UMassAmherst
The Commonwealth's Flagship Campus

Shiver-Ring

FPR Presentation for Team 2

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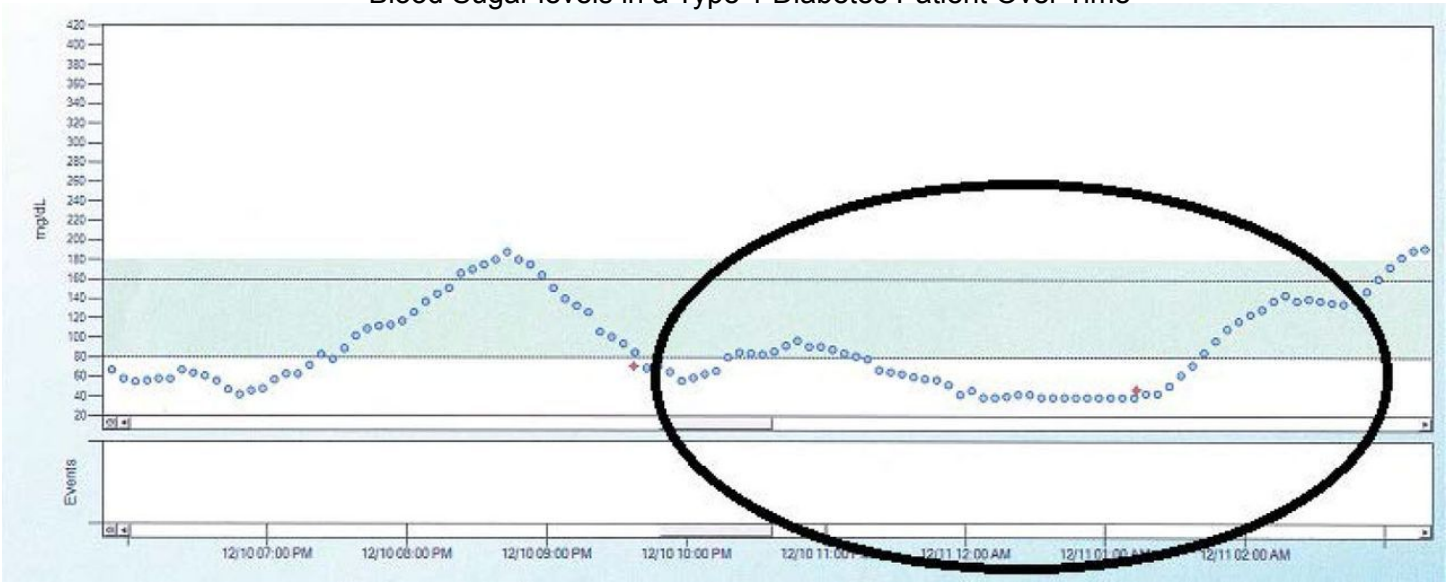
Problem Statement

When diabetic patients sleep their blood sugar levels can drop and result in hypoglycemic events, if the patient is unable to wake these events can go untreated and result in coma and even death.

Blood Sugar levels in a Type 1 Diabetes Patient Over Time

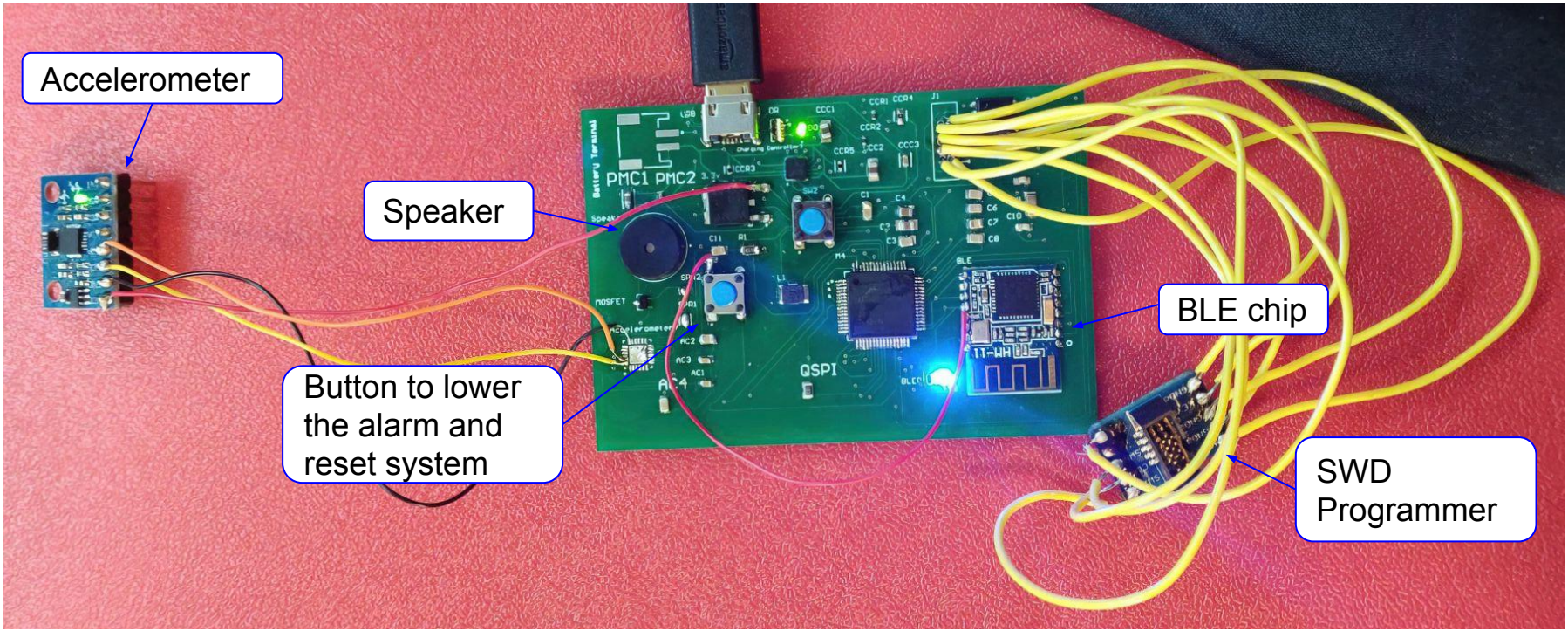


(Source: *Unger J:* Diabetes Management in Primary Care. *2nd ed. Philadelphia, Pa., Lippincott, Williams, and Wilkins, 2012.*)

System Specifications

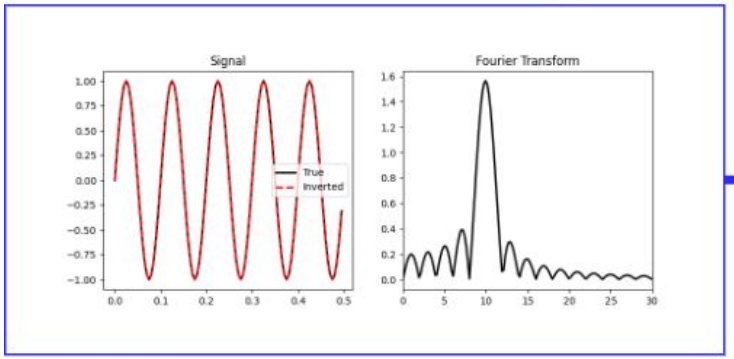
- Sense in range 8-12 Hz
- Have an alarm go off when threshold met for 15 seconds
- Send a message to someone if the event is occurring and alarm has not been disabled within 24 seconds
- Wearable and comfortable wrist strap
- Our SDP budget is the limit to the price of our solution ($500)
- Multiple day battery life

