Olmeca 2021 Team Description Paper

Diana López López* Julio César Sandria Reynoso
Adolfo de Jesus Pedraza Monge,
Anabel Bellido Varela, Eduardo Josué Cortés Gómez
Héctor David Kennedy Cabrera
Universidad Tecnológica del Sureste de Veracruz
*diana.lopez@utsv.edu.mx

May 24, 2021

Abstract. This document presents the Olmeca team that represents the Universidad Tecnologica del Sureste de Veracruz, through the Jaguarbot robot to participate in the RoboCup @ Home 2021.
The main task to be solved by the robot is voice recognition to execute a movement command of the servomotors in the robotic arm, as well as the use of vision sensors for tracking a person.

1 Introduction

The Olmeca team is conformed by students and professors from the Mechatronics Engineering career at the Universidad Tecnologica del Sureste de Veracruz to participate in the RoboCup@Home 2021 n the OPL classification.

Web site: http://www.robotica.utsv.mx/en/robocup-en/

Classification video: https://youtu.be/9xfVrU0nQ6E

The team is formed by: Mechatronics study program students:

Daniela Sarahí Cruz Hernández, Johan López Castillo, Melvin Ramón Leal Quiroz.

Mentoring team:

Julio César Sandria Reynoso (MSc in Artificial Intelligence) Anabel Bellido Varela (Mechatronics Engineer) Adolfo de Jesús Pedraza Monge (Mechatronics Enginneer) Diana López López (Mechatronics Enginner) Héctor David Kennedy Cabrera (MSc in Micro and nanosystems) and Eduardo Josué Cortés Gómez (Student of computer systems)

The Universidad Tecnologica del Sureste de Veracruz participates for the first time in the Robocup at home contest, with the name of robot jaguarbot (inspired by the Olmec Jaguar that symbolizes the darkness of mother Earth and Bot derived from the word Robot capable of performing operations autonomously)

It has a special interest in participating in the OPL league, providing implemetations in the field of service robots through the commercial robot Jupiter from the LattelRobotics company, has experimented with vision control, motorization planning, robotic arm control, as well as voice recognition to execute tasks.

In the following months, it is planned to work in real environments such as university classrooms, local restaurants and shopping mall parking lots. in order to acquire greater knowledge and sensitize our community about the high relevance of these automata.

Details of the robot hardware and software are found in the annex. The main task to be solved by the robot is voice recognition to execute a movement command of the servomotors in the robotic arm, as well as the use of vision sensors for tracking a person.

2 Research focus and interests of the group

The focus of this university group is to implement robot or automaton technology, applying navigation and visualization techniques to perform service activities in small university classrooms through tasks where the interaction of people can be supplied in support of the post-covid scenario.

2.1 Innovative technology and scientific contribution

We are a group new to the university starting to work in these areas, using training from Robocup @ Home Education and the Lattel Robotics company hosted by Dr. Jeffrey Too Chuan Tan

3 Robot Development

3.1 Open source Robot Plataform

The platform used is that of the Jupiter robot, a robot designed for educational solutions, it is an open platform, it has systems that personalize it (manipulator system, upper and lower vision, microphone, speakers) functions used for speech recognition applications and follow me.

The robot has a TurtleBot 2 platform, the TurtleBot2 can execute SLAM logarithms (simultaneous location and mapping) to build a map and drive around the room or stage, it has a mounting structure where various types of hardware can be placed, as well , has software for its control, libraries for visualization, planning and perception is compatible with ROS.

ROS: Robot operation system it is open source software for the Robot, which provides us with a large collection of robotic tools and libraries. With Ros as fundamental software, it allows the work to be adapted so that we can carry out the manipulation of the navigation, vision and speech functions of the robot to be able to carry out the task in robocup home.

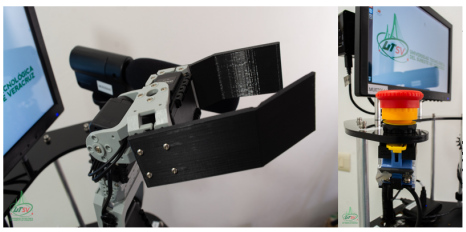

Fig. 1. Robot accesories

Robot navigation: The Kobuki system and the MS Kinect sensor are the mobile base of the robot, the navigation package is from Turtlebot, the previous application is used for the recreation of maps with Gmapping and localization with Rviz running ROS on Ubuntu 16.04 LTS.

The robot can go to a certain location that is indicated from the map, generating a navigation route.

