Teaching Emotion Recognition to Autistic Children with CAESAR

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Research

Title: Teaching Emotion Recognition to Autistic Children with CAESAR

Autism Spectrum Disorder (ASD) is a developmental disorder typified by repetitive actions, impaired communication and social skills, and delayed language development. Often autistic children fixate on one particular object in their environment and exhibit a heightened fondness for mechanical toys that move in predictable, repeated patterns. Children with ASD experience difficulty with self-expression and are overwhelmed by the subtleties of human facial expressions vis-à-vis the relatively simpler interaction with mechanical objects. Currently robotics is being explored to help engage autistic children to learn language skills and to develop empathy through caring for a robotic "pet." However, robot therapy options to engage autistic children to learn emotion recognition and emotion expression skills remain to be fully explored. Our work focused on Cellularly Accessible Expressive Semi-Autonomous Robot (CAESAR), a humanoid robot in development at the Mechatronics Lab of NYU Polytechnic School of Engineering. In particular, we worked on enabling the robot to make recognizable facial expressions that can be recognized by autistic children so that the skill developed with the robot can transfer to social interactions with other humans. An iPad app was designed to enable the children to select one of six specific emotions. Touching one of the expression icons enables CAESAR to enact the corresponding emotion dynamically, i.e., using facial expressions and arm gestures that reinforce the emotional state being portrayed. The emotions were based on psychologist Paul Ekman's research into non-verbal communication and his "Six Universal Emotions", the most immediately recognizable facial expressions that he observed among international cultures. The expressions of happiness, sadness, anger, surprise, fear and disgust are Ekman's universal emotions that are incorporated in our app. CAESAR and the emotion recognition app enables autistic children to strengthen emotion recognition skills by repeated exposure to the same facial expressions. The designed platform can also be used to help autistic children identify and express their own emotional state given their language deficits. CAESAR and the app are unique among the few emotion recognition options available among autism robot therapies in that the children can select the emotions that the robot demonstrates, allowing them to communicate through CAESAR in addition to building their social skills.

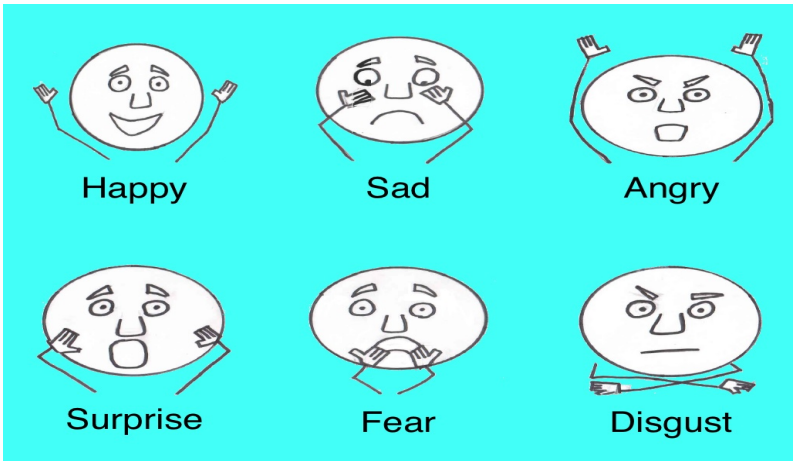

Figure: Emotion prototypes

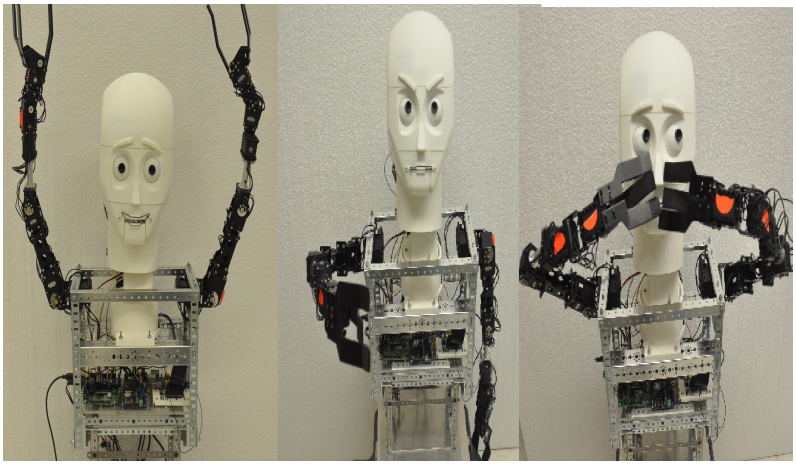

Figure: CAESAR is happy(left), angry (middle), and afraid (right)

Lesson Plan

Title: Infrared Temperature Measurements with the Boe-Bot: Real-world Robotics

Chernobyl and Fukushima have made recent news as the sites of some of the worse nuclear disasters in recent history, but how much do we really know about how those disasters were managed? This lesson requires students to view themselves as engineers at one of these sites who are tasked with determining how rapidly radiation disseminates to create an evacuation plan. The students use a mathematical table or inverse square law to predict the rate at which radiation leaks spread. To simulate how to detect the spread of radiation, students build a circuit using the Parallax Boe-Bot with an infrared sensor and review code for detecting light and heat sources. The Boe-Bot uses the infrared sensor to detect heat from a nearby light bulb that simulates the radiation, moving at intervals directly related to how much light and heat the sensor detects. Students will have the opportunity to revise the code and will use the inverse square law to determine if there are patterns to the extent that the light and heat increases from the source.

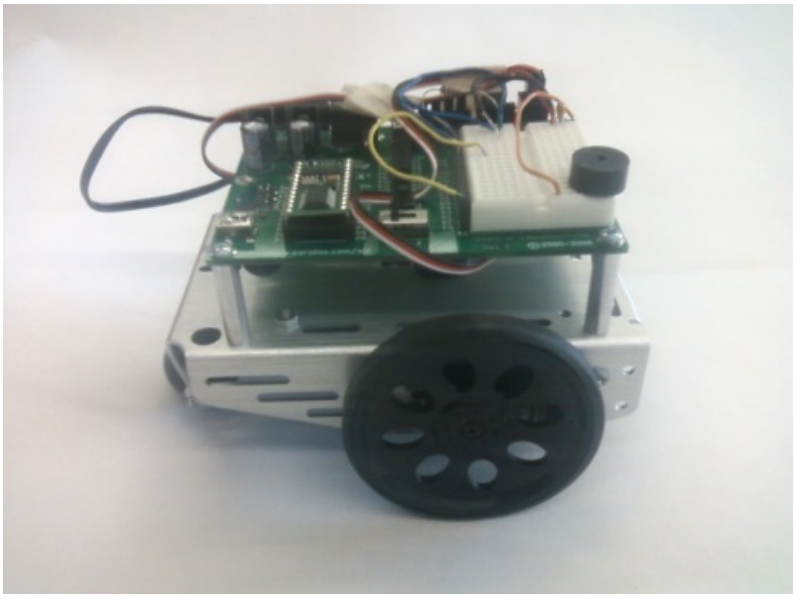

Figure: The Parallax Boe-Bot used for the lesson. The piezoelectric speaker attached to the circuit board sound an alarm at regular intervals when detecting heat and light.

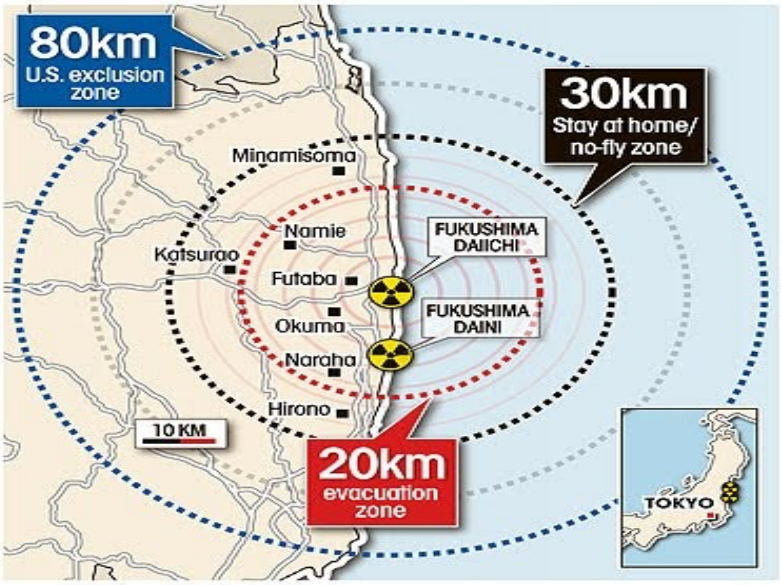

Figure: An actual map of the Fukushima nuclear disaster charting the spread of radiation and evacuation plant. The map is used to introduce the lessons and to emphasize its real-world applications.