Mid-term Task

Group Assignment.

Deadline: Video , Codes and Report (14-04-2024) , Demo and Hardware (18-04-2024)

1. **Create a Differential Drive Robot**:
    - Design or choose a differential drive mobile robot platform (turtlebot3 burger is recommended) then manufacturing and Hardware implementation.
    - Interface motors and sensors (such as encoders for wheel odometry) with an Arduino board. You can use ROS packages like **rosserial_arduino** to communicate between ROS and Arduino.
    - Write embedded code to control the motors based on the commands received from ROS.
2. **Teleoperation Node**:
    - Write a Python script to create a teleoperation node.
    - Use ROS **Twist** messages to send velocity commands to the robot.
    - This node will subscribe to the teleoperation commands (e.g., keyboard input or joystick commands) and publish Twist messages to control the robot's motion.
3. **Visualize Robot Motion in Gazebo**:
    - Create a URDF (Unified Robot Description Format) file for your robot model, including the differential drive base, wheels, sensors, etc.
    - Launch Gazebo simulator with the URDF model using **roslaunch**.
    - Use the **robot_state_publisher** to publish the robot's joint state.
    - Integrate wheel odometry data with Gazebo to simulate the robot's motion accurately.
4. **Testing**:
    - Test your teleoperation node by driving the robot around in Gazebo.
    - Make sure the robot moves as expected based on the teleoperation commands.
5. **Debugging and Optimization**:
    - Debug any issues encountered during testing.
    - Optimize the teleoperation node and robot control for better performance if necessary.
6. **Documentation**:
    - Document the setup, implementation, and any troubleshooting steps.
    - Provide clear instructions on how to run the teleoperation node and visualize the robot in Gazebo.

Best regards,

Dr. Hossam Ammar