

Major Project - Presentation 1

by Michael Lewis

FILE	5293_MICHAEL_LEWIS_MAJOR_PROJECT_-_PRESENTATION_1_165678_1815624611.PDF (654.68K)		
TIME SUBMITTED	25-JAN-2019 02:55PM (UTC+0000)	WORD COUNT	642
SUBMISSION ID	99820976	CHARACTER COUNT	3340



Major Project – Presentation 1

PSDE6019

Mike Lewis

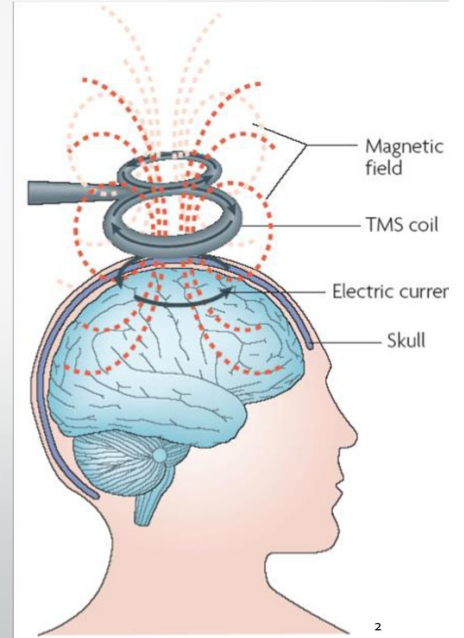
Project Background, Problem Definition And Constraints.

Transcranial magnetic stimulation (TMS) involves creating a powerful magnetic field from a handheld coil which induces currents within the brain.

The problem that the project is going to solve is: Accurate measurement of the peak magnetic field output from the TMS coil.

The constraints for this project are:

- The magnetic field only lasts for 3000S
- To accurately measure the amplitude of the magnetic field by inducing currents in a small coil
- Sample and hold the value of maximum magnetic field output
- Automatically measure each point in space within the effective region of the TMS coil



<https://www.brainclinics.com/rtms>

Functional Design Specification

The project MUST:

- measure a magnetic field of at least 2 Teslas
- move automatically in three-dimensional space
- measure a magnetic field in an area of at least 20cm x 20cm x 20cm.
- The measuring technique used is inducing currents in a smaller coil
- Max field amplitude must be sample and held for a minimum of 600uS.
- The maximum field amplitude values stored on: E.g. EEPROM, NVRAM etc.
- The magnetic field strength outside of the test jig must be kept within safe levels: The field must not exceed 500 microteslas
- The positional accuracy for all axes' must be +/- 1mm.
- The noise emissions from the machine must not exceed 75dB.
- Include an auto-power-off feature when the machine is idle to save on power.
- The main menu for the user interface must match the menu shown in **figure 1**

Main menu

- a) Manual control
- b) Semi-auto control
- c) Auto-control
- d) Monitor system
- e) Home
- f) Service menu

Figure 1

Project Risks, Health And Safety Etc.

The main risks for the project are:

- High strength magnetic fields
- High DC currents
- Large charged capacitors
- Mains voltages
- Automatic moving mechanical components



The following practises/methods are being used to mitigate these risks:

- High strength magnetic fields
 - Shielding on exterior of machine
- High DC currents & large charged capacitors
 - Protected inside enclosure with earthing
- Mains voltages
 - User is protected by enclosure, insulation and earthing
- Automatic moving mechanical components
 - Moving parts will be kept within the machines enclosure



Test Planning

The table shown in figure 2 is the testing procedure that will be performed on the machine to ensure it is fully functional and meets the functional design specification.

The first column is the actual test that will be performed; The second column shown a successful outcome

If the machine passes all test with a successful outcome, the machine functions correctly and is suitable for the task it was designed for.