Documentation of Final Design



Updated Overall Design

Reset If The Switch is Toggled



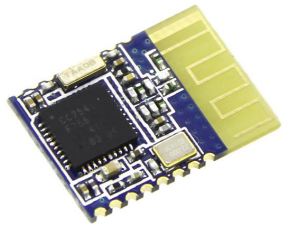
Signal Collection and Processing Loop

Alarm Sent

Buzzer and Timer

Timer Elapses

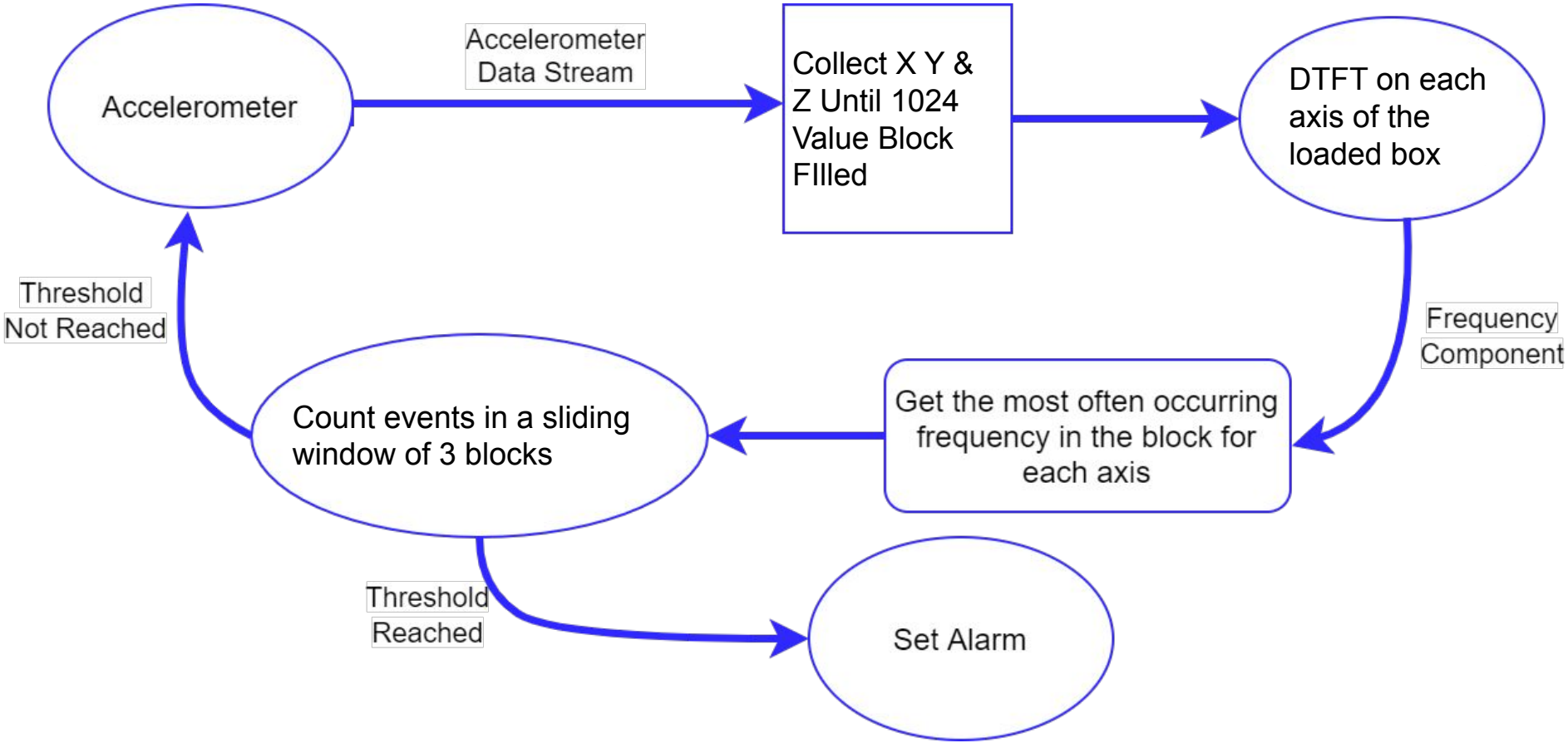
Bluetooth Module

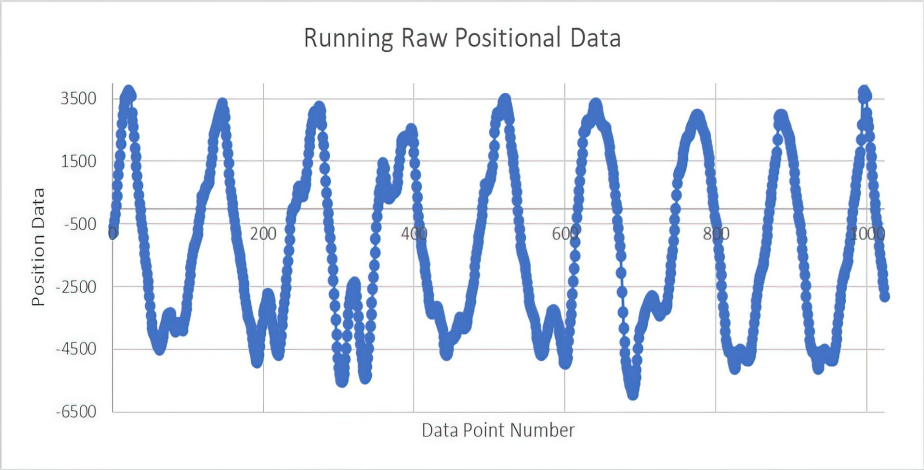


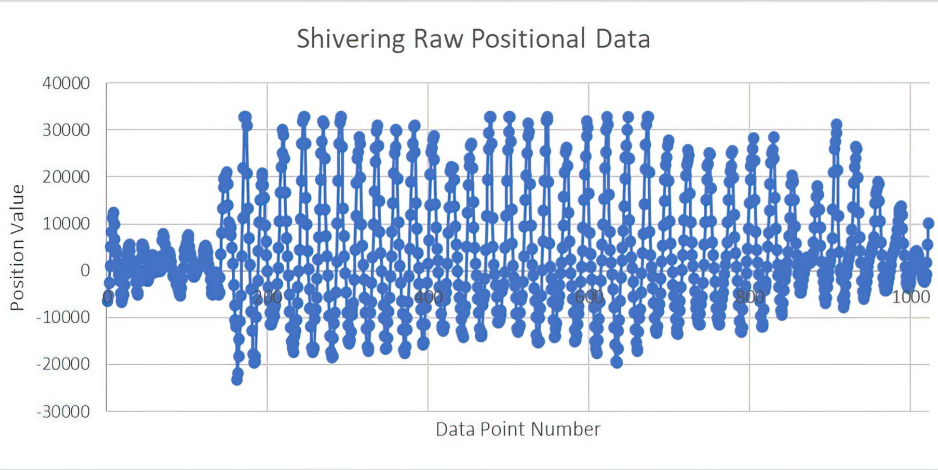
Alert Sent by Bluetooth

Phone with SMS capable Andriod App

Updated Signal Processing




Running Raw Positional Data
Position Data
3500
1500
-500
-2500
-4500
-6500
200
400
600
800
1000
Data Point Number


