Real-Time PID Control of Wireless Two Wheeled Balancing EV3 Lego Robot

by
Dr. Nor Maniha Abdul Ghani
FKEE
normaniha@ump.edu.my

Contents

- **Introduction**
- **Problem Statement**
- **Objectives**
- **Methodology**
- **Results**
- **Conclusion**
- **References**

Introduction

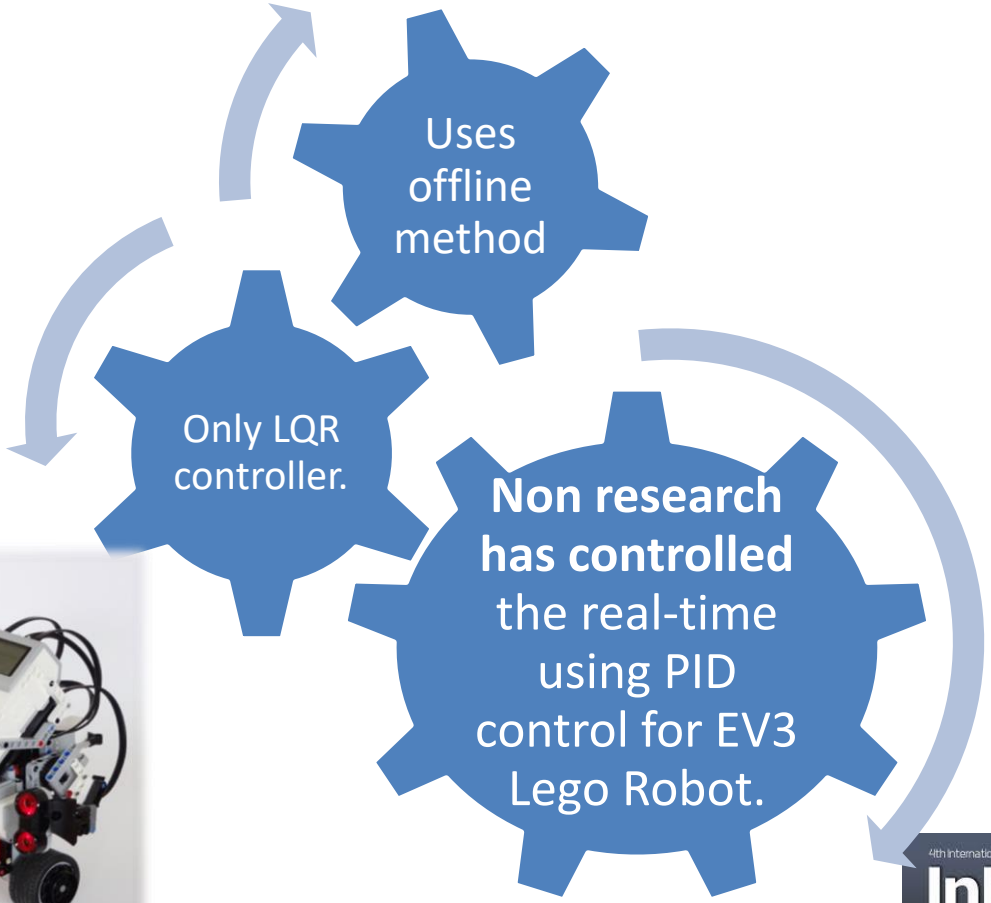
Highly unstable nonlinear system

Common problem in control engineering

Various applications; Segway[2], iBOT[1], etc.

Inverted pendulum concept.

Problem Statement

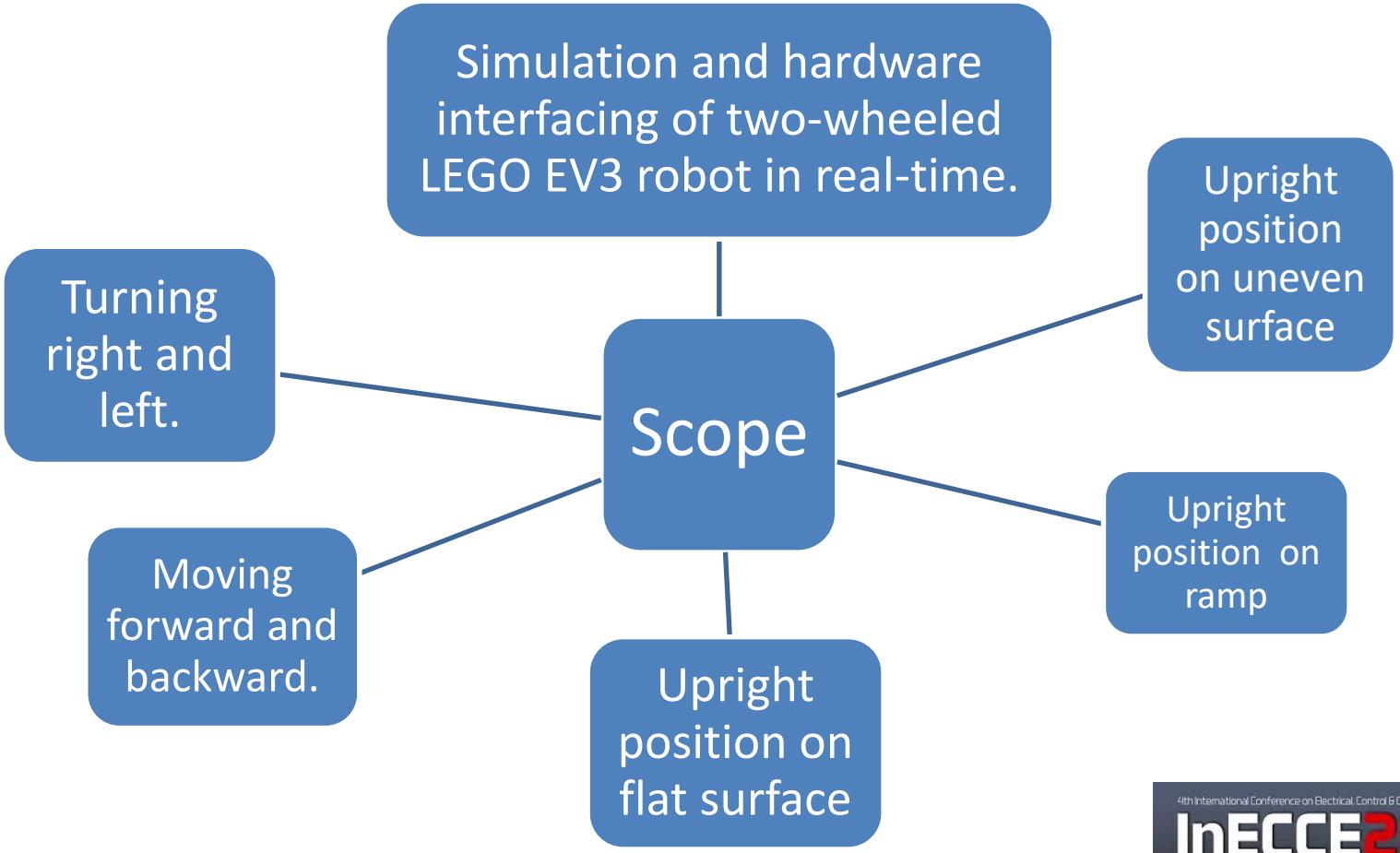


Objectives

To control the tho-wheeled EV3 :ego robot using PID in real-time using GUI.

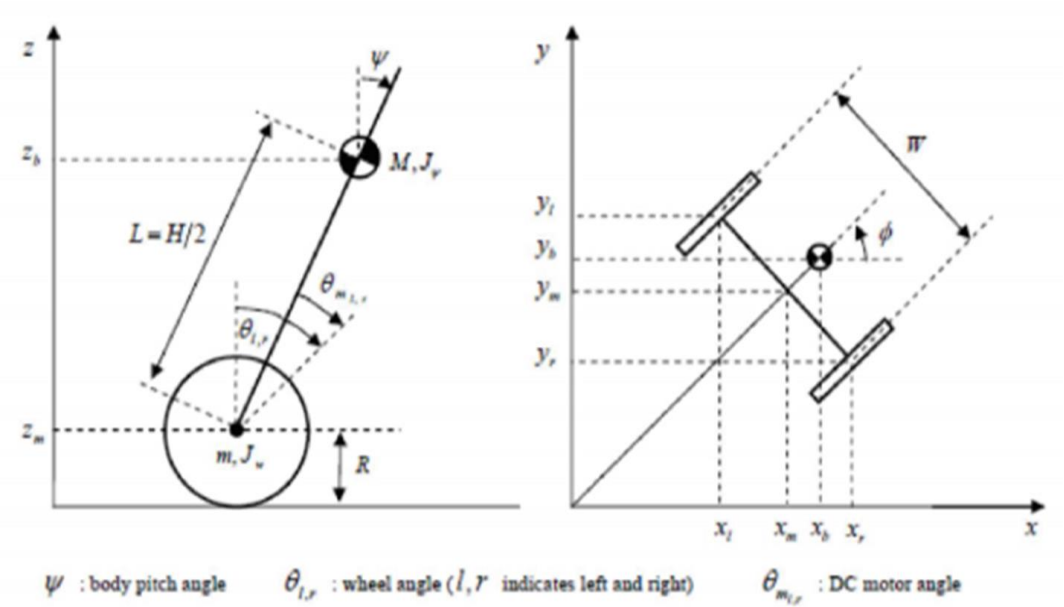
To introduce the application as an **Educational Kit for a beginner** to explore PID control of two-wheeled robotic system.

Project Scope



Methodology-1

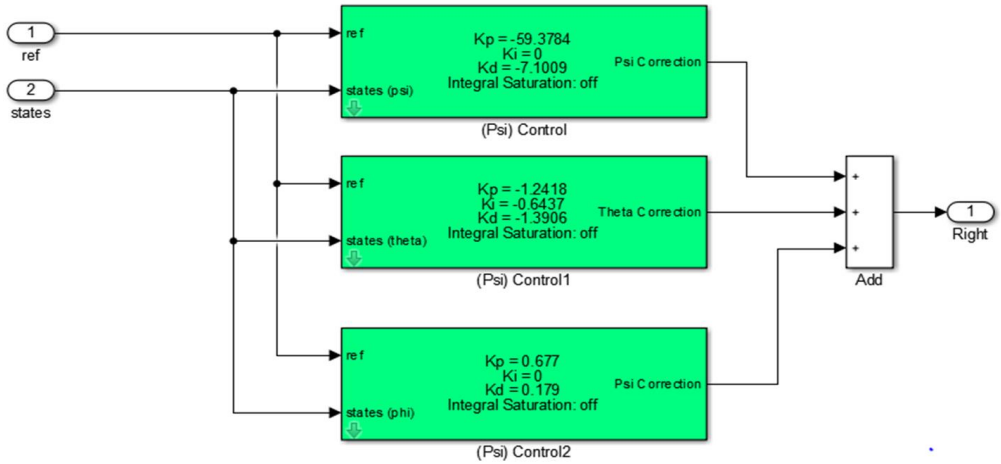
- System Modelling

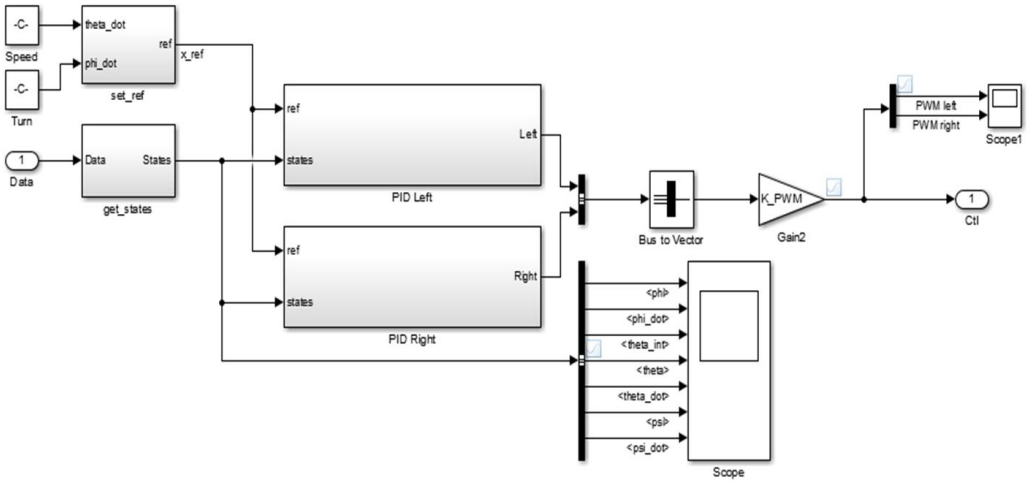


ψ : body pitch angle $\theta_{l,r}$: wheel angle (l, r indicates left and right) $\theta_{m_{l,r}}$: DC motor angle

Methodology -2

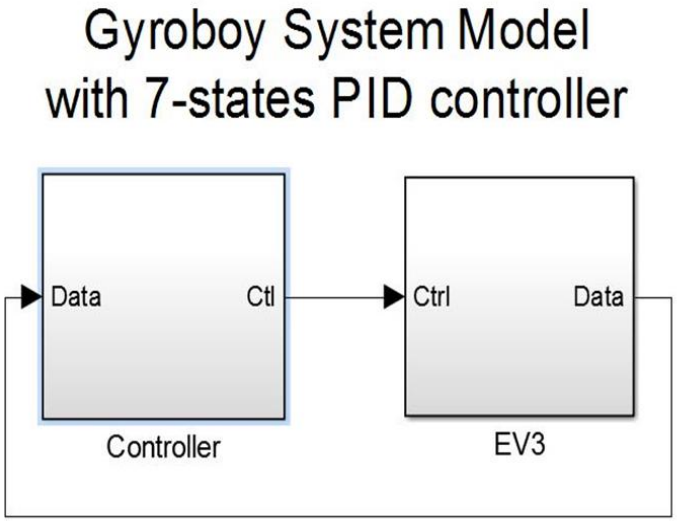
- Simulink Block Diagram

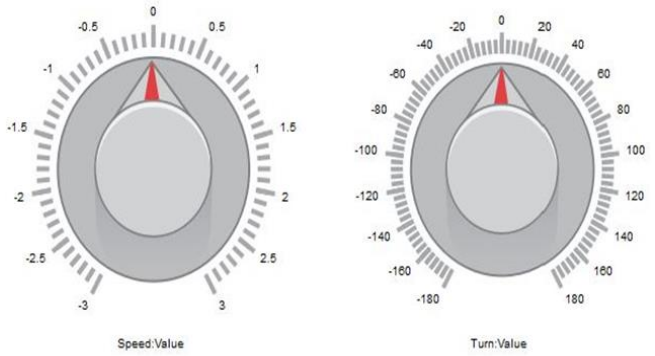




Methodology-3

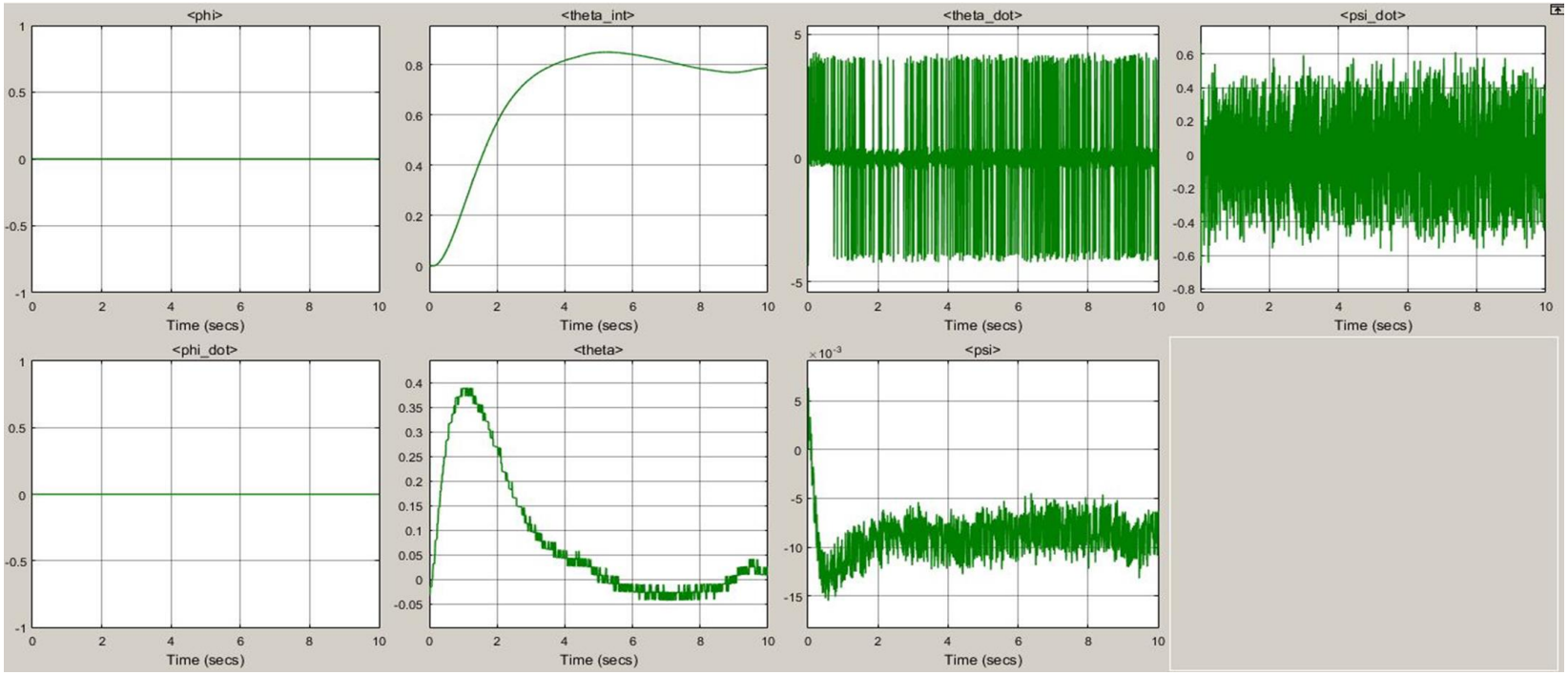
- Simulink Controller Dashboard





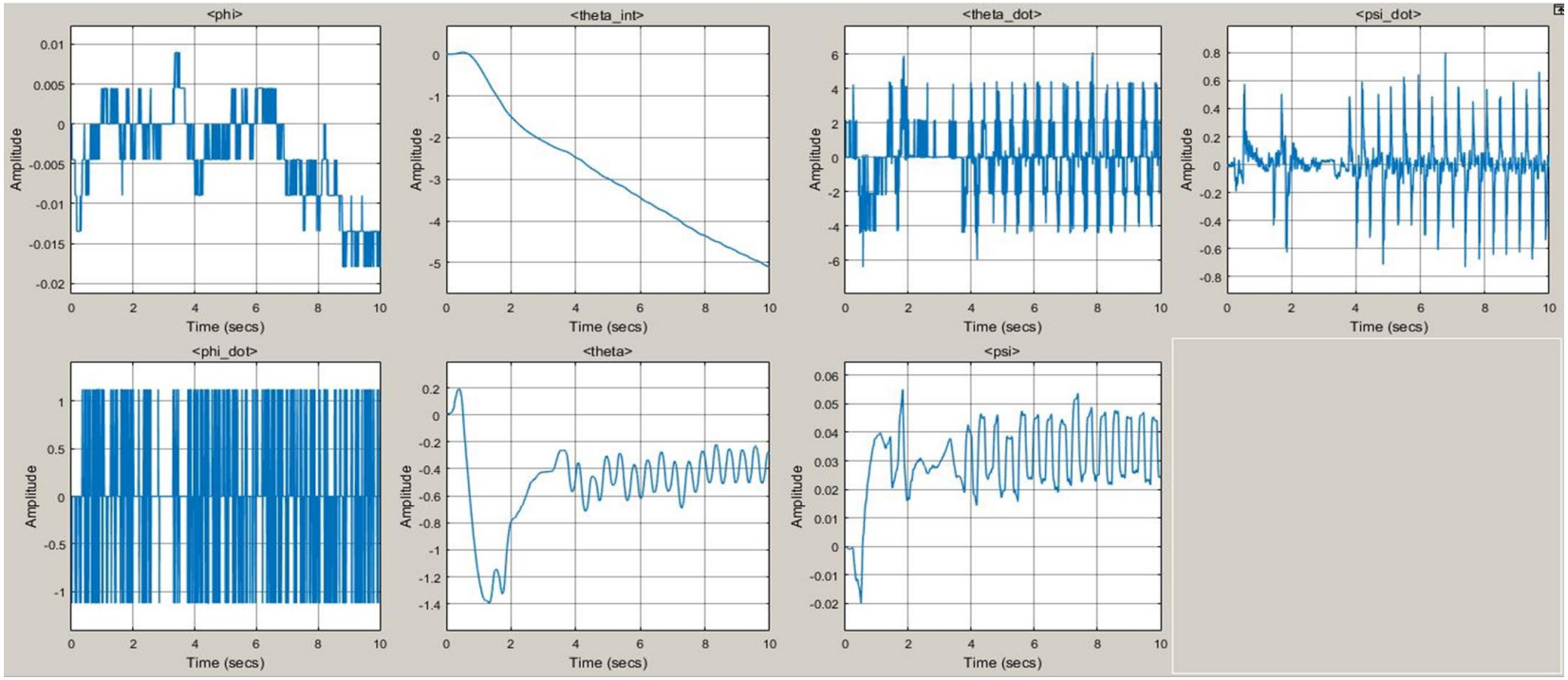
Result-1

- Result from Matlab/Simulink simulation



Result-2

- Result from hardware



Conclusion

- The balancing EV3 Lego robot has been successfully controlled using PID in real-time.

- This project can become as a "**PID control Kit**" for secondary schools & university students (laboratory session).

Main References

[1] COOPER, R. A., BONINGER, M. L., COOPER, R. & KELLEHER, A. (2006). Use of the INDEPENDENCE 3000 IBOT™ transporter at home and in the community: *A case report. Disability & Rehabilitation: Assistive Technology,* 1, 111-117.

[2] KAMEN, D.L., AMBROGI, R.R., HEINZMANN, J.D., HEINZMANN, R.K., HERR, D. AND MORRELL, J.B., (2002). Control of a balancing personal vehicle, U.S. Patent 6 443 250.

Dr. Nor Maniha Abdul Ghani

Universiti Malaysia Pahang,
26600, Pekan, Pahang, Malaysia
Phone: +609-424-6087
Fax: +609-424-6000

http://fkee.ump.edu.my/index.php/en/staff-menu/articles-staff/1034-niha-main-profile