Project Plan

Name: Suraj Kothari

Project Title: Using Neural Radiance Fields (NeRFs) on Dark Cave Scenes

Supervisor's Name: Simon Julier

External Supervisor's Name: N/A

Aim: "*To learn how to represent dark/dimly-lit cave environments using Neural Radiance Fields (NeRFs). Then trying to query the neural network to produce novel views and synthesising them.*"

Objectives:

1. Read and understand the original NeRF paper and find existing code that implements it on a toy dataset
2. Investigate the Onboard Illumination Visual-Inertial Odometry (OIVIO) dataset which consists of dark environments such as mines, tunnels, caves
3. Apply a NeRF to this dataset to represent dark environments which can be harder to learn (than well-lit environments)
4. Evaluate how well the NeRF can output novel views of a 3D cave scene and find applications of using this representation for robotics, scene mapping

Deliverables:

- A literary review/summary of the original NeRF paper explained to a general audience
- Results obtained from novel view synthesis using the NeRF and discussion of how significant the output is
- A fully documented and functional NeRF algorithm trained on dark cave scenes
- A specification for using the trained NeRF algorithm

Work Plan:

- Pre-October/Summer: Literary research on NeRFs, Computer Vision/Graphics and research papers from related domains
- October to Mid-November: Start initial iteration of prototyping. Each prototype will undergo design, implementing, testing, refactoring (if necessary):
    - Running an implementation of the original NeRF on toy datasets
    - Learning to use the COLMAP software package to extract pose information from a set of images
    - Using COLMAP on OIVIO dataset to create the input training data for the NeRF algorithm
    - Training a NeRF on the OIVIO dataset
- Mid-November:
    - Completing Project Plan
    - Completing Ethics review
- Mid-November to Mid-January:
    - Working on Interim Report
    - Wrapping up prototypes into a single piece of software and adding any extra features. This should ideally be completed by End-December
    - Writing up the documentation/specification of the software

- Mid-March: Finishing Video Preview
- Early-April: Making sure Final Report is nearly complete and ready for submission by Mid-April

Ethics Review:

I believe that this project has no ethical issues.

The project is not sensitive as it doesn't involve data of people, animals, nor sensitive/offensive material. Further, the project won't involve undertaking interviews/questionnaires with the general public.

The primary dataset I will be working with, OIVIO, can be used in research given I include the citation of their paper. The data consists of images recorded in dark environments that don't include people/animals.