

# # Internship weekly report (week 1)

Prit\_Varmora

Date: 11 to 17 may\_2020

In this we were basically supposed to make a self balance bicycle using reaction wheel in V-rep. In this task we have divided whole work in partitions like literature survey, physical modeling in v-rep simulation, modeling in matlab/sci-lab, PID controller tuning, inverted pendulum balancing on a pivot, inverted pendulum balancing without pivot, final bicycle balancing and PID tuning. Then controlling the bicycle using an interface (forward/backward, left/right).

In this task we have faced lot more difficulties in terms of simulations as we all were new to v-rep. First we have tried to control our reaction wheel motor in `syscall_actuation()` portion of script using function `sim.addForceAndTorque()` but then we got to know from team A that it is wrong way to control our motor and then we have tried controlling motor in `sysCall_jointCallback(inData)` function of script as the function gets control directly to the parameter of joint we got successful to control motor properly.

In the last phase of development of bicycle I have tried three ways of deriving inclination of bicycle first of all I have tried to find inclination from function `sim.getObjectOrientation()` but as it gives Euler angle around a specified reference frame it was not working then cycle bot changes its direction because then rotation axis also gets changed with respect to reference frame then I have tried to derive inclination from transformation matrix in that case I have successfully derived absolute inclination with z axis of reference frame also during manoeuvring but the algorithm was unable to derive direction of inclination so it won't work for this application then we have used accelerometer and gyroscope to derive absolute inclination of bicycle so that during manoeuvring of bicycle in any direction it can calculate its angle more precisely. To get more precise inclination I have implemented complementary filter for data fusion of accelerometer and gyroscope.

Parallel to this simulation task I have also derived the model mathematically and then simulated it in matlab/simulink. There also I have faced some problem but couldn't verify it until cycle did not simulate but at last we have verified both the things in v-rep simulation and matlab simulation also by comparing both the things with each other. In this task I got firmly introduced with v-rep. I have applied PID controller for a real use first time. Also learnt difference between LQR and PID controller.

And at last we have submitted total 3 files on git hub(master/v-rep\_simulations):

- 1)inverted pendulum balanced using reaction wheel with pivot ([here](#))
- 2)inverted pendulum balanced using reaction wheel without pivot([here](#))
- 3)cycle bot balanced using reaction wheel and also controlled its navigation ([here](#))