An Ultracapacitor Powered Drive System for Electric Bicycle

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***Abstract*— The demand for alternative energy strategies is growing due to increasing fuel consumption and traffic congestion caused by the rise in vehicles. Electric vehicles (EVs), including buses, cars, and bikes, offer eco-friendly and efficient solutions to mitigate pollution from fossil fuel usage. In densely populated regions like Kerala, where uneven terrains discourage traditional cycling, electric bicycles powered by advanced storage systems provide a viable green transportation option. Traditional batteries in EVs face limitations such as low power density, slow charging, and short lifespans. Supercapacitors emerge as an ideal alternative with rapid charging, long lifecycle, high power density, and deep discharge capabilities. However, their low energy density requires innovative solutions like asymmetrical supercapacitors, which combine carbon and nickel to enhance energy density while maintaining the advantages of traditional supercapacitors. A novel drive system incorporating ultra-capacitors, BLDC motors, and DC-DC converters is proposed for electric bicycles. This system optimizes power management between supercapacitors and batteries to improve performance, extend component lifespan, and ensure efficient energy utilization during high-demand scenarios like climbing and engine startup. These advancements make electric bicycles an attractive option for sustainable and eco-friendly transportation in urban and rural areas alike.**

Key words: Electric vehicles, supercapacitors, ultra-capacitors, electric bicycles, renewable energy, BLDC motor, power management, asymmetrical supercapacitors, green transportation, energy storage systems

I. INTRODUCTION

Electric transportation is emerging as a critical solution to environmental challenges posed by fossil fuel-powered vehicles. Electric bicycles represent an innovative approach to sustainable urban and rural mobility, offering multiple benefits to both users and the environment.

Electric bicycles combine the traditional bicycle's simplicity with advanced electric propulsion technologies. Unlike conventional motor vehicles, they occupy minimal road space and provide additional health benefits through pedal-assisted movement. The core of these vehicles is their drive system, typically powered by advanced electric motors like Brushless Direct Current (BLDC) motors.

BLDC motors offer significant advantages over traditional motors. They are more efficient, compact, and reliable, with no brushes requiring frequent replacement. These motors use electronic commutation, reducing mechanical friction and enabling higher operational efficiency. Permanent magnets, especially rare earth magnets, contribute to their high torque and compact design.

A revolutionary development in electric bicycle technology is the use of ultracapacitors (or supercapacitors) as an energy storage solution. Unlike traditional batteries, ultracapacitors present several compelling advantages. They can be charged extremely rapidly, within seconds, and can undergo over one million charge-discharge cycles. They are environmentally friendly, containing no toxic metals, and offer high power density with a long operational lifespan of up to 40 years.

Ultracapacitors store energy through an electrostatic process, different from chemical reactions in batteries. They use porous carbon electrodes with large surface areas to store electrical charge as ions. While their energy density is lower than batteries, their power density is significantly higher, making them ideal for applications requiring quick energy bursts.

The technical implementation of ultracapacitor-based electric bicycle systems involves complex engineering, including DC-DC converters, inverter technologies, microcontroller-based motor controllers, and voltage balancing circuits. Voltage balancing is crucial when multiple ultracapacitors are connected in series, with specialized equalization circuits ensuring uniform voltage distribution and preventing potential system failures.

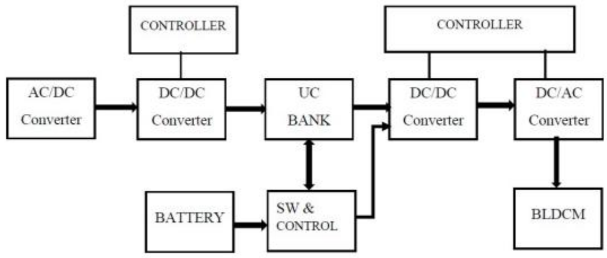

Figure 1.1: Block diagram representation of ultra- capacitor based BLDCM drive system.

Environmental benefits of electric bicycles are substantial. They produce zero direct emissions, reduce noise pollution, require minimal infrastructure, and have a lower carbon footprint compared to conventional vehicles. Additionally, they have the potential to reduce urban traffic congestion while providing an opportunity for personal mobility and physical exercise.

The technology addresses several transportation challenges by decreasing dependence on fossil fuels, offering affordable transportation, and creating sustainable mobility solutions. While current ultracapacitor technology is still evolving, researchers see immense potential. Future developments aim to increase energy density while maintaining the technology's inherent advantages of rapid charging and long-term reliability.

Electric bicycles powered by ultracapacitors represent more than just a transportation solution—they symbolize a sustainable, efficient approach to urban mobility that balances technological innovation with environmental consciousness. As cities continue to grow and environmental concerns become more pressing, these advanced electric bicycles offer a promising path toward cleaner, more efficient urban transportation.

II. MATHEMATICAL FORMUALTION

II.1 ELECTRIC BICYCLE

Electric Bicycle System, basic configuration consists of a power flow controller placed in between the ultracapacitor and brushless dc motor. The passenger of a bicycle may choose relaying on the motor mode only or use the motor and pedal simultaneously or a conventional bicycle. The actuating system consist of super capacitor bank, a brush less dc motor and its control circuits. When a bicycle is moving longitudinally there exists various forces that opposing the motion. The various forces acting against the motion of a bicycle must be taken in to account for the design purpose. The complete power required to drive the bicycle is sum of various powers as follows

(1). To overcome the aerodynamic drag. (2). Power required to overcome the frictional losses (3). The power to overcome slops.

