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Covid-19 and Indian Airline Industries: A Comparative Study of Stock Prices of Listed Airline Companies

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Abstract: *The year 2019 marked a pivotal moment in history with the emergence of the novel coronavirus, commonly known as Covid-19 (SARS-CoV-2). This unforeseen situation created by the virus is a 'Black Swan event' to the world due to its unprecedented and strange nature. The declaration of the World Health Organization (WHO) as COVID-19, an international Public Health Emergency of Concern (PHEIC), has created a shock wave over the global economy. To control the spread of the virus, the authorities all over the world implemented various COVID-19 protocols, encompassing social distancing, mobility restrictions, and lockdowns. Nevertheless, these measures, while crucial for public health, brought about a mixed bag of consequences for various industries across the globe. The pandemic left no sector untouched, affecting it either directly or indirectly, and India was certainly not exempt from its reach. Among the hardest-hit industries was transportation, with the aviation sector feeling the full brunt of the impact. The restrictions on mobility directly impacted these aviation companies, and these reflected the stock market indices as well. In this study, the researcher analyses the short-term impact of the COVID-19 outbreak on the volatility of share prices for listed aviation companies in India. By analysing two years of price movements for four listed airline companies using descriptive statistics, paired t-tests, and trend analysis, to provide a comprehensive understanding of the COVID-19 issue.*

Keywords: Covid-19, Stock Market, Black swan event, aviation sector

I. INTRODUCTION

The year 2019 marked and will be remembered for the birth of the novel coronavirus termed Covid-19 (SARS-CoV-2). It was a "Black Swan" event for the world, as it was entirely strange. The WHO declared the Corona virus (COVID-19) outbreak a public health emergency of international concern (PHEIC)[10], which shocked the global economy. Even though the globe has experienced numerous epidemics like Ebola, Lassa disease, plague, and Zika, among others, COVID-19 stands out among them due to its size and rapid expansion. In addition to bringing the world to a stop, this virus has wreaked havoc on the global economy. More than 100 nations had implemented complete or partial lockdown by the end of March 2020, and between 70 and 90 percent of air and intercity transport between the main cities had been halted, affecting billions of people (Dunford et al., 2020)[15]. Some COVID-19 protocols, such as social isolation, mobility restrictions, lockdown, etc., were implemented by the authorities to prevent the spread of the virus, which exacerbated the situation, as these scenarios were not ideal for most of the industries all around the globe. The actual economy has been severely harmed by Covid 19. If all large gatherings and cultural events had been permitted, the virus would have spread faster. Governments, regulators, and large analysis companies throughout the world struggle to decide the best course of action due to the lack of appropriate models on the economic and medical fronts, as well as the absence of a clear rule book or policy prescription (Phan & Narayan, 2020)[16]. The pandemic also affected different industries in India, as it has in the rest of the world. As of February 27, 2020, the coronavirus disease 2019 (COVID-19) had affected 47 nations and territories around the globe[11]. The Corona Virus was destroying the financial health of the economy by spreading the virus from business to business and economy to economy, just as it was destroying human

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health. In order to flatten the curve, the authorities insisted on different COVID-19 protocols like social distancing, travel bans, etc., which were strange to the world and caused the destruction of the entire economy. The destruction was first seen in the airline and other transportation sectors, as the mobility and gathering restrictions implemented directly affected this sector.

The COVID-19 virus was declared a global pandemic by the World Health Organisation (WHO) on March 11, 2020. The pandemic had a considerable impact on all major international financial markets, including the stock market, commodity market, and debt market. International markets reacted fiercely to such news. According to the World Economic Forum's study (WEF, 2020), by the end of February 2020, the financial markets' volatility had multiplied as a result of investors' and traders' sell-offs to safeguard their capital. Equity markets experienced a crash as a result, according to previous studies that documented the stock market's response to various global events, including disease outbreaks like Ebola and severe acute respiratory syndrome (SARS), natural and man-made disasters (Kowalewski&Piewanowski, 2020), sporting events (Buhagiar et al., 2018), politics (Bash & Al-Saifi, 2019), and sporting events (Chen et al., 2007; Ichev&Marin, 2017). This situation is likely to affect the short-, medium-, and long-term trends of the market. In this paper, the researcher attempted to find out the impact of the "black swan event," the COVID-19 outbreak, on one of the primary economic victims, the airline industry in India.

II. BACKGROUND OF THE INDIAN CIVIL AVIATION INDUSTRY

India is now the 7th largest civil aviation industry in the world and is expected to become the third largest civil aviation market within the next 10 years. The civil aviation industry in India can be broadly classified into three categories: scheduled air transport service, which includes domestic and international airlines; nonscheduled air transport service, which consists of charter operators and air taxi operators; and air cargo service, which includes air transportation of cargo and mail. As of November 2022, nine domestic airline carriers are currently offering scheduled flight services from more than 100 airports across the nation.

III. LISTED AIRLINE COMPANIES IN INDIA

There are four listed airline companies in India: NSE and BSE. They are,

1. **Global Vectra Helicorp Limited (GVHL)**

Global Vectra Helicrop Limited is the largest private offshore and onshore air-logistics helicopter company in India, providing professional helicopter services. The company's range of services includes support for the offshore oil and gas business in India, onshore operations for state governments (VIP flying), election flying, heli-pilgrimage, and other rotary services. The company was incorporated on April 13, 1998, as a private limited company with the name Azal India Pvt. Ltd. In 2004, the name of the company changed to Global Helicorp Pvt Ltd, and on October 10, 2005, the company was converted into a public limited company and its name changed to Global Vectra Helicorp Ltd. On October 27, 2006, the company was listed on both the NSE and the BSE.

2. InterGlobe Aviation Ltd.

Interglobe Aviation Ltd. (IndiGo) is India's largest passenger airline, having started operations in 2006 and currently having a market share of 56.7% as of October 2022. The headquarter of the company is in Gurugram, Haryana, and it primarily operates in India's domestic air travel market as a low-cost carrier. Currently, the company operates over 1600 daily flights, connecting more than 75 domestic and more than 25 international destinations. The company has a fleet size of more than 280 aircraft, which includes A320 NEOs, A320 CEOs, A321 NEOs, and ATRs. The company was listed on both the BSE and the NSE on 10th November 2015 with an opening price of □856 in the BSE and □855.80 in the NSE. As of December 15, 2022, the market capitalization of the company was 776.04 billion INR.

3. **Jet Airways (India) Ltd.**

Jet Airways (India) limited is an Indian airline based in Delhi-NCR (National Capital Region), with a training and developmental centre in Mumbai. Incorporated in April 1992 as a limited liability company, the airline began operations as an air taxi operator in 1993. It began full-fledged operations in 1995, with international flights added in 2004. The airline went public in 2005 and again in 2007, when it acquired Air Sahara. Before the founding of Vistara in

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2015, it was the only full-service airline based in India apart from Air India. The airline is expected to recommence its flight operations by the end of 2022, making it the first Indian airline to be revived after ceasing operations. The company's headquarters are in Mumbai, and it is listed on both the NSE and the BSE, with a market capitalization of 890.60 crore.

4. SpiceJet Ltd:

SpiceJet Limited is Incorporated on February 9 as a private limited company under the name Genius Leasing Finance and Investment Company Ltd., is an Indian low-cost carrier that began commercial domestic flight operations on May 24, 2005. In 2006, the company changed its name to SpiceJet Ltd. from Royal Airways Company. The company started its international operations in October 2010. Currently, the company transports nearly 53000 passengers per day in 91 aircraft, including the Boeing 737-700, 737-800, 737-900, 737 Max, Bombardier Q400, and others, serving 53 domestic and 9 international destinations. The company's headquarters are in Gurugram, Haryana, and the company is listed on both the BSE and the NSE, with a market cap of 24.31 billion INR as of December 16, 2022.

IV. REVIEW OF LITERATURE

Maneenop, S., & Kotcharin, S. (2020)[1]. Have studied the short-term effects of the 2019 new coronavirus (COVID-19) outbreak on 52 listed airline businesses worldwide using the event study approach. The findings reveal that after three big COVID-19 announcements, airline stock returns decreased more noticeably than market returns. Investors respond to the three events in three distinct ways, on average. The World Health Organisation's and President Trump's formal announcements made following the occurrence were recognised to have the strongest overreaction. Furthermore, the results support the notion that merchants in Western nations are more receptive to recent information than dealers elsewhere in the world. The findings urge the creation of swiftly implemented policy plans to lessen the pandemic's effects on the world's airline business.

Mehta, P. (2020)[2]. The objective of this research was to identify the various issues that the global aviation sector has encountered as a result of the pandemic. The research highlighted the various steps taken by the government and airlines to revive their aviation sector. This study has concluded that the pandemic has brutally impacted the aviation sector all around the world, which is consequential for the growth of other sectors of the economy. Further study has reviewed the strengths and opportunities for the aviation industry that can be used by the aviation sector to fight against the threats that have been generated due to the pandemic. The study has also derived the SWOT model for the aviation industry.

Olaganathan, R. (2021)[3]. In this study, the current state of the global airline industry in the face of the COVID-19 pandemic situation is discussed. Assessing the impact of COVID-19 on global air traffic, airline revenues by operating region, number of international passengers by region, and number of domestic passenger traffic by route group was the objective of the first part of this study. The International Civil Aviation Organisation (ICAO) database was used to gather the information for this study between January 2019 and December 2020. The second part of this study's research strategy is based on PEST analysis, which is used to assess the state of the aviation sector at the moment. Based on the findings, this article offers suggestions for COVID-19 Airline Recovery Plan tactics and recommendations for the airline industry to react to the pandemic situation based on technological factors more specifically related to data analytics. The findings and suggestions of this research study will give the aviation industry important information for preparing for the post-COVID-19 era.

Melas, D., &Melasova, K. (2020)[4]. The goal of the paper was to assess the early economic impact of COVID-19 on the aviation industry. COVID-19 has an unprecedented impact on the international passenger seat capacity and gross passenger operating revenues of airlines. The study's first section examines how the epidemic affected the overall economy before moving on to the financial burden that airlines faced. Travel limitations and general economic growth are the two key factors causing this unfavourable trend. The V-shaped path and the U-shaped path are two of the several path scenarios that could potentially drive the trend that are examined in the second section of this study. The U-shaped scenario should be seen as the most likely outcome for the aviation sector during this pandemic, as all previous pandemic breakouts followed the V-shaped scenario, but COVID-19 has paralysed society for longer due to tougher governmental restrictions.

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4.1 STATEMENT OF THE PROBLEM

As stated earlier, COVID-19 has affected almost all sectors of the economy, either directly or in some other way. Despite the pandemic affecting almost all sectors of the economy, limited literature has focused on this specific area. The objectives of the study are to compare the share prices of four listed airline companies in India before and after the pandemic and to analyse the return of different airlines in the Indian market during the pandemic based on their share price trends.

4.2 OBJECTIVES OF THE STUDY

To compare the share prices of listed airline companies in India before and after the COVID-19 pandemic
To compare the stock market returns of different airlines in the Indian market during the COVID-19 pandemic

V. RESEARCH METHODOLOGY

The aim of the study is to investigate the impact of COVID-19 on the share prices of listed airline companies in India. The present study is analytical in nature. This study is based on secondary data. The study used the closing prices for a period of two years, one year each, prior to and after the outbreak of the four listed airline companies in India, such as Indigo, SpiceJet, Jet Airways, and Global Vectra. The data was collected from the BSE website and Yahoo Finance. The researcher used descriptive statistics, paired independent t-tests, and trend analysis to analyse the data.The study spans two years, from 27th January 2019 to to February 14th, 2022, and is divided into two parts of one year each, as before and after the COVID-19 outbreak. The first period starts from January 27, 2019, to January 27, 2020, and the second period is between January 28, 2020, and January 28, 2021. The reason for selecting the period is to understand the situation prior to the COVID-19 outbreak and analyse the situation during the COVID-19 period

VI. DATA ANALYSIS AND INTERPRETATION

The hypothesis of this study is:

H0: COVID-19 has no significant impact on the stock prices of various listed airline companies in India.

Table :1 showing Result of paired t-test of companies

Companies	Period	Number of days (N)	Mean	SD	Std. Error Mean
InterGlobe Aviation (IndiGo)	Before	242	1482.4965	177.07129	11.38257
	After	242	1237.6940	263.85537	16.96127
Global Vectra	Before	242	61.1364	13.60598	.87463
	After	242	51.4777	6.10379	.39237
SpiceJet	Before	242	114.5992	20.20930	1.29910
	After	242	59.2841	19.63165	1.26197
Jet Airways	Before	242	97.2128	87.09936	5.59896
	After	242	40.4176	30.62935	1.96893

Table 2: Paired Samples Test

	Paired Differences					T	Df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pair 1 Globla_vectra_before - Global_vectra_after	9.65868	17.14139	1.10189	7.48811	11.82924	8.766	241	.000
Pair 1 Indigo Before IndiGo After	244.80248	368.66948	23.69897	198.11891	291.48605	10.330	241	.000
Pair 1 Jet_Airways_before - Jet_Airways_after	56.79521	104.35227	6.70802	43.58138	70.00904	8.467	241	.000

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Pair 1 SpiceJet before SpiceJet after	55.31508	35.53615	2.28435	50.81524	59.81492	24.215	241	.000

**At 5% level of significance*

The analysis reveals that there is a significant difference in the stock prices of various listed Indian airline companies before and after the COVID-19 pandemic, with a p-value of less than 0.05. Therefore, we reject the null hypothesis that COVID-19 has no significant impact on the stock prices of Indian airline companies and conclude that the pandemic has had a significant effect on the stock prices of these companies.

Figures showing the trendsof share prices of listed airline companies in India before and after Covid-19

Figure 1: Gobal Vectra

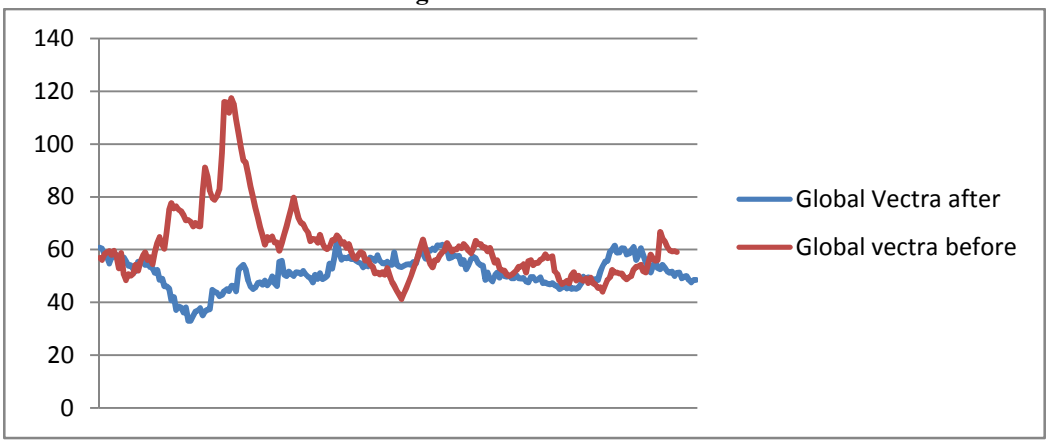

Figure 2: InterGlobe Aviation (IndiGo)

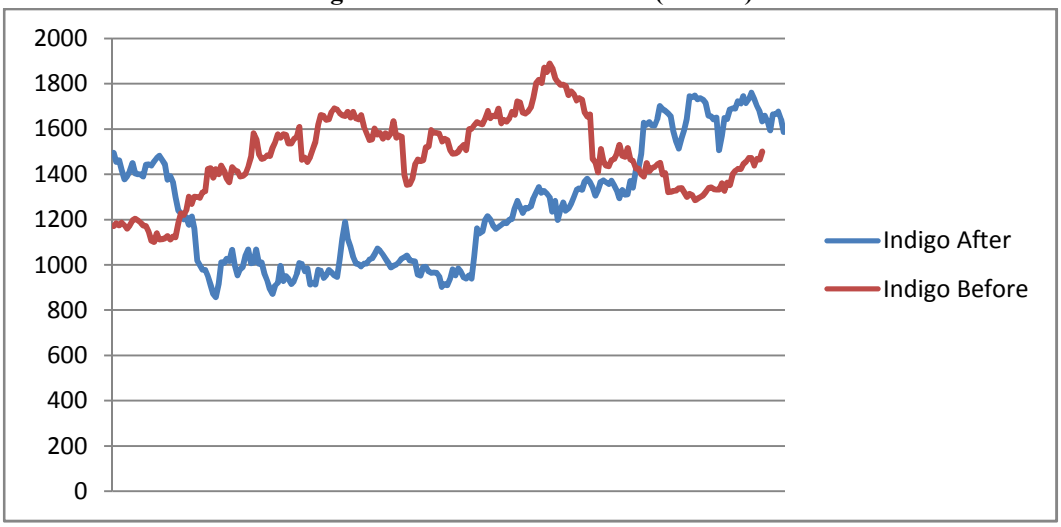

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Figure 3: Jet Airways

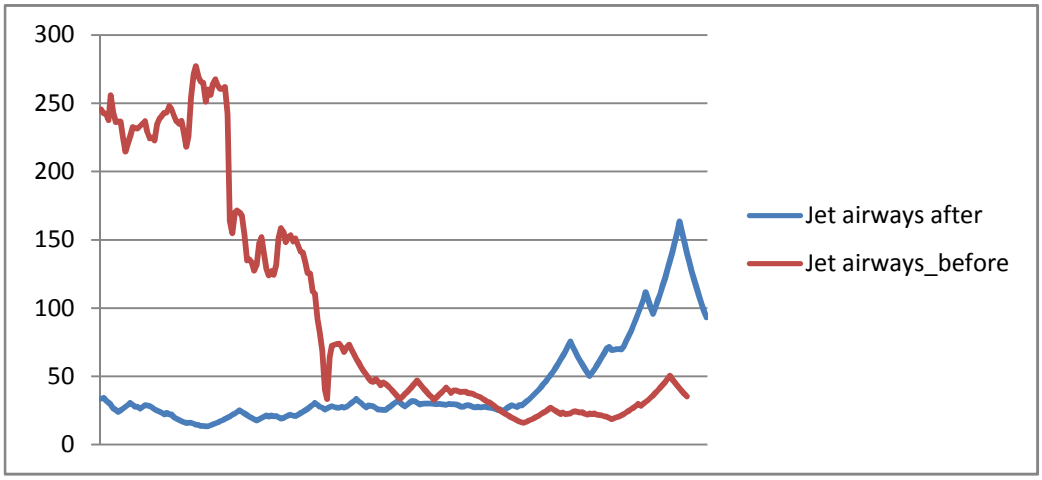
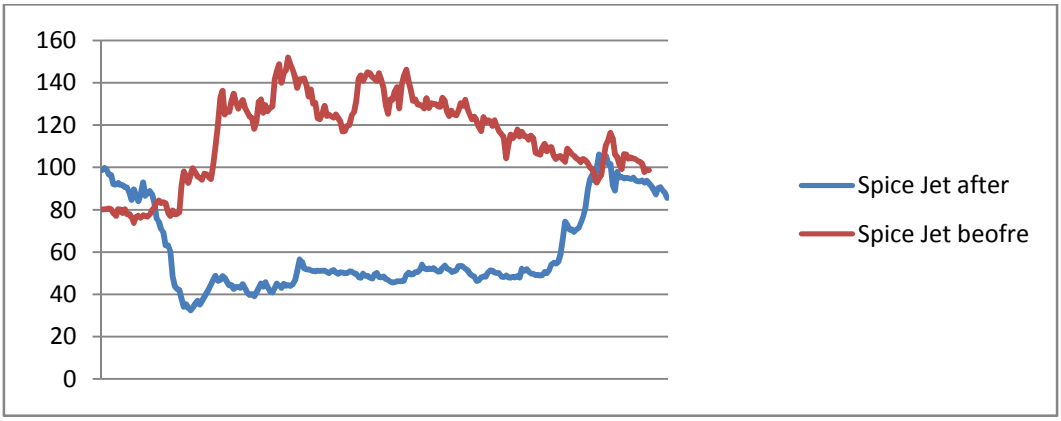


Figure 4: SpiceJet



After analysing the trend of stock prices for four airline companies using Excel before and after the COVID-19 pandemic, the graphs show a clear and consistent trend across all four companies, with a significant decrease in share prices after the pandemic. The decrease in share prices could be attributed to various factors, such as reduced demand for air travel due to travel restrictions, reduced business travel, and increased safety measures, which have all impacted the industry's revenue. Furthermore, the graph shows a sharp decline in share prices immediately after the onset of the pandemic, indicating the immediate and severe impact on the airline industry. While there was some recovery in the latter part of 2020, the overall trend is still one of a sustained decrease in share prices.

VII. CONCLUSION

The study aimed to analyse the impact of COVID-19 on the share prices of publicly listed airline companies in India by comparing their share price movements before and after the pandemic outbreak. The study findings revealed that the COVID-19 outbreak had a significant impact on the share prices of all the listed airline companies. The average return of all four companies has decreased after the COVID-19 outbreak compared to the prior one-year period data. The sharp decline in share prices observed immediately after the onset of the pandemic emphasises the challenges faced by the airline industry, including reduced demand for air travel due to travel restrictions, reduced business travel, and increased safety measures and their effect on share prices.

