ISSN : 2455-9679
SJIF Impact Factor : 6.190

IJRTSM

INTERNATIONAL JOURNAL OF RECENT TECHNOLOGY SCIENCE & MANAGEMENT

"ELECTRIC 2-WHEELER WORKBENCH"

Rajkumar Ahirwar [1], Dharmendra Ahirwar [2], Vinod Ahirwar [3], Sandeep Ahirwar [4], Sanjay Prajapati [5], Sanket Sahare [6], Sanjeev Gupta [7], Abhishek Choubey [8]

[1,2,3,4,5,6] UG, Scholar, Department of Mechanical Engineering SISTEC-E, Ratibad Bhopal, MP, India, 462044

[7] Assistant Professor, Department of Mechanical Engineering SISTEC-E, Ratibad Bhopal, MP, India, 462044

[8] Associate Professor, Department of Mechanical Engineering SISTEC-E, Ratibad Bhopal, MP, India, 462044

ABSTRACT

The Two Wheeler Electric Vehicle Workbench is designed to study, analyze, and demonstrate the working principles of electric two-wheelers. The project aims to provide practical knowledge of electric vehicle technology, including battery systems, motor drives, controllers, charging systems, and power transmission mechanisms. The workbench consists of a BLDC motor, lithium-ion battery pack, motor controller, throttle control unit, charger, and display system. The battery supplies electrical energy to the controller, which regulates power to the BLDC motor according to the throttle input. The motor converts electrical energy into mechanical energy to drive the vehicle wheel. The project focuses on understanding the operation, performance, efficiency, and energy management of electric two-wheelers. Various parameters such as battery voltage, current consumption, motor speed, charging characteristics, and power output can be monitored and analyzed through the workbench setup. This system provides a safe and effective platform for students to gain hands-on experience in electric vehicle technology without the need for a complete vehicle. The Electric Two-Wheeler Workbench is an educational and experimental setup developed to study the operation and performance of electric vehicle systems. The project consists of major EV components such as a lithium-ion battery, BLDC hub motor, motor controller, throttle, and associated wiring. It provides a practical platform for understanding power flow, motor control, energy conversion, and system integration in electric vehicles. The workbench enables students and researchers to perform testing, troubleshooting, and analysis in a controlled environment. This project promotes knowledge of sustainable transportation.

Key Words: EV, BLDC, Battery, Motor.

I. INTRODUCTION

The Electric 2-Wheeler Workbench project is designed to study, analyse, and test the performance of electric two-wheelers. The workbench provides a controlled platform where different components such as the motor, controller, battery, and transmission system can be assembled, tested, and analysed. This setup helps in understanding the working of electric vehicles (EVs) and assists in research, maintenance, and training purposes. An electric vehicle (EV) operates using electrical energy stored in a battery pack. This energy is converted into mechanical energy through an electric motor. The main goal of an electric 2 wheeler is to replace conventional internal combustion (IC) engine vehicles that consume petrol or diesel with an eco-friendly and efficient alternative.

