

# Práctica 1

## Instalación de Herramientas de Software

### Laboratorio de Bio-Robótica

### Robots Móviles

Duración 2 semanas

## Objetivos

- Familiarizar al alumno con el uso del sistema operativo Linux, distribución Ubuntu versión 16.04
- Aprender los conceptos básicos del sistema de simulación Robotics Students

## Desarrollo

### 1. Instalación de Ubuntu 16.04

Instale Ubuntu de preferencia la versión 16.04, para ello, descargue la imagen de la siguiente dirección:

<http://releases.ubuntu.com/16.04/> (Asegúrese de descargar la versión correcta, de 32 o 64 bits)

Para instalar Ubuntu desde Windows, se pueden seguir las instrucciones de la siguiente página:

<http://www.ubuntu.com/download/desktop/create-a-usb-stick-on-windows>

Se recomienda instalar el sistema operativo de manera nativa en un disco duro externo y no en una máquina virtual.

El simulador también funciona para las versiones de Ubuntu 18.04 y 20.04, solamente que hay que usar la versión de python2.7, con el siguiente comando cuando se use el simulador:

```
python2.7 GUI_robotics_students.py
```

Para resolver las dependencias utilizar los siguientes comandos:

```
sudo apt-get install python-tk
```

```
sudo apt-get install python-numpy
```

### 2. Instalación del simulador de robots Robotics Students

Una vez instalado Ubuntu, descargue de la página: <https://biorobotics.fi-p.unam.mx/courses/robots-moviles/> los archivos robotics\_students.zip y data\_students.zip.

Descomprimir los archivos en /home/<usuario>

Siga las instrucciones del apendice A para la instalación y ejecución del software.

## **Evaluación**

La práctica se considerará entregada mostrando al instructor la ejecución del simulador en su computadora.

## **Apendice A**

# Robotics Students

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# Robotics Students

Robotics Students is a system to test robots' behaviors developed by engineering students.

To use it please follow the next instructions:

1. Using an Ubuntu-Linux operating system, unpack `robotics_students.tar.gz` in the user's directory.
2. Unpack `data_students.tar.gz` in the user's directory.
3. Open an X terminal and go to the directory where the programs are with the following command:

```
cd robotics_students
```

Change the permissions of the file `robotics_students_make` with the following command:

```
chmod 777 robotics_students_make
```

Compile the source files with the following command:

```
./robotics_students_make
```

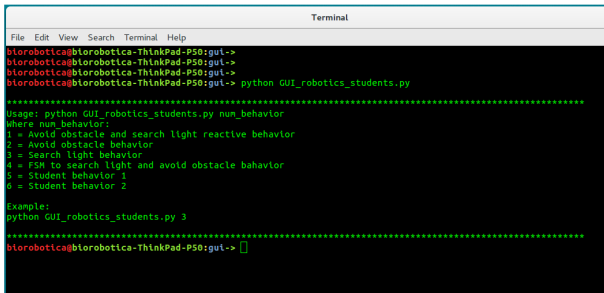
# Robotics Students

During compilation is possible that some warnings will appear.

## 4. GUI usage:

If there were no critical compilation errors, go to directory gui and type the following command to see the system usage:

```
python GUI_robotics_students.py
```



```
Terminal
File Edit View Search Terminal Help
blorobotica@blorobotica-ThinkPad-P50:gui->
blorobotica@blorobotica-ThinkPad-P50:gui->
blorobotica@blorobotica-ThinkPad-P50:gui-> python GUI_robotics_students.py
*****
Usage: python GUI_robotics_students.py num_behavior
where num_behavior:
1 = Avoid obstacle and search light reactive behavior
2 = Avoid obstacle behavior
3 = Search light behavior
4 = FSM to search light and avoid obstacle behavior
5 = Student behavior 1
6 = Student behavior 2
Example:
python GUI_robotics_students.py 3
*****
blorobotica@blorobotica-ThinkPad-P50:gui-> □
```

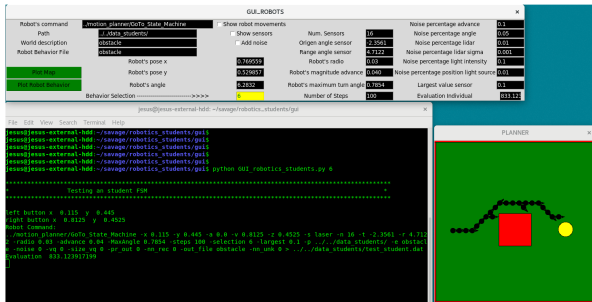
# Robotics Students

5. Select the type of behavior to be tested after the command `python GUI_robotics_students.py`

For example to test "Student behavior 2", type the following command:

```
python GUI_robotics_students.py 6
```

In the PLANNER window select the robot's origin with the mouse's left button. Select the robot's destination with the mouse's right button.



# Robotics Students

6. Different behaviors can be selected in the Behavior Selection option. In the field World description can be selected the environment where the simulated robot operates, there are 14 environments: obstacle, random\_1, random\_2,..., random\_13. When a new environment is selected push the Plot Map button to display it.

The result of robot's results can be seen again pushing button Plot Robot Behavior. To display the robot's sensors select the check button Show sensors.

# Robotics Students

To display the movement of the robot step by step select the check button Show robot movements. To add noise to the sensors and to the movement select the check button Add Noise.

The screenshot displays the GUI\_ROBOTS application interface, which is divided into several sections:

- Configuration:** Includes fields for Robot's command (./motion\_planner/GoTo\_State\_Machine), Path (/data\_students/), World description (obstacle), and Robot Behavior File (obstacle). There are checkboxes for "Show robot movements" and "Add noise".
- Sensor and Movement Data:** A table showing various parameters:

Num. Sensors	16	Noise percentage advance	0.1
Origin angle sensor	-2.3561	Noise percentage angle	0.05
Range angle sensor	4.7122	Noise percentage lidar sigma	0.01
Robot's radio	0.03	Noise percentage light sigma	0.001
Robot's magnitude advance	0.040	Noise percentage light intensity	0.1
Robot's maximum turn angle	0.7854	Noise percentage position light source	0.01
Number of Steps	100	Largest value sensor	0.1
		Evaluation Individual	833.12
- Behavior Selection:** A dropdown menu currently set to "6".
- Terminal:** Shows the execution of the GUI, including the command `python GUI_robotics_students.py 6` and the output of the motion planner, such as `..../motion_planner/GoTo_State_Machine -x 0.115 -y 0.445 -a 0.0 -v 0.8125 -z 0.4525 -s laser -n 16 -t -2.3561 -r 4.7122 -radio 0.03 -advance 0.04 -MaxAngle 0.7854 -steps 100 -selection 6 -largest 0.1 -p ../data_students/ -e obstacle -noise 0 -rec 0 -size-vn 0 -pr out 0 -nm-rec 0 -out_file obstacle -nm_unk 0 > ../data_students/test_student.dat`. The evaluation result is `833.123917199`.
- PLANNER:** A 2D environment map showing a green field with a red square obstacle, a yellow circle representing the robot, and a blue path of dots indicating the robot's movement.