iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 10 **Issue:** XI **Month of publication:** November 2022

DOI: https://doi.org/10.22214/ijraset.2022.47638

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 10 Issue XI Nov 2022- Available at www.ijraset.com

Electric Motorcycle: Study of Speed and Range

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Abstract: ***In the world of ever-changing modes of transport, one that remains and will prevail even in future is Motorbike. In today era electric vehicles are considered as one of the most versatile and sustainable means of transport. Hence, the aim of this research paper is to compare ideal and real-life electric power train motorbike speed and range. This paper includes results conducted and tested effectively on a real-life working and fully functioning model of an Electric motor bike.***
Keywords: Electric motorbike, powertrain, Battery management system, E- Bike, E-Motorbike, lithium ion battery, EVs

I. INTRODUCTION

With the rising prices of fossil fuel, there is also tremendous rise in the prices of roadway vehicles. Hence, a cost effective as well as sustainable way for our environment solution to this problem is use of E-motorbikes. Electric vehicles are undoubtedly the future of our world, which also has been scientifically predicted a number of times. A year of researching has been done for this paper. One of the main reasons of this research paper is to compare the speed and range of ideal and real-life electric power train motorbike and find out the difference that could be constructively used and put into objective. This paper gives us information related to the speed that a real time bike can go.

II. OBJECTIVE

The objective of this project was to explore and built a real-life working model of electric powertrain motorbike which is powered by lithium ion battery, it is low in maintenance, pragmatic and budget friendly compared to the existing products in the market for people who prefer living in middle class lifestyle.

III. COMPONENT DESCRIPTION

A. Battery

Type - lithium ion
Voltage - 48volts
Capacity – 50ah (amp-hour)
Power – 2.4 kilowatts

B. Motor

Type: BLDC motor
Running voltage: 48v (nominal voltage)
Speed control by hall sensor
Peak power: 1 kilowatts
Maximum RPM: 5000rpm

Gears used- 14 teeth of the shaft & 42 teeth on the rear sprocket
Drive system- Chain drive

IV. OUTPUT

Various tests were conducted of the final prototype where the ideal speed and the projected speed is compared with the practical speed. All the data was recorded considering real life situation and use. Tests conducted are in real time environment. Charging pattern of the lithium-ion battery was studied and compared. Range and motor rotations along with the motor performance is analyzed.

- Battery = 2.4kw
- Motor = 1kw per hour peak power
- Ideal output = 2.4 times
- Max speed = 68kmph

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Therefore, ideal range should be 2.4 x 68kms
i.e. 163.2 kilometers
OBSERVED RANGE = 105 kilometers at medium speed
& 80 - 90 kilometers at high speed

V. CALCULATIONS

A. RPM Calculations

Gear ratio = 14/42 (front/rear)
Specified RPM for motor = 5000
RPM at rear wheel would be ~ 1666
Considering tire dimensions - 2 meters are covered per rotation
1666 x 2 = 3332
Which makes ideal Top speed of the motorcycle = 198 km/hour
Maximum Speed observed through GPS and speedometer = 68 km/hour

B. At High Speed



Fig.1 speed vs time graph (High speed)

