LiDAR Object Mapping

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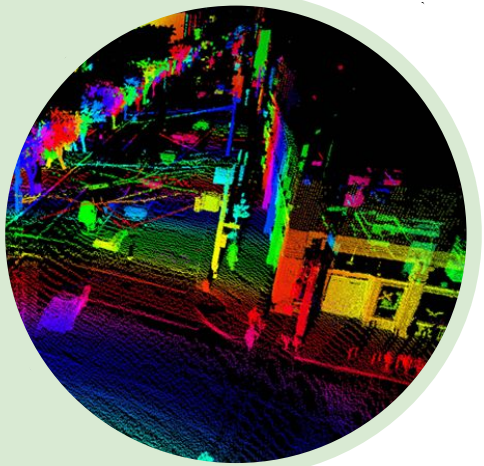
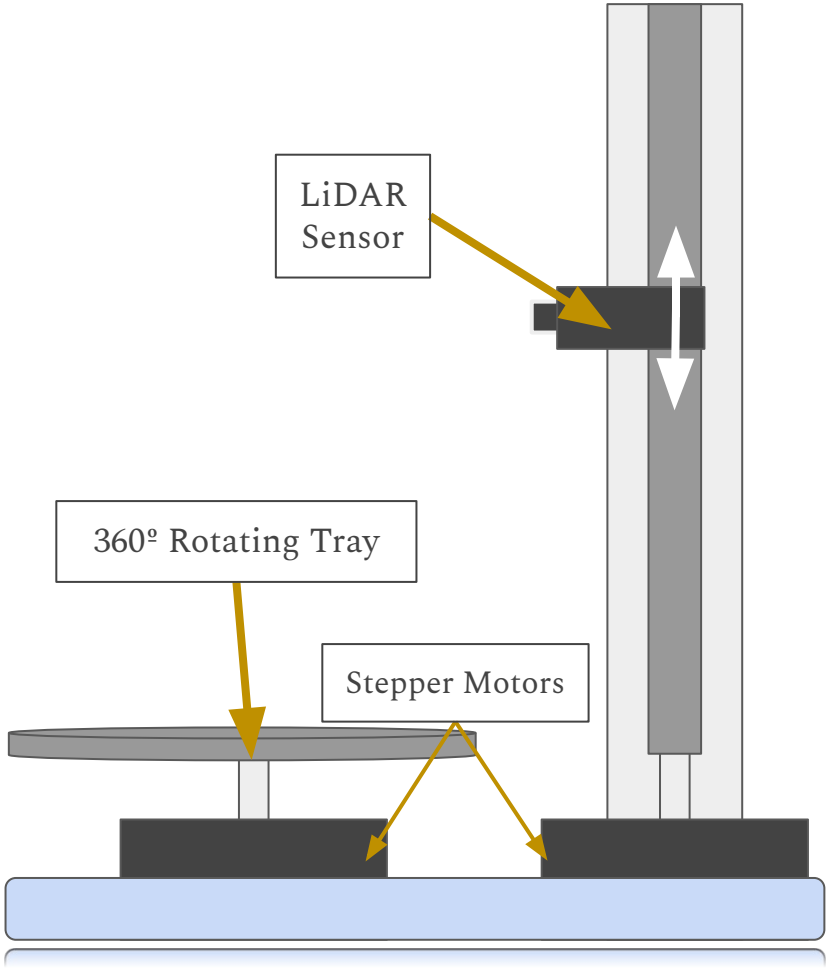


Project Introduction

- The idea for converting LiDAR data into an STL file for 3D printing emerged as a response to several project ideas that failed to meet budget, availability, or feasibility constraints.
- Original goal was to create an autonomous boat that would feature a sonar taking depth measurements. These soundings would then be stitched together to create a depth chart for any given body of water.
- The underwater sonar sensors we were considering proved to be unavailable, extremely pricey, or too bulky; as a result, the team decided that a potential project idea would be to build our own sonar sensor instead.
- Superior range, lighter weights, positive availability, and cheaper prices than ultrasonic alternatives

Problem Description

- Corporations spend millions of dollars designing products and then ensuring that manufactured results are up to the original design specifications.
- Time consuming process. No guarantee that the modeling will be completed perfectly.
- Individual taking measurements or employing a computer vision system can be unreliable and incredibly costly.
- Need for a cost effective, simple solution!

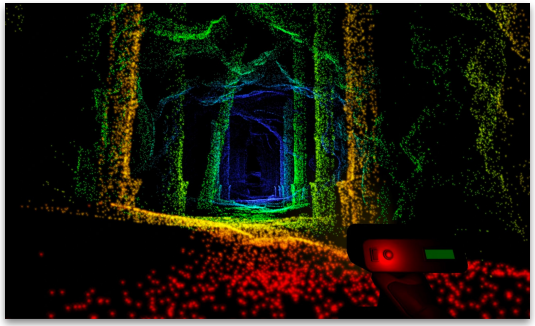


Proposed Solution

- LiDAR scanner could be created. This scanner would employ a lidar array that continuously takes distance measurements.
- Additionally, this array will move to varying heights to record the full dimensions of a part.
- While the LiDar array is moving up, the part will be placed on a 360 degree rotating tray. Because the part is rotating and the LiDAR array is moving to variable heights, this will enable measurements to be taken at every point around a part.
- This data can then be exported to an SD card, and an .STL file can be generated. Additionally, computation can be performed on the data points the LiDAR has recorded to determine if a part's dimension is within a preset acceptable tolerance.