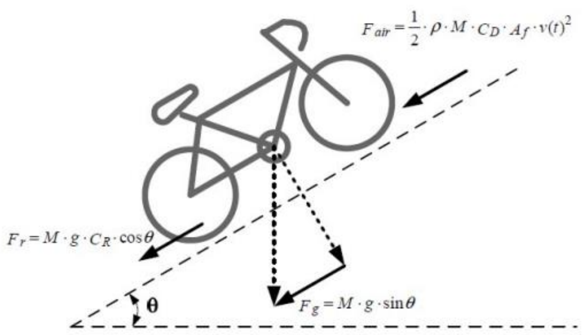

Figure 2.1: Different types of forces acting on a bicycle

different types of forces acting on a bicycle during its motion

. Fa = M.a (2.1)

Fg = Mgsinθ (2.2)

Fair = 1/2ρ.M.Cd.Af .V^2 (2.3)

Fr = MgCR.cosθ (2.4)

Where M represents mass of the vehicle in kilogram. a is the acceleration m/s2 . Fa represents force due to resultant. Fg represents force due to gravitational effect. Fair represents force due to air friction. ρ represents the density of air ,1.29kg/m3 .

Cd is the frictional coefficient of air ,0.8

CR is the wheel friction coefficient,0.01.

The total power required is determined as follows

Ptotal = Pd + Pf + Pg (2.5)

Aerodynamic Power Loss (Pd): Pd = (Cd × D × A / 2) × (Vg + Vw) 2× Vg (2.6)

Friction Power Loss (Pf):

Pf = 9.81 × M × Rc × Vg (2.7)

Gradient Power Loss (Pg):

Pg = 9.81 × G × Vg × M (2.8)

Cd is the drag coefficient approximately equal to 0.5

D represents air density factor in Kg/cubic meter

A= frontal area of the vehicle in square meter approximately taken as 0.4m2

Vg= vehicle speed in road m/s

Vw = Head wind speed m/s

G = Slope or grade in Kg. Acceleration due to gravity is 9.81m/s2

II.2 BRUSHLESS DC MOTOR

BLDC motor (BLDCM) is operated using a controller.The controller is the main part of the drive system.The drive consists of the BLDC machine, the controller based on the digital signal processor (DSP) or a controller based on microcontroller and the power converter based on power electronics. There are three sensors to identify the rotor position. They are named as H1, H2 and H3. Position of the machine rotor sensed and information is sent to digital signal processor.According to the signals received DSP generates gating pulses to semiconductor power switches.The output from converters energise the correct phase corresponding to the pole location the intiate the movement. Thus stator 22 pole windings are activated and deactivated. Thus control the speed as well as torque of the machine. The Rectangular alternating current is fed to the BLDCM.The flux-current interacting each other and produces large torque. These motors are free from brushes and commutators. The armature winding in BLDCM have large cross sectional area . It helps heat dissipation easy.The generated heat dissipated in the metal body of the motor.This increases electric loading and results higher power density. The brush less motors are operated with or without hall sensors.Sensor type motors are usual in practice.Nowadays sensor less motors are also developed. BLDC motor uses rare earth magnets for flux production.High-energy PMs are suitable for energising field winding. It offer higher efficiency,speed and power.So these type of machines are suitable for vehicle drive trains. The rotor magnets are arranged geometrically in BLDCM.According to this the BLDCMs are classified as surface mounted or interior mounted. Figure.2.2 illustrates the circuit arrangement of a BLDCM .

