SC627 Assignment 4, Dhananjay Tiwari, 170020019

In this report, an implementation of motion balancing of a multiple robots is discussed for one-dimensional motion. A total of 8 robots are considered which are placed along the $x-$axis. The first at the eigth robots are placed at $(0, 0)$ and $(14, 0)$ respectively and the rest of them are placed in between. The objective is to balance all the robots such that they are all placed in an equidistant manner along the $x-$axis. The robot $R_i, \forall i \in \{1, 2, \ldots, 6\}$, at every instance of time knows the position of the robots R_{i-1} and R_{i+1}. Using this fact, a PID type control algorithm is used to command the velocity of the robot R_i such that it always moves in the direction of the midpoint between R_{i-1} and R_{i+1}.

If x_i represents the $x-$coordinate of the location of the bot $R_i, \forall i \in \{0, \ldots, 7\}$, then the velocity can be decided according to the following law

$$v_{i,x} = k_p \left[\frac{1}{2} \left(x_{i+1} + x_{i-1} \right) - x_i \right], \; k_p > 0, \; \forall i \in \{1, \ldots, 6\} \tag{1}$$

The position update equation is as follows

$$x_{i,k+1} = x_{i,k} + \Delta t \; v_{i,x}, \forall i \in \{1, \ldots, 6\} \tag{2}$$

The above scheme is implemented in a python script and the result is shown in the following graph

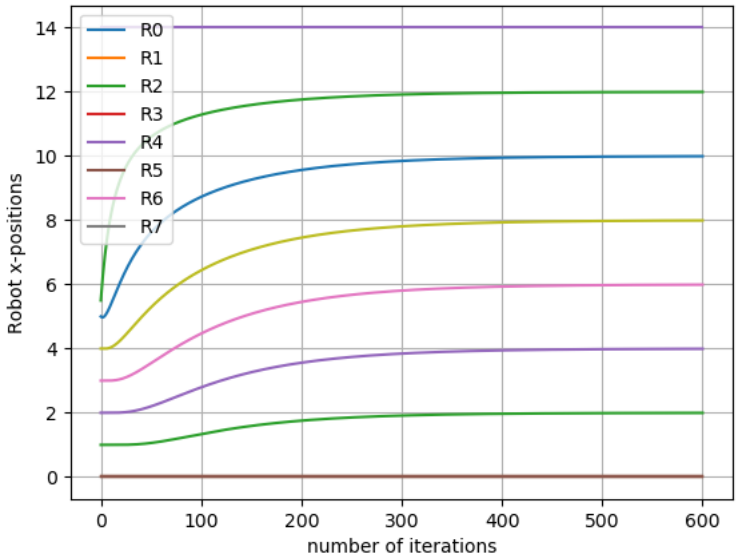

Figure 1: Plot of x-coordinate of each robot vs time

The time step $\Delta t = 0.1s$ and the simulation is performed for 600 iterations. The results show that the positions converge such that all the robots are placed in equidistant manner.