



# **Developing common sense model for mobile service robot**

**G.W.M.H.P.De Silva**

Reg. No.: MS20909246

M.Sc. in IT

Specialized in Information Technology

Supervisor : Mr. Samantha Rajapaksha

October 2021

**Department of Information Technology  
Faculty of Graduate Studies & Research  
Sri Lanka Institute of Information Technology**

# Table of Contents

Table of Contents .....	1
List of Figures.....	2
List of Tables.....	3
1) DECLARATION.....	4
2) ACKNOWLEDGEMENTS.....	5
3) ABSTRACT .....	6
4) Introduction.....	7
5) Background.....	9
6) Literature Review .....	14
6.1. Main Considerations.....	14
6.2. Robotic Operation System – (ROS).....	15
6.2.1. Robot Operating System.....	15
6.2.2. Contribution of ROS in building common sense for Robots.....	15
6.3. Ontology based in robotics.....	18
6.4. Simulator related to robotics - Gazebo. ....	19
6.5. Neural Network Based Language Model.....	21
6.5.1. Count-based Language Model or Statistical Language Models.....	22
6.5.2. Neural Network-based Language Model.....	22
6.6. Human Common-sense .....	23
7) Research Problem.....	27
7.1. Research Question.....	27
8) Research Objectives .....	28
8.1. Main Objective .....	28
8.2. Sub Objectives .....	28
9) Methodology .....	29
9. 1 Installation Process.....	29
9.1.1. Install Ubuntu .....	29
9.1.2. Install ROS and Gazebo.....	31
9.1.3. Develop and install Turtlebot 3 .....	32
9.2. Introduction for Methodology .....	33
9.3. Problem Definition .....	34
9.4. Identify Incomplete Instructions .....	38
9.5. Completing an Incomplete Instruction Using Common Sense.....	39
9.6. Display the output related to the Complete Verb Frame .....	44
9.7. Complete the Sentences which haven't keywords .....	45
10) Testing and Implementation .....	48
10.1. Implementation.....	48

10.2.	Implementation Techniques.....	48
10.2.1.	API Requirements.....	48
10.2.2.	Hardware Requirements.....	48
10.2.3.	Software Requirements.....	48
10.3.	Testing Technique.....	49
10.4.	Test Cases.....	50
11)	Results and Discussion.....	55
11.1.	Research Findings.....	55
11.2.	Results.....	55
11.3.	Discussion of the System.....	59
11.4.	Flow of the Project.....	59
11.5.	Conclusion.....	60
12)	References.....	61
	Appendix.....	64
	Appendix 1: Survey for get the answers related to output.....	64

## List of Figures

Figure 1:	Introduction for a problem and solution.....	8
Figure 2:	Work Process.....	33
Figure 3:	Decision Tree.....	37
Figure 4:	Verb frames example.....	39
Figure 5:	Survey answers for "This room is very hot".....	41
Figure 6:	Survey answers for "This room is very cool".....	41
Figure 7:	Survey answers for "This dress is dirty".....	42
Figure 8:	Survey answers for "I am Thirsty".....	42
Figure 9:	Survey answers for "Need to write on paper".....	43
Figure 10:	Inputs and outputs.....	44
Figure 11:	New flow chart for 2 <sup>nd</sup> step.....	46
Figure 12:	State Chart Diagram.....	46
Figure 13:	Level 1 sentence and output.....	57
Figure 14:	keywords identifying.....	57
Figure 15:	output for above command.....	57
Figure 16:	Level 1 another example.....	58
Figure 17:	Level 2 input.....	58
Figure 18:	Output for too hot command.....	58

## List of Tables

Table 1:Test case 01 .....	50
Table 2:Test Case 02.....	51
Table 3:Test case 03 .....	52
Table 4:Test case no 04 .....	53
Table 5:Test case 05 .....	54
Table 6:step 1 results .....	56

# 1)DECLARATION

I declare that this is my own work and this dissertation does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

.....  
MS20909246 G.W.M.H.P.De Silva

...../...../.....

The above research for the Master of Science in Information Technology Dissertation under my supervision.

.....  
Samantha Rajapaksha  
(Signature of the Supervisor)

...../...../..... Mr.

## **2)ACKNOWLEDGEMENTS**

I highly appreciate all the support received from the academic staff for providing guidance and advice. Another important source of information I got is from a paper regarding “Extracting Common Sense Knowledge from Text for Robot Planning” and “Enabling Robots to Understand Incomplete Natural Language Instructions Using Commonsense Reasoning” Also, I would like to thank my supervisor Mr. Samantha Rajapaksha who helped me a lot to do this.

### **3) ABSTRACT**

Enhance the chance to identify the instructions or incomplete sentence given by a human as a command sentence by using the Natural Language processing and model creating. It would be facilitating the interaction between the human and mobile service robot.

However, when human give the instruction there can be incompleteness or else missing. Which information that are related to the environment. That because of human normally based on the common sense depend on the environment. Then human brain will complete all those incomplete sentences by using the commonsense knowledge. In this research project itself, introduced a model of a service robot who can compete the given incomplete instructions and display the related sentences or words and finally move to the related objects which are in the environment of the robot. All those things happen by using a simulator. To this first it will consider and identify the objects in environment and then consider the given natural language instruction by human. As a first step of the approach complete the incomplete sentences those sentences are coming as natural language instructions. By parsing it into as the frame can identify the related words by using the created model or can call as language model and here used some identify words from the human common sense also, using those identified words as a first step create the code and then implement the model. then the service robot will learn about the commonsense knowledge automatically from the parsing sentences as a speaker. Considering all the parsing sentences it calculates and measure the accuracy of this service robot model. Simply this is a commonsense reasoning model. The result of the provided solution can enable the robot model who works in ROS environment to identify and automatically perform to the tasks.