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| Department of Electrical Engineering and Computer Science  Case Western Reserve University |
| A Low-Cost Mobile Manipulator for Industrial and Research Applications |
| Submitted in partial fulfillment of the requirements for the degree of Master of Engineering |
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| **Edward Venator** |
| **[Pick the date]** |

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| This thesis describes the creation of a mobile robot equipped with an industrial robotic manipulator. The resulting mobile manipulator incorporates a suite of commercially-available sensors and processing hardware to enable the robot to operate as an intelligent agent alongside humans. Ultimately, this robot will be employed in research on autonomous kitting in industrial environments. |

# Introduction

# Mechanical Design of ALEN

## Invacare Ranger Wheelchair Base

## ABB IRB-120 Robotic Arm

# Electronics and Sensor Packages

## Microsoft Kinect

## Sick LMS-291

## End Effector-Mounted Camera

## Drivetrain Control and Odometry

## Safety Systems

### Emergency Stop

### Reflexive Collision Avoidance

### Self-Harm Prevention

## Computing

### PC

### National Instruments cRIO

### ABB IRC5

# Navigation

# Manipulation

# Results