NAIT

Edmonton, Alberta

3D Scanner TPS Report

Submitted to

Ross Taylor, CMPE 2960 CNT Instructor

Kelly Shepherd, CMPE 2960 English Instructor

Submitted by

Karun Kakulphimp, CMPE 2960 Student

Jonas Buro, CMPE 2960 Student

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1. Overview

Ensure that you have the following materials in order to test the system.

1.1. Parts List

- PC running Windows 8 or later
- Microsoft Kinect v2 sensor unit
- Kinect connection kit
- Genuino Uno microboard
- USB B to USB C cable
- Rotating platform with attached NEMA 17 bipolar stepper motor
- 5V 2A power supply for the motor
- Stepper motor driver
- Calibration cylinder
- Electronic or bubble level
- Mounting platform or tripod for Kinect sensor
- 3D viewing software (optional)

1.2. Software

- Scanner executable, contains the following dependencies:
  - Microsoft XNA framework v4.0
  - Kinect SDK v2.0 for driver support
- Arduino IDE, contains the following dependencies:
  - TMC2130 stepper motor chip modified library (included in bundle)
  - Version 1.8.5 or later
  - SPI.h for serial peripheral interface bus support

2. Intended Operation Procedure

Guidelines for operation of the system

2.1. Ensure circuit laid out as shown in Figure 1 below

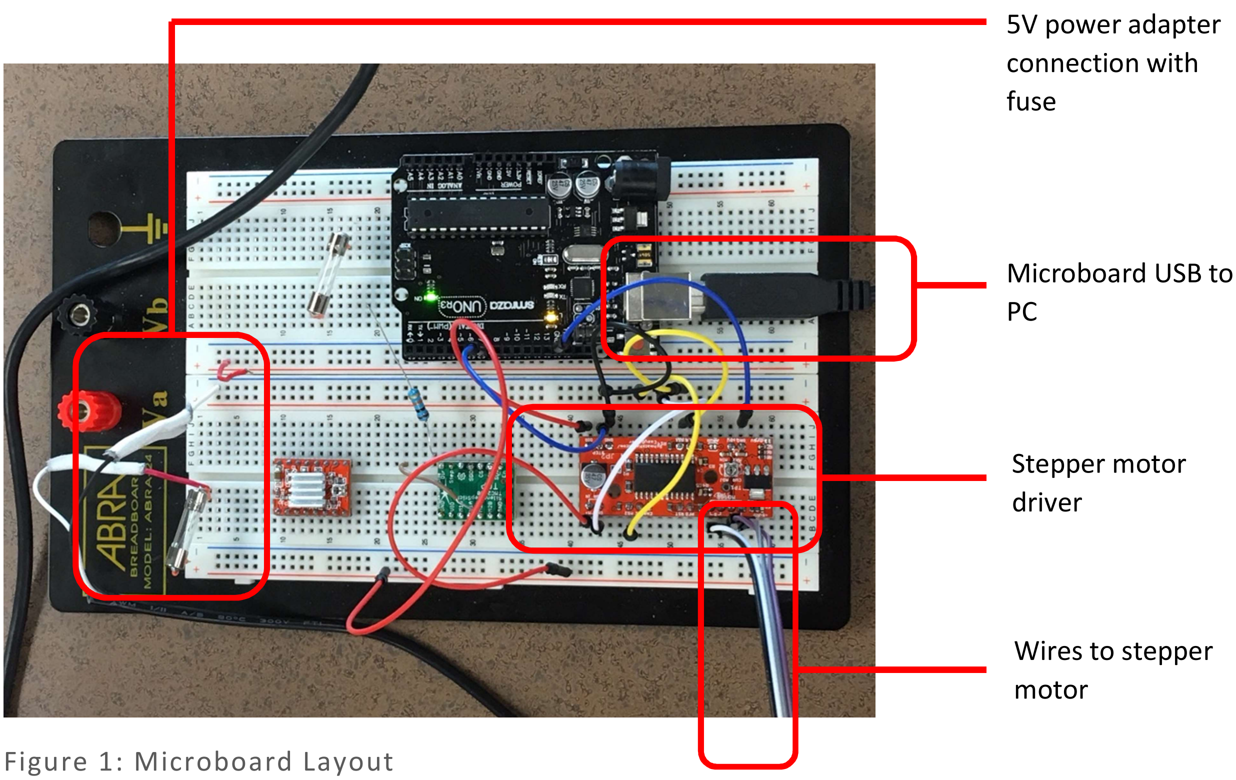

Figure 1: Microboard Layout

2.2. Mount Kinect on platform or tripod as shown in Figure 2

Figure 2: Kinect mounted on tripod

2.3. Connect the power supply to the motor driver circuit
2.4. Connect motor terminals to motor driver coil outputs
2.5. Establish a USB connection between the PC and the Uno
2.6. Connect the Kinect sensor to the PC with the adapter
2.7. Ensure that the platform as well as the sensor are level
2.8. Open Kinect Prototype executable
2.9. Place calibration cylinder on platform as shown in figure 3 below

Figure 3: Scan platform with cylinder used for calibration purposes

2.10. Align X, and Z coordinates in alignment tab. In the depth view, the front face of the object must be highlighted with a red line indicating matching depth points of the rotation axis

2.11. Reduce the millimetre size of the rotation axis and repeat the previous step until the smallest visible red line is aligned with the absolute center of the alignment tool

