Electric Gun

Project Proposal
Fall 2012

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Introduction

I. Title: Cordless nail gun

The most common methods of implementing a nail gun have been by using use batteries and electric motors, combustible gas charges or pneumatically with compressed air. Each of these types of nail guns has their disadvantages. The nail gun from the electric motor is found to be very bulky and heavy. Meanwhile, the pneumatic nail gun consists of extra accessories which make it very hefty and expensive. The explosive gas charge nail guns require regular maintenance and also needs a battery to function. It is evident how much inconvenience each of these nail guns can cause the user. It would be so much easier if we had a battery powered cordless nail gun.

The main goal of the project is to develop the drive mechanism that converts rotational energy from a battery powered open frame motor to translational energy to drive a fastener through a wood substrate. The rotational energy of the motor will be used to compress the spring. The design solution aims to deliver approximately 40 J to the fastener.

Objectives

Features

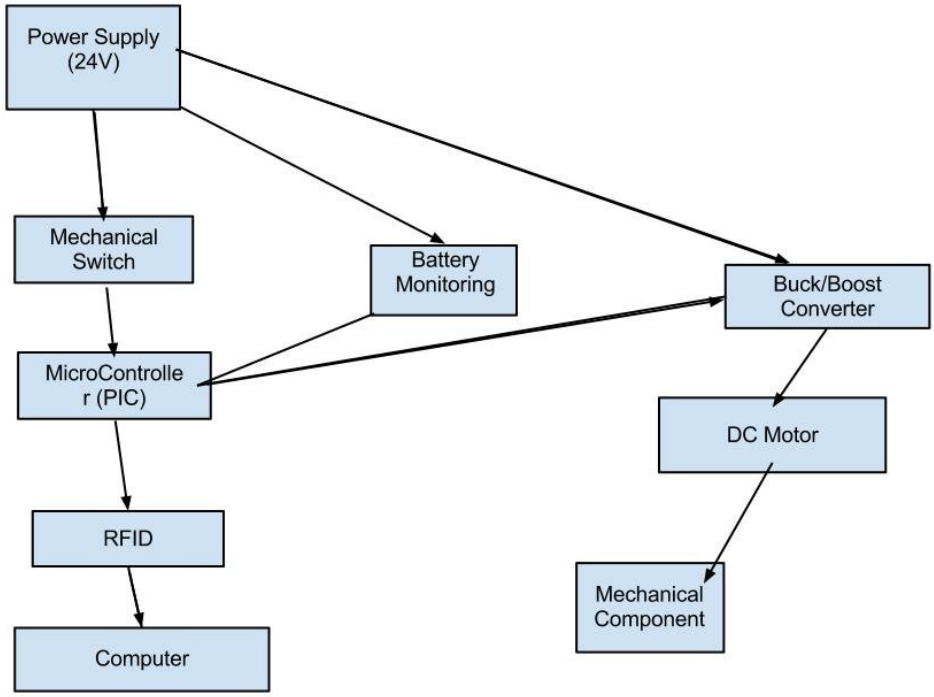
- Handheld which makes it easily operable.
- Displays amount of battery discharged.
- Contains a counter that displays number of shots taken with present battery.

Benefits

- No extra accompaniments that will complicate use.
- Lighter and cheaper than other designs.
- Eco-Friendly.
- Does not emit any waste gases like the current combustion nailer.

II. Design:

i. Block Diagram:



ii. Block Descriptions:

1. **Power Supply:** The power source is a portable 24 Volt rechargeable battery {for now we will be using two power sources 12V each to attain 24 volts}. It will supply the power necessary for the motor and control circuits.

2. **Converter :** We are applying a Buck/Boost Converter that receives the 24 V input from the battery and converts it to lower/higher voltages corresponding to the applied control input. The speed of the DC motor will be determined by the variable voltage levels.

3. **DC Motor and Mechanical Component:** The motor we plan to use is a 24 Volt DC permanent magnet motor. It receives the output voltage from the converter. The motor is used to drive the gear and thus mechanical component of the nail gun. A spring will be attached to the piston. The piston will be attached to the gear as shown below. The piston will press compress the spring when the gear is driven clockwise. The stored potential energy of the spring will be used to fasten the nail. Below is the rough diagram the idea:

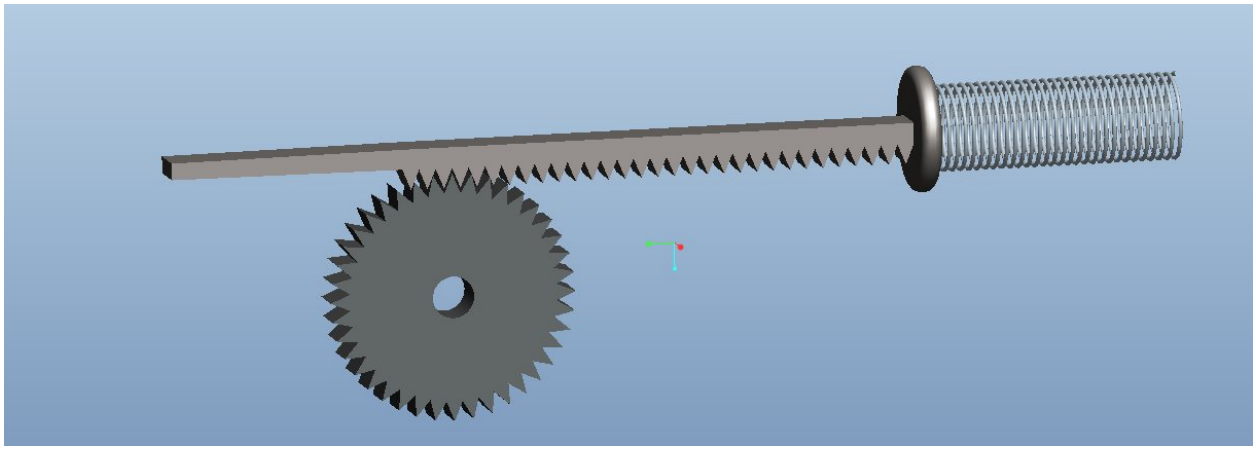


Fig 2. Collapsed Spring

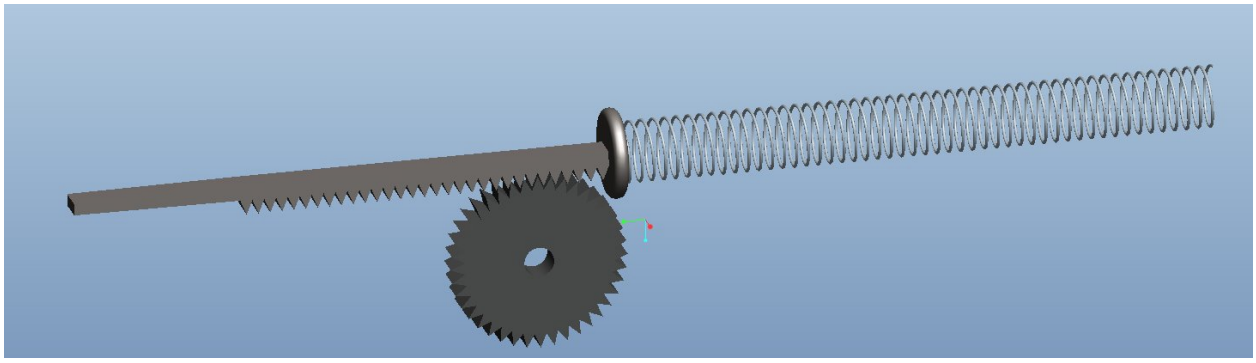


Fig 3. Expanded Spring

4. **Microcontroller (PIC}:**

The PIC micro microprocessor is used to interface with the various components of our project i.e. Buck/Boost convertor and Battery monitor. It is also being used to count the number of nails fired by counting the number of times the trigger is pressed and transmit that data remotely to the computer. The voltage regulation will run through the Microcontroller.

5. **RFID:** RFID will be used to transfer the Battery discharge data and the number of coils shot data to the computer remotely.

Requirements and Verification

Requirements:

1. The nail gun should be able to deliver at least 35 J of energy to the nail, which is a necessary criteria for the nail to penetrate through wood.
2. The energy from given to the motor should be 24 volts.

3. The first stage should push the nail into the second stage. The nail should be ejected out of the gun after the second stage.

Verification:

1. Buck Converter: We can measure the current and voltage on the input and output of the converter under varying loads. This information will help us in calculating the efficiency of the voltage conversion.

2. Control Circuit: We will measure the current draw of the control circuitry to ensure that its power consumption is negligible.

3. The circuit will be powered by 12 volts from function generator. We can see how much output the circuit provides by connecting the output to the oscilloscope.

4. A lot of work will be involved in testing our PIC's sensing of input and output voltage levels. We will have to test its ability to properly drive switching in the converter. We will try to incorporate the PIC into its role as the controller for the buck/boost converter circuit. A crucial part of PIC is its ability to sense voltage levels at the input and the output and hence we will start testing its ability to properly sense these levels. We will place the test voltages directly on the PIC rather than placing them later on the PIC Integrated converter, and then we will send the signal detected by the PIC to a DAQ program where it will be compared against actual values.

Tolerance Analysis:

The main concern of our design is the fact that the batteries may create a voltage that might be very close to the threshold voltage drive the nail. It is imperative that the battery generates enough energy to send the nail out of the gun fast enough to penetrate the wooden surface. We must test the battery to motor circuit and check to see if the motor will spin at the appropriate speed to eventually drive the nail through the mechanical design (provided by ME 470 Students).

Cost and Schedule

Labor Costs

Team Member	Dream Hourly Wage ($)	Overhead(*2.5) ($)	Total Time Spent(hours)	Total Cost ($)
Nithin Reddy	100	250	144	36000
Shaik Mohammad Farooq	100	250	144	36000
			Total	**72,** 000

Note: Total hours = 12 weeks of work at 12 hours/week.

Cost of Parts

Parts	Cost	Quantity	Total
DC motor	$40.00	1	$40.00
PIC	$4.00	3	$12.00
Infrared Sensor	$6.95	1	$7.00

12 Volt Battery	$12.50	2	$25.00
LED	$1.00	4	$4.00
RFID	$25	1	$25
		Total	$102.95

Total Cost = Parts + Labor = $102.95 + $72, 000 = $72, 102.95

Schedule:

Date	**Responsibility**	**Student**
9/19	Proposal	Nithin Reddy
9/19	Proposal	Shaik Mohammad Farooq
9/26	Research about IR sensor design .	Nithin Reddy
9/26	PIC Programming	Shaik Mohammad Farooq
10/3	Design and simulate the circuit for IR sensor	Nithin Reddy
10/3	Design the working battery to motor circuit.	Shaik Mohammad Farooq
10/10	Buy Parts	Nithin Reddy

10/10	Design battery monitoring circuit.	Shaik Mohammad Farooq
10/17	Build IR sensor circuit	Nithin Reddy
10/17	Build battery to motor circuit	Shaik Mohammad Farooq
10/24	Test IR sensor circuit	Nithin Reddy
10/24	Test Battery to motor circuit	Shaik Mohammad Farooq
10/31	Build Battery monitoring circuit.	Nithin Reddy
10/31	Build battery monitoring circuit	Shaik Mohammad Farooq
11/7	Mock-Up demos	Nithin Reddy
11/7	Mock-Up demos	Shaik Mohammad Farooq
11/14	Work on Presentation	Nithin Reddy
11/14	Look for demo locations	Shaik Mohammad Farooq
11/21	Thanksgiving	Nithin Reddy
11/21	Thanksgiving	Shaik Mohammad Farooq
11/28	Testing and Tune Ups	Nithin Reddy

11/28	Testing and Tune Ups	Shaik Mohammad Farooq
12/2	Final Demo	Nithin Reddy
12/2	Final Demo	Shaik Mohammad Farooq