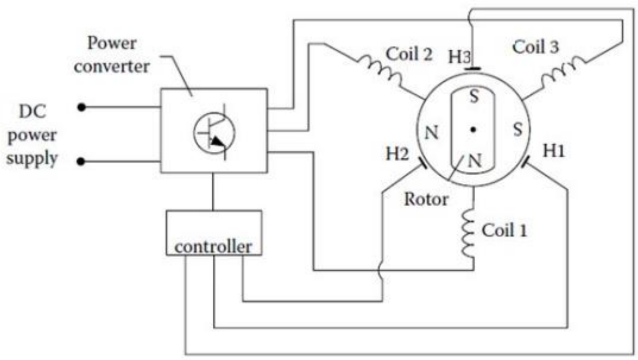

Figure 2.2: The circuit arrangement of a BLDCM

BLDCMs gives better efficiency among all electric motors. The field circuit is permanent magnet in BLDCM. Obviously it does not absorbs electric power.Hence losses are negligible.Also it does not require brushes and mechanical 23 contacts. Therefore the frictional losses are also negligible.Hence the efficiency of BLDCM is greater than ordinary brushed motor. Since the contol variables of BLDCM are stator frequency, stator current, and stator voltage.these parameters can be easily controlled and constant during motor operation.The BLDCM needs only less maintenance,because there is no brushes and contacts.Its service life is therefore determined by life of winding insulation and rotating parts.Also long use degrades magnetic property of rotor PM. High energy magnets offer higher flux density.So it can produce high torque.Thus the size of the machine is also reduced.Therefore the BLDCM is small and light. Ex:Rare earth magnets. However,PMs made of rare earth magnets attracts nearby movable metal objects.Another consequence is high voltage production in stator windings in the event of an accident,if wheels are rotating freely.The passengers may affected by this high voltage .Another possible danger occurs when armature winding get short circuited.If the rotor rotates continuously as the vehicle moves then lare EMF induced on armature,which is short circuited.This results blocking of the rotor due to extremely high torque produced by short circuit current. The dangers of blocking one or more wheels of a vehicle are not negligible.Blocking of rear wheel cause uncontrolled spinning of the vehicle.Loss of directional control is the result of front wheel blocking. The short circuit current also cause demagnetization of PMs. The torque of BLDCM is influenced by back EMF developed in stator.Trapezoidal back emf interact with rectangular current provide a constant torque.But in practice torque ripples occurs.This is due to the imperfections of emf waveform, the ripple of the current and switching of the phase current. Remeady for the current ripple is PWM or hysteresis control. The imperfections of the EMF waveform are due to variations in BLDCM groove, bias and magnet shapes and are subject to design purposes. The voltage applied to a BLDCM is three phase.The electric potential and the back emf must be aligned with the the rotor position for proper operation of the BLDCM.Also commutation 24 events must be aligned with back emf.The interaction between commutation points and back emf produce ripples in the torque wave form.The torque ripples due to commutation are necessary for industrial loads.These ripples are mainly due to the presence of motor winding inductance which distorts the input current of the motor.Because at a particular instant current in one of the three phases decaying while the current in other phase enhancing.This phenomenon continuous through out the operation and hence the commutation ripples exists in the torque wave form. The permanent magnet BLDCMs are similar to synchronous motors except

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the rotor construction.Therefore some variations are observed in dynamic characteristics. The wave form of applied voltage source may be sine, square or any other wave shape.armeture winding model of a three phase BLDCM is expressed as follows.

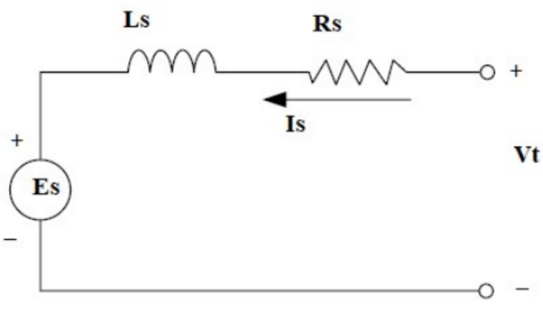

Figure 2.3: The equivalent circuit arrangement of a BLDC motor

Va = Ria + L dia/dt + ea (2.9)
Vb = Rib + L dib/dt + eb (2.10)
Vc = Ric + L dic/dt + ec (2.11)

Where
L=Self-inductance of armature in Henry
R = Resistance of armature in Ohms.
Va, Vb, Vc = Phase voltages in volts.
ia, ib, ic = Input currents in Amps.
ea, eb, ec = Back emf of motor in volts.

II.3 MODELLING OF INVERTER

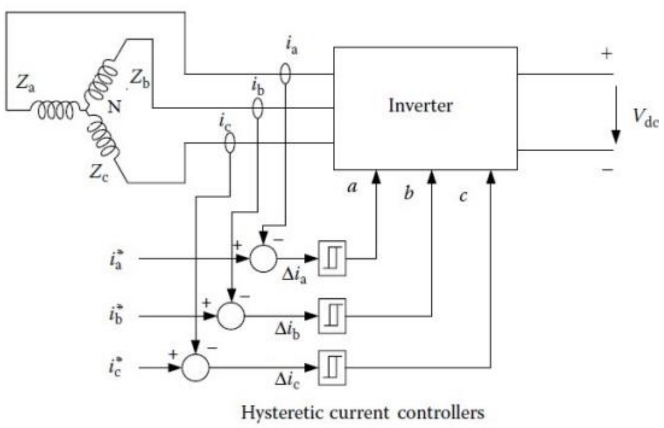

Fig 2.4 Voltage source inverter for BLDC

Figure.2.4 shows a voltage source inverter (VSI) circuit to control a permanent magnet BLDCM. VSIs find applications in electric vehicles to control motors and generators.Active switches are employed in the switching section.The breakers used in inverter circuits are usually insulated gate bipolar transistors or metal oxide field effect transistors. The former one is used for high voltage applications and later is for low voltage applications .Sinusoidal out put voltage is generated with the help of pwm. High frequency switching is used to eliminates harmonics exists in the output wave form. The basic circuit is shown in Figure2.11. This configuration includes six switches. Each switch have a parallel connected diode ,called free wheeling diode. The three phase stator winding of BLDCM is connected to each branch of the circuit.It is usually called a six step inverter, because the switching action generates three phase supply with the necessary phase difference. PWM controls the switching sequence of inverter. The particular application and its power requirements determine the type of switching device to be used in a converter topology. BJTs have higher power ratings and excellent conduction characteristics, but the base drive circuit is complicated, because these are current-driven devices. On the other hand, MOSFETs are voltage-driven devices and, hence, the gate drive circuits are much simpler. The switching frequency of a MOSFET is much higher compared to a BJT, but the maximum available device power ratings would be much smaller for the former. The IGBT is a device, invented in the early 1980s, that combines the positive features of MOSFET and BJT. IGBTs are the devices of choice today, in most cases, due to their availability in high power ratings. The diode is a two-terminal, uncontrollable switch, that is turned on and off by the circuit. A positive voltage across anode and cathode, diode turns on, allowing current conduction up to its rated value. There will be a small forward voltage drop during diode conduction, the diode conducts current in uni-direction only and blocks voltage in opposite direction, which makes it a Quadrant II switch. The diode can block a reverse voltage to its breakdown level

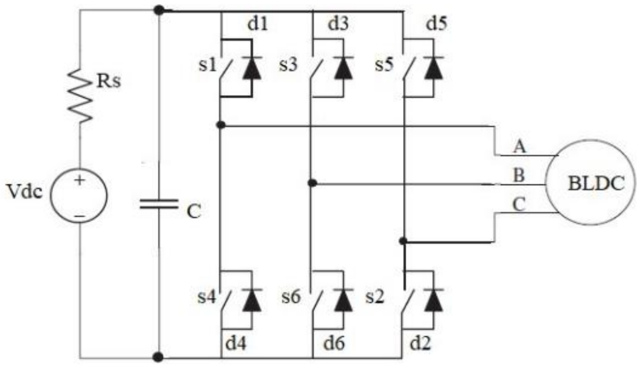

Fig 2.5 basic VSI for BLDCM

Figure.2.5 shows Basic inverter circuit for BLDCM with, It has Six switches and free-wheeling diodes, connected to three-phase stator winding of brush less dc motor

II.4 MODELLING OF SUPERCAPACITOR

The capacitance of a capacitor can be calculated with the equation C˙ = εA/d (2.12)
Where ε = Permittivity of dielectric material
A˙ = Area of plates.
D˙ = Distance between electrodes. Large area of plates increases the capacitance.Activated carbon coating is provided on electrodes in order to increase the surface area,that is about 1400 to 2500m2/g for activated carbon.The UCs are available from few farads to 3000 farads.For modelling of ultra-capacitor equivalent series resistance (ESR), and equivalent parallel resistance (EPR) are considered.ESR increased with time and hence the capacitance of super capacitors decreased.A super capacitor will active for 10 to 20 years.The demerits of UC includes its lower voltage level and lower energy density. The voltage of a super-capacitor is 3 V for organic electrolytes.If higher voltages are applied the electrolyte decomposes and produce gases,leads to reduction in life time of the capacitor . the super-capacitors must required series connection in order to obtain higher voltage levels.Each super=capacitors have its own tolerance,about 20 percent, and due to this uneven voltage distribution occurs and leads to over voltages.To prevent this problem buck boost converter can be connected across each capacitor.Suppose that there are Q number of capacitors then(Q-1) converters are required to be connected in parallel across each pair of UCs.Thus overall efficiency can be increased by 97 percent.How ever it cost higher than that of super-capacitors.Therefore switched resistance topology is usually selected.The excess power is dissipated on the resistors and found that this method is cheaper than converter topology. In recent years double layer capacitors(EDLC),a high performance,long life storage device, have played an important role in braking systems uses regeneration.The EDLC can absorb regenerative energy very quickly.Another concern regarding capacitor balancing includes bidirectional pulse width modulated converters and switched capacitance converters. Selection switches are used to reduce number of equalizing circuits and their complex nature.Alternative strategy is cell to cell equalizing circuits with multi winding or multi stacked buck boost converters.The figure 2.6 illustrates cell balancing of a super-capacitor bank using switched resistors. Active or passive equalizing circuits are employed for minimizing uneven voltage distribution in UC banks.In order to increase the current of cell equilibrium circuits with charge transfer between cells have been considered. The application of equilizing circuits increase the life of super-capacitors.

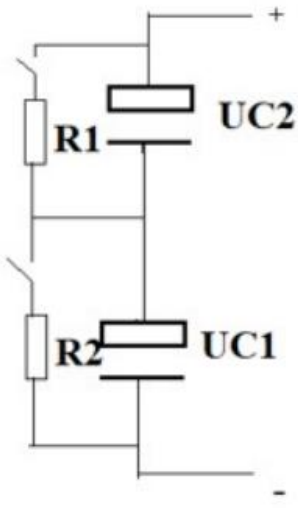

FIG 2.6 CELL BALANCING

The constant power discharge time of super capacitor is given by

$T = 0.5C(V0^2 - V1^2)/P$ (2.13)

Where P= motor output power in Watts
V0= rated voltage of the Supercapacitor
V1= final voltage of the super capacitor
C= capacitance in farads
The energy stored on UCs can be calculated as

$E^{\cdot} = CV^{\cdot 2}/2$ (2.14)