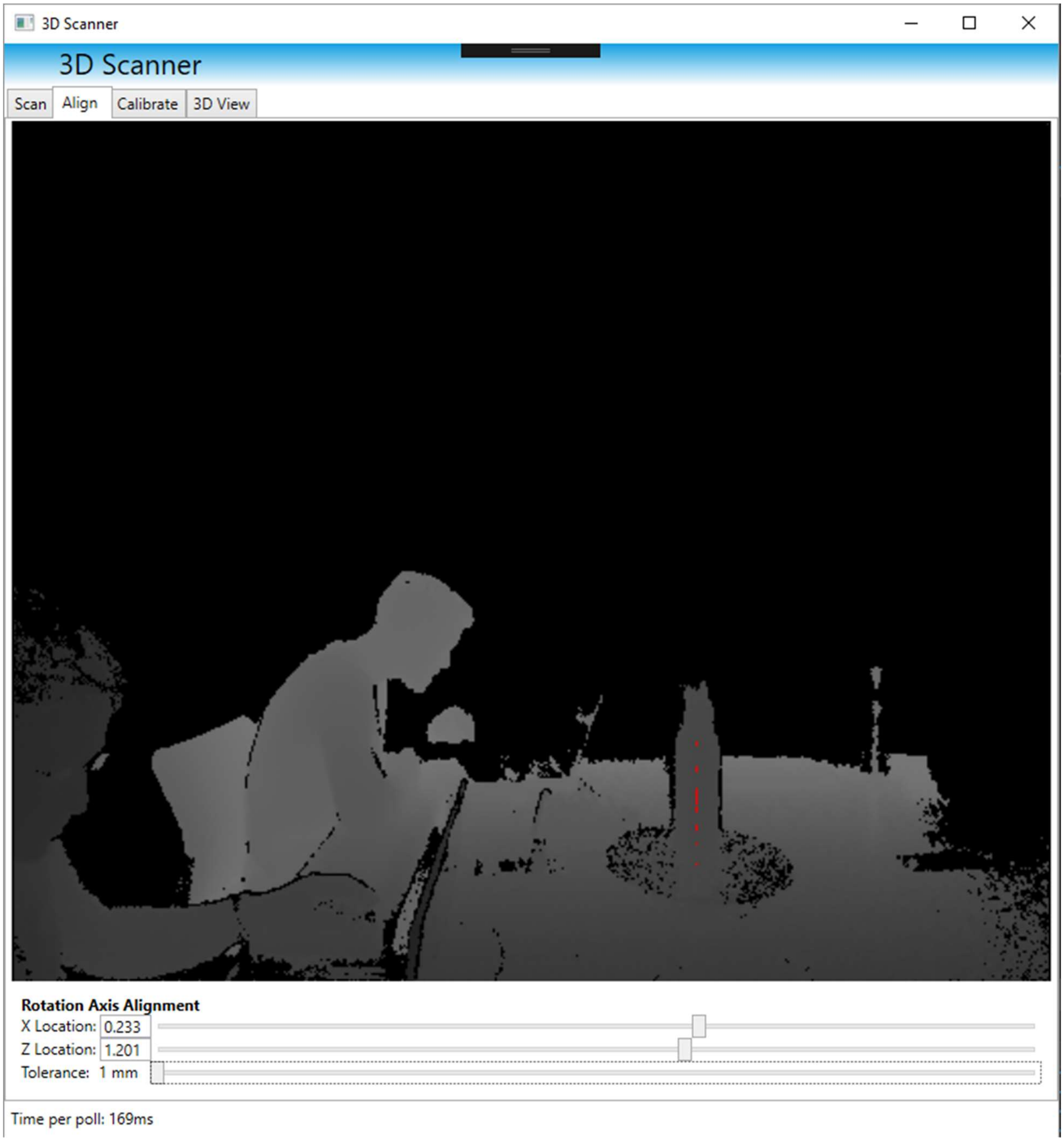

Figure 4: Alignment tab

2.12. Set X, Y and Z minimum and maximum values for scan bounds in calibration tab ensuring only the object is viewable in the depth view

2.13. Set the number of frames to sample in one scan frame with the sampling slider in the calibration tab

2.14. Set the variance tolerance which is the percentage of allowed variance over maximum variance of the dataset with the variance slider in the calibration tab

2.15. Set the allowed number of null pixels for any given pixels which will ignore this pixel if it has too many null points with the null pixel slider in the calibration tab

