ANTI-GRAVITY HARNESS TEAM

TEAM 10

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Project Aims

- Almost 1 million children in the U.S. suffer from diseases like muscular dystrophy or cerebral palsy
- Children with limited mobility are often unable to socialize, leading to developmental challenges later in life
- Parents of these children are often limited by resources

[1]

[2]

Project Description

- The goal of this project is to design a anti-gravity balancing harness system
- The client is Dr. Kyle Winfree from the Wearable Informatics Lab at NAU
- The product is directed towards children (under the age of 18) who need assistance moving about the house
- The system must be simple enough that parents with limited resources and engineering knowledge can construct it

WEARABLE INFORMATICS LABORATORY

NORTHERN ARIZONA UNIVERSITY

Background Devices

G-Trainer

- Technology patented by the National Aeronautics and Space Administration (NASA) in 2005
- Removes need for a harness
- Reduces body weight up to 80%
- Approved by FDA in 2008 for use in hospitals and universities

[3] G-Trainer

Background Devices

ZeroG System

- Patients placed in harness, secured to spreader bar
- Ceiling track supports weight, even through vertical movements like sit to stand
- Register falls through velocity or vertical distance settings
- Supports patients 10-200 lbs moving up to 6 mph

[4] ZeroG

Background Devices

GlideCycle

- Uses seat and suspension to support pelvis and body weight (60-90%)
- Allows user to walk, run, and even sprint with less strain on joints
- Designed for users up to 230lb and anywhere from 4’-6’2” in height
- If needed for a child, could modify as a trike or quad

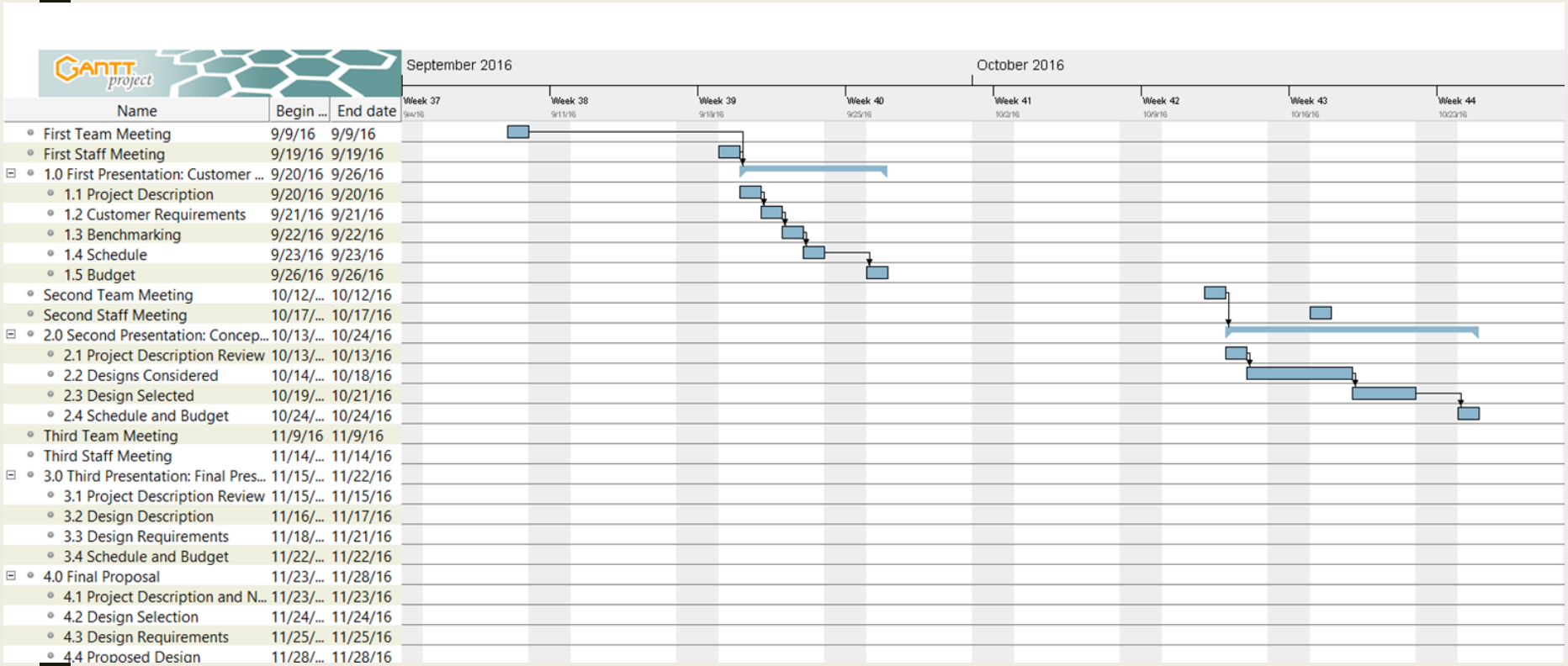
[5] GlideCycle

Customer Requirements

Customer Requirement	Weight (x/10)
Safety: Low choking/entanglement risk	10
Ease of Assembly: Avoid machining, complex parts	7
Adjustability: Accommodate different sized children or growth	5
Durability: Materials pass various strength or fatigue tests	7
Size: Is unobtrusive and allows user to interact freely	6
Comfort: Refrain from using coarse/irritating materials	8

