

# Design and Development of a BLDC Motor Test Bench for Performance Evaluation

Nikita R Bhosale<sup>1</sup>, Sakshi D Shete<sup>2</sup>, Aditi A Gaikwad<sup>3</sup>, Nikita S Patil<sup>4</sup>,  
Suhas B Khadake<sup>5</sup>, Vijay A Savant<sup>6</sup>

LYEE Students<sup>1,2,3,4</sup>, SVERI's College of Engineering, Pandharpur, India

<sup>5,6</sup>Assistant Professor, SVERI's College of Engineering, Pandharpur, India

**Abstract:** *This project focuses on the design and development of a versatile and cost effective test bench for the comprehensive performance evaluation of Brushless DC (BLDC) motors. The increasing adoption of BLDC motors in diverse applications, from electric vehicles to consumer electronics, necessitates a standardized platform for characterizing their operational efficiency, torque speed characteristics, and overall reliability. This test bench will provide a controlled environment to accurately measure and analyze key performance parameters, facilitating motor selection, controller optimization, and further research in motor design. The primary objective of this project is to create a modular and reconfigurable testbench capable of accommodating various sizes and power ratings of BLDC motors. The system will integrate a suite of sensors for precise measurement of critical parameters, including voltage, current, rotational speed, torque, and temperature. A programmable electronic load will be employed to simulate a wide range of operating conditions, enabling a thorough assessment of the motor's performance under different load profiles. The development process will encompass the mechanical design of the test frame, the selection and integration of appropriate sensors and data acquisition hardware, and the creation of a user-friendly software interface for test automation, data logging, and visualization. The successful completion of this project will result in a fully functional BLDC motor testbench that can serve as a valuable tool for academic research, industrial product development, and quality control. The collected data will enable a deeper understanding of BLDC motor behavior, leading to advancements in motor control algorithms and more energy-efficient designs.*

**Keywords:** *BLDC motors*

## I. INTRODUCTION

In Brushless DC (BLDC) motors are widely used in modern applications such as electric vehicles, drones, household appliances, and renewable energy systems due to their high efficiency, low maintenance, and precise speed control. Unlike conventional brushed motors, BLDC motors use electronic commutation, which makes them more reliable and suitable for long-term operation. With the growing demand for energy-efficient solutions, it is important to study and evaluate the performance of BLDC motors under various operating conditions. To analyze motor behavior, a test bench is required that can safely and accurately measure important parameters like torque, speed, current, voltage, and efficiency. A well-designed testbench helps researchers and students understand how the motor performs under load, how efficiently it converts electrical power to mechanical power, and how it responds to changes in input. This makes it an essential tool for both academic learning and industrial product development. In this project, a BLDC motor test bench is designed and developed with the aim of providing a low-cost, easy-to-use, and reliable platform for performance evaluation [1-10]. The setup includes sensors, controllers, and data acquisition systems that allow real-time monitoring of motor characteristics. The developed test bench not only supports experimental learning for students but also helps industries in testing and validating BLDC motors for practical applications.



## **II. PROBLEM STATEMENT**

BLDC motors are widely used in various applications, but their performance evaluation requires accurate measurement of speed, torque, voltage, and efficiency. Many academic and small setups lack a low-cost and user-friendly testbench for this purpose. Without it, analysing motor behaviour and improving performance becomes difficult [11-50]. Hence, there is a need to design and develop a simple and reliable BLDC motor test bench for effective performance evaluation.

## **III. LITERATURE SURVEY**

1. Ogata, K. (2010). Modern control engineering (5th ed.). Pearson..
2. Hanselman, D. (1994). Brushless permanent-magnet motor design. McGraw Hill.
3. Krishnan, R. (2010). Permanent magnet synchronous and brushless DC motor drives. CRC Press.
4. NKumar, S., & Sharma, R. (2019). Development of low-cost test bench for performance evaluation of BLDC motor. International Journal of Engineering Research & Technology (IJERT), 8(6), 1-5.
5. Dhanalakshmi, R., & Balaji, R. (2020). Experimental setup for performance evaluation of BLDC motor for electric vehicle applications. Journal of Green Engineering, 10(9), 6209-6222.
6. Li, J., Chen, J., & Zhu, Z. Q. (2013). Testing and evaluation of brushless DC motor drives. IEEE Transactions on Industry Applications, 49(6), 2494-2503.
7. International Electrotechnical Commission. (2014). Rotating electrical machines – Part 2: Methods for determining losses and efficiency (IEC Standard No. 60034-2-1). IEC..

