

# Mobile Computer Cart

## Engineering Analysis

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November 14, 2014

NORTHERN  
ARIZONA  
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# Overview

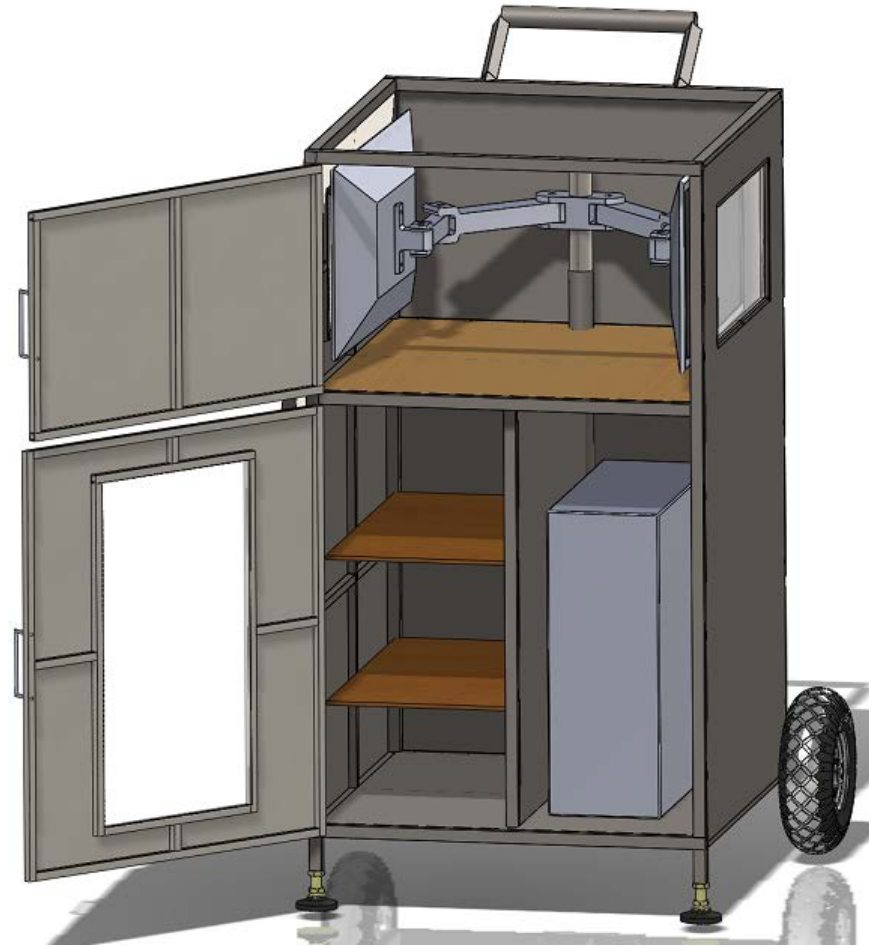
- Project Description
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- Analysis
- Bill of Materials
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- Summary

