

Redefined Scope and Updated Project Plan



Beyond Innovation, LLC

Self-Leveling Pool Table

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Abstract

Traditional pool tables take up too much space and are practically impossible to move or keep level without professional help. Team 6 is designing a self-leveling stow-away pool table to solve this problem. This table will have tournament regulation dimensions while also having the capability of self-leveling, at the push of a button, and being stowed-away by one person to reduce its footprint by 75%. The team has completed the planning and designing portions of the project. During the first half of the project, the team has encountered challenges such as time management and miscommunications between team members. These challenges have led to a change in the project design and the project plan. It was decided that it would be beneficial to use a dual-cart system to rotate the pool table into the stow away position as opposed to the previous design which required the pool table to be wheeled over to a fixed housing to be stowed away. Development of the self-leveling system is nearing the completion of the initial testing process and the leveling algorithm development will begin upon completion of testing. With most of the essential items being procured, Team 6 is now ready to implement the changes in their design and begin the construction process of the design.

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1.0 Introduction

A problem recognized with traditional billiard tables is that they permanently take up a large amount of space. This problem is caused by the large playing surface of the billiard table and its inability to move because of the heavy weight and the need for it to be well leveled. The goal of this project is to design and create a pool table that is capable of self-leveling in less than five minutes, at the push of a button, and also be stowed-away easily by one person so that the footprint of the table is reduced by at least 75%.

2.0 Procurement Progress

Most of the procurement was completed on schedule in the fall of 2014. All of the electrical components required to begin developing and testing the leveling feature arrived before the beginning of the 2015 Spring semester. Specifically, these were the power adapter, microcontroller, motor driver, Infrared distance sensor, inclinometer, linear actuators, and 16 and 22 gauge wires to connect it all. The software to program the microcontroller has been downloaded, for free, from various websites connected with Polulu. Other items must be procured in the coming weeks. This includes nuts, bolts, wood for the frame and other materials that are inexpensive and can be picked up from a local supplier without advanced notice.

The components and materials for the construction of the pool table itself have been procured and stored in the warehouse where most of the construction will take place; these are the items needed to begin the building process. The other items that have not been obtained for the mechanical subsystem of the project are only ones that add aesthetic value to the pool table. Among these are hardwood borders to cover the inner frame of the table, sights, and pockets for the pool balls. These items will be ordered within the next three weeks when a better estimate for the final total cost of the project can be generated and the desired quality within the budget may be obtained.

3.0 Challenges and Lessons Learned

One of the biggest challenges of the first half of this project involved setting objectives and deadlines. Large objectives were set to be completed by set deadlines throughout the semester; the problem was that these objectives were too large and too time consuming so they were often overwhelming for the group. A lesson learned from this challenge was that it is easier to break these objectives into smaller tasks that could be completed on a daily basis. Doing this would ensure that the long term objectives for this report are completed

in a timely, detail oriented manner. In order for the group to remain on the same page with the progress of the project, a master task list has been generated on an Excel file accessible to the team in the shared storage system. As these tasks are accomplished, the individual who completed the task will update the list by putting their name next to it.

Another lesson learned last semester was the importance of maintaining constant communication with all advisors and sponsors. The team has the privilege of having the help of mentors who have years of experience with a wide variety of projects. The team can benefit a lot from the suggestions brought up by the advisor and sponsors. Ultimately, the feedback helps the team stay on the correct path towards proper completion of the project. In order to ensure that all deliverables are clear and concise, the team plans to have all deliverables completed at least a day before their respective deadlines. This will allow time to edit the documents with the professor and TA's critiques before submission. These deliverables will not only help the team communicate with the advisors and sponsors, it will also help document the progress and keep the project organized. For the 2015 fall stage of this project the expected objective is to have a fully functional pool table that will have vertical stowing capabilities, and will have the ability to level itself. This has changed from the initial objective to include plans for manufacturing because the previous design, though providing proof of concept, was so unworkable that the project now requires a complete redesign.