II.5 MODELLING OF DC CONVERTER

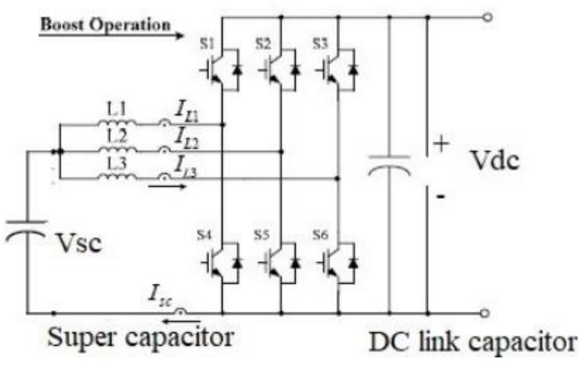

Fig. 2.6 Three leg converter Topology

Figure.2.6 shows a three leg converter topology.To optimize the number of legs, ripple currents must be analyzed. The sizing of inductors and capacitors are based on the ripple current,which cause a lot of losses in the system.These losses sre un desirable, which should be minimized. DC- DC power converters are extensively used in all variety of applications, including power supplies for computers, industry equipments, aerospace, telecommunication and motor drives.The function of this converter is to obtain a variable dc from a fixed dc input which can perform buck, boost and buck-boost operation. The most preferred topology is the boost regulator. The voltage output is greater than the input. Different dc dc converter technologies are available namely step up converter, Interleaved Boost Converter. Modified Boost Converter etc. A stepup dc-dc converter is analogous to a step-up transformer,whose output voltage level is greater than input. For a lossless converter "by law of conservation of energy" power input (Pin) and power output(Pout) was same
Power input = Power out
(Pin) = (Pout)
Since Vin < Vout .
In a boost converter, it follows that the output current is smaller than the input current. Therefore in a boost converter,
Vin < Vout
Iin > Iout

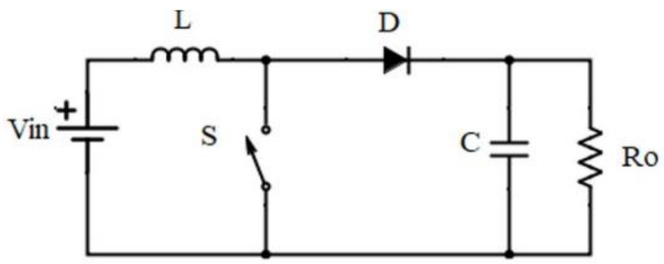

Fig 2.7 schematic diagram of a boost converter

Figure.2.7 shows a schematic diagram of a boost regulator .It can convert the voltage suitable for inverter input to the motor. The inductor(L) plays an important role when the converter is working.The coil oppose any sudden change in the supply current at the input. When switch (S) turned ON, The current through inductor rises to maximum value and thus energy is stored on it. On the other hand switch (S) is turned OFF, the polarity of emf induced in the inductor reverses, as it cannot change direction of current instantaneously and hence the free wheeling diode is forward biased. As a result, the inductor discharges and the stored energy transferred to load.This causes the inductor current to decay. Therefore, voltage across the load will be sum of supply voltage and inductor voltage. Hence, this converter produces an output greater than the input voltage, thus performing boosting action. The output voltage is regulated by setting large time constant compared to switching period. This ensure a stable output voltage.

The conversion gain of boost converter equation is:

V0/Vin = 1 / (1 - D) (2.15)

Where Vo = Output Voltage.
Vin = Input Voltage.
D = Duty Ratio.
The component values are determined as follows
D = 1 - Vin/Vout
R = Vout/Iout
C = IoutD / (fsδVout)
L = VsminD / (fsδIout)
D is duty cycle
Vin is input voltage
Vout is output voltage
R is resistance
Iout is output current
C is capacitance
fs is switching frequency
δ is ripple factor
Vsmin is minimum source voltage
L is inductance

III. Simulation

The ultra-capacitor powered drive system is simulated using Mat Lab Simulink as shown in figure 3.2. The simulation parameters of brush less dc motor is shown in table 3.1. The Parameters of inverter and dc-dc converter is shown in table 3.2 and table 3.3. Ultra capacitors were connected to the DC-AC inverter through a dc-dc boost regulator.The chopper for boost converter is realized using a MOSFET. The switching frequency for gate control circuit is 25 KHz and duty time chose as 80 percent.

Table 3.1: BLDCM Parameters

Stator winding	Y-connected
Stator Resistance per phase	2.875 ohms
Stator inductance per phase	8.5mH
Flux linkage	0.175
Inertia constant	$0.8mJKgm^2$
damping coefficient	$1 * 10^{-3}Nm$
Pole pairs	4

The values of capacitor and inductor are selected as 1000 micro farad and 10 micro henry respectively.A universal inverter block is used to drive the BLDC motor drive.The gate of the three phase inverter is controlled by the feed back signal derived from the motor output terminal of the BLDCM.The inverter parameters are shown in table 3.2

Table 3.2: Inverter Parameters

Type	MOSFET-Diode
Snubber resistance	500 ohms
Snubber capacitance	1 micro farad

The permanent magnet BLDCM is supplied from a three phase inverter. The inverter or dc-ac converter is a six pulse MOSFET/ DIODE bridge. The gate terminal of the bridge is energized by hall signals from the motor.

