



Shiver-Ring

MDR Presentation for Team 2

Michael Burton, Connor Loughman, Adam Maciaszek, John Murray

Updated 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. IMPORTANT CHANGE: No EMG



Blood Sugar levels in a Type 1 Diabetes Patient Over Time

Updated System Specifications

- Sense in range 8-12 Hz
- Have an alarm go off when threshold met for 12 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

Updated Overall Design



Updated Signal Processing

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Updated Hardware Design



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Addressing PDR Questions

- FDA Approved Class 3 medical device
- Find out if big manufacturers (Apple, Fitbit, etc.) have already looked into this problem.
- The shivering threshold is now 12 seconds instead of 5 seconds

Project Management - Administrative and Technical

- Connor Loughman Altium Lead, App Dev (Android Calendar Integration)
- Adam Maciaszek Budget Management Lead, Algorithm/Embedded, Web Service
- Michael Burton Project Co-Manager (Short-Term), FreeRTOS, Web Service
- John Murray Communication Networking, App Dev (General&SMS), Project Co-Manager (Long-Term)

MDR Tests

- 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
 - Android app
 - (only calling functionality, no connectivity with the rest of the project yet)

SDA XDA

Breadboard prototype



Mike Deliverables-FreeRTOS Implementation and Testing

Input-Driven interrupts

Scheduling

Additional Task:

Gathered Shivering data

```
static void threadB( void *pvParameters )
{
   SERIAL.println("Thread B: Started");
   // setup the hardware as a input to listen to
   pinMode(BUTTON_PIN, INPUT_PULLUP);
   attachInterrupt( BUTTON_PIN, Interrupt_MyHandler_IRQ, FALLING );
   while(1)
   {
      // wait for a interrupt to release the task
      while (ulTaskNotifyTake( pdTRUE, portMAX_DELAY ) != pdPASS)
      {
           // do nothing
      }
      SERIAL.print("B");
      myDelayMs(200); // help debounce the interrupt handling
```

xTaskCreate(threadA,	"Task J	A",	256,	NULL,	tskIDLE_PRIORITY + 4,	&Handle_aTask);
xTaskCreate(threadB,	"Task H	в",	256,	NULL,	tskIDLE_PRIORITY + 3,	&Handle_bTask);
xTaskCreate(threadC,	"Task (c",	256,	NULL,	tskIDLE_PRIORITY + 2,	&Handle_cTask);
xTaskCreate(taskMonitor,	"Task 1	Monitor",	256,	NULL,	tskIDLE_PRIORITY + 1,	&Handle_monitorTask);

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John Deliverables-

General Android App Creation & SMS Implementation

- Main Deliverable Android App with SMS functionality
 - Other Tasks
 - Helped with Embedded
 - Gathered Shivering Data



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Connor - Deliverables

- Main Deliverable Custom Hardware Design
 - and Research
 - Research Flexible Circuit Boards
 - Pros/Cons
 - We chose to use flexible PCB
 - Design Schematic for circuit
 - Begin sourcing individual components
 - First version PCB design
- Additional Deliverables
 - Assisted with beginning Calendar Integration into Android App (still in progress)
 - Gathered Shiver Data

Adam Deliverables-Signal Analysis of Accelerometer & EMG

- Using publicly available compact DTFT library was able to facilitate frequency and magnitude referencing of accelerometer output
- Configured parameters for what is a shiver
- In charge of all embedded system activity
- Was able to eliminate EMG through testing
 - Other Tasks
 - Created first iteration and
 - Gathered Shivering data



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

				% OF TASK	PCB/Port Code		CDR Phase			FPR Phase			FPR Final Prep	
TASK TITLE	START DATE	DUE DATE	DURATION	COMPLETE	02/01-02/05	02/08-02/12	02/15-02/19	02/22-02/26	03/01-03/05	03/08-03/12	03/15-03/19	03/22-03/26	03/29-04/02	04/05-04/16
Administrative Tasks											1			
CDR Deliverables	2/22/2021	3/8/2021	14 days	0										
CDR Rehearsals	3/1/2021	3/8/2021	7 days	0										
FPR Deliverables	3/15/2021	4/16/2021	32 days	0										
FPR Rehearsals	4/5/2021	4/16/2021	11 days	0										
Embedded & Software														
Integrate FreeRTOS with Signal Processing	2/1/2021	2/15/2021	14 days	0										
Porting everything to C++/C	2/1/2021	2/28/2021	27 days	0										
Integrate Bluetooth	2/22/2021	03/19/2021	10 days	0										
FInal Design Testing	3/15/2021	4/2/2021	17 days	0										
Hardware														
PCB design Finalization, Ordering, & Recieving	2/1/2021	2/30/2021	30 days	0								1		
Cicuitboard Assembly	3/1/2021	3/10/2021	10 days	0										
Communication														
Connect Bluetooth Android App	2/1/2021	2/19/2021	18 days	0										

Cost Break Down

Part	Number	Price Each	Price	Link to Part
Oymotion Analog EMG	1	\$0	\$0	link
Triple Axis Accelerometer MPU6050	4	\$0	\$0	link
Arm Cortex M4	3	\$14	\$42	link
M4 development Board	4	\$0	\$0	link
Flexible Custom Board	1	\$40	\$40	link
Bluetooth Low Energy 4.0 TI CC2540	2	\$9	\$18	link
2100 mah Li-Po Battery	1	\$24	\$24	
Alarm & Switch	1	\$5	\$5	
Housing and Band Material		\$60	\$60	
Shipping Costs		\$30	\$30	
Total			\$210	



Demo Time