

ELECTRICAL VEHICLES

Submitted in partial fulfillment of the requirements for the completion of

PROFESSIONAL TRAINING

By

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**DEPARTMENT OF ELECTRICAL AND ELECTRONICS
ENGINEERING**

SCHOOL OF ELECTRICAL AND ELECTRONICS

SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY

(DEEMED TO BE UNIVERSITY)

Accredited with grade "A++" by NAAC

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DEPARTEMENT OF ELETRICAL AND ELETRONICS ENGINEERING

BONAFIDE CERTIFICATE

This is to certify that this Professional training report is the bonafide work of PADMA SRI S (REG NO 41140059) who carried out the reports entitled "INTERNSHIP TRAINING IN "NATIONAL SMALL INDUSTRES CORPORATION TECHNICAL SERVICES CENTRE" from Date 15-05-2023 TO 19-05-2023



Internal Guide

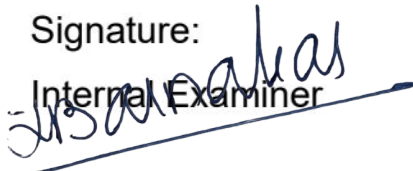


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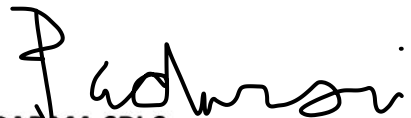

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DECLARATION

I PADMA SRI (REG NO 41140059) here by declare that the Report entitled **ELECTRIC VEHICLS** done by me at **NATIONAL SMALL INDUSTRES CORPORATION TECHNICAL SERVICES CENTRE** is submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering degree in ELECTRICAL AND ELECTRONICS ENGINEERING.

DATE : 15-05-2023 TO 19-05-2023

PLACE : CHENNAI



PADMA SRI S

SIGNATURE OF THE CANDIDATE

ACKNOWLEDGEMENT

I am pleased to acknowledge my sincere thanks to Board of Management of **SATHYABAMA INSTITUTE OF SCIENCE AND TECHNOLOGY** for their kind encouragement in doing this Report and for completing it successfully. I am grateful to them.

I convey my thanks to **DR.N.M.NANDHITHA**, Prof. & Dean, School of Electrical and Electronics Engineering and **DR.S.RADHIKA**, Head of the Department, Dept. of **ELECTRICAL AND ELECTRONICS ENGINEERING**

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Name of the candidate

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CHAPTER-1

INTRODUCTION ABOUT THE COMPANY

National Small Industries Corporation (NSIC), is an ISO 9001:2015 certified Government of India Enterprise under Ministry of Micro, Small and Medium Enterprises (MSME). NSIC has been working to promote, aid and foster the growth of micro, small and medium enterprises in the country. NSIC operates through countrywide network of offices and Technical Centers in the Country. In addition, NSIC has set up Training cum Incubation Centre managed by professional manpower(NSIC CIN No.U74140DL1955GOI002481).

1.1 INTERNATIONAL COOPERATION

NSIC facilitates sustainable international partnerships. The emphasis is on sustainable business relations rather than on one-way transactions. Since its inception, NSIC has contributed to strengthening enterprise-to-enterprise cooperation, south south cooperation and sharing best practices and experiences with other developing countries, especially those in the African, Asian and Pacific regions.

1.2 SCHEMES OF NSIC

NSIC facilitates Micro, Small and Medium Enterprises with a set of specially tailored scheme to enhance their competitiveness. NSIC provides integrated support services under Marketing, Technology, Finance and other Support service.

1.2.1 SINGLE POINT REGISTRATION SCHEME(SPRS)

Under this scheme, NSIC provides a single registration to SMEs, which is valid for both procurement and marketing assistance. It simplifies the process of participating in government tenders and exhibitions. NSIC enlists Micro & Small Enterprises (MSEs) under Single Point Registration scheme (SPRS) for participation in Government Purchases. The units enlisted under Single Point Registration Scheme of NSIC are eligible to get the benefits under Public Procurement Policy for Micro & Small Enterprises (MSEs) Order 2012 as notified by the Government of India, Ministry of Micro Small & Medium Enterprises, New Delhi vide Gazette Notification dated 23.03.2012 and amendment vide order no. S.O. 5670(E) dated 9th November 2018.

