Solar Based Air Compressor For Car/Bike

Hari Prasad[1],Siva[2] Andyala[3]

[1](Department, of Mechanical Engineering, JNTU-H University, Hyderabad..)
[2](Department, of Mechanical Engineering, JNTU-H University, Hyderabad)
[3](Department, of Mechanical Engineering, JNTU-H University, Hyderabad)

Abstract : *With the increased urge for the vehicles in the day to day life for today's generation has led to have a continuous review over the status and working condition of the vehicles. Basically the inflation of the tire and its wear condition. One of the presently used methods is, using the compressors running on the electricity. This manual or electric inflation causes following difficulties.*
 Heavy force is required manually to push the piston along with the bearing in the head stock bore.
 Regular increase in the electric fares.
 Unreachable to the remote areas, where electricity is still a dream.
 Not safe for the user on a monetary basis.

This project is to design and fabricate to minimize manual work as well as to use renewable source of energy by using a solar panel and to overcome the above difficulties. Designing and Fabrication of solar based air compressor has the following merits,
 Environmental friendly.
 More economical, as solar energy is abundantly available.
 Continuous monitoring of air pressure on LCD.
 Easy to maintain.

This process started from the literature survey. Some of the papers reviewed were "Dynamically self inflating tire system". Accordingly a PIC microcontroller is used in this project. Micro controller has the input modules like pressure sensor, control buttons and output modules are LCD display, compressor switching driver and buzzer to give alarm in case of high pressure

Keywords - *PIC microcontroller, Pressure sensors, LCD display, Compressor, Buzzer .*

I.   INTRODUCTION

An Air Compressor is a tool that change energy or control into kinetic energy by compress and pressurize air, which, on grasp can be released in quick burst.

Air compressor specifications:

High Power Model of 12V Car Electric Air
· Compressor Tyre Pump - Tyre Inflator
· High Power Model 250 PSI has a Extra High Power Motor for Better
· Inflation power Stronger Outer Body
· Long air Pipe
· Simply use this for fast
· Easy inflation of car tyres" No strength required for pumping air as it is all electronic
· Powered straight from your car storage Perfect for anyone who want a ease while inflate a tyre
· Time saving as compared to mechanical impel
· Quick operation
· Very Compact and easy to store in car dickey
· Robust and Durable Design.
· Easy to use - just plug into your car cigarette lighter for power, slip.
· Universal adapter over tyre regulator and you are standing by to inflate.
· An invaluable kit for the motorist, no need to be stranded if you have a puncture, simply plug into you.Compact inflator, plugs into car cigarette lighter for the easy inflation of car or bicycle tyres, sports

With the presented push in the path of sustainable, clean sources of energy , it is no surprise that solar power has become one of the most popular alternative energy sources. Free and available everywhere, the power of the sun can be employed to power everything like cell phones and motors. These cells can convert the sun's power into electricity that can be used for a number of purposes. For private use, a handheld solar hybrid charger can be employed to recharge little device for instance a DC fan, a cell phone, or a camera. This task consists of Microcontroller based organize unit that continuously monitor and controls the air difficulty. This live pressure value gets display on Alpha Numeric LCD display in real time.

 keeping up output of Solar cell is attached to rechargeable battery from side to side a unidirectional current flow circuitry. This particular charged battery output given as input to the air compressor motor, this motor will controlled by the user manually using control buttons and also automatically by micro controller by a set point. In this project micro regulator has the contribution module like force sensor, direct button and yield modules are LCD put on view, compressor switch driver and buzzer to give alarm in case of high difficulty


Fig 1.1: Working model of the solar based air compressor.

II. WORKING PRINCIPLE

The photons or solar energy from the sun are trapped by the photovoltaic cells present in the solar panels. Which is made to flow in a unidirection way to the battery such that the battery does not discharge back. The battery is connected to switching circuit which finally drives the air compressor by turning it on. On
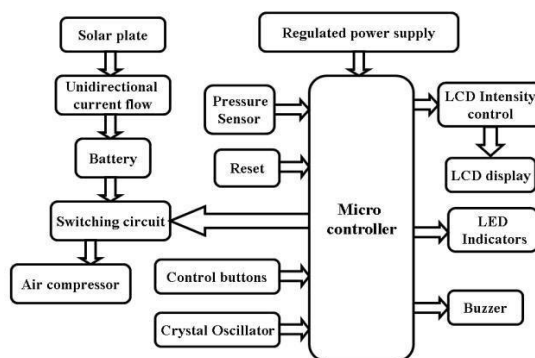
the other hand, the switching circuit is made to work on the basis of the instructions given from the PIC microcontroller, which is the heart of the project. The pin 1 of the microcontroller is connected to the control buttons. The pin 9 and 10 are attached with crystal oscillator, the purpose of external crystal oscillator is to speed up the execution part of instructions per cycle and here the crystal oscillator is having 20 MHz frequency. One of the regulated power supply circuit is used to control the flow of input voltage to the microcontroller. LED and LCD indicators are used in the 27 and 21 pin position of the PIC microcontroller. LCD displays intensity is controlled by the LCD intensity controller. The pressure sensors are also connected to sense the pressure of the tire to be inflated. If the pressure is found to be maximum then a buzzer beeps making a sense to reset the circuit. Such that the whole project model comes to its initial conditions.

