

Problem Number	Identifying & Selecting Problem PSP 1	Analyzing Problem PSP 2	Generating Potential Solutions PSP 3	Selecting & Planning Solution PSP 4	Implementing Solution PSP 5	Evaluating Solution PSP 6	Status
	R1	R2	R3	Y4	Y5	G6	
1	No future 3D-printing access. This may effect our ability to meet the prototype deadline.	Future parts will have a longer lead time or cost associated with it wether it is sent to be made out of house or in the construct. This is not a critical issue but something that needs to be planned for.	Figure in the time it takes to make a new part due to future part failure or design changes.	After reviewing time and cost constraints the future 3D-printing jobs will be scheduled at an earlier date in the construct.	Extra gears were printed ahead of time in the construct in case of part failure.	3D printing in the construct costs only 6 cents per gram of material and has a lead time of about a day making it more convient to print future parts in house.	Completed
2	Decide what springs and how many to purchase from what vendor. Selecting and receiving a spring may effect our ability to meet the prototype deadline.	The spring manufacturer has a minimum cart cost of \$60. The two springs selected on the BOM is below this minimum.	Different springs can be selected to use them in series/parallel to meet the engineering requirement. Another option is to buy the selected springs from the same vendor that meets the specs required and select extra springs with a larger deflection or spring constant to meet minimum cart cost.	Due to the calculations for different spring characteristics and cost it was found it would be more beneficial to purchase different springs to use in parallel.	Purchased 6 springs to use in parallel for about \$15 instead of the original price of \$60.	Although we must purchase more springs to achieve desired characteristics the final price was much less then purchasing from the original spring manufacturer selected.	Completed
3	Shop machined plate incorrectly. This will cause the prototype completion to take longer than planned.	The failure was not due to design issues. Did not budget for extra marerial and there was non left over for a new part.	Ask the shop if they have any extra material that matches what was supplied or purchase more material.	The shop had extra material to replace the bad part.	The plate is to be machined correctly.	Received correctly manufactured part.	Completed
4	How should the device attach to the front of the wheelchair.	A solution to this problem is yet to be designed. This solution must allow for multiple degrees of freedom, so it can be easily adjustable and can be attached to both the soccer and bowling unit as well as future devices.	To attach the unit to the wheelchair, telescoping PVC pipes can be used with a clamp to attach it.	A frame is to be made of PVC at attached using 360°swiveling pipe clamps.	Frame was made and the swiveling pipe clamps were attached to wheelchair arms and the overcomer device.	Inserts need to be made so the pipe clamps can be more stiffly attached to wheelchair arms taking into account different diameters. Otherwise the device is securely attached to the wheelchair with sufficient space for the users' legs.	Completed
5	Shop machined slotted pipe incorrectly. This will cause the prototype completion to take longer than planned.	The design did not leave enough clearance between the slots in the pipe. The material became too thin and sheared during the machining process.	A redesign of the slotted pipe assembly must take place to include more clearance between the two slots.	The slot was made smaller to allow for more clearance. This was possible by changing the BOM to include modified washers in order to decrease the slot size.	Remachine new material to reflect design changes.	The striker bar assembly is a success and slides through the slots as desired.	Completed
6	Cannot bend the PVC to create frame as anticipated. This will change the prototype design.	It was found to be impossible to bend the pvc at right angles as anticipated. If the frame was to be heated and then bent at 90 degree angles it would cause the pvc to cave in and be unusable. Since the original design is to be made of aluminum we should make sure this process is possible for future manufacturing processes as well.	There are a few courses of action that can be taken to create the frame without bending the pvc: 1. Purchase elbows for the prototype and attach with epoxy. 2. Cut the corners at 45 degree angles and attach with epoxy. 3. Redesign	Test the feasibility of attaching the corners using epoxy to ensure it has enough strength.	The pvc epoxied at 45 degree angles did not have enough strength to hold the frame together reliably. Elbows were purchase and epoxy was used to connect the frame.	The frame was sturdy and rigid, an overall success.	Completed
7	The servo arms are stressing the servo horn this may effect the usability of the device.	Since the horn is attached at the end of the servo arm the length extending out stresses the horn. Most of the weight is only on one end of the servo horn and so the arms are hanging downward and are not perpendicular to the axis of rotation. This can be bad for the servo motor.	Can create counter balances to extend from the other side of the servo arms to balance out the stress on the horn. Create guides the servo arms can rest on to relieve stress on the servo horn.	Brackets are to be made to attach to the servo mounting plate. A slot will guide the arms and prevent them from moving in a vertical direction and help prevent stress on the servo horn.	The servo mounting plates were modified and the brackets were attached.	The brackets work as planned and keep the servo arms from moving in the vertical direction as well as help guides the arms to catch the soccer ball.	Completed
8	Was shipped the incorrect spring from mcmaster. This will cause the prototype completion to take longer than planned waiting for the final parts.	Was unsure whether or not the spring exhibited the specifications claimed by mcmaster. The spring was tested and it was found that a spring with a stiffer spring constant then requested was sent.	Send back springs for the what was ordered or buy new springs then originally selected.	Pick springs from lowes with a lower spring constant and desired length.	Springs were purchased from lowes with a much smaller spring constant. These are to be tested, because the spring constant was originally determined for 30 mph which may be too fast for our application. Purchasing more springs to achieve desired result may be required.	The force the spring provides is lower than what was specified in engineering requirements but provides the soccer ball a sufficient velocity to provide enjoyment for the end user playing soccer with the device.	Completed