# Project Description

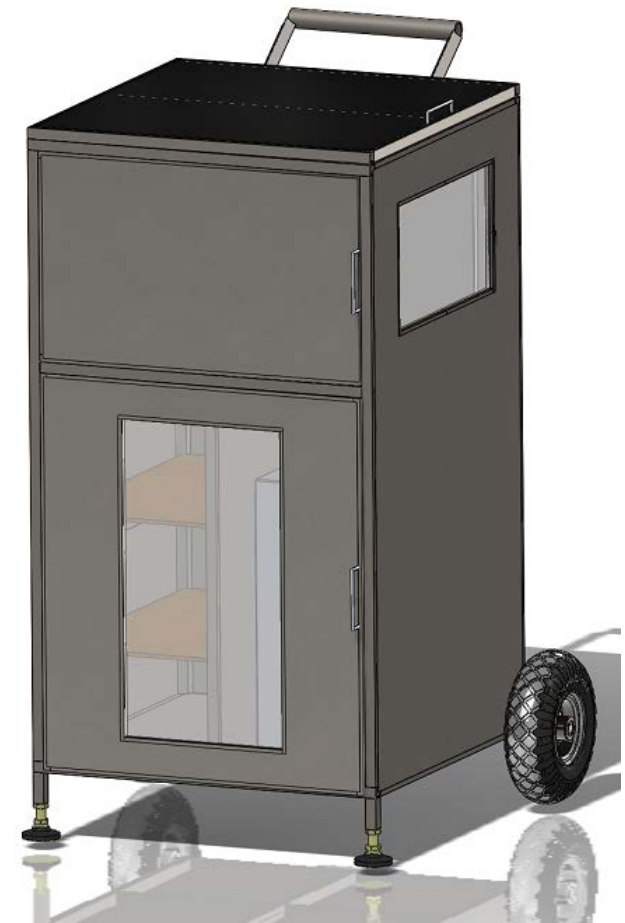
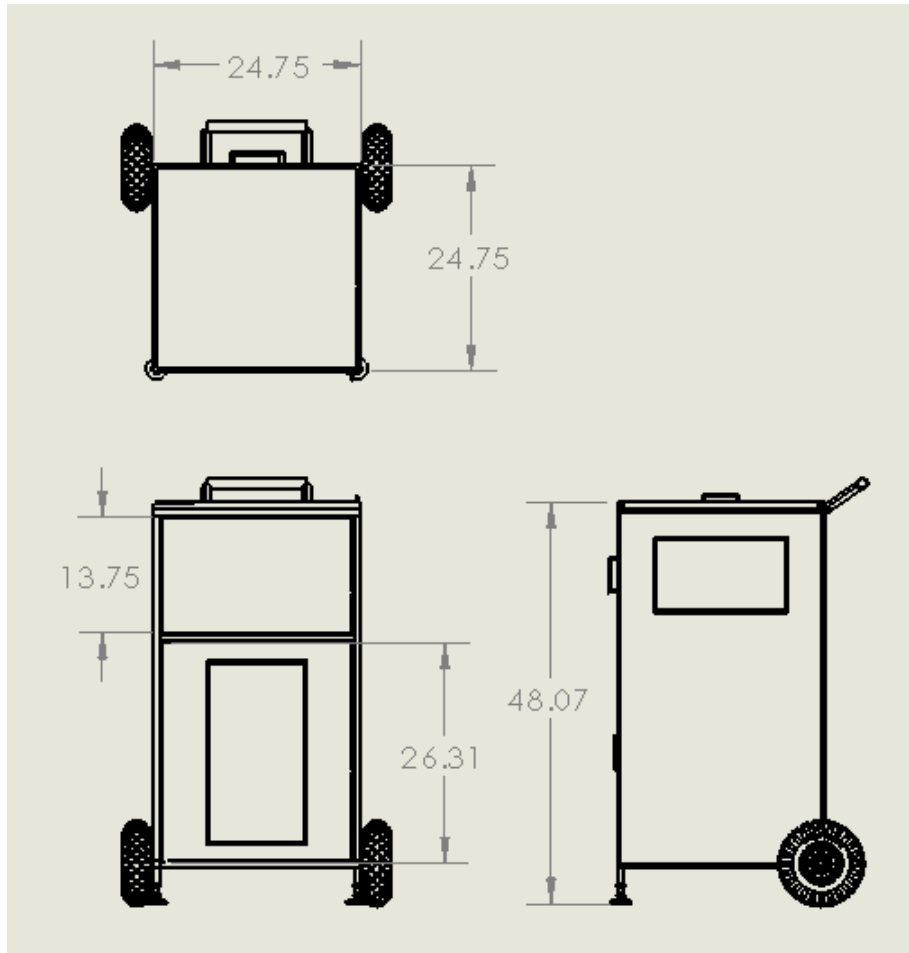
- Client : Dr. Srinivas Kosaraju
- Project: Dr. Kosaraju is currently managing multiple student teams for capstone classes at Northern Arizona University. He is requesting for two mobile computer carts capable of traveling outside to perform experiments.
  - Must be adjustable, weather proof, and each cost under \$500
- Need: The current available mobile computer carts are too expensive and are not designed for outside use.

# Concept 1

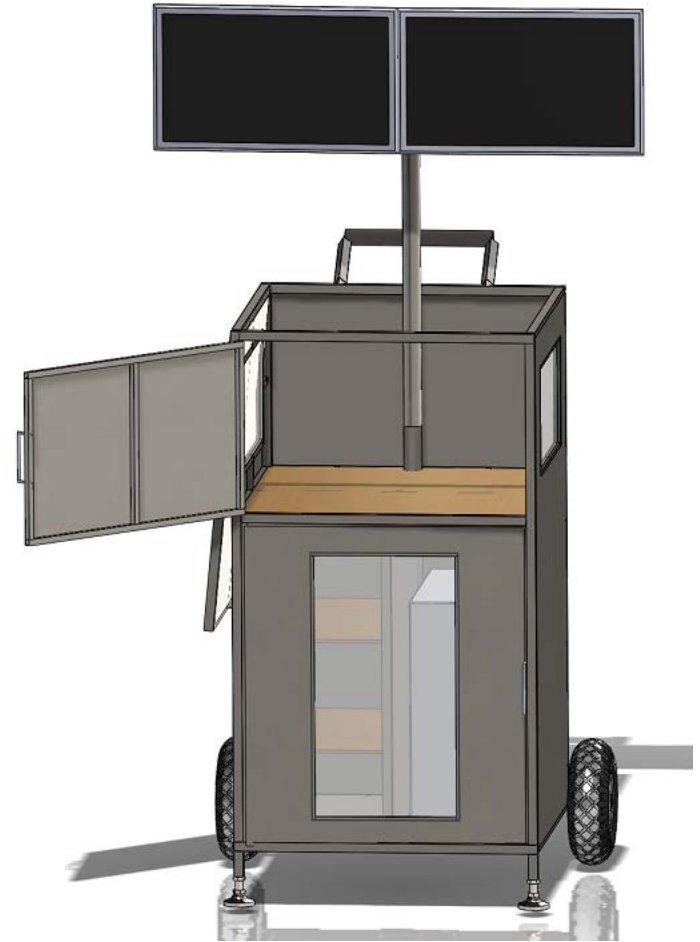
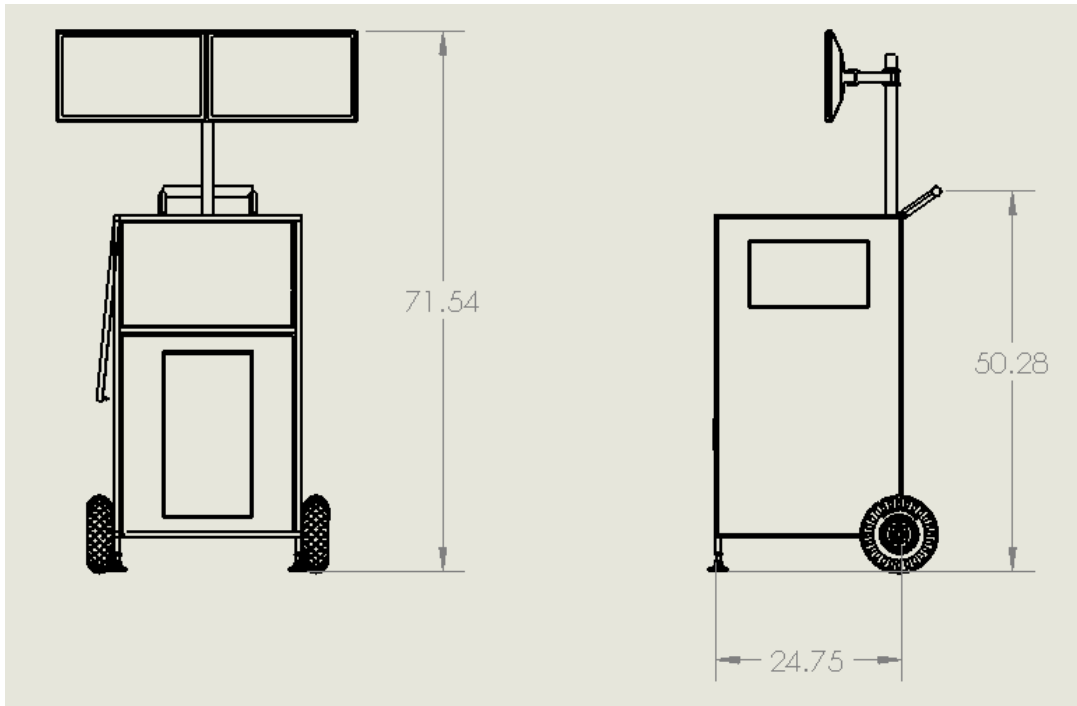
- **Two wheeled dolly Design**
  - Adjustable monitors
  - Large wheel for rough terrain
  - Interior storage space
    - Retractable lid
    - Collapse everything inside
    - Windows
  - Fits through doors
  - Handle for easy maneuverability