## **IV. PROJECT DESCRIPTION**

The Brushless DC (BLDC) Motor Test Bench is an advanced experimental setup designed to test, monitor, and analyze the performance of BLDC motors under various operating conditions. BLDC motors are increasingly used in modern applications such as electric vehicles, drones, industrial drives, and household appliances because of their high efficiency, fast response, compact size, and low maintenance requirements. The main objective of this project is to design a reliable and accurate testing platform where key performance parameters of a BLDC motor can be measured and evaluated. These parameters include speed, torque, input voltage, current, output power, and overall efficiency. By analyzing these parameters, the performance characteristics of the motor can be studied in detail. The test bench consists of several important components such as a BLDC motor, electronic speed controller (ESC), power supply unit, microcontroller or control system, sensors, and a loading mechanism. The electronic controller is responsible for proper commutation of the motor phases, ensuring smooth operation. A variable load, such as a dynamometer or mechanical brake system, is connected to the motor shaft to simulate real-life working conditions[1-10].

Different types of sensors are used to collect data from the system. A speed sensor (Hall sensor or tachometer) measures the rotational speed of the motor. Current and voltage sensors monitor electrical input parameters, while a torque sensor or load arrangement helps in calculating mechanical output. The collected data can be displayed on an LCD screen or sent to a computer for further analysis and graph plotting. The system also allows variation in input voltage and load conditions to observe how the motor behaves under different situations [11-50]. This helps in plotting important characteristics such as speed vs torque, efficiency vs load, and power vs speed curves. These graphs are essential for understanding motor performance and selecting suitable motors for specific applications. Additionally, the test bench improves safety and accuracy by providing controlled testing conditions. It minimizes human error and allows repeated testing with consistent results. This makes it highly useful for research, product development, and quality testing in industries.

In educational institutions, this project helps students gain practical knowledge about BLDC motor operation, control techniques, and performance evaluation. It bridges the gap between theoretical concepts and real-world applications.

In conclusion, the BLDC Motor Test Bench is a valuable tool that enables detailed analysis of motor performance, enhances understanding of motor behavior, and supports the development of efficient and reliable motor-driven system.



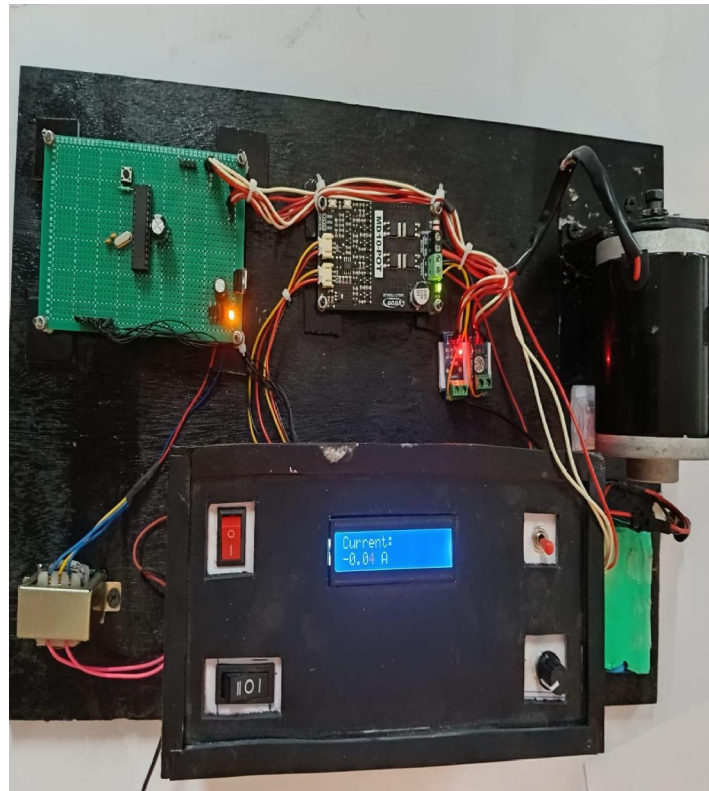


Fig.1. BLDC Motor Test Bench

The Brushless DC (BLDC) Motor Test Bench is an advanced experimental setup designed to test, monitor, and analyze the performance of BLDC motors under various operating conditions. BLDC motors are increasingly used in modern applications such as electric vehicles, drones, industrial drives, and household appliances because of their high efficiency, fast response, compact size, and low maintenance requirements. The main objective of this project is to design a reliable and accurate testing platform where key performance parameters of a BLDC motor can be measured and evaluated. These parameters include speed, torque, input voltage, current, output power, and overall efficiency..

