Bobert Prime & Drivebert
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Bobert is an experimental modular AI robot designed to explore the boundaries of machine perception, decision-making, and learning. This repository includes:

- bobert_prime.py -- Core AI controller: handles speech, hearing, vision, movement decisions, and reinforcement learning.
- drivebert.py -- Movement relay script: sends movement commands to an Arduino Nano based on log entries.
- Drivebert Arduino Nano section.tex -- Documentation on the Arduino Nano wiring and command logic for motor control.

Features

Bobert Prime:

- Audio Input & Output: Records environmental sounds, randomly decides whether to respond, and generates speech-like audio playback.
- Vision Logging: Captures images with libcamera-still, logs them with movement decisions.
- Movement Planning: Chooses the best direction (left, right, forward) based on past reinforcement outcomes.
- Reinforcement Learning: Two GPIO buttons connected to the Raspberry Pi allow real-time reward or punishment input.
- Logging System: Logs all data (audio, visual, movement, state, and reinforcement) to a persistent memory folder.

Drivebert:

- Reads the latest movement decision from the terminal log.
- Sends serial commands to the Arduino Nano (f, l, r, or n).
- Avoids repeating the same command to reduce motor noise and jitter.

Hardware Requirements

- Raspberry Pi 4 (or equivalent with GPIO and camera support)
- USB Microphone
- Speaker (3.5mm or USB)
- Raspberry Pi Camera (compatible with libcamera)
- 2 GPIO-connected buttons (Reward on GPIO 12, Punish on GPIO 16)
- Arduino Nano
- L298N Motor Driver
- 4 DC motors (or adapted for your configuration)

Software Requirements

Install the required Python packages:

```
    pip install sounddevice numpy scipy opencv-python RPi.GPIO pyserial
```

Make sure your Raspberry Pi has libcamera installed and accessible via command line.

Installation & Running Instructions

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1. Clone this repository or download the files to your Raspberry Pi.

2. Ensure your hardware is properly wired and connected:

   - Microphone and speaker
   - Pi camera module
   - Reward and punish buttons on GPIO 12 and 16
   - Arduino Nano connected to USB and motor driver

3. Install dependencies using pip (see above).

4. Run Bobert Prime:

```
python3 bobert_prime.py
```

5. In a separate terminal, run Drivebert:

```
python3 drivebert.py
```

6. Ensure the Arduino is running the correct firmware and listening for serial commands.

Arduino Setup

Refer to the Drivebert Arduino Nano section.tex file for detailed wiring and firmware information. The

Arduino listens for single-character commands and moves the motors accordingly.

File Structure

```
bobert_prime.py                  # Main AI control loop
drivebert.py                     # Movement control via serial
Drivebert Arduino Nano section.tex  # Arduino motor driver wiring and config
/media/Bobert/MEMORYBERT/logs/      # Persistent memory (audio, images, logs)
```

License & Credits

Created by Finn Cullen

This project is part of the OpenBeing Robotics initiative.