1. When we want the robot to move to destination, we change the destination to a new goal. It will go toward the original goal. The reason is that part2 is one time controller.

2. The position error is the distance between the robot current position to the destination position.

3. The heading error is the angle between the orientation of the robot and the destination orientation.

4. Because we need to calculate the angle between the orientation of the robot and the direction of the goal position, then we can know the destination direction.

5. First we are going to calculate the p error, b error and h error. And then we use 0.1 for the controller gains for distance error. Then we set that if the position error is less than 0.02m and the heading error is less than 30 degrees then we will let robot stop. And then we will set that if the position error bigger than 0.04m, then bearing error is more important and if it is less than 0.04m, then heading error is more important in the phi_l and phi_r formula. After that, we use the formula in lectures for phi_l

and phi_r with the parameter we calculated before to calculate phi_l and phi_r. Then we need to see which one is bigger, phi_l or phi_r and use different calculation to calculate the left and right wheel speed pct. Then base on the positive or negative of phi_l, we use sparki.moveRotate to set the actual move of the robot. (idea from Zhenqi Li)

6. Yes.

7. phi_l = (2*xR-theta*axle_diameter)/(2*wheel_radius)

   phi_r= (2*xR+theta*axle_diameter)/(2*wheel_radius)

   Theta depends on the distance error, if distance error is big, then bearing error matter more, else heading error matter more, which means it is equal to bearing error or the heading error depends on the distance error.

   For xR, I use 0.1 as the gain constant, and the equation is 0.1*distance error.

8. If I change the gain constants of the bearing error and heading error, it will make the importance of the role in the equation of each error changed. If it become so large, it will ignore the other one.

9. Increasing the gain constants of distance error will increase the update time and if it is too large it will cause the theta to be ignored and may cause the loop out of 100ms.

   Increase the gain constants of the bearing error and heading error will change the equation of each error. If it become so large, it will ignore the other one. If they are both too large, then it will cause the update time to be longer and out of 100ms.

10. hit the obstacle and stop

11. The robot will rotate right 90 degrees when detects some obstacles, and then it will still go to his goal on a curve line.

12. It will detect the obstacle and turn right 90 degrees and detect some obstacle and turn right 90 degrees and then go to the opposite direction to the goal. Which will cause a fail.

13. Jie Wang, Zhenqi Li ,Joshua Barber

14. 6 hours