



**NANYANG**  
**TECHNOLOGICAL**  
**UNIVERSITY**

# FYP Presentation

*presented by*

**Tran Trong Tri**

School of Mechanical & Aerospace Engineering

08/05/2007

Project: A168

# Design And Development Of A Vehicle Motion Feedback System For A Vehicle

*Supervisor:* A/P Yap Fook Fah

*Student:* Tran Trong Tri

# Contents

- Introduction
- Project's Objective
- Project Overview
- Matlab Modelling
- Steering Control System
- Rear Wheel Control System
- Pedalling Power Measuring System
- 6 DOF Motion Platform
- Vega Virtual Environment
- Conclusion

# Introduction

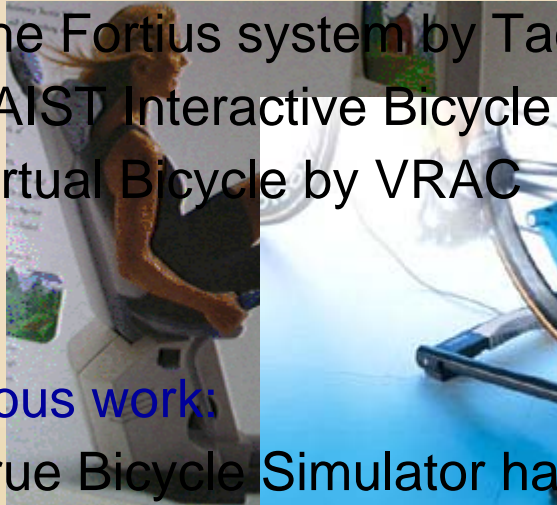
- Many simulators have been developed for many purposes:
  - Training
  - Testing
  - Learning
  - Entertainment
- Some popular simulators:
  - Flight simulator
  - Car simulator
  - Motorcycle simulator
- However, Bicycle Simulation has not been paid high attention.

# Project's Objective

- Many projects have been done.
- Each previous project carried out with individual parts.
- Main objective of this project:
  - Combining all of the previous individual parts so that the system can work properly.
  - Modifying to improve the system performance.

