Mechanical Boots

By Miguel Guerrero
Mentor Francisco R. Ortega

Abstract

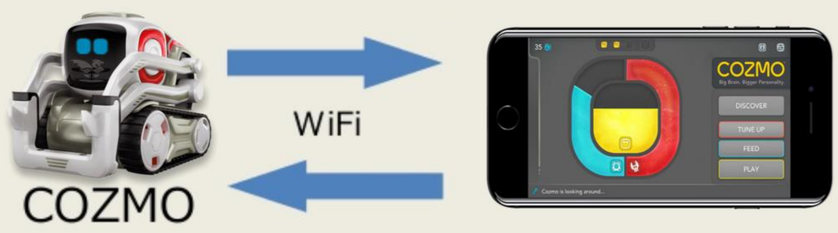
In the event of a natural disaster saving human lives is the first priority and robots could be used to assist these efforts. We can use the capabilities and the hardware of robots to better navigate the environment when it's too dangerous for living beings. The robots can receive commands, operate autonomously, or be connected to another peripheral to enhance its functions. If we train a robot to detect potential dangers and harmful substances and report it back in real time, then it could be used to relay assessments without risking human or animal lives. Robots can serve as scouts, or boots on the ground, for pre and post environmental disasters denoting hazards and safety concerns. My goal is to establish a real-time connection and communication between the Microsoft HoloLens, an augmented reality headset worn by a user, and the robot "Cozmo" for use in uninhabitable areas. I will use software, including Python and TensorFlow, to train Cozmo to perform autonomous tasks. Throughout training, I will document the process as a current protocol is not readily available. I want to be able to determine the practicality of reporting a communication from Cozmo to the headset. Successful results would be the worn HoloLens receiving live time and visual feedback from Cozmo for the user to be able to make decisions. If effective training and communication are established between the robot and the headset, this model could be applied to another robot or technologies, for example, a drone for aerial feedback.

Objective

Utilizing the capabilities and the hardware of robots to better navigate the environment when it's too dangerous for living beings can save lives. Using a small robot for testing purpose to see the practicality and hardware use before testing on a established robot. Improve upon what has been made already with the use of Machine Learning to better detect harmful environment.

Figures

Fig 1. Cozmo

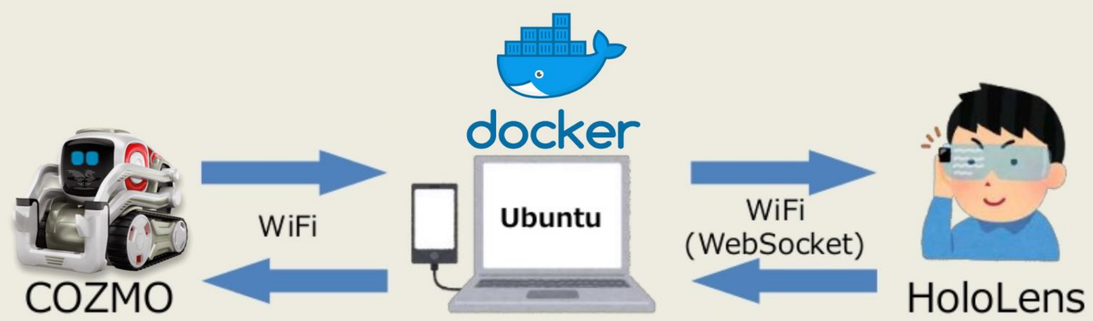


Anki Cozmo is a AI-powerd robot with a personality that evolves the more you spent time with it. At its core it's a toy, but it has a well documented software development kit (SDK) that allows people to program the robot in Python. Cozmo operates natively with a smart phone app. It establishes a Wi-Fi connection to work as intended.

Fig 2. HoloLens

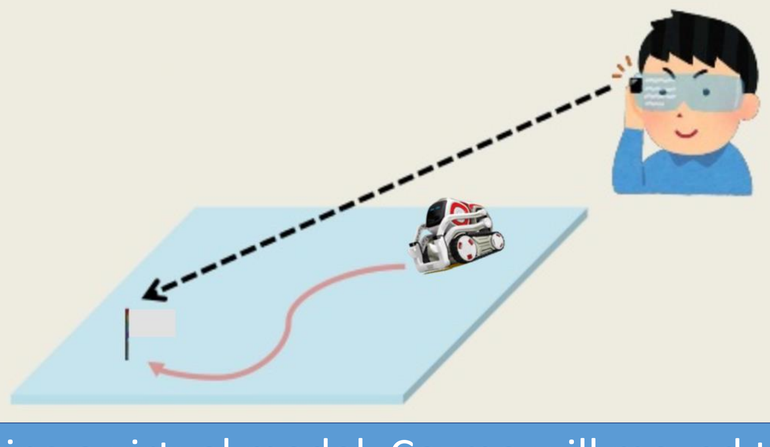
Microsoft HoloLens is an Augmented reality headset that allows the user to see the physical environment with 3D holographic models overlade. The HoloLens is a stand alone hardware that does not need a connection with a computer. Development on the HoloLens can be done with Unity, a cross-platform real-time engine.

Fig 3. Connection



To get the robot to "talk" to the HoloLens I need to use ROS. ROS is a middle ware that allows the user low-level device control, hardware abstraction, and much more. My use was to get the odometry of the robot. I utilized a WebSocket connection, a computer communications protocol to send information back and forth.

Fig 4. Implementation



Manipulating a virtual model, Cozmo will moved to a desire location. A model can be overlaid on Cozmo to always see him when an object is in front of it. Having implemented all this Cozmo can also be controlled with gesture that the HoloLens tracts with its onboard camera. Having this dual connection, it allows a live view of Cozmos camera feed in real time.

Conclusion

This project is a proof of concept. Future directions are moving away from Cozmo and augmented reality and focusing on building my own robot and using virtual reality. The reason for my own robot is to have more control over the hardware due to Cozmo having hardware limitation. The reason for virtual reality is to take control of said robot omnidirectional movement. Future implementation is utilizing TensorFlow to train a model on potential harmful environments.