Table 3.3: DC-DC Boost converter Parameters

Inductance	10 micro Henty
Snubber resistance	1000 micro farads
V_{ref}	24 V

The output of the three phase inverter is fed to the three phase input of the bldc drive unit.Three hall sensors are provided inside the drive determine the operation of the inverter. The hall signals are decoded and converted to equivalent three voltage signals they are then fed to the logic gate circuits and then fed to the gate of the inverter. A step signal is applied to the torque input ,Tm of the drive. Figure.3.2 shows the simulation of the drive system in Matlab Simulink

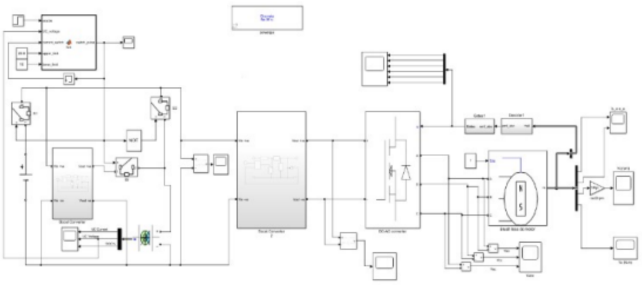

Figure 3.2: Simulation of the drive system in Matlab Simulink

III .1 Simulation Results

Figure.3.3 shows the switching pulse to alternate sharing of power between ultracapacitor and battery.Ultracapacitor deliver power at the starting time.As the set limit of discharging voltage is reached the second switch turned off and first and last switch turned on.At this condition the drive is powered from battery source and charge the ultra capacitor to its set maximum limit through the first

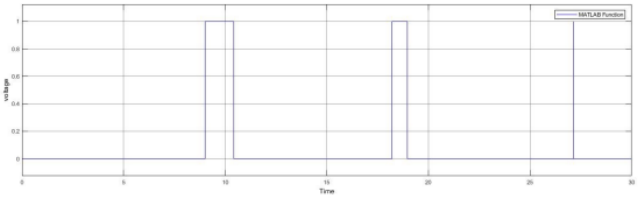

Figure 3.3: switching pulse for power sharing

Figure.3.4 shows the behaviour of ultracapacitor .As the set limit of discharging voltage is reached the second switch turned off and first and last switch turned on.At this condition the drive is powered from battery source and charge the ultra capacitor to its set maximum limit.

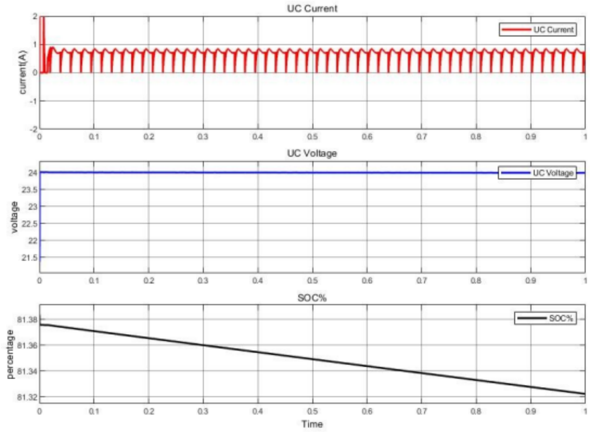

Figure 3.4: SOC , Current,Voltage wave form

Figure.3.5 shows the input signal to the boost converter. the voltage reduces to a particular value and then increases to maximum set value

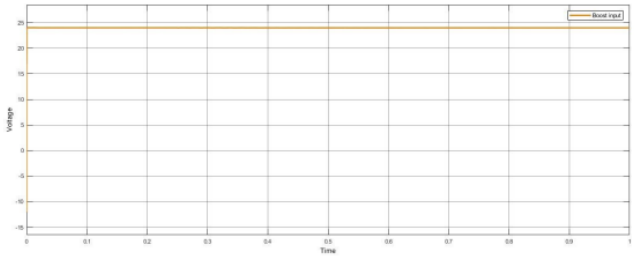

Figure 3.5: Input signal to the boost converter

Figure.3.6 shows the output curve of boost converter.It is almost a steady wave with refer to the output speed of the drive. Figure.3.7 represents the pwm input of the control circuit for boost converter. Figure.3.8 shows the gating pulse for the inverter circuit. A mosfet/diode inverter is employed for simulation.

