Autodesk Sustainable Design Challenge

GSMST Team 675D

For the 2013 VEX sustainable design, we have decided to tackle the problem of trash build up at beaches. Beaches are always greatly occupied because of its soothing and mild temperatures throughout the year. However, the effects of such a populated beach result in an abundant amount of litter. This litter is both bad for the environment and economy. We used the Autodesk Sustainability Workshop and the vex forum to design an ideal beach bot.

To first design the BeachBot, we listed the limitations and requirements for the robot. We realized that we need an adaptable drive system and intake for the versatile environment of the beach. The intake system also needed to be efficient in collecting trash. The robot also needs to filter out unwanted sand and detect obstacles to avoid them. We also realized that we needed an efficient energy supply to power the robot. Moreover, communications had to be established with the robot in case of any damage. GPS had to be in place so that we could track the robot’s location. Identification markers were required so that people could easily spot them. In addition, the robot has to have a pleasing appeal, so tourists don’t think it’s so out of place. Finally, efficiency, sustainability, and an eco-friendly design were necessary to reach our goal in this robot.

To tackle our problems, we agreed to have a tank drive system so that it can maneuver easily over various environments. We also added an arm to the intake so that it could adjust its height according to the ground level. This would prevent any damage to the intake. Cameras with flashlights are used to analyze the ground so that the BeachBot can adjust its arm accordingly. Many ideas were brainstormed for our intake, but our final decision was a roller intake that could continuously plow through the sand and successfully intake the trash. The trash is then placed into the waste basket that is designed with holes to filter out unwanted sand. The waste basket is also designed to be large enough so that it is able to carry a great load in one trip. Sonar sensors and bumper sensor would be used to detect obstacles, in which the BeachBot could avoid. We added a solar panel to the top of the robot so that it could re-charge during the day and operate during the night. The robot also contains 3 batteries to hold all the energy the solar panels captures during the day, so it can work throughout the entire night. In a more real scenario the robot would use a bigger battery that is designed to last longer times compared to the vex competition batteries. The BeachBot has GPS and Satellite communication to call a technician when it has broken down. The flashlights used with cameras could also act as identification marker for tourist to see. This prevents from adding additional lights that would be consume more energy than necessary. The BeachBot has a nice, clean casing over it giving it a pleasing look to tourists.

We have made our BeachBot sustainable in many different ways. The GPS tracking is used to make sure the robot does not repeat its tracks; thus cutting down on both time and energy consumption. The robot is made out of recycled aluminum, allowing us to eliminate the need to produce new aluminum and the waste to produce that aluminum. We also used some polycarbonate to eliminate the use of aluminum all together. Various sensors are used to reduce the risk of damaging the BeachBot in which creates a longer lasting device. The BeachBot can also be easily disassembled to repair, so the need to trash the trash cleaner would be eliminated. Solar panels and clean electrical energy greatly reduce CO2 emissions. The pleasing look of the BeachBot also would increase sales of it, moreover producing a large profit to further develop new ideas.

While designing the BeachBot we found many of the various features in Autodesk Inventor useful. The copy feature prevented us from making another identical part from scratch. The rendering feature also helped us publish our CAD model with great detail. Constraints helped us make the model with great precision. The movement motion constraint allowed us to show how one gear would affect the other giving us a more real life example.

We would like to give credit to the Vex Forum and the Autodesk Education Community and its Sustainability workshop.