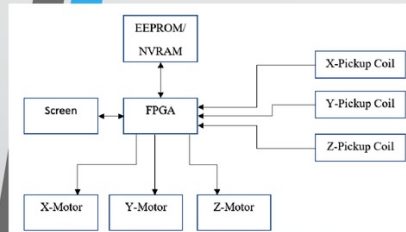
If the machine fails ANY test; The machine is not functioning to spec and the problem has to be rectified

Name/Description of test	Expected outcome	Pass/Fail
Produce a magnetic field of 2 Teslas, measure peak field with search coil	The pickup coils should all be able to measure a peak field of up to 2 teslas	
Machine in manual mode. Move along X, Y and Z axis	Each axis should move both directions in manual mode when the command is sent from the PC	
Produce a magnetic pulse and allow the search coil to measure pulse	Ensure that the peak value of the magnetic pulse is held by the sample and hold circuit for at least 600uS	
Set the machine to run in auto mode	The machine should automatically start measuring, based on the settings provided by the user	
Ensure the data is being saved correctly	Once data has been collected, remove power from machine for 30 seconds, turn back on and ensure the data is held in the EEPROM/NVRAM	
Measure the magnetic field outside of the machine when the magnetic pulses are being fired	The magnetic field strength outside the machine must be below 500 microTeslas	
Manually move all axis 10mm, one at a time	The axes must land between +-1mm of the 10mm moved	
When the machine is running in auto, measure the noise emissions from outside of the machine	The noise level outside the machine must be below 75dB	
Leave machine in idle for 5 mins untouched	The machine should automatically power off	
Measure the power consumption of the machine in auto mode	The power drawn must not exceed 1KVA	

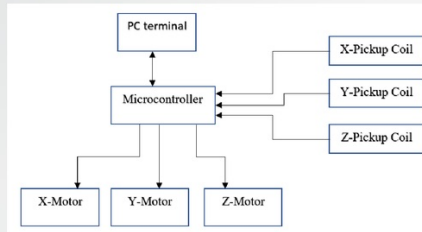
5

Figure 2

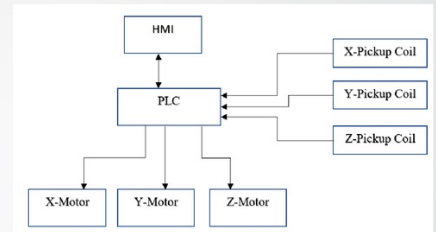
Review of Three Solutions



FPGA



Microcontroller



PLC

	FPGA	Microcontroller	PLC
Controller cost	good (£113)	Very good (£74.86)	Bad (£348)
Software cost	Very bad (£2,345)	Very good (free)	Bad (£331 for 1 year)
Screen/Interface cost	Very good (PC screen)	Very good (PC screen)	Bad (£284.37)
Size of controller (Smaller is better)	Very good (Chip)	Very good (Chip)	Very bad (Large housing, requires extra panel)
Contains NVRAM/EEPROM	NO	YES	YES
Number of I/O	Very good (190 to 540)	Good (23 programmable I/O)	Good (16 inputs, 10 outputs)

Best Solution = Microcontroller

Project Planning And Work Breakdown Structure

The work breakdown structure (WBS) is shown in **figure 3**.

The WBS breaks the main task of the project into subtasks, and then breaks the subtasks into further subtasks.

A rough estimate of how many weeks each task and subtask will take has been assigned.

This WBS was developed into the full Gantt timing chart for the project.

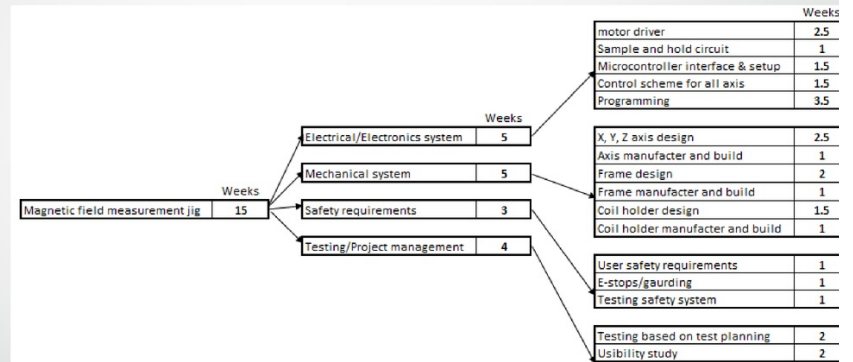


Figure 3

An important note is that some tasks/subtasks overlap and/or are carried out simultaneously. For this reason the number of weeks assigned to subtasks is greater than the 15 weeks assigned for the entire project.

Current Progress

The current progress of the project is shown in the section of the Gantt chart in **Figure 4**.

