ROBOTIC ADF 2.0

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Problem Statement
- Customer expressed a need for an update on the version 1.0 robot to address concerns with the noise level of the previous design, as well as the control interface, and placement accuracy of the fingerprint cards on the scan bed.

Approach
- To do this, the device uses a linear rail design, which reduces the number of movements that occur in the process to give a rigid and controllable path. Additionally, an added alignment tray increases the accuracy of the device as it performs its task. And lastly, the decibel level has been reduced by going with an inline-filtered-oiled compressor. The control system is based off of the ATMega328P Microcontroller, which utilizes a vast sensor network for added accuracy, and provides direct user control of the device through serial communication with a computer.

Solution
- The result is a streamlined process that reduces failure rate, and is designed for high system reliability, manufacturability, and quieter operation. This solution will operate at less than 60dB indoor volume, will complete a batch of 500 cards in less than 6 hours and 30 minutes and will have <1% card selection and placement error.

Overview

- Linear Robot
- Steppers
- Ultrasonic Sensor
- Slide Tool
- Electronics Bin
- Scanner
- Alignment Brush
  - 18° Brush for Corner-Crowding
  - Servo for Deployment and Retraction
- Rack and Pinion Gear
  - Continuous motion servo allows opening and closing motion of the slide

Pneumatics

- SilentAire DR-500
  - 84-114 PSI Operating Pressure
  - 1.5 gallon main tank, plus 10 gallon reserve
  - Operates silently at 42dB
- Bernoulli Cup
  - Bernoulli principle device used for creating lift on the cards

Electronics

- Main Control Board
  - Integrated Signal Processing and Motor Control
  - Voltage Regulation and Over Current Protection
  - Serial Communication
  - Temperature Regulation
- Technologies:
  - ATMega328P Microcontroller
  - FTDI 232R USB-to-Serial
  - L293D Quad H-Bridges
  - 12V/5V DC-DC Converters
  - HC-SR04 Ultrasonic Sensors
  - GP2Y0A21YK IR Sensor
  - TMP36 Temperature Sensor
  - RJ45 Connectors
  - Cat6e STP Cables
  - USB-B Connector
- RJ45 Hub
  - Routes Signal and Control Lines
- Hand Hub
  - Allows for multiplexing trig/echo lines
  - Routes motor control signals

ADFUSB Communication Protocol
- USB over Serial
- 5 Byte Messages
- ROXTX Verification

Client-Side Control Software
- C# and C Libraries for integration with Mentalix Software

Software

ADFUSB Communication Protocol
- USB over Serial
- 5 Byte Messages
- ROXTX Verification

Conclusion

Robotic ADF 2.0 successfully achieves its goal by using advanced custom designed fine motor control software system. In addition to that, it uses a card alignment tray to correct the card orientation and quiet, oil-lubricated compressor which helps to maintain lower noise level around the working environment.