1.2.2 PERFORMANCE AND CREDIT RATING SCHEME

NSIC provides a performance and credit rating to SMEs, which helps them in accessing credit at competitive rates from banks and financial institutions.

1.2.3 TECHNOLOGY SUPPORT

Technology is the key to enhancing a company's competitive advantage in today's dynamic information age. Small enterprises need to develop and implement a technology strategy in addition to financial, marketing and operational strategies and adopt the one that helps integrate their operations with their environment, customers and suppliers.

1.3 SOFTWARE TECHNOLOGY CUM BUSINESS PARKS

NSIC has established Software Technology cum Business Parks at New Delhi and Chennai for providing the space to small and medium enterprises in software development and to IT/ITES/MSME units not reg. with STPI or the units that are falling under the overall definition of MSME as per the guidelines of Ministry of Micro, Small and Medium Enterprises. Units other than MSME such as Banks/PSUs/Financial Institutions, corporate sector etc. would also be considered for allotment on a case-to-case on merit with the approval of Competent Authority. NSIC Software Technology cum Business Parks, New Delhi is located in a prime location at Okhla Industrial Area adjacent to NSIC Bhawan with a total built up area of approx. 53000 sq.ft. This location is in the near vicinity to Nehru Place. (the commercial centre of computer industry). NSIC Software Technology cum Business Parks, Chennai is located in a prime location at Guindy Industrial Estate (Jawahar Lal Nehru Statue) with a total built area of 48,000 Sq. Ft. This location is in the near vicinity to domestic and international Airports.

1.4 MSME GLOBAL MART B2B WEB PORTAL FOR MSMEs

Information today is becoming almost as vital as the air we breathe. We need it every minute of our working lives. With increase in competition and melting away of international boundaries, the demand for information is reaching new heights. NSIC, realizing the needs of MSMEs, is offering Intermediary Services which is a one-stop, one-window bouquet of aids that will provide information on business, technology and finance, and also exhibit the core competence of Indian SMEs through digital presence. The corporation is offering Intermediary Services through its MSME Global Mart www.msmemart.com; which is a Business to Business (B2B) web portal. The services are available through Annual Membership.

- 1) Create your Company's Web Page in minutes
- 2) Display Products & Services 24*7
- 3) Connect with Buyers & Suppliers Globally
- 4) Information's on Events & Exhibitions
- 5) Keyword based Unlimited Tender Alert

- 6) Franchise & Distributorship Opportunities
- 7) Request For Quotations
- 8) Trade Leads
- 9) Platform to Buy/Sell Used Machinery
- 10) Service Available in Multiple Language

1.5 EXHIBITIONS AND TECHNOLOGY FAIRS

To showcase the competencies of Indian MSMEs and to capture market opportunities, NSIC participates in select International and National Exhibitions and Trade Fairs every year. NSIC facilitates the participation of the small enterprises by providing concessions in rental etc. Participation in these events exposes MSMEs to international practices and enhances their business prowess.

1.6 CREDIT SUPPORT

NSIC facilitates credit requirements of small enterprises in the following areas:

1.6.1 FINANCING FOR PROCUREMENT OF RAW MATERIAL (Short term)

NSIC's Raw Material Assistance Scheme aims at helping Small Enterprises by way of financing the purchase of Raw Material (both indigenous & imported). The salient features are Financial Assistance for procurement of Raw Material up to 180 day, MSMEs helped to avail Economics of Purchases like bulk purchase, cash discount, etc...

1.6.2 FINANCING FOR MARKETING ACTIVITIES (Short term)

NSIC facilitates financing for marketing activities such as Internal Marketing, Exports and Bill Discounting.

