Automated Beach Cleaner

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Abstract

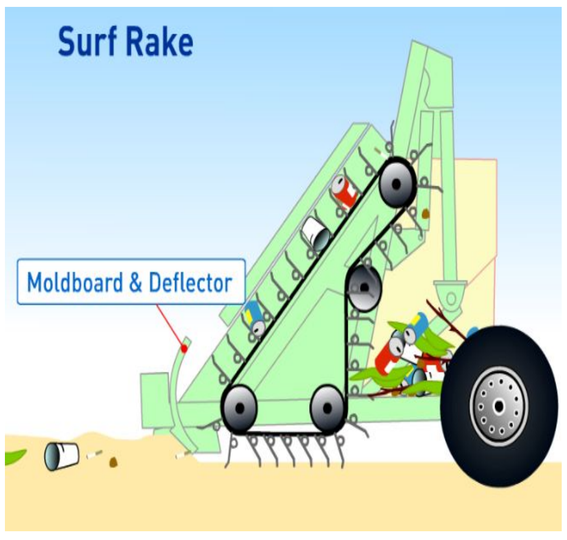
In today's world of plastic, beaches all over the earth are suffering from litter and waste that inevitably reaches the shore and gets swept into the ocean and seas. Even today, litter such as plastic bags and cigarette butts are still a common sight in even some of the most remote beaches. The world responded to this by creating beach cleaners, which clear beaches at night from the leftover litter by visitors. These however are usually found to be large and expensive, as well as limited to utilization when there are no people around as it might be dangerous to operate during human activity. This project exploits the complications with these industrial sized beach cleaners and presents a comprehensive, automated beach cleaner that accounts for these challenges.

Introduction

The Ocean Conservancy recently released the totals from last years' worldwide Coastal Cleanup Day (CCD) and each of the top seven items picked up are typically made from plastic. The image below from May 2013 shows the amount of beach waste that was collected during this mass cleanup. As you can see, beach waste is a major issue that is continually affecting the marine life environment as the dangers are growing with each year.

The beach cleaner presented in this project is fairly small in comparison to existing models, that can get as big as a tractor, and the smallest available is about the size of a golf cart. A smaller model allows for more dexterous movement and less danger for bystanders. The design of the trash collector is made in a way to effectively separate the litter from the sand with as few electrical components as possible to reduce the overall power consumption. By combining this with supplementary mechanical ingenuity, we will be maximizing efficiency by having less complex approaches. A system of interleaved bands and scoopers would be gathering the litter and retaining it into a storage vessel without any amount of sand going with it. To automate this machine, we will incorporate an Arduino MEGA microcontroller. This allows the machine to follow a pre-programmed route, while at the same time being able to account for certain stimulus, such as sudden movement or an object too big or too heavy in its route, thanks to the ultrasonic sensors installed in the front and sides of the beach cleaner. These sensors' roles will be to protect native wildlife from getting caught, as well as preventing collisions with beach visitors. This will allow for protection of the beach cleaner and ensures that it performs effectively.

"BeachTech Sweepy Hydro", as big as a golf cart and has to be manually maneuvered.

