Mobile Computer Cart

UGRADs Presentation

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Overview

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- Problem Formulation
- Proposed Design
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Introduction

- Client : Dr. Srinivas Kosaraju

- Dr. Kosaraju is currently managing multiple student teams for mechanical engineering capstone classes at Northern Arizona University. He is requesting for a mobile computer cart capable of traveling outside to perform experiments.
  - Capstone
  - ME-450
  - ME-495

Problem Formulation

Need Statement:

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

Goal Statement:

- The project goal is to design a mobile computer station that is less expensive than available marketed products, which can be operated in outside conditions.

Objective

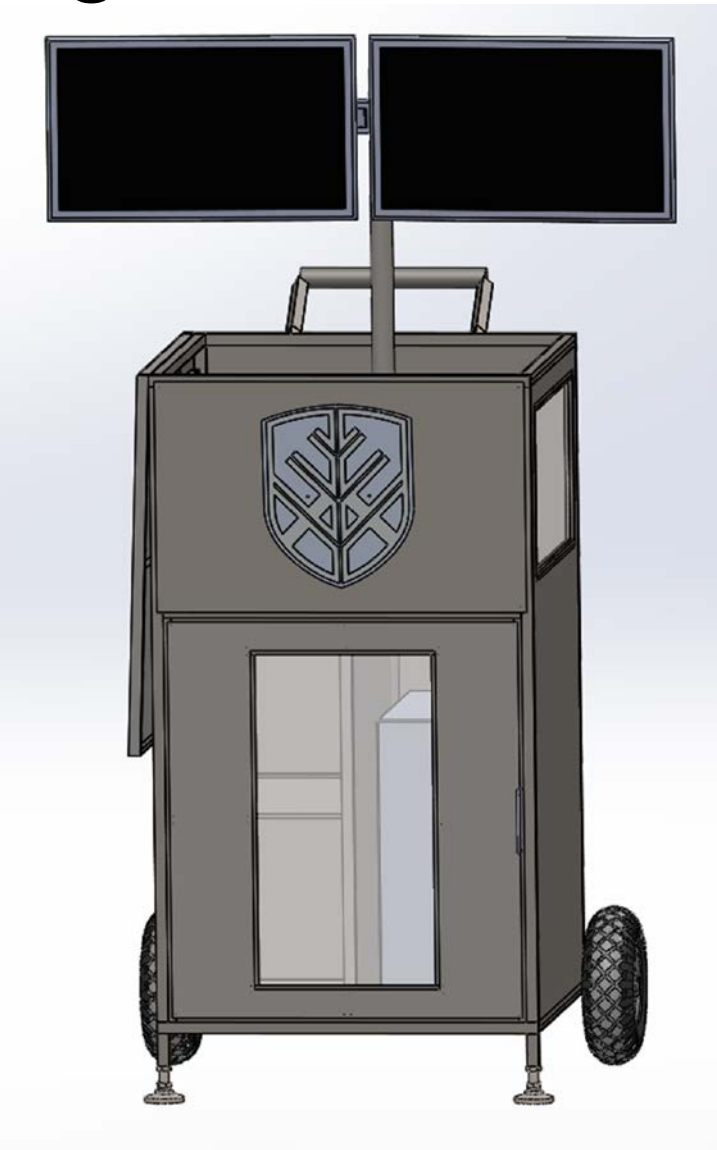
Objectives	Measurement Basis	Units
1. Inexpensive	Prototype cost	dollars
2. Manufacturability	Production capability	hours
3. Maneuverability	Time to transport	Minutes
4. Weather Resistant	Water accumulation	in
5. Reasonable size	Fits through door	ft^3
6. Functional after transported	Material not deformed	psi
7. Adjustable for multiple users	Change the height of the station	ft
8. Hold CPU, 2 Monitors, equipment	Amount of the storage area	ft^3

Constraints

Design Constraints
1. Support two screen monitors
2. Hold a CPU, keyboard, and a mouse
3. Move through rough terrain
4. Easily transported with only one individual
5. Weather resistant
6. Cost less than $500.00
7. Storage space must accommodate 2 ft^3
8. Width must be less than 3 ft
9. Height must be less than 7 ft

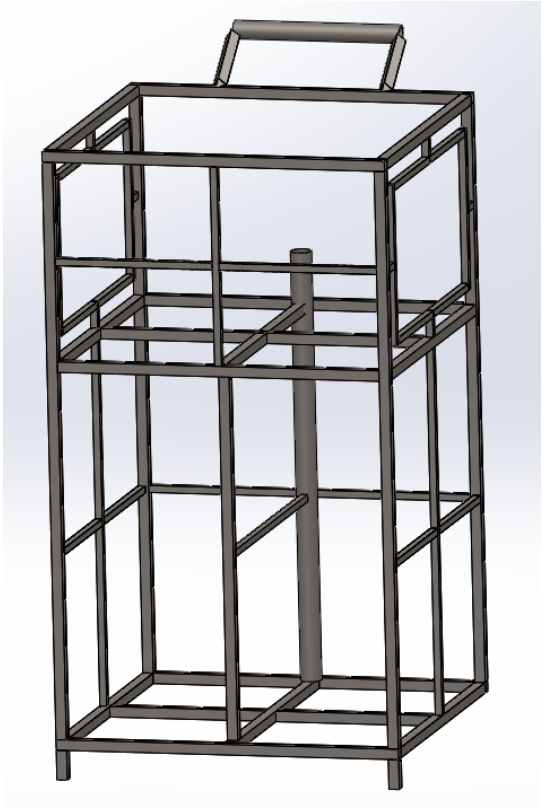
Final Design

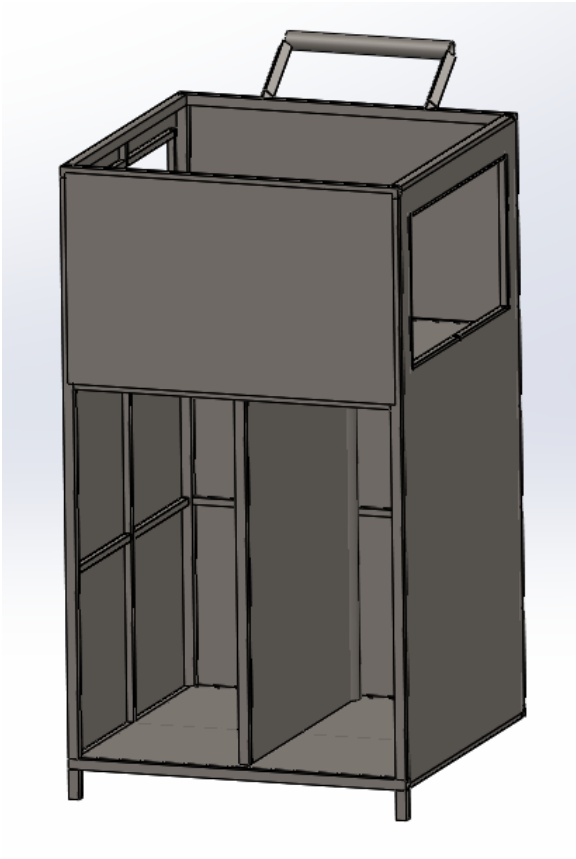
- **Two wheeled dolly design**
  - Adjustable monitors
  - Large wheel for rough terrain
  - Interior storage space
  - Weather proof
    - Retractable lid
    - Collapse everything inside
    - Windows
  - Handle for easy maneuverability



Final Design
(Frame)

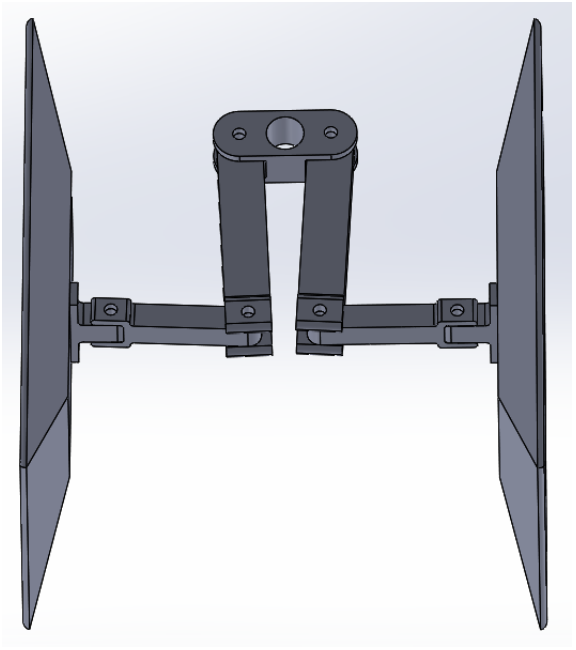
- **Square tubing**
  - A513 hot rolled steel
  - 0.75’’ x 0.065’’
  - 0.5’’ x 0.065’’
- **Sheet metal**
  - 20 gage steel (0.035’’ thick)
  - 24’’ x 48’’





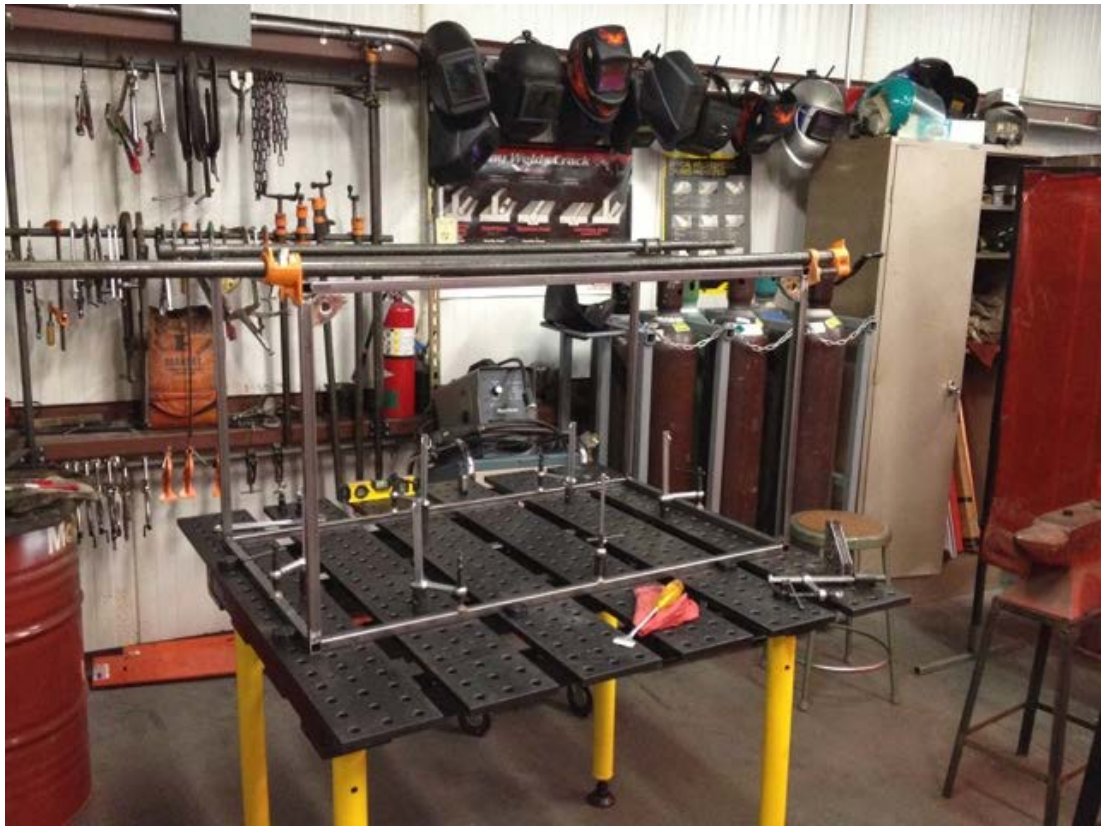
Final Design
(Adjustability)

- **Telescoping tubing**
  - 1.5” square tubing
  - Pre-drilled hole
  - Pin to restrict movement
- **Monitors**
  - Purchased monitor mount
  - Capacity: two 24” monitors
  - 360^{o} of movement



Prototype Fabrication
(Frame)

- Square tubing cut to length
  - Horizontal band saw
- Mounted on welding table
  - Leveled and clamped down
- GMAW (gas metal arc welded)
- Welds grinded down
- Process used for whole frame



Prototype Fabrication
(Sheet metal)

- Sheet metal cut to length
  - Manual shear
- Tacked into position
  - Avoid warping do to heat
- Remaining sections welded
  - Avoid burning creating holes
- High points grinded down

Prototype Fabrication
(Telescoping tubing / Windows)

Telescoping tubing

- Welded to frame
- Round tubing : attachment point
- Steel pin used to restrict movement

Windows

- Impact-Resistant Polycarbonate
- 1/8” thick
- Cut to dimensions
- Aluminum frame bolted to cart
  - Replaceable if broken
- Clear epoxy to seal gaps

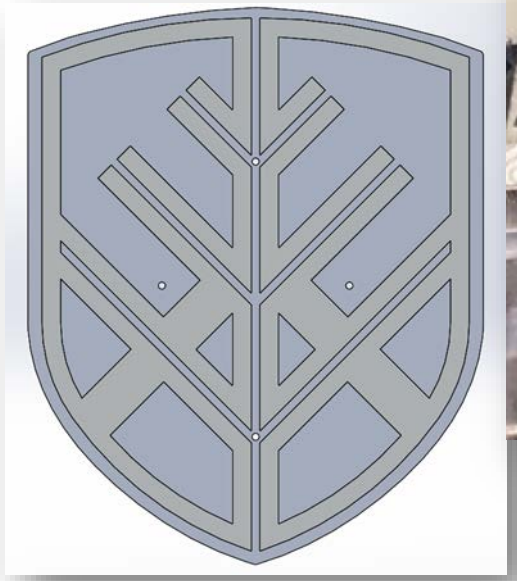
Prototype Fabrication
(Paint)

- Exterior grinded and sanded
- Bondo used to fill rough area
- Blue and grey paint applied
  - 3 coats
- Sanded (1000 grit)
- Clear coat applied
  - Protect metal from rust

Prototype Fabrication

(NAU Logo)

- NAU shield drawn in SolidWorks
- CAMWorks used to produce G-Code
  - Feeds and speeds calculated
- Machined
  - 1/8’’ thick aluminum
  - 3 axis CNC mill



Prototype Fabrication

(NAU Logo)

Prototype Fabrication

(Final Product)

Prototype Fabrication

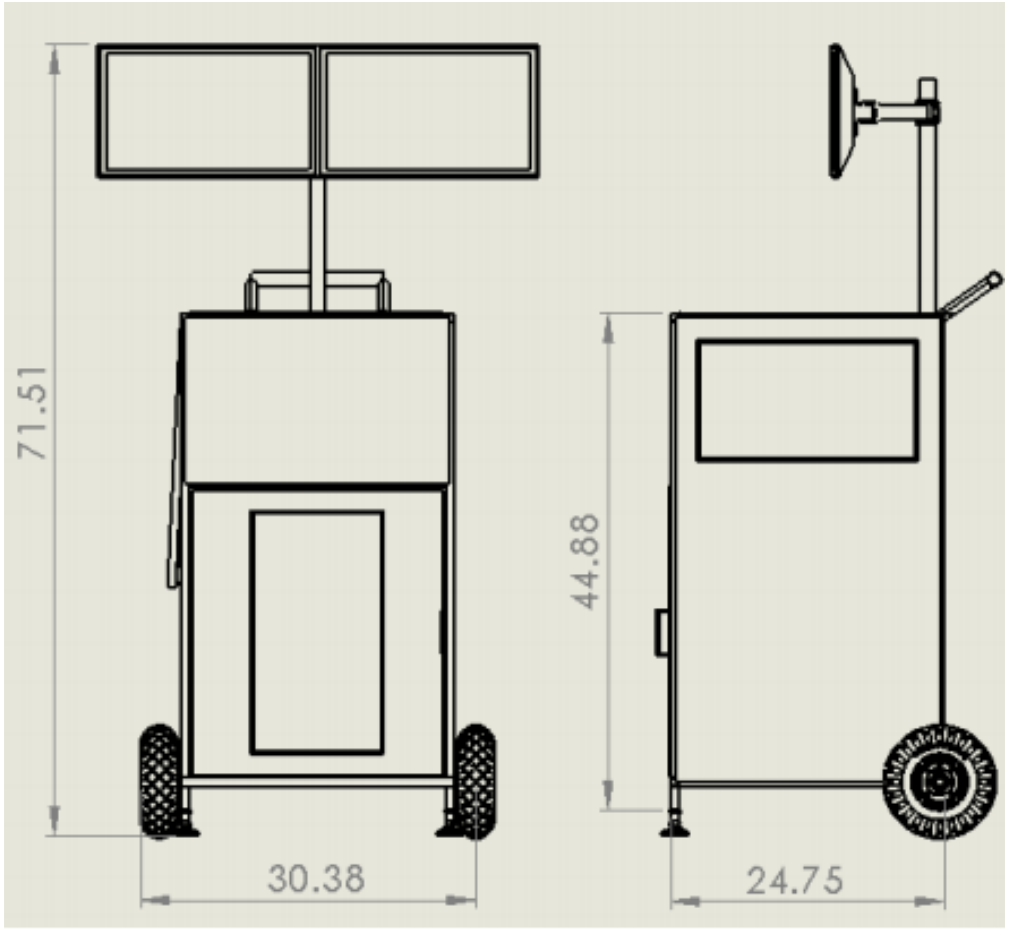
(Final Product)