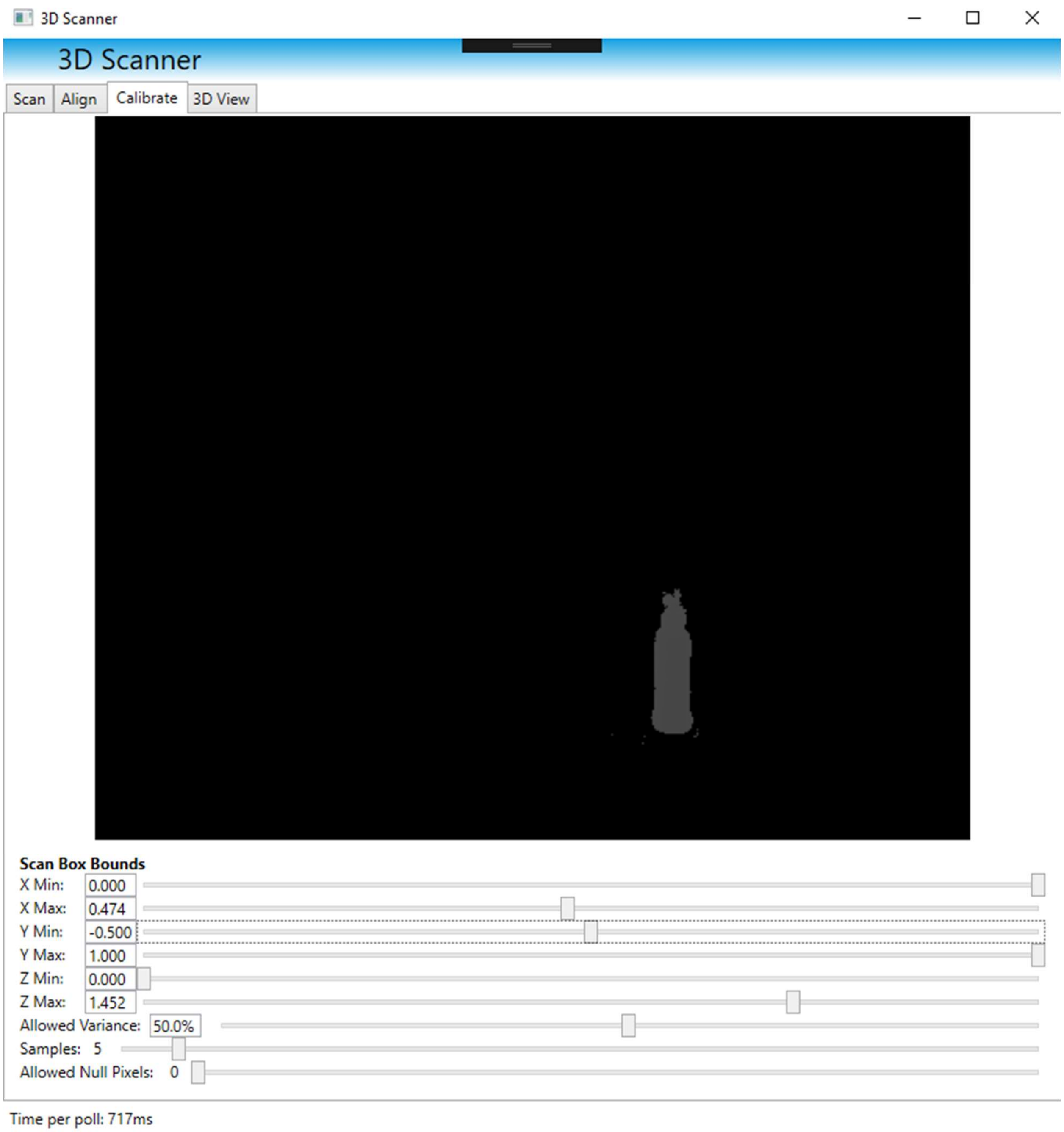

Figure 5: Calibration tab

2.16. Once all alignments and calibrations are complete go to the scan tab and set the number of scans to perform on the object (numbers are fixed between numbers evenly divisible within 200)

2.17. Press the scan button and observe the preliminary rotation; after the preliminary rotation is complete the scan will commence

