

Snow Shoveling Robot

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Overview

- Objective
- Introduction
 - Problem Statement
 - Proposed Solution
- Limitations
- Specification
- Engineering Design
 - Mechanical Design
 - Electrical Circuits
 - Coding
- Cost Analysis
- Conclusion
- References



Objective

General:

- To shovel and remove snow from the sidewalk with the utmost efficiency and minimum human intervention and labor

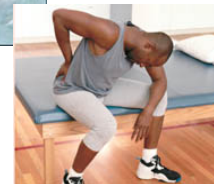
Additional:

- To create a walkway path and dispense salt in order to prevent snow/ice buildup

Introduction

Problem Statement

- Walking on Snow and Ice can be very dangerous
- Manual Snow Shoveling can be very painful
Many medical side-effects:
 - Increase Blood Pressure + Heart Rate
 - Back Pain + Muscle Strain
 - Promotes blood clotting + Sudden Heart Attack
- “One study estimated as many as 1200 heart related deaths yearly during and after major snowstorms”



-Eyewitness News

(<http://abclocal.go.com/wabc/story?section=health&id=3902666>)

Introduction

Proposed Solution

- An autonomous snow shoveling device to remove snow with minimum human labor



Before



After

Introduction

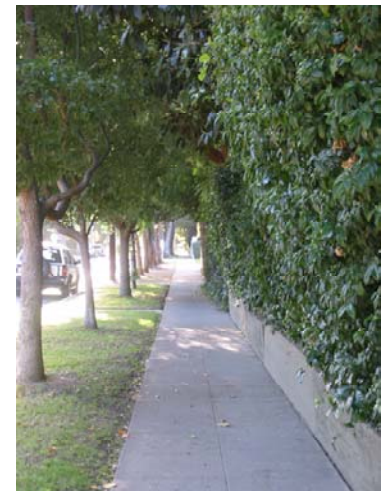
Proposed Solution

- Benefits of our autonomous snow shoveling device:
 - No human labor required
 - Performs task with minimum supervision
 - Creates a walkway path for pedestrians
 - Prevents snow/ice buildup from salt



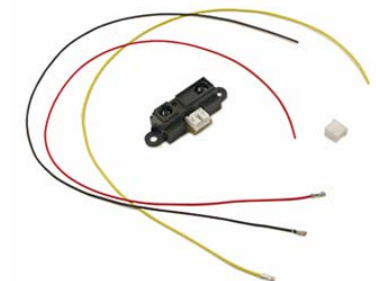
Limitations

- Restricted to user input
- Straight and flat pavement
- Stops when device detects obstacle
- Stops when salt level is low



Specifications

- Basic Stamp II
 - (Board of Education)
- 3 Servo Motors
- IR (Infrared) Sensor
- 1 Photo resistors
- Compass
- Limit Switch
- Push Buttons
- Piezo Speaker
- Red LED



Specifications

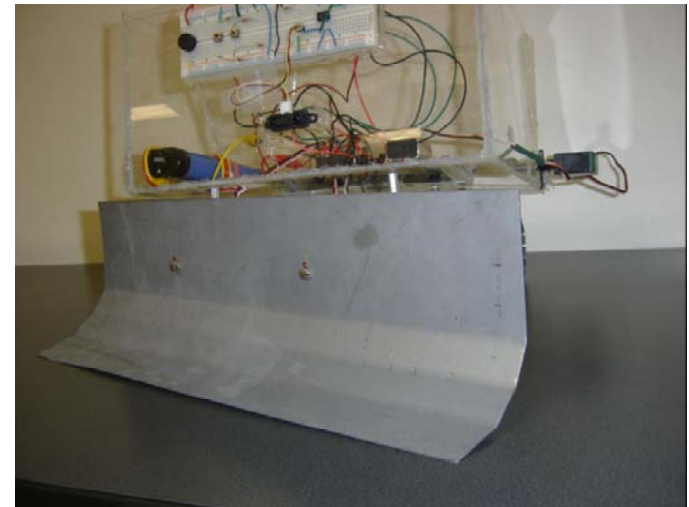
Selection of Sensors

- **Basic Stamp (Microcontroller):**
 - Read sensor signals, process data, control output devices
- **Servomotors:**
 - Power source for mobility/Control output rate of salt
- **Infrared Sensor:**
 - Detect obstacles and impediments
- **Photo resistor:**
 - Detect amount of salt in dispenser
- **Compass:**
 - Ensures movement on a straight path
- **Limit Switch:**
 - Measure distance traveled

