Facial Recognition and Learning with Embedded Computing

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Research

Title: Facial Recognition and Learning with Embedded Computing

Human fascination with robotics continues to grow as technologies and algorithms improve. One way in which humanoid robots can behave more like humans is to design robots to distinguish between objects and people, as well as learn to recognize new objects and people. An algorithm was developed using Local Binary Pattern Histograms (LBPH) for facial recognition, and a combination of K Nearest Neighbors (KNN) and confidence threshold values for facial learning. The system is designed for a Cellulary Accessible Expressive Semi-Autonomous Robot (Robot-Head), a humanoid robot in development at NYU-Poly's mechatronics lab. Robot-Head's eyes consist of two webcams that may be used for face recognition and learning. However, the system was implemented and initially tested on a laptop with a built in webcam. Robot-Head continues to grow as parts are continuously designed, made, and tested on the robot's body. Currently Robot-Head's processing and control comes from an attached laptop acting as its brain. The use of a single-board, embedded computer, e.g., a Raspberry Pi, was investigated to replace the laptop. Initial testing revealed that video capturing on the Raspberry Pi is slower than that of a laptop. However, the facial recognition and learning system was still able to recognize and label known faces and learn new faces using the embedded device. Such a system with facial recognition and learning on an embedded device may be used in robots, security systems, or even as smart doorbells.

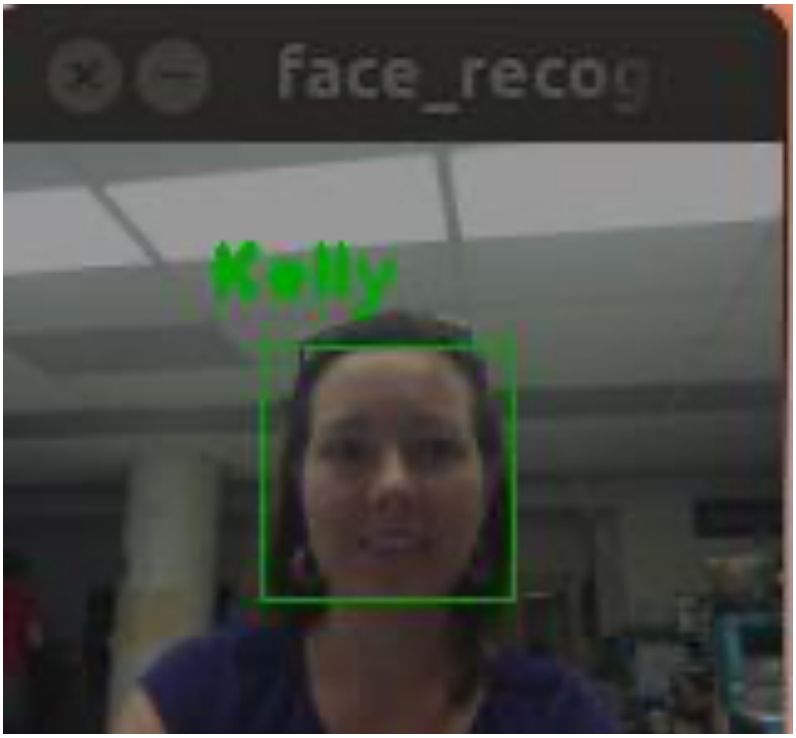
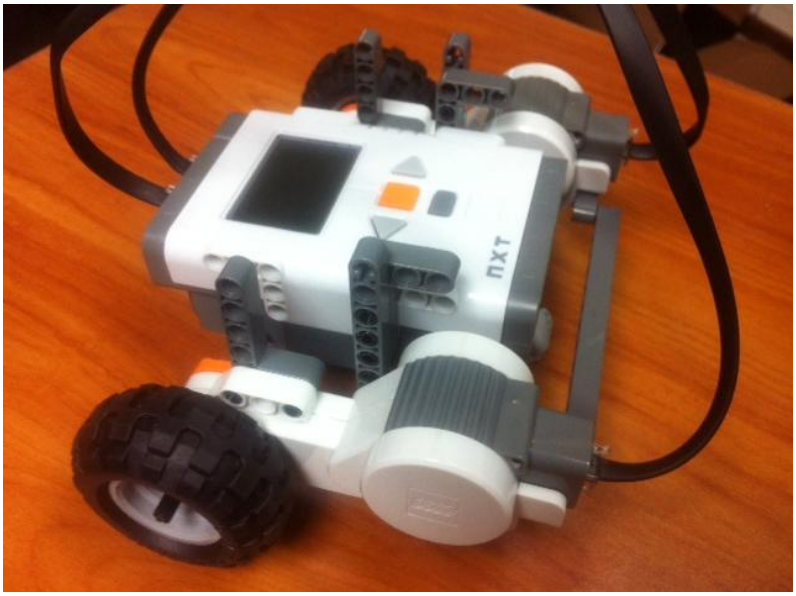


Illustration of facial recognition and a single-board embedded computer

Lesson Plan

Title: Angular Velocity: Sweet Wheels

Groups of students will predict, measure, and analyze the relationship between linear velocity, wheel radius, and angular velocity using a LEGO NXT robotic vehicle. Students will use pairs of wheels with various radii to compare the times the vehicle takes to travel a set distance. Group data is collected and analyzed to find the angular velocity of the vehicles, which are all set to the same motor speed. Students will experiment with the variables such as radii and motor speed (angular velocity) and other factors such as weight that they may discover, to optimize the speed of the vehicle. A group discussion will ensue relating the conclusions from the investigation to cars, trucks, bicycles, and other such vehicles.



Illustrative LEGO vehicle for classroom lesson