C. At Medium Speed

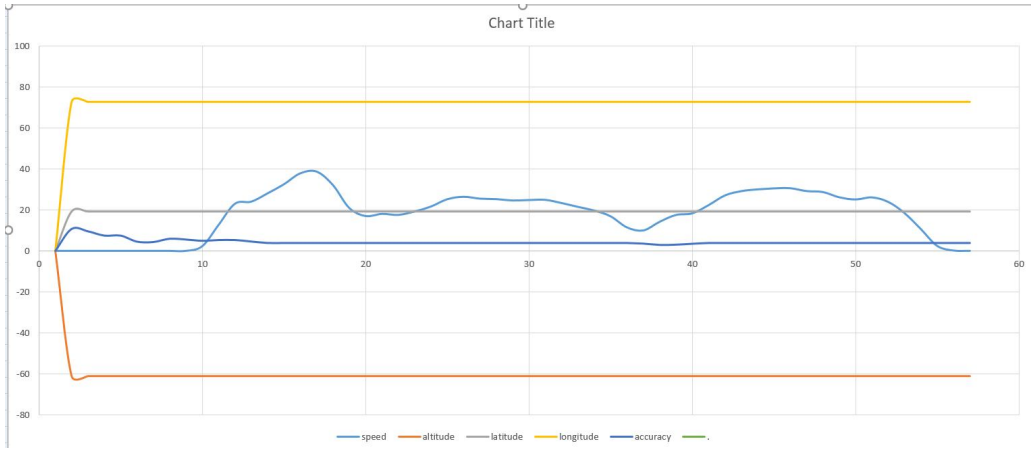


Fig.2 speed vs time graph (Medium speed)

D. Battery Charging

Typical lithium ion charge curve shows linear pattern for a time being during charge, charging for a span of 20 minutes is recorded and the data graph is produced.

REFERENCE GRAPH

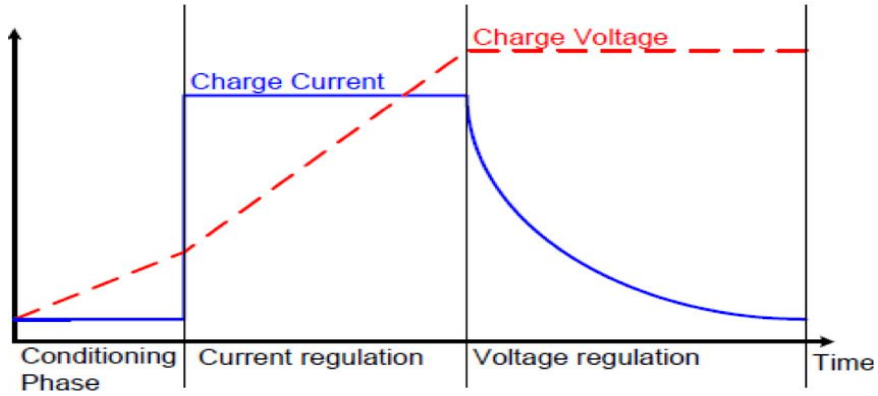


Fig.3 Typical charge curve of lithium ion cell battery

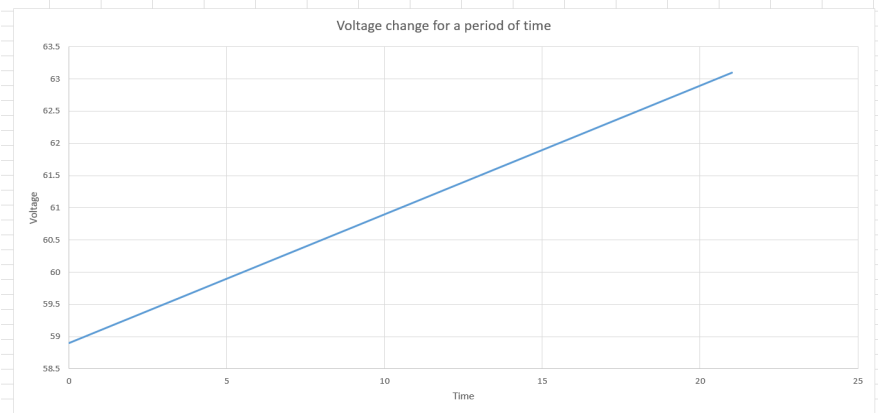


Fig.4 linearity of battery charging for a time period Time vs Voltage

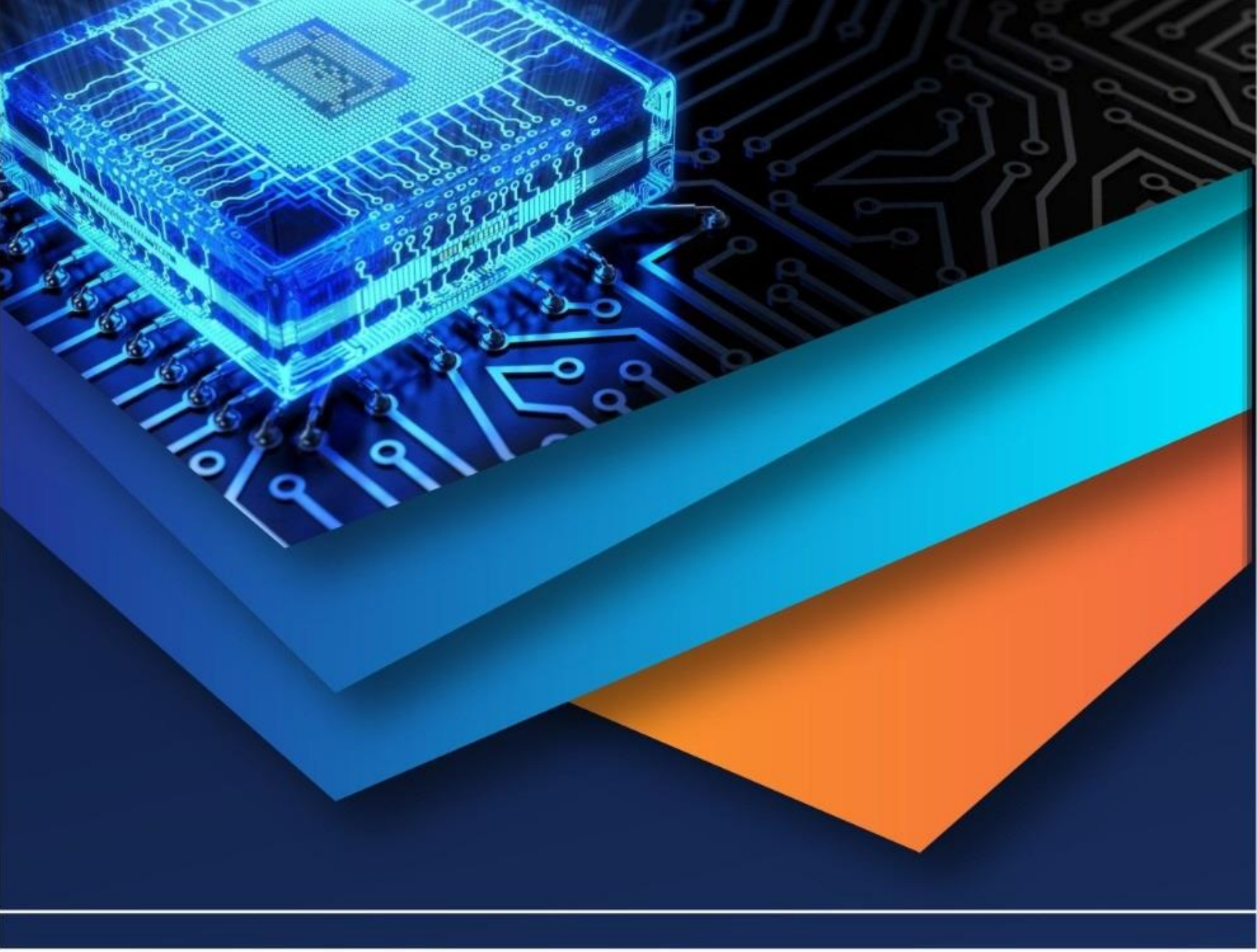
Linear pattern of the graph was observed for a brief time period. After that, the linearity is changed.

VI. CONCLUSIONS

We would like to conclude this research paper by saying that we have successfully conducted and tested the speed and range parameters of an ideal electric bike and real-life electric bike which is extensively powered by lithium ion battery. The ultimate goal of this paper has been achieved.

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