ISSN : 2455-9679
SJIF Impact Factor : 6.190

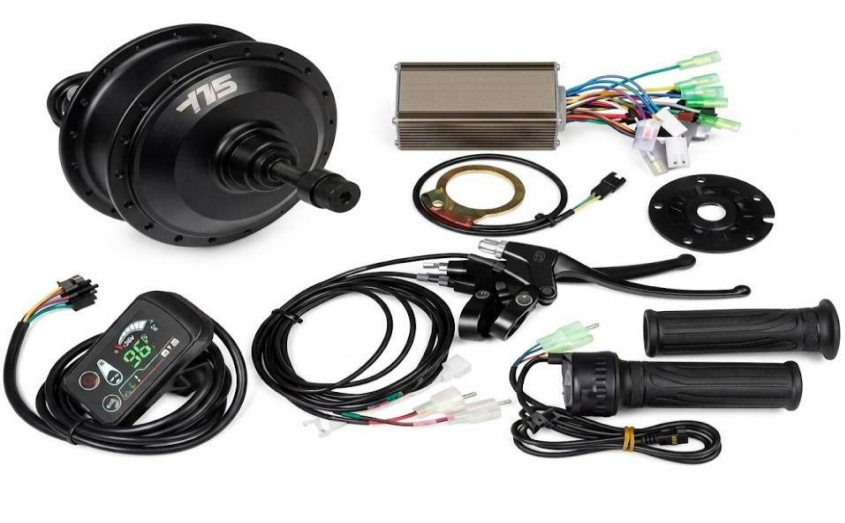

Fig.1 – Basic Components

II. LITERATURE REVIEW

Design & Development of Electric Two-Wheelers: Earlier research on electric scooters and bikes focused mainly on replacing internal combustion engines with electric motors to reduce air pollution and fuel consumption. Initial models used lead-acid batteries, but modern studies emphasize lithium-ion technology due to higher efficiency and longer life. Rahul B.Gupta, Parth C. Patel, Azlankhan A. Pathan, Viranchi Shastri are explore Electric vehicles are in used in the automotive world as it is the most reliable option to overcome Environmental issues like global warming and greenhouse effect. In batteries, lithium ion has good features like lightweight, fast charging, low self-discharge and long lifespan so it is used widely. The performances of the Electric Vehicles are affected by the performance of battery packs. whereas in motors Brushless DC motors have better specifications over conventional brushed DC motor, which have advantages better speed versus torque characteristics, high efficiency, high dynamic response, long operating life, noiseless operation higher speed ranges, low maintenance. To control and operate the motor and battery smoothly for the long run efficient drive controller and battery management system is used Battery Technology Advancements: According to various studies, lithium-ion batteries provide higher energy density, faster charging, and better cycle life compared to lead-acid batteries. Researchers have also explored the use of Battery Management Systems (BMS) to ensure safety and improve battery performance. Ramesh Kumar Chidambaram is explore In recent times, electric two-wheelers (ETWs) are changing the face of the global automotive market. This study focused on selecting the proper material and mechanical isolation gap to design a protective enclosure for the battery pack of ETW. The integration of the failure, modes, mechanism and effect analysis (FMMEA) method is utilized to develop the interface matrix and these verity in dex of different components of the enclosure. By analysing different forces from the road conditions, dynamics during turn, acceleration and deceleration with the enclosure, it becomes a crucial load-bearing element.

III. METHODOLOGY

Methodology Overview The project follows an experimental and analytical approach. The methodology in volves the following major stages:

1. Problem Identification–Understanding the need for an educational and testing setup for electric two-wheelers.
2. Literature Review– Studying existing electric-vehicle technologies, battery systems, and workbench models.
3. System Design– Selecting appropriate components such as motor, controller, battery, and frame layout.
4. Fabrication and Assembly– Constructing the physical setup of the workbench and integrating all components.
5. Testing and Analysis–Measuring system parameters such as voltage, current, speed, and torque.
6. Result Evaluation – Analysing performance, efficiency, and component behaviour under various conditions.

ISSN : 2455-9679
SJIF Impact Factor : 6.190

7. Conclusion and Future Scope–Identifying improvement sand applications for research and learning.

Fabrication Process

1. Designing the frame structure using mild-steel an gles.
2. Mounting motor and wheel assembly.
3. In stalling battery, controller, and throttle.
4. Wiring connections as per circuit diagram.
5. Checking electrical insulation and connections.
6. Performing trial run sand recording data.

IV. Experimental Setup

Material Used: Mild Steel (MS) Angle sand Sheet–for making the frame and table structure Wooden/ Metal Board– for mounting components- Nuts, Bolts, Screws–for fitting parts Wires and Connectors–for electrical connections Paint–for finishing and protection.

Tools and Machines Used: Cutting Machine: For cutting MS angles and sheets to the required size Drilling Machine: For making holes to fix bolts and electrical components.

Grinding Machine: For removing roughed gas and giving smooth finishing after cutting or welding.

Welding Machine: For joining MS angles and frame parts permanently.

Measuring Tools: For accurate marking and alignment (steel rule, measuring tape, marker). Material Cutting: MS angles and sheets were cut into required dimensions using a cutting machine. The 50 mm MS angle was marked and cut to the required lengths using a cutting machine. Each piece was measured accurately before cutting to maintain uniform size for the workbench frame. Material cutting involves measuring steel sections accurately, marking with chalk or marker, and cutting using a chop saw or band saw to maintain straight 90-degreeedges.

Frame Making: The cut pieces were welded together to form the table frame using a welding machine. A workbench frame is usually made from mild steel square or rectangular tubes. The top frame is welded first, then legs and cross braces are added for strength. Drilling Work: Holes were drilled at required points to fit bolts, clamps, and electrical components. Drilling is done to create holes for bolts or mounting points. Mark hole positions accurately using a punch. Apply cutting oil to reduce heat and ensure smooth drilling. Clean burrs after drilling for proper fitting.

Grinding and Finishing: After welding, the joints and edges were ground using a grinding machine for a smooth surface.

Testing and Operation: After complete assembly, the system was tested by switching ON the supply and checking motor operation and speed control through throttle. Testing and operation involve checking the stability of the workbench and verifying that all mounted components and electrical connections work correctly.

V. Result and Analysis

The Electric Two-Wheeler Workbench was successfully developed and tested to study the performance and operation of an electric vehicle system. The workbench integrates key components such as the battery, motor, controller, charger, and display unit, allowing detailed analysis of their functions and interactions. During testing, the battery provided a

ISSN : 2455-9679
SJIF Impact Factor : 6.190

stable power supply and maintained consistent voltage under varying load conditions. The motor demonstrated smooth operation with efficient power conversion and reliable speed control.

Performance evaluation showed that the controller effectively regulated motor speed and ensured safe operation of the system. The charging system functioned properly, maintaining battery health and reducing charging losses. Energy consumption measurements indicated that the electric drive system operates with higher efficiency compared to conventional fuel-based vehicles. The system also produced no direct emissions during operation, highlighting its environmental benefits.

The workbench proved to be an effective educational and research tool for understanding electric vehicle technology. It enabled practical observation of power flow, battery management, and motor control characteristics. The obtained results confirm that electric two-wheelers are a cost-effective, energy-efficient, and eco-friendly transportation solution. Overall, the developed workbench met the intended objectives and can be used for academic demonstrations, laboratory experiments, and future research in electric mobility systems.

