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HEAD AND HAND OPERATION OF 3 AXIS PICK AND PLACE SENSORY ROBOT

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Abstract—
This paper represents the designing of a 3 axis pick and place robot with an advanced feature of its head and hand operation. The head and hand operation enhances the compatibility of the robot functionality and cuts down the implemented effort for a certain work. The head and hand operation is provided as per the reliability factor of the sensors as well as for the human comfort. The CC2500 RF module is suitable for transceiver purpose due to its flexibility of assisting the device to be feasible for multiple baud rates. The redundant features furnished by the module are its working potential on the ISM band, no labyrinthine connections and no gratuitous antennas required. The RF module is designed at 2.4 GHz using lumped parameters. The PIC microcontroller used covers a huge range of devices from tiny 8-bit microcontrollers to 32-bit advanced PIC 32 devices .Mid range devices have 14-bit bus and high end core has 16-bit instructions. The PIC 16F877A has a 14 bit instruction program memory. The simulation results as the movement of the pick and place bot, picking and obstacle detection by the head and hand with the help of tilt,grip and ultrasonic sensors respectfully.

Keywords- CC2500 RF module, PIC 16F877A microcontroller

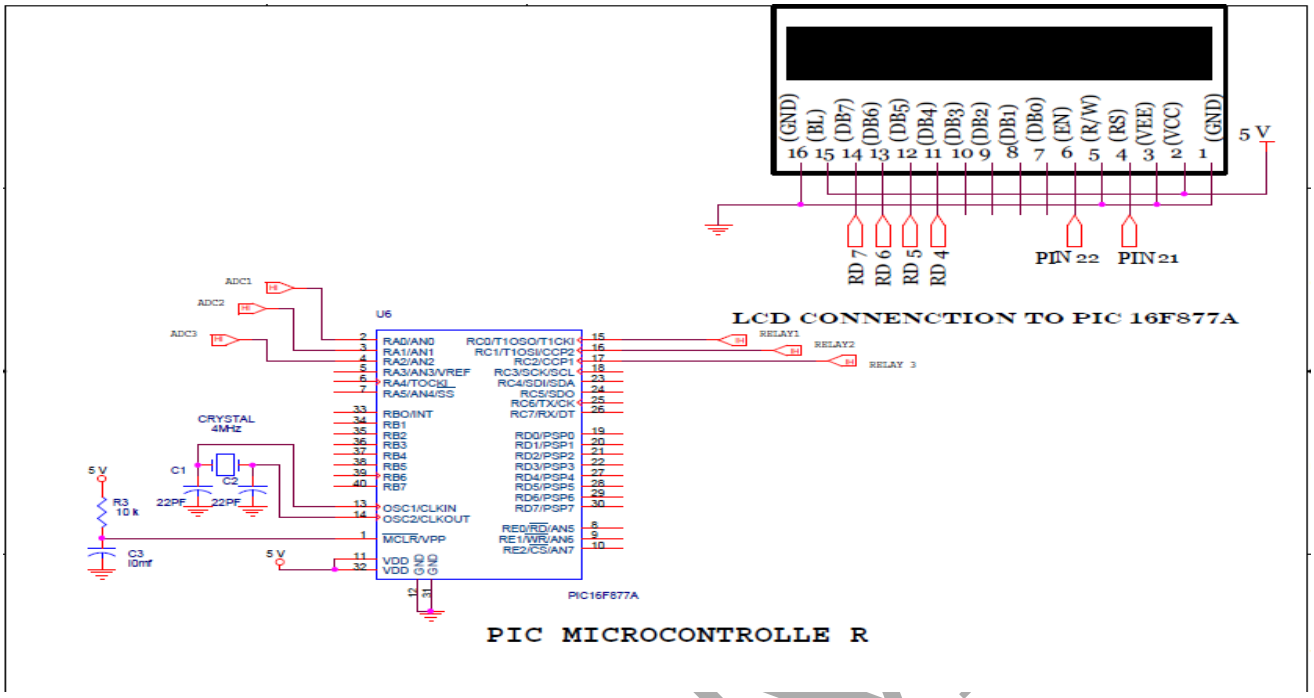
1. INTRODUCTION:

Nowadays, RF module CC2500 is the most widely used transreceiver in any transmitting and receiving electrical device. It is pretty flexible for per the operation as well as handling purpose. The most prior virtue of the module is its compatibility with multiple baud rates. This feature helps the circuit to sustain a good range of baud rates. It works on ISM band at 2.4 GHz. The RF module RF module CC2500 does not require any redundant antennas, which also reduces the labyrinthine connections and eases the level of pact. This module is direct line in replacement for serial communication as it requires no extra hardware. It works in a half duplex mode i.e. it provides communication in both directions, but only one direction at a time.

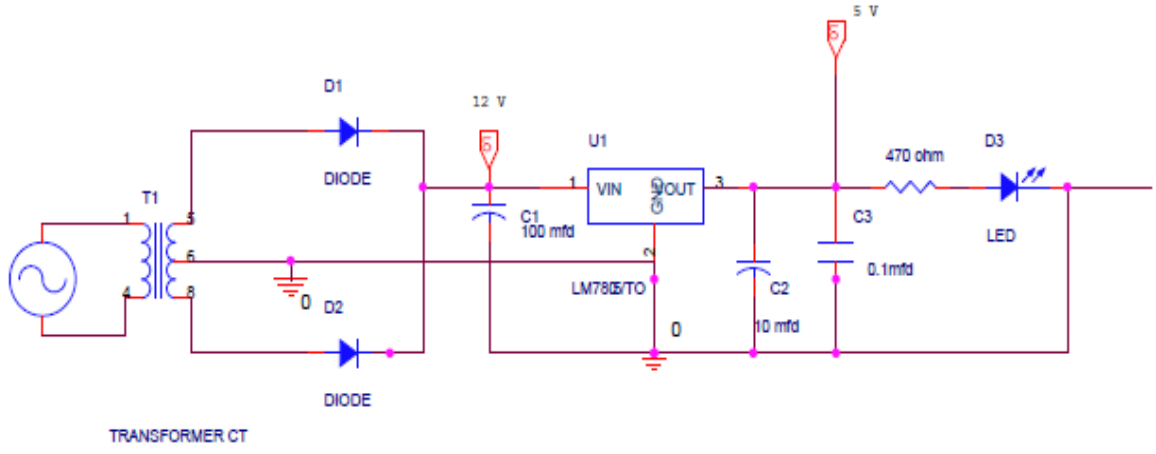
The PIC microcontroller has ample benefits such as low cost, wide availability, high clock speed and efficient coding as compared with its competitors. Some PIC have a built in 4MHz RC clock, not very accurate, but requires no external components. The program memory used in it is EPROM, FLASH and ROM. The microcontroller uses an extremely efficient CPU which uses only 35 single word instructions to learn. It is also able to generate an interrupt the ADC conversion is done. The tilt sensors used for the assistance of the device are capable of moving the robot in the 3 axes. The movement of the bot is in the X, Y axis whereas the arm of the bot is able to move in all the three axes. The grip sensor used in the device helps to grip the object properly which is to be picked. The ultrasonic sensors used can be of variable range. The ultrasonic sensors detect the presence of an obstacle on the path of the device and ask the microcontroller to stop. The exceptional thing to point out is that the ultrasonic sensors starts its work as soon as it picks up an object .The ample amount of features engulfed in the device makes it easy to use. This design has several applications in commercial and household systems.

2. CIRCUIT DESIGN:

1. PIC16F877A microcontroller



2. Power supply circuit



POWER SUPPLY

3. COMPONENTS USED:

1. LIQUID CRYSTAL OSCILLATOR
2. PCB PLATE
3. VOLTAGE REULATOR IC(7805)
4. CRYSTAL DISPLAY
5. RESISTORS

6. CAPACITORS:
7. BATTERIES AND CONNECTORS
8. MICROCONTROLLER
9. DIODE
10. LIGHT EMITTING DIODE
11. TRANSISTOR
12. RF MODULE

4. PIC16F877 MICROCONTROLLER:

A family of Harvard architecture microcontrollers made by Microchip Technology. Derived from the PIC1650 originally developed by General Instrument Microelectronics Division. The name PIC was originally an acronym for "Peripheral Interface Controller ".

They cover a huge range of devices, from tiny 8-bit microcontrollers to 32-bit advanced PIC32 devices. All PIC microcontrollers use Harvard architecture, which means that they have separate buses for data and instructions. If a device is called an 8-bit microcontroller, this means that its data bus is 8-bit, a 16-bit device has a 16-bit data bus and, guess what, a 32-bit microcontroller has an 32-bit data bus. Later PIC families have a 16-bit data bus, which include PIC24 and dsPIC series so these are 16-bit microcontrollers but they have a 24-bit instruction bus, hence the PIC24 name. PIC32 series have 32-bit data bus. The instruction bus is always bigger, and different 8-bit PIC families have various sizes of instruction. The bigger the instruction bus, the bigger the memory that can be accessed with each instruction, as part of the instruction can include an address. Baseline PIC devices have 12-bit instruction bus and include all PIC10, PIC12F5x and PIC16F5x microcontrollers

Mid range devices have 14-bit bus, most PIC12F and PIC16F series

High end core has 16-bit instructions, these are PIC18 series

The F means that devices have flash memory, so they can be reprogrammed lots of times, including in circuit. Older C devices are OTP, One Time Programmable, except PIC16C84 that has EEPROM so can be reprogrammed. In this day and age, avoid using C devices unless you are using millions of them!

All 8-bit PIC microcontrollers have a reduced instruction set (RISC). This makes execution much faster than earlier microcontrollers such as 8051 and this coupled with lower cost made the PIC so successful. The baseline PIC devices only have 35 different instructions but this has increased to 80 in the later high end core, mainly to accommodate the needs of efficient C compilers.

Apart from the core, all PIC devices have a range of peripherals built-in. These include timers, communication channels like UART, I2C and SPI plus ADC, Analog comparators and PWM for analog work. They also come with different amounts of I/O pins

Baseline from 6-pin to 40-pin

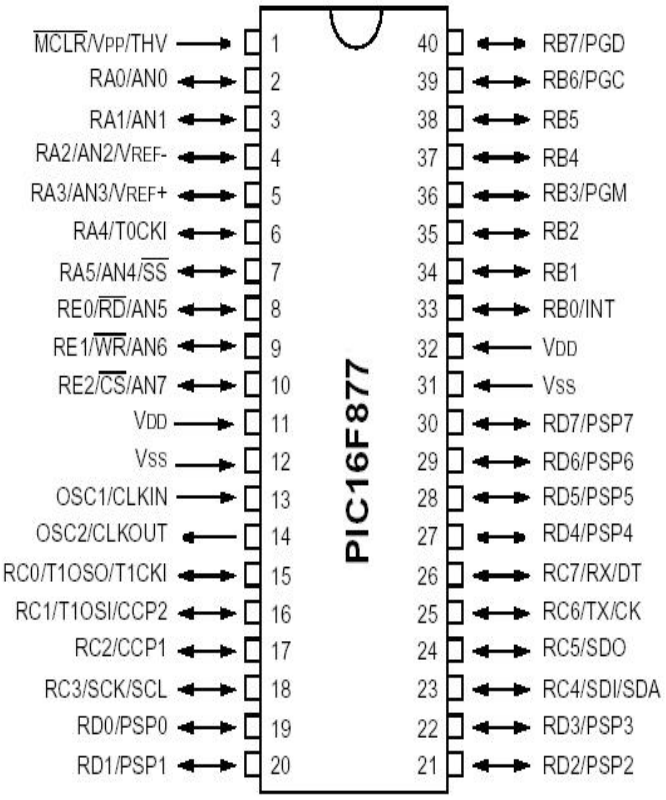
Mid range from 8-40 pin

High end (PIC18F) from 18-100 pin

Available program memory also varies with the different families:

- Baseline up to 3KB
- Mid range up to 14KB (28KB for some enhanced PIC16F)
- PIC18F up to 128KB

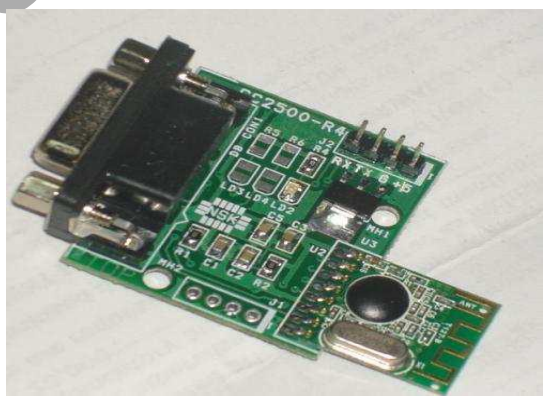
PIN DIAGRAM:



5. RF Module:

CC2500 RF Module is a transreceiver module which provides easy to use RF communication at 2.4 Ghz. It can be used to transmit and receive data at 9600 baud rates from any standard CMOS/TTL source. This module is a direct line in replacement for your serial communication it requires no extra hardware and no extra coding to It works in Half Duplex mode i.e. it provides communication in both directions, but only one direction at same time