# Dimensions / CAD



# Dimensions /CAD



# Analysis

- Omitted analysis for bought Materials:
  - 10" wheel – rated 300lbs per tire
  - Tyke Supply dual monitor mount – holds up to two 16 lb. monitors
- Weight of frame before components added inside

Frame weight					
Material	Description	QTY.	Length (ft)	Weight/ft (lbs)	Weight (lbs)
0.75" x 0.065" thick	A513 steel Square tubing	7	8	0.6054	33.90
0.5" x 0.065" thick	A513 steel Square tubing	7	8	0.3845	21.53
24" x 48" x .03" thick	Steel sheet metal	5	n/a	9.7804	48.90
				Total	104.34

# Analysis

- Static Forces Equations
  - Compressive Stress :  $\sigma = f/a$
  - Shear stress :  $T = f/a$
- Material

<b>Material Specifications</b>			
Parts	Material	Cross-section (in <sup>2</sup> )	Yield Strenght (Psi)
Pins	A513 Hot rolled steel	0.0767	72,000
Telescoping Fixture	A513 Hot rolled steel	0.1656	72,000
Frame Tubing	A513 Hot rolled steel	0.3869	72,000



# Calculations

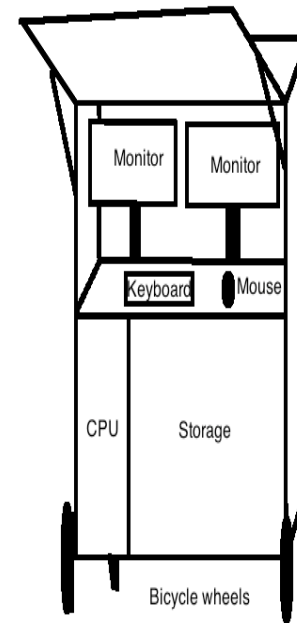
- Frame tubing compressive stress
  - $\sigma = f/a = (105 \text{ lbs.}) / (0.1656 \text{ in}^2)$   
 $= 634.06 \text{ psi} < 72,000 \text{ psi}$
- Telescoping tube compressive stress
  - $\sigma = f/a = (16 \text{ lbs. })(2) / (0.3869 \text{ in}^2)$   
 $= 82.708 \text{ psi} < 72,000 \text{ psi}$
- Shear stress of pin
  - $T = f/a = (16 \text{ lbs./monitor})(2 \text{ monitors}) / (2)(0.0767 \text{ in}^2)$   
 $= 208.604 \text{ psi} < 72,000 \text{ psi} \text{ ( only 1 pin needed)}$

# Bill of Materials

Bill of Materials					
No.	Parts	QTY.	Vendor	Description	Cost
1	8ft Frame Tubing 1	7	Online Metals	0.75" x 0.75" x 0.065" square tubing A513 HOT ROLLED MILD STEEL	\$78.68
2	8ft Frame Tubing 2	7	Online Metals	0.5" x 0.5" x 0.065" square tubing A513 HOT ROLLED MILD STEEL	\$49.49
3	Sheet Metal	6	Mc Master Carr	24" x 48" x 0.03" steel	\$108.80
4	Plexiglass 1	1	Mc Master Carr	12" x 24" x .025" Tinted Polycarbonate	\$16.66
5	Plexiglass 2	1	Mc Master Carr	24" x 24" x 1/8" UV Resistant Polycarbonate	\$21.53
6	Air Tires	2	Amazon	Double bearing , Dia 10" x Width 3"	\$23.38
7	Telescope Tubing	1	Mc Master Carr	2" x 2" x 4ft Telescoping tubing	\$50.00
8	Pins	1	Mc Master Carr	5/16" Locking pins	\$2.16
9	Hinges 1	1	Mc Master Carr	12" long x 1 1/16 wide x .05" thich piano hinge	\$1.93
10	Hinges 2	1	Mc Master Carr	12" long x 1 1/16 wide x .05" thich piano hinge	\$2.48
11	Hinges 3	2	Mc Master Carr	270 Degree Hinge	\$6.60
12	Monitor Mount	1	Amazon	Tyke Supply Dual LCD Monitor Stand	\$43.99
13	Leveling Mounts	2	Mc Master Carr	1/4 - 20 Swivel Leveling Mounts	\$3.62
14	Weather Stripping	2	Homedepot	3/8 " x 5/16 " x 10" High-Density Rubber Foam Weatherstrip Tape	\$5.14
15	Wood	1	Homedepot	11/32 " x 4 " x 8 " Yellow Pine Plywood Sheathing	\$17.43
16	Latches	2	Mc Master Carr	Draw latches	\$9.00
17	Door latch	2	Mc Master Carr	Magnet latches	\$2.60
Total:					\$443.49

