Team 3 “Knuckles” Project Description (full outline below)

Our team aims to create a robotic arm that can detect its surroundings, pick up objects, and interact with people using AI.

The mechanical objectives of the arm are 6 degrees of rotational freedom, capacitive touch sensing, and dexterity.

* Rotational freedom allows the robot to access anything in its surroundings without any assistance
* Capacitive touch gives the robot feedback on objects it contacts
  + Sensors in hand when it pick up objects
  + Sensors on arm itself so it can react to being pet
* Dexterity
  + Robot should be able to reliably pick up an object and hand it to someone

The programming objectives of the arm include voice and face recognition, machine learning, and visual mapping.

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The Makerspace robotics team aims to design an assistive robotic arm that will operate on a desk or lab space.

Object and facial recognition will be handled using OpenCV and TensorFlow. These libraries will allow us to access and process images, while building a neural network to improve recognition. In addition, radar sensor will also be equipped to the arm to form a 3D map of the environment.

The arm’s 6-axis movement and mechanics will be developed using Robot Operating System, ROS, on Ubuntu. The gripper will be created in AutoCAD and 3D printed as we prototype.

Voice recognition and response is likely to be processed using an Arduino. When users make requests of the arm, it should …..

Technical skills, languages and capabilities learned by this project include: Python, C, C++, OpenCV, TensorFlow, ROS, Linux, ….. , Object Recognition, Facial Recognition, Speech Recognition, Machine Learning, Neural Networks, Artificial Intelligence, Robotics, ...

Additional objectives include: pet-like animations to create an organic response to users and environment.

* Overall Idea
  + The Makerspace robotics team aims to design an assistive robotic arm that will operate on a desk or lab space.
  + it can detect its surroundings, pick up objects, and interact with people using AI.
* List of Possible Applications
  + Assistive arm for
    - Lab use
    - People with disabilities
* More in-depth info
  + Mechanical objectives
    - 6 degrees of rotational freedom
      * allows the robot to access anything in its surroundings without any assistance
    - Capacitive touch gives the robot feedback on objects it contacts
      * Sensors in hand when it pick up objects
      * Sensors on arm itself so it can react to being pet
    - Dexterity
      * Robot should be able to reliably pick up an object and hand it to someone
  + Programming objectives
    - Visual Processing
      * will be handled using OpenCV and TensorFlow. These libraries will allow us to access and process images, while building a neural network to improve recognition. In addition, radar sensor will also be equipped to the arm to form a 3D map of the environment.
    - Machine learning
      * In connection with visual processing, robot will learn to recognize objects and how to find the best path to grab it
    - Voice recognition
      * Voice recognition and response is likely to be processed using an Arduino.
      * Recognizes different users’ voice
      * Robot can process commands that require a chain of steps e.g. “Give me a pencil”
      * Can also process movement commands e.g. “open hand”
    - Autonomous motion
      * 6-axis movement and mechanics will be developed using Robot Operating System, ROS, on Ubuntu. The gripper will be created in AutoCAD and 3D printed as we prototype.
* Learning objectives
  + Programming languages
    - Python
    - C
    - C++
  + Programs/Software
    - OpenCV
    - TensorFlow
    - ROS
    - Linux
    - AutoCAD
    - Arduino
  + Programming Concepts
    - Object Recognition
    - Facial Recognition
    - Speech Recognition
    - Machine Learning
    - Neural Networks
    - Artificial Intelligence
* Milestones
  + By the end of summer:
    - Prototype of arm
    - Working program for object recognition
    - Working program for voice recognition
    - Functional Gripper
  + End of Fall semester: