

P14045: Mobile Pediatric Stander

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Agenda

- Introduce team
- Project background
- Problem statement & project deliverables

- Use scenarios
- Customer requirements

- Engineering requirements

- Draft of project plan

Who's who?

- Greg Roeth: Project Manager/Mechanical Engineer
- Alex Hebert: Lead Mechanical Engineer
- Emily Courtney: Mechanical Engineer
- Martha Vargas: Lead Electrical Engineer
- John Daley: Electrical Engineer

What is a Mobile Pediatric Stander

- Teaching Style
Push In vs Pull Out
- Happier Kids
- Standing vs Sitting

Standing can:

- increase bone density
- decrease joint contractures
- improve cardiopulmonary function
- improve digestion
- increase bone growth
- increase alertness



*Facts/Image: Snug Seat Product Guide 2013

Understanding the User

- Predominantly pre-school kids with Cerebral Palsy (CP)
 - CP is a “non progressive brain disorder” caused by damage to a developing brain
 - disconnection between muscles and the brain
 - wide range of motor skills/control
 - condition typically doesn’t worsen or improve over time
 - Some users are on the Autism spectrum as well

Current State- Phase 2 Stander

- Rabbit Stander
- Controls
- Motors
- Bluetooth Connectivity
- Sensors
- Known issues



P14045 Problem Statement

- Current State - Phase 2 stander (shown previously)
- Desired State - smooth start/stopping, a second, separate control interface (i.e. remote control), straighter travel
- Project Goals - modular control system, 3rd party control, and straighter travel
- Constraints - safety, weight, cost, power consumption

P14045 Project Deliverables

A ready-to-use modified pediatric stander equipped with modular control choices

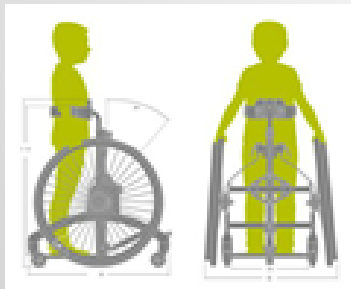
- “Functional prototype that could be marketed to companies”



*images taken from
Google images

P14045 Stakeholders

- User
- Physical Therapist or teacher's aid
- Baggage handler (i.e. airline employees)
- Assistive Technology Engineers
- Inventors
- Our Team



Usage Scenarios Considered

- Therapeutic:
 - Independent Control
 - Child is free to drive/control stander by his/herself.
 - Assisted Control
 - Child drives, teacher assists/overrides when needed
 - Full External Control
 - Stander completely controlled by remote
- Classroom use
 - Lots of obstacles in close proximity, tight turns required
- Hallway use
 - Few obstacles, extended straight runs.

P14045 Customer Requirements

Customer Rqmt. #	Importance	Description	Comments/Status
CR1	9	Update current standers	Modify P13045's Stander and/or the Mk1 stander
CR2	3	Stander Fits Student	Small size stander is preferred for preschoolers
CR3	9	Drives Straight	Figure out last year's shortfalls
CR4	9	Start/Stop	No start/stop jerk
CR5	9	3rd Party Controls	Assist, override features
CR6	3	Collision Detection	incorporating into the board
CR7	3	Multiple Styles of Control (joystick, buttons, ipad app)	Modular system?
CR8	1	Professional look	Possible routing through tubing of stander
CR9	1	Package as upgrade kit	potential future option, long term
CR10	1	Ti controller	to enter into TI competition
CR11	3	Low Weight	Light enough for Linda to carry it
CR12	3	Battery Lasts all day	last a whole school day w/heavy use.
CR13	1	Capable of rougher terrain	use on playground surfaces
CR14	9	full access to tables	controls more out from in front of child
CR15	3	Child/weather-proof	Acidents and tampering proof
CR16	3	Adaptable control system	teachers/therapists able to change out controls
CR17	9	non-interference with regular use	added equipment can't get in the weay of how the child is strapped in
CR18	1	Affordable parts	

P14045 Engineering Requirements

rqmt. #	Quality Score	Engr. Requirement (metric)	Unit of Measure	Ideal Value
S1	9	Straight Travel over 6.1m	cm	0
S2	3	Runtime to be all day	hours	8
S3	3	Object sensor presicion	cm	6
S4	18	acceleration of stander	g	tbd
S5	9	Top speed	kph	6
S6	3	Add low weight to stander	kg	<9
S7	3	Overall weight	kg	tbd
S8	1	Cost	\$	1000
S9	3	Max weight of child	kg	tbd
S10	3	Max height of child	m	tbd
S11	9	response time of stander controls	ms	100
S12	9	response time of remote controls	ms	150
S13	9	distance of remote control	m	5
S14	18	turning radius	m	tbd
S15	12	Remote control features	binary	yes
S16	9	Non-interference	binary	yes
S17	15	Interchangeable Controls	binary	yes
S18	9	minimum distance to table	cm	0

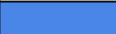








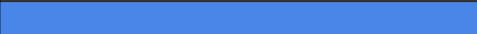

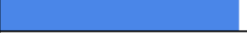









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Matched Engineering & Customer Requirements

Customer Requirements	Engineering Requirements	Straight Travel over 6.1m	Runtime to be all day	Object sensor precision	acceleration of stander	Top speed	Add low weight to stander	Overall weight	Cost	Max weight of child	Max height of child	response time of stander controls	response time of remote controls	distance of remote control	turning radius	Remote control features	Non-interference	Interchangeable Controls	minimum distance to table	
Update current standers																				9
Stander Fits Student										1	1									3
Drives Straight		1			1	1									1					9
Start/Stop					1							1			1					9
3rd Party Controls													1	1		1		1		9
Collision Detection				1																3
Multiple Styles of Control																		1		3
Professional look																				1
Package as upgrade kit																				1
Ti controller																				1
Light Weight							1	1												3
Battery Lasts all day			1																	3
Capable of rougher terrain																				1
full access to tables																			1	9
Child/weather-proof																				3
Adaptable control system																1		1		3
non-interference with regular use																	1			9
Affordable parts									1											1
		9	3	3	18	9	3	3	1	3	3	9	9	9	18	12	9	15	9	

P14045 Preliminary Schedule

Tasks	Week #3	Week #4	Week #5	Week #6	Key:
Define the scope of the system					Week # Regular
Finish Customer Interview					Week # 3-week
<i>Research:</i>					
Wheel/Motor					
Motor drivers/encoders					
Control Input requirements					
TI requirements					
Sensors					
Support System					
Materials					
Refine Eng. Requirements					
Ensure compatibility between					
Measure existing stander					
<i>Decide:</i>					
Upgrade or Build?					
Control Inputs					
Recruit students (e.g. business)					
Organize a power point					
<i>Develop:</i>					
Straightness test					
Sensor test					
Usage conditions					
Remote control					
Routing of wiring					

Issue & Corrective Actions

- Lost an Electrical Engineer in the group
 - Be more efficient
- No one with background in robotics or programming
 - pull RIT resources through GCIS and Innovation Center
- Current state of project plan is weak
 - High priority for the following weeks

Thank you!

Questions?