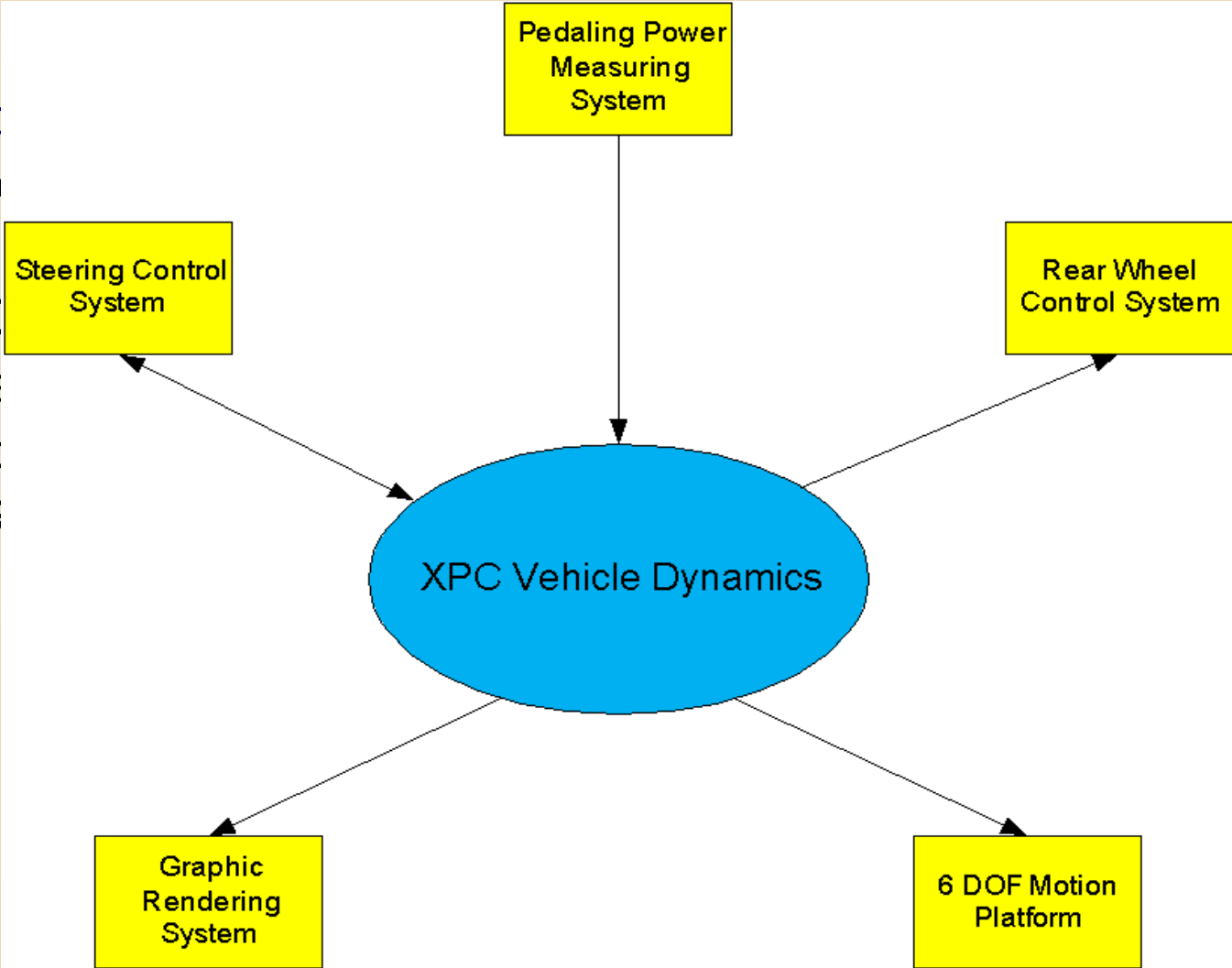
# Literature Review

- Some of Bicycle simulators:
  - By CyberGear and Tectrix
  - The Fortius system by Tac
  - KAIST Interactive Bicycle
  - Virtual Bicycle by VRAC
- Previous works:
  - True Bicycle Simulator has  
Research Centre of Nanyang