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In today's world of dwindling resources and ever increasing prices, spending a lot on fuel has become a major part of the economic budget. Reducing fuel consumption can have a major impact on decreasing the capital spent on fuel. To achieve this, hybrid electric vehicles (HEV) and plug in hybrid electric vehicles (PHEV) [2] are an alternate solution.

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Installation of high energy battery packs and regenerative braking play an important role in improving the drive range [7] of the electric vehicles as well as improving the battery life.In order to extract the maximum electrical energy from the rotational mechanical energy, DC/DC converters with appropriate charging and discharging profile are required. Various topologies of DC/DC converters have been discussed in . However, regenerative braking [7], has to be carried out with the conventional frictional braking. In the braking process, there are two issues that are to be addressed. First is accurately applying the brakes which restrains the vehicle speed and maintains the vehicle's travelling course. And the second issue is to recover the braking energy to increase the energy efficiency of the battery. In practical scenario, factors like state of charge (SOC) of batteries, speed of the vehicle and driver's brake force requirements limit the effectiveness of electric braking. Thereby mechanical braking has to be incorporated along with regenerative braking. In literature, many works on regenerative braking and various algorithms for the control during the regenerative braking are proposed. The work proposed a method wherein vehicle's speed is taken into account and not the SOC. Authors in [4] have taken the SOC into account and computed the regenerative force. However, the above works have not stated any methods to utilize the regenerative power to charge the battery. Works carried out in [5] and [6] have used different topologies of bi-directional DC/DC converters to charge the battery. However, the converters used in the works do not address the issue that arises if the terminal voltage of the machine falls below the battery voltage during low speed of the vehicle. The back emf is neglected when the battery voltage is greater than the terminal voltage of the machine.In this paper, the focus is on the dual (voltage and current) control strategy which is used to extract the maximum possible energy during the regenerative braking and to ensure that the vehicle stops in an optimum time frame. In addition, fuzzy logic control is used to determine the battery charging current as its determining factors (SOC, vehicle speed and brake force requirement) have an uncertain relation with it. In addition, a cascaded bi-directional DC/DC buck-boost converter with a PMDC machine has been used. This is done to charge the battery even when the back emf of the PMDC machine is less than the battery voltage and at the same time have an effective braking while taking the safety issues and battery conditions into consideration. In this paper we have PV as parallel source to the battery

II. LITERATURE REVIEW

SR. NO	TITLE OFPAPER	AUTHOR ANDPUBLISHED	SIGNIFICANCE
1	A Dual control Regenerative Braking Strategy For Two Wheeler	Siddharth Mehta, S. Hemamalini*, Science Direct.com by Elsevier, 1st International Conference on Power Engineering, Computing and CONtrol,	This paper has focused on increasing the energy stored by the battery during the regenerative braking process in order to make the system more reliable and
	Electric Vehicle	PECCON-2017, 2-4 March 2017,VIT University, Chennai Campus	reduce the vehicle stopping time. More energy is stored in the battery during the regenerative braking process, by charging the battery even at low back emf, which is achieved by using the cascaded bi-directional converter with the proposed strategy [1].
2	Regenerative Braking System of Electric Vehicle Driven by Brushless DC Motor	Xiaohong Nian, Fei Peng, and Hang Zhang, IEEE Transactions on Industrial Electronics, vol. 61, no. 10, pp. 5798-5808, OCTOBER 2014.	By using PID control and Fuzzy control it is possible to produce constant brake torque. So, vehicle average stopping time reduces [2].

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3	An Efficient Battery Charging Algorithm based on State- of-Charge Estimation for Electric Vehicle	Jung-Song Moon, Jung-Hyo Lee , In-Yong Ha Taeck-Kie Lee Chung-Yuen Won, International Conference on Electrical Machines and systems, Beijing, China 20-23 August 2011.	This paper uses the charging algorithm improved CC-CV method. This method uses the SOC and the simple SOC estimation method. By using this method the total charge time is reduced and the battery is maintained safely during battery charging [3].
4	Regenerative Braking Torque Estimation and Control Approaches for A Hybrid Electric Truck	Xiangpeng Yu, Tielong Shen, Gangyan Li and Kunihiko Hikiri, 2010 American Control Conference Marriot Waterfront, Baltimore, MD, USA, June 30- July 02, 2010	In this paper, a regenerative braking torque estimation approach is proposed which requires the wheel speed measurement only. Based on the estimated regenerative braking torque, a feedback braking torque

