



# LazyBots

MCMaster UNIVERSITY

Draft Verification and Validation  
SE 4GA6 & TRON 4TB6

GROUP 9

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## 1 Revisions

Table 1: LazyBots Table of Revisions

Date	Revision Number	Authors	Comments
February 17 <sup>th</sup> , 2018	Revision 0	Karim Guirguis David Hemms Marko Laban Curtis Milo Keyur Patel Alexandra Rahman	-

## 2 Purpose

The purpose of the document is to help support the development process of the drink dispensing autonomous robot known as Alfred. In particular, this document will describe what tests have been performed to ensure that Alfred will be able to perform the act of navigating to and pouring drinks correctly.

## 3 Scope

This document will focus on different software systems that have been discussed within the system design document. This document will focus on performing tasks on the system as if it was a black box, meaning the important aspects are the inputs and outputs of the system rather than the internal mechanics. For smaller sub-features, depending on the implementation, the code may have been considered when creating test cases to ensure the system is robust.

## 4 Background

Alfred is designed to work with various different software systems, so that it can receive the desired drinks of the user, and be able to determine based on internal knowledge of the restaurant to be able to navigate by itself to the correct table. Alfred will then have internal containment units for beverages that will allow the user to put there cup into the drink dispenser to have Alfred pour there drink for them.

Alfred will be able to receive the drink that the user that the user request by requesting the next drink from a designated server. This server will story any incoming drink requests form the mobile application. This mobile application is designed to be used on a tablet or mobile device, where the servers could sign in and give it a table identification number to allow Alfred know which table has sent this order.

Management staff will be able to view Alfred's status from the computers within the back. This system will give the management the ability to modify tables, view the errors that the robot has sent, and will allow the management staff to call Alfred back to the home base.

## 5 Validation

### 5.1 Project Goals and Functional Validation

### 5.2 Alfred Manager System

### 5.3 Alfred Pumping System

## 6 Verification

## 7 Supporting Material

Please refer to previous design documents.

## 8 Appendix

Test Number	Description	Requirement Reference	Inputs	Expected Outputs	Actual Outputs	Results
1	Testing Positive Change of Left Encoder	AF3	movement of encoder	60= 60+1	61	pass
2	Testing Negative Change of Left Encoder	AF3	movement of encoder	60= 60-1	59	pass
3	Testing Positive Change of Encoder	AF3	movement of encoder	60= 60+1	61	pass
4	Testing Negative Change of Encoder	AF3	movement of encoder	60= 60-1	59	pass
5	Open Loop Test of Movement going forward	AF3	10% duty cycles	Both wheels spin forward	Both wheels spin forward	pass
6	Open Loop Test of Movement for turning	AF3	10% duty cycles with one pin on to specify backward motion	Wheels spinning in different directions	Wheels spinning in different directions	pass
7	Ultra Sonic distance test at 1.5m	AF10	a wall 1.5m in front of robot	Nothing blocking	Nothing blocking	pass
8	Ultra Sonic distance test at 0.35m	AF10	a book blocking the path	Blocked	Blocked	pass
9	Able to take picture	AF3	software trigger to take the picture	A picture	a Picture	pass
10	Able to detect circles from an image	AF3	Image with a circle	Position of the circle	Position of the circle	pass
11	Speed is slewed on start	AF3	A 30% in duty cycles	Printing showing a duty cycle increase	Printing showing a duty cycle increase to 30%	pass

Test Number	Description	Requirement Reference	Inputs	Expected Outputs	Actual Outputs	Results
12	Closed Loop Test of Movement going forward	AF3	reference of 20 encoder counts/sec	Both wheels spin forward at 20 encoder counts/s	Both wheels spin forward at 20 encoder counts/s	pass
13	Closed Loop Test of Movement going forward	AF3	reference of 10 encoder counts/sec	Both wheels spin forward at 10 encoder counts/s	Left side failed to correctly start	fail - the software worked correctly but there was mechanical issues at slow speeds
14	Closed Loop Test of Movement going forward with unequal resistance	AF3	reference of 20 encoder counts/sec	Both wheels spin forward at 20 encoder counts/s	Both wheels spin forward at 20 encoder counts/s	pass
15	Closed Loop Test of Movement for turning	AF3	reference of 20 encoder counts/sec	Wheels spinning in different directions at 20 encoder counts/s	Wheels spinning in different directions at 20 encoder counts/s	pass
16	Ultra Sonic Stop	AF3	reference of 20 encoder counts/sec then something blocks its path	Something is blocking the path while moving so Alfred stops	Alfred Stopped	pass
17	Image processing stop with node close	AF3	an image close up to camera while moving	Has reached the next node so Alfred stops motion	Alfred Stopped	pass
18	Image processing stop with node at ceiling away	AF3	An image further away at ceiling height distance	Has reached the next node so Alfred stops motion	Alfred Stopped	Conditional pass-needed lighting

Test Number	Description	Requirement Reference	Inputs	Expected Outputs	Actual Outputs	Results
19	Turn of 90deg	AF3	A reference of 90 degrees	Alfred will turn 90deg and stop	Alfred continued to turn	fail- needs to be re-designed.
20	receiving an order	A1	An order of Coke and Diet Coke on the User Application	Alfred receives a drink that corresponds to tank 1 and 2	Alfred receives a drink that corresponds to tank 1 and tank 2	Pass

Test Number	Description	Requirement Reference	Inputs	Expected Outputs	Actual Outputs	Results
1	Testing Serial communication to Arduino by sending d1d2x sent from Computer	AF1	d1d2x via serial signal	reading d1d2x read by USB	reading d1d2x read by USB	pass
2	Testing Serial communication from RPI by sending d1d2x sent from RPI	AF1	d1d2x via serial signal	reading d1d2x read by USB	reading d1d2x read by USB	pass
3	Testing Serial communication from RPI by receiving 11110000x sent from Arduino	AF1	11110000x via serial signal	reading 11110000x read by RPI USB	reading 11110000x read by RPI USB	pass
4	Testing receiving a value of 20C water with the temperature sensor	AF1	Temperature sensor in 20C water	20	19.8	pass
5	Testing receiving a value of 1Kg with the load sensor	AF1	1kg on load cell	1kg	0kg	Fail
6	Able to receive from the correct tank based on drink order (Tank 1)	AF2	Order for tank 1	Tank 1 pours	Tank 1 pours	pass
7	Able to receive from the correct tank based on drink order (Tank 2)	AF2	Order for tank 2	Tank 2 pours	Tank 2 pours	pass
8	Able to receive from the correct tank based on drink order (Tank 3)	AF2	Order for tank 3	Tank 3 pours	Tank 3 pours	pass
9	Under Weight error when tank is empty	AF2	No weight	Under Weight Error	Nothing	Fail need applifier for weight sensor
10	Over Temperature error when tank is empty	AF2	a hot liquid	Over Temperature Error	Over Temperature Error	Pass
11	Not over Temperature error when tank is empty	AF2	a cold liquid	No Over Temperature Error	Nothing	Pass