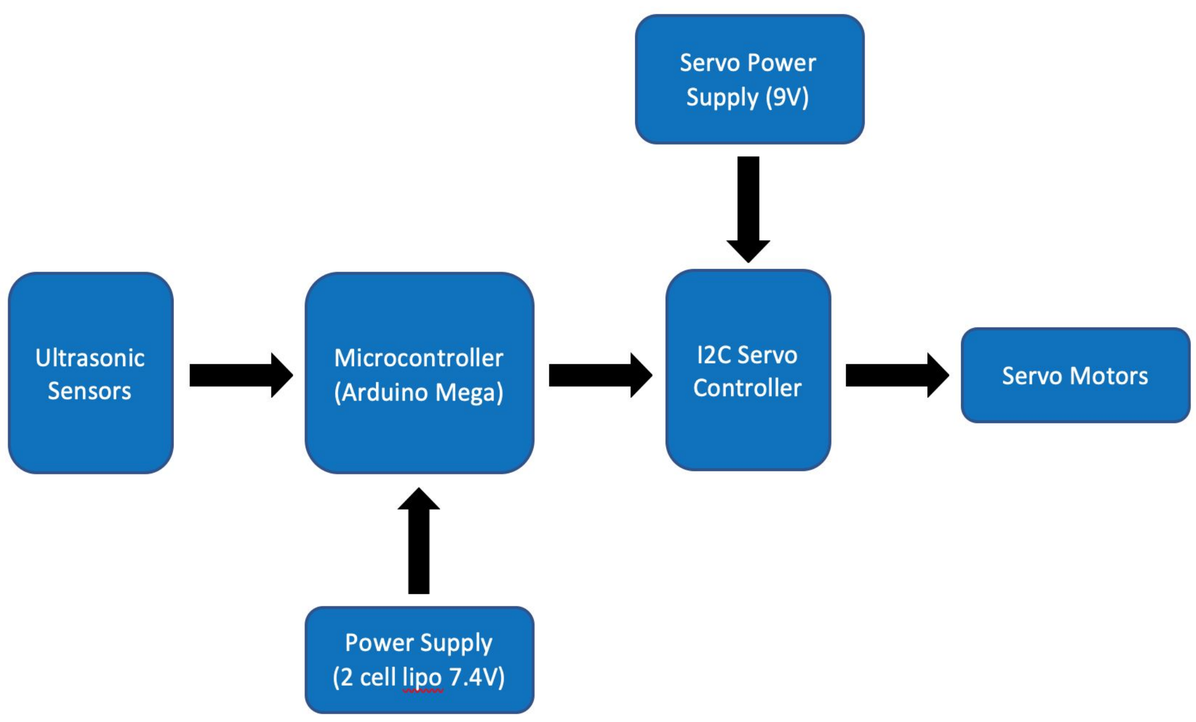


"Surf Rake", too big and has to be carried by a tractor

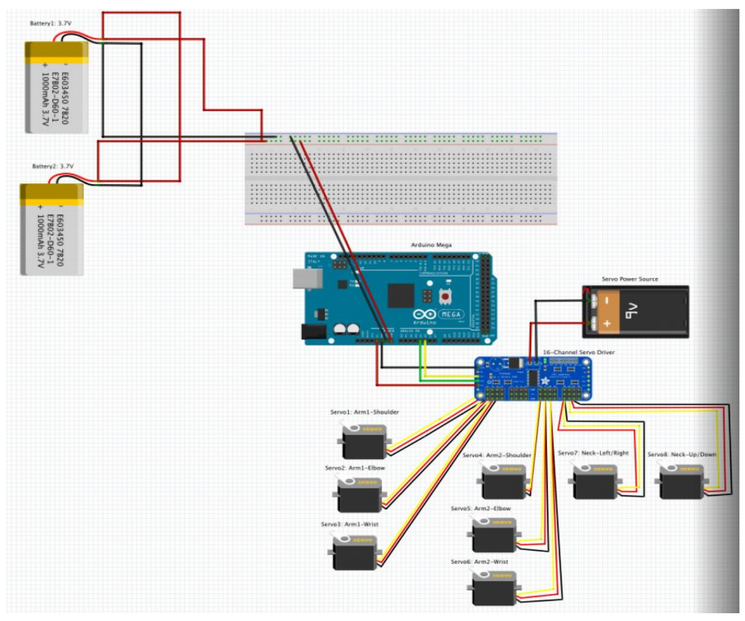
Device Components

- ❏ Adafruit 12C interface - PCA9685
- ❏ JST 2-pin Extension Cable with On/Off Switch
- ❏ Powerboard
- ❏ Arduino Mega 2560 Rev3
- ❏ Battery (2 cell lipo)
- ❏ Wire wraps insulation
- ❏ Futaba S-148 servo Motor
- ❏ Premium Jumper wires
- ❏ Carbon fibre (3D printing material)

Block Diagram

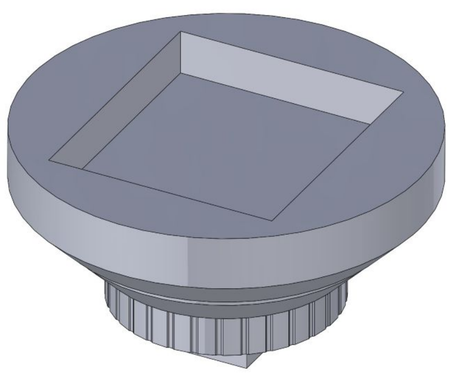


Working principle

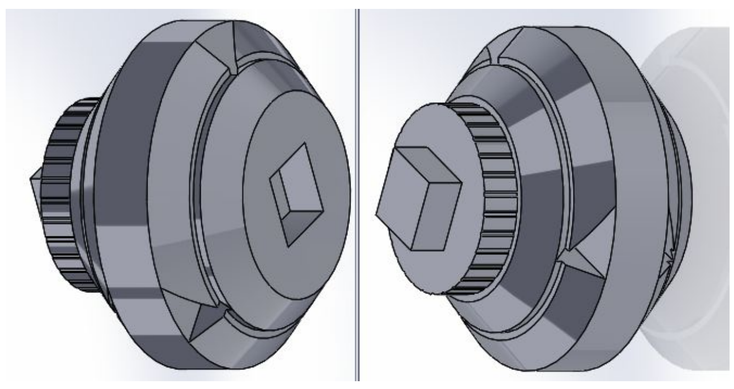


Basic circuitry of Beach cleaner

- Red wires represent voltage connection lines.
- Black wires represent ground connection lines.
- Yellow wires represent PWM servo controller connection lines.
- Green wire represents the signal data line (SDA).
- I2C power source (9V)

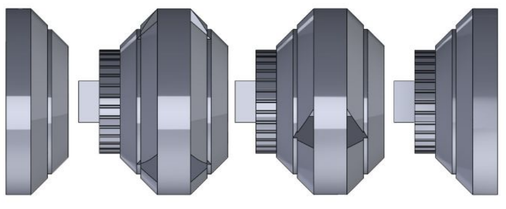


part that connects to rotor

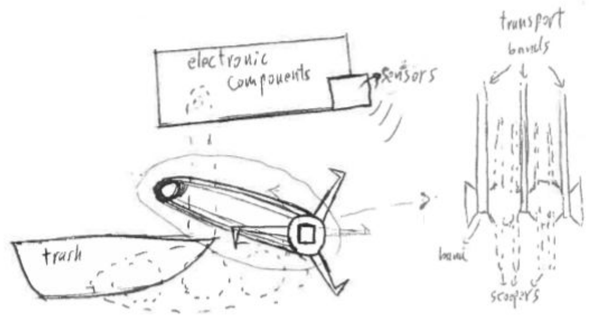


middle connector, has holes to insert scoopers and a side track for the bands

General scooper/band design, designed to trap the trash while allowing the sand to pass through.The band will rotate faster than the scooper so trash will not get stuck in between.



conceptual assembly of parts



left: conceptual beach cleaner from the side with invisible structure. Right: system scooper bands from the top.

The sensors are located on the front right and left of the machine to allow for a wider range of movement detection. The electronic bay will be located on the belly (underneath) the machine.

Future Work and Implementation

For our future work we will be starting off by ordering electrical components as well as 3D printing mechanical components from the school 3D printer. With our parts in hand we will move onto the assembly and testing phase. This will be our most difficult task in our project, for we will require a lot of time fine tuning as well as accounting for all the variables previously discussed throughout our research. After rigorous testing we will be confident and ready to present our final project to the ASEE conference. We will demonstrate how this automated beach cleaner will help push us into a cleaner, environmentally conscious era where sea life can flourish and help bring new hope to our earth. It is of most importance that humanity finds a way to save our planet from our own doing, and with bright innovation from the new generation I am certain that we can restore our planet.