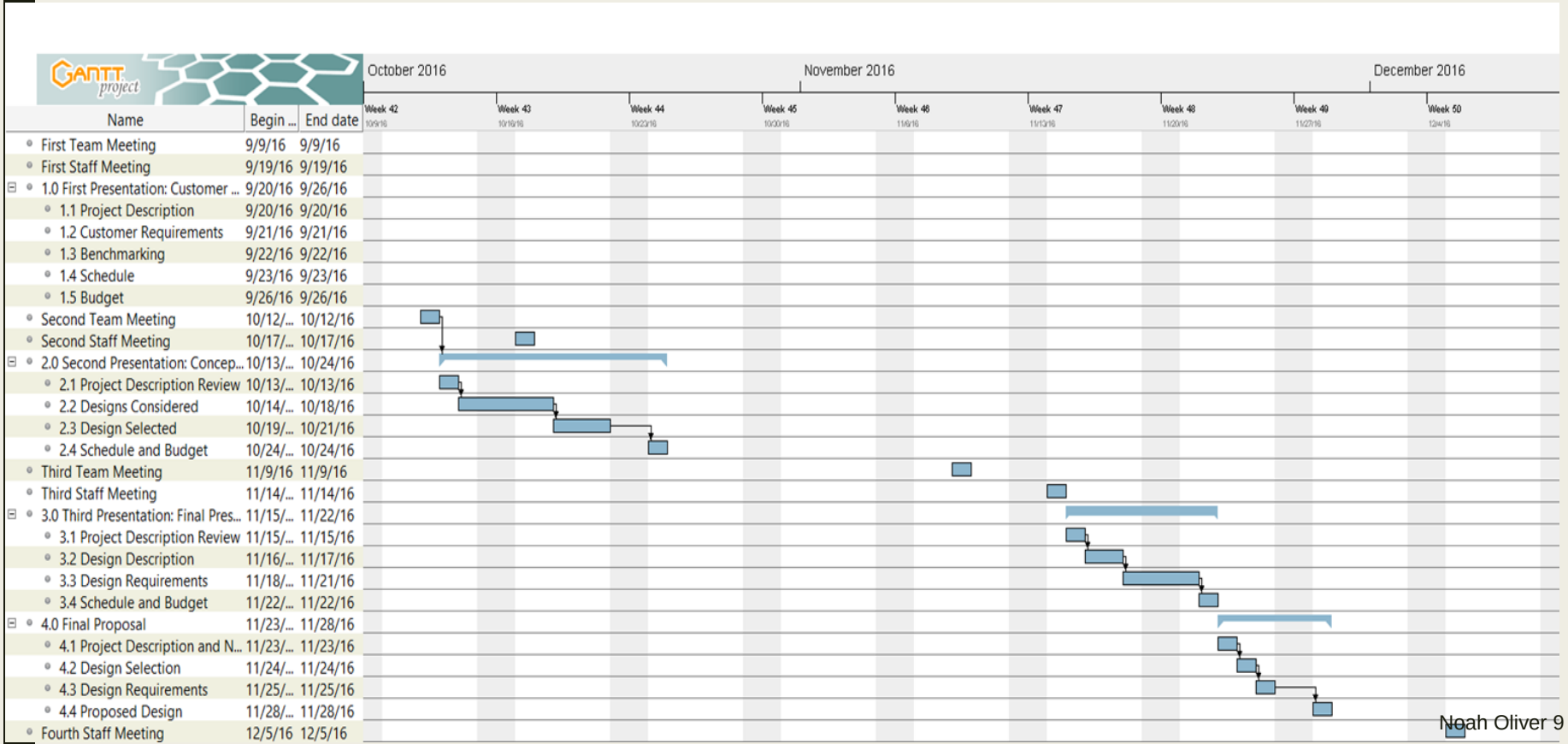
Schedule

- We are currently on schedule with all due dates



Name	Begin ...	End date
First Team Meeting	9/9/16	9/9/16
First Staff Meeting	9/19/16	9/19/16
1.0 First Presentation: Customer ...	9/20/16	9/26/16
1.1 Project Description	9/20/16	9/20/16
1.2 Customer Requirements	9/21/16	9/21/16
1.3 Benchmarking	9/22/16	9/22/16
1.4 Schedule	9/23/16	9/23/16
1.5 Budget	9/26/16	9/26/16
Second Team Meeting	10/12/...	10/12/16
Second Staff Meeting	10/17/...	10/17/16
2.0 Second Presentation: Concep...	10/13/...	10/24/16
2.1 Project Description Review	10/13/...	10/13/16
2.2 Designs Considered	10/14/...	10/18/16
2.3 Design Selected	10/19/...	10/21/16
2.4 Schedule and Budget	10/24/...	10/24/16
Third Team Meeting	11/9/16	11/9/16
Third Staff Meeting	11/14/...	11/14/16
3.0 Third Presentation: Final Pres...	11/15/...	11/22/16
3.1 Project Description Review	11/15/...	11/15/16
3.2 Design Description	11/16/...	11/17/16
3.3 Design Requirements	11/18/...	11/21/16
3.4 Schedule and Budget	11/22/...	11/22/16
4.0 Final Proposal	11/23/...	11/28/16
4.1 Project Description and N...	11/23/...	11/23/16
4.2 Design Selection	11/24/...	11/24/16
4.3 Design Requirements	11/25/...	11/25/16
4.4 Proposed Design	11/28/...	11/28/16

Schedule



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Fourth Staff Meeting	12/5/16	12/5/16

Budget (Estimated Fall Prototype)

	Cost	Material	Length(ft) /Wide
Sliding Barn Kit	$49.99-$400	Carbon Steel Steel Aluminum.	0.666667 / 6 ft
GuideWire (Rob: it connects from the barn to Johnny jumper)	It depends on the length needed. 46¢-80$	Natural fibers Nylon Polyester	2 ft - infinity
Harness	$14.99 - $80	Plastic + Cloth	15.6 x 7.0 x 3.2

[6]

Total Estimate: ~$280

Total Budget

Total Dollars Available: $1500

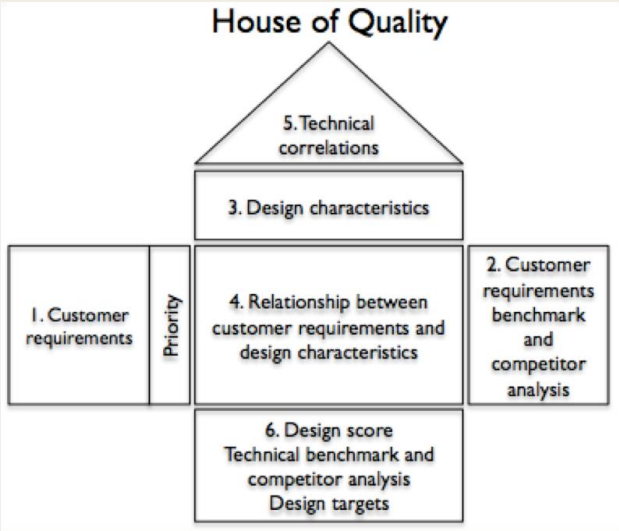
Anticipated expenses:

- Fall Semester Prototype: $280
- Spring Semester Prototype: $380
- Final Product: $480

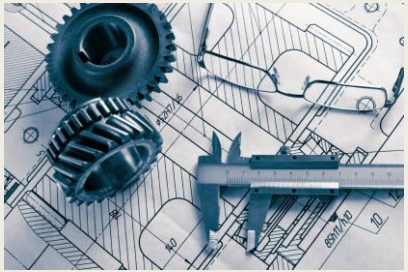
Actual expenses to date: $0

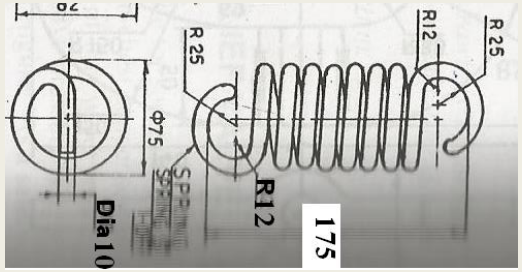
Resulting Balance: $1140

Future Work



- House of Quality
  - *Translate CR to ER*
- Begin design process
  - *Design system and subsystem levels*
  - *Create multiple concept sketches*
- Select design
  - *Determine if designs conform to customer requirements*
  - *Confirm final design with client for approval*





References

[1] "Definition of Cerebral Palsy", *cerebralpalsy.org*, 2016. [Online]. Available: http://www.cerebralpalsy.org/about-cerebral-palsy/definition.

[2] "Muscular Dystrophy Association", *Muscular Dystrophy Association*, 2016. [Online]. Available: https://www.mda.org/.

[3] N. S., "'Anti-Gravity' Treadmills Speed Rehabilitation," National Aeronautics and Space Administration 2009.

[4] J. Hidler, D. Brennan, i. Black, D. Nichols, K. Brady and T. Nef, "ZeroG: Overground gait and balance training system", *The Journal of Rehabilitation Research and Development*, vol. 48, no. 4, p. 287, 2011.

[5] D. Vidnar, "Join the Running Revolution," GlideCycle, 2015. [Online]. Available: http://glidecycle.com.

[6] Kohl's. "Johnny Jump Up Door Jumper." Kohls, 2016. [Online]. Available:http://www.kohls.com/.