Risk Assessment
Safety Plan

Project information:

Robotic Trash Cart	11/16/2018
Name of Project	Date of submission

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Faculty mentor	Phone Number	e-mail
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Jerris Hooker	(850)410-6463	hooker@eng.famu.fsu.edu
Michael Devine	(850)410-6370	mdevine@fsu.edu

I. Project description:

In order to help automate the trash removal process, a device that holds and transports waste containers from the home position to the designated pickup location and back to the home position will be designed and built.

II. Describe the steps for your project:

Step1. Design the Robotic Trash Cart (RTC) and determine the parts necessary to complete the project.

Step 2. Purchase parts and prepare for assembly.

Step 3. Assemble frame, which will require welding work.

Step 4. Integrate the drive system and power supply to the frame. Assembly will require work with small tools.

Step 5. Integrate the control system to the power supply and drive system. Connecting wires will be needed.

Step 6. Code the controls for the drive system using a remote control

Step 7. Test the remote control handling of the RTC

Step 8. Test the capabilities of the RTC on a 5 degree gradient and on a paved driveway

III. Given that many accidents result from an unexpected reaction or event, go back through the steps of the project and imagine what could go wrong to make what seems to be a safe and well-regulated process turn into one that could result in an accident. (See examples)

During welding, proper personal protective equipment (PPE) should be worn and proper precautions need to be taken to ensure no combustibles or hazardous materials are inadvertently ignited. Electric shock can occur when assembling the drive system or connections to the power supply. Safety gloves, eyewear, and other PPE need to be worn to avoid accidental shocks or mishaps. Another possible accident that could occur is carpal tunnel syndrome or computer vision syndrome from coding. The frame of the RTC will need to be welded together. Injuries, such as burns from explosions or electric shocks, are possible.

IV. Perform online research to identify any accidents that have occurred using your materials, equipment or process. State how you could avoid having this hazardous situation arise in your project.

Researching possible accidents during the welding process,has helped us to identify three safety hazards. They are primarily eye hazards, hearing hazards, and body hazards; the most prominent hazard is the bodily harm due to the blow torch being able to burn through bone, tissue, and any standard clothing. The harm to the eyes is due to the excessively high temperature and intensity of the light from the blow torch. The hearing hazard comes from flying debris as well as ultra high-pitched sounds when welding. Wearing proper PPE when welding and having all unnecessary personnel away from the vicinity can prevent accidents from occurring. According to Lincoln Electric, there are safety concerns for possible explosions due to fumes and arcing. Another possible that can occur is carpal tunnel and computer vision syndrome from coding.This could be reduced by purchasing a pre-programmed processor and taking breaks every hour you are on the computer. Harvard Medical School recommends to take shorter breaks within each hour to rest your hands. Another possible hazard occurs when batteries overheat and combust. One needs to be alert for any signs of overheating, such as hissing, bulges, or leaks, and immediately clear any flammable or hazardous materials away from the battery. Working with batteries on a non-combustible surface greatly reduces the chances of further accidents from occurring. If the battery does catch fire, then a foam extinguisher is the ideal way to extinguish the flames.

V. For each identified hazard or "what if" situation noted above, describe one or more measures that will be taken to mitigate the hazard. (See examples of engineering controls, administrative controls, special work practices and PPE).

Whenever working with welding or power tools, work in pairs. The three hazards associated with welding can be mitigated through the use of PPE. The noise hazard can be mitigated through the use of industrial ear muffs. There are specially designed welding masks to protect eyes from harmful light rays and heat. The body hazards of welding can be removed by wear specialized clothing that can withstand extreme temperatures. Having all unnecessary personnel clear the welding area will prevent any overcrowding of the works space and prevent unnecessary risks for other team members. Lincoln Electric recommends scouting the area and removing any hazardous or flammable materials before welding. These hazards can be removed entirely by ordering a frame that is already assembled and welded together. Having a non - combustible workstation will also prevent accidents when working with the power supply. Wearing appropriate PPE, such as chemical splash goggles or a face shield, gauntlet style gloves, and rubber boots, could help prevent any injuries when working with batteries.

VI. Rewrite the project steps to include all safety measures taken for each step or combination of steps. Be specific (don't just state "be careful").

Step 1: Design the RTC and determine the parts needed for the project
Step 2: Purchase the Parts
Step 3: Remove any hazardous or flammable material from the workstation before welding or using power tools.
Step 4: Wear PPE when welding or using power tools to assemble the frame. Remove extra personnel from the work area. Work in pairs when welding or using power tools
Step 5: Wear PPE, such as gloves and boots, and with a partner when integrating the drive system and power supply to the frame
Step 6: Integrate the control and drive systems to the power supply wearing proper PPE. Work in pairs.
Step 7: Code the control system of the RTC. Make sure to take regularly scheduled breaks from coding every hour and shorter breaks in between.
Step 8: Test the remote control capabilities of the RTC
Step 9: Test the capabilities of the RTC on a paved driveway and a 5 degree incline

VII. Thinking about the accidents that have occurred or that you have identified as a risk, describe emergency response procedures to use.

Aside from coding, we will be working in pairs when doing any assembly or testing of the RTC. Before working on the RTC, we will take note of any emergency shower stations, fire extinguishers, and first aid kits in the room. We will also remove any hazardous or flammable material near the workstation before working on the RTC. If an accident occurs with welding equipment or power tools, then the tools will be immediately turned off. Campus police or emergency services will be immediately notified. If they are not responding, then 911 will be called. If there are any hazardous conditions that remain, then the team will evacuate the area and notify campus personnel. Campus personnel that will be notified is the head of the lab we are working in, such as Dante Ford. Once the situation is under control, then the senior design supervisor, Dr. Hooker,and team advisor, Dr. Edrington, will be notified of the situation.

VIII. List emergency response contact information:

- Call 911 for injuries, fires or other emergency situations
- Call your department representative to report a facility concern

Name	Phone Number	Faculty or other COE emergency contact	Phone Number
(Jacob) Shannon Emerson	(904) 860-5565	Jerris Hooker	(850) 410-6463
(Oscar) Maria Flores	(561) 281-9231	Christopher Edrington	(850)645-7213
(John) LaVonia Williams	(850) 322-0241	Michael Devine	(850)410-6370
(Bishoy) Mirna Hanna	(850) 544-7378		

IX. Safety review signatures

- Faculty Review update (required for project changes and as specified by faculty mentor)
- Updated safety reviews should occur for the following reasons:
  1. Faculty requires second review by this date:
  2. Faculty requires discussion and possibly a new safety review BEFORE proceeding with step(s)
  3. An accident or unexpected event has occurred (these must be reported to the faculty, who will decide if

a new safety review should be performed.

4. Changes have been made to the project.

Team Member	Date	Faculty mentor	Date

Report all accidents and near misses to faculty mentor.