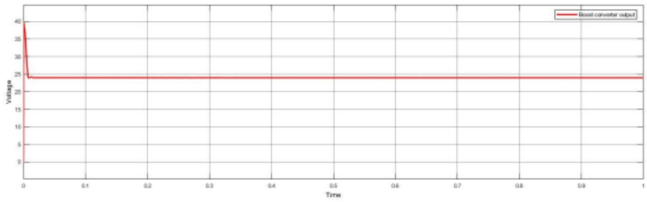

Figure 3.6: Output wave forms of bost converter

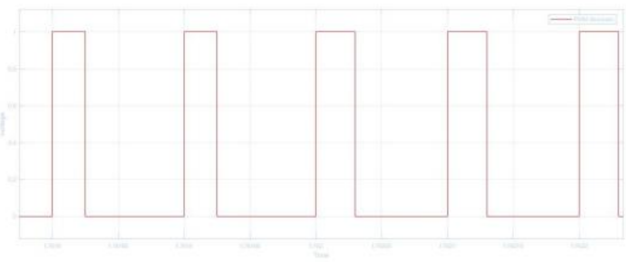

Figure 3.7: PWM pulse to the boost converter

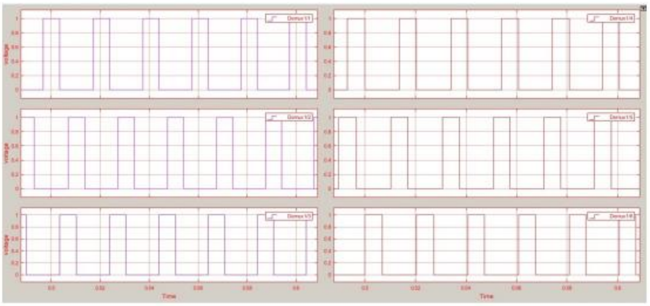

Figure 3.8: gating pulse for inverter

Figure.3.9 shows the gating pulse for the inverter circuit. A mosfet/diode inverter is employed for simulation.

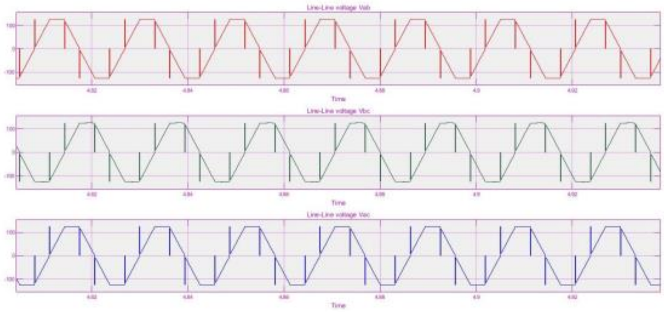

Figure 3.9: Output waveforms of inverter

Figure.3.10 shows the output speed curve.the speed can be changed using a reference speed.

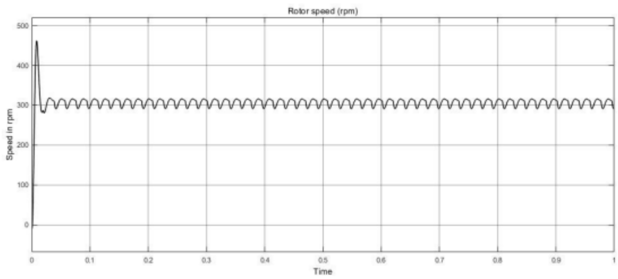

Figure 3.10: speed output of BLDCM

Figure.3.11 shows the output torque curve.the torque is about 0.65 Nm

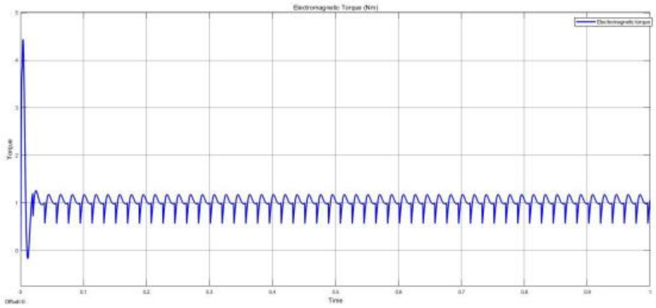

Figure 3.11: Torque output of BLDCM

IV. HARDWARE IMPLEMENTATION

A proto type of the proposed system was implemented and tested using a 250 watts BLDC hub motor fitted with a 26 inch bicycle wheel.The experiment is conducted with a 250 Watts rear wheel hub brush less dc motor .A ultra-capacitor bank consists of 10 numbers 500F, 2.7V super capacitors. These are connected in series and to avoid over charging Zener diodes of 2.4 V is connected across each capacitor. An inverter controller unit is used to drive the BLDCM. The series connected UC bank is main power source to the inverter The UC bank is connected to the inverter through a dc-dc converter which maintain a constant output.

Fig 4.1 prototype of the proposed system

. Figure 4.2 shows the discharging voltage performance of the ultracapacitor bank. The charge discharge cycle of the UC bank is shown in figure 4.3. The speed torque characteristics of the drive system is shown in figure 4.4.The torque is calculated using the following equation

E = P N /9.55 (2.16)

