**Tentative plan for Thesis draft**

Abstract

*This section provides a brief and clear explanation of what has been done in this thesis. In Particular about devising a comparative metric for comparing simulators used for autonomous vehicles and development of generative model based simulator.*

1. Introduction
   1. Autonomous Vehicle

*This section explains the evolution and need of autonomous Vehicles. Also, it describes the recent advancements and major players in the field. Furthermore, the types of AV’s, it’s application in public and private sector(industries) and possible future works in AV’s could be discussed.*

* 1. Simulators

*This section answers the question “what is a simulator?” and need for it. Also, advantages, limitations and applications of it will be discussed. The usage of simulators in Machine learning will be covered in this section.*

* 1. Problem Statement

*Here, two problems will be explained*

*1. There is no proper method for evaluating and comparing the existing simulators*

*2. Applying Generative AI in the working of simulator in the aim of generating new plausible scenarios*

1. Literature review
   1. State of art simulators

*This part highlights the* [*key features*](../Comparision%20metrics%20study/Research%20papers/Take%20away.docx) *of market available simulators and discuss its official published paper*

* + 1. CARLA *(*[*link*](../Comparision%20metrics%20study/Research%20papers/1.%20CARLA.pdf)*)*
    2. LGSVL *(*[*link*](../Comparision%20metrics%20study/Research%20papers/2.%20LGSVL.pdf)*)*
    3. SUMMIT *(*[*link*](../Comparision%20metrics%20study/Research%20papers/3.%20SUMMIT.pdf)*)*
    4. Torcs *(*[*link*](../Comparision%20metrics%20study/Research%20papers/4.%20TORCS.pdf)*)*
    5. Gazebo *(*[*link*](../Comparision%20metrics%20study/Research%20papers/5.1%20GAZEBO%20Base.pdf)*)*
  1. Comparative studies

*This part explains the need for comparative metrics and its challenges. Also, explains* [*few approaches*](../Comparision%20metrics%20study/Research%20papers/Metrics/Take%20awaay.docx) *which aimed to devise a method for evaluation*

* + 1. Comparative study of connected vehicles *(*[*link*](../Comparision%20metrics%20study/Research%20papers/Metrics/Comparative_study_of_connected_vehicle_simulators.pdf)*)*
    2. Survey on autonomous vehicle simulation platforms *(*[*link*](../Comparision%20metrics%20study/Research%20papers/Metrics/Survey_on_Autonomous_Vehicle_Simulation_Platforms.pdf)*)*
  1. Conditional GANs

*This part speaks about few types of successful GANs and its* [*results*](../Generative%20AI/Research%20papers/1907.08556.pdf) *(link)*

* + 1. VGAN *(*[*link*](../Generative%20AI/Research%20papers/VGAN.pdf)*)*
    2. Imaginator *(*[*link*](../Generative%20AI/Research%20papers/WANG_ImaGINator_Conditional_Spatio-Temporal_GAN_for_Video_Generation_WACV_2020_paper.pdf)*)*
    3. MoCoGAN *(*[*link*](../Generative%20AI/Research%20papers/Tulyakov_MoCoGAN_Decomposing_Motion_CVPR_2018_paper.pdf)*)*
    4. Pix2pix GAN *(*[*link*](../Generative%20AI/Research%20papers/pix2pixgan.pdf)*)*

1. Framework for Comparative Metrics Study
   1. Methodology

*Here, the question “How the proposed method binds the gaps in the existing methods?” will be answered. The rough idea of how this comparison works will be discussed*

* + 1. Base Score

*The Meaning of and necessity of base score will be elaborated*

* + 1. User Weight

*The Meaning of and necessity of User weight will be elaborated*

* 1. Parameters

*All the* [*parameters considered for comparison*](../Comparision%20metrics%20study/Table/Criteria%20chart.xlsx) *will be detailed here* in same order as in the rough draft with the following subcategories

* + 1. Sensor Compatibility
    2. Actors Behaviour
    3. Environment
    4. Agent Vehicle
    5. Framework
    6. Algorithm

*A Detailed explanation of the math and the method for calculation will be explained here with reference to* [*example*](../Comparision%20metrics%20study/Table/Scoring_Example.xlsx) *(in appendix)*

1. Generative Model Based Simulators

*This part explains what is Generative AI, it’s application and the role of generative AI in Simulation (briefly).*

* 1. Neural Networks

*This part illustrates the working and math behind Neural Network and how it can be used as generative Models. Also, the advantages and limitations over conventional AI will also be discussed*

* 1. Data Generation

*The problem with available datasets and the problem associated with it will be addressed and the proposed idea for data generation will be discussed*

* + 1. Extension of existing simulator

*The simulator used for data collection and its math will be explained*

* + 1. Data Collection

*The Method of data collection, format and type of data will be discussed*

* 1. Model Architecture

*The proposed model architecture (GAN) and how it differs from typical networks will be explained. The components of the architecture will be explained in respective fields*

* + 1. Autoencoders
    2. GAN
       1. cGAN
          1. Generator
          2. Discriminator
          3. Training Loop

1. Evaluation and Results
   1. Comparative study

*The Results of the comparative study will be discussed with the example (Using CARLA and Summit and LGVSL)*

* 1. Generative Modelling

*The results of cGAN with respect to various parameters and architecture will be discussed here.*

1. Conclusion

*Concluding how the proposed methods for both system of comparison and Generative model-based simulation addresses the problem stated (theoretically without any math and results). The limitations of the proposed approach will also be discussed*

1. Future Works

*Discussing the process of leveraging the proposed method of cGAN to other sensory data.*

Appendix

*The reports (spreadsheet) which explains the results of scores of two different users (hypothesis) for 3 simulators.*