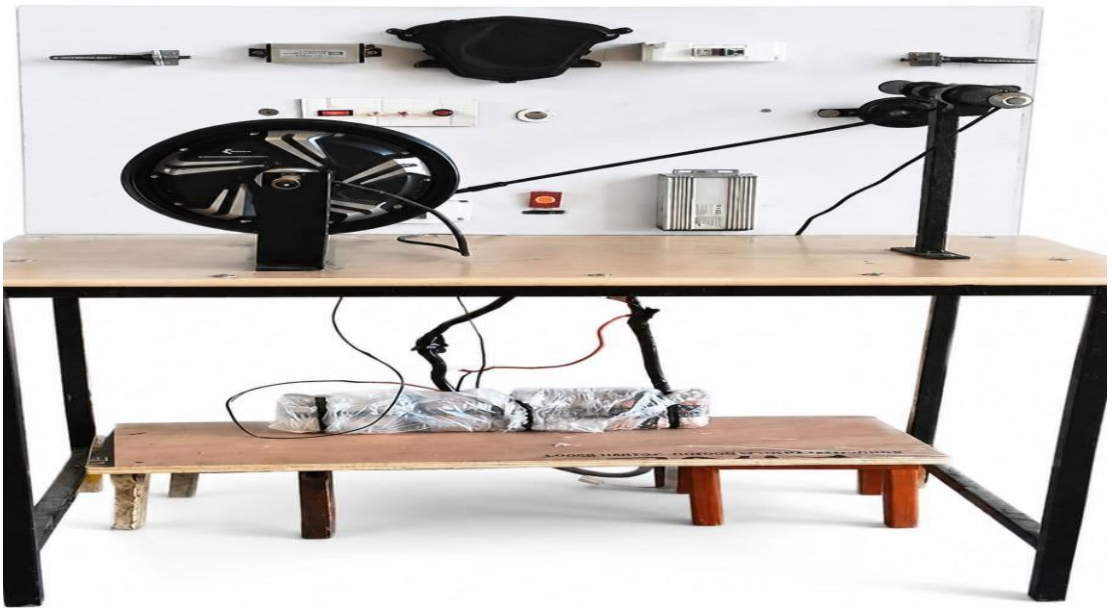

Fig.2 Final project

VI. CONCLUSION

Conclusion The project demonstrates that electric two-wheelers are a clean, efficient, and sustainable alternative to conventional petrol-powered vehicles. T he workbench developed serves as a training and experimental platform for students and researchers to study EV technology. It contributes to ward understanding the key concepts of electric mobility, including power conversion, control systems, and energy management. Future Scope Use of smart sensors and IoT for performance monitoring. Development of a battery management system (BMS) to ensure safety and enhance battery life. Implementation of solar charging systems for renewable and clean energy operation. Expansion of the setup to test different motor types and battery chemistries. The Electric Two-Wheeler Workbench project successfully demonstrates the working principles and integration of key electric vehicle components, including the battery, BLDC hub motor, controller, throttle, and wiring system. The developed setup provides a practical platform for understanding EV technology, energy conversion, power transmission, and vehicle operation. It helps students and researchers gain hands-on experience with electric mobility systems in a safe and controlled environment. The project also highlights the advantages of electric vehicles, such as reduced emissions, lower operating costs, and improved

ISSN : 2455-9679
SJIF Impact Factor : 6.190

energy efficiency. Overall, this workbench serves as an effective educational and research tool for future EV development. The Electric Two-Wheeler Workbench has been designed to provide a clear understanding of the construction, operation, and performance of electric vehicle systems. Through this project, the interaction between the battery, motor, controller, and other electrical components can be studied effectively. The workbench enables practical learning, troubleshooting, and testing of EV technologies without requiring a complete vehicle setup. It promotes awareness of sustainable transportation and supports the development of technical skills related to electric mobility. The project proves to be a valuable educational tool that bridges the gap between theoretical concepts and real-world applications in electric vehicle engineering.

REFERENCES

[1] SrinivasaChari.V, Dr.Venkatesh P.R, Dr.PrasannaRao N.S, Adil Ahmed S "Automatic Pneumatic Bumper And brake Actuation Before Collision", 2015, International Research Journal Of Engineering And Technology (Irjet) Volume: 02 Issue: 04, Pp1015-1023
[2] Dr. P. Poongodi. Mr. P. Dineshkumar, "Automatic Safety System For Automobiles"
[3] Jadhav N. D., Gulmire S.M., Ghutukade R.S., Gaikwad A.S., Prof.Fegade S.G. "Automatic Braking With Pneumatic Bumper System" 2015,Ijsart Volume 1 Issue 5, Pp
[4] Jadhav N. D., Gulmire S.M., Ghutukade R.S., Gaikwad A.S., Prof.Fegade S.G. "Automatic Braking With Pneumatic BumperSystem" 2015,Ijsart Volume 1 Issue 5, PP
[5] Dr.EungSooKim,"Fabrication Of Auto Braking System Using Sensor", International Journal Of Control And Automation,Vol-2, And No1.
[6] Takahiro Wada, "A Deceleration Control Method Of Automobile For Collision Avoidance Based On Driver PerceptualRisk" IEEE International Conference On Intelligent Robots And Systems, Oct 4881-4886.
[7] Lee, "A Theory Of Visual Control Of Braking Based On Information About Time To Collision", Perception, Vol 5, Pp 437-459
[8] J. T. Wang, "An Extendable And Retractable Bumper
[9] S. P. Patil, "Mechanical System Design", Second Edition, JAICO Publishing House, Mumbai 400001
[10] Intelligent Mechatronic Braking System",G.V.Sairam, B. Suresh, CH. SaiHemanth, K. Krishna sai,International Journal ofEmerging Technology and Advanced Engineering ,Volume 3, Issue 4, April 2013 pp.100-105
[11] Collision Control and Collision Avoidance Using Ultrasonic Sensor", Anusha c, Dr. P. Venkataratnam, International Journalof Current Engineering and Scientific Research (IJCESR), Volume-2, Issue-7, 2015 pp.218-223