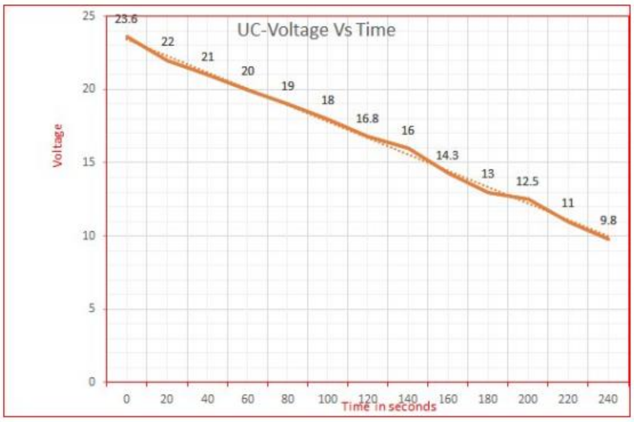

Fig 4.2 discharging voltage performance of the ultracapacitor bank

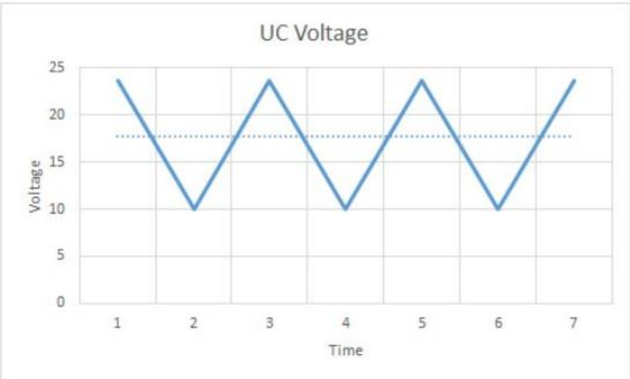

Fig 4.3 The speed torque characteristics of the drive system

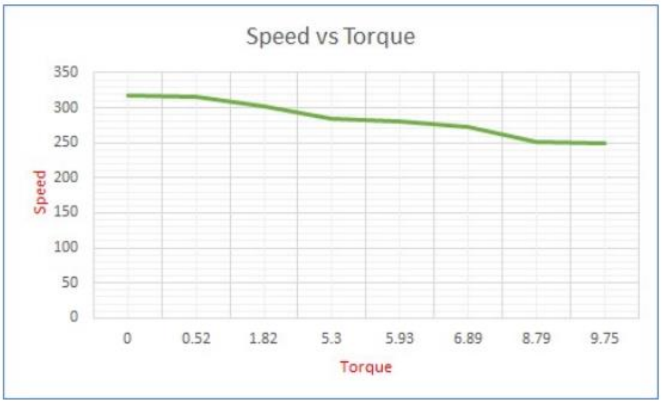

Fig. 4.4 speed torque characteristics of the drive system

The supercapacitors connected in series can be charged from a 12V,5A DC voltage source through a boost dc–dc converter.Each capacitor have capacitance of 500 farads and 2.7 volts.The super capacitor bank is allowed to attain a voltage of 23.6 V.This stored energy in the ultracapacitor is used to drive the motor A dc– dc boost converter is used to maintain the voltage at the motor terminal constant.It is observed that the motor runs about three to five minutes .Obviously the supercapacitor bank discharges from 23.6 V to 9.8 V.In this voltage range the boost converter maintains the input to the brush less dc hub motor, constant about 24 V. the motor draws two to three amperes from the source It is also noted that by adding parallel combinations of supercapacitor banks increases its total capacitance and be able to store more charge and increase the run time of the drive system. This traction system is useful for an electric bicycle or a wheelchair used in hospital or home where upgrade ramp climbing is frequently required.The high power density of the ultracapacitors and its sudden discgarge ability enable sufficient torque production of the drive system. A combination of the ultra capacitor and battery helps to reduce the overall cost of the system. The boost converter is introduced between the ultracapacitor and the brush less dc hub motor enable long duration drive than using the ultra capacitor alone.The combined power source using battery and ultra capacitor improves the total behaviour of the system.This also avoid deep discharge of the battery.In this proto type system the supercapacitors having a total capacitance of 50 farads since ten 500 fared capacitors are connected in series and total voltage rating is 27 V.But tis voltage limit is limited to 24V for protecting the capacitor by accidental over voltages.This is achieved by connecting 2.4V zener diodes across each capacitor and hence the voltage across the capaitors are slightly less than 24V.The combination of battery with ultra-capacitor improves the runtime.A switching scheme is introduced for power sharing.

V. CONCLUSION

The countries constantly looking forward to alternative energy management strategies and reduce the use of available fuel supplies A better means for economic, efficient, eco-friendly transportation is electric vehicles. The electric vehicles take away high pollution problem due to the immense use of fossil fuels. Another concern is road traffic. This road congestion can be reduced by the use of electric bicycles. It is a means of green transportation. Many motor driven electric bicycles are available with the use of batteries as the power source. But the batteries have a number of limitations when used in electric vehicles such as low power density, Inability to deliver rapid power discharge, long charging duration, frequent maintenance, lower life cycles and frequent replacement and cost. Taking into considerations of these factors the immediate alternative is the supercapacitors. The super or ultra-capacitors have long life cycle, deep discharge, instant charging -less than a minute. Rapid discharging capability, which is advantageous in up grading and high power density. The life cycle of ultra-capacitors are ten thousand and more. The emerging technologies in the development of ultra-capacitors completely replace batteries from the storage systems. A new drive system powered by ultra-capacitor is proposed for electric bicycles. This system is composed of a BLDC motor, DC-DC converter, control schemes and ultra-capacitors. The proposed system is simulated in mat lab using the supercapacitor, an inverter and BLDC motor. The results shows that with one full charging of the super capacitor capable to deliver power to drive the motor more than 30 seconds continuously. The hardware implementation were done using bldc hub motor, ten numbers of 500 farad 2.7 volt supercapacitors connected in series, and boost converter etc. The system gives 4 to 5 minutes run time with 50 farad 24 V super capacitor bank.The emerging technologies in the development of ultra-capacitors completely replace batteries from the storage systems. In this paper a drive system powered by ultra-capacitor is proposed for electric bicycles. The proposed system is simulated in mat lab using the supercapacitor, an inverter and BLDC motor, battery and power sharing schemes. The results shows that the super capacitor power source give better performance.

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