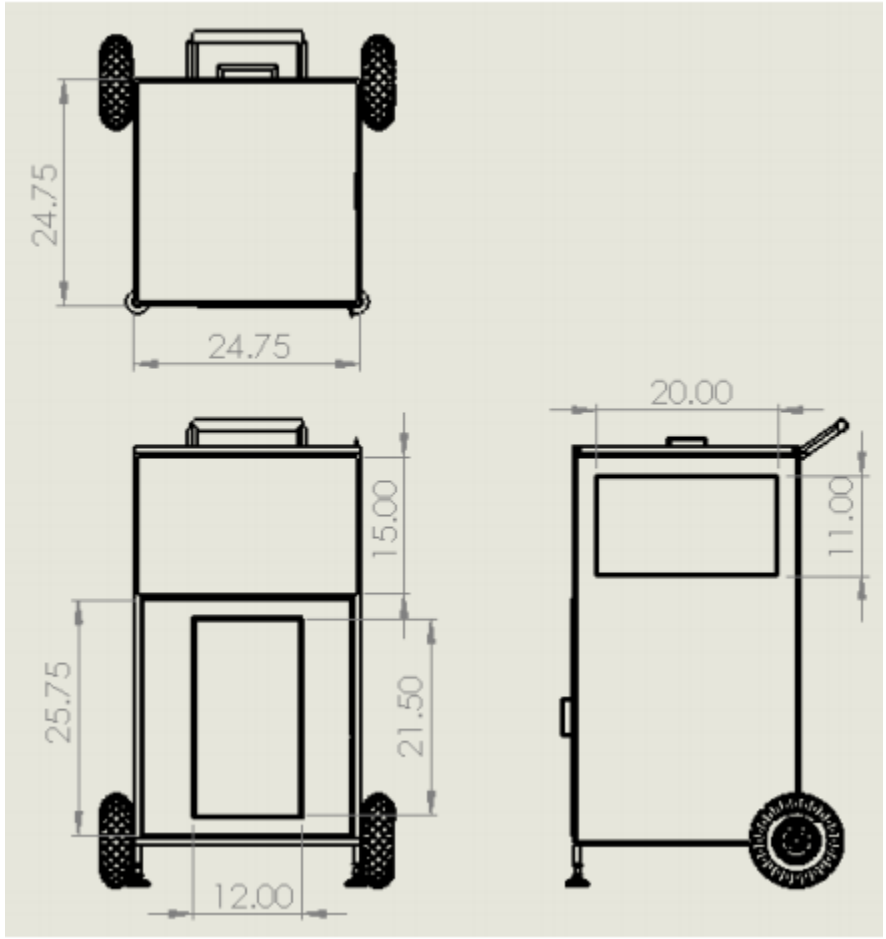
Prototype Fabrication
(Final Product)

Demonstration

(Video)

Dimensions





Testing Environment

- Field Test
  - Terrain : rocks, grass and dirt
- In and out of building
- Function properly
  - Undamaged during transportation
- Transport with one person
  - Weight
  - Maneuverability
- Monitor transition time

Physical Testing

- Transported outside through terrain including: dirt, grass, concrete, rocks, and up/down 40^{o} slopes.
- Window are sealed with clear epoxy providing a water tight seal.
- Lid sealed with laches and weather stripping.
- Locks keep lid and door closed.

Component	Function	Details
Mobile cart	Total weight fully loaded	135 lbs.
Monitors	Time to put in/out position	< 1min
Monitors	Adjustability maximum height	71 in
Monitors / Tubing	Force to pull monitors in up position	20 lbs.

Cost Analysis

Parts	QTY.	Cost [USD]
0.75'' x 8' square tubing	6	78.68
0.5'' x 8' square tubing	7	49.49
Sheet metal	6	106.02
Plexiglass	2	52.07
Telescoping tubing	1	42.69
Hinges	3	6.68
Monitor mount	1	43.99
Latches / Camlocks	2	14.98
Aluminum plate	1	29.75
Paint	9	38.50
Wheels	2	49.59
Padding	2	13.29
Window siding	3	14.52
Total:		$540.23

Conclusion

- The team produced a mobile computer cart that met the clients needs and constraints which can be used by future engineering students.
- 100% of the manufacturing processes completed by members of the team at the NAU Machine shop during the 2015 Spring semester.
- The mobile computer cart works as an effective transportation device for experimental and computer equipment.
- Easily maneuverable inside and outside by one individual.
- The final cost came in $40.23 over the requested budget, but was significantly less than off the shelf mobile carts.
- We feel the overall concept design can be improved on and eventually marketed.

Acknowledgments

- Dr. Srinivas Kosaraju for support and advisement
- NAU Machine Shop

References

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Questions ?