Engineering Design

Mechanical Structure

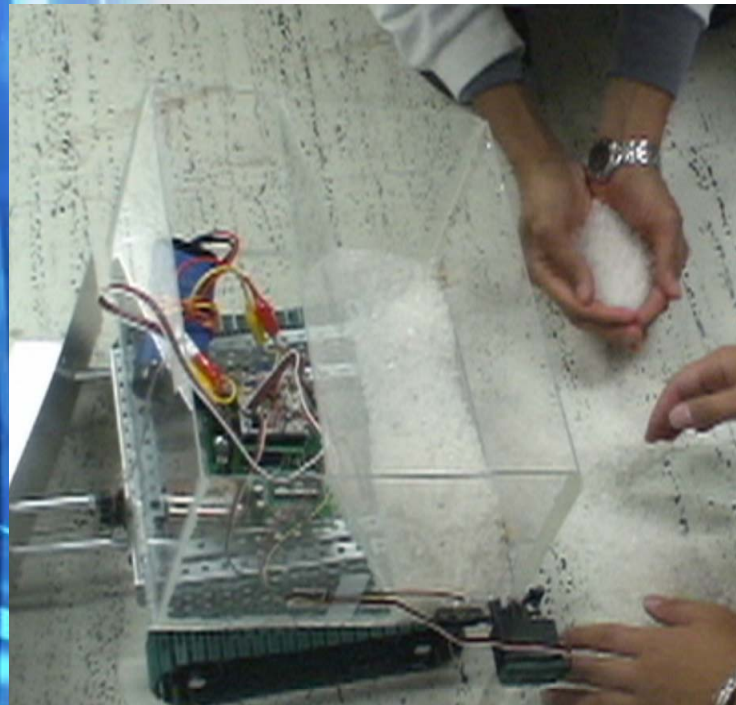
Snow Shovel



Engineering Design

Mechanical Structure

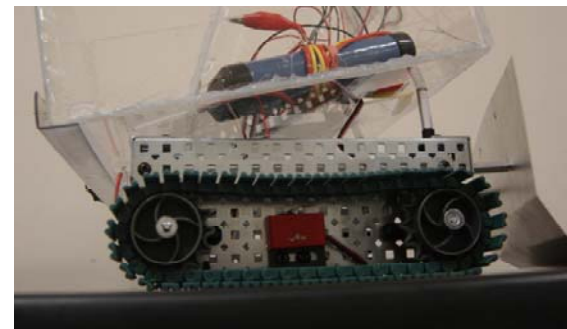
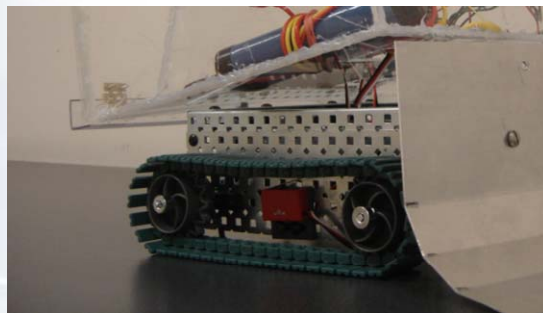
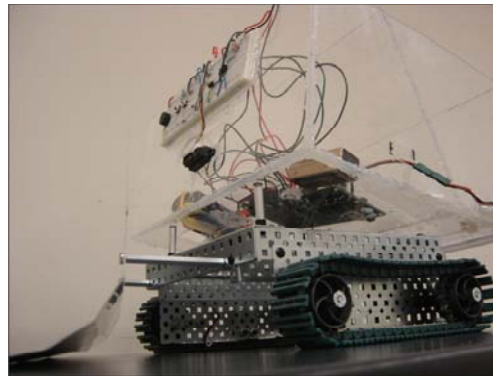
Salt Dispenser



