Vision-Guided Autonomous Navigation in ROS (TheConstruct.ai)

Objective:

Develop an autonomous mobile robot simulation in TheConstruct.ai using ROS, focusing on vision-based navigation and object recognition.

Step-by-Step Instructions:

Before proceeding to the actual programs make sure you install and setup the ROS Noetic in your Ubuntu. Use this Install ROS Noetic link for installing and for setup the Noetic.

Step 01 : Book the TurtleBot3 Model

Step 02 : Set the TurtleBot3 Model

This tells ROS what model of TurtleBot3 you're using.

Paste this in your terminal:

```
echo "export TURTLEBOT3_MODEL=waffle_pi" >> ~/.bashrc
source ~/.bashrc
```

Step 03 : Install TurtleBot3 Gazebo Package

This installs the simulation environment.

Paste this in your terminal:

```
sudo apt-get update
sudo apt-get install ros-noetic-turtlebot3-gazebo
```

Step 04 : Launch the Gazebo Simulation

This opens the Gazebo simulation with TurtleBot3 in a default world.

Paste this in your terminal:

```
source /opt/ros/noetic/setup.bash
source ~/catkin_ws/devel/setup.bash
roslaunch turtlebot3_gazebo turtlebot3_world.launch
```

Wait until the robot appears in the Gazebo world before moving on.

Step 05 : Create Your ROS Workspace [Create a new terminal by clicking (+)]

Paste this in your new terminal:

```
cd ~

mkdir -p catkin_ws/src

cd catkin_ws

catkin_make

source devel/setup.bash
```

Step 06 : Create Your ROS Package

You'll create a new package named vision_nav.

Paste this in your terminal:

```
cd ~/catkin_ws/src

catkin_create_pkg vision_nav rospy std_msgs sensor_msgs cv_bridge geometry_msgs
```

Step 07 : Create the Python Script for Color Tracking

Paste this in your terminal:

```
cd ~/catkin_ws/src/vision_nav

mkdir scripts

cd scripts

touch vis_gui_aut_nav.py

chmod +x vis_gui_aut_nav.py
```

Step 08 : Install Dependencies

You need OpenCV and cv_bridge to process images.

Paste this in your terminal:

```
sudo apt-get update

sudo apt-get install ros-noetic-cv-bridge python3-opencv
```

Step 09 : Paste the Python Code into vis_gui_aut_nav.py

Open the file using a text editor (e.g., nano or VS Code) and paste the following code: **[catkin_ws > src > vision_nav > scripts > vis_gui_aut_nav.py]**

Python Code : vis_gui_aut_nav.py

Step 10 : Build the Workspace

Paste this in your terminal:

```
cd ~/catkin_ws

catkin_make

source devel/setup.bash
```

Step 11 : Run the Color Tracker Node

Make sure the simulation is already running, then in a new terminal tab, run:

Paste this in your terminal:

```
source ~/catkin_ws/devel/setup.bash

rosrun vision_nav vis_gui_aut_nav.py
```