The test bench consists of several important components such as a BLDC motor, electronic speed controller (ESC) power supply unit, microcontroller or control system, sensors, and a loading mechanism. The electronic controller is responsible for proper commutation of the motor phases, ensuring smooth operation. A variable load, such as a dynamometer or mechanical brake system, is connected to the motor shaft to simulate real-life working conditions. Different types of sensors are used to collect data from the system. A speed sensor (Hall sensor or tachometer) measures the rotational speed of the motor. Current and voltage sensors monitor electrical input parameters, while a torque sensor or load arrangement helps in calculating mechanical output. The collected data can be displayed on an LCD screen or sent to a computer for further analysis and graph plotting.

The system also allows variation in input voltage and load conditions to observe how the motor behaves under different situations. This helps in plotting important characteristics such as speed vs torque, efficiency vs load, and power vs speed curves. These graphs are essential for understanding motor performance and selecting suitable motors for specific applications. , the test bench improves safety and accuracy by providing controlled testing conditions. It minimizes human error and allows repeated testing with consistent results. This makes it highly useful for research, product development, and quality testing in industries.



In educational institutions, this project helps students gain practical knowledge about BLDC motor operation, control techniques, and performance evaluation. It bridges the gap between theoretical concepts and real-world applications. In conclusion, the BLDC Motor Test Bench is a valuable tool that enables detailed analysis of motor performance, enhances understanding of motor behavior, and supports the development of efficient and reliable motor-driven systems.

#### **V. OBJECTIVE OF SYSTEM**

- To design and develop a test bench for analyzing the performance of a BLDC motor.
- To measure important parameters such as speed, torque, voltage, current, and power.
- To study the relationship between speed and torque of the BLDC motor.
- To evaluate the efficiency of the motor under different load conditions.
- To analyze motor behavior by varying input voltage and load.
- To plot performance characteristics like torque vs speed and efficiency vs load.
- To provide a practical platform for understanding BLDC motor operation.
- To ensure accurate and safe testing of the motor.
- To help in selecting suitable motors for different applications.
- To gain hands-on experience in motor control and testing techniques

#### **VI. ADVANTAGES & APPLICATION**

##### **Advantages:**

The test bench provides accurate measurement of important motor parameters such as speed, torque, voltage, and current by using sensors and electronic instruments. This ensures that the readings obtained are reliable and precise, which is very important for proper analysis and evaluation of the motor. It helps in analyzing motor performance under different load conditions by applying variable loads to the motor and observing how its behavior changes. This allows users to understand how the motor will perform in real-life applications. The system allows plotting of important characteristics such as speed–torque curves and efficiency curves using the collected data. These graphs make it easier to study and compare the performance of the motor under various conditions. It also improves understanding of BLDC motor working and behavior by providing a practical platform where users can directly observe how the motor operates, rather than only learning theory. The test bench ensures a safe and controlled testing environment, as all components are properly arranged and designed to handle electrical and mechanical operations securely.

This reduces the risk of accidents and damage to equipment. It also reduces human error because most of the measurements are taken automatically using sensors and digital systems, which minimizes manual mistakes. This setup is very useful for research, development, and quality testing of motors. Engineers can use it to test new designs, improve efficiency, and ensure that motors meet required standards before they are used in actual applications. It also helps in selecting the right motor for specific applications by providing detailed performance data, making it easier to choose the most suitable motor. The test bench saves time by allowing quick and repeated testing without the need for complex setup each time. This increases efficiency in both academic and industrial environments. Additionally, it provides practical learning experience for students and engineers, helping them develop better technical skills and a deeper understanding of motor testing

#### **VII. APPLICATIONS**

The BLDC motor test bench is widely used in educational institutions such as engineering colleges and technical laboratories for practical learning. It helps students understand the working, control, and performance analysis of BLDC motors through real-time experiments.



- It is used in industries for testing and quality control of BLDC motors before they are used in actual applications. Manufacturers can check whether the motor meets required standards and performance specifications.
- The test bench is useful in research and development activities where engineers test new motor designs, improve efficiency, and analyze different control techniques. It helps in developing better and more efficient motor systems.
- It is also used in the electric vehicle industry to test motors used in electric bikes, cars, and scooters. Engineers can evaluate motor performance under different load and speed conditions.
- In automation and robotics, the test bench helps in selecting suitable BLDC motors by analyzing their characteristics. This ensures proper functioning of robotic systems and automated machines.
- It is used in maintenance and troubleshooting to identify faults or performance issues in motors. By testing the motor, problems like overheating, low efficiency, or abnormal behavior can be detected.
- The test bench is also applied in household appliance industries where BLDC motors are used in fans, washing machines, and air conditioners. It helps in ensuring smooth and efficient operation.
- Overall, the BLDC motor test bench is an important tool used in education, industry, research, and real-world applications

### **VIII. RESULTS AND DISCUSSION**

The BLDC motor test bench was successfully developed and tested under different operating conditions. The system was able to measure important parameters such as speed, voltage, current, and load accurately using sensors and measuring instruments. The readings obtained were stable and consistent, which shows that the setup is reliable for performance analysis.