Many of the tasks listed have been partially completed:

- Ordered parts
 - Microcontroller
 - Stepper motors
 - Some peripheral components
- Controller interface and setup
 - The configuration of the microcontroller has been started
- Programming
 - This task also encompasses the interface and setup task

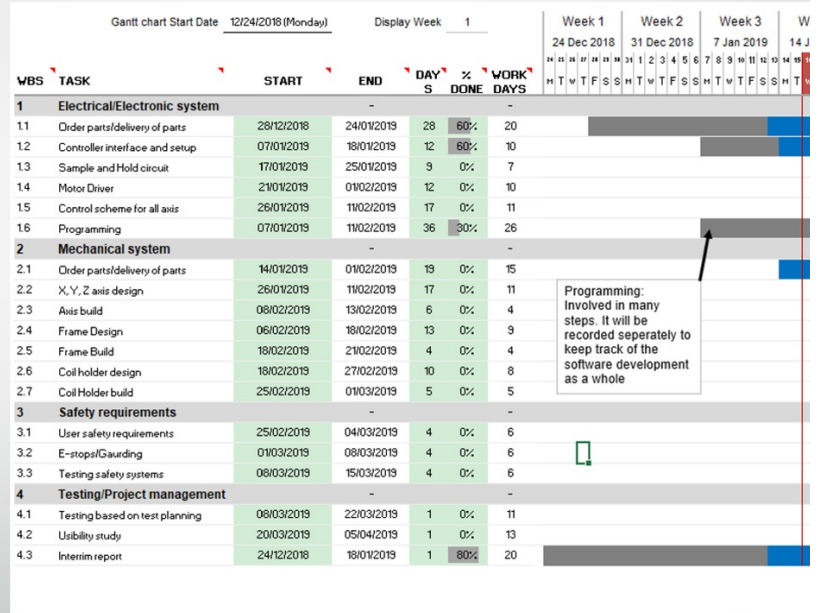


Figure 4



Thank You For Listening

Any questions will be appreciated

Major Project - Presentation 1

GRADEMARK REPORT

FINAL GRADE

GENERAL COMMENTS

62/100

Instructor

PAGE 1

PAGE 2

PAGE 3

PAGE 4

PAGE 5

PAGE 6

PAGE 7

PAGE 8

PAGE 9

GRADING FORM: NEW CSG-RUBRIC

MICHAEL LEWIS

62

1. ENGAGEMENT WITH LITERATURE

 Good evidence of background research demonstrated. (4/5) Evidence from answers to questions showed that other solutions had been considered in detail. (3/5)

7

2. KNOWLEDGE AND UNDERSTANDING

 Background and context described, but any commercial, economic and social context was not clear. (2.5/5) Legislation covered by research, risks and health and safety given good consideration. However, risk assessment could have been more rigorous considering this is a medical device. (2.5/5) Showed a good awareness of risk and supplied some detailed answers to questions relating to business and customer needs, wider context, public perception, commercial, economic and social context, legal requirements and IP issues. Some consideration given, but questions were not fully prepared for. (5/10)

10

3. COGNITIVE AND INTELLECTUAL

 Problem explained briefly and clearly with good slides that defined the problem in it context and set out the constraints. However, what was being done is described, why it is being done was vague. (6/10) Good level of detail provided in the FDS that set out the requirements of the end product. However, the specification was vague and lacked context at times. (7/10) For testing, some consideration given during presentation but further details were provided for calibration and concerns over reliability were

23

satisfied by answers to questioning. However, testing lacked clarity. (6/10) Answers to questions: Generally good, covered sustainable by discussing recycling and ethics by sourcing of components. Preparation for these questions was evident from the answers on sustainability. (4/5)

4. PRACTICAL APPLICATION

-  Section 5: Critical choice and justification of final solution: Detailed, covering most aspects though a scoring system would have been better in order to justify the correct solution selected. A better method of comparison should have been used rather than “bad and good”. (5.5/10) A good WBS explained with reference to the Gantt chart for planning with a detailed break down of tasks to be performed with contingencies. However, WBS does not conform to any standard methodology i.e. the sum of each level does not equal its parent level. (6/10) Questions on code of conduct and management techniques were well answered. (4/5) **15.5**

5. TRANSFERABLE SKILLS

-  Generally good quality though slides contained too many words in small font. (3.5/5) Generally good. However, too much time was spent looking at and reading from the slides, slightly nervous delivery but showing some confidence. (3/5) **6.5**