Consider a differential drive mobile robot as shown in the figure below. Both wheels have radius \( r \). Both wheels can be driven independently. The distance between the two wheels is \( L \). Please write a short article (5~6 pages) which includes at least the following information:

- **The derivation of the kinematics model of the mobile robot:**
  Please include all the details. For example, what are the assumptions for the kinematics model? What is the constraint for the kinematics model? What are the coordinate systems?

- **The development of a motion control algorithm for path tracking**

- **The simulation/experimental results for your algorithms with discussions:**
  Please include the simulation results for at least two paths: a circle and a sinusoidal wave. Please vary your parameters and compare your results.

The format of the short article shall follow the IEEE paper standard as follows:

**Title**

**Author with affiliation**

**Abstract**

I. Introduction
II. Kinematics Model
III. Path Tracking Control
IV. Experiments/Simulations
V. Conclusion
Reference