III. TYPES OF BRAKING

The methods of braking employed in an induction motor drive can be classified into:
Regenerative braking, b) Plugging or reverse current braking, c) Dynamic or DC Rheostatbraking.

a) Regenerative braking

In regenerative braking the generated energy is supplied to the source. Here, the rotor speed becomes greater than the synchronous speed, the relative speed between the rotor conductors and air gap rotating field reverses. This reverses the rotor induced emf, rotor current and component of the stator current which balances the rotor ampere turns. Consequently, the phase angle between the stator phase voltage and stator phase current becomes greater than 90 degrees. In this situation, the motor satisfies the condition that the back emf is greater than the rate rated voltage, reversing the directionof the armature current making it negative. Thus, power flow reverses, resulting in regenerative braking. For variable voltage sources, regenerative braking is possible for below rated speed. As demonstrated in Fig. 2.1., the kinetic energy available to bereabsorbed after regenerative braking undergoes losses before getting stored in the battery.However, in the case of mechanical braking, all of this dissipated energy is wasted, thus making regenerative braking advantageous. [16]

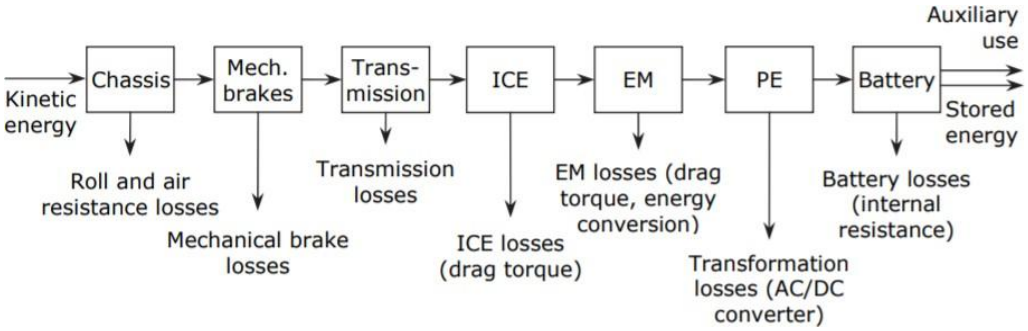

Fig. 1. Energy regeneration process with potential losses

b) Plugging or reverse voltage braking: In plugging, the supply voltage of a separately excited motor is reversed so as to assist the back emf in forcing the armature current in the reverse direction. When the phase sequence of the supply of the motor running at a speed is reversed by interchanging the connections of any two phases of the stator with respect to supply terminals, operation shifts from motoring to plugging. Reversal of phase sequence reverses the direction of the rotating field. Plugging helps reach fast braking due to the high average torque, even when there is a section of series armature resistance connected to limit the armature current. Since torqueis not zero at zero speed, when utilized for stopping a load, the supply voltage must be disconnectedwhen close to zero speed. It is a highly inefficient method due to generated power and power supplied by sources is also wasted on the resistances.[16]

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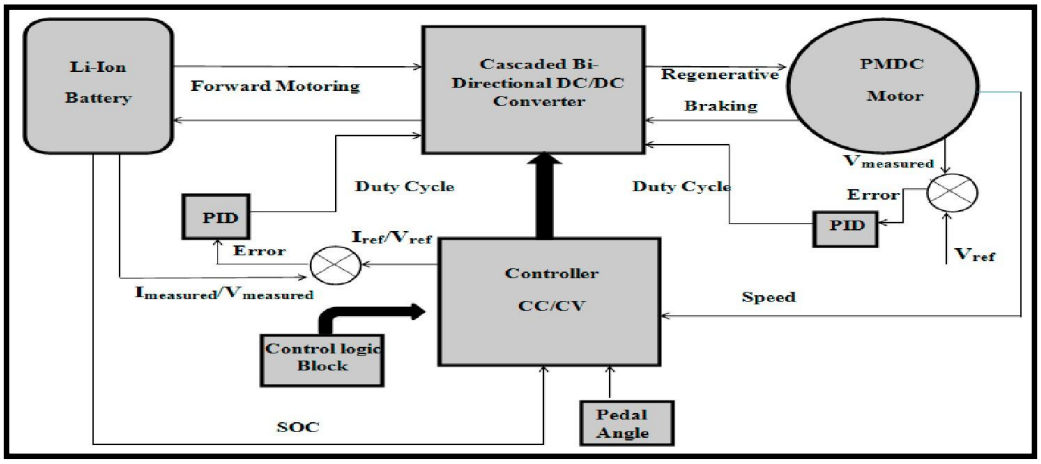
c) **Dynamic or rheostat braking:** In dynamic braking, the motor armature is disconnected from the source and connected across the resistance. It is also obtained when the motor is run on a single-phase supply by disconnecting one phase from the source or leaving it open or connecting it withanother machine phase. When connected to a 1-phase supply the motor can be considered to be fed by positive and negative sequence three- phase sets of voltages. Net torque produced by the machine is the sum of torques due to top positive and negative sequence voltages. When the rotor has a high resistance, the net torque is negative and braking operation is obtained. In dynamic braking, a large amount of energy is dissipated, which leads to the concept of regenerative braking.Dynamic braking is most commonly used when reabsorption of energy is not assured (i.e. lack of system for regenerative braking), with regenerative braking for safety and when vehicles aretravelling up sloping gradients and need to be halted. [6]

