The purpose of this project is to design and create an autonomous vacuum robot to clean the floors of a shop environment. Other robots currently exist on the market such as the well-known Roomba, as well as more shop-oriented competitors from traditional tool companies. However these competitors are either too large and expensive, or not large and rugged enough to fit the needs of a robot capable of traversing a shop environment while having enough capacity and battery life to clean the entire space.

This robot is being built for Mr. Don Heer, since all other vacuum robots he has purchased have been insufficiently powerful to deal with his working environment. He is a woodworking enthusiast who has been dealing with the issue of excess sawdust building up in the shop.He has had other off the shelf models previously, but they did not fit his needs so he has commissioned the creation of a robot which can fit better within the shop.

Sequel to the above, a more robust and smart design was required providing an advanced electromechanical robot which will ensure a more efficient, safe and intelligent mechanism of cleaning the debris without much human intervention. Hence, the primary focus in the design and implementation of this robot would be on removing the problems faced by the user by using its predecessors and enabling this design to be a better upgrade as far as size, weight, power consumption, robustness, adaptability and capital and operating expenditures.

This project was developed over the period of nine months, or one academic year at Oregon State. It will serve as a design project for a group of ten students, a required project in order to graduate. These ten primary contributors are all seniors in either ECE or CS majors, which will be a good split of skill sets in order to develop the most capable and effective robot. This large group of contributors should also allow for a relatively advanced and finished project to be created. The team will also have to be aware, however, that communication is extremely important in such a large team to keep progress moving in the same direction.

The development phases of this project break down into three main phases, being design, assembly and testing, and display. During the design process, we will work closely with our project partner, Don, to meet his requirements for the project and set ourselves up for the next phase, assembly and testing. During this phase, we will buy, assemble, and test our system both in separate subsystems and finally as one complete robot. Should we be successful in this phase, we will then move into the final phase which is demonstrating our work to both our sponsor and at the Senior Design Expo to both our fellow students, professors, and interested industry personnel.

These were the updated blocks of this project were updated to these ,Power Regulator (Charging Base), Power Converter, Microcontroller (Robot), IR Emitter (Charging Base), IR Code, Real Time Clock, Power Regulator (Robot), Battery and Charge Management, Motor Control, Dust Bin, Connectors. In the start, we had a different version of these blocks but with time we came up with more efficient ideas.

1. Motor Control Block
This block contains necessary hardware setup and coding arduino microcontroller to control the motion and speed and turn of the robot using both motors. Furthermore, this block takes commands from the nav team and gives respective signals to both motors to behave accordingly. Also, this block contains motor driver circuits which ensure safety of controllers from back emf generated by the motor and providing separate terminals for power and signal sources i-e battery and arduino respectively. The problem we faced with this block is ensuring the same speeds for both motors. It got delayed due to a damaged encoder and we had to reorder a new set of motors.

2. Dust Bag Sensor
We had installed two pairs of IR transmitter receivers in the dust bag which monitor whether the dust bag is empty or half full or full. This is very important as we cant overfill the storage from debris and we need to stop suctioning when the bag gets full. The ir transceivers send ir radiations straight and if it finds debris on its path then it reflects back the radiation to the ir receiver thus knowing whether there is debris infront or not. One of them is placed on the top level and one on the middle level.

3. Connectors
This block's job is to provide a connection between the charging station and the robot to ensure safe sparkless charging. The previous idea contains copper made pads placed for the robot and charging station which provides connection once the robot comes for charging.The problem here was to ensure firm bonding n connection for which i proposed spring connected pads and the elasticity of spring pushes pads together thus avoiding loose connection for flow of current.

4. Power Regulator (Charging Base)
The power regulator in the charging base converts 12V from the converter to 5V to power the IR emitter.

5. Power Converter
The power converter in the charging base converts power from 120V standard wall outlet to 12V DC to charge the battery and the power converter in the robot is a custom designed PCB that converts 12V DC to 5V DC to power the IR sensors.

