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Student Name	
Student Matriculation Number	
UESTC Student Number	
Degree programme	B.Eng. of Communication Engineering
Academic year	2020-21

Placement Company (if appropriate)	UESTC
Working Title of Project	The development of a USB Spectrometer for optical frequencies
Name of First Supervisor	Hasan Abbas
Name of Second Supervisor	
Declaration of Originality and Submission Information	<i>I affirm that this submission is all my own work in accordance with the University of Glasgow Regulations and the School of Engineering requirements</i> Signed (Student) :

Your report should be NO more than 6 pages in length and include the below subject headings and incorporated within this document:

Project Description (no more than half a page):

In this project, my goal is to design and then construct a USB (Universal Serial Bus) based optical spectrometer. A CCD (Charge-coupled Device) detector will be used to record the light after it has passed through a diffraction grating. Through a USB interface, the collected light will be processed in the digital domain and a graphical user interface will be developed. Through this project, the student will learn to design an electronic circuit to process and convert the optical signal into digital signals.

Technical Background (no more than one page)

Optical spectroscopy has revolutionized humanity in the past two centuries by helping astronomers and chemists precisely measure the chemical constituent of the sample or the distance stars through analysis of their characteristic spectrums and it is still widely used in these two areas today. Although the technology for it is quite mature yet, the instruments are often quite expensive and have a large size, therefore, can only be accessed at specialized places, such as laboratory and an astronomical observatory. So, it is necessary to have a relatively cheap, portable, and easily constructed solution for outside research and enthusiast.

Main tasks and targets (no more than half a page)

1. Design and choose the diffraction grating
In this part, I need to learn the properties of the diffraction grating and because there are many providers online, I can give the parameter to them and purchase one.
2. Design and choose the CCD detector

Project Specifications and Preliminary Report on UESTC4006P(BEng) Final Year Project

This part is relatively the same as the first one, I can buy some cheap Webcams online and take out its CCD detector and USB interface.

3. Build the software for data processing

In this part, I will write a python-based software to allocate the light intensity signal to the right wavelength light.

4. Build a graphical user interface

In this part, I will use some opensource GUI (Graphical User Interface) framework to build a modern style GUI to show the frequency analysis of the light.

Measurable Outcomes (no more than half a page): Tangible outcomes (Hardware, Software, Hardware & Software, Theoretical research)

1. A fully functional spectrometer with a USB interface.

The grating in the spectrometer will separate the incoming light and beaming the light to the CCD sensor, then the sensor will send the data to the computer through the USB interface.

2.

The software will process the data and showing the frequency analysis graphically. And the parameter on the graph can be easily adjusted by the GUI.

Project outline (no more than one page)

1. Initial analysis

To build an optical spectrometer, I need to firstly choose the right kinds of diffraction grating, CCD detector, and optical instruments, then place them into a proper structure to make light separated by the grating and shining on the CCD. And then the image signal will be sent to a computer to analyse and show the light component intensity graphically.

2. Data processing

The image signal from the CCD will be processed to get the light intensity of different wavelengths, and a calibration curve may be added to the result to provide further accuracy.

3. Algorithms, methodologies, and other techniques

Optical physics, image recognition, the techniques to use CAD tools.

4. Tools and Programming language

The software will be written in the Python programming language. Some Computer-Aided Design tools like AutoCAD or SolidWorks may be used to design the structure of the spectrometer.