Demonstrated Features

- Functional Lidar
- Precise Motor Adjustment/Control
- Real-Time Preview of Model (Wireless Communication)
- Successful STL file creation
- Quality Control/ Rejection of a part based on preset dimensional criteria

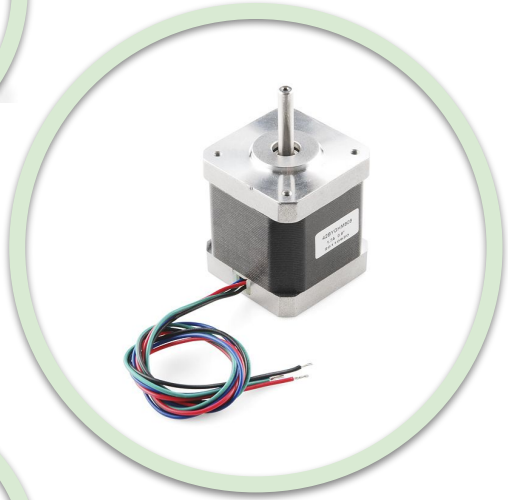


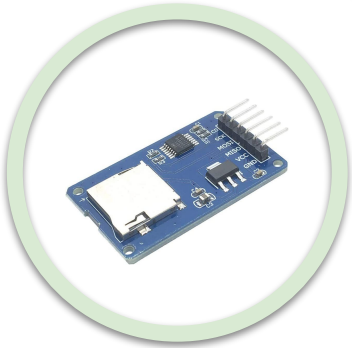
Available Technologies

LiDAR Sensor - Use the Lidar sensor to capture the physical dimensions of the object we want to scan. The sensor uses an interface.
TFMini Plus - Micro LiDAR Module - SEN-15179

SD Card Module – The data collected from the LiDar Sensor will be stored on a SD card. The SD card module has an SPI interface driver installed and can read and write through a file system.
HiLetgo Micro SD TF Card Adapter Reader Module 6 Pin SPI Interface Driver Module

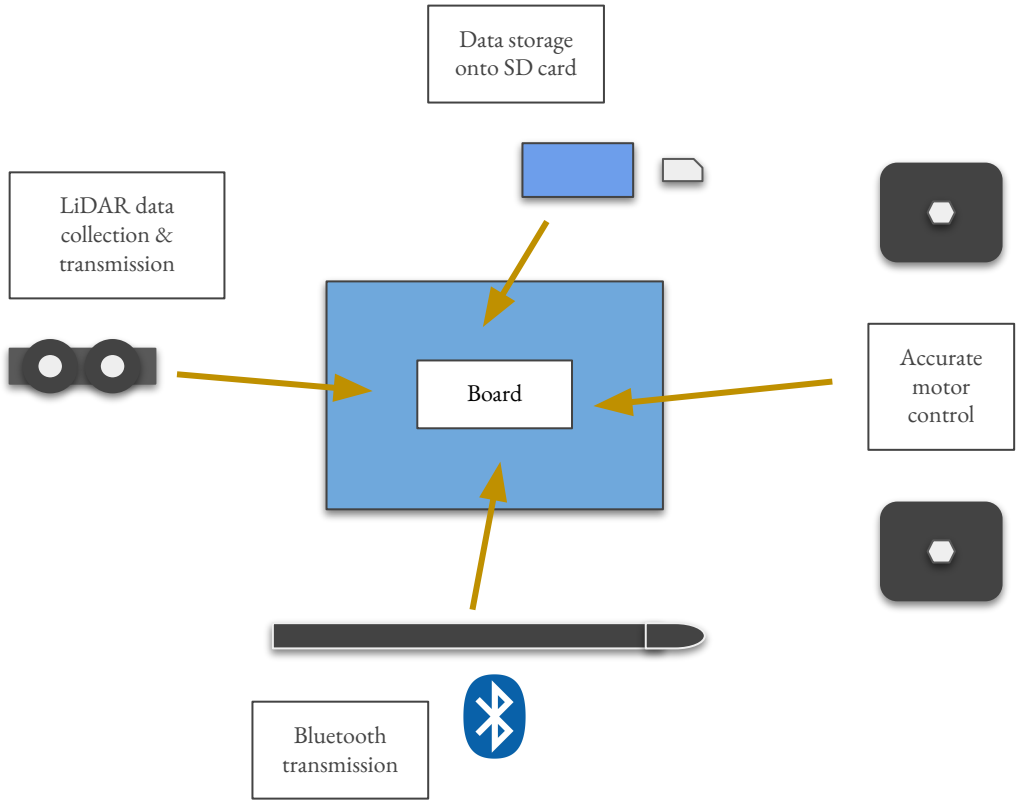
Stepper Motor - The project will use two of these motors for all of the operations. One motor will be used to rotate the object to be scanned. The second motor will be used, in conjunction with a screw, to raise and lower the LiDAR sensor.
STEPPERONLINE Nema 17 Stepper Motor Bipolar 2A 59Ncm(84oz.in) 48mm Body 4-lead W/ 1m Cable





Engineering Content

- Data collection and transmission from the LiDAR sensor to the microcontroller
- Data storage onto an SD Card
- Accurate motor control of a stepper motor
- Bluetooth transmission of data collected real-time to a web server
- Programming to convert data collected into a STL file
- Frame Mechanism to support the sensor



Conclusions

This design could be used for several purposes. First, if there is a part that an individual or a corporation would like modeled, there is no need to spend valuable time making a CAD model. Instead, the part can simply be placed on a scanning tray and a 3D model with 5 mm resolution will be generated. Due to cost constraints, a LiDAR sensor with greater resolution cannot be implemented for this project; however, in a corporate setting with increased funds, resolution could be greatly improved.

Additionally, the model generated from the LiDAR can be used for quality control purposes. By setting a specific tolerance between two data points, this system could accept or reject parts. Thus, this LiDAR scanner can serve multiple purposes and could be outfitted with several different sensors depending on the resolution required.