Shivering Raw Positional Data
Position Value
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30000
20000
10000
0
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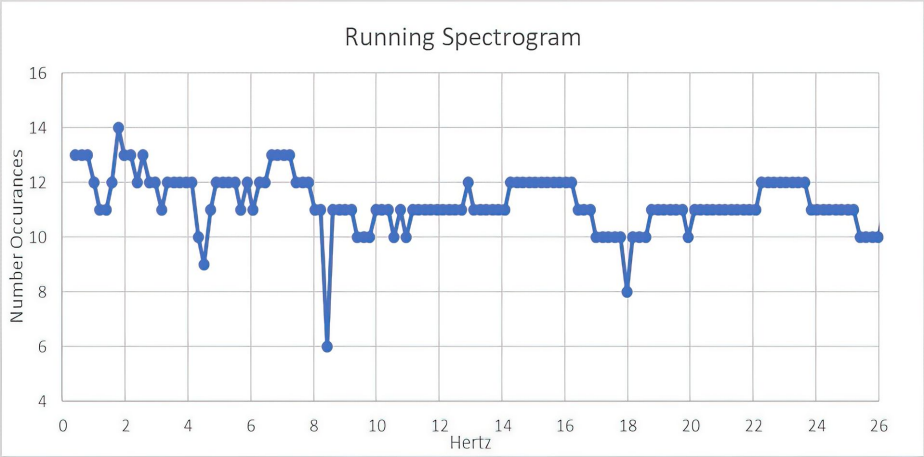
-20000
-30000
200
400
600
800
1000
Data Point Number


Running Spectrogram
Number Occurances
16
14
12
10
8
6
4
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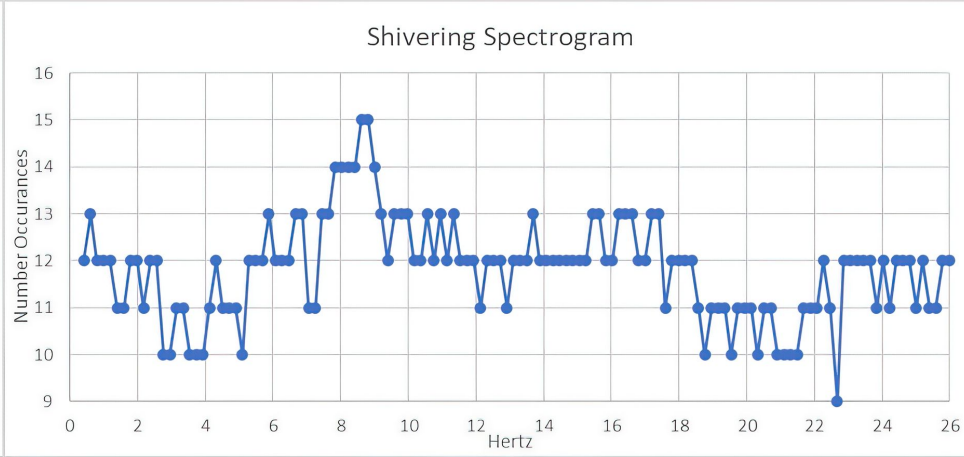
2
4
6
8
10
12
14
16
18
20
22
24
26
Hertz


Shivering Spectrogram
Number Occurances
16
15
14
13
12
11
10
9
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2
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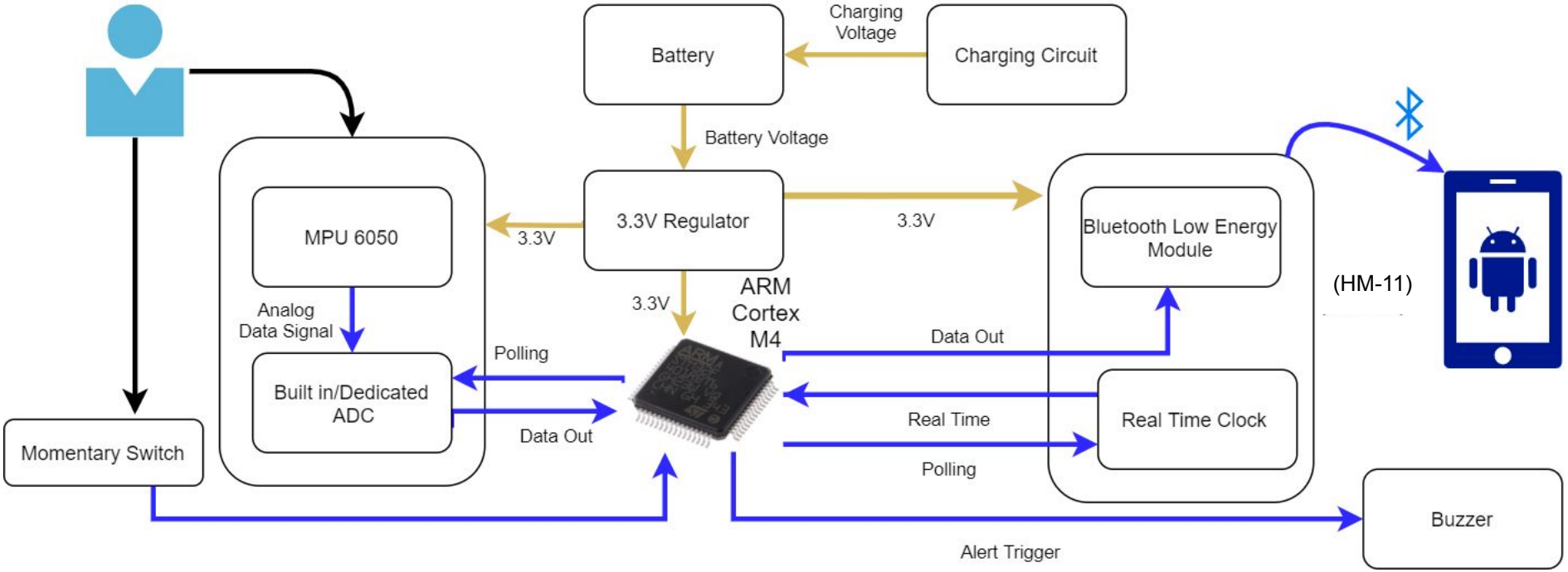
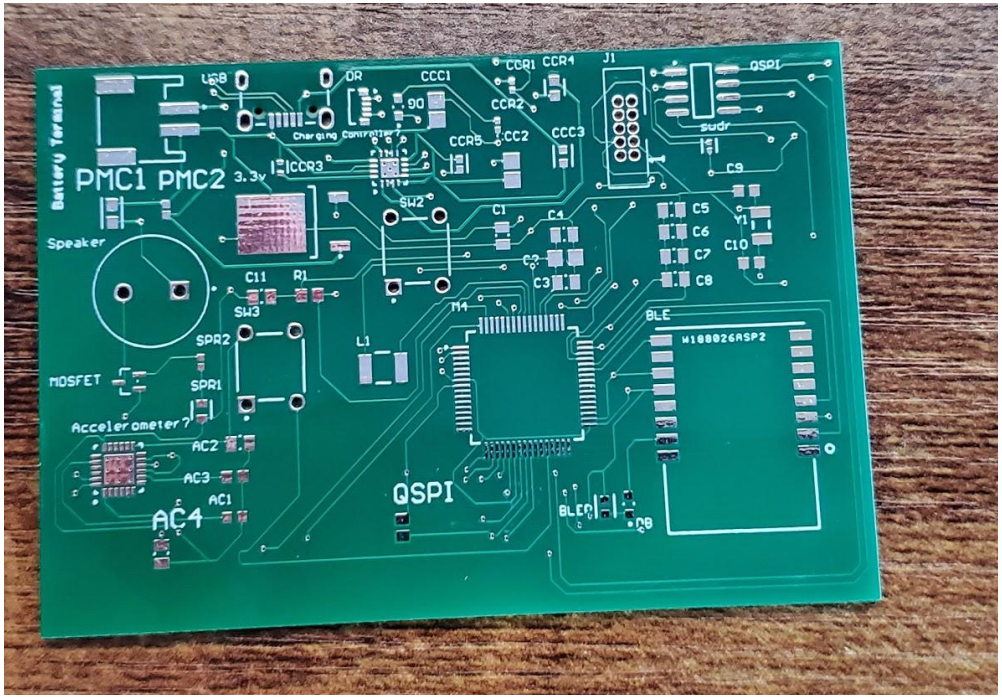
6
8
10
12
14
16
18
20
22
24
26
Hertz

