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Alert Device for Walker

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BME Design

Overview

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Client Description

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Problem Statement

Older adults want to remain independent. Those who use a walker device often feel confined or do not want to admit when it is not as easy anymore and possibly lose independence. An alert system associated with their walker could provide warnings and reminders that could improve safety for older adults.

Background Research

- The use of a walker affects an elderly person's self-identity and self worth. [4]
- Walker users face mobility and independence challenges. [4]
- The most number of falls occurs from 74 to 85 in age. [2]
- Falls are the leading cause of injury among older adults which causes dependence and less quality of life. [1]
- Elderly adults may not have enough strength or control to stop the walker by themselves, leading to injury. [1]

Competing Designs

Self locking brake system:

- Certain pressure is applied to the handles which triggers the locking mechanism. [1]
- The brake system is used to prevent movement on a sloped surface and unwanted movement of the walker. [1]

Electronic braking system by Cornell Biomedical Researchers:

- The walker starts with brakes on and the user will push a button to begin movement. [3]
- As the movement begins, once the user moves their hands from the handlebars the automatic brake system employs through hand sensors. [3]

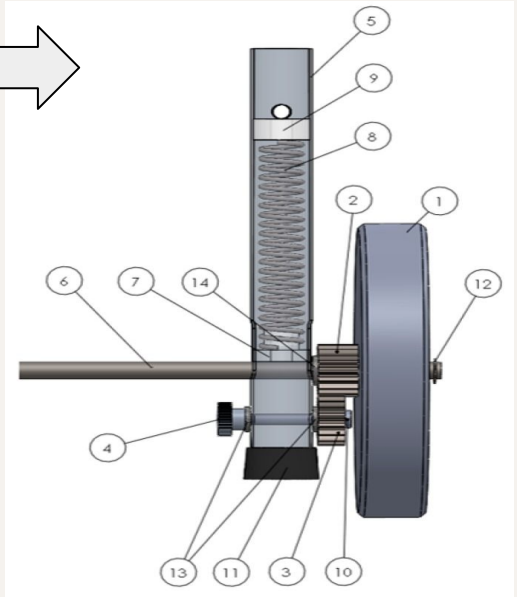


Figure 1. Self locking brake system mechanism [1]

Product Design Specifications / Evaluation Criteria

- Able to lock wheels to improve safety and prevent falls
- Attached alert system that emits low frequency noise
- Accessories; seat, basket, handles, wheels, and lock for wheels
- Improve ease of use for a walker
- Easy to learn for older patients and potential caregivers
- Follow FDA/ADA regulations [14]
- Budget $300-$500

Design 1: Button Brakes

Button automated lock system

- Adafruit fingerprint sensor
  - 3.6-6V DC source
  - 150mA peak current
- Arduino microcontroller
- Tapping provides locking/unlocking of breaks
- Personalized usage

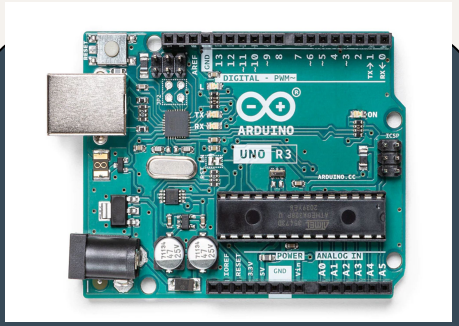
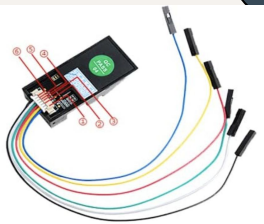


Figure 2. Arduino microcontroller (UNO REV3) [5]



Pin Nmuber	Name	Type	Function Description
1	Vtouch	In	Touch sensor power input(color: blue)
2	Sout	Out	Touch sensor output(color:yellow)
3	Vin	In	Power input(color: red)
4	TD	in	Data output. TTL logical level (color: green)
5	RD	out	Data input. TTL logical level (color: whrite)
6	GND	–	Signal ground. Connected to power ground (color: black)

Figure 3. Adafruit sensor with pin specifications [6]

Design 1: Evaluation

- Benefits
  - Cheapest option
  - User friendly
  - Huge storage capability
- Constraints
  - Coding experience
  - Integrating onto walker
  - Lack of fail system

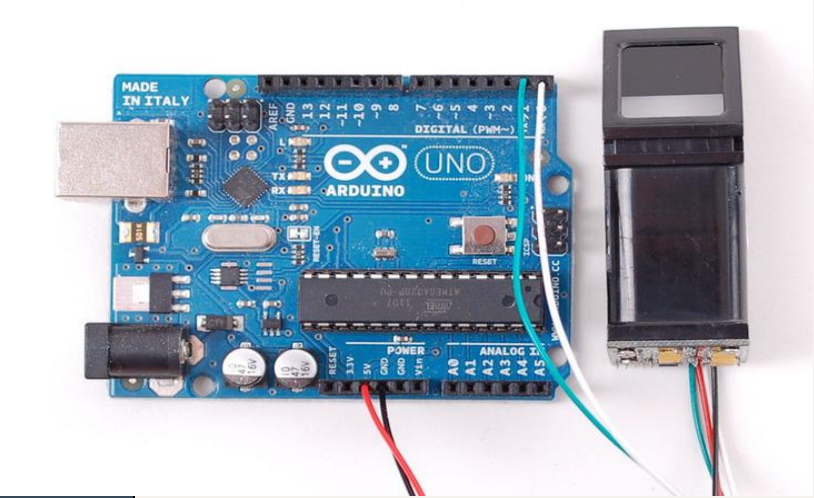


Figure 4. Adafruit sensor connected to Arduino [7]

Design 2: Noise Alert

Figure 5. Digi key speaker [8]

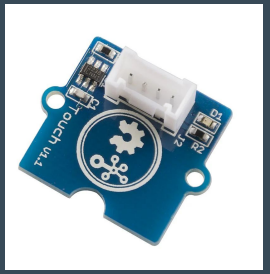


Figure 6. Arduino Touch Sensor [9]

- Similar to unbuckled seat belt alarm
- Touch sensor on handles
- 15 seconds without touch while brakes are unlocked, then alarm goes off
- Low pitch frequency
- Flashing lights for users with hearing impairments

Design 2: Evaluation

Benefits

- Reminds user
- Creates habit
- Easy to use
- Cost effective

Constraints

- No automatic locking
- Alarm could be annoying
- False positives
- Doesn’t change brakes

Design 3: Pressure Sensing Brakes

Pressure Sensing Break Release

- Reason for Design
- Locks engaged when walker not in use
- Pressure sensors embedded in walker grip
- Controlled by an arduino UNO microcontroller

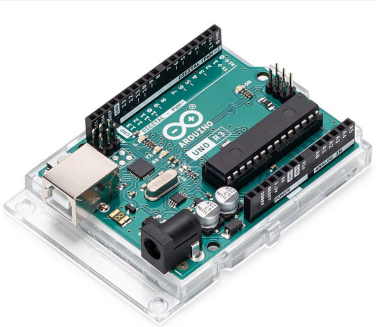


Figure 7. Arduino UNO [10]

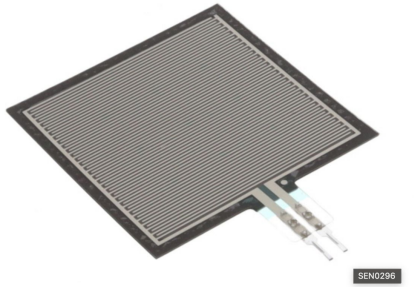


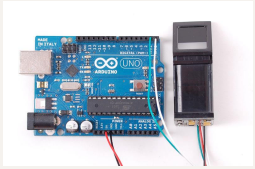
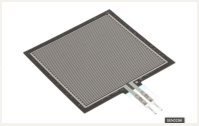
Figure 8. DigiKey Pressure Sensor [11]

Design 3: Evaluation

- Benefits
  - Breaks always activated
  - Ergonomic
- Constraints
  - Coding experience
  - Cost
  - Integration into walker grips

Figure 9. Rollator with pressure sensors in grips [12]

Design Matrix

	Design 1: Button Brakes 		Design 2: Noise Alert for Brakes 		Design 3: Pressure Sensing Brakes 	
Criteria (weight)	Score	Weighted Score	Score	Weighted Score	Score	Weighted Score
Feasibility (20)	3/5	12/20	4/5	16/20	2/5	8/20
Ease of Use (30)	4/5	24/30	5/5	30/30	4/5	24/30
Safety(30)	4/5	24/30	4/5	24/30	3/5	18/30
Cost (10)	4/5	8/10	5/5	10/10	3/5	6/10
Durability (10)	5/5	10/10	5/5	10/10	5/5	10/10
	Sum	78/100	**Sum**	90/100	**Sum**	66/100

Conclusion

We have decided to pursue a prototype that incorporates both an alerting noise and a button-action braking system.

- Feasible fabrication
- Cost effective
- Easy to use
- Improve overall safety for user

Figure 10. Walker depicted with speaker and button-action brakes [13]

Future Work

- Conduct a focus group of potential users
- Purchase components for button-action braking system
  - Breadboard
  - Audio player
  - Arduino E-Brake
  - Wires & Resistors
  - Analog Button Switch
- Design case for electrical components to be fixed to walker

Acknowledgements

Thank you to our client, Dr. Beth Martin for providing us with a walker!

Thank you to our advisor Dr. Megan Settell!

References

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