Robotic arm and manipulation of objects: We are using TurtleBot Arm9 for object manipulation. It consists of 5 Dy-namixel AX-12A servo motors, controlled by an ArbotiX-M / USB2 Dynamixel controller board. A raised arm is developed for flexible height manipulation. The current design aims to allow the manipulation of objects in height ranges from 0.4 m to 0.8 m. Fig 1.

Speech interaction and location of the sound source: For human speech interaction we use CMU pocketsphinx, as our Robot is a lightweight speech recognizer, it is based on a support library called sphinxbase. The recognizer requires a language model and a dictionary file that can be built automatically from a corpus of sentences, for text to speech (TTS) we are using the CMU festival system together with the ROS package sound-play. In order to improve the efficiency of speech recognition, we use a strategy for the robot to hear the trigger keyword, recognize itself, and switch to searching for programs to recognize the actual command.Once the command has been recognized, the robot can switch to grammar search to acknowledge confirmation and then return to keyword listening mode to wait for another command.

4 Robot application relevance

Different packages are used so that the robot can carry out activities such as: the initialization of the Turtlebot base, the enablement of the arm motors, the spatial vision for tracking people, as well as the configuration of voice recognition from the development from a dictionary where it is capable of executing activities such as "open" the claw of its arm to hold a bag or luggage, as well as following the person to a specific point, the latter was worked with the python programming language.

With this application of the robot you can work with the implementation of mapping, travel sensors, tasks are optimized from voice commands, it allows

detecting obstacles and avoiding them, the efforts made in this work group allow articulating the different university careers and promote the adoption, adaptation and use of free software and hardware.

References

1. Subir Kumar Saha. *Introducción a la Robótica*, volume 1. McGraw-Hill España, México, 2011.
2. Jhon J Craig. *Robótica*, volume 1. Pearson Educación, España, 2006.
3. RoboCup at Home Education. *Open Course Ware for AI focused service robotics*, volume 1. RoboCup at Home Education, none, 2020.
4. Antonio Barrientos. *Fundamentos de Robótica*, volume 2. McGraw Hill España, España, 2012.

Annex: Jaguarbot Hardware Description OPL

Universidad Tecnológica del Sureste de Veracruz.

The jaguarbot robot is based on the design of the Jupiter robot from the LattelRobotics company . Specifications are as follows:

- Base: Turtlebot2, 50cm/s max speed.
- Robot dimensions: height: 0.92 m (max), width: 0.35 m depth 0.35m
- Robot weight: 9.5 kg.
- Maximun angular speed: 180 deg/s
- Vertical slopes: detects slopes greater than 5 cm in height
- Maximum slope: overcome slopes of up to 12mm.
- Operating time:3 - 7 hours

Also our robot incorporates the following devices:

- Motor overload detection
- Odometry: 25718.16 ticks/ revolution.
- Gyro: default calibration, 1 axis (100 deg/s).
- Bumpers: left, center, right.
- Status LED
- Battery: Lition-Ion 2200mAh
- Computer: Intel NUC i5, 120GB SSD, 8 GB DDR

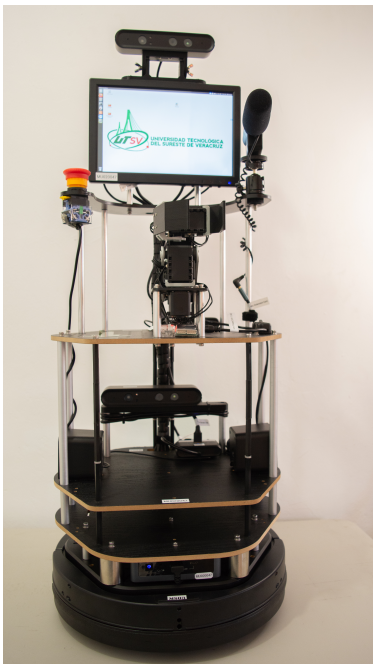

Fig. 2. Jaguarbot

Robot's Software Description

For our robot we are using the following software:

- Platform: Ubuntu Operating system 16.04 Lts.
- Navigation: Kobuki drivers for ROS and other C++ enviroments, Gazebo
- Face recognition: Opencv
- Speech recognition: based in language model mode Sphinx
- Speech generation: based in language model mode Sphinx

External Devices

Jaguarbot robot relies on the following external hardware:

- Microphone:1 omni-directional condenser by Takstar
- Speakers USB plug 3.5 mm.
- Camera: 2 Astra S 3D
- arm degree of freedom: 5