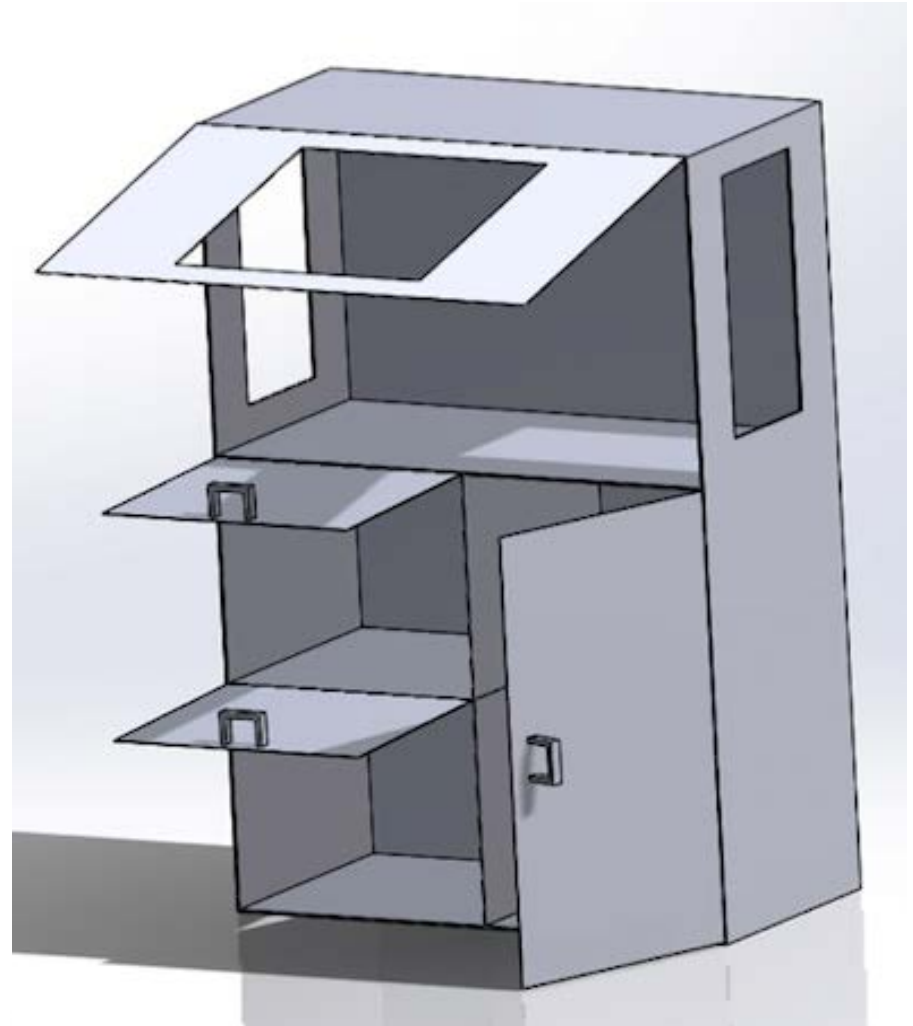
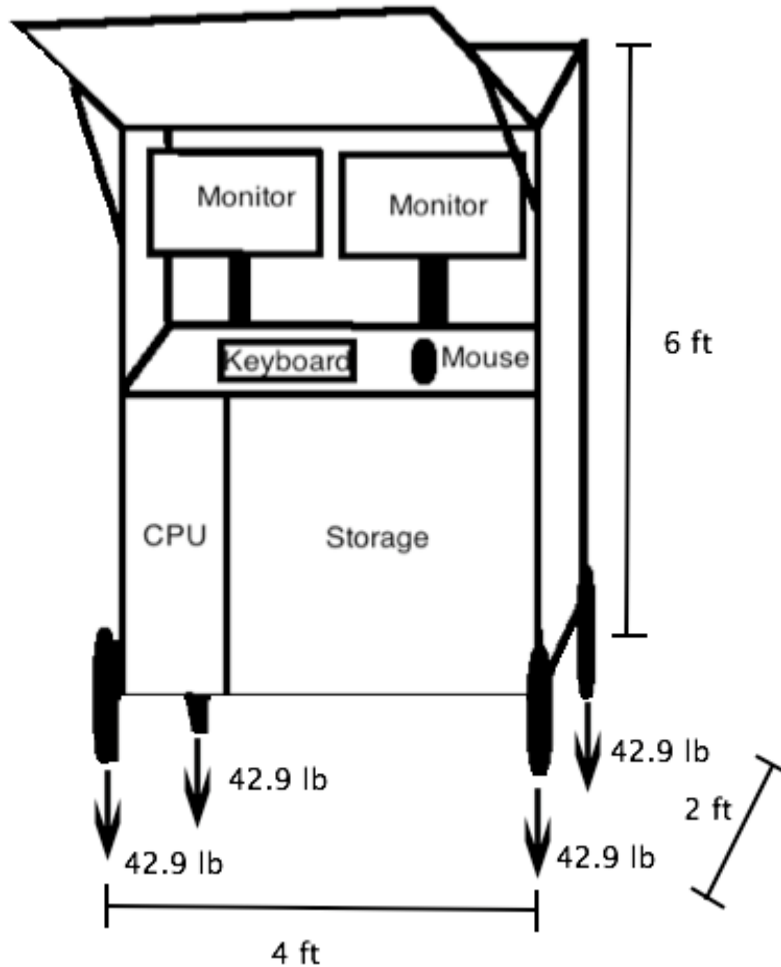
# Concept 2

- **Four wheeled Design**
- Adjustable monitors
- Ample storage space
- Weather Proof
  - Completely Enclosed
  - Plexiglass Windows
- Workbench
- Handle for maneuverability



- Waterproof shell to protect monitors/CPU
- Dual monitors.
- Platform for keyboard/mouse.
- Separated CPU and storage areas.
- Air/foam filled tires.
- Front door lifts up to provide shade.
- Hydraulic arms hold door open.

# Dimensions / CAD



# Analysis

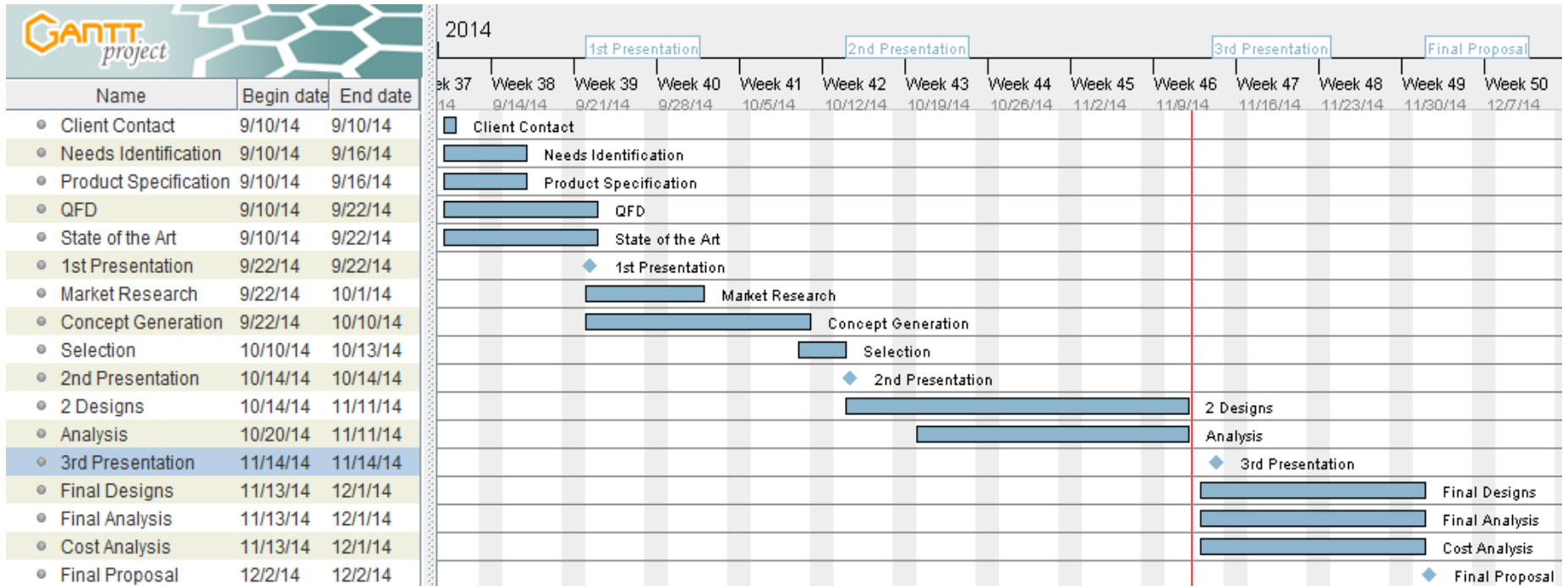
- More than 10 ft<sup>3</sup> of storage
- Omitted analysis for bought Materials:
  - 5” wheel – rated 400 lbs per tire
  - Two 24” monitors or one 37” monitor
- Weight of frame before components added inside:

<b>Material Specification</b>				
<b>Material Description</b>	<b>Amount</b>	<b>Price</b>	<b>Total Price (\$)</b>	<b>Weight (lbs)</b>
0.065" T 0.75" H A513 Hot Rolled Mild Steel Square Tubing	86.5 ft	1.405 \$/ft	121.53	48.523
0.03" T 24" W 48" L Cold Roll Mild Steel Sheet Metal A366/1008	86 ft <sup>2</sup>	1.905\$/ft <sup>2</sup>	163.83	107.580
Clear 3/32" T Cast Acrylic (Plexiglas)	10 ft <sup>2</sup>	3.80 \$/ft <sup>2</sup>	38	15.624
<b>Total</b>			<b>323.36</b>	<b>171.727</b>

# Bill of Materials

Bill of Materials					
No.	Parts	QTY	Vendor	Description	Cost
1	8ft Frame Tubing	11	OnlineMetals	0.065" T 0.75" H A513 Hot Rolled Mild Steel Square Tubing	\$121.53
2	Sheet Metal	11	OnlineMetals	0.03" T 24" W 48" L Cold Roll Mild Steel Sheet Metal A366/1008	\$163.83
3	Plexiglass	3	McMaster-Carr	Clear 3/32" T Cast Acrylic (Plexiglas)	\$38
4	Polyolefin wheels	4	Northerntool	Swivel Caster wheels with brakes	\$43.96
5	Hinges 1	1	McMaster-Carr	Steel Piano Hinge with Holes, Unfinished, .025" T, 3/4" W	\$7.08
6	Hinges 2	1	McMaster-Carr	Unfinished Steel Piano Hinge without Holes, .025" Thick, 3/4" Width	\$1.39
7	Hinges 3	2	McMaster-Carr	Unfinished Steel Piano Hinge without Holes, .025" Thick, 3/4" Width	\$2.16
8	Door Latches	3	McMaster-Carr	Magnet Latches	\$3.90
9	Open-Up Lid Supports	1	McMaster-Carr	Soft Close, for Side Lid, Right Side Mounting	\$17.62
10	Monitor Mount	2	Amazon	Wall Mount Bracket for Monitor TV, up to 37" screen size	\$48.98
<b>Total</b>					<b>\$448.45</b>

# Project Progression



# Summary

- **Need:**

The current available mobile computer carts are too expensive and are not designed for outside use.

- **Concept 1: Two Wheeled Dolly Design**

- Adjustable monitors, Large wheel for rough terrain, Interior storage space, Weather proof, Fits through doors, Handle for easy maneuverability.
- Frame weighs 104.34 lbs
- Cart costs \$443.49.

- **Concept 2 : Four Wheel Design**

- Adjustable monitors, Ample storage space, Weather Proof, Completely Enclosed, Glass Windows, Workbench, Handle for maneuverability.
- Frame weighs 171.73 lb
- Cart costs \$448.45.



# References

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