CHAPTER VII

CONCLUSIONS AND SUGGESTIONS

7.1 Conclusions

In this research, the wheel-ground contact angle estimation has been presented and integrated into a kinematics modeling. Unlike the available methods that applicable to the robots operating on flat and smooth terrain, the proposed method uses the Denavit-Hartenburg notation like a serial link robot, due to the rocker-bogie suspension characteristics. The steering angle is estimated by using geometric approach.

A traction control is proposed based on the slip ratio. The slip ratio is estimated from wheel rolling velocities and the robot velocity. The traction control strategy is to minimize this slip ratio. So the robot can traverse over obstacle without being stuck.

A robot test bed "Lonotech 10" is designed, built and tested. The experiments consisted of move in linear motion, turning around a point, rotation in place. The traction control is verified in the simulation with two conditions. Climbing up the slope and moving over a ditch. And the robot is tested in the real world, outdoor condition to verify the simulation results.

7.2 Suggestions and Future Works

7.2.1 Robot Structure

The robot test bed can climb over obstacle, which height is about its wheel diameter. Because some parts of the robot have excessive strength. Making the robot too heavy and reduce power-to-weight ratio. Compare to the prototype, which made from light weight material with high power-to-weight ratio and can overcome the obstacle, which is double size of its own wheels.

There are several ways to reduce the overall weight. In the design phase, many redundant parts can be removed without sacrifice the strength of the structure. Some parts which are oversized and have excessive strength can be reduced to proper size.

Undesired flexible in Rocker and Bogie joints can be reduced by redesign the joint, replace with a smaller bearing with a larger one. Couplings in steering and drive train which use set screw type can be replaced with non-backlash couplings.

7.2.2 Onboard Controller

MCS-51 family controller with 33 MHz speed used in the robot may not fast enough for more complex control. For higher and more reliable speed, PC-104 can be used, but it consumes more power and space to install.

7.2.3 Robot Navigation

The robot has only one camera and one distance measuring sensor mounted at the top front of the body. Although it is mounted on a pan-tilt structure, at the lowest tilt position, the operator still cannot see the robot's wheel. The operator also has no information of the environment behind the robot. Then it is very hard to control using only information from the camera.

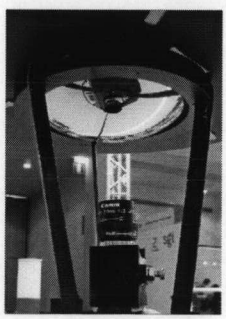

Figure 7.1: Omni-direction camera

This problem can be reduced by equipped an additional omni-direction camera on the top of the body. This camera will provide the information of the environment around the robot to the operator; make it easier to navigate through unknown environment.