iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 11 **Issue:** VI **Month of publication:** June 2023

DOI: https://doi.org/10.22214/ijraset.2023.54302

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue VI Jun 2023- Available at www.ijraset.com

Solar Operated Air Compressor

Mr. V. V. Gundage[1], Vaibhav P.Nale[2], Sagar A.Jathar[3], Rushikesh N. Adalinge[4], Aniket A.Pisal[5], Vaibhav H.Kharat[6]
[1]*Asstistant Professor at College of Engineering, Phaltan in Mechanical Engineering*
[2, 3, 4, 5, 6]*Mechanical Engineering/PES's COE, Phaltan/Dr. B.A. Technical University/India*

Abstract: ***Solar energy is a renewable energy source which can be used in many applications such as energy production, heating, cooking, etc. Air compressors, sometimes called gas compressors, are devices or tools which reduce the volume of a gas thereby creating pressure and heat in the compressor tank ,to operate these air compressors, a lot of electrical power is required based on the air outlet pressure. Non-renewable resources for electricity generation have become limited and are about to disappear, leading to high energy costs or an energy crisis. In such situations, renewable sources such as solar are very useful and the application of this technology for running the air compressor is called solar air compressor.***
Keywords: Air compressor, Solar Energy.

I. INTRODUCTION

When we see the scenario of today, it is clear that there is a worldwide demand for Clean and Renewable Energy. The first problem is that fossil fuels are becoming depleted rapidly and it will be more difficult to recover them. That's why, if we don't take care of it now, we could face energy crises in the future. The cost of energy will skyrocket, and a lot of individuals or countries won't have it. We need to find alternatives and use them to their full potential in order to avoid such a disaster scenario. The land is warming up, and the climate has changed. The parts of the world are going to get drier if more rains and sunshine came, but other parts won't be as dry. The thinner Ness of the ozone layer is a further bad thing, which will also lead to Earth warming. In addition to these two effects, it is more important than ever to take another step in a different direction. We're going to make use of renewables in this step.

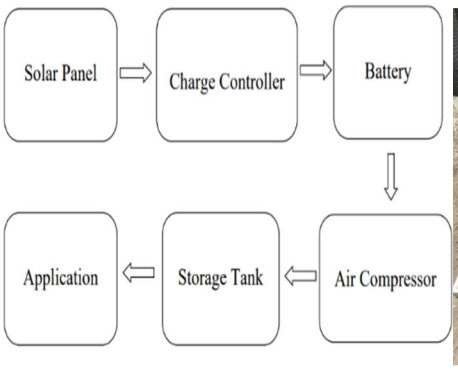
II. PROBLEM STATEMENT

Vehicle Puncture is suddenly occurring major problem, Puncture repairing shop is far away from our college and air compressor completely depends on electricity due to electricity fluctuation and unavailability of electricity in some rural areas we can't completely rely on electricity and also puncture repairing shop is far away from our college.

III. OBJECTIVE

1) To construct solar-operated air compressor to provide an environmentally friendly, cost-effective, and sustainable solution for compressed air needs while reducing reliance on traditional energy sources and minimizing the environmental impact.
2) To modify the auto cutoff valve of air compressor to set the maximum pressure at 60psi and find the charging time required of battery.

IV. EXPERIMENTAL SETUP



Layout



Fig. 1

©IJRASET: All Rights are Reserved

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue VI Jun 2023- Available at www.ijraset.com

V. CALCULATION

1) *Selection of compressor :-* Compressor should develop more than 5 bar pressure ;thus, compressor of capacity 10 bar shall fulfill the requirements and is readily available in market according to the survey. Calculation For Power Required To Run The Compressor: Different batteries available in market. 12 V, 3.5 Ah Power = 12 * 3.5 = 42-Watt 12 V, 7.5 Ah Power = 12 & 7.5 = 90 Watt Power required to run the compressor is 168 Watt (12 V * 14A) Therefore we select battery of power outage 90 Watt. When the battery is completely charged, the compressor would run for about 30 minutes, till the battery is completely discharged.
2) *Selection of storage tank :-* The various capacity of storage tanks is available in market are: 25 lit, 45 lit, 100 lit, 200 lit 25 lit storage tanks would be a little small for suitability of our project. Thus, 45 lit tank is best suited. Specifications :Storage capacity: 45L ,Weight:- 20.8 kg, Cost: Rs.2300, Material: Mild steel

Calculations:-Length - 0.761m = 7.61dm, Diameter – 0.2733m = 2.733dm

Area of circle = $\pi r2$ = 3.14 * 1.366 * 1.366 = 5.85 dm

Volume = Area* Length= 5.85* 7.61 = 44.518 ltrs. Volume of Tank = 44.51~ 45 ltrs

Theorotically, Time required to fill the tank = capacity of tank/discharge of compressor = 45/90 = 0.5 hrs.

But practically as compressor run longer its efficiency decreases due to heat generation and air back pressure that's why in real life, Practically, Time required to fill the storage tank = 1hr. 7min. But due to safety and overrunning of compressor we are filling tank up to 60psi in 20min.

3) *Selection of battery:-* We have selected air compressor of 12V,220W power output. So, we have to select battery which should run our compressor as per our requirement. Theoretically battery can last 1hr 40 min but practically battery can last up to 1hr 20 min only hence we have selected high power battery than requirement. Hence If we select 32Ah battery the power output will be Battery power = Battery (Ah) x Voltage x No of batteries x Power factor = 32 * 12 * 1 * 0.8 (standard) = 307.2W Therefore, to calculate battery backup, Battery backup = Battery power/ Load = 307.2/220 = 1.40 hrs.
4) *Selection of Solar panel:-* We have selected battery of 32Ah, 12V so we have to select solar panel which should charge our battery in moderate time and the acceptable maximum temperature of polycrystalline solar panels is 85 °C while the acceptable minimum temperature is -40 °C and in our region temperature ranges from 12 °C to 38 °C hence polycrystalline solar panel we have selected. greater heat resistance.

Calculations: Battery charging time = Battery Ah / Charging Current ,Battery = 32Ah

Solar Current = 10A(By Using Charge Controller)

Battery Charging time = 32/10 = 3.2 = 3Hrs 20Mins

But practically there are current losses up to 40% . So, we should add 40% current loss in total charging time. Now If we consider 40% loss then , 32/100 * 40 = 12.8Ah , 32 + 12.8 = 44.8Ah , Battery = 44.8Ah (Including 40% Loss) Battery Charging time = 44.8/10 = 4.48= 4Hrs 48Mins.

VI. RESULT

1) We get 1 hour 40 minutes backup of compressed air once the compressor tank is full.
2) We require 20minutes to fill the compressor tank up to 60psi which was calculated by stopwatch.

VII. CONCLUSION

1) We have constructed a solar-operated air compressor which provides an environmentally friendly, cost-effective (up to 22%), and sustainable solution for compressed air needs while reducing reliance on traditional energy sources and minimizing the environmental impact.
2) We have modified the auto cutoff valve of air compressor by reducing the spring stiffness and set the maximum pressure at 60psi and the charging time required to fully charge the battery using 12V solar plate is 4.48hours.

VIII. FUTURE SCOPE

1) In Agriculture: Our project model can help the farmers for spraying fertilizers without relying on electricity to get rid of this electricity fluctuation problem. Since our project model is small in size and portable, therefore it will prove to be a boon for them.
2) In Automobile Service Station: A compressor that we have developed would prove to be a boon for roadside bicycle stores and automobile service stations and also can be made useful for the service center.

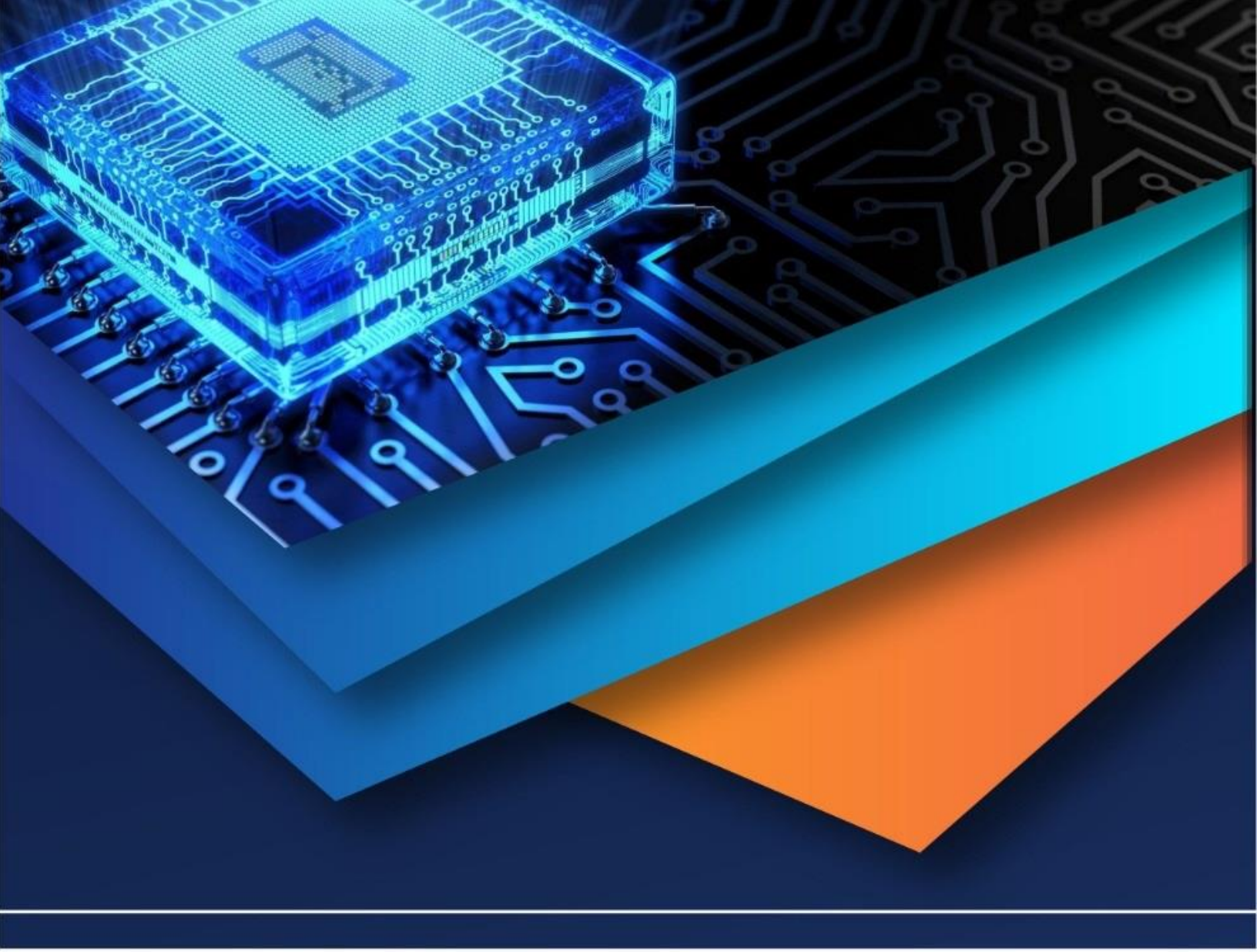
©IJRASET: All Rights are Reserved | SJ Impact Factor 7.538 | ISRA Journal Impact Factor 7.894 |

3) In Automobile Spray Painting: We can use our compressor for spray painting in small and big painting service shops.

REFERENCES

[1] V. A. Dahate "A Solar based Working Model to Run Air Compressor" IJSRD - International Journal for Scientific Research & Development| Vol. 3, Issue 02, 2015.
[2] Shrinivas N.T. "Solar Based Air Compressor for Tire Inflation" IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) Volume 13, Issue 5 Ver. VIII (Sep. - Oct. 2016).
[3] Sachin Prabha "Solar Based Air Compressor For Car/Bike Tyre Inflate" International Journal For Technological Research In Engineering Volume 3, Issue 10, June-2016.
[4] R. Mathan Kumar "Solar Based Portable Air Compressor For Tyre Inflation" Solar Based Portable Air Compressor For Tyre Inflation Volume: 06 Issue: 03 | Mar 2019.
[5] Mrs. O. Hema Latha "Solar Based Air Compressor for Inflating Tyres" IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) Volume 11, Issue 5 Ver. IV (Sep- Oct. 2014).
[6] Mayur H.G. "Solar Based Air Compressor for Tire Inflation" IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) Volume 13, Issue 5 Ver. VIII (Sep. - Oct. 2016).
[7] P. Kanaga John Christ "Solar Based Portable Air Compressor For Tyre Inflation" Solar Based Portable Air Compressor For Tyre Inflation Volume: 06 Issue: 03 | Mar 2019.
[8] M. A. Janbandhu "A Solar based Working Model to Run Air Compressor" IJSRD - International Journal for Scientific Research & Development| Vol. 3, Issue 02, 2015.
[9] Mr. S.Irfan Sadaq "Solar Based Air Compressor for Inflating Tyres" IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) Volume 11, Issue 5 Ver. IV (Sep- Oct. 2014).
[10] Deepak V. P. "Solar Based Air Compressor for Tire Inflation" IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) Volume 13, Issue 5 Ver. VIII (Sep. - Oct. 2016).

©IJRASET: All Rights are Reserved | SJ Impact Factor 7.538 | ISRA Journal Impact Factor 7.894 |



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089 (24*7 Support on Whatsapp)