

**DOC NO:** ECE495-2025G502      **ISSUE DATE:** 07-10-2025  
**FILE NAME:** g5\_assign2\_requirements\_specification.pdf      **VERSION NO:** 0.2  
**FILING PATH:** <https://github.com/AneekMubarak/MobileToolAssistant/blob/main/docs/>  
**TITLE:** Requirement Specification  
**PROJECT:** Mobile Tool Assistant  
**KEYWORDS:** tools, assistant, navigation, transport, follow, requirements, specifications, constraints, functional, non-functional.

**APPROVED BY**

Daniel Teng  
Customer

Date

**PREPARED BY:**

Chidubem Emeka-Nwuba  
Design Engineer

Date

Aditya Ramakrishnan  
Design Engineer

Date

Aneek Mohamed Ruksan  
Design Engineer

Date

Ethan D'Almeida  
Design Engineer

Date

**REVIEWED BY:**

Chandler Janzen  
Supervisor

Date

© Chidubem Emeka-Nwuba, Aneek Mohamed Ruksan, Aditya Ramakrishnan, Ethan D'Almeida.

This document is CONFIDENTIAL and PROPRIETARY and is for the use of the copyright holders, except to the extent that permission is expressly granted elsewhere.

In any event, no part of this document may be reproduced in any form without the express written consent of the copyright holders.

## REVISION HISTORY

Version No.	Date	Originator	Summary of Changes
1	07-10-2025	C.E.N, A.R, E.D, A.M.R	Document Created
2	04-11-2024	E.D	Modified Design Constraints, reframed some requirements

© Chidubem Emeka-Nwuba, Aneek Mohamed Ruksan, Aditya Ramakrishnan, Ethan D'Almeida.

This document is CONFIDENTIAL and PROPRIETARY and is for the use of the copyright holders, except to the extent that permission is expressly granted elsewhere.

In any event, no part of this document may be reproduced in any form without the express written consent of the copyright holders.

## Table of Contents

Requirement Specification .....	4
Functional Requirements: .....	4
Non-Functional Requirements: .....	5
Design Constraints .....	6
APPENDIX I: KEY REQUIREMENTS.....	7

© Chidubem Emeka-Nwuba, Aneek Mohamed Ruksan, Aditya Ramakrishnan, Ethan D'Almeida.

This document is CONFIDENTIAL and PROPRIETARY and is for the use of the copyright holders, except to the extent that permission is expressly granted elsewhere.

In any event, no part of this document may be reproduced in any form without the express written consent of the copyright holders.

# Requirement Specification

This section outlines the functional and performance requirements of the system, detailing the design objectives, operational constraints, and expected behaviors necessary to ensure that the implementation meets its intended purpose.

## Functional Requirements:

The functional requirements for the design and implementation of this project are listed below:

### Functionality (ID: 01):

Type of Constraint	Requirement Description
Performance/Capability	The robot shall be able to follow the user at 1m ( $\pm 0.5\text{m}$ ) when not in standby.
Performance/Capability	The robot shall be able to follow the user at a speed of 5km/h ( $\pm 1\text{km/h}$ ) when following a user.
Performance/Capability	The robot shall be able to carry a payload of up to 5kg securely during operation.
Performance / Timeliness	The system shall be able to detect and avoid obstacles within 1.0m and reroute to continue following the user.

### Hardware (ID: 02):

Type of Constraint	Requirement Description
Performance/Capacity	The system shall be able to accommodate objects not exceeding 30 cm $\times$ 20 cm $\times$ 15 cm in dimension.
Performance/ Operability	The system shall be able to navigate autonomously on flat, smooth, single-floor indoor surfaces during normal operation.

### UI (ID: 03):

Type of Constraint	Requirement Description
Functionality / Accessibility	The system shall be able to provide a user interface to start and stop operation.

### Power (ID: 04):

Type of Constraint	Requirement Description
Performance / Timeliness	The system shall be able to return to a designated charging station and initiate charging when battery capacity falls below 10%.

Sustainability / Power	The system shall be able to recharge using standard 120 V AC power and reach full charge within 6 hours.
Performance / Power	The system shall be able to last for 2 hours on a single charge cycle.

## Non-Functional Requirements:

The non-functional requirements for the design and implementation of this project are listed below:

### Environmental (ID: 05):

Type of Constraint	Requirement Description
Environmental / Operability	The system shall be able to function within enclosed spaces and shall not be exposed to outdoor conditions such as rain, direct sunlight, or uneven terrain.
Environmental / Operability	The system shall be able to operate indoors only, within room temperature (20–25 °C).
Environmental / Operability	The system shall be able to function in an under environmental conditions with noise levels of up to 50dB.

### Security (ID: 06):

Type of Constraint	Requirement Description
Security / Data integrity	The system shall not store any visual/audio data of the user.
Security / Access Control	The system shall be able to pair and operate only with authorized user devices or identifiers.

## Design Constraints

The constraints below define the limitations and conditions that influence the system's design:

1. The system shall be designed for indoor operation only under controlled environmental conditions such as stable temperatures and dry surfaces.
2. The system shall be designed to support navigation only on smooth, flat surfaces to ensure traction and stability.
3. The system shall be limited to operating on a single floor level, without the ability to traverse stairs, ramps, or steep inclines.
4. The system shall be capable of carrying a payload of not more than 5kg while maintaining stable motion on smooth surfaces.
5. The system shall be developed within a total budget not exceeding \$500 CAD.
6. The system design shall accommodate a maximum object size of 30cm x 20cm x 15cm.
7. The system shall be battery-powered and rechargeable using a standard electrical outlet.
8. The system requires the user to be positioned at the front of it at startup to ensure proper initialization and tracking.

## APPENDIX I: KEY REQUIREMENTS

Requirement #	R01-01
Requirement Type:	Functional
Description:	The robot shall be able to follow the user at a distance of 1 m ( $\pm 0.5$ m) when not in standby.
Originator:	Client (G5)
Fit Criterion:	The robot maintains a following distance between 0.5 m and 1.5 m from the user during motion, verified through testing in an indoor environment.
Priority:	1
Conflicts:	None
History:	Date Created: 8 <sup>th</sup> October, 2025

Requirement #	R01-02
Requirement Type:	Functional
Description:	The robot shall be able to carry a payload of up to 5 kg securely during operation.
Originator:	Client (G5)
Fit Criterion:	The robot shall successfully transport a payload of 5 kg without loss of balance, slippage, or system malfunction over a continuous operation period on a smooth indoor surface.
Priority:	2
Conflicts:	None
History:	Date Created: 8 <sup>th</sup> October, 2025

Requirement #	R02-01
Requirement Type:	Hardware
Description:	The system shall be able to navigate autonomously on flat, smooth, single-floor indoor surfaces during normal operation.
Originator:	Client (G5)
Fit Criterion:	The system successfully demonstrates autonomous movement across a smooth indoor floor without manual intervention, maintaining stable operation and obstacle avoidance.
Priority:	3
Conflicts:	None
History:	Date Created: 9 <sup>th</sup> October, 2025

Requirement #	R01-03
Requirement Type:	Functional
Description:	The system shall be able to detect and avoid obstacles within not less than 1.0m and reroute to continue following the user.
Originator:	Client (G5)
Fit Criterion:	During testing, the system consistently detects obstacles at a minimum distance of 1.0m and successfully adjusts its path to avoid collision while maintaining continuous user tracking.
Priority:	4
Conflicts:	None
History:	Date Created: 9 <sup>th</sup> October, 2025