During the experiment, it was observed that the motor speed decreases as the load on the motor increases. At no-load condition, the motor runs at maximum speed, while increasing load causes a drop in speed due to higher torque demand. The current drawn by the motor increases with increase in load, which indicates that more electrical power is required to maintain operation under heavier load conditions.

The efficiency of the BLDC motor was found to be higher at moderate load conditions and slightly lower at very low and very high loads. This shows that the motor performs best within a specific operating range. The relationship between speed and torque was also observed to be nearly linear within the operating limits, which matches the theoretical behavior of BLDC motors.

Graphs such as speed vs torque, current vs load, and efficiency vs load were plotted using the collected data. These graphs helped in better understanding of motor performance and validated the expected characteristics. Minor variations in reading were observed due to factors such as sensor accuracy, temperature rise, and supply fluctuations.

The test bench proved to be effective for studying motor behavior and analyzing performance under controlled conditions. It provided accurate results and helped in understanding practical aspects of BLDC motor operation. Overall, the system worked efficiently and can be used for educational, testing, and research purposes.

### **IX. WORKING OVERVIEW**

The BLDC motor test bench works by supplying electrical power to the BLDC motor through an electronic controller, which controls the switching of motor phases. When the system is turned on, the power supply provides DC input to the controller (ESC), and the controller converts it into controlled signals required for the motor operation. Based on these signals, the motor starts rotating.

A speed control input is given to the controller to vary the motor speed as required. As the motor runs, different sensors continuously measure important parameters. A speed sensor (such as a Hall sensor or tachometer) measures the rotational speed of the motor shaft. Voltage and current sensors measure the electrical input given to the motor.



A mechanical load is applied to the motor using a dynamometer or braking arrangement. This load simulates real working conditions and allows the study of motor performance under different loads. As the load increases, the motor draws more current and its speed changes accordingly.

All the measured data from sensors is sent to a display unit or microcontroller system. The values are either shown on an LCD screen or recorded for further analysis. Using this data, performance characteristics such as speed–torque, power, and efficiency can be calculated.

The entire process allows controlled testing of the BLDC motor, where speed and load can be varied easily, and results can be observed in real time. This helps in understanding motor behavior, evaluating performance, and comparing it with theoretical values.

## X. CONCLUSION

The design and development of the BLDC motor test bench has successfully achieved its objective of creating a low-cost, reliable, and efficient platform for motor performance evaluation.

- The test bench allows for real-time monitoring of critical parameters such as speed, torque, voltage, current, power, and temperature, ensuring accurate data collection for analysis.
- The performance curves obtained, including torque–speed, power–speed, and efficiency–load characteristics, provide a clear understanding of the motor’s behavior under different operating conditions.
- The results obtained from the test bench were validated against datasheet values, confirming the accuracy and dependability of the system.
- The project emphasizes safety through protective features like emergency stop and overcurrent protection while maintaining affordability with an estimated cost in the range of ₹14,000–₹17,000, making it suitable for academic institutions and research labs. In addition to its practical utility, the system is designed to be modular and expandable, offering flexibility for testing motors of different ratings and adapting future upgrades such as regenerative loading, automated test sequencing, and IoT-based data monitoring. Overall, the developed BLDC motor test bench is not only a valuable educational tool for students and researchers but also a foundation for further innovations in motor testing and electric vehicle applications. Its reusability, scalability, and comprehensive documentation make it an impactful contribution toward enhancing experimental learning and supporting advancements in electrical engineering.

## XI. FUTURE SCOPE

1. The test bench can be upgraded with advanced sensors to improve accuracy in measuring torque, speed, and efficiency.
2. Integration of wireless data acquisition and IoT connectivity can allow remote monitoring and cloud-based analysis.
3. Automation and AI-based control systems can be added to predict faults, optimize motor performance, and support smart testing.
4. The setup can be scaled to handle higher capacity BLDC motors for industrial-level testing.
5. Software-based features such as graphical dashboards, data logging, and performance comparison tools can be developed for better analysis.
6. The test bench can be adapted for testing other motor types like PMSM (Permanent Magnet Synchronous Motor) or induction motors.

## REFERENCES

- [1]. Khan, M., Ramadan, M., Dol, S. S., Ghazal, M., & Alkhedher, M. (2024). A comprehensive review of thermoelectric cooling technologies for enhanced thermal management in lithium-ion battery systems. Journal / Publisher.
- [2]. Li, X., & Zhang, Y. (2023). Effective temperature control of a thermoelectric-based battery thermal management system with double-layer TECs. Journal / Publisher.



- [3]. Author(s). (2025). Internet of Things Enabled Automatic Battery Cooling System Using Peltier Module. In SAE Technical Papers.
- [4]. Gan, Y., Liang, J., Tan, M., & Wang, J. (2021). A Li-ion battery thermal management system combining a heat pipe and thermoelectric cooler. *Energies*, 13(4), 841.
- [5]. Dodiya, S. T. (2022). Performance analysis of thermoelectric cooling with thermal control battery system for electric vehicle. *International Journal of Engineering and Advanced Technology (IJEAT)*.
- [6]. Hwang, H., et al. (2023). A review of thermal management and heat transfer of lithium-ion battery systems. *Energies*, 17(16), 3873.
- [7]. Zhang, L., & Wang, C. (2023). Recent advancements in battery thermal management systems for 2023–2024. *Journal / Publisher*.
- [8]. Mahek, M. K., Ramadan, M., Dol, S. S., Ghazal, M., Alkhedher, M. (2024). A comprehensive review of thermoelectric cooling technologies for enhanced thermal management in lithium-ion battery systems. *PMC / Open Access*.
- [9]. Xu, J., & Ouyang, D. (2023). Modeling and model predictive control of a battery thermal management system with thermoelectric cooling. *Energy Technology / EnTE (or similar journal)*.
- [10]. Researcher(s). (2024). Study on a battery thermal management system based on a thermoelectric effect. *MDPI / Energies*.
- [11]. Khadake, S., Kawade, S., Moholkar, S., Pawar, M. (2024). A Review of 6G Technologies and Its Advantages Over 5G Technology. In: Pawar, P.M., et al. *Techno-societal 2022. ICATSA 2022*. Springer, Cham. [https://doi.org/10.1007/978-3-031-34644-6\\_107](https://doi.org/10.1007/978-3-031-34644-6_107).
- [12]. V. J. Patil, S. B. Khadake, D. A. Tamboli, H. M. Mallad, S. M. Takpere and V. A. Sawant, "Review of AI in Power Electronics and Drive Systems," 2024 3rd International conference on Power Electronics and IoT Applications in Renewable Energy and its Control (PARC), Mathura, India, 2024, pp. 94-99, doi: 10.1109/PARC59193.2024.10486488
- [13]. A BalkrishnaDudgikar, A Ahmad Akbar Ingalgi, A GensidhaJamadar et al., "Intelligent battery swapping system for electric vehicles with charging stations locator on IoT and cloud platform", *International Journal of Advanced Research in Science Communication and Technology*, vol. 3, no. 1, pp. 204-208, January 2023. DOI: 10.48175/IJARSCT-7867. Available at: <https://ijarsct.co.in/Paper7867.pdf>
- [14]. S. B. Khadake and V. J. Patil, "Prototype Design & Development of Solar Based Electric Vehicle," 2023 3rd International Conference on Smart Generation Computing, Communication and Networking (SMART GENCON), Bangalore, India, 2023, pp. 1-7, doi: 10.1109/SMARTGENCON60755.2023.10442455.
- [15]. V. J. Patil, S. B. Khadake, D. A. Tamboli, H. M. Mallad, S. M. Takpere and V. A. Sawant, "A Comprehensive Analysis of Artificial Intelligence Integration in Electrical Engineering," 2024 5th International Conference on Mobile Computing and Sustainable Informatics (ICMCSI), Lalitpur, Nepal, 2024, pp. 484-491, doi: 10.1109/ICMCSI61536.2024.00076.
- [16]. Suhas B. Khadake, Sudarshan P. Dollu, K.S. Rathod, O.P. Waghmare and A.V. Deshpande, "AN OVERVIEW OF INTELLIGENT TRAFFIC CONTROL SYSTEM USING PLC AND USE OF CURRENT DATA OF VEHICLE TRAVELS", *JournalNX*, pp. 1-4, Jan. 2021.
- [17]. Shraddha S Magar, Archana S Sugandhi, Shweta H Pawar, Suhas B Khadake, H. M. Mallad, "Harnessing Wind Vibration, a Novel Approach towards Electric Energy Generation- Review", *IJARSCT*, Volume 4, Issue 2, October 2024, pp. 73-82. DOI: 10.48175/IJARSCT-19811.
- [18]. Khadake, S. B., Padavale, P. V., Dhere, P. M., & Lingade, B. M., "Automatic hand dispenser and temperature scanner for Covid-19 prevention", *International Journal of Advanced Research in Science, Communication and Technology*, 3(2), 362-367. DOI: 10.48175/IJARSCT-11364. <https://ijarsct.co.in/A11364.pdf>
- [19]. Seema S Landage, Sonali R Chavan, Pooja A Kokate, Sonal P Lohar, M. K. Pawar, Suhas B Khadake., "Solar Outdoor Air Purifier With Air Quality Monitoring System", *Synergies Of Innovation: Proceedings Of Ncstem 2023*,



Pp. 260-266, September, 2024. Available At: [https://www.researchgate.net/publication/383631190\\_Solar\\_Outdoor\\_Air\\_Purifier\\_with\\_Air\\_Quality\\_Monitoring\\_System](https://www.researchgate.net/publication/383631190_Solar_Outdoor_Air_Purifier_with_Air_Quality_Monitoring_System)

[20]. Suhas B. Khadake. (2021). Detecting Salient Objects Of Natural Scene In A Video's Using Spatio-Temporal Saliency & Colour Map. Journalnx - A Multidisciplinary Peer Reviewed Journal, 2(08), 30–35. Retrieved From <https://Repo.Journalnx.Com/Index.Php/Nx/Article/View/1070>

[21]. Khadake Suhas .B. (2021). Detecting Salient Objects In A Video's By Using spatio-Temporal Saliency & Colour Map. International Journal Of Innovations In Engineering Research And Technology, 3(8),1-9, <https://Repo.Ijiert.Org/Index.Php/Ijiert/Article/View/910>.

[22]. Prachi S Bhosale, Pallavi D Kokare, Dipali S Potdar, Shrutika D Waghmode, V A Sawant, Suhas B Khadake., "DTMF Based Irrigation Water Pump Control System", Synergies Of Innovation: Proceedings Of NCSTEM 2023, Pp. 267-273, September, 2024. Available At: [https://www.researchgate.net/publication/383629320\\_DTMF\\_Based\\_Irrigation\\_Water\\_Pump\\_Control\\_System](https://www.researchgate.net/publication/383629320_DTMF_Based_Irrigation_Water_Pump_Control_System)

[23]. Pramod Korake, Harshwardhan Murade, Rushikesh Doke, Vikas Narale, Suhas B. Khadake, Aniket S Chavan., "Automatic Load Sharing of Distribution Transformer using PLC", Synergies Of Innovation: Proceedings Of NCSTEM 2023, Pp. 253-259, September, 2024. Available At: [https://www.researchgate.net/publication/383628063\\_Automatic\\_Load\\_Sharing\\_of\\_Distribution\\_Transformer\\_using\\_PLC](https://www.researchgate.net/publication/383628063_Automatic_Load_Sharing_of_Distribution_Transformer_using_PLC)

[24]. Suhas B khadake, Pranita J Kashid, Asmita M Kawade, Santoshi V Khedekar, H. M. Mallad ., "Electric Vehicle Technology Battery Management –Review", International Journal of Advanced Research in Science, Communication and Technology, Volume 3, Issue 2, Septeber 2023, pp. 319-325. DOI: 10.48175/IJARSCT-13048. Available at: [https://www.researchgate.net/publication/374263508\\_Electric\\_Vehicle\\_Technology\\_Battery\\_Management\\_-\\_Review](https://www.researchgate.net/publication/374263508_Electric_Vehicle_Technology_Battery_Management_-_Review)

[25]. Suhas B. khadake, Amol Chounde, Buddhapriy B. Gopnarayan, Karan Babaso Patil, Shashikant S Kamble. (2024). Human Health Care System: A New Approach towards Life, 15th International Conference on Advances in computing, Control, and Telecommunication Technologies, ACT 2024, 2024, 2, pp. 5487-5494.

[26]. Khadake SB, Patil VJ, Mallad HM, Gopnarayan BB, Patil KB. Maximize farming productivity through agriculture 4.0 based intelligence, with use of agri tech sense advanced crop monitoring system. Grenze Int J Eng Technol. 2024;10(2):5127–5134. Available At: [https://www.researchgate.net/publication/382625572\\_Maximize\\_Farming\\_Productivity\\_through\\_Agriculture\\_40\\_based\\_Intelligence\\_with\\_use\\_of\\_Agri\\_Tech\\_Sense\\_Advanced\\_Crop\\_Monitoring\\_System](https://www.researchgate.net/publication/382625572_Maximize_Farming_Productivity_through_Agriculture_40_based_Intelligence_with_use_of_Agri_Tech_Sense_Advanced_Crop_Monitoring_System)

[27]. Suhas B Khadake, Santoshi V Khedekar, Asmita M Kawade, Shradhha Shivaji Vyavahare, Pranita J Kashid, Chounde Amol B, H. M. Mallad., "Solar Based Electric Vehicle Charging System-Review", IJARSCT, vol. 4, Issue 2, December 2024, pp. 42-57, DOI: 10.48175/IJARSCT-22705.

[28]. Akshay B Randive , Sneha Kiran Gaikwad , Suhas B Khadake , Mallad H. M., "Biodiesel: A Renewable Source of Fuel", IJARSCT, vol. 4, Issue 3, December 2024, pp. 225-240, DOI: 10.48175/IJARSCT-22836 Available at: [https://www.researchgate.net/publication/387352609\\_Biodiesel\\_A\\_Renewable\\_Source\\_of\\_Fuel](https://www.researchgate.net/publication/387352609_Biodiesel_A_Renewable_Source_of_Fuel)

[29]. K. K. Sayyad Liyakat, S. B. Khadake, A. B. Chounde, A. A. Suryagan, M. H. M. and M. R. Khadate, "AIDriven-

IoT(AIIoT) Based Decision Making System for High-Blood Pressure Patient Healthcare Monitoring," 2024 International Conference on Sustainable Communication Networks and Application (ICSCNA), Theni, India, 2024, pp. 96-102, doi: 10.1109/ICSCNA63714.2024.10863954.

[30]. K. K. Sayyad Liyakat, S. B. Khadake, D. A. Tamboli, V. A. Sawant, M. H. M. and S. Sathe, "AI-Driven-IoT(AIIoT) Based Decision-Making- KSK Approach in Drones for Climate Change Study," 2024 4th International Conference on Ubiquitous Computing and Intelligent Information Systems (ICUIS), Gobichettipalayam, India, 2024, pp. 1735-1744, doi: 10.1109/ICUIS64676.2024.10866450.

[31]. Suhas B khadake, Shradhha S Magar, Archana S Sugandhi, Shweta H Pawar, " A Research Paper on Harnessing Wind Vibration Novel Approach towards Electric Energy Generation", IJARSCT, Volume 5, Issue 4, May 2025, pp.