Engineering Design

Mechanical Structure

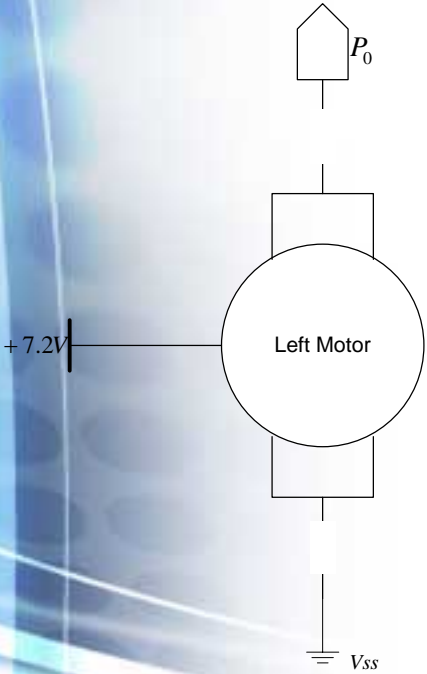
Treads/



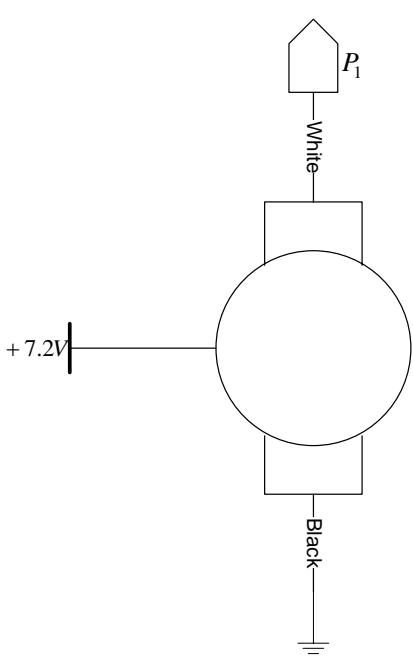
Engineering Design

Motor Circuits

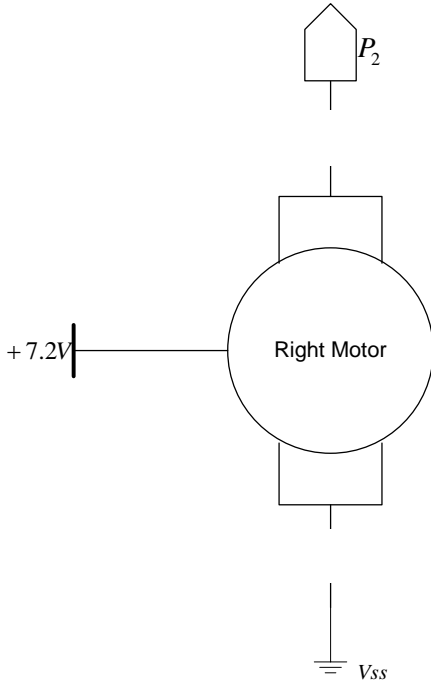
Left Motor



Servomotor



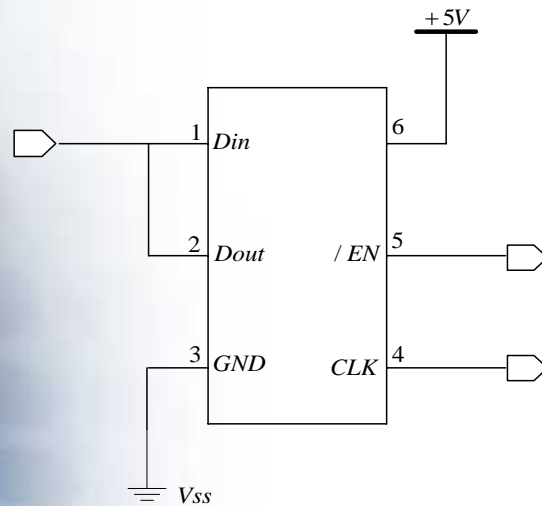
Right Motor



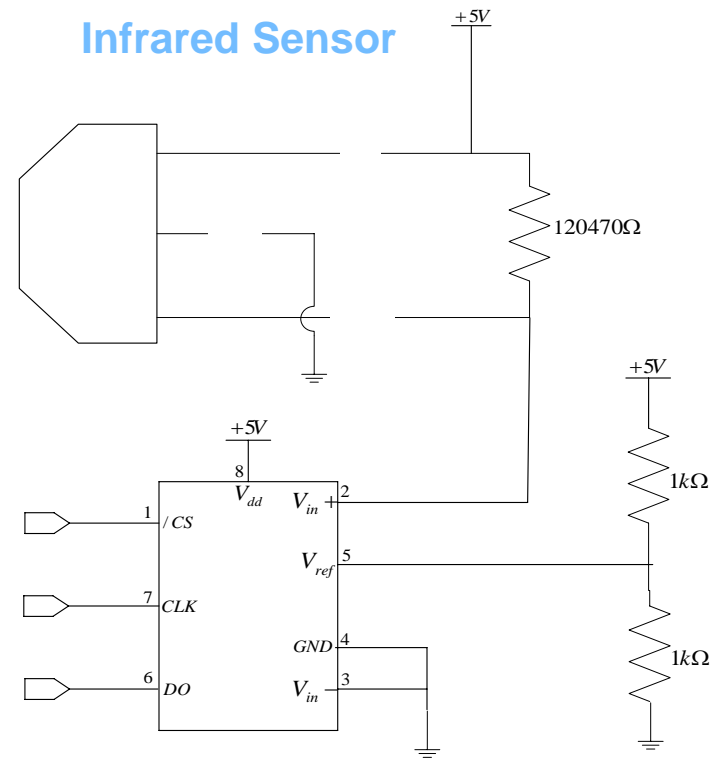
Engineering Design

Sensor Circuits

Compass



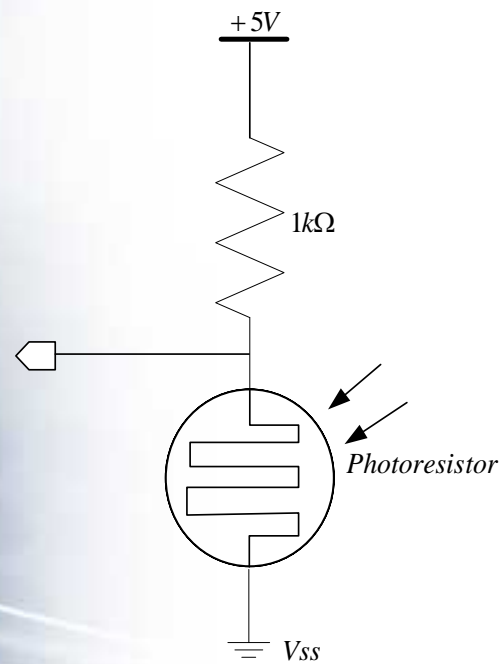
Infrared Sensor



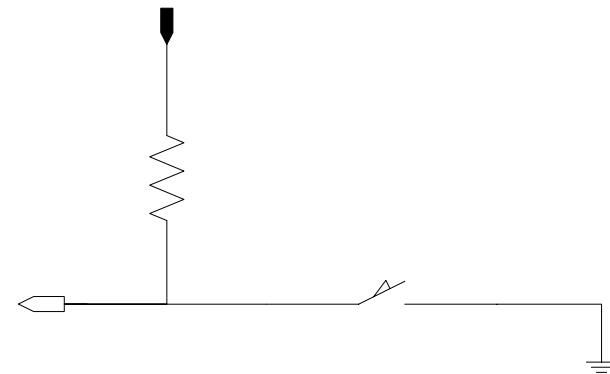
Engineering Design

Sensor Circuits

Salt Sensor



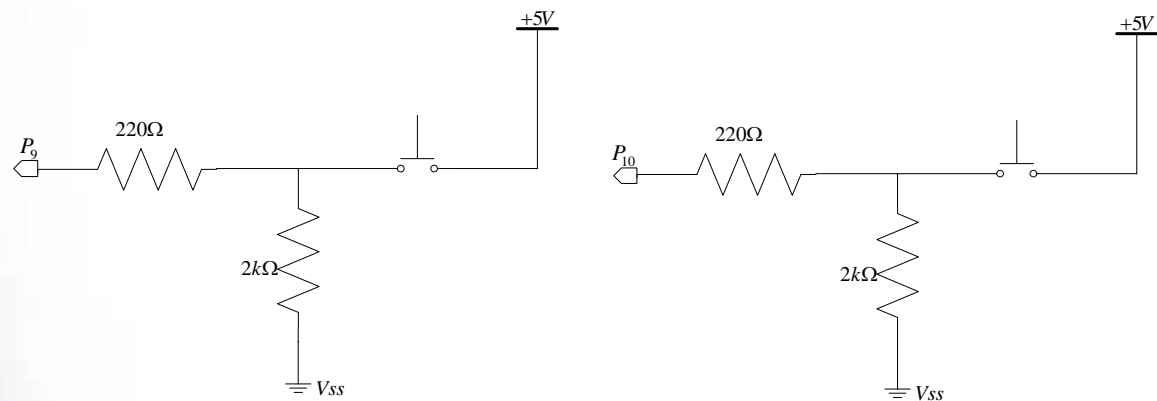
Limit Switch



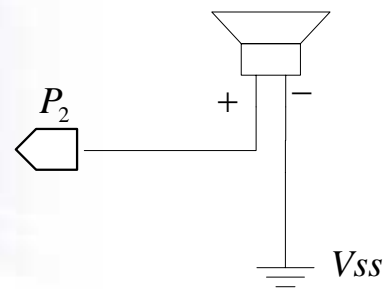
Engineering Design

User Interactives

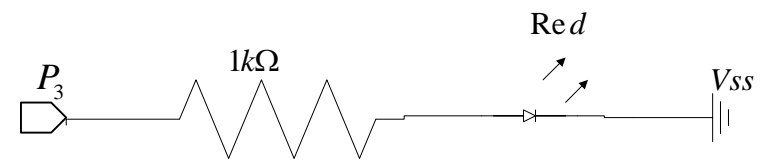
Push Buttons



Piezo Speaker

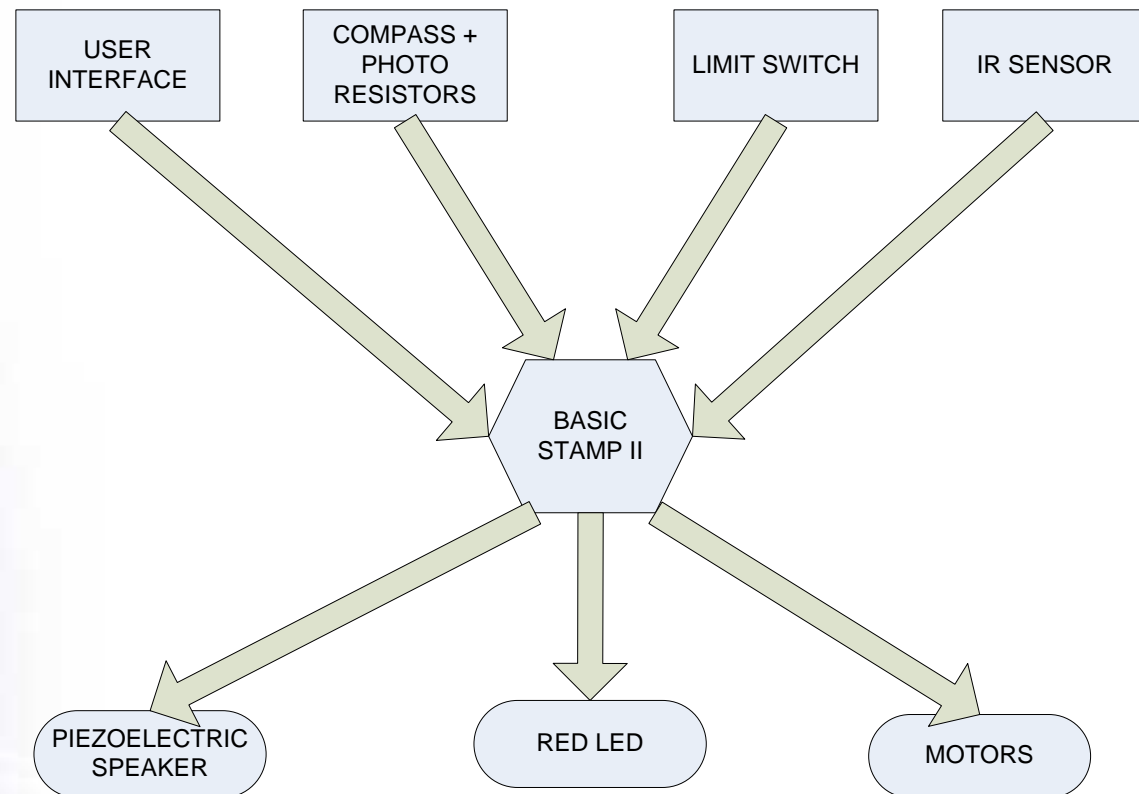


Red LED



Engineering Design

Schematic Design Operation





Engineering Design

Coding Aspect

[[Hyperlink](#)]

\$ Prototype Cost \$

Part	Quantity	Price Each	Total
BS2 [Board of Education]	1	\$ 100.00	\$ 100.00
Vex Motors	3	\$ 20.00	\$ 60.00
Infrared Sensor	1	\$ 12.50	\$ 12.50
Photo Resistor	2	\$ 1.95	\$ 3.90
Limit Switch	1	\$ 6.00	\$ 6.00
Compass	1	\$ 29.95	\$ 29.95
Plexiglas	-	-	\$ 10.00
Chassis	-	-	\$ 31.00
Tank Treads	2	\$ 15.00	\$ 30.00
Steel Plate	-	-	\$ 6.00
Miscellaneous	-	-	\$ 30.00
Total Cost			\$ 319.35

\$ Mass Production \$

Part	Quantity	Price Each	Mass Production
BS2 [Board of Education]	100	\$ 85.00	\$ 8,500.00
Vex Motors	100	\$ 17.50	\$ 1,750.00
Infrared Sensor	100	\$ 10.00	\$ 1,000.00
Photo Resistor	100	\$ 1.50	\$ 150.00
Limit Switch	100	\$ 4.50	\$ 450.00
Compass	100	\$ 22.00	\$ 2,200.00
Plexiglas	100	\$ 7.50	\$ 750.00
Chassis	100	\$ 25.00	\$ 2,500.00
Tank Treads	100	\$ 13.00	\$ 1,300.00
Steel Plate	100	\$ 5.00	\$ 500.00
Miscellaneous	100	\$ 25.00	\$ 2,500.00
	Total	\$ 216.00	\$ 21,600.00

Conclusion

Summary

- Snow Shoveling Robot
 - Most efficient method of removing snow without labor
 - Creates a safe travel path
 - Inexpensive device
 - User Friendly
 - Capable for upgrades & modifications (open slots for new sensors)



Conclusion

Improvements

- Orientation of Basic Stamp to accommodate larger volume of salt
- More powerful motors
- Ability to remove snow on inclined surfaces
- Ability to bypass obstacles and impediments
- Treads made of Rubber

References

- <http://abclocal.go.com/wabc/story?section=health&id=3902666>
- <http://www.parallax.com>
- <http://www.vexlabs.com>
- http://www.nd.edu/~srdesign/ame470/project3/prva/documents/conc_eptsheehan.pdf
- <http://www.acronym.com>

