CS 4970/5973
Intro Robotics

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Team 2 / Project 2

Robot Design and Hardware

In this project we completed the design of robot in two stages (1) Prototype design was made to test the feasibility of design and compatibility with code, (2) Final Design was completed after getting feedback from initial testing. Following are the key features of this design.

Chassis:

Design of this robot is based on a tricycle type frame. The main objectives behind this design was to avoid all the obstacles including rocks and to keep the size of robot as small as possible so that it can make sharp turns without hitting any objects. This was also the reason for choosing front castor tricycle model because four wheel designs needs extra space for backing up and turning towards the right spot and needs to perform extra movements. We faced some problem of slippage on front castor when robot was making turns more than thirty degrees because of the weight of handy board placed more towards the back of robot chassis. But this problem was taken care of by changing the motor speed according to the sharpness of turn angle i.e. Motor power was reduced to very low levels when turn were greater than forty five degrees.

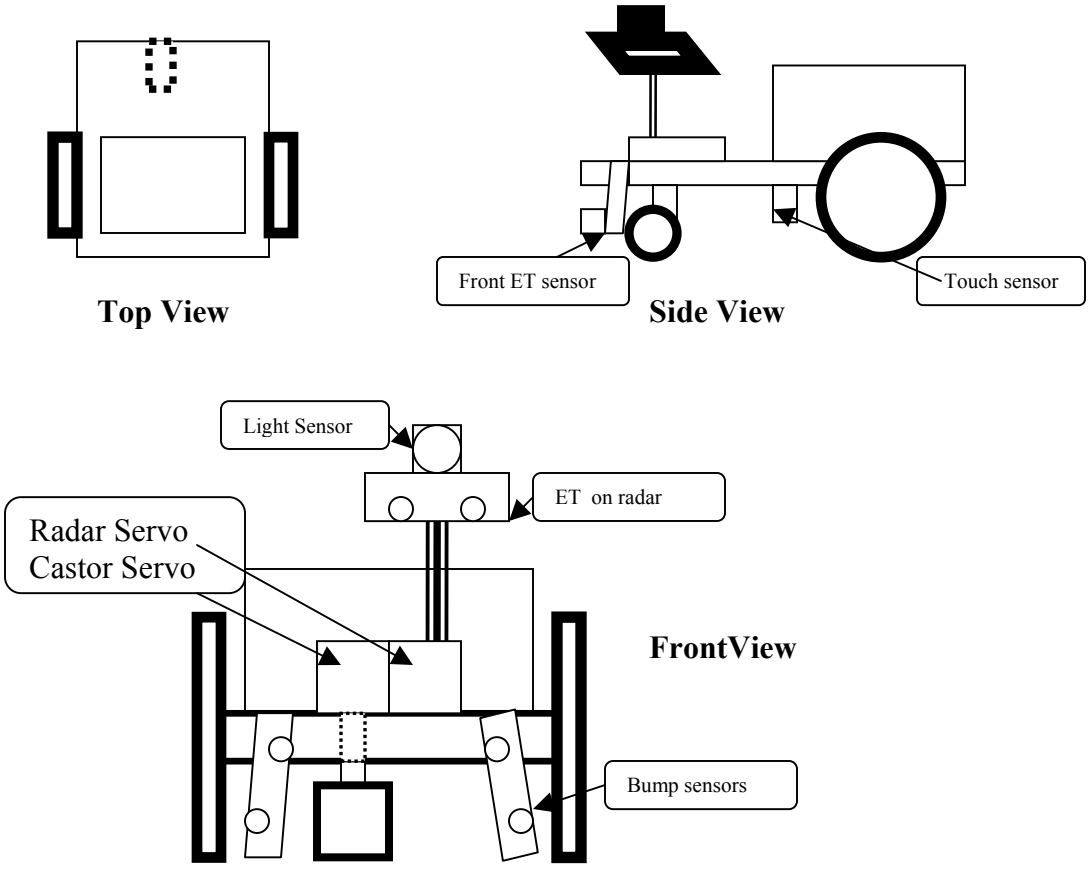

Figure 1: Design basics

Power Transmission and Wheels:

Two back wheels are powered by two motors connected separately to each of the motor by gears. Motor speed was reduced using the gear ratio of 1: 15.It was important to use low gear ratio so that the total distance moved by the robot during full radar sweep should be less than the range of Optical range finder "ET "sensors.

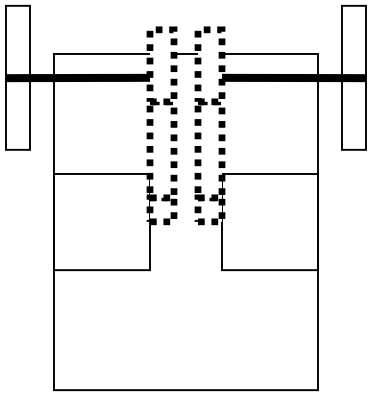

Figure 2: Motor Gearing

Front castor wheel is used as a directional wheel. This is connected to a servo to make accurate turns. Full turn angle was limited to 40 degrees in one direction in order to avoid slippage of front wheel.

Sensors:

During initial stages of design we thought of putting an arm carrying range finder “ET” sensors on the front of chassis, which can be lowered up and down to differentiate between rocks and buckets. But later on we decided to avoid all the obstacles. In final design we used an ET sensor and light sensor placed on the top of a pole attached to a servo to sweep 180 degrees like radar and detect obstacles in the front of the robot. Light sensor worked on the same principle of obstacle avoidance to sweep full front to detect maximum light value. Radar and front castor are coupled together to make turns in direction of light and avoid obstacles. Another ET sensor was placed at the front to detect obstacle right in front. This ensured that robot should not hit right in front even when ET sensors placed on radar is sensing other direction. Two touch sensors are placed right in front of back wheels to come out of a situation if back wheels are stuck on a rock or other obstacle. Two touch sensors were placed in front to trigger backup move in case of light post hit or a boxed canyon type situation. Two front bump sensors were covered with conductive wool to compete the light bulb turn off circuit.