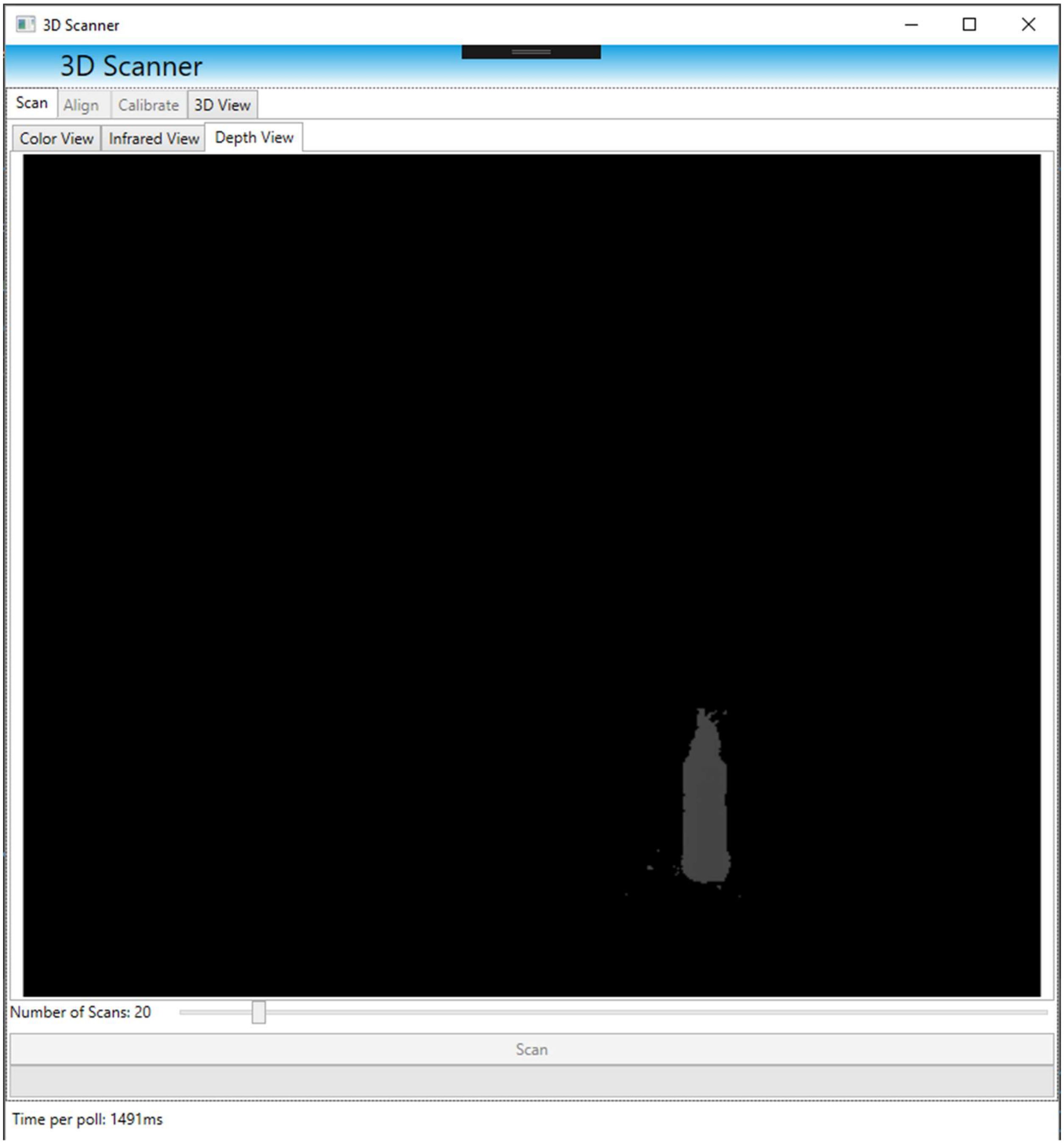

Figure 6: Scan tab

2.18. While staying clear of the scanning zone, wait for the scan to complete

2.19. The last scanned color, depth, and infrared images are viewable in their respective tabs during the scan process
2.20. Save file dialog opens to allow the user to save to save STL file to preferred location
2.21. Open STL file in any outside 3D object viewer if a thorough inspection is required

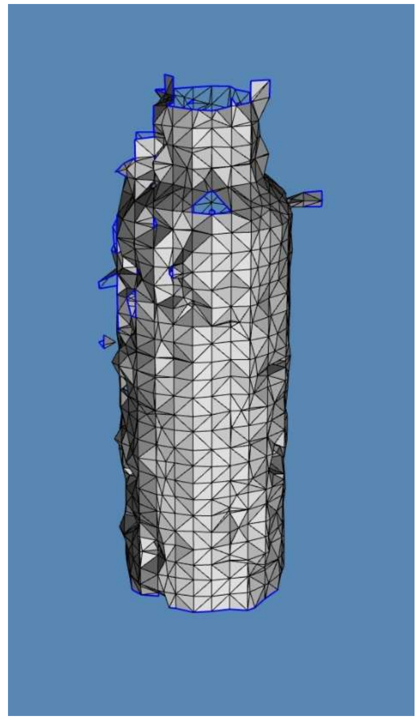

Figure 7: Object compared to its 3D mesh

3. Troubleshooting

General advice in case things are not working

3.1. If the application does not run, ensure that XNA framework 4.0 and Kinect SDK 2.0 are both installed.
3.2. Ensure that upon connection of the microboard to the PC, the onboard LED turns on. If it does not, verify connections.
3.3. If the resultant mesh or point cloud files are of low quality, ensure that you have completely leveled both the Kinect and the platform. Additionally, be sure to precisely calibrate the center point of rotation.
3.4. If the motor does not execute its preliminary rotation successfully upon pressing scan, make sure that the wiring from the motor to the motor driver chip is correct. Motor coil A and B terminals are paired and are directly adjacent to each other.
3.5. If the resultant shape is too "bumpy", tighten the constraints on the calibration tab with more samples or lower allowed variance

3.6. If motor does not receive power, ensure that the fuse has not blown on the power adapter circuit

4. Caution

4.1. The components are very susceptible to shock and even the slightest touch of the scanner or the platform during a scan will yield useless results.
4.2. Do not supply more than 5V to the motor circuit as you risk blowing the motor driver chip if no fuse is present.
4.3. Do not use objects weighing more than 3kg, you will risk the malfunction of the motor.
4.4. Fuse on motor power adapter is used to protect from overcurrent

5. Conclusion

The above information is a comprehensive overview of the operation of our 3D infrared scanning system. For additional information, troubleshooting issues, or any further questions, feel free to contact us at jonas.buro1@gmail.com or karunkakulphimp@gmail.com.