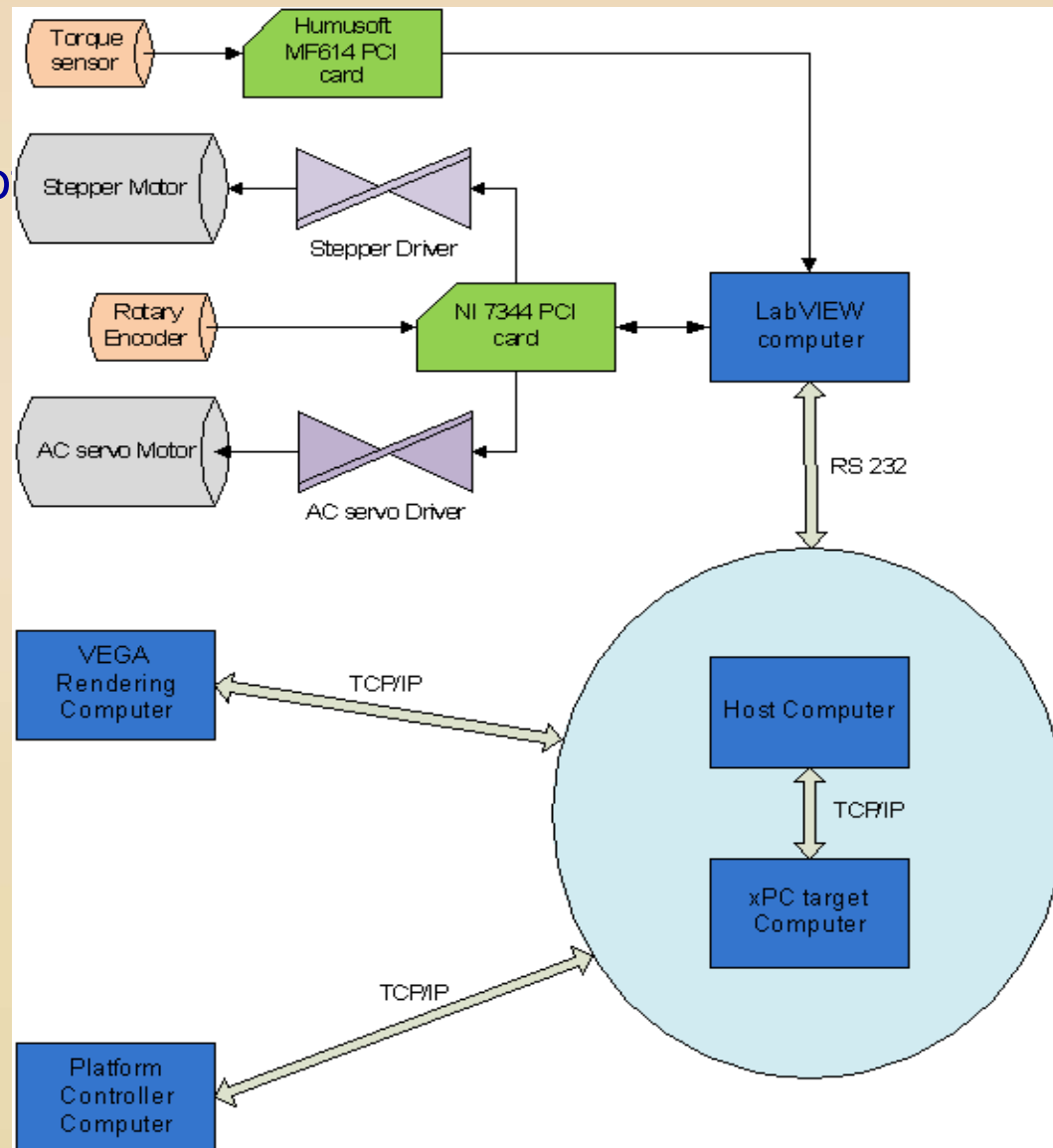
# Overview

- Overview of c
  - xPC Vehi
  - Pedalling
  - Steering C
  - Rear Whe
  - 6 DOF Mo
  - Graphic R



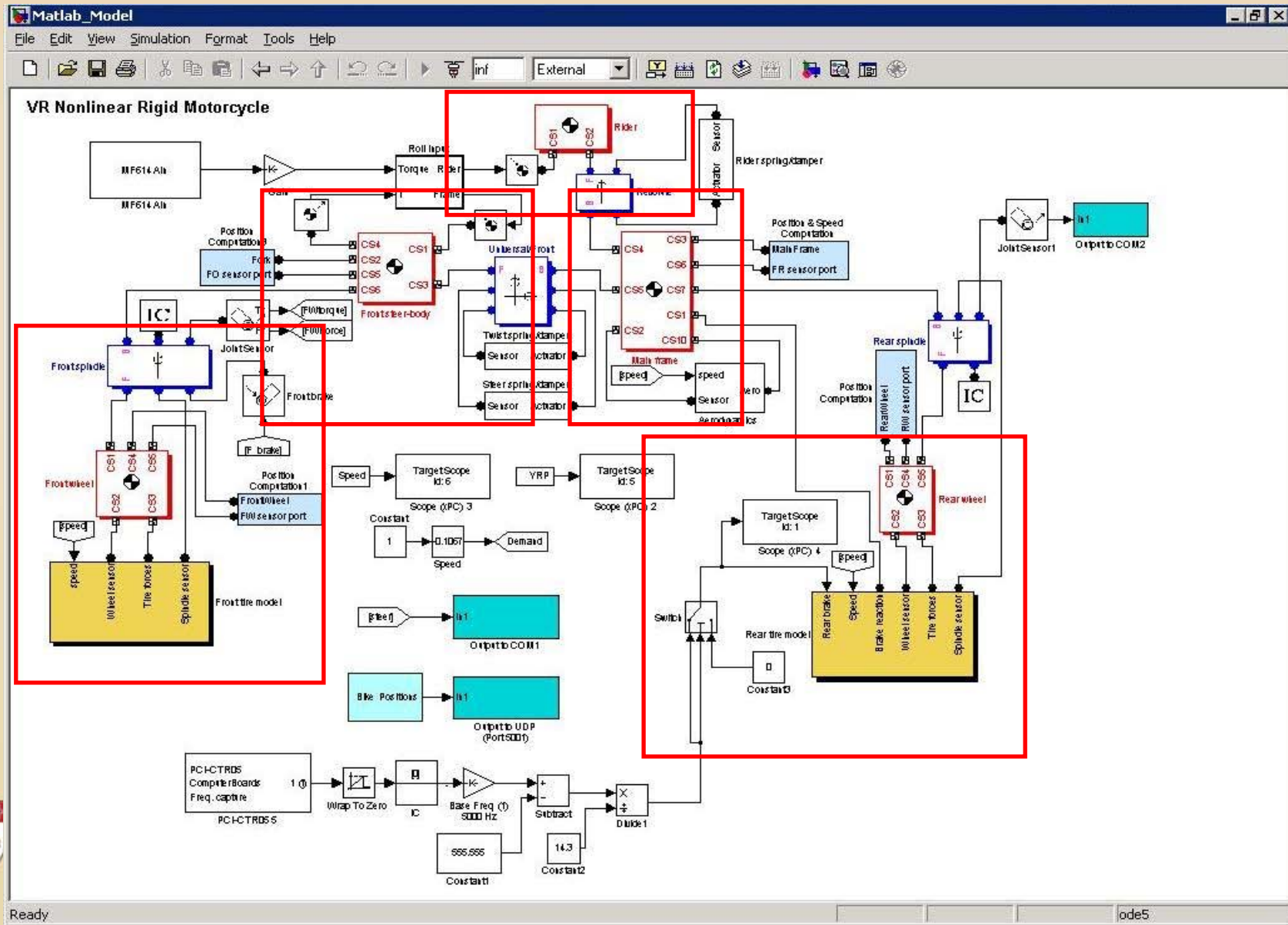
# Overview

- The connection layout of



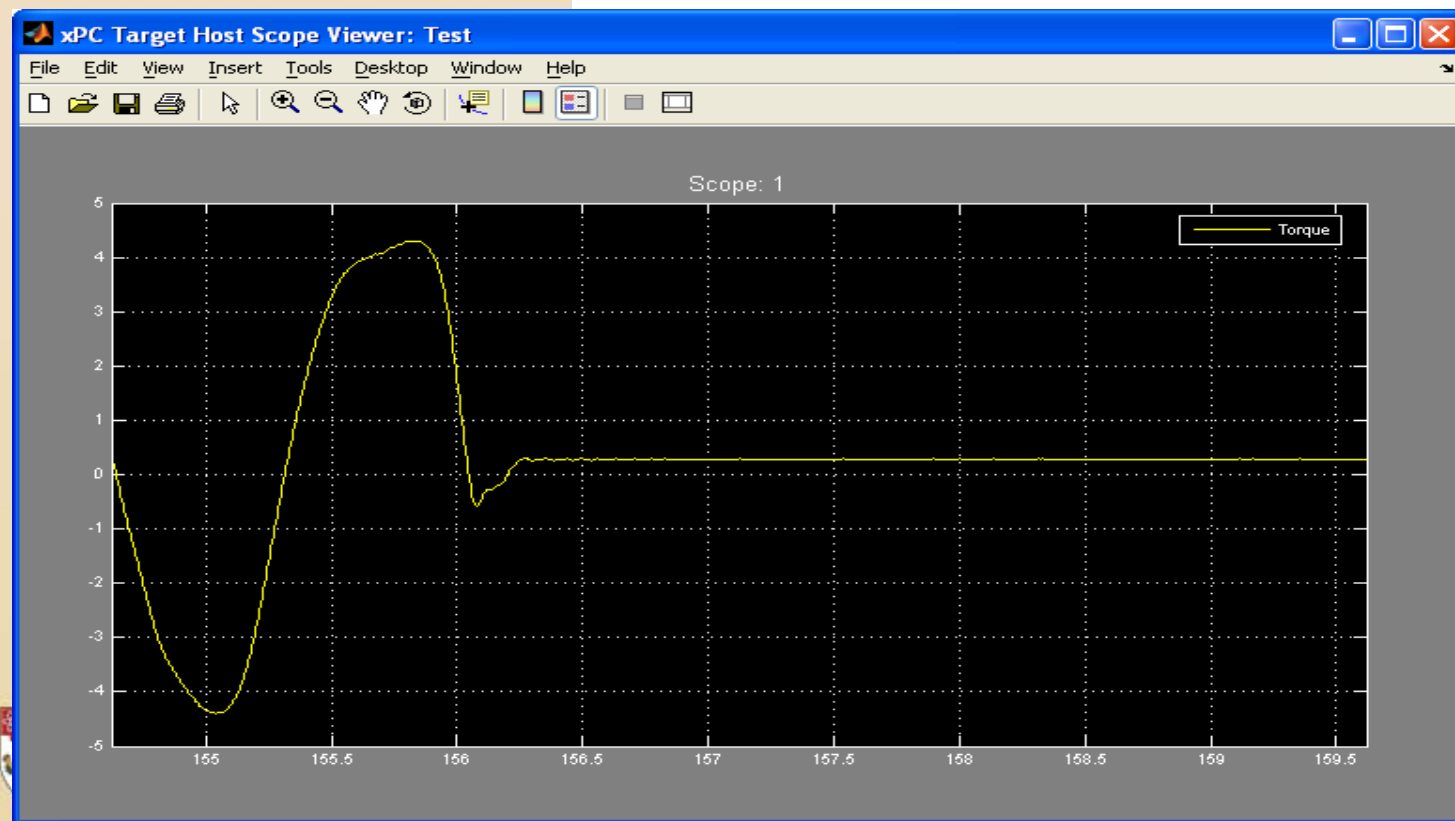


# Matlab Model



# Steering Control System

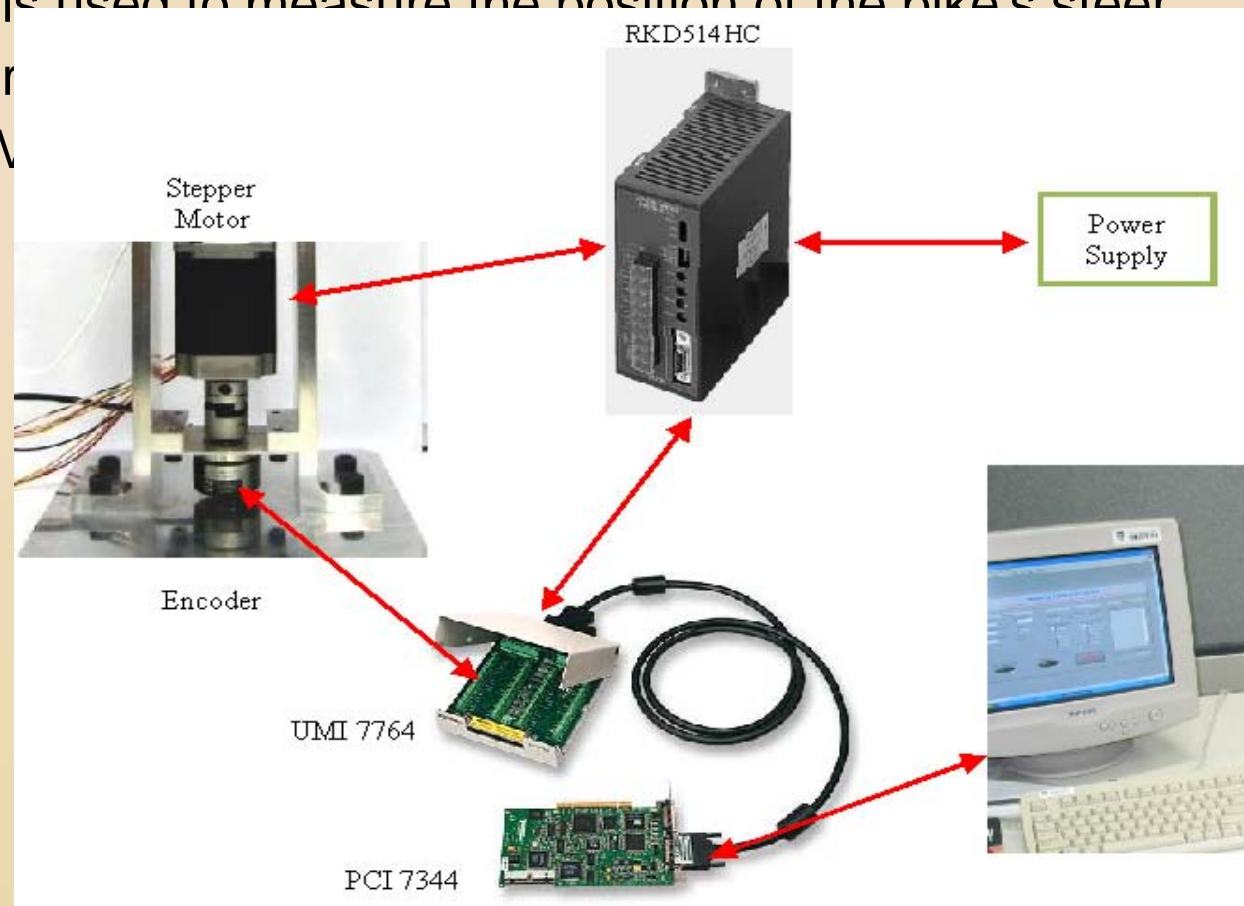
- Torque sensor:
  - Used to obtain the torque at the steer.
  - The measured torque is transferred to the xPC computer.



Humusoft MF614

# Steering Control System

- Stepper Motor and the Incremental Optical Rotary Encoder:
  - The Encoder is used to measure the position of the bike's steer
  - Stepper Motor
  - The Stepper Motor is controlled by a computer



# Rear Wheel Control System

- The AC servo Motor at the Rear Wheel:

AC Servo Motor

AC Servo Driver

Servo Motor2\_2.vi

File Edit Operate Tools Browse Window Help

**Rear Wheel Controlling Program**  
This program will read data from serial port and use them to control the stepper motor.

