Executive Summary

New applications of RGB-Depth cameras are in high demand due to their widening availability to industry and to consumers. 3D modeling is one such application, and while done before in various research projects, the process of using RGB-Depth cameras to model a space has yet to become an automated process [1]. The goal of this project was to combine a robotic moving platform and a commercially available RGB-Depth camera to autonomously build a 3D model of an unknown environment.

Objectives

- Fully navigate room autonomously
- Avoid collisions
- Complete low-level (table height) 3D model
- Integrate color and/or texture into model

Results

Budget

<table>
<thead>
<tr>
<th>Number</th>
<th>Item</th>
<th>Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>iRobot Create 2 Programmable Robot</td>
<td>211.99</td>
</tr>
<tr>
<td>2</td>
<td>Microsoft Kinect Camera for Windows v2</td>
<td>149.99</td>
</tr>
<tr>
<td>3</td>
<td>Kinect to Windows Adapter</td>
<td>49.99</td>
</tr>
<tr>
<td>4</td>
<td>Power Supplies</td>
<td>67.06</td>
</tr>
<tr>
<td>5</td>
<td>Structure</td>
<td>50.00</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>529.03</td>
</tr>
</tbody>
</table>

Acknowledgements and References

We would like to acknowledge our sponsor, Dr. Daniel Morris, for his guidance and advice; our facilitator, Dr. Hayder Radha, for his suggestions and comments; Matthias Nießner and Michael Zollhoefer for their Voxel Hashing code and Matthias Nießner’s correspondence; and our team member, Kexiang Qian, for loaning his laptop for the project.


Conclusion

We have made great strides towards accomplishing the initial goal: to create a fully autonomous system capable of creating a 3D model of an unknown environment.

Successes

- Combined different equipment into one functional machine
- Able to detect most objects in the robots path
- Capable of constructing a 3D model

Future Work

- Increase in collision avoidance functionality
- Room completion detection

Method Flow Chart

- Start 3D model building software → Real depth data from Kinect → Process data → Make movement decision → Build 3D model → Done?

No