# BALLISTIC PANDA

Team: E2

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ME 2110 Design Project: Tech Startup – Spring 2013

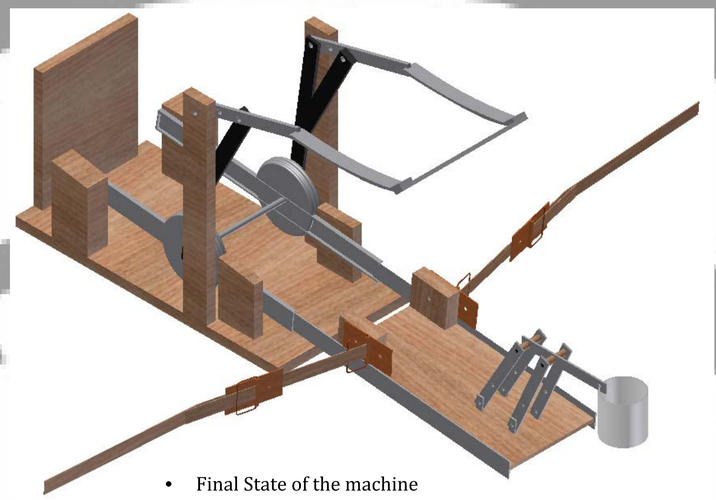
## ABSTRACT

**Objective:** Design, build, and finalize an autonomous robotic system that can compete in the ME2110 Tech Startup design competition and that will earn the maximum amount of money points, $95, by completing all the series of tasks.

**Tasks:** The selected strategy for winning will be the completion of assigned tasks in the following priority order: fit in box, raise capital gate ($10), press button first ($25), invest funds ($10), bring sponges to zone ($20), and finally to launch products to market ($15) without being detected b the IR sensor (-$2 penalty per dice).

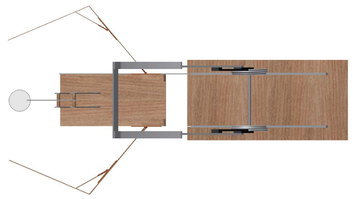
**Restrictions:** The project has many challenges which includes building the robot within a 7 week period, being less than $100 in budget, and adhering to tolerances across the competition arena.

## EXPLODED VIEW



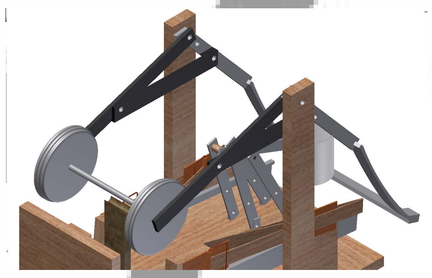
- Final State of the machine

## SECURE PATENT RIGHTS

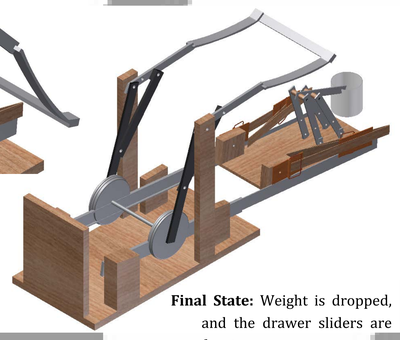


- The **deployable arms** are planks of wood attached to the movable board by **mouse traps**.
- When the effort arm of the lever is raised, the mouse traps have **spring potential energy** stored that pushes the arms out of the machine and on to the arena.
- A second mouse trap simultaneously triggers to cause a inward rotational movement toward the machine, thus sweeping the sponges into zone.

## RAISE CAPITAL AND OPEN A BUSINESS



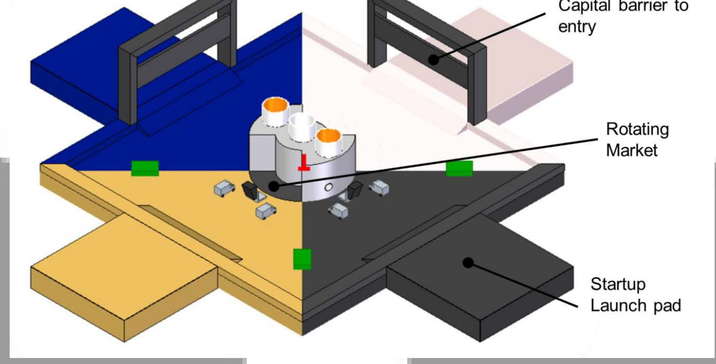
**Initial State:** The weight is held in place by the Bar of wood



**Final State:** Weight is dropped, and the drawer sliders are free to move.

- The **lever**, used is triggered by a **pneumatic actuator** which, when activated, kicks out a bar of wood that is holding the resistance arm with a load of **15 pounds**.

## ARENA




- Illustration of the Tech Startup marketplace.

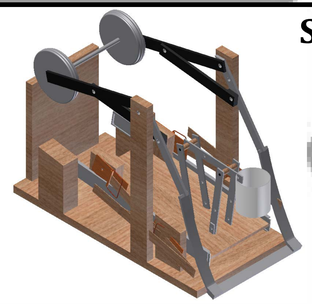
## INVEST STARTUP FUNDS

- To deposit the Squash Balls and thus Investing Startup Funds into the PVC pipe, a **four bar linkage system** is used.
- The squash ball deliverer consists of a horizontal straight beam that is held to the movable board by two vertical beams, with freedom of movement toward the PVC pipes.
- A cup, located at the end of the beam, is used to hold the squash balls. When the rotating marketplace makes contact with the cup, the cup will rotate and release the squash balls through a hole on the side of the cup.

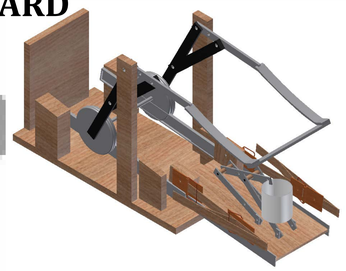
## WIN GOVERNMENT CONTRACT

- When the **lever** is raised, a **board** rolls outwards into the arena by the use of **drawer rails** powered by **gravitational force.**
- The drawer sliders extend towards the button, and the base makes contact.

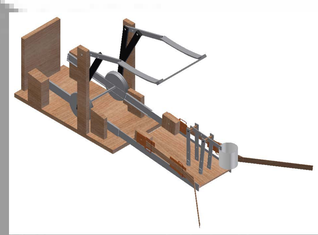
## STORY BOARD



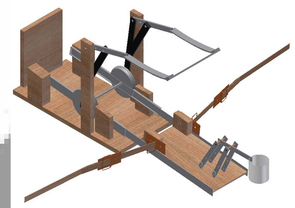
**(1)** Pneumatic Actuator kicks out weight suspender.



**(2)** Drawer slider moves board on to marketplace.



**(3)** Mouse traps cause the deployable arms swing out and straighten.



**(4)** Deployable arms sweep sponges into zone and pneumatic actuator moves four bar linkage into the rotating marketplace.

## CONCLUTIONS

- The following **design approach tools** were used: Objectives tree, problem understanding form, function tree, specification sheet, and quality function deployment.
- The following **conceptual design tools** were used: Function Decomposition, Solutions Principle Matrix, Morphological Chart, and a 3rd Level Evaluation Matrix.
- The following **management and planning tools** were used: Affinity Diagram, Tree Diagram, Prioritization Matrix, Job Responsibility Matrix, and a Gantt Chart.
- Prototyping results revealed repeatability for the lever was 100%, right sponge collector 90%, left sponge collector 70%, Squash Ball deliverer 60%, and hitting government contract 100% within a 3 second time frame.