Port to Read  
COM4

Unwanted Data  
0

Trash Bin

Move Constraint

Accel/Deccel (Counts/s<sup>2</sup>)  
100000

S-Curve Time (samples)  
1

Encoder Data

Revolutions  
0

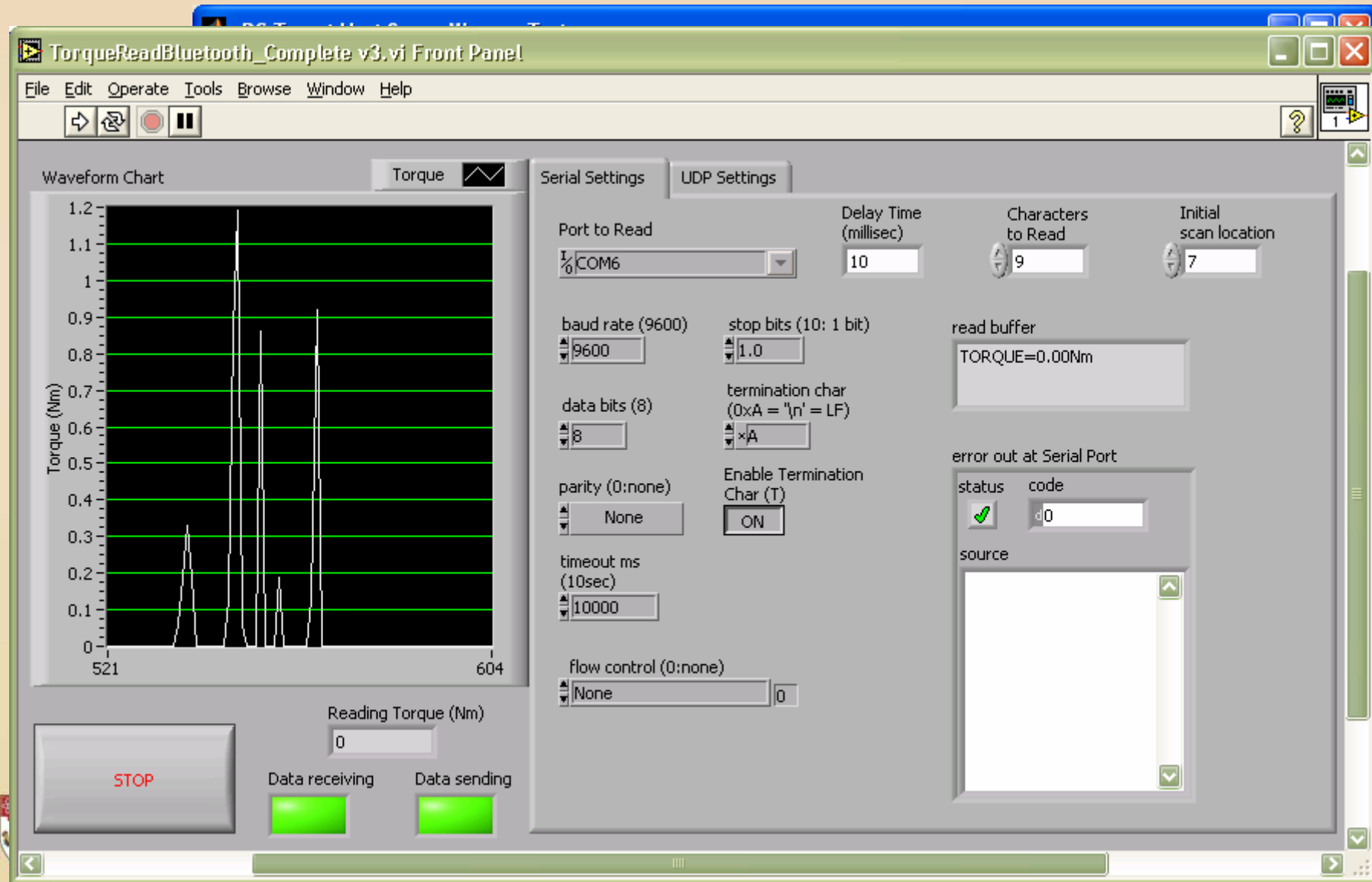
Steps  
0

Distance (km)  
0.000

Stop Programme  
STOP

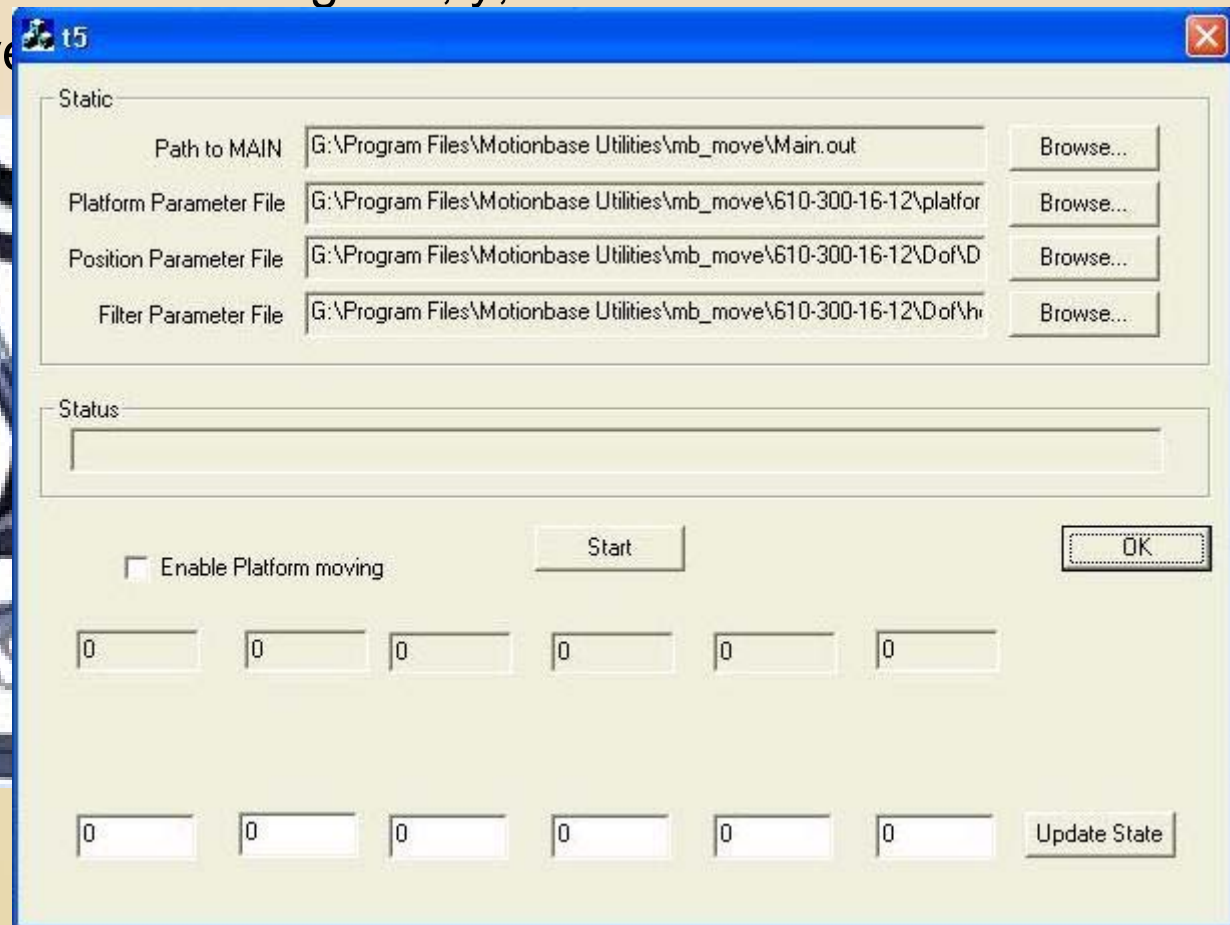


# Peddalling Power Measuring System



# 6 DOF Motion Platform

- The 6 DOF platform is used to simulate the reaction of the bicycle:
  - Linear movements: according to x, y, z axis
  - Non-linear movements





# VEGA Virtual Environment

- Vega Lynx is use for graphic rendering and displaying of the Bicycle simulator.



# Conclusion

- The Bicycle Simulator is built for researching and studying the dynamic behaviors of a realistic bicycle in a virtual environment.
- A real bicycle model has been built and simulated successfully in Matlab using Simulink toolbox.
- Besides the hardware developing, software parts also be built and tested so that the system can perform accurately in real-time.
- However, some modifications can be carried out in future to perfect the system:
  - Modify so that there is not necessary to recompile the model when the IP address of one of the computers is changed.
  - Simplify the system, therefore only one computer is required to simulate the whole system.



**Thank you for your attention**



**Q & A**