

## Water Deterrence System:

### **Sprayers:**

For the water deterrence system, we are planning on purchasing windshield-washer nozzles and attaching them to the robot so that the spray is 180°. A set of two nozzles from amazon.com costs \$12.99. These have a simple two-wire hookup with red LEDs. Since the current plan is to have the robot use the sprayers only when the plant is stolen, the red LEDs will help alert nearby people to its “angry” personality. Figure 1 is an image of the nozzles taken from amazon.com.



Figure 1 – Red-Glowing Windshield Nozzles

### **Pump:**

For the pump to activate the above sprayers, it was decided that using a pump for dispensing windshield washer fluid will be cost effective and easy to implement since it will draw water from a washer fluid reservoir and push water through windshield washer nozzles. There are several different options for pumps depending on the reservoir of the car (i.e., the year, make, and model of the car the reservoir came from). The pump in figure 2 comes with a pump, hoses, and splitters and is listed at \$34.85 on amazon.com. Since there is a chance this one does not fit with the reservoir we plan to get, there are many other possibilities for pumps; amazon.com has an option for you to pick out the year, make, and model of the car and it determines whether or not this pump will fit the reservoir for that car. Using that option, it can be determined if the pump and reservoir are compatible before purchasing anything.



Figure 2—Pump with Splitters and Hoses

## Reservoir:

Since there are two nozzles for the physical deterrence, and one for the plant that may need to be used, there are a few options for the reservoir that we have considered.

First, we can implement a 3-way splitter that will connect the pump to both the nozzles and the plant. Our concerns with this include not being able to find a proper splitter to fit the pump, the proper splitter being too expensive, not being able to control the sprays individually (i.e. when the plant gets watered, the sprayers for the alarm go off and vice-versa), and the water from the reservoir getting depleted too quickly and making either the sprayers ineffective, or the robot fail at its mission.

Another option is to purchase a reservoir that is meant for two pumps, and having one of the pumps for watering the plant, and the other for controlling the nozzles. Figure 3 is a representation of such a pump. Our concern with this option is cost of the reservoir, the size of it (i.e. will it fit in the robot), and similarly to before, the water getting depleted too fast.

A third option is to modify the current reservoir by installing an additional pump, effectively making it a 2-pump reservoir. This option would probably be the most cost efficient, however it might be more complicated to implement than expected, and if done incorrectly would require the purchase of a new reservoir, and once again there is the concern of the water getting depleted too quickly.

The last option that was considered was purchasing either one or two new single pump reservoirs. The amount of reservoirs purchased depends on the volume of each reservoir and space currently available in the robot for another reservoir to be installed. This option, while probably the most expensive, would eliminate the issue of the water getting depleted too quickly from the reservoir(s) and will also probably be the easiest and most time efficient to implement.

At the moment, we are considering going with the fourth option, however we are open to suggestions and ideas.



Figure 3—Option for Reservoir (2-pump)