9	Frame was not square or to the specifications designed. The plate could not mount on frame as specified. Modifications will change the prototype design.	The pvc was incorrectly cut so the ends were not square. Another cause may be the knock out that occurred when epoxing the pvc to the elbows. The	Align the axis from one edge of the frame to mount the plate and on other end make up for the difference.	Create a thin platform to mount one edge of the plate to the frame and a spacer to keep the plate level to the frame surface. Assume one side of the frame is square and mark and drill precise holes from this origin with disregard to the excess pvc length that does not impact the function of the device.	Attach to the frame the plate and spacers and make sure everything aligns as required.	Special brackets were made to act as spacers also to assist in mounting the frame to the plate. The brackets included a 90 degree bend as well as a precise hole to allow the striker bar to be mounted at the correct distance. This ensure the gears to mesh as specified.	Completed
10	To install the striker bar the plate assembly must be taken apart.	When adjustments need to be made you must take the entire assembly apart from the frame to enable the striker bar to slide out. The design of the striker bar sub assembly was not made to be independent from the device.	Redesign the device to be self contained from the frame and have the plates sub assembly independent from the striker bar assembly in case of maintenance or adjustments. Another option is to modify the existing frame design to allow us to more easily remove the striker bar.	TBD	TBD	TBD	In progress
11	Budget is low. Almost out of funds.	Last minute purchases made the budget tighter than anticipated. There was also a lot of cost associated with shipping that was not anticipated due to the weight of the plates ordered. Lastly money from returns is still in process. This is an issue in case of future purchases that may need to be made for part failures or design changes. This may be a critical failure mode for the prototype to be able to function according to customer specifications.	1. Ask the customer for more money. 2. Come up with creative solutions with materials provided for free from RIT.	Work with the other overcomer team to purchase materials that will benefit both projects as well as ask for emergency funds from the customer.	The other overcomer team supported the project by purchasing 360° swiveling pipe clamps with their surplus budget and the customer provided us with emergency funds.	Continue product testing with support of back up funds for product failure.	Completed
12	Incoming ball may damage the servo leading to failure of meeting customer requirements.	An incoming soccer ball may generate enough force to break the servo horn/damage the servo. More testing must be done to measure the capability of the prototype.	Create a stop for the servo arms to ensure it does not swing back faster than anticipated.	Brackets are to be made to attach to the servo mounting plate. A slot will guide the arms and prevent them from moving in a vertical direction and help prevent stress on the servo horn. This will also limit the movement of the servo arms when impacted with an incoming ball.	The servo mounting plates were modified and the brackets were attached.	The brackets work as planned and keep the servo arms from moving in the vertical as well as the horizontal direction providing a stop preventing the servo arms from swinging back or over the soccer ball.	Completed
13	Depending on the direction of the incoming ball the device cannot catch and center the soccer ball. This leads to failure of meeting customer requirements.	Depending on where the soccer ball meets the servo arm the arms cannot close or center the soccer ball. This leads to failure of "kicking" the soccer ball. This may be happening due to the small size of the servo arms or its distance from the ground causing the soccer ball to get wedged instead of guiding it to the center.	Improve the servo arm design so it can guide the soccer ball to the center independent of where the soccer ball lands relative to the servo arms.	TBD	TBD	TBD	In progress
14	The timing of the device is inconsistent. This leads to failure of meeting engineering requirements.	The timing of the device is inconsistent so when used repeatedly it will be in the wrong spot to kick the soccer ball with its full force.	Add limit switches to the device to provide feedback on the position of the rack. This will allow the device to know when it is the correct position to release the striker ball.	Select a limit switch and create a mounting plate to attach to the device.	The limit switch was added along with mouting plate so it is engaged at the end of the striker bars travel.	Due to other issues with the device the limit switch did not fix the issue but greatly improved the devices performance (timing was more consistent).	Completed
15	The servo motor broke causing the battery to die. This leads to failure of the device to perform therefore not meeting customer requirements.	Testing the functionality of the device it was found the servo motor no longer operated and the battery would no longer holds its full charge. Analyzing the system it was determined the malfunction was due to the motor trying to draw more current than the system could allow.	Fuzes could be rated to pop before the system could be affected therefore we will not kill the battery and the motor or any other components if this issue were to occur again.	A inline fuze was selected for the motor and the battery and a new battery was selected.	The system was adjusted and calibrated with the new components and it was performing similarly to before the issue arised.	The servo motor died again leading us to believe we did not purchase a motor correctly rated for our system. Although the battery did not die again so the fuzes did protect the rest of the components.	Completed