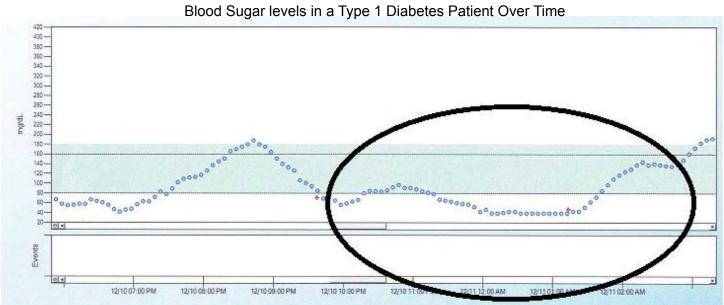


Problem Statement

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.



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

Preliminary System Specifications

- Sense in range 8-12 Hz
- Have an alarm go off when threshold met for 5 seconds
- Send a message to someone if the event is occurring and alarm has not been disabled within 10 seconds
- Wearable and comfortable wrist strap
- Our SDP budget is the limit to the price of our solution (\$500)
- 12 Hour battery life

Survey of Competing Solutions in Marketplace





Advantages:

- FDA Approved Class 3 medical device
- Non-Invasive
- No calibration required

Disadvantages:

- Expensive
- 10% failure rate
- Only alerts nearby users using a buzzer, no secondary alert system

Advantages:

- 96% success rate
- user monitoring app
- data shared to family and health professionals

Disadvantages:

- Invasive
- Has to be replaced every 90 days
- Sends data every 5 minutes



90-day Implantable Sensor subcutaneous



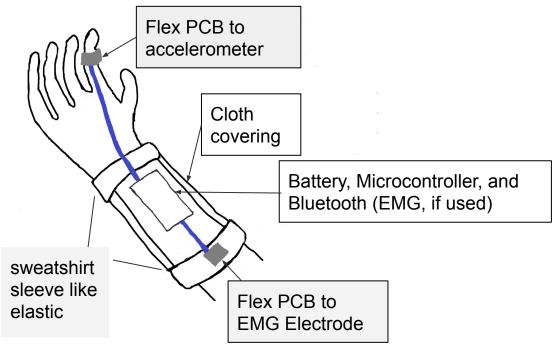
Removable Transmitter worn over skin



Mobile Application

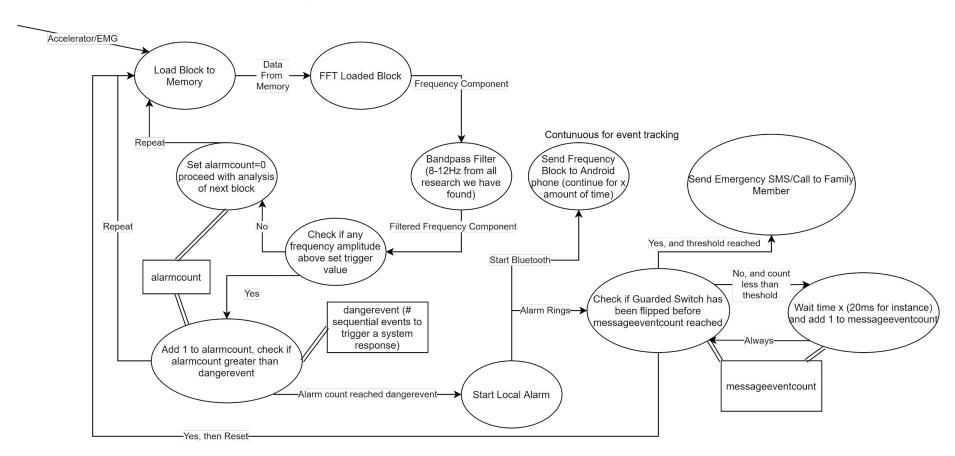


Design Alternatives/Ideas

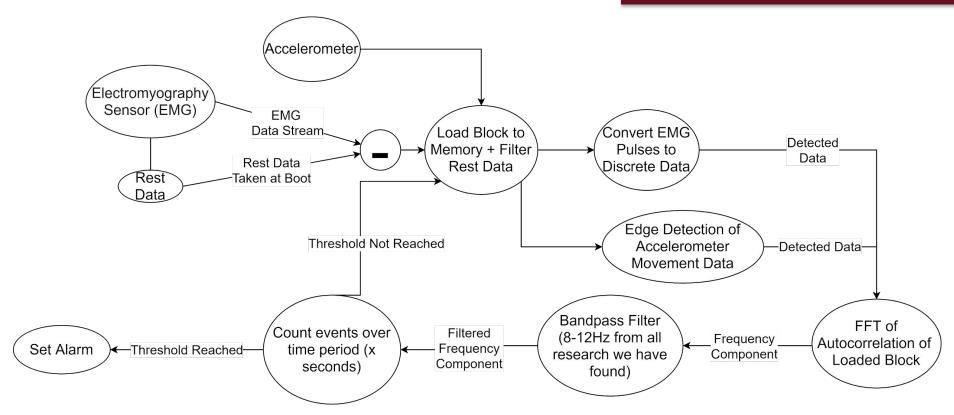


Preliminary Design

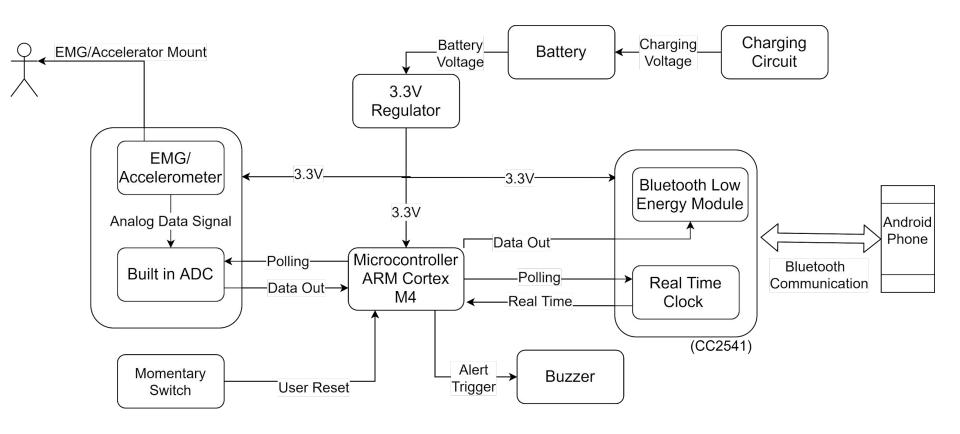
Overall Design:



Signal Processing



Significant Custom Hardware Design



Proposed MDR Deliverables

- A survey of sensors:
 - Oymotion Analog EMG
 - needs electrodes
 - wet and dry electrodes
 - conductive textile electrode
 - Triple Axis Accelerometer MPU6050
- Tests to report back on:
 - determine the better sensor
 - location tests to get the best signal for EMG
 - signal processing in MATLAB or similar
 - Android app (only calling functionality, no connectivity with the rest of the project yet)
 - Breadboard prototype







Cost Break Down

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Part	Number	Price Each	Price	Link to Part		
Oymotion Analog EMG	1	\$38	\$38	link		
Triple Axis Accelerometer MPU6050	3	\$10	\$30	link		
Arm Cortex M4	2	\$14	\$28	link		
M4 development Board	2	\$28	\$56	link		
Flexible Custom Board	1	\$40	\$40	link		
Bluetooth Low Energy 4.0 TI CC2540	2	\$9	\$18	link		
3,600mah Li-on Battery	1	\$14	\$14			
Alarm & Switch	1	\$5	\$5			
Housing and Band Material		\$40	\$40			
Shipping Costs		\$30	\$30			
Total			\$299			

Project Management - Administrative and Technical

- Connor Loughman PCB design, App Dev, Web Service
- Adam Maciaszek Budget Management, Algorithm/Embedded, Web Service
- Michael Burton Embedded + Security, Project Co-Manager (Short-Term),
 Web Service
- John Murray Communication Networking, App Dev, Project Co-Manager (Long-Term)

Project Management - Gantt Chart

PROJECT TITLE Shiver-Ring	INSTITUTION
PROJECT CO-MANAGERS John Murray & Mike Burton	PROJECT MEMBERS Michael Burton, Connor Loughman, Adam Maciaszek, John Murray

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				% OF TASK	PDR			MDR Phase 1			MDR Phase 2			MDR Final Prep
TASK TITLE	START DATE	DUE DATE	DURATION	COMPLETE	09/07-09/11	09/14-09/18	09/21-09/25	09/28-10/02	10/05-10/09	10/12-10/16	10/19-10/23	10/26-10/30	11/02-11/06	11/09-11/13
Administrative Tasks									8					
Problem Statement & Research	9/8/2020	9/9/2020	2 days	100										
Preliminary System Specifications	9/9/2020	9/15/2020	6 days	100							6			
Preliminary Design (Hardware & Software)	9/16/2020	9/17/2020	2 days	100										
Component Purchase Request	9/17/2020	9/25/2020	9 days	40										
MDR Deliverables	10/12/2020	11/13/2020	33 days	0		2								
MDR Rehearsals	11/02/2020	11/13/2020	12 days	0										
Embedded & Software														
Load FreeRTOS On Cortex-M4	10/1/2020	10/8/2020	7 days	0		3					3			
Get test program running on top of FreeRTOS	10/9/2020	10/13/2020	4 days	0										
Sensor Evaluations and Data Gathering	10/12/2020	10/22/2020	10 days	0										
Preliminary Signal Processing	10/19/2020	11/4/2020	17 days	0		9							5	
Hardware														
Breadboard Design/Order Parts	9/28/2020	10/9/2020	11 days	0		2							3	
Breadboard assembly	10/5/2020	10/15/2020	10 days	0										
Communication														
Make Base Android App	9/28/2020	10/23/2020	26 days	0		2								
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