The user can choose a picture from a number of sources:
- User device
- Device camera
- Cloud storage of arDRAWino application (using Azure platform)
- Real time drawing

Choose a picture

The app calls Canny Edge Detection few times, each time with different parameters that represent the threshold and filters. This step is calculated with arDRAWino mobile service using Azure platform. Results can be seen in the next picture.

The Canny Edge Detector uses a multi-stage algorithm to detect a wide range of edges in images. The algorithm can be broken down into 5 different steps:
1. Apply Gaussian filter to smooth the image in order to remove the noise.
2. Find the intensity gradients of the image.
3. Apply non-maximum suppression to get rid of spurious response to edge detection.
4. Apply double threshold to determine potential edges.
5. Finalize the detection of edges by suppressing all the other edges that are weak and not connected to strong edges.

Choose a canny picture

The dominant pixels of the chosen picture from the last step are calculated into a graph. The graph is sent to an adapted DFS algorithm: the algorithm finds all the continuous paths of pixels to draw, with some improvements for minimal movement for the servo engines. Each point in the path is composed of (X, Y) value from the relevant pixel.

Convert the paths to servo's angles

Using some geometric calculations, each (XY) point in a path is converted into two angles (one per servo), so each servo engine would turn in the direction of the specified angle in order to reach the (XY) location from the original path.

Send the paths to Arduino by Bluetooth connection

Each path is sent to the Arduino so it will draw each point in the path. The paths are divided into small packages. Each package is synchronized and sent through Bluetooth connection to the Arduino itself.

Components:
- Drawing Surface
- Erasable pen
- Eraser
- Mini-Servo Engines
- Servo for pen lifting
- Bluetooth chip
- Arduino Nano

Choose the best processed picture between Canny outputs to print by arDRAWino. The user can also choose the original picture.

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Storage Services

System and Software Development Laboratory
236504 – Project in Arduino and IOT, Winter 2015-2016