Students' Placement Office, IIT Kanpur

Project Verification Form

Title of the Project	Parallel Computing for Autonomous Vehicle Simulation
Commencement Date	17-05-2012
Completion Date	23-07-2012
Project Supervisor	Prof. Ragunathan "Raj" Rajkumar
Organization/Institution where the Project was accomplished	Carnegie Mellon University, Pittsburgh, PA, United States of America

Project Description (You can use extra A4 sheets in case you run out of space however the extra sheets should also have the seal & signature of the Project Supervisor or the relevant authority)

The goal of the project is to making AutoSim Work on GPU (device).

AutoSim is software that simulates Autonomous car in hybrid environment i.e. real car and autonomous cars. AutoSim is been implemented in terms of models. Some models are :

1. Control Model
2. Position Model
3. State Model
4. Mobility Model
5. Path Tracker
6. Communication Model, etc.

Each model is actually a class and inheritable. So each car call these models to change its position, state, speed, direction, avoiding collision with other cars or road and many more things. AutoSim was coded in C++. Due to sequential execution of AutoSim it could only be used for simulating smaller number of cars and hence was not useful for inheriting real world map of cities in AutoSim and run it for few thousand cars.

We tried to implement models on GPU and use parallelism of GPU while calling same models for different cars. We implemented four models on GPU :

1. Position Model
2. Control Model
3. State Model
4. Path Tracker

As all models are not yet implemented on GPU we had to copy data from host (CPU) to device and again back to host after model is updated on GPU. This memory copy is bottle neck in execution. So for less number of cars we got poorer performance for GPU. But for larger number of car GPU was way better. We also made path tracker more efficient. Initially each car stored its path separately. But we have few static paths only. So instead of copying data for each car, we can just pass Path ID to car for accessing the path.

The future scope is to implement AutoSim completely on GPU and to add some other feature like dynamically generating path and including world model so that AutoSim can be used to generate real world simulation.

We collected data about time of execution for various models that were running on CPU and now are implemented on GPU for different number of cars and plotted them. Using GPU would be very useful not only for AutoSim but also for Autonomous Vehicles.

We used Qt Creator to build project. We coded in CUDA and C++.

By appending your signatures to this form you acknowledge and agree that:

- This form along with the certificate would serve as the official document between the project supervisor and Students Placement Office, IIT Kanpur regarding verification of the student's project work
- The student will provide additional information and documentation relevant to his/her project upon request by the Students' Placement Office
- The student has clearly defined his/her individual role in projects done in cooperation with other students, faculty, groups or company personnel.
- Incorrectly over-stating the reach, impact and/or quantitative/qualitative results of a project is unethical.
- In case of violation of any of the above rules, Students' Placement Office, IIT Kanpur reserves the right to take necessary action including de-registering the student from the placement season and reporting the misconduct to the Institute Authorities.

Submitted by:-	**Project Supervisor Details:-**
Name: Nikhil Aggarwal	Name: Prof. Ragunathan "Raj" Rajkumar
Roll No:10446	Designation:
Signature:	Signature: