MTRL 466 - Sensing Failure Weekly Meeting Minutes

Date: 30 October 2019, 3 - 4 PM

Room: FF308A

Week 9: Understanding Laser Line Projection and Edge Detection

Leader: Clement Asiedu-Antwi

Secretary: Sofia McGurk

Attendance:

Individual	In Attendance
Catherine Greenwood	Y
Jenna Moledina	Y
Clement Asiedu-Antwi	Y
Isabela Taketa	Y
Aleisha Cerny	Y
Sofia McGurk	Y

Agenda:
Chad away next week… not back till November 12th
Two options: meet with Daan or just we meet up without supervisors. If we wanna meet with Daan organize ASAP could meet Friday 12-1.
We need to provide an agenda/ recap of what we have done since this meeting to Chad next week (by Wednesday)- showing we have met, what we have done and any questions we have.

1. Status Update
    a. Requested Items
Chad: Borrow retort stands from Marlin in stores. Chad will send an email to him asking if we can borrow them. Will has one so we could ask him too.
S: caliper instead of feeler gauge.
Chad: Digital calipers we can use at noon on Friday.

    b. Printer Access
C: key access?
Chad: Find someone to let us into the room if the room isn't open. No key access for students. Go in during labs or ask a grad student. Password from computer need to get from Will.

2. LCA Update

A: Material waste is not the best approach, instead look into electricity use of the machine (energy consumption). Do systematic analysis of enviro impact of FDM by comparing material variation.

A: ABS bad for health is that in risk assessment.

Chad: that would go into impact factors normally but that is too complex for us. So talk about the impacts (health) give supporting evidence as to if they are large or small impacts. If there is a lot of info don't worry about the health.

Chad: Start from perspective of mtrl waste is bad in 3D prints, question from Enviro is: is contribution of waste material a significant portion of the energy footprint of the process? How much impact does 34% have in terms of 3D print energy consumption? Reduce waste = reduced energy consumption. Then factor in the recycling process which also requires energy. For materials: are biodegradable polymers benin (no additional impact because it will degrade… but will it)? Compostable bags actually do not work any better than regular ones. Compare PLA to ABS maybe. Need specific temperature and humidity to degrade it. Look at it from energy point of view- reducing waste would reduce enviro impact of 3D printer? And what happens to the waste material- is waste from PLA that much better than that of ABS.

A: Analyse commercial vs manufacturing uses?

Chad: There is waste in 3D printing: scaffolding, rejected parts… Thermo casting wastes less than 3D printing.

Chad: Start with answering: how much less environmental impact is there if you reduce waste? Is there significant impact- define it yourself… Significant impact relative to total energy used in 3D printing. What does the impact look like: linear or other relation? Leave 3D printer out of it, think about just operating it. Imagine we are comparing the same printer, same part, same rates. Change the amount of waste and see what the reduction (?) of energy is… then go into materials and other if not enough information.

3. Software Team Update
    a. Image Processing

I: separate images into Red, Green and Blue band…

Chad: most intense signal in red.

I: detects way more than just laser (too many edges)... maybe put minimum signal?

Chad: Why don't you just crop image? Noise comes from complicated stuff in background.

Chad: Bad background- use plain black.

Cat: Turn off lights, put a filter in front of the camera. Why not take a reference image without laser, then one with laser and subtract the 2 images. At each layer maybe take pic with laser and pic without. Take 2 images: image background remove = img- img 2.

J: Do we have to look at it at each layer or can we skip?

Chad: up to you

Chad: Explain how the edge detection works…

J: How to calculate the intensity of a pixel?

Chad: img is a nxmx3 matrix and each entry in that will have an intensity.

Chad: alpha is overall intensity between 0-1 or 0-255.

Chad: Move all entries in matrix by one pixel to the left (row in matrix) and take difference between initial and moved. Can look into that tomorrow or Friday.

Chad: our method is detecting the edge but what is it doing as it is surprisingly flat? Algorithm might have too much info. Try subtraction of images to get rid of background. Send chad the image and he will try to do stuff to it tonight and python script also.

        b.   Pillow Module

I: Used to open and save images

    4.   Hardware Team Update

        a.   Improved Setup

Cat: Took picture from side and used word to calculate angle (right triangle). Shone laser on a nickel. Within 30 microns.

Chad: could we measure the relief in the coin. More about can we see it.

Cat: We could see the defect but could not measure with naked eye.

        b.   Error Calculation

C: Based off of the ruler- assume uniform distribution. Wait for angle uncertainty when we have a retort stand.

Cat: Software doing measurements?

Chad: For a defect measurement do we need an absolute value?

C: Uncertainty as the error?

Chad: Minimum size of error is the size of the layer… but coin indicates that we measure better.

Chad: can we refine this more? 300 microns is just at the detection level.

Cat: send coin pictures to software team.

Chad: What is the thickness of the filament?

Cat: We have a ruler in the scale do we need this in final set up.

Chad: Does the absolute value of x?

Cat: y is thickness of the coin.

Chad: we need absolute value of x.

        c.   Standards used to test for failures

C: Failure tests- CAD models that contain: overhangs, bridges, etc…

Chad: Try bridge or overhang we should get a defect (above 45 degrees). Stop at different levels in defect formation. Find one that will give us a model that will fail so we can measure defects- proof of concept.

Chad: Access to room he will check with Marie or Heli to see if they can let us in? Or ask Daan or Will or Chad. Get in and print sooner rather than later. Maybe ask WIll for standard prints that failed.

Cat: Have pixels of image- how do we know how this relates to height.

Chad: Can you do this under cost of printer.. Maybe fixed focus camera.

Cat: Isn't it changing during print?

Chad: How are we gonna account for the print getting taller? Might be able to get the raising table from Marlin. What if you fixed camera to the bed? Shaking- when are we doing this measurement is it continuous or at the end of the laser. Want to talk about at the end of the term things that still need improvement- damping tools so you don't shake the crap out of the camera. Don't need to have it worked out but we need to think about it. When picture taken,

when data analyzed? Where on the part will we be making the measurements- we define or user has to pick at the beginning?

Cat: Take print and put fishing line on it.

Chad: we just need to print something and then prove we can measure a defect… does not have to be during printing.

J: What about if laser was in the wrong view and we don't detect defect?

Chad: Do we need 2, 3 or 4 lasers.

Chad: Need people to look at what it will finally look like.

Chad: For final have schematic of what it might look like…. Take a picture and then add the important parts: camera, etc.. Maybe have a video of printer printing.

Chad: Choose one thing that will fail on us in a reproducible way and also integration of the whole thing (FULL pictures). Overhang (at high enough angle).

Cat: Next semester we would have a camera, but this semester is it good if someone is there with a camera taking pics then analysed later.

Chad: yes we dont need in situ this semester. What can we measure and what can we not? Degrees of "badness".

Cat: Would the edge detection work for warping

C: minimum size for a feeler gage

Chad: get what we can- ~0.1mm

We can contact him while he is away.

Action Items:

	Item	Assigned To
1.	Get retort stands (Marlin or otherwise)	Hardware Team
2.	Ask Will for PW to computer for Prusa	Hardware team
3.	Send chad the image and he will try to do stuff to it tonight and python script also.	Software Team
4.	Make an agenda/ recap of what we have done since this meeting to Chad next week (by Wednesday)- showing we have met, what we have done and any questions we have.	All
5.	Print a defective part	Hardware
6.	Improved setup for Hardware	Hardware
7.	Continue to work on LCA and software	LCA and Software

8.	Think about how this all comes together (FULL picture)	ALL

Next Meeting Time: Chad out of town.