**WNR (Wireless Neural Recorder)**

Rice University

Weekly Progress Report 7

10/16/2015 - 10/22/2015

**Agenda for meetings**

Mentor Meeting:

1. FOSS I Evaluation
2. Confirm whether or not to purchase Intan chip given the cost and our application
3. Confirm strategy for determining FOSS II goals and creating wireless network

**Activities this week**

1. Prepare cycle one documentation
2. Look into other approaches for BLE other than CC2650 (found the Nordic Labs chips)

**Problems encountered**

1. Could not figure out BLE environment from TI, but we will still continue to try.
2. Nordic Labs has a BLE chip, but has no sample code. Testing on this board may be difficult.

**Time devoted to project this week**

|  |  |  |
| --- | --- | --- |
| **Name** | **Tasks Accomplished** | **Hours Spent** |
| Stephen Xia | * Week Two Documentation * BLE development | 12 |
| Tingkai Liu | * Week Two Documentation * BLE development | 13 |
| Xin Huang | * Week Two Documentation * BLE development | 10 |
| Yuan Gao | * Week Two Documentation * Research compression | 12 |
|  | **Team Total** | 47 |

**Meetings Minutes**

TI 1-on-1 Meeting – 10/16/2015, 1:00PM - 2:00 PM

Attendees: Stephen Xia, Tingkai Liu, Xin Huang, two TI engineers

Completed objectives:

1. Difficult part is to reduce required data rate
2. ADC:
   1. More precision may not be useful in our application, so we can reduce data rate by reducing the bit precision
   2. Better signal conditioning may reduce the bits required for the ADC
3. Wireless Components:
   1. Store all data and decimate by only sending a fraction of it using ffts or other methods
   2. Aim for 750 kb/s
   3. Possibly use 802.11g; look into the documentation for this protocol
   4. Data overhead: packets may get lost, so what will the scheme do when data gets lost?
4. Things to consider:
   1. Reduce the dimensionality of the problem by taking FFTs and transmit the frequencies you need
   2. Understand how UDP and TCP works to deal with error correction and lost packets
   3. Packet error rates:
      1. Lots of wireless devices in an area, like in a hospital, will increase the packet error rates
      2. Transmit and lower frequencies to reduce packet error rates
      3. Should conduct throughput tests in hospitals where the system will be used

Mentor Meeting – 10/22/2015, 12:30PM - 1:30 PM

Attendees: Stephen Xia, Tingkai Liu, Xin Huang, Yuan Gao, Hamed Rahmani, Gary Woods

Completed objectives:

1. FOSS I Evaluation:
   1. Most objectives completed
   2. Creating wireless transmission scheme was not successful due to difficulty in using the TI BLE stack.
      1. Continue development while also looking into simpler schemes, like the point-to-point connection and BLE chips from Nordic Labs
2. Next Steps:
   1. Ask for IEEG data from Dr. Tandon or Professor Aazhang
   2. Purchase the 64 channel Intan chip; it does exactly what we need for AFE
   3. Really need to get wireless BLE working
      1. Work on CC2650 and Nordic Labs chips in parallel with each other
      2. research udp and tcp
   4. Compression:
      1. Adaptive Huffman encoding compresses by 40% at most and only if the data is highly correlated
      2. Vector Quantization has 60% compression; look more into this method
   5. Another possible way to reduce data rate:
      1. Dr. Tandon specified we should sample at 1 kHz, but in papers released by Reid Harrison of Intan Technologies, signals of only up to 30 Hz are seen. As such, we can reduce the sampling rate by more than a factor of two if this is true, making our system feasible

**Expenditures**

* N/A

**Action items list**

|  |  |  |  |
| --- | --- | --- | --- |
| **Action item** | **Owner** | **Due date** | **Status** |
| Research Wireless/BLE technologies | Xin Huang | 10/23/2015 | 100% |
| Survey analog front-end chips for neural recording | Tingkai Liu | 10/23/2015 | 70% |
| Research analog front-end circuits for high SNR amplification | Stephen Xia | 10/23/2015 | 70% |
| Battery module research/survey | Xin Huang | 10/23/2015 | 99% |
| Intan Chip/Analog front-end power consumption research | Tingkai Liu | 10/23/2015 | 50% |
| Wireless transmission power consumption research | Stephen Xia | 10/23/2015 | 50% |
| Research compression algorithms | Yuan Gao | 10/23/2015 | 30% |
| CC2650/CC2640 BLE Development | Xin Huang | 10/23/2015 | 2% |
| Design Strategy | Stephen Xia | 10/23/2015 | 100% |
| Team Contract | Tingkai Liu | 10/23/2015 | 100% |
| Standards and Regulations | Yuan Gao | 10/23/2015 | 100% |
| Product Safety Analysis | Xin Huang | 10/23/2015 | 100% |
| Setup SVN; compile documentation online and offline | Tingkai Liu | 10/23/2015 | 100% |
| List of Purchases and Expenditures | Yuan Gao | 10/23/2015 | 100% |

**Additional Comments/Questions for Mentors**