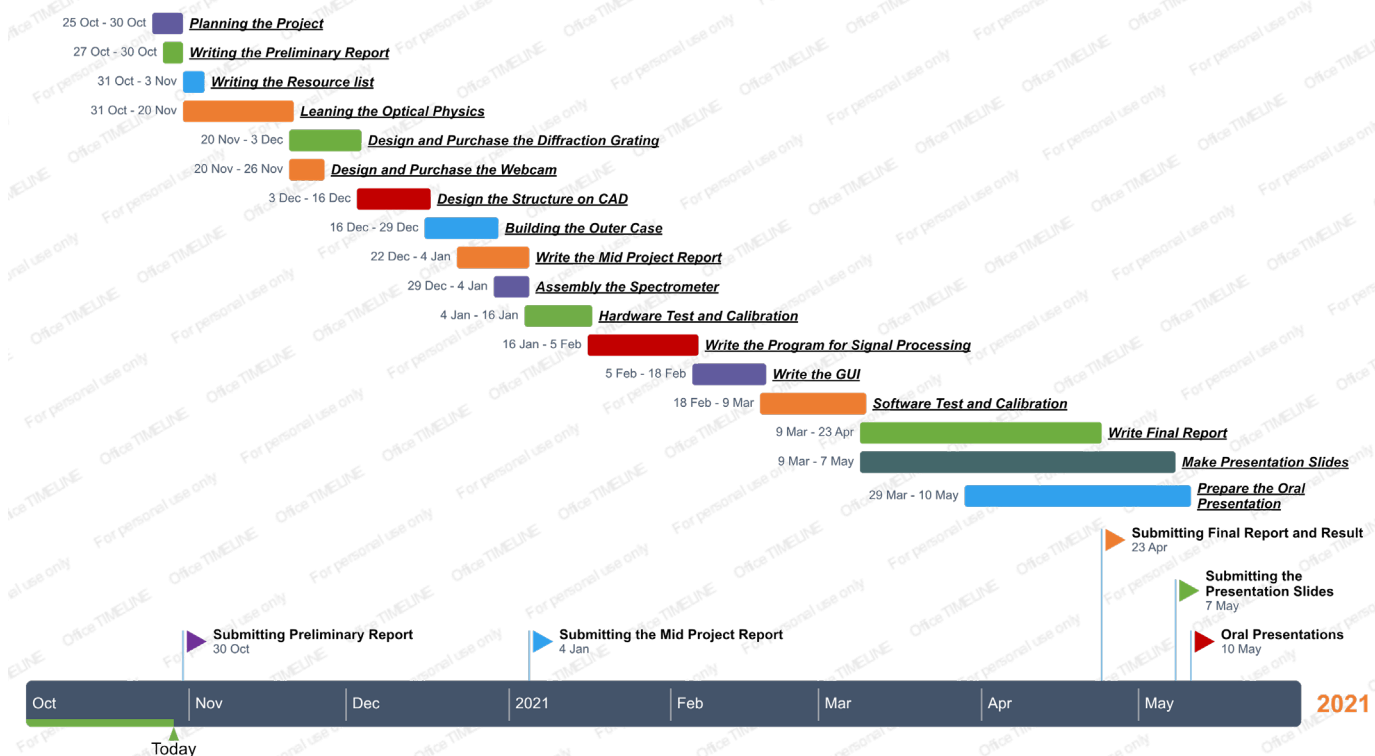
Work plan (no more than one page)

Type	Title	Start date	End date	Duration (in days)
Task	Planning the Project	10/25/2020	10/30/2020	5
Task	Writing the Preliminary Report	10/27/2020	10/30/2020	4
Milestone	Submitting Preliminary Report	10/30/2020	10/30/2020	-
Task	Writing the Resource list	10/31/2020	11/03/2020	2
Task	Learning the Optical Physics	10/31/2020	11/20/2020	15
Task	Design and Purchase the Diffraction Grating	11/20/2020	12/03/2020	10
Task	Design and Purchase the Webcam	11/20/2020	11/26/2020	5
Task	Design the Structure on CAD	12/03/2020	12/16/2020	10
Task	Building the Outer Case	12/16/2020	12/29/2020	10
Task	Write the Mid Project Report	12/22/2020	01/04/2021	10
Task	Assembly the Spectrometer	12/29/2020	01/04/2021	5
Task	Hardware Test and Calibration	01/04/2021	01/16/2021	10
Milestone	Submitting the Mid Project Report	01/04/2021	01/04/2021	-
Task	Write the Program for Signal Processing	01/16/2021	02/05/2021	15

Project Specifications and Preliminary Report on UESTC4006P(BEng) Final Year Project

Task	Write the GUI	02/05/2021	02/18/2021	10
Task	Software Test and Calibration	02/18/2021	03/09/2021	14
Task	Write Final Report	03/09/2021	04/23/2021	34
Task	Make Presentation Slides	03/09/2021	05/07/2021	44
Task	Prepare the Oral Presentation	03/29/2021	05/10/2021	31
Milestone	Submitting Final Report and Result	04/23/2021	04/23/2021	-
Milestone	Submitting the Presentation Slides	05/07/2021	05/07/2021	-
Milestone	Oral Presentations	05/10/2021	05/10/2021	-

Build Spectrometer



Resources: Complete the component request form and email the form to your 1st supervisor separately

Risk Assessment Form: You may be asked to submit a Risk Assessment Form if your project includes hazardous activities. Please check with your supervisor if you need to submit it.

Deadlines for submission of this report: Please upload this report via the Moodle page by the deadline mentioned in Table 1 of your project handbook.

Comments from your Second Supervisor will be made via Moodle or via email.

Project Specifications and Preliminary Report on UESTC4006P(BEng) Final Year Project

Feedback from Second Supervisors: Second supervisors may provide their feedback by adding comments directly on Moodle taking into account the questionnaire below **or** by filling out the below form and uploading it to Moodle.

Name of Second Supervisor	
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Was the report satisfactory?

Yes		No	
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Is project suitable for an BEng project?

Yes		No	
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Is the project plan feasible?

Yes		No	
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Would you like to give any suggestions/recommendations?

Yes ☐ No ☐

Please write your comments in the space provided below:

Signature:

Date: