

Delivery Robot

I. Introduction:

- 1. Purpose:** The purpose of this document is to present a detailed description of the Delivery Robot Application. It will explain the purpose and features of the system, the interfaces of the system, what the system will do, the constraints under which it must operate and how the system will react to external stimuli. This document is intended for both the stakeholders and the developers of the system.

- 2. Scope:** This software system will be a Delivery Robot Software Application for the German International University Campus. The Software will be designed to maximize the Stakeholders' by automating the pickup process and minimizing the time lost to send or deliver anything on campus which would otherwise have to be done manually by the stakeholder and consume much time. By maximizing the Stakeholder's work productivity and time management the system will meet the stakeholder's needs while remaining easy to understand and use. More specifically, this system is designed to allow anyone on GIU Campus to send and receive packages by using an application that allows a delivery bot to navigate around the campus and deliver one's packages to a certain coordinate desired by the stakeholder, Thus, decreasing too much wasted time by the stakeholder who wasn't capable of doing it manually in the 15 minutes GAP time-span, as a result, this will increase the productivity and efficiency for all the stakeholders

- 3. Definitions, acronyms, and abbreviations:**
 - Software Requirements Specification: A document that completely describes all of the functions of a proposed system and the constraints under which it must operate. For example, this document.
 - Stakeholder: Any person with an interest in the project who is not a developer.
 - Authentication: Process of verifying an identity

4. **Document Overview:** The next chapter, the Overall Description section, of this document gives an overview of the functionality of the product. It describes the informal requirements and is used to establish a context for the technical requirements specification in the next chapter. The third chapter, Requirements Specification section, of this document is written primarily for the developers and describes in technical terms the details of the functionality of the product. Both sections of the document describe the same software product in its entirety, but are intended for different audiences and thus use different language.

II. Preliminary Definition:

- **2.1 Problem:** Many people in GIU (German International University) camps do not have time to send anything to another one or students that they have enough time between gaps to get food so they arrive late to lectures or tutorials that makes them lose attendance.
- **2.2 Goal:** The aim of this project is to deliver package from sender to receiver without any of them spend time in just delivering anything
- **2.3 Domain:** this system will operate only in GIU Campus
- **2.4 Stakeholders:** The stakeholder can be any person on campus that would like to send and/or receive a package.

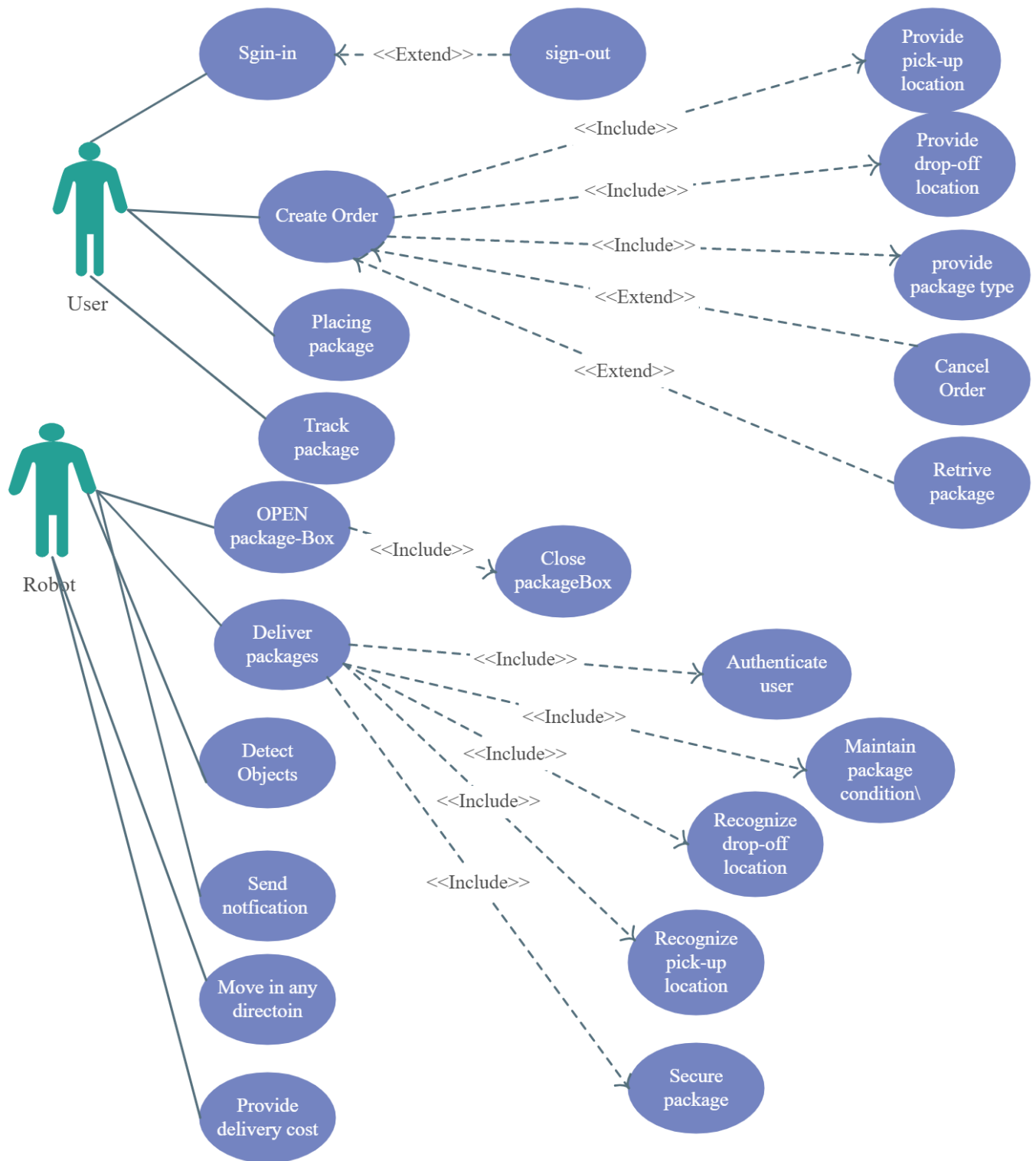
2.5 Functional Requirements:

1. User should be able to login app
2. User should be able to order a robot when it is available
3. User should be able to place the order inside the package box
4. User Should be able to pick-up package after arrive
5. User should provide pick-up location
6. User should provide drop-off location
7. User should be notified when the robot arrives at the pickup destination
8. Robot should be able to recognize the pickup location.
9. Robot should be able to recognize the drop-off location.
10. Robot should be able to self-recharge.
11. Robot should be able to detect obstacles.
12. Robot should be able to avoid obstacles.
13. Robot should be able to send notification when destination is reached.
14. Robot should be able to open the package box to the requested person.
15. Robot should have a package box.
16. Robot should be able to start the trip after user close the package box.
17. Robot should identify the routes that it can move in.
18. Robot should be able to move in any direction.
19. Robot should be able to start the trip after user close the package box
20. System should be able to navigate the robot.
21. System should provide the routes to the robot

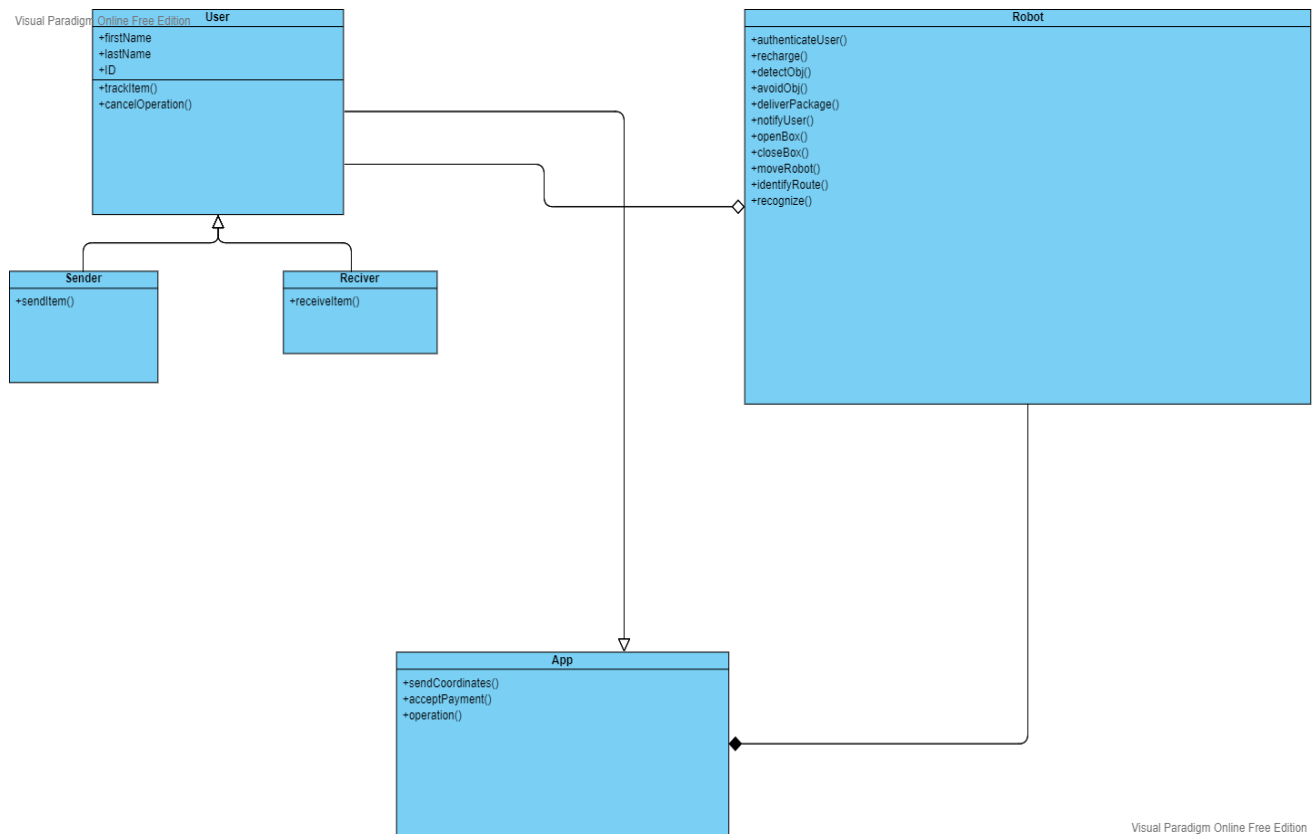
2.6 Non-Functional Requirements:

1. User able to track the shipment
2. User able to cancel the request
3. User able to know the rate of my trip
4. Sender able to retrieve my package
5. Robot have mid-sized package box
6. Robot shall have reasonable speed (10 KM/H)
7. Robot able to work the whole UNI-day per charge
8. Robot should authenticate the requested person
9. Robot should be able to maintain package condition (for example: food)
10. System shall provide determine the shortest route

2.7 Use Case Diagram:



2.8 Class Diagram:



III. Issues with Preliminary Definition:

3.1 Domain: Weather might be windy and rainy in the campus during winter

3.2 Functional Requirements:

- 1. Sender may change his location after booking the robot**
- 2. Receiver may change his location before getting package from the robot**
- 3. Robot cannot press the elevator buttons**
- 4. Robot may run out of battery while delivering a package**
- 5. Robot might crash with people walking inside the campus even if it is avoiding still obstacles**
- 6. Sender couldn't see the pick-up notification**
- 7. Receiver couldn't see the drop-off notification**
- 8. Robot can't recognize the exact pickup location**
- 9. Robot can't recognize the drop-off location**

10. Robot is not available to order because it is busy
11. Robot might deliver the package to the wrong person
12. Satellites recognize only street routes, System can't recognize robot routes
13. Rain can damage the robot
14. Whether condition (rain, high winds, heat) may be not good for robot
15. Whether condition (rain, high winds, heat) may be not good for package
16. satellite can't identify its exact location

3.3 Non-Functional Requirements:

1. User might not find the exact location of the robot through the map if the robot is operating inside one of the buildings
2. Robot might not deliver a package in correct times due to delay in crowd routes
3. Robot might face technical problems that stop the delivery
4. User opens app many times and the robot are unavailable to book
5. User can't fit the package inside robot package box
6. User can't specify the exact pickup location in the map
7. User can't specify the exact drop-off location in the map
8. Robot wait too much until the receiver arrive and open the package box
9. Someone may try to open the package box
10. After robot arrive pickup location, sender cancels the order
11. After robot arrive pickup location, sender cancels the order
12. Receiver arrive late at the drop-off location
13. Sender arrives late at the pick-up location

IV. Improved Understanding:

4.1 World:

- Assume that sender will not change his package pick-up location
- Assume that receiver will not leave his package drop-off location
- Assume that sender will not change his package drop-off location
- Assume that people will help robot to press the elevator buttons
- Assume that robot deliver package on time to be able to receive another request
- Assume that there is equilibrium in supply and demand between robot and the user
- Assume that people are collaborative with the robot
- Assume that sender don't cancel the request after robot arrive pickup location
- Assume that the user will pay to the notifications

4.2 Requirements Specification: (HOW)

- 1. User should give his university id as an input and app developer should authenticate it**
- 2. User should check the availability of the robot and have the option to order if it is available**
- 3. The package box should be opened for the user when a user requests to send a package**
- 4. The package box will open upon successful scanning of the qr code of the receiver**
- 5. User should select his or her pick-up location from robot stations from the app map**
- 6. User should select his or her drop-off location from robot stations from the app map**
- 7. The System will automatically send a notification message to the receiver after the robot arrive to the destination**
- 8. The robot will compare its coordinates with the coordinates of the destination on map to check if it is the same**
- 9. The robot will compare its coordinates with the coordinates of the destination on map to check if it is the same**
- 10. Robot go to warehouse to recharge when become in low battery mood**
- 11. Robot should tell people which floor it wants to go by showing the number on a dashboard**
- 12. Robot will be occupied with a sensor to detect obstacles in order to signal the robot**
- 13. Robot will change its lane after receiving a signal from the detection sensor**
- 14. Robot will go to the charging base immediately after the system reads a battery level below the certain threshold**
- 15. Robot will start moving towards the receiver destination immediately after the package box is closed and confirmed by the sender**
- 16. Robot will start an alarm when someone tries to open its package box before arriving to the destination**
- 17. Robot move through the lanes that provided by the System**
- 18. ..(Deleted specification but don't remove to maintain the order)**
- 19. Robot will have a wheels and mechanics that allow it to rotate left and right through the lane provided by the system**
- 20. Robot receives the package from the sender in specific check point**
- 21. User be able to trace shipment through application**
- 22. User able to cancel request before insert package in robot**
- 23. Robot max speed to navigate in campus 10 km/h to avoid any damage**
- 24. Robot have battery able to work whole day inside university**

25. Robot have checkpoints in each area(Essen, Boosters,etc..) in the campus to get food from it and deliver it to reviver

26. System provides the shortest routes to bot to deliver package in shortest time

4.3 Functional Requirements:(What)

- 1. Robot shall always has sufficient energy to operate**
- 2. Robot can navigate throughout the building**
- 3. Robot can take the elevator to any floor**
- 4. System will put the user waiting to order in a queue list**
- 5. User can specify from different pick-up locations**
- 6. User can specify exact different drop-off locations**
- 7. User is able to pick up the package by showing the QR code shown in the app**
- 8. System provide robot with lanes through the campus**
- 9. System provide robot with lanes through the building**
- 10. GIU have specified lanes on the ground for robot in around in the campus**
- 11. Robot made of materials resist extreme weather conditions to take care off package from any damage**
- 12. Sender can retrieve his package from warehouse after robot deliver it to warehouse**
- 13. Receiver can pick up the package later from warehouse**
- 14. System provides drop-off and pick-up location to the robot**

4.4 Non-Functional Requirements:

- 1. Robot has maintenance in the warehouse at the end of day**
- 2. Robot have decent space for most packages**
- 3. Robot have to accept another request after waiting for 5 min for pick-up location**
- 4. Robot have to go to warehouse after waiting for receiver in location for 10 min then be able to get another request**
- 5. Robot have 2 drop-off or pick-up points in each floor**

5. Backward/Forward Traceability:

N-FR id	Requirement description	Issue ID	Issue description	Improved Requirement Id	Improved requirement description	Requirements specification id	Specification Description
FR1	Signing the user into the app	-	-	-	-	1	User should give his giu id card as an input and the system will authenticate the card
FR2	Ordering the robot when it is available	10	Robot might be not available	4	System putting the user in queue lists	2	User will check the availability of the robot and have the option to order it if it is available
FR3	Robot should identify the routes that it will move in	Robot might clash with people walking	5	-	Assuming people are collaborati ve with the robot	17	System provides lanes to robot in order to move through
FR4	User should be able to pick up the package after it arrive	11	Robot Delivery is to the wrong person	7	User should be able to pick up the package by the qr code	4	Qr code authentic ate the user receiving the package
FR5	User should provide pick-up location	16	satellite cant identify it's exact location	5	User can specify from different pick-up locations	5	User should select his or her pick-up location from robot stations

							from the app map
FR6	User should provide drop-off location	16	sataleite cant identify it's exact location	6	User can specify exact different drop-off locations	5	User should select his or her drop-off location from robot stations from the app map
FR7	receiver should be notified when the robot arrives at the pickup destination	7	Receiver couldn't see the drop-off notification	-	-	7	The System will automatically send a notification message to the receiver after the robot arrive to the destination
FR8	Robot should be able to recognize the pickup location	8	Robot cant recognize the exact pickup location			8	The robot will compare its coordinates with the coordinates of the destination on map to check if it is the same

FR9	Robot should be able to recognize the drop-off location	9	Robot cant recognize the exact drop-off location			8	The robot will compare its coordinates with the coordinates of the destination on map to check if it is the same
FR10	Robot should be able to self-recharge.	4	Robot may run out of battery while delivering a package			9	Robot go to warehouse to recharge when become in low battery mood
FR11	Robot should be able to detect objects.					11	Robot will be occupied with a sensor to detect obstacles in order to signal the robot
FR12	Robot should be able to avoid objects.					12	Robot will change its lane after receiving a signal from the detection sensor
FR13	Robot should						

	be able to send notification when destination is reached.						
FR14	Robot should be able to open the package box to the requested person					15	Robot will start an alarm when someone tries to open its package box before arriving to the destination
FR15	Robot should have a package box.	3	Robot might face technical problems that stop the delivery	16	Robot will start an alarm when someone tries to open its package box before arriving to the destination		
FR16	Robot should be able to start the trip after user	-	-	-	-	14	Robot will start moving towards the receiver destination

	close the package box						n immediat ely after the package box is closed and confirmed by the sender
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