4.0 Design Changes

After discussions with the sponsors and advisors it became apparent that some design changes were necessary. The following new stowing design decreases the risk of injury to the user. Figure 1 shows what the stowed system will look like according to this design.

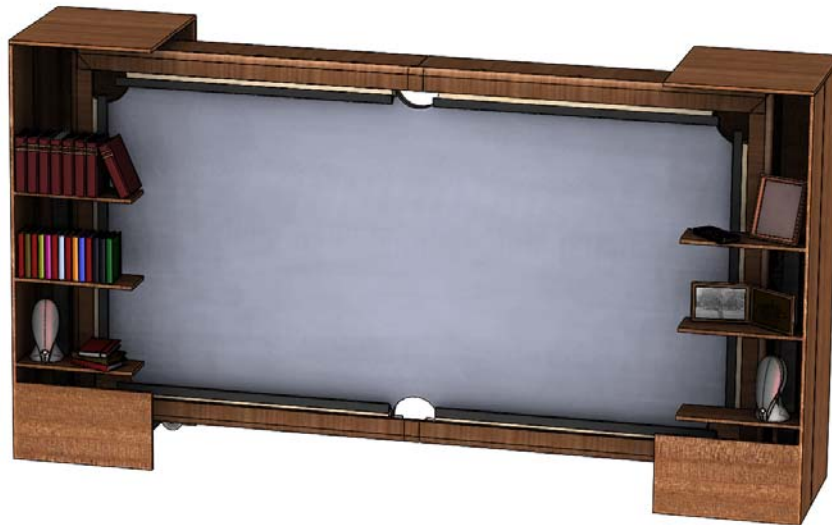


Figure 1. Stowed table according to new design.

When the pool table is being stowed away, its weight will be borne by a pair of carts. The user then carts the table closer to the redesigned housing. This method is preferred over the previous cantilever-type loading placed on arms extending from the housing. In addition to increasing safety, this new design reduces the cost of the product by eliminating unnecessary material used in the housing. Since the carts will bear the load, the housing is now only needed for aesthetic purposes. This will now take the form of two cabinets that house and conceal the carts when the pool table is being used, and that elegantly complement the look of the room when the table is stowed between them. Figure 2 shows the two carts being used to rotate the pool table 90 degrees about its longitudinal axis in order for it to be safely wheeled to the housing to be concealed.

5.0 Project Plan

The Fall 2014 objectives that were completed were the procurement of long lead items and the selection of materials for the build. Because of design changes, the total CAD model was only partially completed. The updated project plan for the 2015 Spring semester reflects the time allocated to accomplish that final objective

from 2014. This, as well as the time allocated for the spring 2015 objectives, is presented in the form of a Gantt chart found in the appendix.

Due to the project requiring redesign from the 2013/2014 prototype, some good ideas for a final product are being designated as secondary objectives. These are things that are not necessary to meet the main functional objectives, but that if time and money permit would make the final product more marketable or the 2014/2015 prototype more memorable for the college of engineering.

- Incorporate IR sensor to determine the height of the table.
- Add a screen to have a modern graphic user interface.
- Display a leveling progress bar or the inclinometer's angle reading for the user.
- Automate the folding of the legs.
- Add shelves to the cabinets to make them dual purpose.
- Obtain custom College of Engineering cloth.

During the first semester of Senior Design, Joel Manahan was solely in charge of the electronics aspect of the project. The work required for the mechatronic leveling system proved to be more than expected especially without the help of an electrical engineering student on the team. To increase efficiency this semester and complete the redefined scope, the team is now split into two subsystems. Jarboe works with Manahan on the electronics and programming while McHugh works with Silva on the mechanical systems. This dual team work is also shown in the Gantt chart along with the completion dependence of certain tasks on others and as always, the team works together as a whole on the deliverables.

