PROJECT R.I.C.K

Robotic · Integrated · Control · Kinect

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RIT Computer Engineering Senior Design Project—Fall 2017

An all-in-one system that takes input directly from a human's arm/hand movements from an array of multiple sensors to then be translated into machine code as output to control a robotic arm

Need

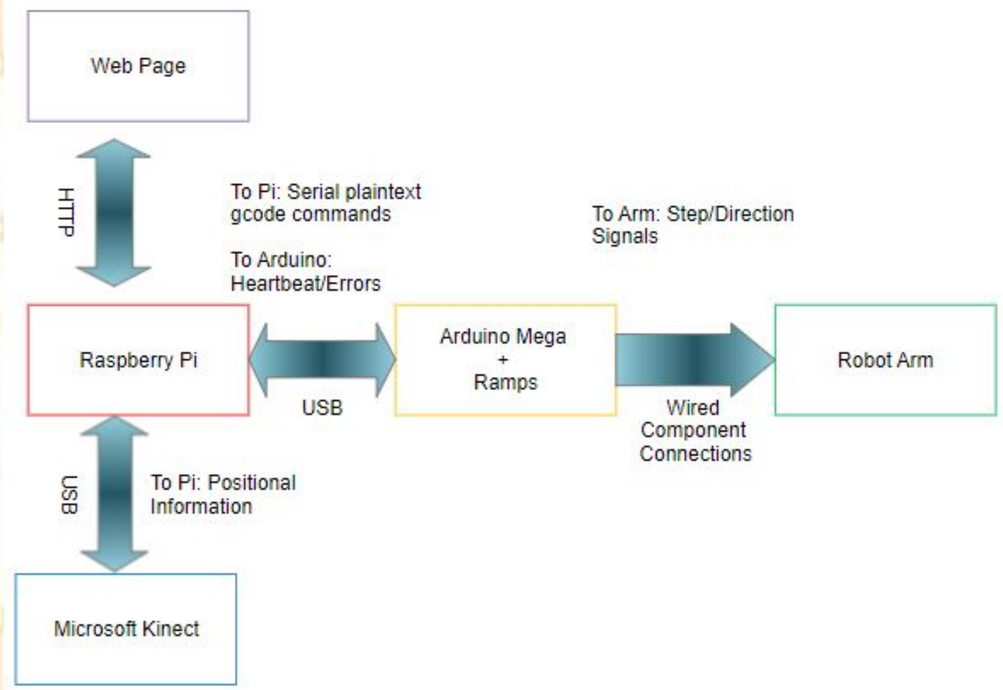
During the first half of 2017, a total of 19,331 robots valued at approximately $1.031 billion were sold in North America, which is the highest level ever recorded. These figures represent growth of 33% in units and 26% in dollars over 2016. This is expected to increase, resulting in demand for quicker and simpler programming procedures. Current robotic programming solutions are complex, need training, and require expensive programming units. Some systems even require technicians to be close to the robot that is being programmed, causing a potential risk to the human operator.

Objective

The objective of this project is to design and prototype a device that will convert human actions into robot code. Motion sensing technology will be used to gather the user's arm movements to intuitively control an industrial style robotic arm. The device will record these movements and translate them to G-code so that the robotic arm is swiftly and accurately programmed. The usage of the device will reduce the amount of time it takes to add or repurpose a robotic arm on an assembly line.

Overview

Project R.I.C.K is a reliable, real-time, remote-controlled system that translates a user's arm and hand movements into machine code for easy robotic arm programming. The system can repeat recorded movements taken from human movements. The system utilizes a Kinect that records the real-time movement and transmits it to a microcontroller to convert into code that the robotic arm understands and reproduces.



Technical Details

User Control - Microsoft Kinect 2.0, developed by Microsoft.

- Captures the movement and position of a user
- Outputs the data to a CSV file on the Raspberry Pi over USB
- Allows users to move a robotic arm through hand movements/gestures

Microcomputer - Raspberry Pi 3 Model B, developed by the Raspberry Pi Foundation.

- Receives input from the Kinect over USB
- Calculates the inverse kinematics of the robotic arm
  - Uses the ikpy python library developed by Pierre Manceron
  - Uses a Universal Robotic Description Format (URDF) file to model the robotic arm for the movement calculations
- Outputs G-code commands to Arduino Mega over USB

Robotic Arm - BCN3D Moveo, open-source design by BCN3D Technologies.

- 3D printed
- Joints controlled by stepper motors
- Paired with Arduino Mega
  - Receives input from Raspberry Pi in the form of G-code over USB
  - Controls the stepper motors

The Team

Part Description	Cost ($)	Team Cost ($)	Availability
Arduino Mega 2560	10.00	15.00	Banggood.com
Stepper/Servo - Various Types(7)	95.00	95.00	omc-stepperonline.com
RAMPS v1.4	10.00	10.00	Banggood.com
PSU	150.00	0.00	
Screws/Bolts	30.00	30.00	Banggood.com
Raspberry Pi 3	39.95	0.00	
Microsoft Kinect V2	99.99	49.99	Microsoft Store (7days)
Total	483.93	247.93	

System Cost