IV.



PROPOSED MEHODOLOGY

Fig-2 Proposed system

The system consists of a lithium ion battery, permanent magnet DC (PMDC) machine, bidirectional DC/DC buck-boost converter, control logic block. The bi-directional DC/DC converter can operate in both buck and boost mode. The converter operates in boost mode during motoring operation. During regenerative braking mode, the converter can operate in boost or buck mode and the power flow is from the machine to the battery. The mode of operation during the regenerative braking [depends upon the generated voltage at the terminals of the PMDC machine. If the generated voltage is less the than battery voltage, the DC/DC converter operates in the boost mode and if the generated voltage is greater than the battery voltage the converter works in the buck mode.The control logic block functions during the regenerative braking mode and irresponsible for shifting of control strategy from current control (CC) to voltage control (VC) mode during the braking process.

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Figure.1. shows the overall configuration of the electric vehicle system, with the dual control strategy we propose. Different parts of this block diagram are simulated on MATLAB/Simulink. The various components include:

- Li-ion battery
- Permanent Magnet DC motor
- Cascaded bidirectional buck-boost dc-dc converter
- Fuzzy logic reference current generator
- Control logic block

V. MODES OF OPERATION OF OPERATION BIDIRECTIONAL CONVERTER

Mode 1: Boost Operation – Battery to DC Bus during motoring operation (Primary Boost Mode)
Switches S3, S4 are off, S1 is on and S2 is in PWM switching mode. The battery voltage is stepped up to the level of the terminal voltage of the PMDC machine. The converter operates in this mode when the PMDC machine is running as a motor. [1]

Mode 2: Buck operation - DC bus to battery during the regenerative braking.
Switch S1 is on, S2 and S4 are off and S3 is in PWM switching mode. The PMDC's terminal voltage is stepped down to the level of battery voltage during the braking operation. The converter operates in this mode when the PMDC machine is operating as a generator and the generated voltage is greater than the battery voltage. [1]

Mode3: Boost operation - DC bus to battery during the regenerative braking (Secondary Boost mode)
The terminal voltage of the PMDC is stepped up to the level of battery voltage. This situation occurs when the generated battery voltage is less than the battery voltage. During this mode S1 and S2 are off, S3 is on, S4 is in PWM switching mode. [1]

Table 1: switching sequence for various operating modes

Mode	S1	S2	S3	S4
1	ON	SW	OFF	OFF
2	ON	OFF	SW	OFF
3	OFF	OFF	ON	SW

V. CONCLUSION

Review on Dual Control Strategy For Two-Wheeler Electric Vehicle" suggests, through the course of this p we have thoroughly studied the proposed control strategy for two-wheeler electric vehicles. We will done so by Understanding the concept of regenerative braking in electric vehicles and why this is particularly useful but difficult for two-wheeler EVs. Understanding how the dual control strategy as well as our chosen components can help extract maximum energy and stop the vehicle safely in a limited time frame, irrespective of speed. Performing modelling of different components comprising the regenerative braking system of the vehicle as per the proposed control strategy. This helped us understand the merits of each component and their contribution to making the process as efficient as possible. The modelling performed on MATLAB/Simulink.
Overall parameter of battery ad motor observed and analyzed using MATLAB which will be better using Proposed Methodology

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