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Review on Solar Powered Air Compressor Pump for Car, Bike Tire Inflate

Mr.Amit
Assistant Professor
SRM University, NCR Campus
Modinagar

V.Narendra Kumar, Aman Batra, Kshitij Kulshrestha, Shubham Sharma
Final Year Students
SRM University, NCR Campus
Modinagar

ABSTRACT:
Solar energy is an abundant source of green energy. It plays a crucial role due to increasing price of fossil fuels and acute shortage of them which leads to global warming. In comparison with non renewable energy sources like coal, solar power energy is more efficient in being converted to electrical energy. The onus of this project is to use solar energy to charge a battery with the help of solar panel which is composed of photovoltaic cells. These cells are composed of silicon oxide which has the property to convert solar energy to electrical energy on reaction with photons. A rechargeable battery will be used to power an air compressor pump which can be used to inflate car, bike tires. The AT mega328 microcontroller will be programmed to continuously monitor the pressure level in tire and inflate it as soon as the pressure in the tube drops below a preset value, once the tire reaches the desired value the microcontroller will switch off the air compressor pump.

KEYWORDS: Solar panel, Air compressor pump, Air Pressure

I.INTRODUCTION:

Humans had a penchant for utilizing natural resources to supply to their needs for a long time, much before the utilization of non renewable energy resources came into being. With the discovery of coal and the invention of machines the world encountered the industrial revolution which ushered us in a new era of prosperity. But the happiness it brought with it was short lived. Since then humans have utilized these fossil fuels indiscriminately and have heavily depleted our energy resources leading to a global energy crisis which has unfortunately affected all developed and developing nations' alike which sadly includes our beloved country. This has ledto great bearings on socioeconomic developments. Scientists have calculated thatin the present rate we will have depleted more than 80% of our non renewable energy sources by the year 2060. Summits and conventions taking place all over the world have brought together the greatest minds from different countries to get a solution to this impending crisis and the collective decision is to focus on renewable sources of energy such as solar energy, wind energy, geothermal energy to name a few. Solar power generation is one of the most sought after methods to tackle the energy crisis, closing down on the energy demand and supply gap and achieving sustainability. The energy from the sun can be used to power a whole range of devices. In this project we wish to harness the solar energy and use it to power a device an air compressor pump thereby making it green i.e., environment friendly. The air compressor pump has several applications and powering it with solar energy has great environmental implications. This project can serve as the base for powering various devices with the power of the sun. This low cost prototype has the potential to revolutionize the energy industry and contribute in the walk towards sustainability.

II.AIR COMPRESSOR:

An air compressor device in layman's term can be defined as a device which basically converts power to kinetic energy by compressing air. This compressed air can be released as pressurized bursts of air. There are two generic principles for the compression of air (or gas): dynamic compression and positive displacement compression. In positive displacement compression, the air is drawn into one or more compression

chambers, which are closed slowly gradually decreasing the volume of the chambers hence compressing the air. Once the pressure inside the chamber has reached the desired ratio level, a valve is opened to let out the compressed air with increased pressure due to continued reduction of the compression chamber's volume. In dynamic compression, there are rapidly rotating compressor impellers with blades through which is air is drawn in. A diffuser discharges the compressed air thus converting the kinetic energy to static pressure.
Air compressor pump have several applications such as:
1) For filling tires
2) To fill gas cylinders with high pressure clean air
3) To power pneumatic tools with a large amount of pressurized air
4) To produce large volumes pressure air for large-scale industrial processes

III.SOLAR AIR COMPRESSOR:

A solar powered air compressor is nothing but a regular compressor which is powered by solar energy that is the sun. Air compressor devices have several applications which also includes some heavy industrial work such as drilling in search of fossil fuels powering other pneumatic tools, since this work is usually is carried out in areas with low or no power supply at all we use solar energy to power the tools. In order to use the air compressor at night we can use a battery to provide power by charging it through a solar panel. Though solar air compressor pump is readily available in market, in this project we have attempted to create a similar device using a microcontroller- AT mega 328. This device is blue and it will not harm the environment in any manner since it is powered by the sun.

SOLAR PANEL SPECIFICATIONS:

We are using a 25 watt photovoltaic solar panel which is rated to an output in the range of 12volts. Depending on the working and the conversion efficiency of the photovoltaic cells, a solar cell can be graded as A, B or C with grade C been the lowest and grade A been the highest grade. The solar cells are constituted of polycrystalline silicon. The average lifetime of a solar panel composed of grade A solar cells is about 25 years. MC4 cables which come attached to the junction box serve as outlet from the panel.

AIR COMPRESSOR PUMP SPECIFICATIONS:

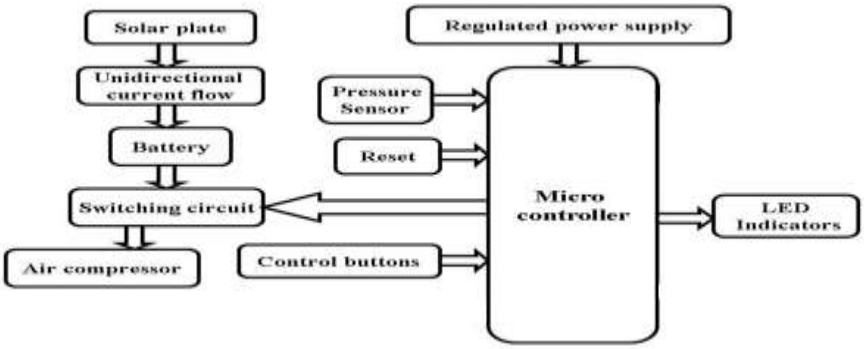
- 12V Car Electric Air Model
- Compressor Tire Pump
- High Power Model 300 PSI
- Long air Pipe
- Quick operation
- Robust and Durable Design
- Completely electronic hence no physical power required
- Saves time as compared to mechanical pump
- Very Compact and can be stored in a small space.
- Easy to use and has a universal adaptor.
- The pressure gauge of the compressor pump shows reading in kg/cm bar.
- Invaluable kit as it can be used at any time and any place to inflate tires.