1.6.3 CREDIT FACILITATION THROUGH BANK

To meet the credit requirements of MSME units, NSIC has entered into a Memorandum of Understanding with various Nationalized and Private Sector Banks. Through syndication with these banks, NSIC facilitates MSME in accessing credit support (fund based or non-fund based limits) from the banks. NSIC assists MSMEs in completion of the documentation for submitting the proposals to the banks and also does the follow up with the banks. These hand holding support are provided by NSIC without any cost to the MSMEs

1.7 INTERNATIONAL CONSULTANCY SERVICES

For the last five decades, NSIC has acquired various skill sets in the development process of small enterprises. The inherent skills are being networked to offer consultancy services for other developing countries. The areas of consultancy are as listed below:

- 1) Capacity Building
- 2) Policy & Institutional Framework
- 3) Entrepreneurship Development
- 4) Business Development Services

CHAPTER-2

NATURE OF WORK DONE

Interning at a company like NSIC that specializes in electric vehicles can be a valuable experience . It offers several benefits:

Learning and Observation: Initially, interns often spend time observing and learning about the company's operations, culture, and industry. This may involve shadowing employees, attending meetings, and getting acquainted with company procedures.

Industry Exposure: Interns gain firsthand knowledge of the electric vehicle industry, including emerging trends, technologies, and market dynamics.

Skill Development: We can acquire practical skills in areas such as electric vehicle design, manufacturing, testing, and maintenance.

Networking: Internships provide opportunities to connect with professionals in the field, potentially leading to future job opportunities.

Resume Building: Experience at a renowned company like NSIC enhances a student's resume, making them more competitive in the job market.

Innovation: Electric vehicles are at the forefront of environmental sustainability, contribute to cutting-edge, eco-friendly technology.

Research and Development: Interns may be involved in research projects related to EV components, battery technology, charging infrastructure, or software development. This could include conducting experiments, data analysis, or prototyping.

Manufacturing and Production: Gain hands-on experience in manufacturing processes specific to electric vehicles. This might include assembly line work, quality control, or process improvement initiatives.

Testing and Validation: Interns could be responsible for testing EV components or entire vehicles to ensure they meet safety, performance, and efficiency standards. This may involve lab testing, field testing, and data collection.

Overall, an internship at NSIC or a similar electric vehicle company can be a transformative experience, helping students prepare for a career in this growing industry.

OVERALL THE E- VEHICLES

Electric vehicles are not something new to this world, but with the technological advancement and increased concern on controlling pollution has given it a tag of future mobility. The core element of the EV, apart from Electric Vehicle Batteries, which replaces the Internal Combustion engines is an Electric motor. The rapid development in the field of Power electronics and control techniques has created a space for various types of electric motors to be used in Electric Vehicles. The electric motors used for automotive applications should have characteristics like high starting torque, high power density, good efficiency, etc.

CHAPTER-3

METHODS AND PROCESS

An electric vehicle (EV) internship typically involves working with a company or organization in the electric vehicle industry. During an EV internship, you can expect to gain practical experience and knowledge related to electric vehicles and sustainable transportation.

3.1 METHODS

Orientation and On-boarding: Interns are welcomed to the organization and introduced to its culture, policies, and safety procedures. They receive an overview of the EV internship program, including its goals, expectations, and learning objectives.

Theoretical Learning: Provide classroom training where students can learn the theoretical aspects of EVs. Topics may include battery technology, electric motors, power electronics, vehicle dynamics, and environmental impact.

TYPES OF E-VEHICLE MOTORS

- 1) DC Series Motor
- 2) Brush less DC Motor
- 3) Permanent Magnet Synchronous Motor (PMSM)
- 4) Three Phase AC Induction Motors
- 5) Switched Reluctance Motors (SRM)

Hands-On Training: Hands-on experience is essential in an EV internship. Set up workshops, labs, or simulation exercises where we can gain practical skills in EV-related tasks.

Mentor ship: Many companies pair interns with mentors who provide guidance and support throughout the internship. Mentors can help interns navigate the workplace, offer technical advice, and provide valuable insights into the industry.

3.2 PROCESSES

Training: Interns may receive training in electric vehicle (EV) technology and relevant tools or software. This training can include classroom sessions, hands-on workshops, or online courses to familiarize interns with the EV industry.

Regular Feedback: Companies often have regular check-ins and feedback sessions with interns to track their progress and address any challenges they may be facing.

E-VEHICLE MOTORS

1.DC SERIES MOTORS

High starting torque capability of the DC Series motor makes it a suitable option for traction application.

