

Progress Report

Portable MRI Scanner

by



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1. Background

MRI is widely used in the diagnosis of bone and soft tissue conditions; however, a conventional MRI scanner is very expensive. MRI Solutions is currently working on building a portable and low cost MRI scanner prototype, capable of producing a 2D image by relaxing the homogeneity constraints of the magnetic field and using the inhomogeneity of permanent magnet for spatial encoding. A portable and low cost MRI will increase access to affordable MRI scans as well as immediate diagnosis in situations where normally an MRI scanners is not available such as sporting venues, military operations, and portable medical clinics. The design will be centred around cost-effectiveness, portability, safety and scalability.

2. Schedule

The initially proposed schedule is shown in Figure 1. The team has finished assembling, testing and adding rotational components for the magnet system. The research for RF system has been completed and team is focussing on assembling and testing the components for RF system. Currently, the project is approximately two weeks behind. The individual systems required more research than initially expected and it was the primary reason in falling behind the schedule. The team decided to build its own components instead of buying directly, due to high market price and power requirements, which has added to the time and complexity of an already large project. In some cases, extensive additional research is required. Also, due to lack of access to high frequency devices in engineering labs, the team has had to come up with innovative methods to test the performance of the high frequency circuits. These factors have contributed in pushing the project by approximately two weeks.

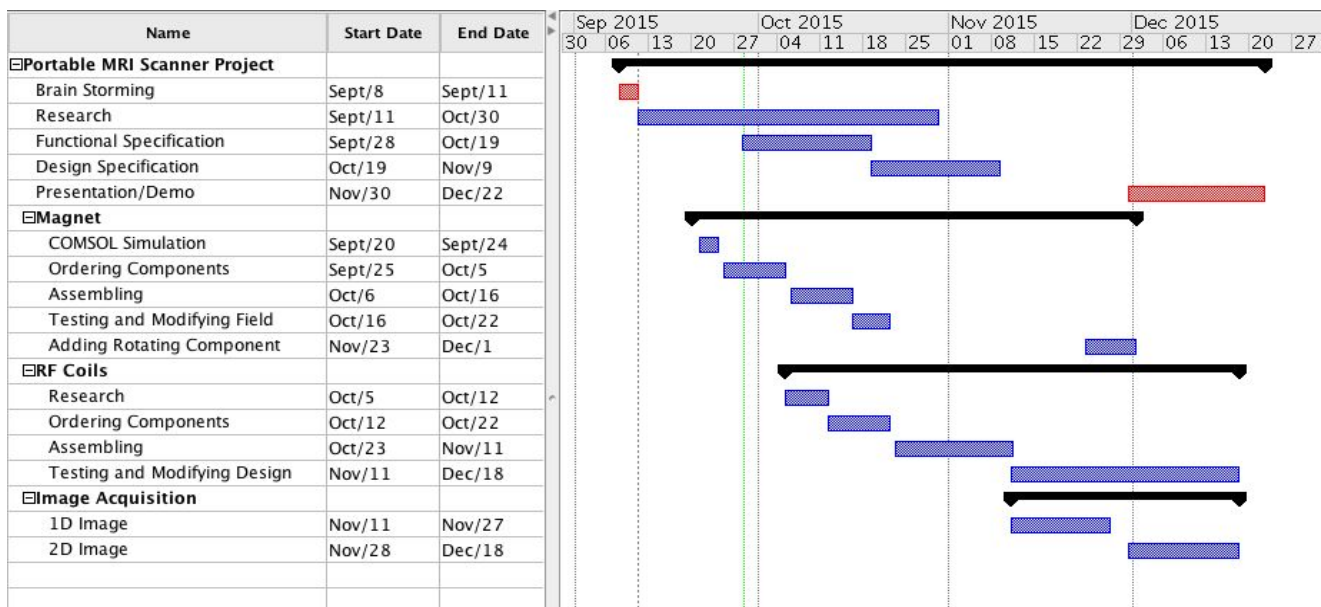


Figure 1: Schedule proposed for the project on September 28, 2015

3. Finances

Table 1: Cash Flow

	Amount (\$CAD)
Proposed budget	\$1404.00
Spending	\$1385.84
Difference	-\$18.16
ESSEF Funding	\$500.00
Cost Exceeded	\$885.84

As shown in table 1, the project is just under budget to date. The team is expected to spend up to a maximum of \$100 on unforeseen hardware components through the end of the project. The primary reason for the exceeding the proposed budget slightly is due to changes in design of the radiofrequency system and underestimating the price of parts. ESSEF funding has contributed \$500 to the project, which is insufficient to cover all the incurred expenses. The remaining \$885.84 has been covered by team members in equal contributions. MRI solutions will apply to the Wighton fund in December to cover the exceeded cost.

4. Progress

4.1 Hardware

The progress for our hardware components has been going well. The majority of components have been built and testing is in progress.

4.1.1 Magnet System

The magnet system has been completed and tested using Hall effect sensor and Arduino. It meets the requirements for field strength, homogeneity, and it is ready to be integrated into the entire MRI system.

4.2.2 RF Transmitting module

All the individual components that compose the RF transmitting module such as the DDS, power amplifier, and the blanking switch have been designed and tested. A complete RF transmitting module will be tested starting the week of Nov 30th, 2015.

4.3.3 RF Receiving module

The design of the RF receiving components has been completed and the necessary parts have been purchased. Currently the team is building circuits for the bandpass filter and ADC (Analog to Digital Converter). Testing of individual components for the receiving module will be carried out in parallel with transmitting module. We are aiming to test the RF receiving module in the week of December 7th, 2015.

4.2 Software

Overall the development of the software is behind schedule. The software being used on the transmitting side of the MRI system is completed and tested. The software being used on the receiving side is in progress with testing beginning the week of December 7th, 2015. We are confident all the software will be completed, tested, and implemented by the demo date.

Remediation

Due to some miscommunication, the SFU Engineering office delayed our first order for magnet housing by one week. Due to fact the radiofrequency systems design is dependent on the magnet system and its associated parameters, the radiofrequency system design was also pushed back as a result. Also, the lack of high frequency devices in the engineering labs has resulted in additional time needed to test of every component.

In order to keep the project on track, the CEO has started assigning daily goals for all team members. The team has been spending an extra 15-20 hours every week to compensate for the time lost. The few remaining components are being built in parallel by all the team members. The team members have started meeting more often and working together to avoid any inconsistencies between components which can result in more time being wasted during testing. The team has determined that obtaining a 2D image will require a small amount of extra work to implement, after acquiring the 1D image. The demo date is almost one week after our proposed finish date, that will allow the team to make up for time after falling behind the original schedule.

To avoid delays due to any unforeseen circumstances, the team has ensured that all the tasks are done in pairs. This is because in an emergency there will be at least one person who is able to continue with the design and testing of the components. To avoid a shortage of components, the team has ordered a few extra components needed to finish the project.

Conclusion

The MRI solutions team is working hard to catch up to our proposed schedule deadlines and to have a working MRI scanner by the demo date. The project is just under the estimated budget of \$1404.00 and is unlikely to exceed \$1500. Unforeseen problems, extensive research and added complexities have largely been responsible for the delay but the team is optimistic we can deliver a working MRI scanner prototype by December 22nd, 2015.