UROP Proposal: Robot Pupper

Project Description

Over the years, voice commanded electronics have become widely popular. They can be seen implemented on smartphones and virtual assistants such as Amazon Alexa and Google Assistant. The video gaming industry has also applied this to their products, with games such as Yasuhati, which reads the volume of a player's voice to make the character mobile, and Phasmophobia, a horror game that is able to understand the specific words of the player and acts upon it. There are, however, some limitations to the current state of voice-command electronics. For starters, there is no sense of companionship between the user and the electronic. While Amazon Alexa and Google Assistant try to accomplish this by using AI trained voice assistants, it is hard to gain an emotional connection. Additionally, many products with voice-commands generally have to be plugged into an outlet to be used which makes them hard to use while moving around outside of the residence. The question was raised of, what if this functionality was fused with other machines, not simply gadgets that are able to speak back but can physically act upon the commands? This is a question that the Robot Pupper Project intends to tackle.

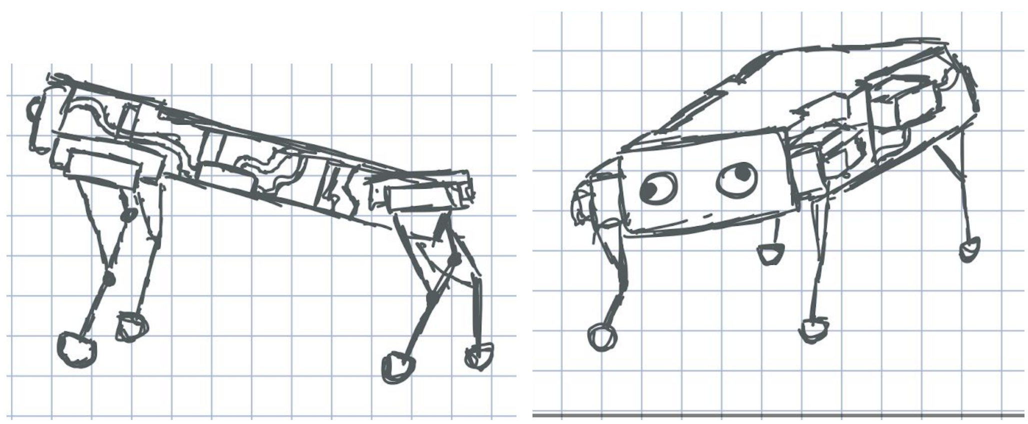

Figure 1. Inspired Diagram

Inspiration for the Robot Pupper Project comes from the Stanford pupper (hence the similar names). The team behind it, Extreme Mobility, created an "inexpensive 12 degree-of-freedom robot capable of walking on various terrain, hopping, and being cute". Here, we envision to create a version of our own but with additional features. In contrast to their robot's utilization of a controller to operate the pupper, we're hoping to create a machine that has a capability to act like a lifelike pet, being able to respond to the speaker's voice and autonomously move on its own.

The Robot Pupper Project aims to combine the convenience of voice control functionalities with a tactile and agile robot companion. For the voice control function to shine through and as a corequisite for this project to succeed, high mobility of the pupper is a partnered priority. In addition to the research that will go behind the functions of voice control, an extensive amount of time will be dedicated towards the movement mechanism to operate the physical structure of the robot. The robot must be able to do not only the basics of walking and turning but also more complex movements, including walking backward, crawling, jumping and potentially performing tricks, such as rolling over. This is all while utilizing object detection and recognition software though voice control. All these capabilities will be given a final check at the competition taking place at the end of the year, where all teams under Robot Pupper compete against each other under a variety of trials.

With this project, our team hopes to put a new perspective on the connection between the human and machine world. With building a companion that very much resembles a puppy, we hope to incite emotion from the user, bringing them closer and producing a sense of companionship. Moreso, throughout this year, we hope to become well-versed on mechanical and embedded systems, and open the door even wider for applications of such technology.

Approach + Responsibilities

There are many intricacies involved in making this project happen, which will require everyone's diligent research. Because this team is composed of undergraduates with differing STEM majors, work will be allotted to whoever applicable, so anyone with the expertise can provide good insight as the rest of the team will provide feedback. The mechanical team is responsible for 3D Modeling the parts to help the team visualize the product; the programming team will research the embedded systems for voice and object sensors, implementing a speech to text program that the system can recognize; the hardware team will work in conjunction with the mechanical team to visualize and devise the movement mechanism of the robot. The project will be completed in four primary steps; design, software, manufacturing and optimization, checked off throughout the year.

Team Members + Project Roles

Software (Programming): Gabe Villena, Johnny Tran, Arienne Agno
Hardware (Wiring, Electrical): Johnny Tran, Arianne Agno
Mechanical (CAD, SW Drawings): Angelina Licos, Colin Nisbet, Allana Ilagan
Manufacturing (3D Printing, Assembly): Allana Ilagan, Angelina Licos

Faculty Advisor:

David Copp
Assistant Professor of Teaching
Mechanical and Aerospace Engineering
dcopp@uci.edu

Project Timeline

Itemized Budget

Part	Name	Cost (USD)	Link
Servo Motors	ANNIMOS 20KG Digital Servo High Torque Full Metal Gear Waterproof for RC Model DIY, DS3218MG,Control Angle 270°	203.88	Amazon
Controller	DualShock 4 Wireless Controller for PlayStation 4 - Magma Red	64.98	Amazon
Battery	Zeee 4S 14.8V 7200mAh 80C RC LiPo Battery Hard Case with EC5 Connector for RC Buggy Truggy Crawler Monster Car Boat Truck	65.69	Amazon
Magnetometer	SparkFun VR IMU Breakout - BNO080 Combination triple-axis accelerometer/gyro/magnetometer SiP Virtual Reality Triple axis sensor board I2C and SPI Qwiic connector For Android-based cellular devices	34.95	Amazon
Microcontroller	Teensy LC with pins	17.7	Amazon
Breadboard	ELEGOO 3pcs MB-102 Breadboard 830 Point Solderless Prototype PCB Board Kit for Arduino Proto Shield Distribution Connecting Blocks	8.99	Amazon
Breadboard Wires	24 Gauge Wire - 6 Colors Tinned Copper Wires with Silicone Rubber Insulation (Black, Red, Yellow, Green, Blue, White) 30ft / 9m Each - 24 AWG Stranded Hook Up Wires from Plusivo	12.99	Amazon
Raspberry Pi	Raspberry Pi 3 Model B+ Board (3B+)	37.1	Amazon
Micro SD Card	Samsung (MB-ME32GA/AM) 32GB 95MB/s (U1) microSDHC EVO Select Memory Card with Full-Size Adapter	7.49	Amazon
Raspberry Pi Power Source	Raspberry Pi Lipo Battery Power Hat with USB Hub	13.9	Tinkersphere
Voice Sensor	MOVI Speech Recognizer and Speech Synthesizer Shield Compatible with Arduino (Speech Recognition ASR Board)	74.9	Amazon
Adapter	Raspberry Pi MOVI™ Adapter	6.5	Audeme
Ultrasonic Sensor	SainSmart HC-SR04 Ranging Detector Mod Distance Sensor (Blue)	4.95	Amazon
Infrared Sensor	DIYmall 5 Pack HC-SR501 Pir Motion IR Sensor Body Module Infrared for Arduino	8.99	Amazon
Pixy Cam	Pixy2 CMUcam5 Sensor	64.95	Adafruit
Speaker	2 Inch 5W 8 Ohm Miniature Full Range Speaker	13.48	Newark
Total		**641.44**	

References

[1] https://stanfordstudentrobotics.org/robots