

Internet of Things Based Demand Side Energy Management System

Submitted in partial fulfillment of the requirements for the award of
Bachelor of Engineering Degree in
Electrical and Electronics Engineering

by

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**DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
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SATHYABAMA

**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

Accredited with Grade "A" by NAAC

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CERTIFICATE

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Certificate

Srinath g

of Sathyabama Institute of Science and Technology

(Department of EEE)

has participated 5 days Industrial Training on Electric Vehicle

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REPORT

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ELECTRIC VEHICLE:

Electric vehicle is one of the developing part in automobile industry. Unlike internal combustion engine the EV (electric vehicle) operates on battery. Electric vehicle is first invented by **Scotsman Robert Anderson** in between **1832** and **1839**. Electric vehicle is the most conventional vehicle created in automobile industry.

TOPIC

SNO	TOPIC	METHODOLOGY
1	Conventional vehicle-mechanical and electrical systems	Theoretical class
2	Basics of EV power train and architecture	
3	Components of EV	
4	Electric motors and control techniques	

5	Power convertors and energy storage systems	
6	Types of battery and design the battery for EV	
7	Battery management system	
8	Challenges and policies of EV	
9	Conventional vehicle assembly and dismantling	Practical
10	Testing of EV components	
11	DC motor control with MOSFET	
12	Buck and boost convertors	
13	Induction motor control with VFD	
14	Battery testing and design of battery for EV	
15	Assembling and dismantling of EV	

1. Conventional vehicle-mechanical and electrical systems

Regular vehicle or conventional vehicle is something that uses internal combustion engine in order to convert chemical energy into mechanical energy.

THE 4 STROKE ENGINE :

In this engine, the piston completes four separate strokes while turning the crankshaft. A stroke refers to the full travel of the piston along the cylinder, in either direction. The four separate strokes are termed:

1.Intake: Also known as induction or suction. This stroke of the piston begins at top dead center (T.D.C.) and ends at bottom dead center (B.D.C.). In this stroke the intake valve must be in the open position while the piston pulls an air-fuel mixture into the cylinder by producing vacuum pressure into the cylinder through its downward motion. The piston is moving down as air is being sucked in by the downward motion against the piston.

2.Compression: This stroke begins at B.D.C, or just at the end of the suction stroke, and ends at T.D.C. In this stroke the piston compresses the air-fuel mixture in preparation for ignition during the power stroke (below). Both the intake and exhaust valves are closed during this stage.

3.Combustion: Also known as power or ignition. This is the start of the second revolution of the four stroke cycle. At this point the crankshaft has completed a full 360 degree revolution. While the piston is at T.D.C. (the end of the compression stroke) the compressed air-fuel mixture is ignited by a spark plug (in a gasoline engine) or by heat generated by high compression (diesel engines), forcefully returning the piston to B.D.C. This stroke produces mechanical work from the engine to turn the crankshaft.

4.Exhaust: Also known as outlet. During the exhaust stroke, the piston, once again, returns from B.D.C. to T.D.C. while the exhaust valve is open. This action expels the spent air-fuel mixture through the exhaust valve.

2.Basics of EV power train and architecture

In conventional IC engine architecture the engine is power conversion device but in the EV powertrain Architecture Motor is the one does the energy conversion work transmission driveshaft axles and differential is the main components in terms of EV powertrain

3.Components of EV

The main components of EV are,

- Battery Bank
- Onboard Charger
- DC-DC Converter
- DC-AC Inverter
- Motor
- Auxiliary DC-DC Inverter
- Auxiliary Battery

1.Battery Bank

Electrical vehicles uses DC voltage in range from 200 to 800V DC. For achieving such high DC voltage 50 to 200 such small cells are to be connected in series and similar banks will have to be connected in parallel to get high "Ah" rating to hold more power so that vehicle runs longer per charge.

2.Onboard Charger

These charger units are usually placed in front side of vehicles which can be identified with two input cables and two output cables. All high voltage cables inside EV are having specific colour like "Orange". This charger is uni-directional, i.e. it only use to convert AC input to DC supply for charging but not the reverse process.

3.DC-DC Converter

DC-DC converters are used to match the right input voltage which is required for DC to AC inverter section which drives the motor. The li-ion cells have full charge terminal voltage of 4.2V and full discharge voltage is 3.0V for safe operation. If a li-ion cell is charged above 4.2V, it may get over heated and get damaged. Similarly, if they are discharged below 3.0V, they may not charge up next time.

4.DC-AC Inverter

The high voltage DC supply received from DC-DC converter is fed to AC inverter section which produces high voltage AC supply to run the asynchronous motor. Motors are usually 3-phase type, hence the DC-AC inverter produces high voltage 3-phase AC supply.

5.Motor

To convert the electrical energy received from battery banks into mechanical energy, electric cars use motors. For smaller vehicles DC motors are also used, but for electric cars, buses and trucks we use 3-phase induction motor due to its high efficiency and brushless operation. Other brushed motors need replacement of carbon brushes time to time as they wear out due to rotation of shaft.

4.Electric motors and control techniques

An **electric motor** is an electric machine that converts electrical energy into mechanical energy. Most electric motors operate through the interaction between the motor's magnetic field and electric current in a wire winding to generate force in the form of torque applied on the motor's shaft. Electric motors can be powered by direct current (DC) sources, such as from batteries, or rectifiers, or by alternating current (AC) sources, such as a power grid, inverters or electrical generators.

5.Power converters and energy storage systems

Energy storage is the capture of energy produced at one time for use at a later time¹ to reduce imbalances between energy demand and energy production. A device that stores energy is generally called an accumulator or battery. Energy comes in multiple forms including radiation, chemical, gravitational potential, electrical potential, electricity, elevated temperature, latent heat and kinetic. Energy storage involves converting energy from forms that are difficult to store to more conveniently or economically storable forms.

6.Types of battery and design the battery for EV

A battery used to power the electric motors of a battery electric vehicle (BEV) or hybrid electric vehicle (HEV). These batteries are usually rechargeable (secondary) batteries, and are typically lithium-ion batteries.

There are 5 types of electric vehicle batteries they are,

- Lithium-Ion (Li-On)
- Nickel-Metal Hybrid (NiMH)
- Lead Acid (SLA)
- Ultracapacitor
- ZEBRA

7.Battery management system

A Battery Management System AKA BMS monitors and regulates internal operational parameters, i.e. temperature, voltage and current during charging and discharging of the battery.

A BMS is an electronic board consisting of a variety of components and circuitry. After detecting a problem in operational parameters (voltage, temperature etc.) BMS triggers input to the alarm system followed by disconnecting the battery pack from the load or charger.

8.Challenges and policies of EV

The transition to de-carbonized mobility solutions requires a robust, fast, and accessible charging infrastructure that is conducive for both short and long-distance travel. While the government and private players have set up a network of charging stations across the country, there is a long way to go.

Limitations of EV

- 1.battery cost is too high.
- 2.Electric vehicles are not water resistant.
- 3.Eventhough lithium ion batteries are recyclable they are not recycled properly.

4. Electric vehicles take more time to recharge.

Conclusion

Even though EV is useful to environment it also leaves lithium waste but it is very much better than IC engine's. In future the EV can lead the world to a better development.