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Vibrating Alert Bracelet

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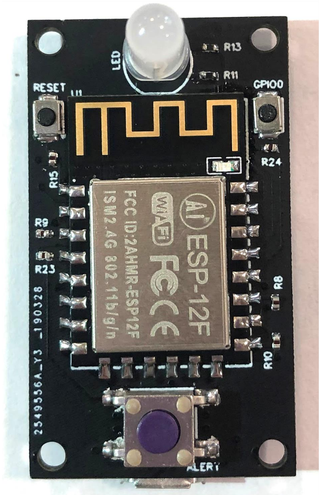
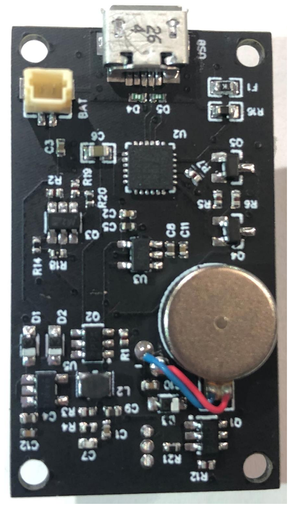
Abstract

The goal of this project was to implement an emergency alert system for hearing-impaired individuals via a vibrating wristband. The system as implemented consists of four main components:

- Android App for Administrator Control
- Server back-end running on a Raspberry Pi
- Bracelet based on an ESP8266 microcontroller with integrated WiFi
- 3D Printed housing





Conclusion & Future Work

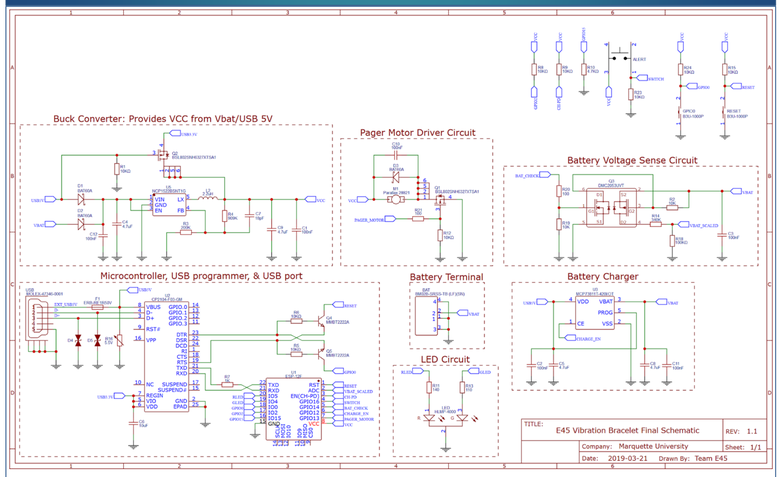
Tasks achieved:

- Successfully implemented a WiFi-connected microcontroller that controls a pager motor & receives input from a push button
- Successful creation of an Android App that can communicate with the hardware through a custom server back-end

Future work:

- A larger, 850 mAh battery would increase battery life almost threefold with no significant form factor expansion.
- A redesign based around Bluetooth Low Energy would improve battery life by up to 30%

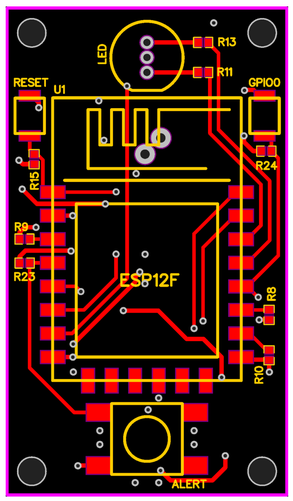
Hardware



The hardware implementation is centered around an ESP8266 microcontroller. The ESP8266 was chosen for its integrated WiFi radio, low power operation, and wealth of open-source code libraries.

The ESP has 6 major sub-circuits peripheral to it:

- Buck Converter/Power Delivery
- Battery Charger
- USB to UART via CP2104 IC
- Pager Motor Driver
- Red/Green LED Driver
- Battery Voltage Sense



The bracelet is powered via a 290mAh Li-ion battery. Battery life can be extended to up to 22 hours with the use of the ESP's "Light Sleep" mode.

