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| Deliverable #1 |
| Needs Assessment |
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| **9/26/2013** |

**Team 19: Self-Stabilizing Pool Table**

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# Problem Statement

The problem that was recognized is the amount of space that is required to own a traditional billiards table. The project is to have a table that has the ability to automatically store itself in a space with the footprint of a large bookshelf. The mechanisms in mind will be a mechatronic system that will require no user input more complicated than pushing a button. This device will allow users to own a billiards table without the sacrifice to the space that owning one consumes. The total floor footprint will be decrease by more than 75%.

# Background

This Project is sponsored by Beyond Innovation LLC. Founded by inventors and engineers who have a passion for life and love to build, create, invent, and innovate. Either it be a new revolutionary idea needed to be produced or a product which needs improvement or upgrades for commercialization, Beyond Innovation LLC provides sophisticated solutions to the challenges that human kind may face during the ever changing fast-pace and highly technological environment.

For this project Beyond Innovations has decided to create a billiards table. The design for this billiards table is a new venture with amazing feats. The table will be capable of vertically stowing itself in a discrete housing whenever additional space is needed in the area the table is kept. Along with its amazing storage ability this table will also be capable of self-stabilization. After it has been removed from its housing, the table will level the slate to be perfectly horizontal to its respective location.

# Objective

For 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 objective will be completed by the end of the spring semester of 2014.

The goals for completion for the fall semester are the following:

1. Create the final design of the entire system
2. Construct a scaled prototype to act as a test bed for various vertical stowing mechanisms
3. Develop a control algorithm for the self-leveling element
4. Structural Design Analysis

# Methodology

In order to assist in the development of this project, the system was broken down into discrete sections. Focusing on the main objectives, there are two main components of the system: The vertical stowing capability and the self-leveling features.

**Vertical stowing**

The vertical stowing capability will be partitioned into two sub-sections in order to focus our efforts. The first section will focus on the retractable legs of the system. Concept designs of the different retractable configurations will first be created, then once the feasibility of the designs are determined, the best concept will be developed and implemented into the prototype. The second section categorized within the vertical stowing is the vertical lifting mechanism. As with previous methodology, concept designs will be created and analyzed for feasibility. Before a design is implemented for prototyping, a structural design analysis will be performed in order to provide documentation that the system will not fail under stress. After the design for the lifting mechanism is successfully chosen, our team will develop the prototype.

**Self-leveling**

The self-leveling capabilities will separated into two major focuses. First focus will reside with the mechanisms that will be used to level the table top. Multiple designs will be created and carefully selected to the one which most effectively fits the project’s needs. The electronic control system and control algorithms will be developed a part of the second focus within the self-leveling capabilities.

In addition to the aforementioned methodology, a scaled prototype will be created for each selected design so that the concepts can be physically tested before full scale production. This reduced risks of failure, reduces cost, and provides a better understanding for limitations of the designs.

# Expected Results

The expected outcome from this project is to have a fully functional prototype. The prototype will be able to store itself into some type of housing in order to reduce occupied space with the implementation of some simple mechanical system. The storing process will be automated and will cause the table to be stowed vertically, not horizontally, and out of sight. The storing process is to be fluent and controlled with a built in safety feature since the weight of the table can cause catastrophic damage in a sudden system failure.

Also the table will have to be able to stabilize itself after being deployed from the housing. This is a very important part of the project because an uneven slate for the pool table would cause major disturbances in the game. Therefore the product will use some mechatronic system comprised of sensors, microcontrollers and motors etc. to accomplish this goal every time the table is deployed, and will lock once completed.

# Constraints

**Time:** In this senior design course there are a total of eight months to bring an idea to a fully functional prototype. The amount of time to design, development, and test a new product can be extensive. We will accomplish this by using applying commonly used methods for rapid prototype development.

**Budget:** There is limitation due to the amount of funding that our project has acquired. To date there is immediate access to $3000.00 in funding for this project. We plan on creating sponsorship proposals to solicit for additional funding. Having a larger designated budget will allow for a wider range of materials that can be implemented in the design.

**Team Members:** There are a total of 2 team members designated for this design project. Due to this lack of resources in terms of manpower, we must have maximum efficiency in every step we undergo. Each team member is a vital asset to the success of this project.

**Lack of Research and Development:** Since this project explores a product that has never been produced before, there is a lack of resources that we have at our disposal in terms of previous designs. This will require us to apply existing technologies towards new applications.

# Design Requirements

**Mechanical Design Requirements**

Stowed System Dimensions: 2ft x 4ft x 8ft (LWH)

Table dimensions: Must have a length to width ratio of 2:1

Outside dimensions: 7ft x 3.5ft

Playing Field: 78 inches x 39 inches

Height Restriction: Between the range of 29 inches to 31 inches

Maximum Table Weight: 750lbs

Leveling requirements: A tolerance of +/- 0.25 degrees from the horizontal

Safety Redundancies: A fail safe must shall be designed for the event of failure during the storing process

Vibration Criteria: The system must be able to absorb the level of shock and vibration experienced during an average game of billiards.

**Electronics and Controls Requirements**

Power: Tethered through an electrical outlet

Needed control algorithms

Leveling controls

Stowing

Leg control

User interface: GUI or Button control

# Gantt Chart