Updated Hardware Design

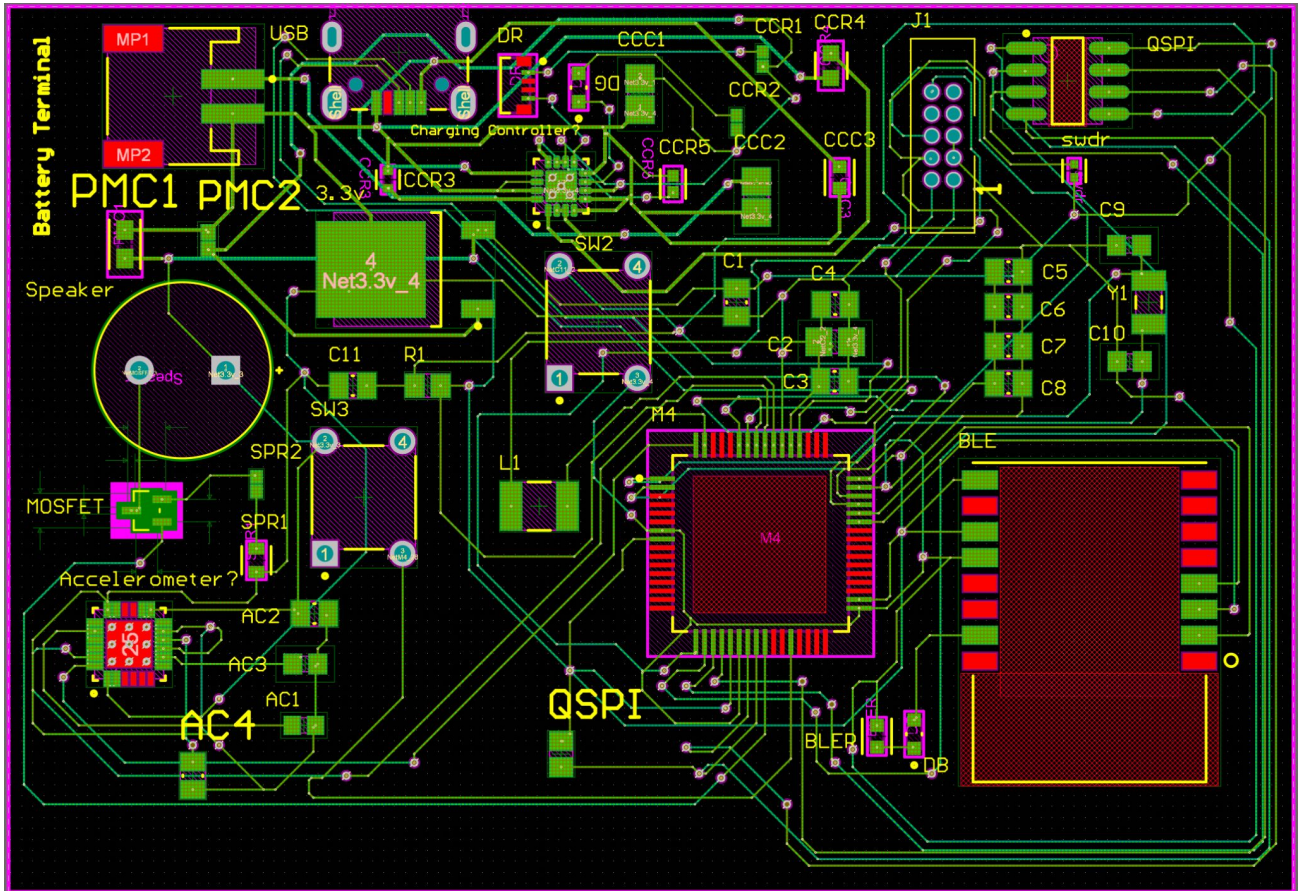


Custom PCB

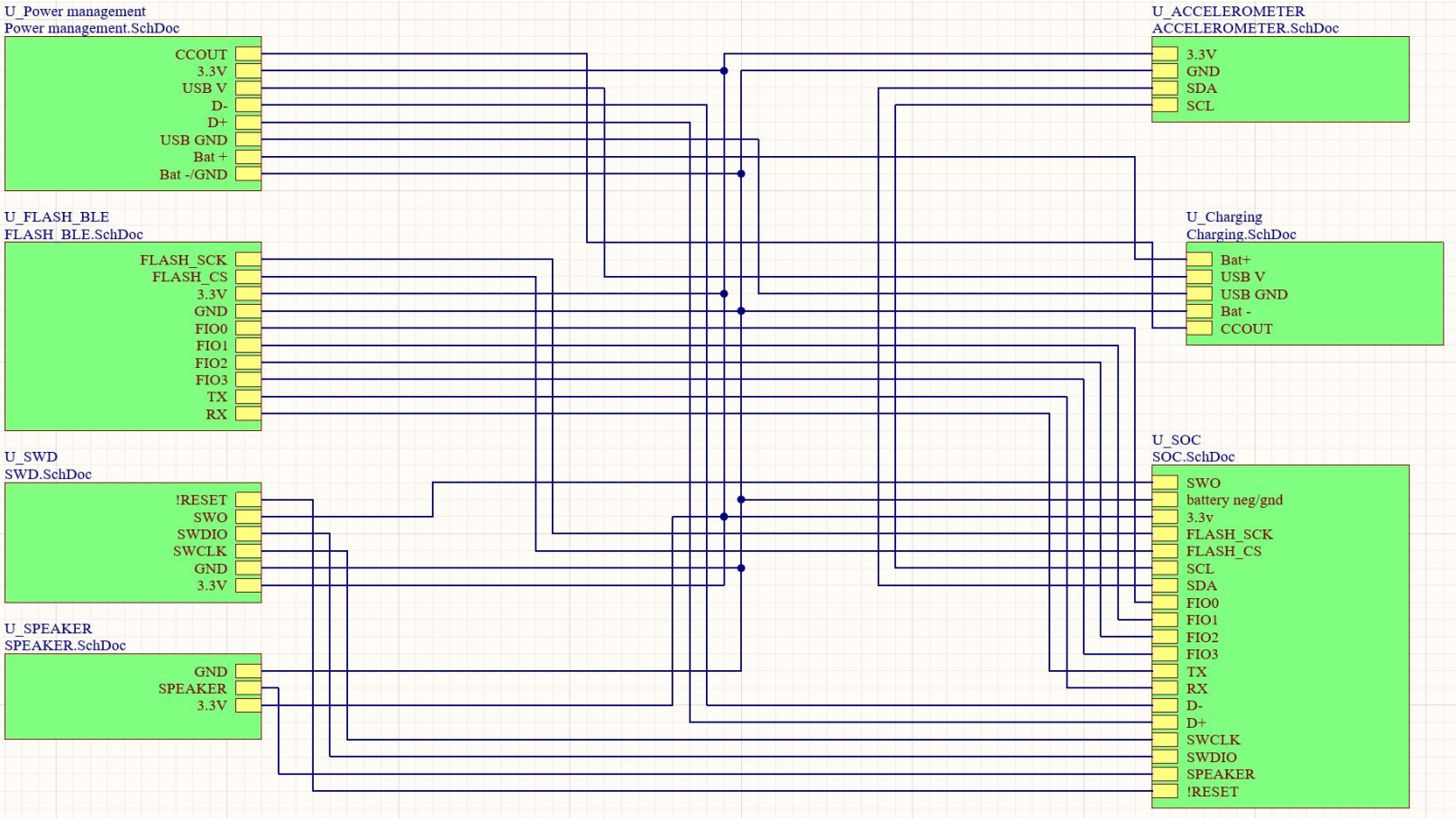
- Errors found during assembly
  - unable to find workarounds for a variety of issues in design
  - Had to redesign and order new boards
- Rigid board to show functionality
  - Flex boards would not arrive in time



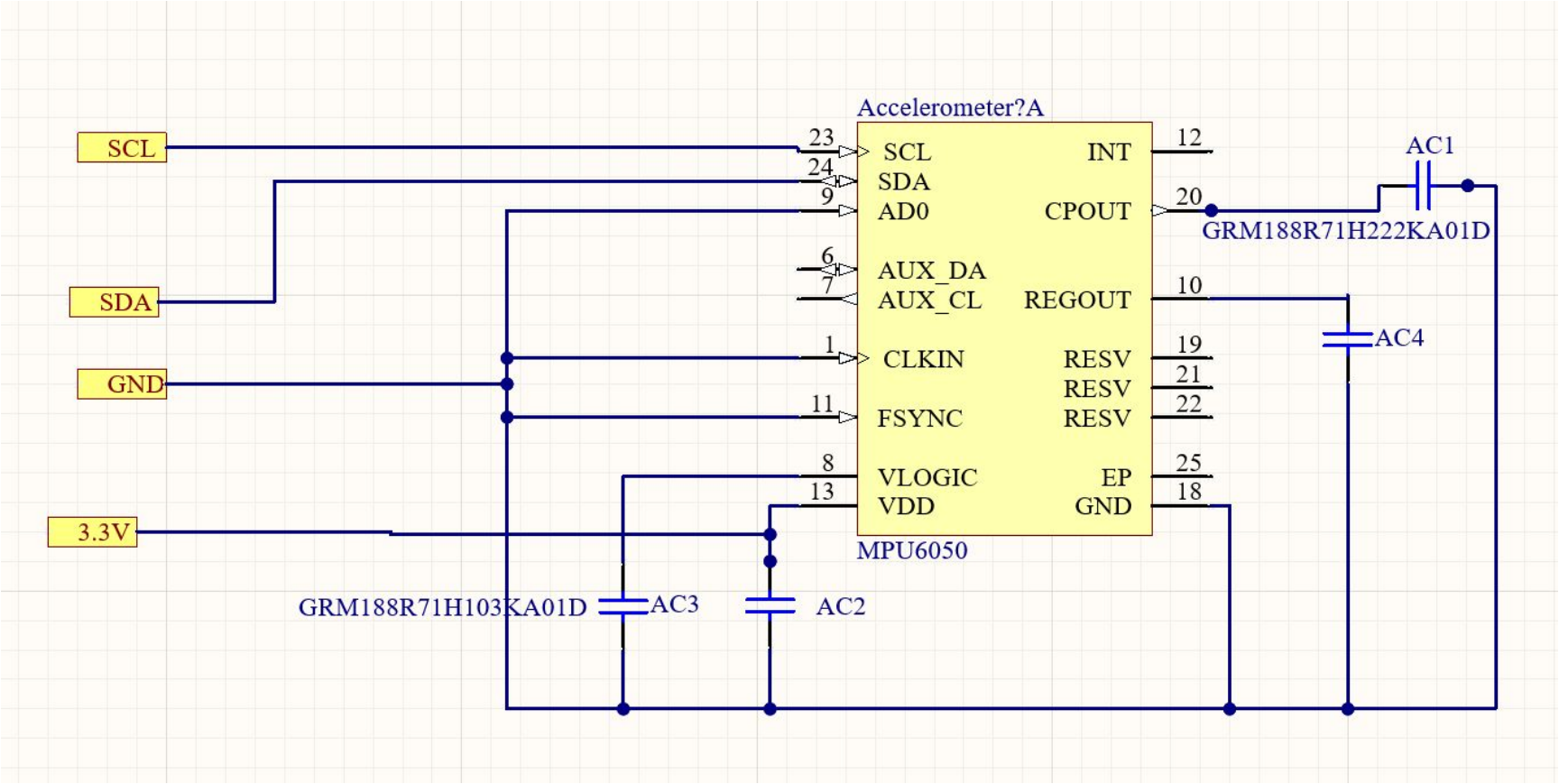
Board Layout



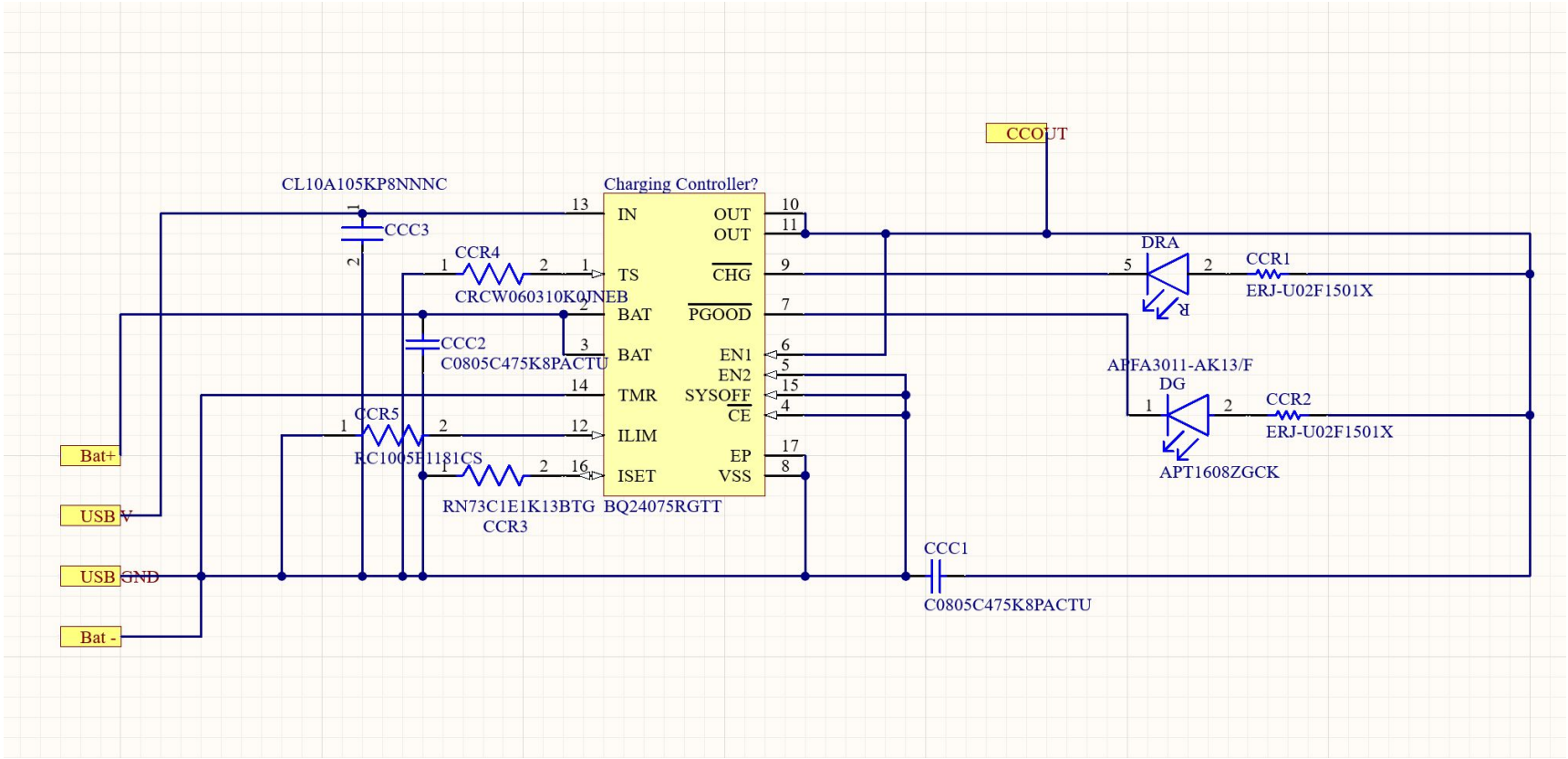
Main Schematic



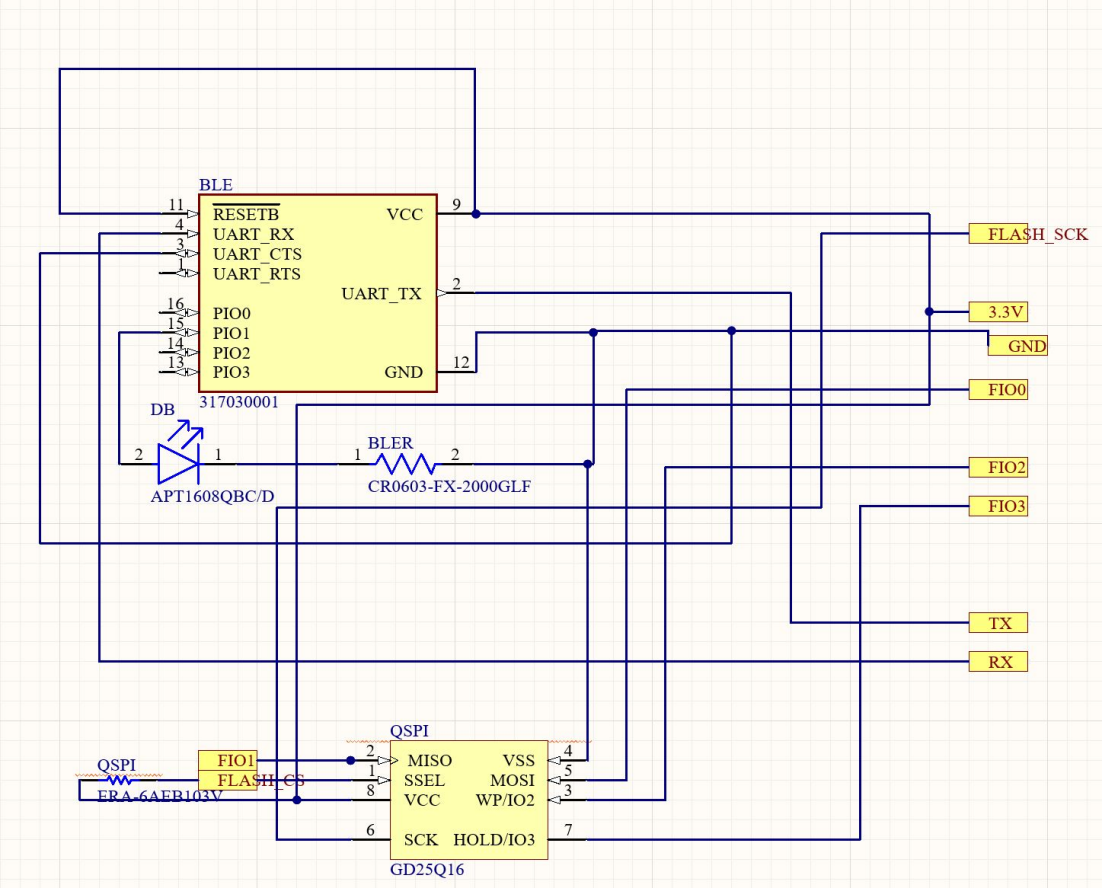
Accelerometer



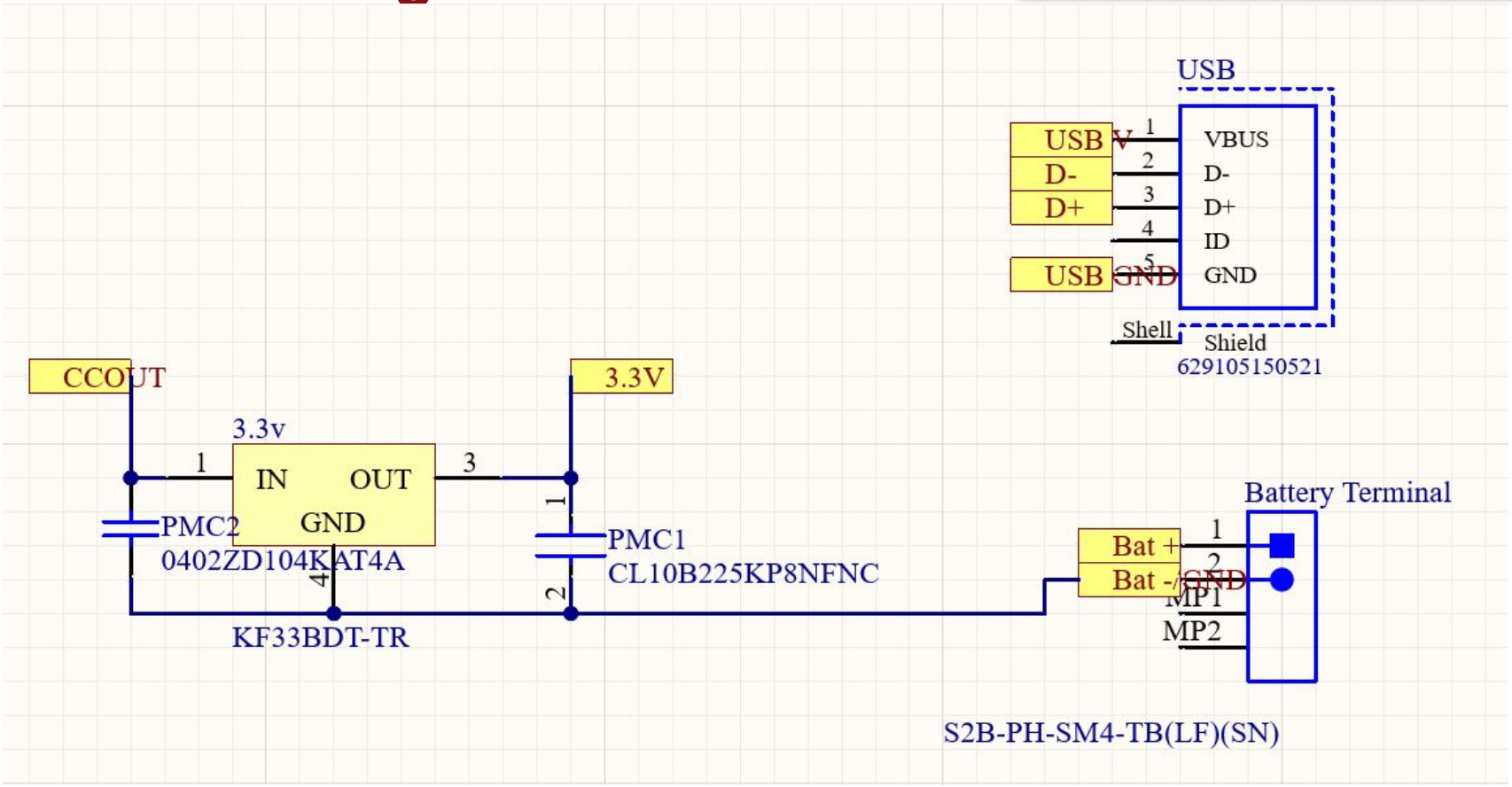
Charging Circuit



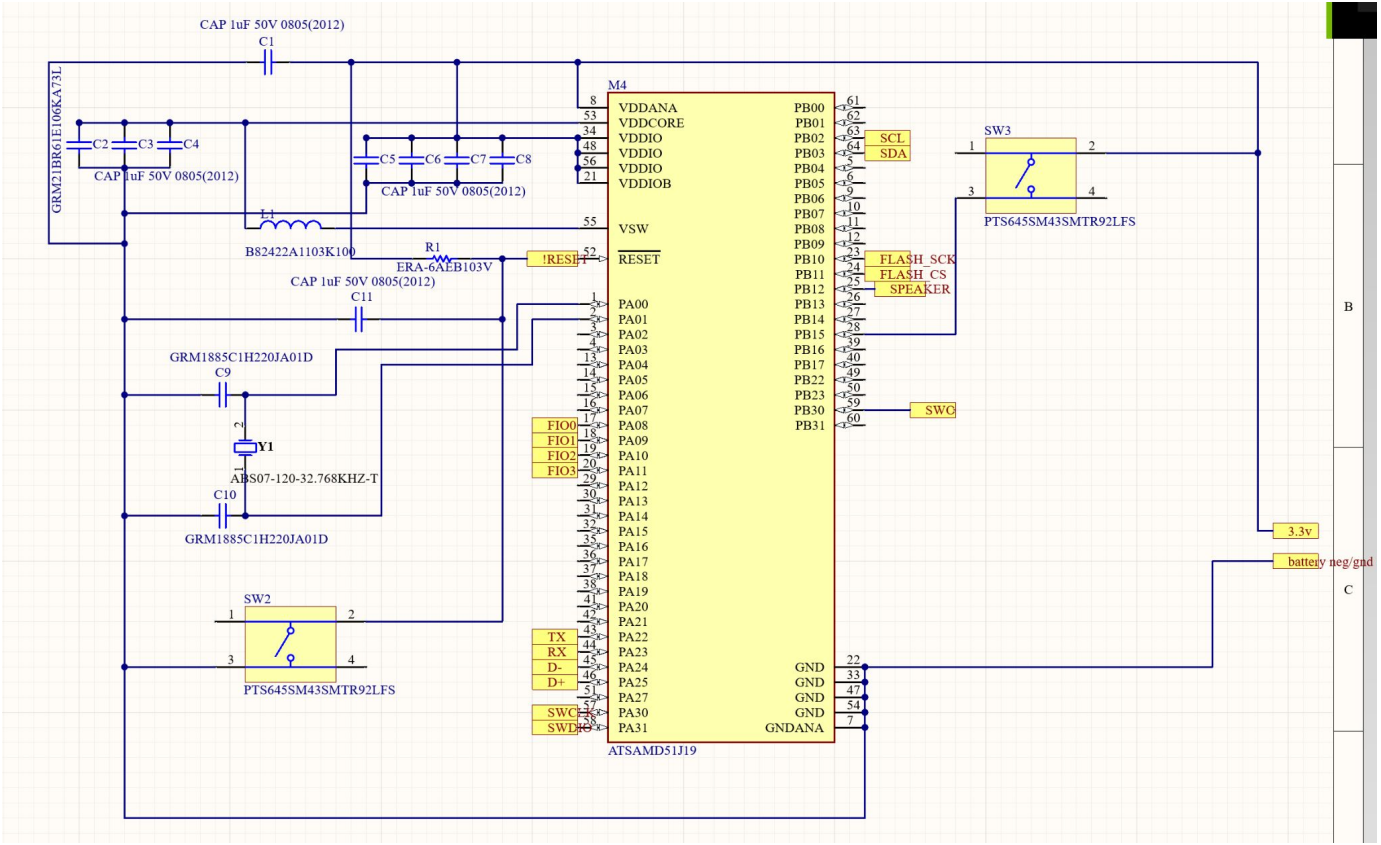
Flash and BLE Circuit



Power Management



SoC


CAP 1uF 50V 0805(2012)
C1
GRM21BR61E106KA73L
C2
C3
C4
CAP 1uF 50V 0805(2012)