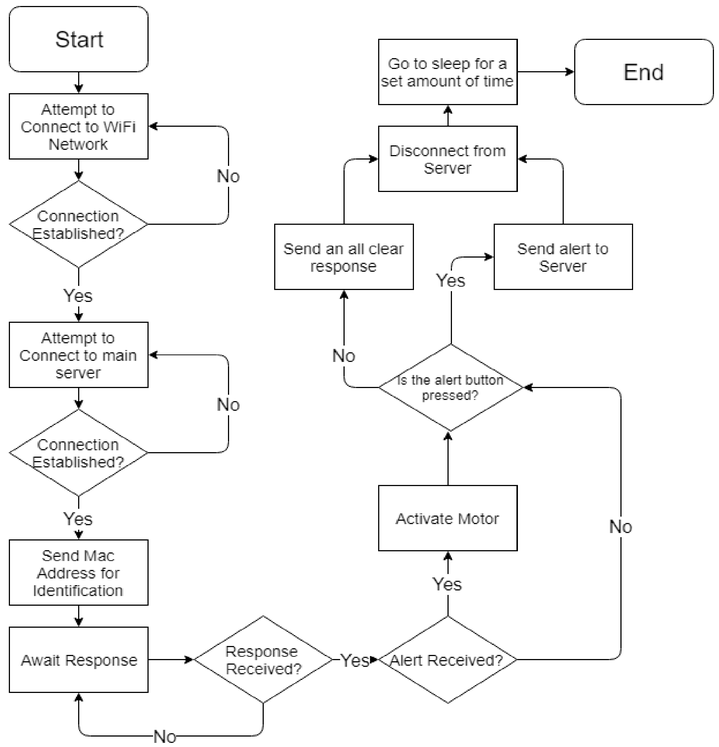
The PCB has four layers and is relatively compact at 23.7 x 41.3 mm with 57 total components.

Software

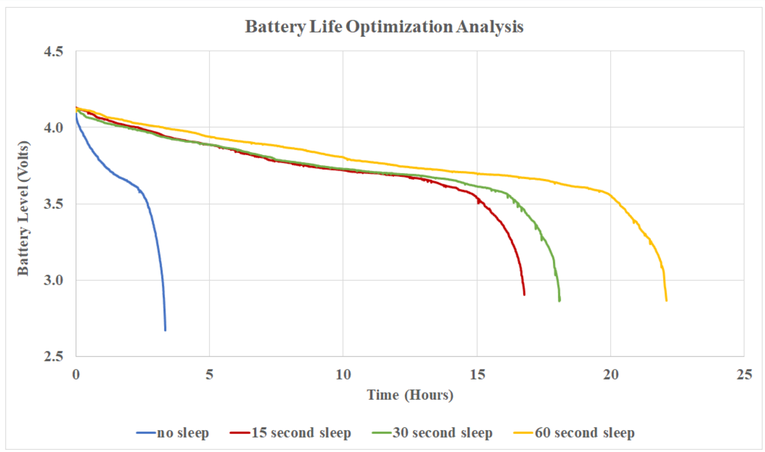
The app tracks the status of connected bracelets and can send out alerts to all users connected to the network. Connected clients are reported by the server and displayed in the app. If an alert is received from a bracelet, the app issues a notification to the phone and displays which user sent the distress signal.

The server maintains an active list of clients' check-in times to accurately report whether a bracelet is connected. Upon sending an alert, the client will remain alerted for a set amount of time before reverting.

The bracelets will frequently contact the server to receive updates and send any alerts. Below is shown the flow chart for the bracelets' operation procedures.

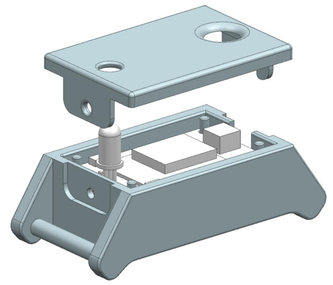


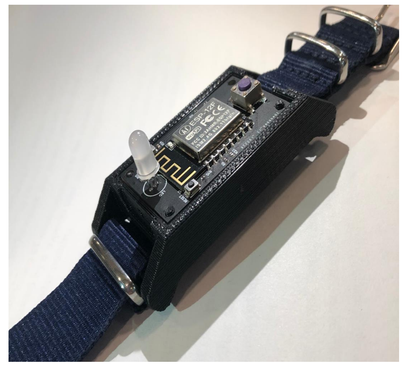
Battery Life



Due to the significant power draw of the WiFi radio putting the system to sleep periodically was required for prolonged operation. Battery life can be extended to almost a day using reasonable sleep durations.

Enclosure





The enclosure was 3D printed using the plastic material Stratasys ABS-M30. Fully assembled the case is 65 x 31 x 16 mm. It is secured to the wrist with a NATO style watch strap and allows for access to the button, LED and USB port while worn on the wrist.