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A SURVEY ON TECHNIQUES IMPLIMENTING BATTERY MANAGEMENT SYSTEM AND CRASH DITECTION SYSTEM IN ELECTRIC VEHICLE IN INDIA

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Abstract : since 1960s india is producing motorcycle in india by Hindustan motors and later in 1980 when revolution happened in india the Yamaha motors come in india and produce a revolutionary change in india they introduced Yamaha rx100 for racing and it changed the india it became the status symbol of india in may 1999 honda launched its first family vehicle honda activa which was the favorite scooter of india later due to increase in carbon dioxide in india and due to global warming government of india introduced electric vehicle policy which gave the users benefits of subsidiary scheme in india by which the people made us of it and buyed electric vehicle today also the people don't buy the electric vehicle because of the blast in battery and front suspension being broken and it was introduced to reduce the green house gases .

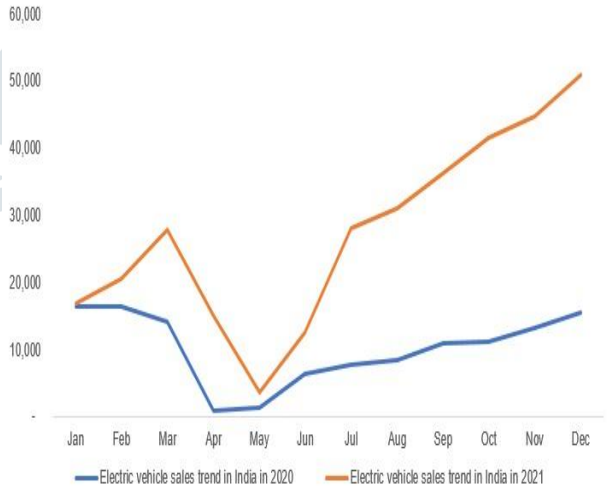
1.0.0: KEYWORDS: IMPROVING ELECTRIC VEHICLE, BATTERY MANAGEMENT TECHNOLOGY, CRASH DETECTION SYSTEM.

1.1.1: Introduction

The global electric vehicle (EV) market is developing at a rapid pace. According to EV volumes, overall electric vehicle reached a global share of 8.3% (including battery electric vehicles [BEVs] and Plug-in hybrid electric vehicles [PHEVs]) in 2021 from 4.2% in 2020 with 6.75 million vehicles on the road. This is an increase of 108% as of 2020. EVs are gaining attention across the globe as they help reduce emissions and depletion of natural resources. The Indian EV market is also evolving fast as close to 0.32 million vehicles were sold in 2021, up 168% YoY.

Ongoing electric vehicle adoption in India is based on the Paris agreement to reduce carbon emissions, to improve the air quality in urban areas and reduce oil imports.

Electric Vehicle Sales Trend in India (2020-21)



Source: EV reporter

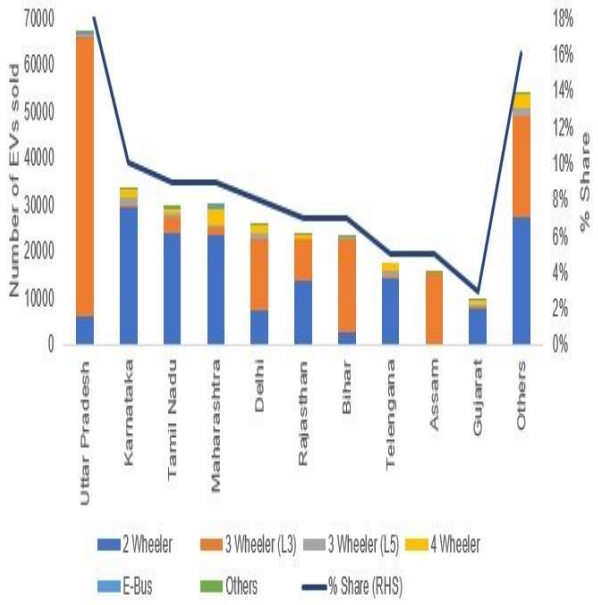
EV Market in India

The Indian automobile industry is the fifth largest in the world and is expected to become the third largest by 2030. As per India Energy Storage Alliance (IESA), the Indian EV industry is expected to expand at a CAGR of 36%. As population rises and demand for vehicles grow, dependence on conventional energy resources is not a sustainable option as India imports close to 80% of its crude oil requirements. NITI Aayog aims to achieve EV sales

penetration of 70% for all commercial cars, 30% for private cars, 40% for buses and 80% for two and three-wheelers by 2030. This is in line with the goal to achieve net zero carbon emission by 2070. Over the last three years, 0.52 million EVs were registered in India, according to the Ministry of Heavy Industries. EVs recorded robust growth in 2021, supported by the implementation of favourable policies and programmes by the government.

In India, Uttar Pradesh held the highest share in EV sales in 2021, with the number of units sold across all segments reaching 66,704, followed by Karnataka with 33,302 units and Tamil Nadu with 30,036 units. Uttar Pradesh dominated the three-wheeler segment, while Karnataka and Maharashtra led the two-wheeler segment and four-wheeler segment, respectively.

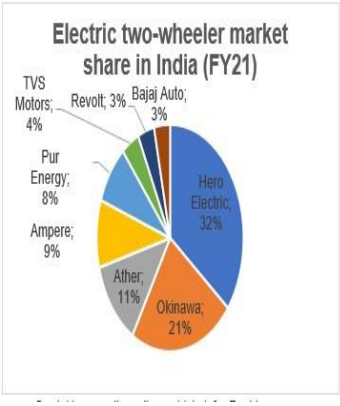
State -Wise-EV Sales Trend in 2021

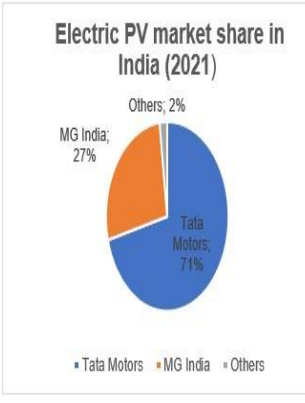


Source: EV Reporter

Hero Electric, Okinawa and Ather Energy controls the electric two-wheeler market in India with a combined market share of 64%. Hero Electric has a market share of 36% followed by Okinawa with 21%. Ather Energy with an 11.1% market share is slowly gaining market share, as the company is currently expanding its distribution network across India. In the passenger vehicle segment, Tata Motors enjoys a commanding position in electric vehicle space with a market share of 71%, led by their two key models, Nexon and Tigor EV. MG Motors India enjoys the second position and offers the longest-range EV (MG EZS provides 439 KM range on a single charge). Other Indian manufacturers have announced their models and is expected to be launched in the future.

Company	EV related plans
Kia	Kia plans to manufacture small SUV EVs in India for global markets in 2025.
Maruti Suzuki	Maruti Suzuki plans to launch its first EV model in India by 2025.
Tata Motors	Tata Motors bags an order worth US$ 678 million (Rs 5,000 crore) order from the government for electric buses; it plans to launch 10 more EVs in India.
Hyundai	Hyundai plans to launch IONIQ 5 EV in India by the second half of 2022.
Hop charge	Hop charge, a Gurgaon-based start-up has created the world's first on-demand doorstep fast charge service.
MG Motors	MG Motors India has partnered with Bharath petroleum for expanding the EV charging infrastructure.
Mahindra & Mahindra	Mahindra and Mahindra targets to launch 16 EV models across its SUV and LCV categories by 2027.





Source- Cardekho, gaadiwaadi, e-vehicle info.,Rushlane.

1.1.2 : Key Policy Initiatives – Growth Levers

The Government of India has always been at the forefront of framing policies related to EV adoption in the country. Few of the programmes launched by the government to increase EV adoption are shown below:

1.1.3:Business Opportunities

The EV push in India opens a plethora of

business opportunities across three key segments – mobility, infrastructure, and energy. These include opportunities in EV franchising, EV OEM market, battery infrastructure, solar vehicle charging and battery swapping technology among several others. According to NITI Aayog, the complete transition to EVs requires a total investment of US$ 267 billion (Rs.19.7 lakh crore) in EVs, battery infrastructure and charging infrastructure.

According to the Ministry of Skill Development and Entrepreneurship (MSDE), the EV industry could add 10 million direct jobs by 2030 which would create 50 million indirect jobs in the sector. Several automobile companies have plans to participate in the EV industry as listed in the table below:

1.1.4: FAME India Scheme: Faster Adoption & Manufacturing of (Hybrid &) Electric Vehicles (FAME) India was launched in 2015 for promoting growth and early adoption of hybrid and electric vehicles in the country. FAME-II scheme was launched in India with a budget outlay of US$ 1.3 billion (Rs. 10,000 crore) to support 1 million e-two-wheelers, 0.5 million e-three -wheelers, 55,000 e-passenger vehicles and 7,000 e-buses. The government extended the scheme until 2024, as announced in Union Budget 2022-23.

1.1.5: PLI Scheme: The government introduced Production Linked Incentive for Advanced Chemistry Cell Battery Storage (PLI-ACC) scheme. The scheme is expected to boost India's battery infrastructure. As per the Union Budget, the total outlay for the scheme is US$ 2.45 billion (Rs 18,100 crore), which would be disbursed to beneficiaries over five years once the manufacturing facility is set up.

1.1.6: Battery Swapping Policy: A wide-spread charging infrastructure is essential for EV adoption. In this regard, on April 22, 2022, NITI Aayog released a draft battery swapping policy which will be valid until March 31, 2025. The policy will be implemented over a period of 1-2 years from the date of launch of the policy and will cover all metropolitan cities with a population greater than four million. The second phase will be implemented over 2-3 years from date of launch of the policy and will cover all UT's and major cities with a population greater than 5,00,000.

1.1.7: Other Initiatives-

a. Tax exemption of up to Rs.1,50,000 (US$ 1,960) under section 80EEB of income tax while purchasing an EV (2W or 4W) on loan.
b. Reduction of customs duty on nickel ore (key component of lithium-ion battery) from 5% to 0%.
c. State- wise reduction of road tax and other incentives.

Business Opportunities

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2.0.0: RESEARCH METHODOLOGY ON IMPROVING ELECTRIC VEHICLE IN INDIA ACCORDING TO THE INDIA's all weather condition the company should develop the vehicle that can sustain heat ,rain and cold weather and in recent years we have seen there are been many electric vehicles start ups and unicorn company which are established in india and made in india for example ather , ola , honda , revolt etc. are the companies which are growing their market in india in recent times ather is the fast growing 2 wheeler scooter in india. Ather started its journey from it city and the garden city of india Bengaluru. ola in india is just a scooter of fun but it is made only for the people who love to ride fast and listen music while driving.

2.0.1: BATTERY MANAGEMENT SYSTEM

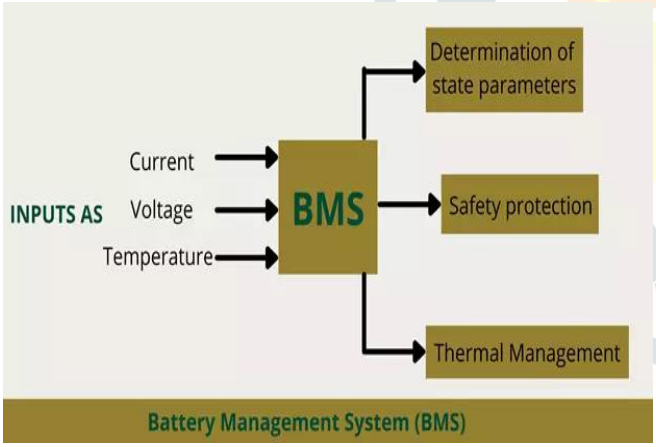
Rechargeable batteries are used to deliver power to the auxiliary systems and motors in electric vehicle applications. Among all rechargeable batteries, Lithium-Ion Batteries will give high efficiency for electric mobility because Li-Ion batteries have a low self-discharge rate, wide operating range, maximum energy density, and high life cycle. To improve the quality of battery and safe operation, a Battery Management System (BMS) is employed, and it plays a vital role in the application of Electric Mobility. here is the Why do we require Battery Management System (BMS) in Electric vehicles?