C5
C6
C7
C8
CAP 1uF 50V 0805(2012)
L1
B82422A1103K100
R1
ERA-6AEB103V
!RESET
CAP 1uF 50V 0805(2012)
C11
GRM1885C1H220JA01D
C9
Y1
ABS07-120-32.768KHZ-T
C10
GRM1885C1H220JA01D
SW2
PTS645SM43SMTR92LFS
M4
VDDANA
VDDCORE
VDDIO
VDDIO
VDDIO
VDDIOB
VSW
RESET
PA00
PA01
PA02
PA03
PA04
PA05
PA06
PA07
PA08
PA09
PA10
PA11
PA12
PA13
PA14
PA15
PA16
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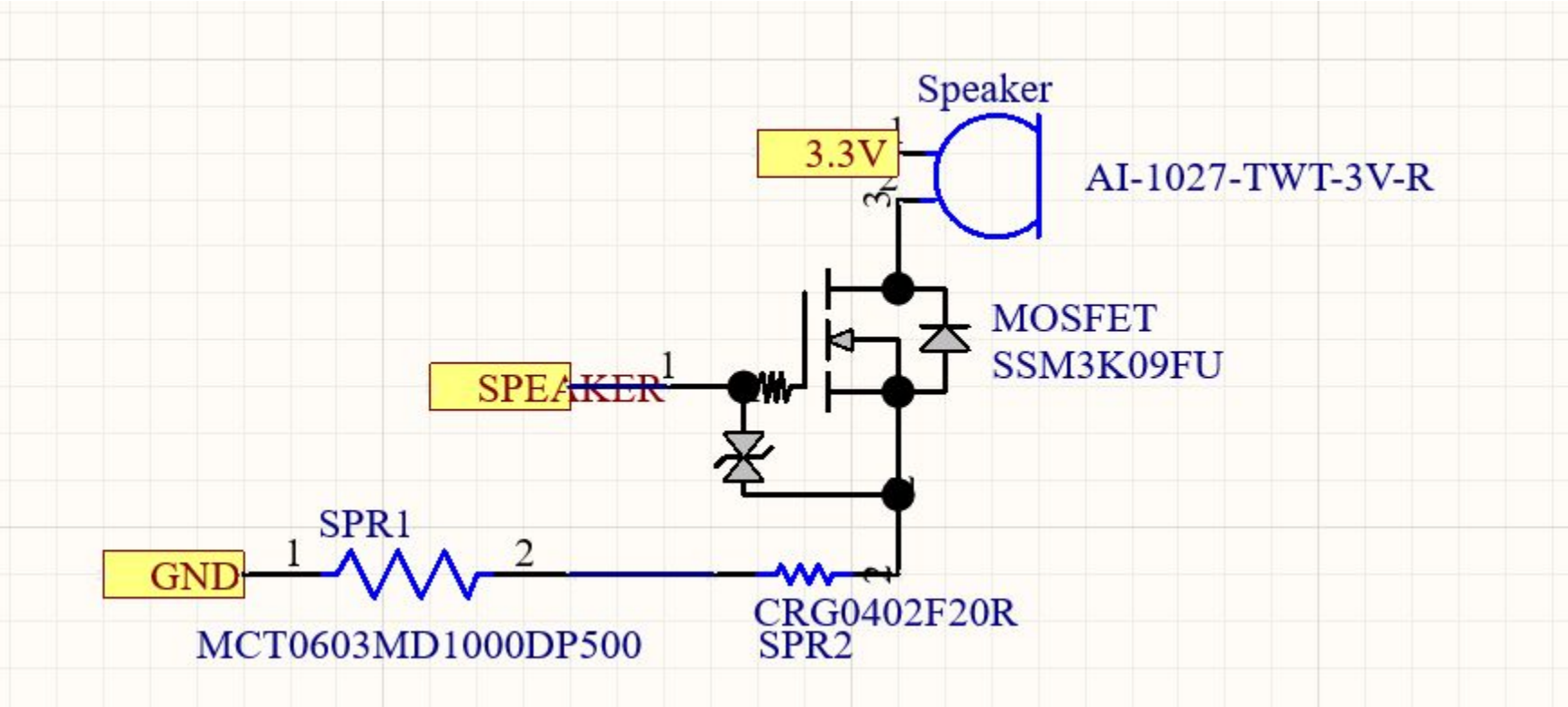
PB15
PB16
PB17
PB22
PB23
PB30
PB31
GND
GND
GND
GND
GNDANA
ATSAMD51J19
FIO0
FIO1
FIO2
FIO3
TX
RX
D-
D+
SWCLK
SWDIO
SCL
SDA
FLASH_SCK
FLASH_CS
SPEAKER
SWO
SW3
PTS645SM43SMTR92LFS
3.3v
battery neg/gnd
B
C

Speaker


Speaker
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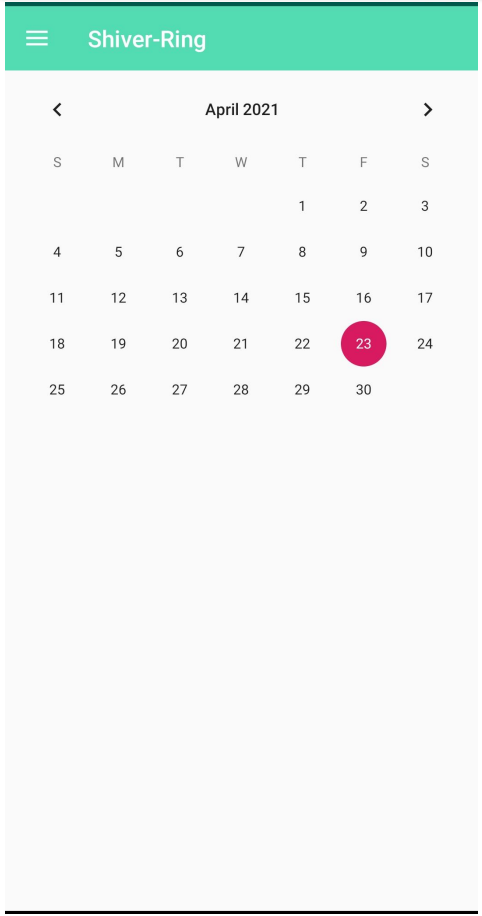
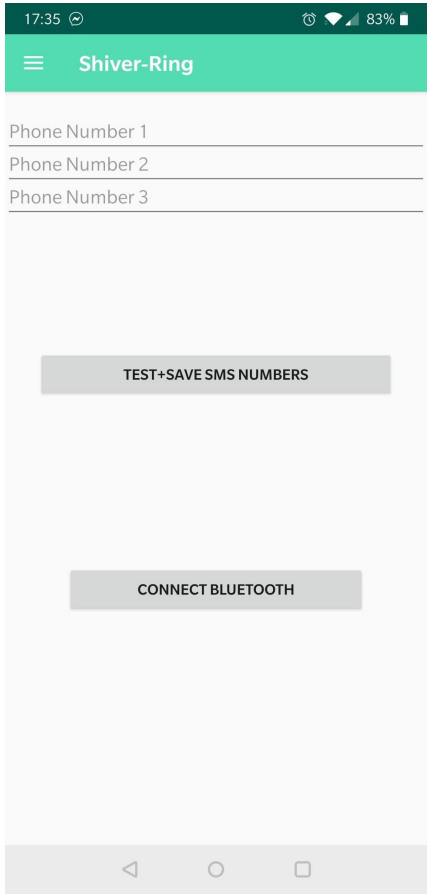
AI-1027-TWT-3V-R
MOSFET
SSM3K09FU
SPEAKER
SPR1
GND
MCT0603MD1000DP500
CRG0402F20R
SPR2

Calendar integration

- Event triggers text
- Time is recorded and written to a file for that date
- Calendar reads data from date file
  - displays list of times of events for that day
- Top half - Calendar plugin
- Bottom half - listView



Multiple Phone Number Selection



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Demo Time