

**Multidisciplinary Senior Design
Project Readiness Package**

Prepared by Harold Paschal on June 7, 2020

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| Project Title | RIT Pinball Machine |
| Project Number | P21362 |
| Primary Customer | Professor Stephen Jacobs sj@magic.rit.edu |
| Sponsor | |
| Faculty Champion | [Optional, assigned by MSD] |
| Other Support | [As applicable] |
| Project Guide | [Assigned by MSD] |
| IP Considerations (must pick one) | Technical docs on construction, etc will be open source. Playfield design, art and graphics will be RIT IP as we'll be using the University logo, etc. |

When complete, please submit this document through our online form, located at
<https://goo.gl/forms/J3G8G2jhTUFuJCYe2>

Project Information

Overview

A Pinball machine is a complex arcade game with electromechanical sub systems that enable a player to manipulate one or more steel balls on a playing field. The objective is to score the most amount of points in a single game. The main game elements of a pinball machine include player-controlled paddles called flippers, which actively prevent the ball from falling down into drain. The game will be terminated after the ball falls into the drain a certain number of times. Scoring elements such as pop bumpers, ramps, and targets are what maximize a player's points during game play. The playing field of a pinball machine can be made more or less challenging by the placement of game elements on the field and by the influence of motion on the steel ball.

The previous MSD project P20362 focused on creating a Pinball machine prototype playing field, which could enable students from the Interactive Games and Media department to evaluate different pinball playing field layouts for their Pinball History Course. Although the design was substantially completed and some components of the pinball machine were fabricated, due to the covid-19 pandemic assembly and testing were not completed.

The goal of this project is to start with P20362 and design a non-modular version that incorporates RIT Weather Machine features from IGM class. The end result for this project is to create a student-built pinball machines that will eventually be added to The Strong Museum pinball exhibit.

Preliminary Customer Requirements (CR)

| REQUIREMENT | DESCRIPTION |
|--|--|
| Traditional pinball machine | Must look and feel like a traditional pinball machine |
| Full scale pinball machine | Must be a full scale pinball machine |
| Use standard pinball components for prototype design | Components must be off the shelf pinball components |
| Can be customized after the team has finished | Must be simple to use and must be easily passed to follow on MSD teams |
| Meets applicable safety requirements | Must meet applicable standards to maximize reliability |
| All game pieces must be contained inside the machine | Design must prevent human tampering with game/scoring elements |
| Robust pinball machine design | Must withstand repeated game play and use |

Preliminary Engineering Requirements (ER)

| REQUIREMENT | DESCRIPTION |
|---|--|
| Buy off the shelf pinball components | 95% - 100% off the shelf components |
| Minimum active effects on playfield | 7 – 10 game/scoring elements on field |
| Minimum number of flippers | 2 control flippers minimum |
| Player feedback: lights, sound, music, vibration, score | 3 – 5 game scoring elements with player feedback |
| Side to side tilt trigger | Alert if machine is tilted (stops game play) |
| Front to back tilt range | 6 – 9 degrees tilt |
| Easy to follow user manual | ImagineRIT visitors must be able to play |

Constraints

This project must start with previous MSD project P20362 and extend its capabilities.

This'll only be a viable project if it can run physically in a lab at RIT for a full school year. We can't do it distributed and remote.

Project Deliverables

Minimum requirements:

- All design documents (e.g., concepts, analysis, detailed drawings/schematics, BOM, test results)
- Working prototype
- Technical paper
- Poster
- All teams finishing during the spring term are expected to participate in ImagineRIT

Budget Information

TBD

Intellectual Property

Technical docs on construction, etc will be open source. Playfield design, art and graphics will be RIT IP as we'll be using the University logo, etc.

U.S. Citizenship

U.S. citizenship not required

Travel Opportunities

No travel opportunities are anticipated

Project Resources

Anticipated Student Staffing by Discipline

| Department | Expected Activities |
|----------------------------------|--|
| Biomedical Engineering | |
| Computer Engineering | game control |
| Electrical Engineering | power, control, interconnect components; visual/audio feedback |
| Industrial & Systems Engineering | |
| Mechanical Engineering | design structure; mount components |
| Other | |

Required Resources

Describe the resources necessary for successful project completion. When the resource is secured, have the responsible person initial and date to acknowledge that they are aware and agree. We assume that all teams with ME/ISE students will have access to the ME Machine Shop and all teams with EE students will have access to the EE Senior Design Lab, so it is not necessary to list these. Limit this list to specialized expertise, space, equipment, and materials.

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|--------------------|---|
| Faculty | [List individuals and their area of expertise (people who can provide specialized knowledge unique to your project, e.g., faculty you will need to consult for more than a basic technical question during office hours)] |
| Environment | [e.g., a specific lab with specialized equipment/facilities, space for very large or oily/greasy projects, space for projects that generate airborne debris or hazardous gases, specific electrical requirements such as 3-phase power] |
| Equipment | [Specific computing, test, measurement, or construction equipment that the team will need to borrow, e.g., CMM, SEM] |
| Materials | [List materials that will be consumed during the project, e.g., test samples from customer, specialized raw material for construction, chemicals that must be purchased and stored] |
| Other | |