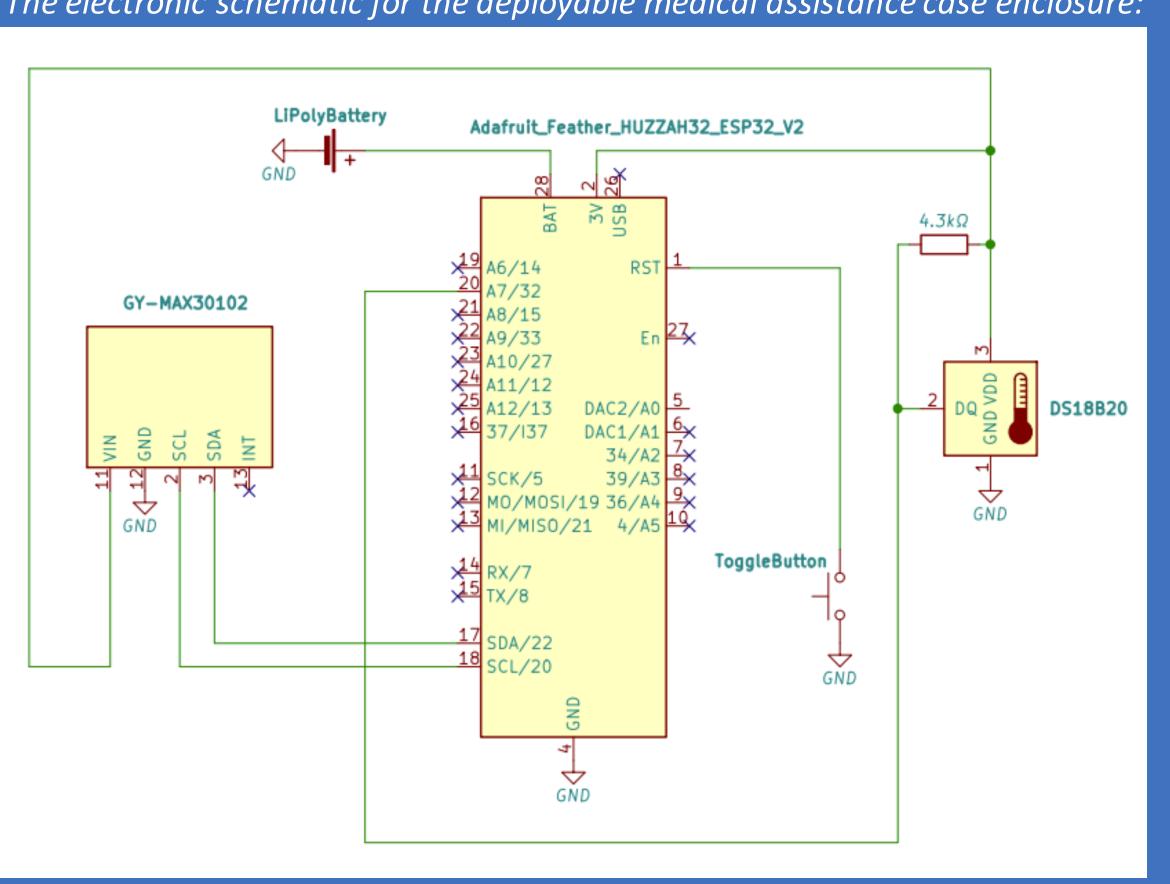
COST ANALYSIS

Combined, the total material cost of SmartChart per case comes to be less than $150 (excluding the computer). The web app has no costs other than maintenance activities and hosting. Our goal is to provide quality healthcare to all people, so we want to minimize the price as much as possible. To do this, SmartChart could apply for an SBIR grant (small business innovation research). Funding would be used to find ways to minimize costs of production and further develop the product.

IMPACT ON FUTURE HEALTHCARE

Our goal is to empower EMTs with the tools and knowledge they need to save lives, reduce patient morbidity and mortality, and improve the overall quality of emergency medical care. We hope that by using our app, patients can receive faster and more accurate diagnoses as well as receive the quality treatment they need.
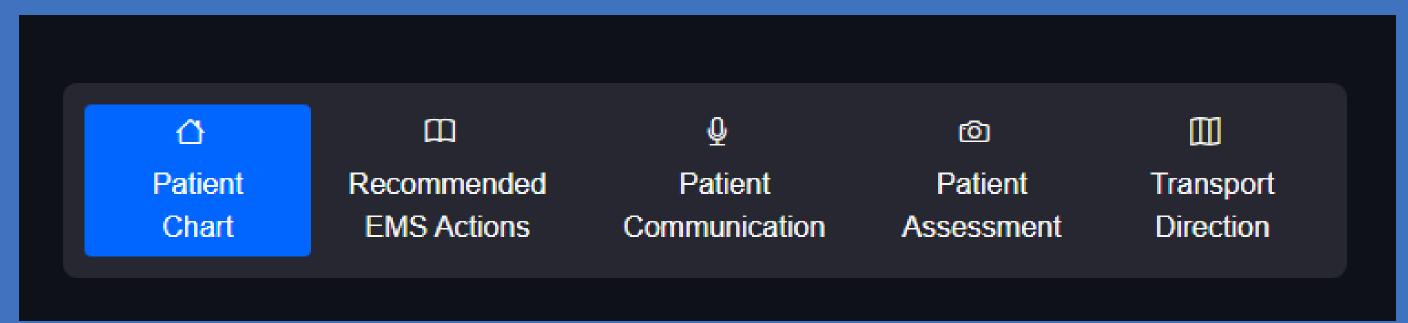
The electronic schematic for the deployable medical assistance case enclosure:

HOW IT WORKS

In the web app, users can navigate through the different tabs by using a convenient navigation bar.

Patient Chart

- EMTs can enter vitals manually or use the voice input to save time. There is also an area for inputting the EMTs hand written care report into the chart using optical character recognition
- AI was designed for the voice input understand recognize all speech patterns, understand them in any order, and take as many vitals as needed.
- Patient charts can be saved and exported.

Recommended EMS Actions

- Lists recommended actions that live updates dynamically to each patient, according to the algorithm.
- Each result also indicates possible contraindications and relative contraindications based on the patient's information.
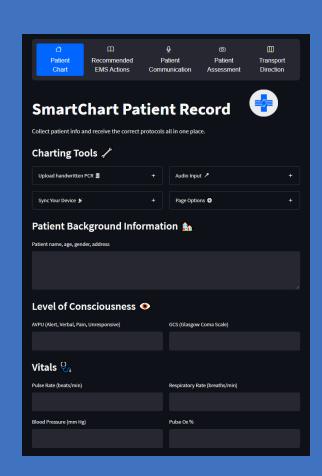
Patient Communication

- On-demand translations help with language barriers
- Conversations can be audio or text-based
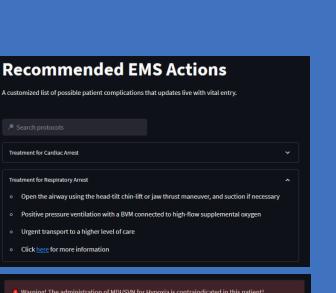- 10 language options to translate the EMT or the patient's message
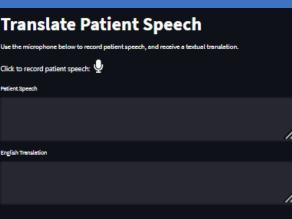
Patient Assessment

- Trained a machine learning model to classify different patient presentations using computer vision technology.
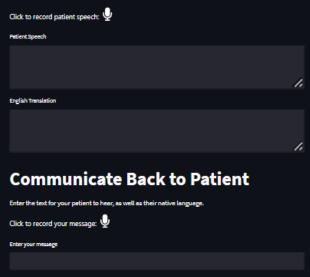- Presents relevant protocols based on classification to save time for the EMT

Transport Directions

- Alerts EMT about inclement weather conditions.
- Provides a list of the nearest facilities including hospitals, burn centers, trauma centers, stroke centers, and cardiac centers.
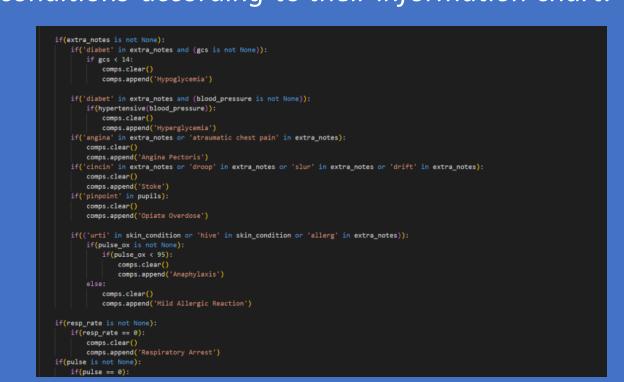- Recommends and reorders nearby facility types and provides directions based on patient information.

The algorithm for determining all possible patient conditions according to their information chart:
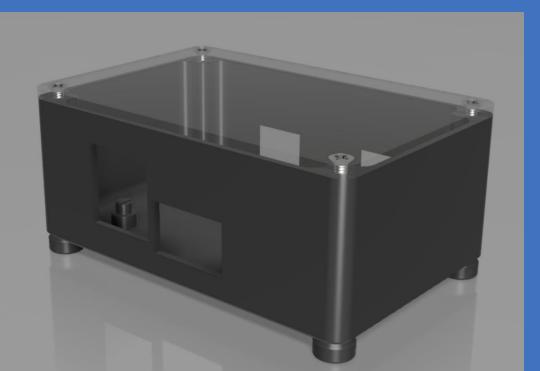

THE DEPLOYABLE MEDICAL ASSISTANCE CASE (DMAC)

The DMAC houses a microcontroller, a pulse oximeter, a temperature probe, and a secure and portable electronics enclosure for the battery. The enclosure includes a customizable LiPo battery system and onboard Wi-Fi interfacing. The DMAC also comes with a solar panel system capable of fully charging the case in just about 60 minutes. The data is then sent, recorded, and processed in real-time, allowing for accurate and efficient care of the patient.

3D render of custom CAD finger pulse oximeter clip: *3D render of custom CAD solar charger enclosure:*

Disclaimer: All above images are original student images

Adafruit ESP32 Feather HUZZAH V2

A compact and powerful microcontroller board based on the ESP32 chipset. It offers built-in Wi-Fi and Bluetooth capabilities, making it ideal for projects requiring wireless connectivity. With its small form factor and rich features, it enables easy prototyping and development of IoT applications.
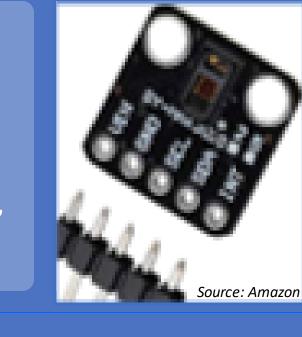
Source: Adafruit Industries

Adafruit MCP73871 Solar Charger

A handy device designed to charge Lithium Polymer (LiPo) batteries using solar power. It incorporates a specialized charging chip that efficiently regulates charging, ensuring optimal battery performance and longevity. It is an excellent choice for projects that require sustainable and eco-friendly power sources.

Source: Adafruit Learning Systems

GY-MAX30102 Pulse Ox and Heart Rate Sensor

A highly sensitive and accurate sensor module that measures both heart rate and blood oxygen saturation levels. It utilizes infrared and red-light sensors to detect changes in blood volume, providing valuable data for monitoring health and wellness.

Source: Amazon

DS18B20 Temperature Sensor

A digital thermometer that measures temperature with high precision. It uses a unique one-wire protocol, allowing multiple sensors to be connected to a single microcontroller pin. It has a compact size and waterproof casing.

Source: Amazon

Adafruit LiPo Battery 3.7V 500mAh

A rechargeable Lithium Polymer (LiPo) battery specifically designed for small electronic projects. It offers a high energy density and a compact form factor, making it suitable for applications where space is limited.

Source: Adafruit Industries