It was the most widely used motor for traction application in the early 1900s. The advantages of this motor are easy speed control and it can also withstand a sudden increase in load. All these characteristics make it an ideal traction motor.

The main drawback of DC series motor is high maintenance due to brushes and commutators. These motors are used in Indian railways. This motor comes under the category of DC brushed motors.

2.BRUSH LESS DC MOTORS

It is similar to DC motors with Permanent Magnets. It is called brush-less because it does not have the commutator and brush arrangement.

The commutation is done electronically in this motor because of this BLDC motors are maintenance free. BLDC motors have traction characteristics like high starting torque, high efficiency around 95-98%, etc.

BLDC motors are suitable for high power density design approach. The BLDC motors are the most preferred motors for the electric vehicle application due to its traction characteristics.

3.BLDC MOTORS FURTHER HAVE TWO TYPES

A)Out-runner type BLDC Motor:

In this type, the rotor of the motor is present outside and the stator is present inside. It is also called as Hub motors because the wheel is directly connected to the exterior rotor.

This type of motors does not require external gear system. In a few cases, the motor itself has inbuilt planetary gears. This motor makes the overall vehicle less bulky as it does not require any gear system.

It also eliminates the space required for mounting the motor. There is a restriction on the motor dimensions which limits the power output in the in-runner configuration.

This motor is widely preferred by electric cycle manufacturers like Hullikal, Tron x, Spore, light speed bicycles, etc. It is also used by two-wheeler manufacturers like 22 Motors, NDS Eco Motors, etc.

B) In-runner type BLDC Motor:

In this type, the rotor of the motor is present inside and the stator is outside like conventional motors.

These motor require an external transmission system to transfer the power to the wheels, because of this the out-runner configuration is little bulky when compared to the in-runner configuration.

Many three- wheeler manufacturers like Goenka Electric Motors, Speedo Vehicles, Kinetic Green, Volta Automotive use BLDC motors. Low and medium performance scooter manufacturers also use BLDC motors for propulsion.

4. PERMANENT MAGNET SYNCHRONOUS MOTORS (PMSM)

This motor is also similar to BLDC motor which has permanent magnets on the rotor. Similar to BLDC motors these motors also have traction characteristics like high power density and high efficiency.

The difference is that PMSM has sinusoidal back EMF whereas BLDC has trapezoidal back EMF. Permanent Magnet Synchronous motors are available for higher power ratings.

PMSM is the best choice for high performance applications like cars, buses. Despite the high cost, PMSM is providing stiff competition to induction motors due to increased efficiency than the latter. PMSM is also costlier than BLDC motors.

Most of the automotive manufacturers use PMSM motors for their hybrid and electric vehicles. For example, Toyota Prius, Chevrolet Bolt EV, Ford Focus Electric, zero motorcycles S/SR, Nissan Leaf, Honda Accord, BMW i3, etc use PMSM motor for propulsion.

5.THREE PHASE AC INDUCTION MOTORS

The induction motors do not have a high starting torque like DC series motors under fixed voltage and fixed frequency operation. But this characteristic can be altered by using various control techniques like FOC or v/f methods.

By using these control methods, the maximum torque is made available at the starting of the motor which is suitable for traction application. Squirrel cage induction motors have a long life due to less maintenance.

Induction motors can be designed up to an efficiency of 92-95%. The drawback of an induction motor is that it requires complex inverter circuit and control of the motor is difficult.

6.SWITCHED RELUCTANCE MOTORS

Switched Reluctance Motors is a category of variable reluctance motor with double salience. Switched Reluctance motors are simple in construction and robust.

The rotor of the SRM is a piece of laminated steel with no windings or permanent magnets on it. This makes the inertia of the rotor less which helps in high acceleration.

The robust nature of SRM makes it suitable for the high speed application. SRM also offers high power density which are some required characteristics of Electric Vehicles.

Since the heat generated is mostly confined to the stator, it is easier to cool the motor. The biggest drawback of the SRM is the complexity in control and increase in the switching circuit. It also has some noise issues.

Once SRM enters the commercial market, it can replace the PMSM and Induction motors in the future.

Evaluation: The company evaluates the performance of interns, and interns often provide feedback on their internship experience. This assessment can be used for future hiring decisions.

Progress Assessments:Regular assessments, quizzes, assignments, and evaluations help monitor intern progress.Feedback is provided to help interns improve their skills and understanding.

INSIGHTS FOR SELECTING THE RIGHT MOTOR FOR YOUR EV

For selecting the appropriate electric vehicle motors, one has to first list down the requirements of the performance that the vehicle has to meet, the operating conditions and the cost associated with it.

For example, go-kart vehicle and two-wheeler applications which requires less performance (mostly less than 3 kW) at a low cost, it is good to go with BLDC Hub motors.

For three -wheeler and two-wheeler, it is also good to choose BLDC motors with or without an external gear system. For high power applications like performance two-wheeler, cars, buses, trucks the ideal motor choice would be PMSM or Induction motors.

Once the synchronous reluctance motor and switched reluctance motor are made cost effective as PMSM or Induction motors, then one can have more options of motor types for electric vehicle application.

CHAPTER-4

KNOWLEDGE AND EXPERIENCE

WHAT IS E-VEHICLE?

An EV is defined as a vehicle that can be powered by an electric motor that draws electricity from a battery and is capable of being charged from an external source. An EV includes both a vehicle that can only be powered by an electric motor that draws electricity from a battery (all-electric vehicle) and a vehicle that can be powered by an electric motor that draws electricity from a battery and by an internal combustion engine (plug-in hybrid electric vehicle).

BENEFITS OF E-VEHICLES

Electric vehicles are around 3-5 times more efficient than internal combustion vehicles in utilizing energy. Electric vehicles save energy by regenerative braking. Electric vehicles have no tail pipe, so they don't emit any exhaust gases. Electric vehicles are much quieter and may contribute to a reduction in noise pollution levels in the cities. Electric vehicles have much fewer moving parts as compared to vehicles with IC engines. Thus, being simpler, they are cheaper and easier to maintain. Electric motors can deliver high torque at low speeds. As a result, electric vehicles deliver much better performance while starting off and on slopes than IC engine-powered vehicles.

HISTORY OF E-VEHICLES

In 1828 Anyos Jedlik invented an electric motor, and, using his motor, he created the small electric car. Between 1832 and 1839, Scottish inventor Robert Anderson also developed a crude electric carriage. In 1996, the first electric vehicle was a three-wheeler, invented by Scooter's India Pvt Ltd, and it was named VIKRAM SAFA. Approximately 400 vehicles were made and sold. These vehicles ran on 72 volt lead acid battery. In 2000, BHEL developed an eighteen-seater electric bus, which became popular too.

TYPES OF E-VEHICLES

1. Battery Electric Vehicle (BEV)
2. Plug-in Hybrid Electric Vehicle (PHEV)
3. Hybrid Electric Vehicle (HEV)
4. Fuel cell Electric Vehicle (FCEV)

1) BATTERY E-VEHICLE

A Battery Electric Vehicle (BEV), also called All-Electric Vehicle (AEV), runs entirely on a battery and electric drive train. This types of electric cars do not have an ICE.

Electricity is stored in a large battery pack that is charged by plugging into the electricity grid. The battery pack, in turn, provides power to one or more electric motors to run the electric car.

2) PLUG IN HYBRID E-VEHICLE

PHEV is a type of hybrid vehicle that both an ICE and a motor, often called as series hybrid. This types of electric cars offers a choice of fuels.

This type of electric cars is powered by a conventional fuel (such as gasoline) or an alternative fuel (such bio-diesel) and by a rechargeable battery pack. The battery can be charged up with electricity by plugging into an electrical outlet or electric vehicle charging station (EVCS).

3) HYBRID E-VEHICLE

This type of hybrid cars is often called as standard hybrid or parallel hybrid.

HEV has both an ICE and an electric motor. In this types of electric cars, internal combustion engine gets energy from fuel (gasoline and others type of fuels), while the motor gets electricity from batteries.

The gasoline engine and electric motor simultaneously rotate the transmission, which drives the wheels.

The difference between HEV compared to BEV and PHEV is where the batteries in HEV can only charged by the ICE, the motion of the wheels or a combination of both.

There is no charging port, so that the battery cannot be recharged from outside of the system, for example from the electricity grid.

This unit manages the flow of electrical energy delivered by the traction battery, controlling the speed of the electric traction motor and the torque it produces.

4)FUEL CELL E-VEHICLE

Fuel Cell Electric Vehicles (FCEVs), also known as fuel cell vehicles (FCVs) or Zero Emission Vehicle, are types of electric cars that employ 'fuel cell technology' to generate the electricity required to run the vehicle.

In this type of vehicles, the chemical energy of the fuel is converted directly into electric energy.

4.1 KNOWLEDGE GAINED

During an electric vehicle (EV) internship, we have the opportunity to gain a wide range of knowledge and skills related to electric vehicles and the EV industry. Here are some key areas of knowledge and skills that we can expect to acquire during an EV internship.

EV Technology:Understanding the basic principles of electric vehicle technology, including electric motors, battery systems, power electronics, and regenerative braking.

Battery Systems:Learning about the different types of batteries used in EVs, their chemistry, performance characteristics, charging and discharging processes, and safety considerations.

Electric motors:DC Series Motor,Brush less DC Motor,Permanent Magnet,Synchronous Motor (PMSM),Three Phase AC Induction Motors,Switched Reluctance Motors (SRM).

Sustainability and Environmental Impact:Exploring the environmental benefits of electric vehicles, including reduced greenhouse gas emissions and the potential for renewable energy integration.

4.2 EXPERIENCE

We may work on research projects related to electric vehicle technology, such as battery improvements, energy efficiency, or electric propulsion.

Typically, an internship starts with an orientation to familiarize the student with the company's culture, values, safety procedures, and expectations.

In the case of electric vehicle , internships may involve developing applications or firmware for EV control systems and user interfaces.

Depending on the internship, students might have the opportunity to work on real electric vehicles, components, or systems. This hands-on experience can be a valuable learning opportunity.

Internships often include training sessions or workshops to enhance the intern's knowledge and skills related to electric vehicles

CHAPTER-5

SUMMARY AND CONCLUSION

5.1 SUMMARY

NSIC provides technical support to MSMEs through 'NSIC Technical Services Centre (NTSCs) and a number of TICs & LBIs spread across the country. The range of technical services provided through these centers include skill development in Hi-Tech as well as conventional trades, material and product testing at our testing laboratories accredited by NABL / BIS, common facilities, energy audit, environment management etc. Interns often acquire technical skills relevant to electric vehicles, such as knowledge of EV components, battery technology, electric propulsion systems, and software development for EVs. work on EV- related projects, gaining practical, hands-on experience that can be applied to their future careers. Internships provide valuable insights into the EV industry, including market trends, environmental impact, and the challenges and opportunities in the field. The learning opportunities Interns often have access to training sessions and workshops, enhancing their knowledge and skills related to electric vehicles. Working as part of a team on EV projects fosters collaboration and teamwork skills, which are essential in the professional world. Internships provide opportunities for personal growth, including increased confidence, adaptability, and a deeper understanding of one's career goals.

5.2 CONCLUSION

In conclusion, an internship in the electric vehicle (EV) industry offers a valuable opportunity to gain practical experience, technical skills, and industry insights. Through hands-on work, mentor ship, and collaboration, interns can develop a deep understanding of EV technology and its environmental impact. This experience contributes to personal and professional growth, enhances resume credentials, and builds a network of industry contacts.

No. : 35105



एन एस आई सी
N S I C

राष्ट्रीय लघु उद्योग निगम लिमिटेड
NATIONAL SMALL INDUSTRIES CORPORATION LIMITED
(A Govt. of India Enterprise)

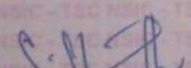
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CERTIFICATE

This is to certify that Ms. **PADMA SRI S.** D/o.
Shri. **SENNIAPPAN**, student of II year B.E. (EEE),
Sathyabama Institute of Science and Technology,
has undergone **"Internship Training on
ELECTRIC VEHICLES"** conducted at our centre
for a period of one week from 15.05.2023 to
19.05.2023.




HEAD OF TRAINING


HEAD OF CENTRE