6. Microcontroller
We used the ATMEGA 2560 microcontroller as the brain of the system.

7. Real Time Clock
We used the DS1307 RTC module to keep track of the time even when the battery of the robot was out.

8. Battery and Charge Management
We custom designed a PCB around the LTC2943 to monitor, read and output the batteries charge and other functions.

The final result for the stakeholders will be a working robot which will meet the requirements of the original sponsor and hopefully last for many years to come. This finished robot will help keep his shop clean and more easy to work in, and potentially even make it a more healthy space by removing dust which could create breathing issues. For the student design team who creates this robot, they will gain experience working in a team environment, something which is extremely common in industry. The project will also result in a valuable display of their skills to hopefully impress industry professionals and aid in getting a position in a company

The requirements of the project were as follows:
1. Battery State of Charge
The robot must know how close the battery is to being empty so it can move itself to the charging station.
2. Wheel Tangle Detection
The wheel motors will know if they are entangled.
3. Dust Bag Capacity Sensing
The robot should know when the dust bag is filled up so it can notify the user that it needs to be emptied.
4. Return to Base
The robot will return to the charging base.
5. Navigation Commands
The navigation team needs to be able to control the robot base.
6. Real Time Clock
The robot needs to keep track of time at all times.
7. Robot Motion Quality
The robot should move accurately enough for dead reckoning.
8. Sending Out Commands
The system will send updates to the navigation team.

All of these requirements were met.

  The key lessons that we learned from this project is to have everything in place. Having spare parts of everything, making sure that the hardware design is complete.

ID	Task Name	Start	Finish
1	Project Conception and Initiation	Thu 10/1/20	Fri 10/16/20
2	Plan review	Thu 10/1/20	Tue 10/13/20
3	Client/Instructor Meeting	Mon 10/5/20	Fri 10/16/20
4	Project Definition and Planning	Mon 10/19/20	Fri 6/11/21
5	Draft of Engineering Requirments	Mon 10/19/20	Thu 10/22/20
6	Draft of Block diagram	Mon 10/19/20	Thu 10/29/20
7	Draft of power Budget	Mon 10/19/20	Thu 11/12/20
8	Requirments Finalized and Approved	Mon 10/19/20	Thu 11/26/20
9	RIR Draft	Mon 10/19/20	Thu 12/3/20
10	Scope and Goal Setting	Mon 10/19/20	Fri 11/13/20
11	Budget	Mon 10/19/20	Fri 4/9/21
12	Bi weekly Client meeting	Mon 10/19/20	Fri 6/11/21
13	Project Execution	Mon 12/14/20	Fri 6/18/21
14	Design Construction	Mon 12/14/20	Fri 5/21/21
15	Majority of Block has a physical implementation	Mon 2/1/21	Thu 3/18/21
16	Implementation	Fri 1/1/21	Sat 5/8/21
17	All Block have a physical Implementation	Fri 3/19/21	Wed 5/19/21
18	Block 1 check Off	Mon 1/25/21	Fri 1/29/21
19	Block 2 Check off	Mon 2/15/21	Sun 2/21/21
20	All Block Check Off	Mon 3/22/21	Fri 3/26/21
21	PCB Fabrication and Assembly	Mon 3/15/21	Fri 3/26/21
22	Technical parts Completed	Tue 3/30/21	Fri 4/9/21
23	Initial System Check off	Tue 4/13/21	Mon 4/19/21
24	Project Performance Testing and Control	Mon 3/29/21	Fri 6/11/21
25	Final System Check Off	Mon 4/26/21	Mon 5/17/21
26	Testing	Mon 2/1/21	Mon 5/17/21
27	Tweaking	Mon 3/29/21	Fri 4/16/21
28	Project Close	Mon 5/10/21	Fri 6/11/21
29	Finishing touches	Mon 5/10/21	Fri 5/28/21

Project: Project Know It's Off
Date: Thu 5/20/21

Task
Split
Milestone
Summary
Project Summary
Inactive Task
Inactive Milestone
Inactive Summary
Manual Task
Duration-only
Manual Summary Rollup
Manual Summary
Start-only
Finish-only
External Tasks
External Milestone
Deadline
Progress
Manual Progress

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