Studying Cell Behaviors in Micro-Tissues using a LabChip

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Introduction:

- Goal: Design a Matlab program to assist with cell behavior studies on our client's LabChip device
- Must track migration of one or multiple cells in arrayed microtissues formed on the microfluidic LabChip device
- Must have graphical user interface and track the cell migration using images from an optical microscope as input data

Intended Users and Use:

- Researcher that studies behavior of biological cells
- Studying cell migration in different microtissues
- Provides cell migration trajectory data automatically

General Process:

- **Start**
- **Collect Data**
- **Run Program**
- **Get Trajectory Data**
- **End**

Process Breakdown:

Reads in a stack of images, frame by frame.
Source image is checked for full droplets by finding well-defined circles, and using these circles,, crops the source image to each droplet to check for the presence of cells.
If the first few frames on the droplet aren't empty, the entire stack is processed to track cell position between the frames. Empty droplets are skipped.

GUI displays the circles in the source, the current chamber in process, the binary image result of the detection function, and the position plot. Images and progress values are refreshed every frame. If a frame doesn't provide a reasonable change in position, or fails to detect an object at all, the frame is dropped. Number of dropped frames is tracked.

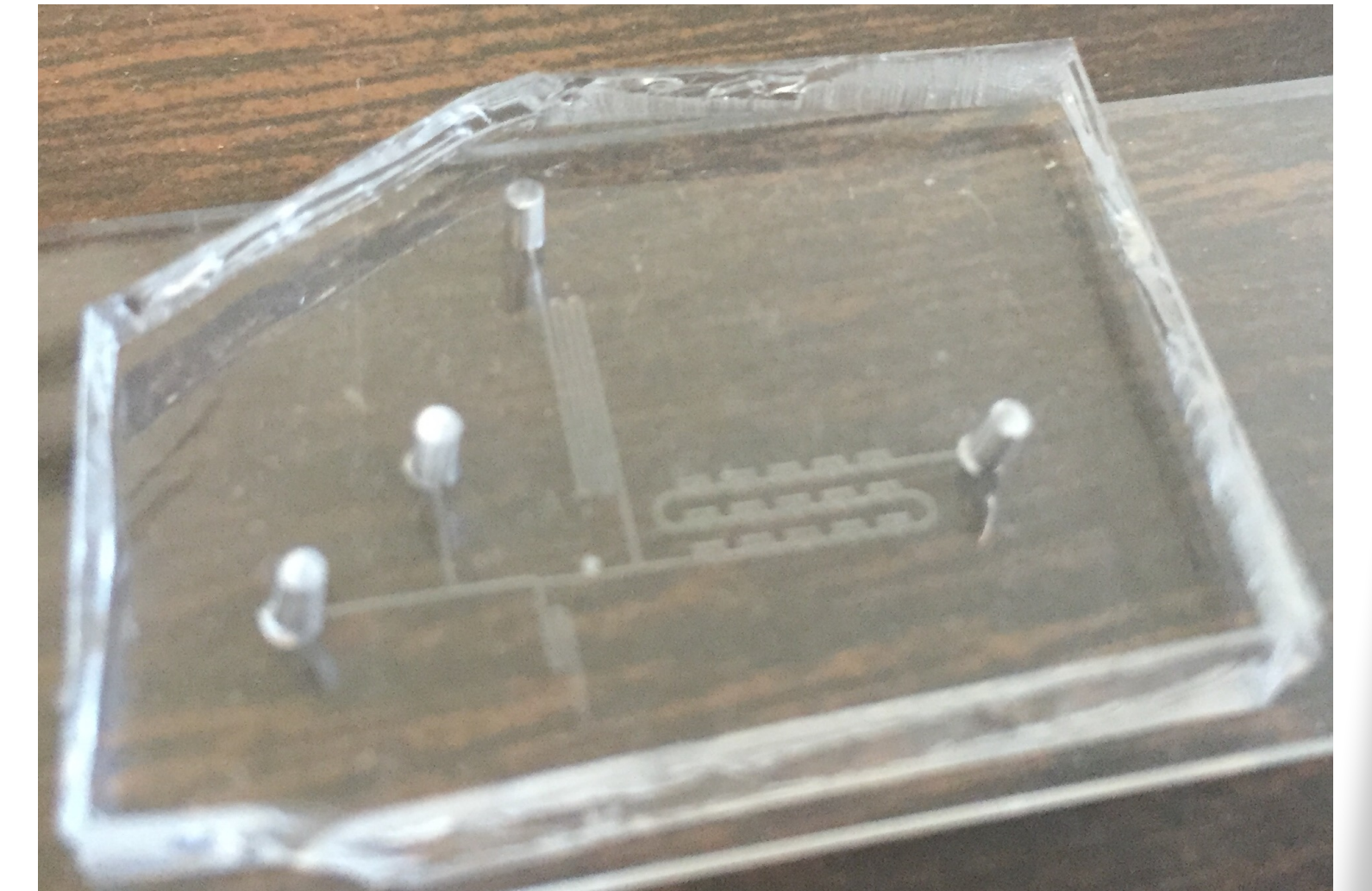Program outputs the trajectory information to the Matlab workspace and files.

Design Requirements:

Hardware:
- Proper Droplets & Microfluidic Chip
- Optical Microscope

Software:
- Matlab Program

Technical Details:

1. Image the migration of cells in microtissues using optical microscope.

2. Plot the migration trajectory of the cells using our Matlab program.

3. Analyze the effect of density and composition of microtissues on the cell migration.

Program Process: