

3D Scanner Project

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Functions of our project

- To scan an object and generate a 3D model from it
- A rotating platform allows the object to be scanned from all sides
- Lead screw moves the laser along z-axis
- Platform and laser controlled by stepper motors



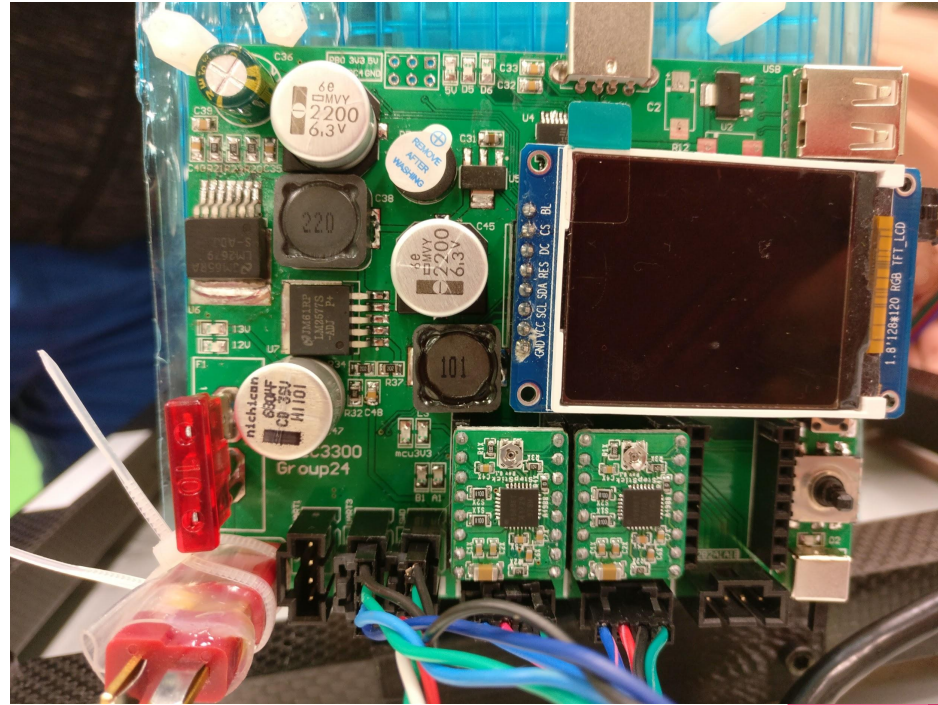
Demo of project

- We will demonstrate the 3D scanning process on a small portion of an object.



Hardware design

- STM32F405RG



Software implementation

- ADC gets the distance from object surface (ADC1, PC0)
 - Coordinates are calculated from current platform angle and distance
 - Sine / cosine values are stored in table to be directly used
 - DMA is used to transfer from peripheral to local variable efficiently
- Steppers are controlled using driver modules
 - Each pulse to the driver moves the stepper by one step (1.8 deg)
 - Output compare function of TIM3 is used
 - For each stepper velocity, the time between pulses is calculated
 - 0us -> 6us: toggle TIM3_CH1 to high
 - 6us -> 15000us: toggle TIM3_CH1 to low
 - Change by writing to TIM3_CCR



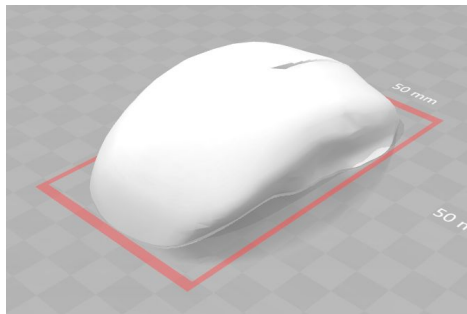
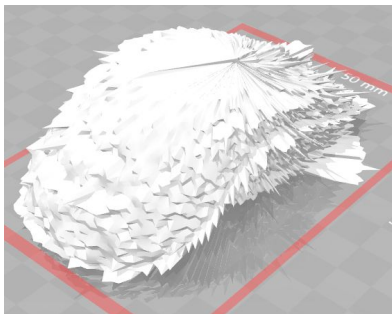
STL Format

- Transferred using UART protocol (USART1 peripheral, PA9/PA10)
- Received on PC side via Coolterm serial terminal
- Header - 84 bytes
- Face - 50 bytes each
 - Each 3D vector is 12 bytes (3 floats)
 - Normal vector (12 bytes)
 - 3x vertices coordinates (36 bytes)
 - 2 bytes of attribute byte count (not used in this project)
- 34 layers for the mouse model
 - $34 * 200 * 2 * 50 + 84 = 680084 = 664 \text{ KB}$



Post processing of model

- Blender 2.78c
- Smooth modifier
 - Average out the spiky points
- Decimate modifier
 - Reducing vertex count while keeping the shape
- Size is reduced from 664 to 59.1 KB



Improvements

- Previously planned
 - Save onto USB Drive via controller IC
 - Graphical user interface
- Color detection
- Employ smoothing / polygon reduction as part of the process
- Scan with multiple laser sensors
- Use sensor with higher resolution