Source ref: to this diagram about why we require battery management system(Bms) in electric vehicle. Diagram 2.0.1

To prevent battery failure and mitigate potential hazardous situations, there is a need for a supervising system that ensures that batteries function properly in the final application. This supervising system is referred to as a Battery Management System (BMS).

2.0.2: FUNCTION OF BATTERY MANAGEMENT SYSTEM(BMS) IN ELECTRIC VEHICLE

The primary function of a BMS is to fulfill safety requirements. But there's more to it. Objectives related to the more efficient usage of battery cells and prolongation of their lifetime are also being increasingly integrated into the design of BMS. While there is no unique definition of a BMS, it should be designed with a minimal set of requirements Such as- It must measure individual cell voltages The BMS must measure temperatures at different points as close as possible to the battery It must measure currents flowing through it The BMS should communicate information to control units and undertake action to ensure the battery will be operated within safety limits The BMS should balance battery cells passively or actively And, the BMS should provide thermal management.



SOURCE REF: DIAGRAM 2.0.2 FUNCTION OF BMS (BATTERY MANAGEMENT SYSTEM)

2.0.3: BATTERY STATE PARAMETERS

For the management of the batteries during electric vehicle operation, to achieve the best performance and prolong battery life, it is necessary to monitor various states inside the battery depending on the battery management system (BMS) in real-time. These states include state of health (SoH),state-of-charge (SoC), state-of-function (SoF), charge acceptance (CA), etc.

2.0.4: State of Charge (SoC)

All vehicles have a fuel indicator, in the same way, EVs also have a battery state of charge (SoC) indicator. BMS helps in indicating and showing the driver the actual state of charge in the battery. The SoC of a cell is a percentage value that expresses the remaining charge Q of a battery.

2.0.5: State of Health Definition (SoH)

With advancing battery degradation, the internal resistance of the battery increases while the capacity of the cell fades. This leads to drastic changes in cell behavior and might make a cell unsuitable to be used for its primary application, such as in an EV. Therefore, it is necessary to track the cell degradation, using the parameter state of health (SoH). The battery SoH characterized by the slow-changing parameters, such as capacity fading and resistance increasing, varies with cycles and hence it needs to be monitored in a long timescale.

2.0.6: State of function definition (SoF)

In simple words, SoF can be defined as a parameter that describes how a battery's performance meets the application's demands during use. The SoF can either be a percentage value, a concrete value in, for example, kW, or even a binary value representing whether the battery is or is not able to fulfill the demand of the application.

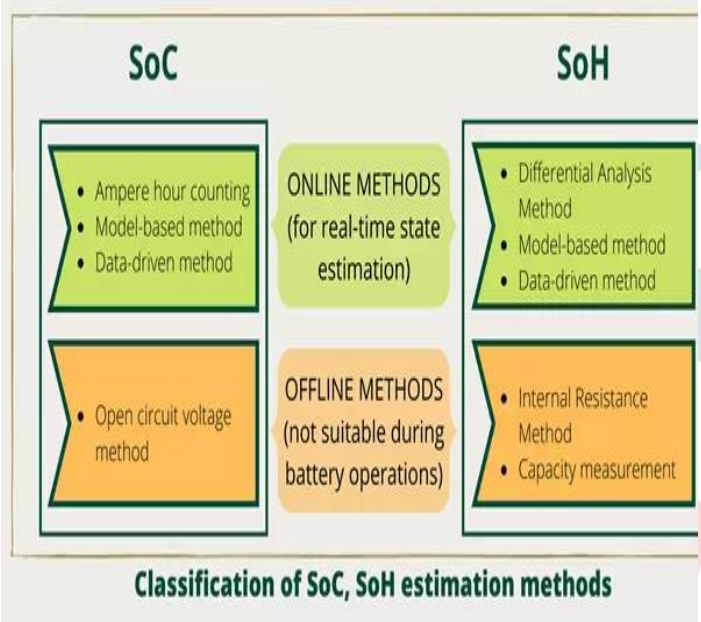
A more generalized definition of SoF can be as the fraction of the ΔP (difference of available power to demanded power) to the ΔPmax (difference of maximum power battery pack can supply to demanded power), that is, it is a percentage value that describes how much the current battery state (SoC, SoH, temperature, etc.) differs from the optimal battery state.

2.0.7: Charge acceptance (CA)

It indicates the maximum charging current the battery can accept at present conditions (SoC, SoH, temperature) and for a given charging voltage and is therefore highly relevant for regenerative braking. However, both SoC and SoH cannot be directly measured by the sensors, they are only monitored and reflected based on the measured parameters such as voltage, current, temperature, and internal resistance.

A variety of methods have been developed for both SoC and SoH estimation. Considering the practical applications, the methods can be roughly categorized into online and offline ones. The online methods can be used for the real-time state estimation of the battery. However, the offline methods are not suitable during battery operations due to strict experimental schemes or high computational costs.

2.0.8: Classification of Soc, SoH Estimation Methods

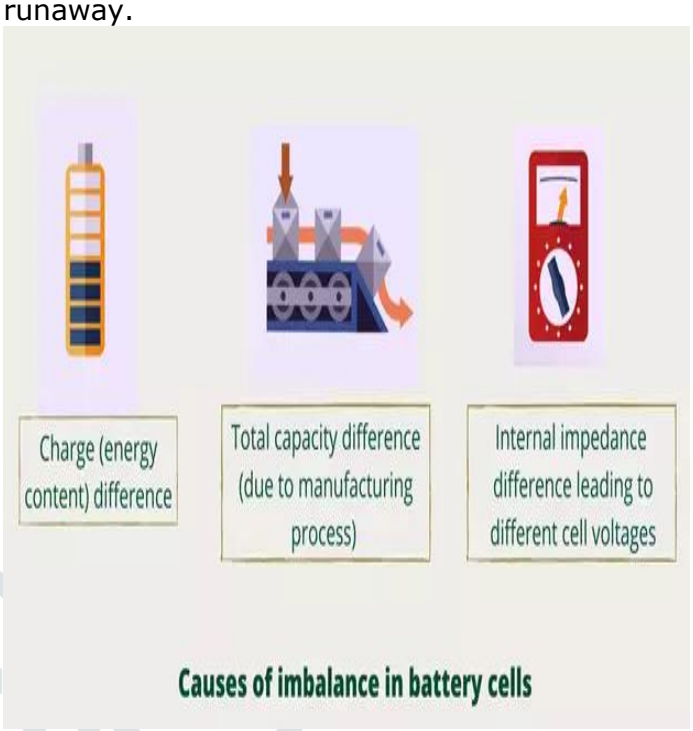


Beyond the basic functionality of a BMS for hybrid electric vehicles (HEVs)/ battery electric vehicles (BEVs) of measuring cell voltages, cell temperatures, and the current flowing through the battery pack, automotive BMS must provide methods for charge equalization of imbalances between the individual cells of a multi-cell battery system to increase both the cell lifetime and the usable energy in each discharge cycle.

3.0.0: Battery Cell Balancing

The imbalances between the cells are exacerbated by continual charge/discharge cycles if they are not corrected, which results in drifting apart of the cells. Cells with less total capacity than the best performing cells in the system could become overcharged, which causes those cells to degrade prematurely. This degradation leads to a capacity fade and consequently accelerates the original problem. Additionally, this overcharging can become a safety hazard as it might cause.

active components in the battery to react with each other and cause a thermal runaway.



3.0.1: Classification Systems for Balancing Methods

There are different classification systems for balancing methods.

Static Methods

Static methods: Methods that are either carried out before the pack is in operation or are not controllable by the BMS once the pack is in operation.

Dynamic methods

Dynamic methods: Balancing methods that are controllable by the BMS, further divided into active and passive methods. The active cell balancing technique uses inductive charge shuttling or capacitive charge shuttling to transfer the charge between the cells. This technique is proven to be an efficient approach as it transfers energy to where the energy is needed instead of wasting it.

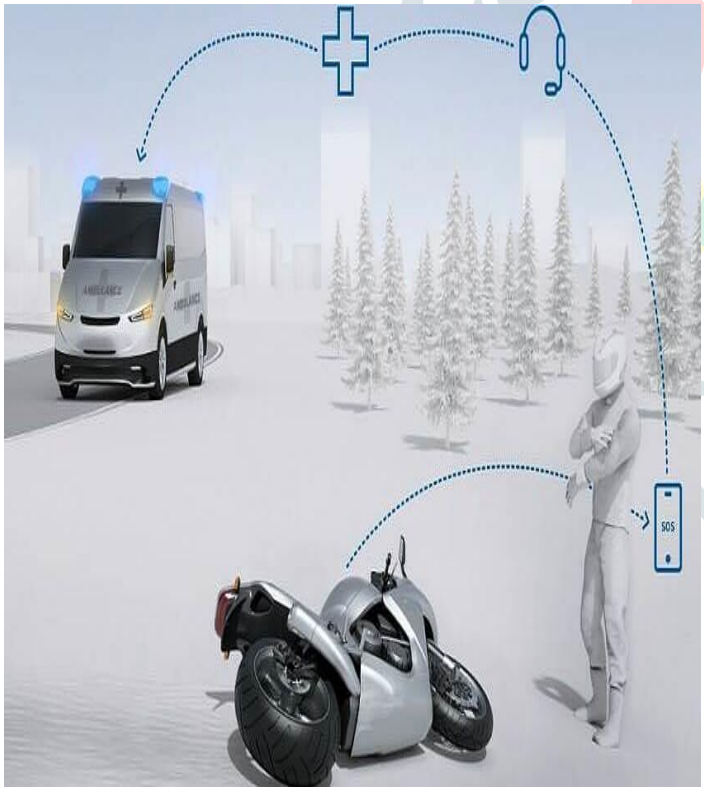
However, this demands additional components to be added to the system which in turn translates to increased cost. The passive cell balancing technique uses the idea of discharging the cells through a bypass route that is mostly dissipative in nature. It is simpler and easier to implement than active balancing techniques as the bypass can either be external or be integrated — keeping the system more cost-effective either way. However, since all the excess energy is

dissipated as heat, battery run time is adversely impacted and is less likely to be used during discharge. Adopting precise cell balancing achieves a larger capacity for the intended application because the state of charge (SoC) that can be accomplished is higher.

3.0.2: CRASH DETECTION SYSTEM

crash or accident means when a car, lorry or 2-wheeler bikes or scooter coliid or come in front of each other is called an accident or crash to avoid this kind of deadly and life threating incident in India the government developed a system of detecting crash or accident immediately and efficiently reach and rescue them and to provide them with health facility quickly and to make sure one's life to be saved .

in ev we can easily install a micro chip that can detect and avoid the collusion to be happen according to bikewale.com bosch is developing a chip for the bikes a crash detection system.



- Bosch develops motorcycle crash detection alert system

- Sends accident information to Bosch

- Helps in reducing deaths due to motorcycle accidents

Bosch has developed a new emergency call system that goes by the name Help Connect. This system will automatically call for assistance when it detects motorcycle accidents.

This new Bosch system relies on the inertial sensor unit that's integrated into the Bosch's motorcycle stability control. This system measures the bike's acceleration along with the angular velocity a hundred times a second. This information will help the system determine the position and the angle of lean of the bike.

This system also has a crash algorithm that determines if the motorcycle got into an accident or whether it was just a fall. If Help Connect decides that a vehicle got into an accident, it will transmit information about the scene and the rider to the Bosch Service Center. In severe accidents, the service could use the rider's phone to find their location and direct emergency responders to the scene.

Bosch plans to first launch this technology in Germany. It has plans for further expansion but as of now, it doesn't have any confirmed plans for the tech's international launch.

RESULT AND FIGURE:

2020	Nexon	MG ZS	Kona EV	Tigor	e-Verito	Total
Jan	0	0	0	0	0	0
Feb	0	158	32	0	0	190
Mar	198	116	14	0	0	328
April	0	0	0	0	0	0
May	78	38	4	25	0	145
June	188	145	16	37	1	387
July	286	85	25	24	6	426
Aug	296	119	26	9	0	450
Sep	303	127	29	5	2	466
Oct-Dec	1,253	455	37	0	0	1,745
Total	2,602	1,243	183	100	9	4,137
MS%	62.90	30.05	4.42	2.42	0.22	100.00

ACKNOWLEDGEMENT

The main acknowledgement means acknowledging or appreciating one's work for what he has done and how he has achieved it. And motivating to do the things he never done before is called acknowledgement.

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