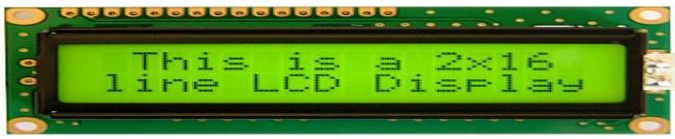
- Input Voltage - 5Volts DC
- Baud Rate - 9600
- RS 232 Interface & TTL Interface
- Range – Max 30 Mtrs. - Line of Sight



6. LIQUID CRYSTAL DISPLAY (LCD):

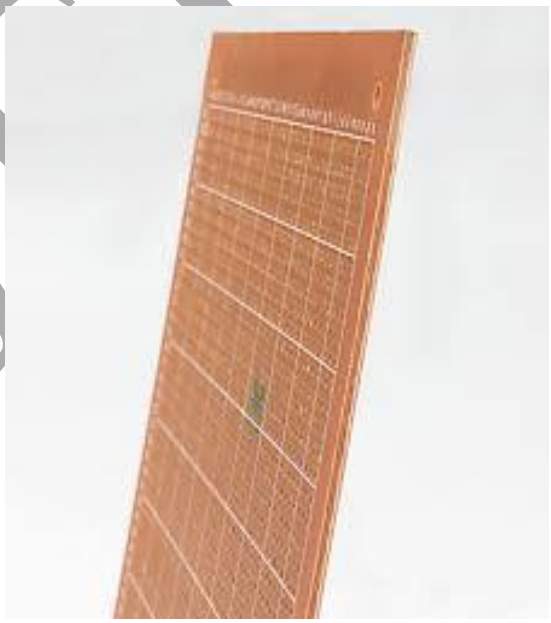
Basic diagram of LCD is as shown in figure and description of its layers as follows:

1. Polarizing filter film with a vertical axis to polarize light as it enters.
2. Glass substrate with ITO electrodes. The shapes of these electrodes will determine the shapes that will appear when the LCD is turned ON. Vertical ridges etched on the surface are smooth.
3. Twisted liquid crystal.
4. Glass substrate with common electrode film (ITO) with horizontal ridges to line up with the horizontal filter.
5. Polarizing filter film with a horizontal axis to block/pass light.
6. Reflective surface to send light back to viewer. (In a backlit LCD, this layer is replaced with a light source.)



7. PCB PLATE:

PCB is a platform where many of the embedded systems to be made. PCB (Printed Circuit Board) is used for the assembly of various components on a single plate. The connections on the PCB should be identical to the circuit diagram, but while the circuit diagram is arranged to be readable, the PCB layout is arranged to be functional, so there is rarely any visible correlation between the circuit diagram and the layout. PCB layout can be performed manually (using CAD) or in combination with an Auto router. The best results are usually still achieved using at least some manual routing sometimes abbreviated PCB, a thin plate on which chips and other electronic components are placed. Computers consist of one or more boards, often called cards or adapters



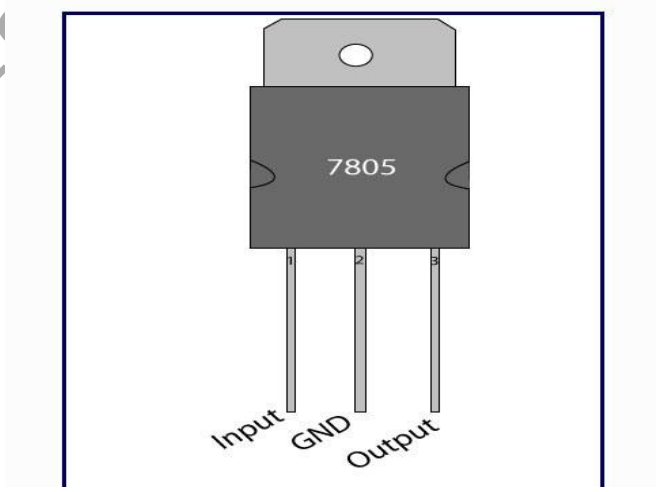
A PCB is a printed circuit board, also known as a printed wiring board. It is used in electronics to build electronic devices. A PCB serves two purposes in the construction of an electronic device; it is a place to mount the components and it provides the means of electrical connection between the components.

8. CRYSTAL OSCILLATOR:

A crystal oscillator is an electronic circuit that uses the mechanical resonance of a vibrating crystal of piezoelectric material to create an electrical signal with a very precise frequency. This frequency is commonly used to keep track of time (as in quartz wristwatches), to provide a stable clock signal for digital integrated circuits, and to stabilize frequencies for radio transmitters and receivers. The most common type of piezoelectric resonator used is the quartz crystal, so oscillator circuits designed around them were called "crystal oscillators". Quartz crystals are manufactured for frequencies from a few tens of kilohertz to tens of megahertz. More than two billion (2×10^9) crystals are manufactured annually. Most are small devices for consumer devices such as wristwatches, clocks, radios, computers, and cell phones. Quartz crystals are also found inside test and measurement equipment, such as counters, signal generators, and oscilloscopes.

9. IC 7805:

7805 is a voltage regulator integrated circuit. It is a member of 7805 series of fixed linear voltage regulator ICs. The voltage source in a circuit may have fluctuations and would not give the fixed voltage output. The voltage regulator IC maintains the output voltage at a constant value. The xx in 78xx indicates the fixed output voltage it is designed to provide. 7805 provides +5V regulated power supply.

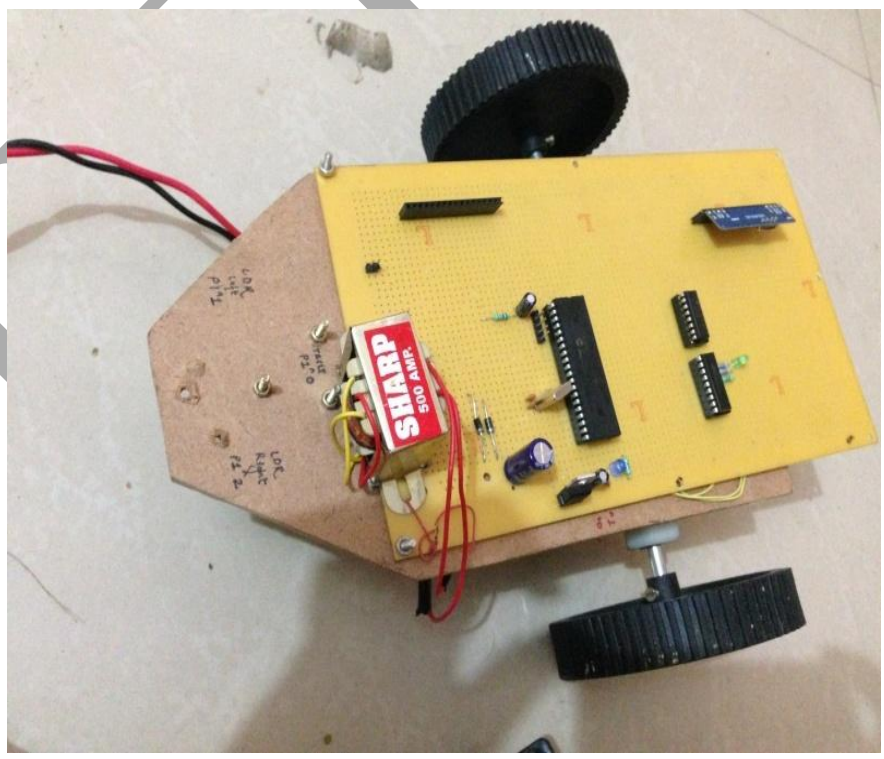


Pin No	Function	Name
1	Input voltage (5V-18V)	Input
2	Ground (0V)	Ground
3	Regulated output; 5V (4.8V-5.2V)	Output

10. WORK DONE TILL DATE

1. Tilt circuit

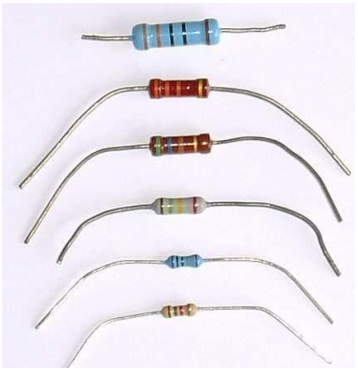
2. Basic Body of bot



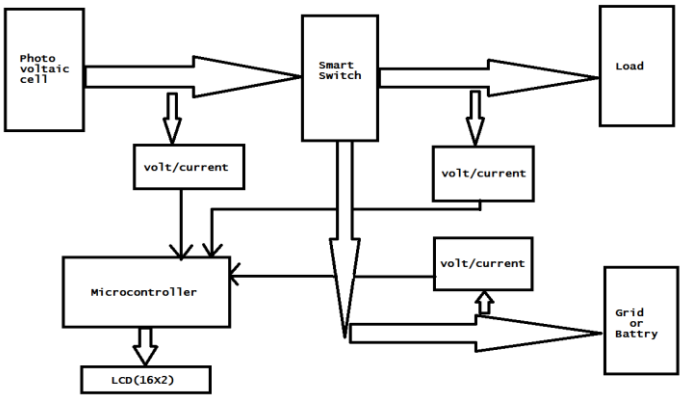
11. RESISTORS:

A resistor is a two-terminal electronic component that produces a voltage across its terminals that is proportional to the electric current passing through it in accordance with Ohm's law:

V = IR



12. BLOCK DIAGRAMS:



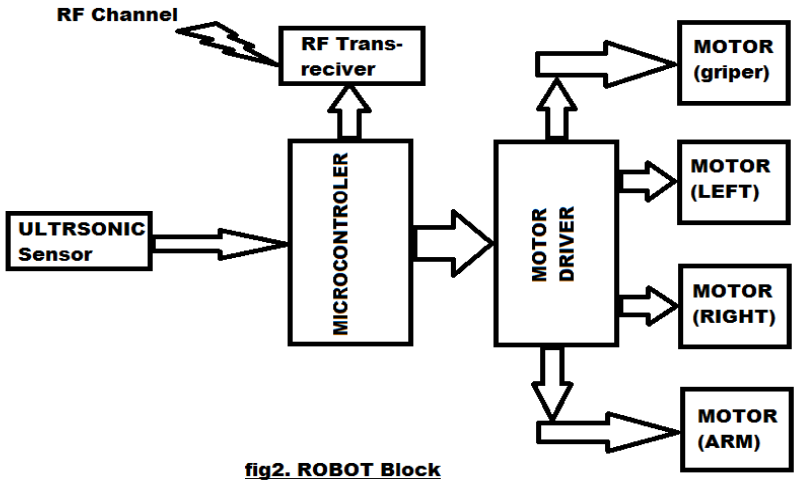
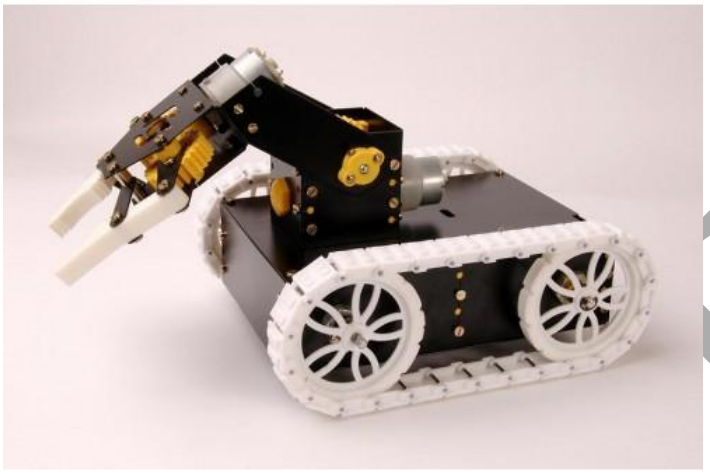


fig2. ROBOT Block

13. FINAL IMAGE OF ROBOT



13. Implementations and points to ponder:

Through the detailed analysis of the device, it is not hard to find the optimistic outcomes it could provide

1- For construction industries it would be a very beneficial device as it would cut down the human labour by a great factor.

2- A rectified class of people will be chosen for the operation of the device. So in a way it will also assist in reducing the "unemployment of the deserving".

3- It would be flexible to be used on any scale (small, medium or large) by changing the considerable parameters. Along with industries it will also prosper as a domestic product, as it would be also capable of doing small household works.

4- It can also help in the ammunition unloading for the military purposes.

References:

1. "ATMega16&16L series MCU Datasheet," available in file ATMega16&16L english.pdf.
2. Speed Control Fundamentals Theory. [Online]. Available:http://www. stefanv.com/electronics/escprimer.html (2011)
3. Li-po Battery Theory. [Online]. Available: http://www.rcgroups. com/forums/showthread.php?t=209187 (2012)
4. Formula of theoretically flight time. [Online]. Available: http://www.rctoys.com/pr/2008/07/23/lithium-polymer-battery-faq/ (2012)
5. Barnett, Cox. 2006. "Embedded C Programming and the Atmel AVR, USA: Thomson.