- 533-552. DOI: 10.48175/IJAR SCT-26466. Available At  
[https://www.researchgate.net/publication/391857597\\_A\\_Research\\_Paper\\_on\\_Harnessing\\_Wind\\_Vibration\\_Novel\\_Approach\\_towards\\_Electric\\_Energy\\_Generation](https://www.researchgate.net/publication/391857597_A_Research_Paper_on_Harnessing_Wind_Vibration_Novel_Approach_towards_Electric_Energy_Generation)
- [32]. Avinash. A. Suryagan, Arti L Nemte, Kirti D Thorat, Suhas B Khadake, "IoT Based Flood Monitoring System by using Thing Speak Cloud", IJAR SCT, Volume 5, Issue 4, May 2025, pp. 666-687. DOI: 10.48175/IJAR SCT-26480
- [33]. Sagar M Chavare, Prasad P Nanaware, Shriprasad S Wagh, Ashish T Jadhav, Yeole Yogesh, Suhas B Khadake, "Smart Plant Monitoring and Automated Irrigation System Using IOT", IJAR SCT, Volume 5, Issue 4, May 2025, pp. 688-706. DOI: 10.48175/IJAR SCT-26481
- [34]. Swapnil S Sudake, Suhas B Khadake, Santoshi V Khedekar, Asmita M Kawade, Shraddha S Vyavahare, "Solar Based Wireless Electric Vehicle Charging System", IJAR SCT, Volume 5, Issue 5, May 2025, pp. 325-348. DOI: 10.48175/IJAR SCT-26647
- [35]. Manjeet Kumar, Shubhangi S Sul, Jyoti S Lakhara, Pranita J Kashid, Shravani R Bhinge, Amaraja S Waghmode, Suhas B Khadake, "Small Wind Electric System Energy Saver", IJAR SCT, Volume 5, Issue 5, May 2025, pp. 447-466. DOI: 10.48175/IJAR SCT-26663
- [36]. Namrata Ganesh Jadhav, Pranjali R Nagane, Akanksha M Khapare, Arvind Pande, Suhas B Khadake, "Identify and Measuring Parameter of PV Module Test Bench with the Ammeter and Voltmeter", IJAR SCT, Volume 5, Issue 6, May 2025, pp. 5-24. DOI: 10.48175/IJAR SCT-26702
- [37]. Sujit N. Bhandare, Prashant R. Mule, Yogesh A. Yeole, Krushna D More, Suhas B. Khadake, "Vehicle Tracking And Accident Alert System", IJAR SCT, Volume 5, Issue 6, May 2025, pp. 234-252. DOI: 10.48175/IJAR SCT-26728
- [38]. Manjeet Kumar, Suhas B Khadake, Madhuri S Doke, Shivani D Pujari, Pratiksha B Rupnar, "Sun Track: A Compact IoT System for PV Parameter Monitoring with NodeMCU", IJAR SCT, Volume 5, Issue 9, May 2025, pp. 261-280. DOI: 10.48175/IJAR SCT-27037
- [39]. Nikita R Bhosale, Sakshi D Shete, Laxmi A Koganure, Aditi A Gaikwad, Vedhangi S Sukre, Suhas B Khadake, "Development of a Real-Time Hydrogen Level Detection System for Storage Cylinders", IJAR SCT, Volume 5, Issue 4, June 2025, pp. 690-708. DOI: 10.48175/IJAR SCT-27666
- [40]. Bhinge Shravani Rajendra, Salunkhe Majushree Jayant, Tarse Mayuri Kundlik, Suhas B Khadake, B. B. Gopnarayan, Manisha P Bidve, "Smart Water Waste Collection System Using Bluetooth Control", IJAR SCT, Volume 5, Issue 7, June 2025, pp. 561-578. DOI: 10.48175/IJAR SCT-28072
- [41]. K. K. Sayyad Liyakat, S. B. Khadake, P. S. More, R. J. Shinde, K. P. Kondubhairi and S. S. Kamble, "AI-Driven IoT based Decision Making for Hepatitis Diseases Patient's Healthcare Monitoring: KSK Approach for Hepatitis Patient Monitoring," 2025 7th International Conference on Intelligent Sustainable Systems (ICISS), India, 2025, pp. 256-263, doi: 10.1109/ICISS63372.2025.11076213.
- [42]. K. K. Sayyad Liyakat, S. B. Khadake, K. Galani, K. B. Patil, A. Dhavale and S. D. Sarik, "AI-Powered-IoT (AIIoT) based Bridge Health Monitoring using Sensor Data for Smart City Management- A KSK Approach," 2025 7th International Conference on Intelligent Sustainable Systems (ICISS), India, 2025, pp. 296-305, doi: 10.1109/ICISS63372.2025.11076329.
- [43]. Rani N Bhosale, Tejashri M Salunkhe, Sayali S Ghodake, Shruti S Deshpande, Chandani N Kendale, Suhas B Khadake, "Smart Lawn Cutter using Solar and Bluetooth", IJAR SCT, Volume 5, Issue 1, August 2025, pp. 158-171. DOI: 10.48175/IJAR SCT-28618.
- [44]. Ganesh Navnath Surwase, Ashish Tukaram Jadhav, Krushna Dinesh More, Ingudam Chitrasen Meitei, Suhas B Khadake, "Accident Detection and Alerting Using Embedded System", IJAR SCT, Volume 5, Issue 2, October 2025, pp. 550-562. DOI: 10.48175/IJAR SCT-29269.
- [45]. Rohini Walke, Samarth Mole, Rohan More, Sonali Salunkhe, Rahul Jadhav, Suhas B Khadake, "Automated Canopy System", IJAR SCT, Volume 6, Issue 3, January 2026, pp. 438-447. DOI: 10.48175/IJAR SCT-30956.
- [46]. Samarth S Mole, Rohini J Walke, Rohan D More, Sonali A Salunkhe, Rahul N Jadhav, Sagar S Kawade, Suhas B Khadake, "Automated Fertilizer Dispensing System", IJAR SCT, Volume 6, Issue 4, January 2026, pp. 256-268. DOI:



0.48175/IJARSCT-31034.

[47]. Khapare Akanksha Mahadev , Jadhav Namrata Ganesh , Kshirsagar Manasi Pravin , Waghmode Amarja Santosh,

Dr. Mrinal K. Rajak , Suhas B Khadake,” Paper on Aqua Lift OWS (Oil Water Separator)”, IJARSCT, Volume 6, Issue 8, March 2026,pp.468-477. DOI: 10.48175/IJARSCT-32164.

[48]. Sujit N. Bhandare, Prashant R. Mule, Yogesh A. Yeole, Suhas B. Khadake, ” Vehicle to Vehicle Charging System”, IJARSCT, Volume 6, Issue 2, April 2026,pp.433-442. DOI: 10.48175/IJARSCT-32459.

[49]. Sujit N. Bhandare, Prashant R. Mule, Yogesh A. Yeole, Suhas B. Khadake, “Vehicle to Vehicle Charging System”,IJARSCT, Volume 6,Issue 2, April 2026,pp.433-442. DOI: 10.48175/IJARSCT-32459.

[50]. Suyog P Maindarkar, Soham R Salunke, Shriprasad S Wagh, Prathmesh A Dhekane, Sagar S Chaugule, Suhas B Khadake, “Solar-Powered Automated Electrocoagulation System for Sustainable Sugar Mill Wastewater Treatment”, IJARSCT, Volume 6, Issue 3, April 2026,pp-523-536. DOI: 10.48175/IJARSCT-32576.

