



# AARDVARK

## Requirements Presentation

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# Product Overview

- For older adults at risk of falling
- **Monitors** user movement
- **Identifies** fall risk
- **Intervenes** to prevent injury
- **Contacts** EMS in case of injury

Automated

Assistive

Robot

Doing

Visual

Analysis

Running

Kinects

# Project Scope

- For older adults at risk of falling
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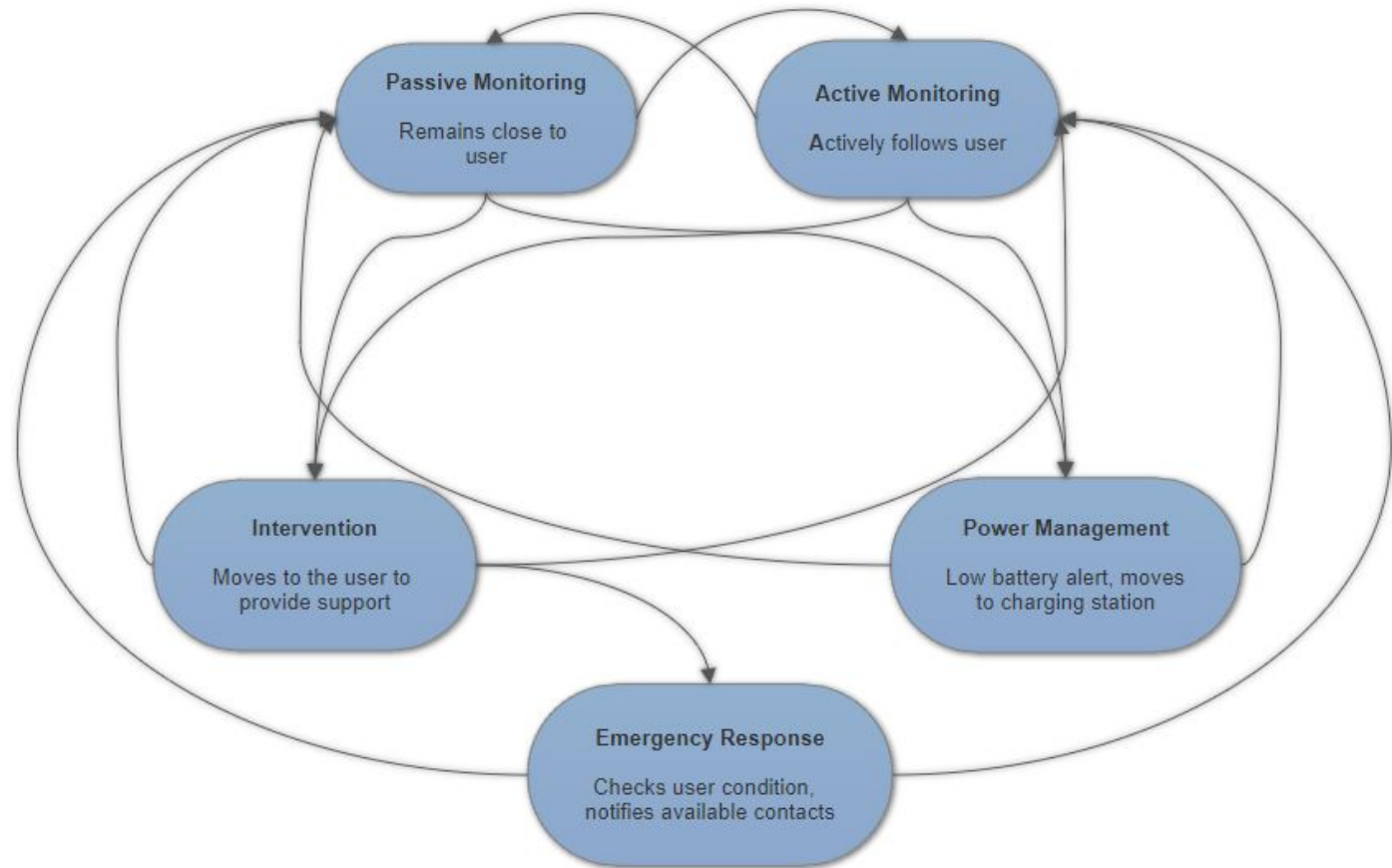
Visual

Analysis

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Kinects

# State Transition Diagram



	Category	Requirement	Functional/Non/Wish	Priority	Volatility	Time (hrs)	Classification (for doc)	Purpose
NIK	<u>Robot monitoring process</u>	<u>Robot will stay a few (3) strides from person (~6-8 ft. pendir</u>	<u>functional</u>	<u>high</u>	<u>high</u>	<u>10.4</u>	<u>4</u>	<u>Close enough to monito</u>
		<u>Robot will stay directly in front of person</u>	<u>functional</u>	<u>high</u>	<u>med</u>	<u>10.5</u>	<u>4</u>	<u>Allows monitoring</u>
		Robot will keep pace with person when walking	functional	med	med	<u>37.5</u>	4	
		Robot will go into stationary position when person is working	functional	low	low	<u>24.5</u>	4	
	<u>Robot intervening process</u>	<u>If person unsteady, robot will move to individual</u>	<u>functional</u>	<u>high</u>	<u>low</u>	<u>4.1</u>	<u>4</u>	
		<u>Intervening robot stops at distance of ~0.5 m</u>	<u>functional</u>	<u>high</u>	<u>med</u>	<u>15.8</u>	<u>4</u>	
		<u>If person unsteady, arm will move to provide stability</u>	<u>functional</u>	<u>high</u>	<u>low</u>	<u>1.4</u>	<u>4</u>	
	Post-fall response	If person falls, ask if is okay	functional	med	low	24.4	4	
		If person falls and is unresponsive issue a message	functional	med	low	1.6	4	
		If person falls robot will record person to send to responders	functional	med	med	10.1	4	
BEN	Data management	Robot will record all available data to make informed decisions	functional	med	low	8.8	4	
		Robot will keep emergency contacts	non	med	low	7.9	5.2	
	Power management	Robot will notify user if battery will expire in 30 minutes	functional	low	med	8.2	4	Do Introduction
		Robot battery will be able to be swapped out	non	med	low	8.6	2.5	---
		Robot will not turn off	non	med	low	38.6	2	---
	<u>Operating environment</u>	<u>Indoor use</u>	<u>non</u>	<u>high</u>	<u>low</u>	<u>non</u>	<u>2.4</u>	<u>---</u>
		<u>Will not traverse stairs</u>	<u>non</u>	<u>high</u>	<u>low</u>	<u>non</u>	<u>2.4</u>	<u>---</u>
		<u>Flat environment use</u>	<u>non</u>	<u>high</u>	<u>low</u>	<u>non</u>	<u>2.4</u>	<u>---</u>
		<u>No hazardous conditions (wet, hot, uneven)</u>	<u>non</u>	<u>high</u>	<u>low</u>	<u>non</u>	<u>2.4</u>	<u>---</u>
JENNA	Physical attributes	Robot will be about the size of a shopping cart	non	high	low	non	2.5	X
		Robot will be stable enough to be bumped into	non	high	low	non	2.5	X
		Arm will have cusion/soft material	non	low	low	non	3.2 (3.1?)	X
		No part of the robot should pose a danger in a collision	non	high	low	non	5.2	
		Robot will have touch screen display ~10"	non	med	med	non	3	X
		Robot will have a keyboard and touchscreen	non	med	low	non	3	
	Software Interface	Robot will only have one 'profile'	non	med	low	31.3	3	
	Operating constraints							
		Robot will not be pushed, or used as a walker	non	med	med	5.8	2.5	X
		Robot operating noise will never be above normal conversation	non	med	med	38.4	2.5	X



# Requirements Overview

## FUNCTIONAL

**Feature 1: Passive Monitoring**

**Feature 2: Active Monitoring**

**Feature 3: Intervention**

**Feature 4: Emergency Response**

**Feature 5: Power Management**

**Feature 6: Initial Setup**

## NON-FUNCTIONAL

Assistance speed

Assistance proximity

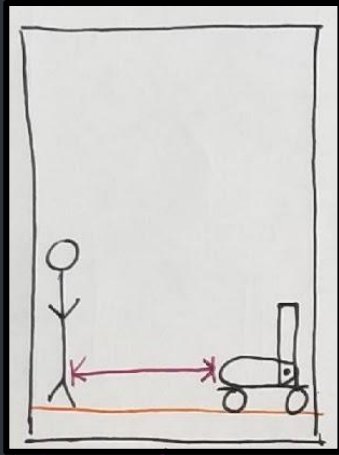
Emergency contact

No physical danger from robot

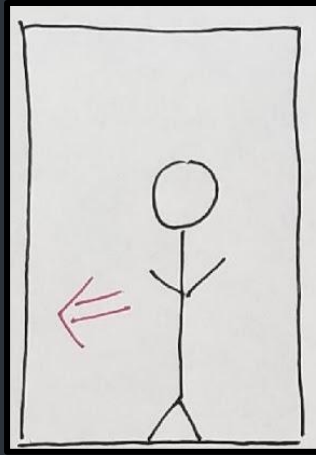
Secure video feed



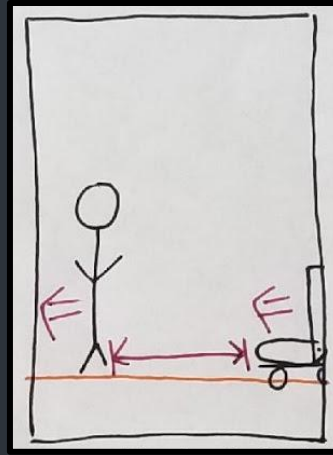
# Feature 1: Passive Monitoring



Robot shall stay 3 strides (6-8 feet) from the person during passive monitoring



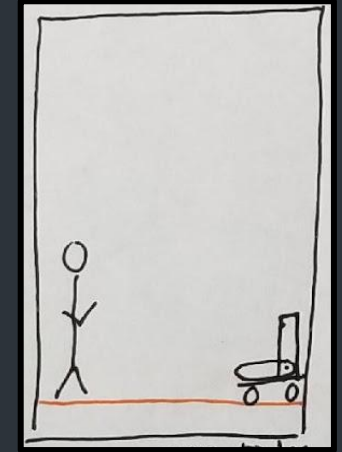
Robot shall change its position only if person moves more than three (3) strides from the robot (or if state changes)



Robot shall move into active monitoring state if called by user.

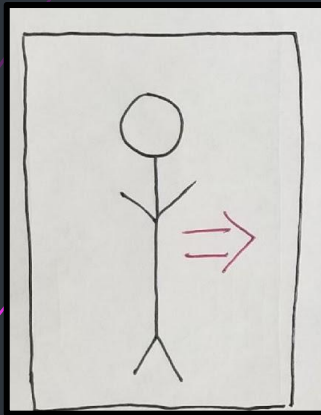


Robot shall move into active monitoring state if person appears to be changing activity.



Robot shall move into intervention state if person appears to be falling.

## Feature 2: Active Monitoring



Robot shall stay three (3) strides (6-8 feet) from the person during active monitoring.



Robot shall remain this distance directly in front of person.



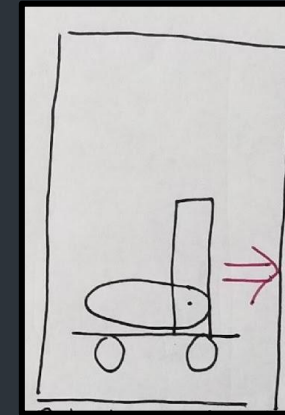
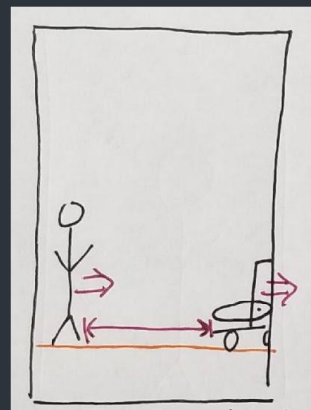
Robot shall keep pace with the person while they are walking, moving not more than 8mph.



Robot shall move into passive monitoring state if user begins stationary activity.



Robot shall move into intervention state if person appears to be falling.

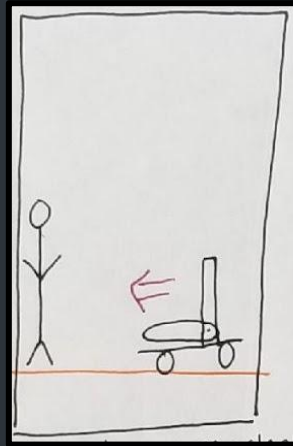




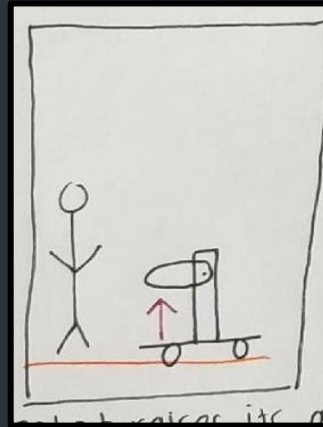
# Feature 3: Intervention



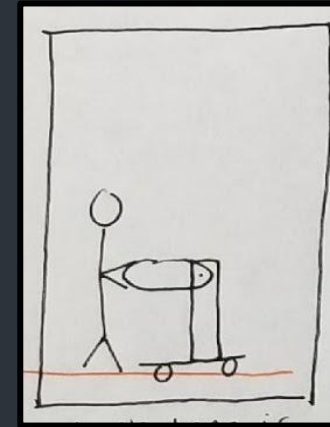
Robot shall move towards the person.



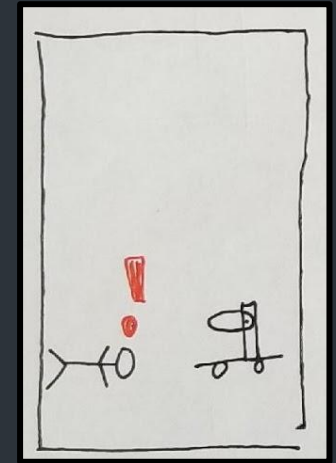
Robot shall stop when it reaches 1.5 ft from the person.



Robot shall raise arm to provide support

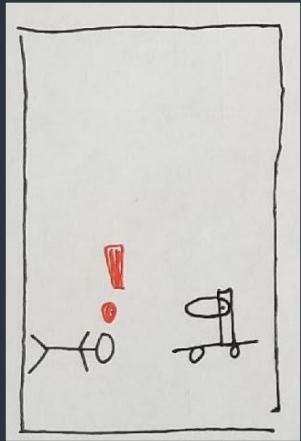


If fall is interrupted, robot shall not move until person has released support arm. Robot shall then return to previous state.

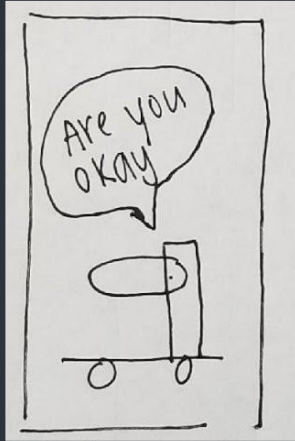


If fall is not interrupted, robot shall not move unless prompted by user. Robot shall enter emergency response state.

# Feature 4: Emergency Response



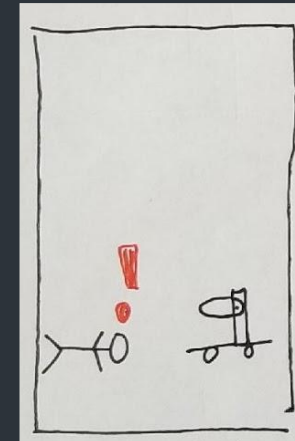
Robot shall not move unless prompted by user.



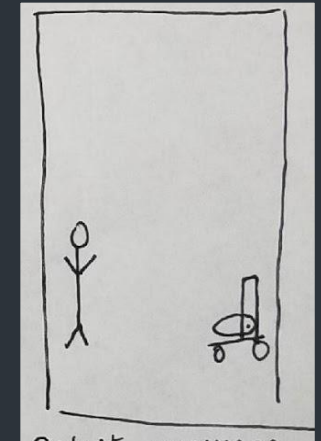
Robot shall attempt to contact the user by playing the message: "Are you okay?".



If the user responds and indicates they are physically sound, robot shall move to active or passive monitoring.



If the user does not respond or indicates they are not physically sound, robot shall play the message: "help", contact the stored emergency contact via video call, streaming video of the user.



Unless otherwise specified, robot will not exit this state unless manually reset by emergency contact.

# Feature 5: Power Management

Robot shall alert the user it is low on battery for 30, 20, or 10, 5, 4, 3, 2, and 1 minutes left of operation by playing the message: "Low battery." The robot shall then revert to its previous mode.

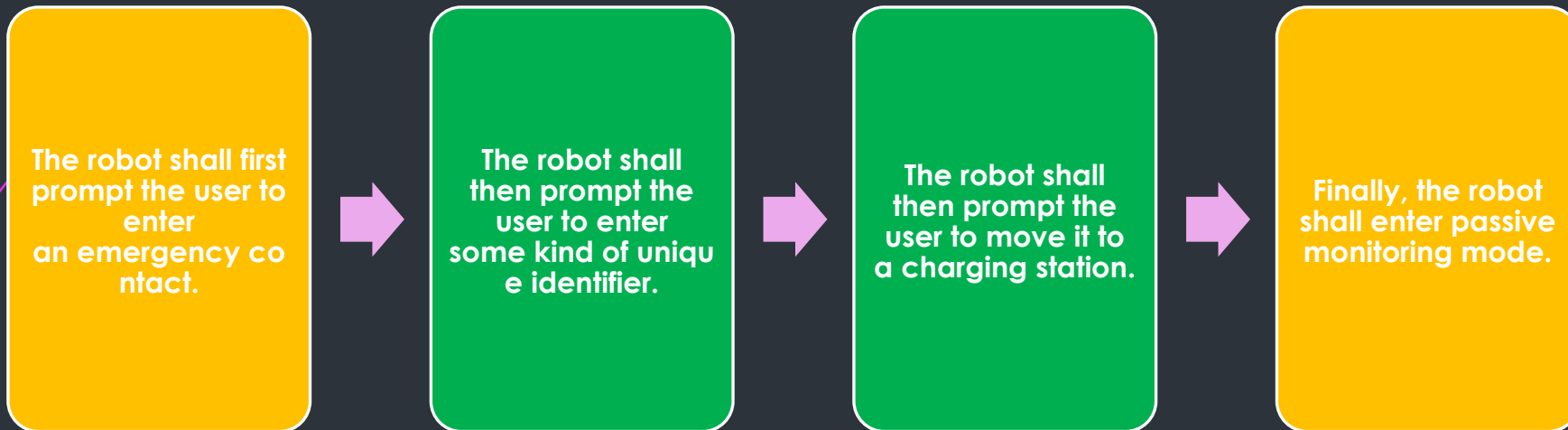


If the robot is allowed to recharge, it shall move to a predefined charging station and swap batteries from the station.



The robot shall then return to its previous position and revert to its previous mode.

## Feature 6: Initial Setup





# Nonfunctional Requirements

- Performance
  - Assistance within 0.5 seconds of fall perception
  - Proximity of 0.5 m from user
- Safety
  - Emergency contact programmed
  - No physical danger from robot (soft robotics, enclosed machinery, durable)
- Security
  - Video feed accessible only to emergency contact
- Operating Conditions
  - Flat terrain, room temperature



# Allocation of Developers

## **Gait Monitoring and Fall Risk Assessment/Communication:**

Jenna and Ben

*(passive/active monitoring, emergency response)*

## **Robot Response and Design:**

Hannah and Nik

*(intervention, power management, initial setup)*



# Testing and Validation

- Make robot perform task
- Ensure robot fulfills task according to requirement
- If robot doesn't perform, fine-tune requirements or modify software





# Volatility and Potential Risks

## **Areas of High Volatility:**

- Specified distances, speeds, and sizes may change based on comfort of user and physical design of robot
- Methods of interacting with user aside from physical intervention

## **Areas of Low Volatility:**

- Monitoring states and act of intervention

## **Potential Risks:**

- Liability with this robot used as a safety measure
- Robot more of a nuisance than benefit