IV.DESIGN OF THE SYSTEM:

A. FEATURES OF THE SOLAR BASED AIR COMPRESSOR PUMP:

The features of the solar based air compressor pump are as listed below:
1) Dynamic tire pressure setting.
2) Usage of Solar energy.
3) Continuous monitoring of air pressure

B. THE DESIGN OF THE SYSTEM:



Block Diagram

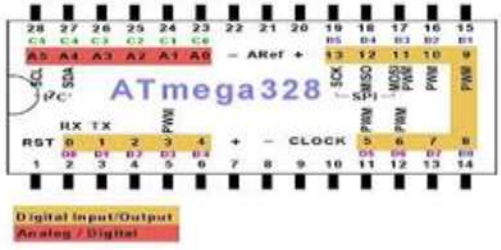
The radiation from sun is collected by the solar photovoltaic cell which converts the solar energy to electricity. This energy is stored in the battery. Once the battery is charged the power is taken out through two supply lines, one part (12 volts) is used to power the air compressor pump while the other supply is passed through a voltage regulator and is brought down to 5 volts to power the microcontroller. The switching circuit or the relay controls the interface of the air compressor to the microcontroller. The pressure sensor continuously monitors the pressure inside the tire. The microcontroller is programmed to switch on the air compressor to inflate tires whenever the pressure in the tire drops below a preset level.

V.SYSTEM ARCHITECTURE:

The main components used in the system are as follows:

1) MICROCONROLLER:

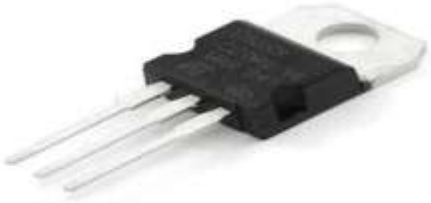
The microcontroller we are using here is AT mega 328,it is the heart of the circuit on the platform Arduino Uno. Arduino is an open-source electronics prototyping platform based on flexible, easy-to-use hardware and software. Today we will help you get started by showing you some of the options available and how easy it is to get started.Arduino hardware is an open-source circuit board with a microprocessor and input/output (I/O) pins for communication and controlling physical objects (LED, servos, buttons, etc.). The board will typically be powered via USB or an external power supply which in turn allows it to power other hardware and sensors. The Uno is a great starter Arduino, it provides a solid foundation for those just getting started and has a lot of the options you will want as you explore the platform. It also works with almost every shield available.



2) VOLTAGE REGULATOR:

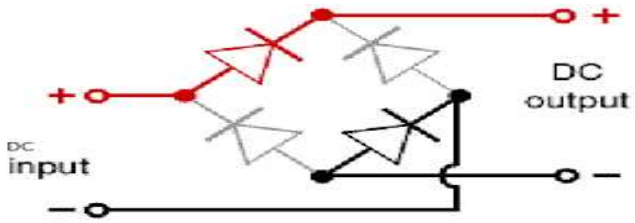
7805 is a voltage regulator integrated circuit. It is a part of 78xx series voltage regulator ICs. The 78xx is a family of IC that consists of fixed linear voltage regulator integrated circuits. There are lots of applications of 78xx family voltage regulators. They are commonly used in electronic circuits requiring a regulated power supply due to their ease-of-use and low cost. These are the main advantages of 78xx family regulators. The voltage regulator IC maintains the output voltage at a constant value. It is basically used to lower down

the voltage from a high value to low value. 7805 provides +5V regulated power supply. It lowers down the voltage from a high value to +5V. These ICs do not require any additional components to provide a constant, regulated source of power. This makes them easy to use, as well as economical and efficient uses of space.



3) RELAY CIRCUIT:

Relay is an electromagnetic device. It separates two circuits electrically but connects them magnetically. Relay is also known as electronic switch that works similar to manual switch. Some form of relay switching mechanism is always required to keep the 'ON' and 'OFF' tasks at check .A relay switch is basically classified into two parts: input and output. Both input and output sections are isolated from each other. The input section consists of a coil which magnetizes when a small voltage from an electronic circuit is applied to it. This voltage which is applied to magnetize the relay coil is called the operating voltage. Next comes the output section. It mainly consists of contactors which connect or disconnect mechanically. When operating voltage is applied the relay coil gets magnetized due to which the switch gets connected to the coil side. The main application of relay circuit is to interface an electronic circuit to an electrical circuit which works at very high voltage. The foremost advantage of using it is that it requires low power to operate, but high power devices can be powered with it.



V.CONCLUSION:

The project has been successfully completed and it has been observed that powering an air compressor pump with solar power helps in saving energy and makes the system environment friendly by eliminating the usage of conventional sources of energy. We hope that this project serves as an inspiration to others to use renewable sources of energy to power devices.

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