III. ADVANTAGES OF SOLAR BASED AIR COMPRESSOR.

☐ Dynamic tire pressure setting.
☐ Usage of Solar energy.
☐ Continuous monitoring of air pressure on LCD.
☐ Alerts of improper inflated tires.

Solar Photovoltaic Applications:

• Solar Electric Power Generation

IV. MATERIAL SPECIFICATION

Selection of solar based air compressor materials depends on any considerations, which can in general be categorized as cost and technically overall performance. Cost includes initial material cost, manufacturing cost and maintenance cost. The key material properties that are pertinent to maintenance cost and overall performance are

☐ size of the solar panel
☐ capacity of the battery
☐ Power of the air compressor

  PIC MICROCONTROLLER PIC stands for Peripheral Interface Controller given by Microchip Technology to identify its single-chip microcontrollers. These devices have been very successful in 8-bit microcontrollers. The PIC16F72 CMOS FLASH-based 8-bit microcontroller is upward compatible with PIC16C72/72A and PIC16F872devices (A/D) converter, 2 capture/compare/PWM functions, a synchronous serial port that can be configured as either 3-wire SPI or 2-wire I2C bus, a USART, and a Parallel Slave Port. Some most important features are • High performance RISC CPU • Only 35 single expression instructions to learn • All single cycle information except for course branches which are two-cycle
• Operating speed: DC - 20 MHz clock input DC - 200 nsinstruction cycle
• 2K x 14 words of Program Memory
128 x 8 bytes of Data Memory (RAM)
• Pin out compatible to the PIC16C72/72A and PIC16F872
• Interrupt capability
• Eight level deep hardware stack
• Direct, Indirect and Relative Addressing modes
  CRYSTAL OSCILLATOR
The semiprecious stone oscillator rapidity that can be linked to the PIC microcontroller collection from DC to 20Mhz. Using the CCS C compiler normally 20Mhz oscillator will be used and the price is very cheap. The 20 MHz crystal oscillator should be connected with about 22pF capacitor. Please refer to my circuit schematic. There are 5 input/output ports on PIC microcontroller namely port A, port B, port C, port D and port E. Each port has different function. Most of them can be used as I/O port.
  REGULATED POWER SUPPLY

Regulated Power supply

The main blocks of regulated power supply circuit are
☐ 230V Ac mains
☐ Transformer
☐ Bridge rectifier(Diodes)
☐ Capacitor
☐ Voltage regulator(IC 7805)
☐ Resistor
☐ LED(Light emitting diode)

LCD DISPLAY One of the most common devices attached to a micro controller is an LCD display. Some of the most common LCD"s connected to the many microcontrollers are 16x2 and 20x2 displays. This means 16 characters per line by 2 lines and 20 characters per line by 2 lines, respectively. In this project we have used 16x2 displays.

The LCD requires 3 control lines as well as either 4 or 8 I/O lines for the data bus. 8-bit data bus is used the LCD will require a total of 11 data lines (3 control lines plus the 8 lines for the data bus). The three manage
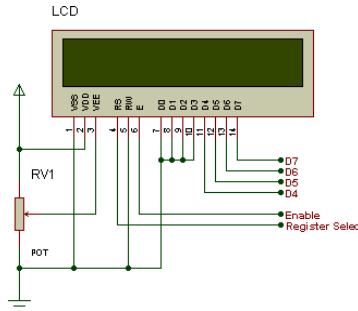
Fig4.5.1LCD Pin diagram

Pin No.	name	Description
Pin no. 1	VSS	Power supply (GND)
Pin no. 2	VCC	Power supply (+5V)
Pin no. 3	VEE	Contrast adjust
Pin no. 4	RS	0 = Instruction input 1 = Data input
Pin no. 5	R/W	0 = Write to LCD module 1 = Read from LCD module
Pin no. 6	EN	Enable signal
Pin no. 7	D0	Data bus line 0 (LSB)
Pin no. 8	D1	Data bus line 1
Pin no. 9	D2	Data bus line 2
Pin no. 10	D3	Data bus line 3
Pin no. 11	D4	Data bus line 4
Pin no. 13	D6	Data bus line 6
Pin no. 14	D7	Data bus line 7 (MSB)

lines are referred to as EN, RS, and RW. The EN line is called "Allow."The RS line is the "Register Select" line. The RW line is the "Read/Write" control line. Finally, the data bus consists of 4 or 8 lines namely as DB0, DB1, DB2, DB3, DB4, DB5, DB6, and DB7.