Appendix

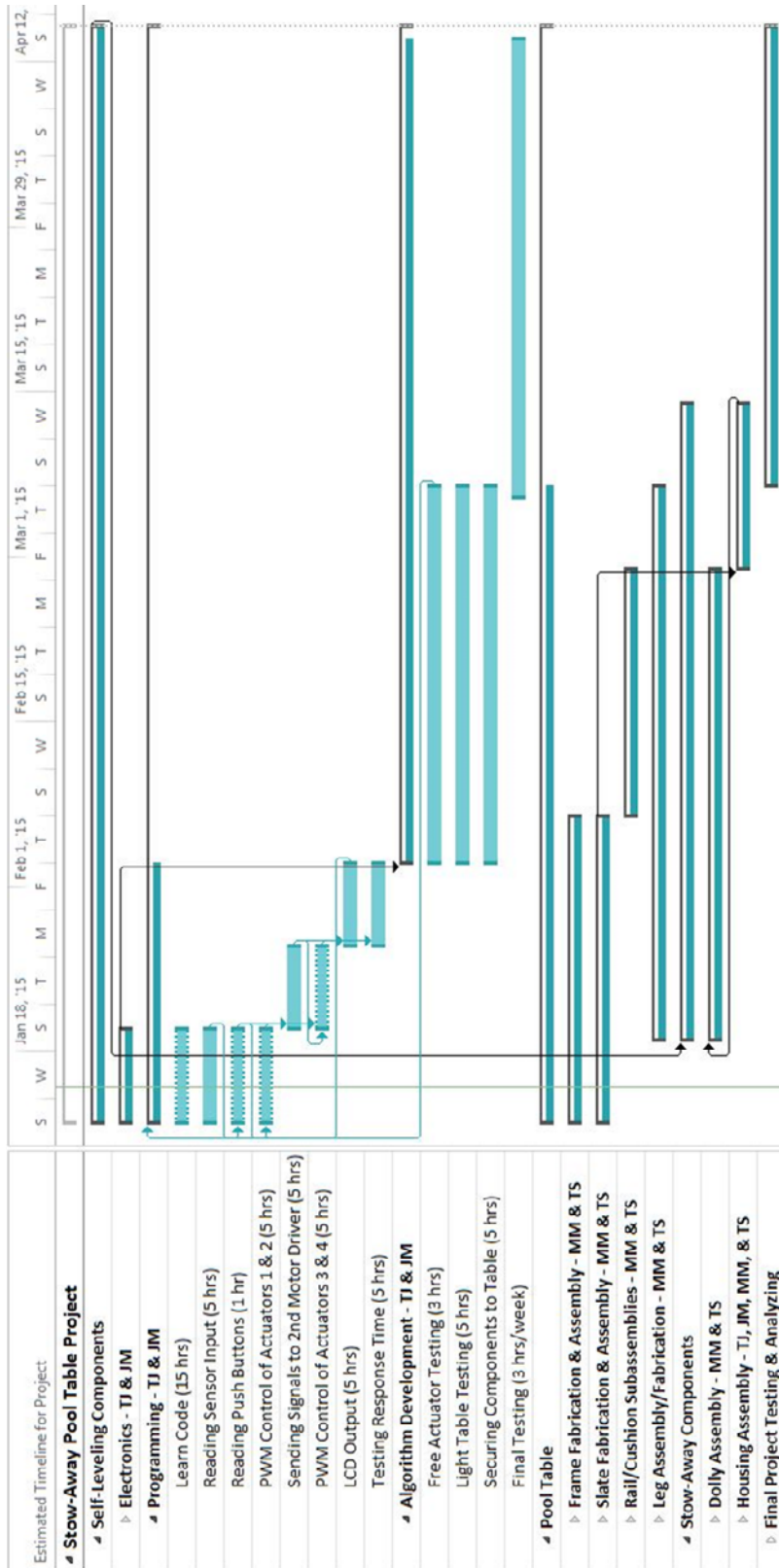


Figure 2. Gantt chart for the Spring 2015 semester.