BUZZER

Basically, the sound foundation of a piezoelectric sound part is a piezoelectric diaphragm. To border a buzzer the regular transistor interfacing circuit is used. Note that if a different power supply is used for the buzzer, the 0V rails of each power supply must be connected to provide a common reference. If a battery is used as the power deliver it is worth remembering that piezo sounders represent much less modern than buzzers. Buzzers also just have one „tone", whereas a piezo sounder is able to create sounds of many different tones. To switch on buzzer -high 1 To switch off buzzer -low 1 1) When the piezoelectric buzzer is set to produce intermittent sounds, sound may be heard continuously even when the self drive circuit is turned ON / OFF. This is because of the failure of turning off the feedback voltage. 2) it mainly contains signaling.. So there is no need to arrange another circuit to drive the piezoelectric buzzer. 3) Rated voltage (3.0 to 20Vdc) must be maintained. 4) Do not place resistors in series with the power source, as this may cause abnormal oscillation. If a resistor is essential to adjust sound pressure, place a capacitor (about 1μF) in parallel with the piezo buzzer. 5) Do not close the sound emitting hole on the front side of casing. 6) watchfully build up the piezo buzzer so that no obstacle is located within 15mm from the sound discharge hole on the front side of the casing. 4.7 Pressure Sensor A force sensor usually acts as a transducer; it generates a signal as a function of the pressure imposed.. The piezo resistive pressure sensor or silicon cell consists of a micro-machined silicon contains strain gauges diffused into it, fused to a silicon or glass back plate. The resistors have a value of approx. 3.5 kOhm. Pressure induced strain increases the value of the radial resistors (r), and decreases the value of the resistors (t) transverse to the radius.

A solar cell is a tool that change solar energy into electricity by the photovoltaic effect. Solar cell efficiencies vary from 6% for amorphous silicon-based

. Solar cell energy conversion efficiencies for commercially available multi crystalline Si solar cells are around 14-19%. 1. Photons in sunlight hit the solar panel and are absorbed by semi conducting materials, such as silicon. 2. Electrons (negatively charged) are knocked loose from their atoms, allowing them to flow through the material to produce electricity. Due to the special composition of solar cells, only allow the electrons to move in a single direction. The complementary positive charges that are also created (like bubbles) are called holes and flow in the direction opposite of the electrons in a silicon solar panel. 3. An array of solar panels converts solar energy into a usable amount of direct current (DC) electricity.

LED A light-emitting diode (LED) is a semiconductor light source. When a diode is forward biased (switched on), electrons are able to recombine with holes within the device, releasing energy in the form of photons. This reaction is called voltage and the color of the light is determined by the energy gap of the semiconductor. The electrical symbol and polarities of led are shown in fig.
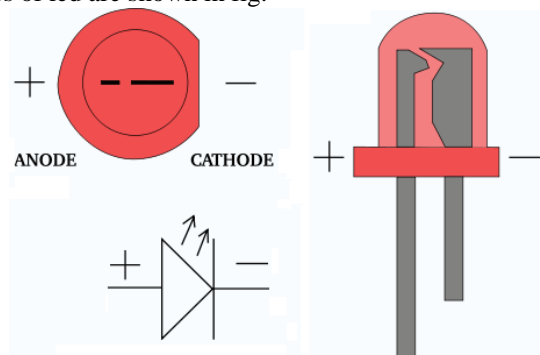

Fig 4.9.1 Electrical Symbol & Polarities of LED.

I gave each symbol a **meaning** and a color A push-button is a simple switch mechanism for controlling some aspect of a machine or a process. In built-up and commercial applications, push buttons can be linked together by a mechanical linkage so that the act of pushing one button causes the other button to be released. In this way, a emergency can "force" a start button to be released. This method of linkage is used in simple manual operations in which the machine or process have no electrical circuits for control.

V. SOFTWARE DESCRIPTION

This project is implemented using following software‟s:
☐ Express PCB– for designing circuit

☐ Proteus 7 (Embedded C)– for simulation part
  Express *PCB*

Express PCB is a software tool to design PCBs specifically for manufacture by the company Express PCB (no other PCB maker accepts Express PCB files). It is very easy to use, but it does have several limitations. Express PCB has been used to design many PCBs (some layered and with surface-mount parts. Print out PCB patterns and use the toner transfer method with an Etch Resistant Pen to make boards. However, Express PCB does not have a nice print layout.

The PIC is a software used where the language code of machine is written and compile. After compilation, the machine source code is converted into hex code which is to be dumped into the microcontroller for further processing. PIC compiler also supports C language code. As we are going to use microchip , hence we also call it PIC C. The PCB, PCM, and PCH are separate compilers. PCB is for 12-bit opcodes, PCM is for 14-bitopcodes, and PCH is for 16-bit opcode PIC microcontrollers. We have to add header file for controller you are using, otherwise you will not be able to access registers related to peripherals. #include <16F877A.h> // header file for PIC 16F877A// *5.3 Proteus* Proteus is software which accepts only hex files. Once the code is changed into homeobox, that hex code has to be neglected into the microcontroller and this is done by the Proteus. Proteus is a programmer which itself contains a microcontroller in it other than the one which is to be programmed. This microprocessor has a program in it written in such a way that it accepts the hex file from the pic compiler and dumps this hex file into the microcontroller which is to be programmed. As the Proteus programmer requires power supply to be operated, this power supply is given from the power supply circuit designed and connected to the microcontroller in proteus. The program which is to be deserted in to the microprocesser is edited in proteus and is compiled and executed to check any errors and hence after the successful compilation of the program the program is dumped in to the microcontroller using a dumper.

VI. PROJECT DESCRIPTION

Schematic diagram and interfacing of PIC16F72 microcontroller with each module is considered.
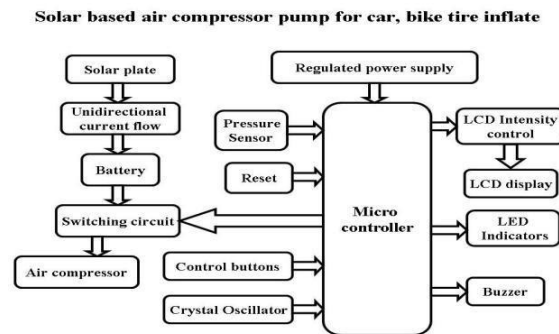

Fig 6.1 Schematic diagram

The above schematic diagram of Solar Based Air Compressor explains the interfacing section of each component with micro controller and LCD. The crystal oscillator connected to 9th and 10th pins of micro controller and regulated power supply is also connected to micro controller and LED‟s also connected to micro controller through resistors and motor driver connected to micro controller. *6.1 Interfacing crystal oscillator with micro controller*
Fig 6.2: explains crystal oscillator and reset button which are connected to micro controller. The two pins of oscillator are connected to the 9th and 10th pins of micro controller; the purpose of external crystal oscillator is to speed up the execution part of instructions per cycle and here the crystal oscillator having 20 MHz frequency. The 1st pin of the microcontroller is referred as MCLR ie, master clear pin or reset input pin is connected to reset button or power-on-reset.
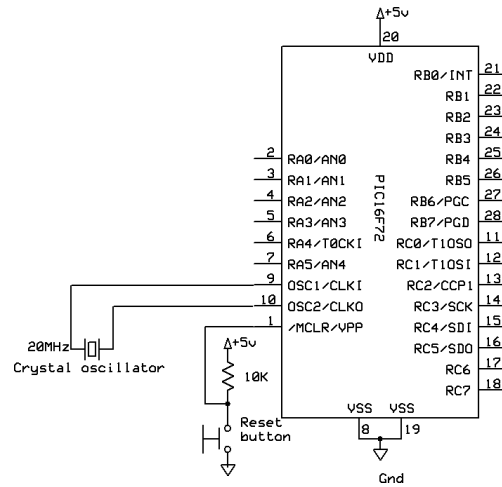
Fig 6.2 Crystal oscillator interfacing with micro controller

Result

The project "Solar Based Air Compressor" was designed such that the system continuously monitors and controls the air pressure. The system also displays the amount of voltage generated by the solar panel on the LCD.

VII. CONCLUSION

Integrating features of all the hardware components used have been developed in it. Presence of every module has been reasoned out and placed carefully, thus contributing to the best working of the unit. And aiso using highly advanced IC"s with the help of growing technology, the project has been successfully implement. Thus the project has been successfully designed and tested. Future Scope This project can be extended by using GSM technology, which helps in sending the monitored and controlled data to any place in the world by an SMS.

ACKNOWLEDGEMENT

REFERENCES

[1] www.wikipedia.com
[2] www.allaboutcircuits.com
[3] www.microchip.com
[4] www.howstuffworks.com

Books referred:

[1] Raj kamal –Microprocessor Architecture, Programming, Interfacing and System Design.
[2] Mazidi and Mazidi –Embedded Systems.
[3] PCB Design Tutorial –David.L.Jones.