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RESEARCH ARTICLE OPEN ACCESS

Electric Bobber Bike

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ABSTRACT
The adoption of EV (Electric vehicle) technology is hampered by a number of problems. Since charging electric e-bikes is typically done with normal power outlets, the most notable drawbacks for low-powered electric motorcycles are range anxiety and purchasing cost. Therefore, it is predicted that the adoption rate of electric motorcycles would rise quickly if their operational range was extended and their cost of purchase was decreased. It is challenging to address the range issue without raising the cost of purchases. This thesis describes a design approach that was specifically adapted to the design of an electric motorcycle and was intended to design for affordability, high efficiency, simplicity, and manufacturability. This method relies on requirements management to make decision-making in the project's conceptual design phase simple. Additionally, design choices are checked against motorcycle performance limitations and criteria using designing and analytic tools to see if requirements were met. The approach was developed with the intention of beginning with an understanding of the system to be created, then identifying the system's issues during the design process and choosing tools to address these challenges.

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I. INTRODUCTION

Since vehicles are selling quickly in metro areas and urban areas, it is reasonable to assume that an E-bike needs to be modified in order to address the pollution problem. The strategy for the country's domestic electric car development was created by the Indian government in April 2012. As the name suggests, electric two-wheelers are powered by electricity. The two primary parts placed to store and transform power are a battery pack and a motor.

Typically, a handlebar-mounted user control is used to brake and change the speed. an electrically powered Vehicle refers to a car or truck that has been modified for road usage and is powered solely by an electric motor, whose traction energy is supplied solely by the traction battery that is built into the car. One electric motor serves as the source of power for an electric vehicle, sometimes referred to as an electric drive vehicle. There are two basic categories of electric vehicles: those that are powered directly by an outside power station and those that are powered by electricity that was initially stored from an outside power source. A bicycle that is powered by an electric motor and a battery is known as an electric bike. Every design project starts with a target user, which in this project is the commuter motorcyclist who drives low-powered motorbikes in the city. Designing motorcycles for a specific user/use requires a lot of knowledge about the functions and behavior of the product. For this reason and to answer the first research question, the project started by conducting literature research on motorcycle operation, functionality, parts, etc.

II. LITERATURE REVIEW

A vehicle without fuel that is powered by a dynamo and an accumulator is a bike with an electric motor driver. Hybrid vehicles, such as electric bikes, are produced by motorized vehicle manufacturers in response to the growing problem of pollution and the lack of fuel oil. Compared to a regular bike, the idea behind an electric bike is much simpler. Without using any human force, an electronic bike can be pushed by the gas pedal. On an electric bike, the battery serves as a source of the dynamo's electric current. The controller controls how much voltage and current the motor or dynamo needs to operate. The motor, battery, and controller are an electric bike's three essential parts.

Using electric automobiles is one way to combat global warming brought on by the exhaust gas emissions from fossil fuel-powered vehicles. Since electric motors power their drives, electric cars don't produce air-polluting exhaust fumes. An

electromagnetic tool that transforms electrical energy into mechanical energy is an electric motor. Electric vehicles move thanks to this mechanical energy**.**

III. OBJECTIVE:

To make a pocket-friendly electric bike under 50000/- that has all the features of a general e-bike and which gives more than sufficient range in city use. There is much old design present in the current situation so our main objective is to build a fresh vintage bobber design that can be used by college students as well as all bike lovers.

COMPONENTS OF E-BIKE

The e-bike consists of the following components

1. BLDC Motor 48 volt 1000 watt
2. Lithium-Ion Battery Pack 51 volt 24ah
3. Controller 48volt
4. 12-volt DC to DC Converter
5. Transmission Drive
6. Brakes

BLDC motor

Since its creation in the 19th century, brushed DC motors have become widely used. Electromagnets, which are composed of a wire coil wound around an iron core, can be found in either one or both sets of magnets. The magnetic field is created by DC current flowing through the wire winding, and this current also powers the motor. In an effort to realign the fields, the misalignment produces torque. It is important to shift either the rotor's or stator's field in order to maintain the misalignment, continue to produce torque and continue to move the rotor as the fields align as the rotor travels and the fields come into alignment. The commutator refers to the apparatus that shifts the fields in accordance with the orientation of the rotor.

Fig.1: BLDC motor

It employs an electronic controller to switch DC currents to the motor windings, resulting in magnetic fields that effectively revolve in space and which the permanent magnet rotor follows. To control the speed and torque of the motor, the controller modifies the phase and amplitude of the DC pulses.

A brushless motor system is often built in the same manner as a permanent magnet synchronous motor (PMSM), although it can also be a switching reluctance motor or an induction motor. As runners (the rotor is encompassed by the stator), outrunners (the stator is surrounded by the rotor), or axial motors, they may also use neodymium magnets. (the rotor and stator are flat and parallel).

The high power-to-weight ratio, high speed, almost immediate control of speed (rpm) and torque, high efficiency, and cheap maintenance are all benefits of brushless motors over brushed motors. Brushless motors are used in a variety of devices, including hand-held power tools, model airplanes, automobiles, and computer peripherals (disk drives, printers). Brushless DC motors have made it possible for direct-drive designs to replace rubber belts and gearboxes in contemporary washing machines.

LITHIUM PHOSPHATE BATTERY

The LIFEPO4 kind of lithium-ion battery pack is a typical choice for electric vehicles, portable devices, and expanding number of military and aerospace applications.

The lithium iron phosphate battery (LiFePO4 battery), also known as the lithium ferro phosphate battery (LFP battery), is a type of lithium-ion battery that combines lithium iron phosphate (LiFePO4) as the cathode material and a graphitic carbon electrode with a metallic backing as the anode. Due to their lower cost, excellent safety, low toxicity, and

extended lifespan, LFP batteries are utilized in a number of applications, such as backup power, utility-scale stationary applications, and automotive use, and other advantages LFP batteries don't include cobalt. By September 2022, 68% of the LFP-type battery market share for EVs was accounted for by production from just Tesla and the Chinese EV manufacturer BYD. The production of LFP batteries is currently almost entirely controlled by Chinese companies. LFP-type manufacturing is anticipated to increase further to surpass lithium nickel manganese cobalt oxides (NMC) type batteries in 2028 as a result of patents beginning to expire in 2022 and the increased demand for less expensive EV batteries.

more favourable aging and life-cycle qualities

Compared to other lithium-ion chemistries, LFP chemistry has a significantly longer cycle life. It sustains more than 3,000 cycles in most situations and more than 10,000 cycles in ideal situations. Depending on the circumstance, NMC batteries can endure between 1,000 and 2,300 cycles.

In comparison to lithium-ion battery chemistries like cobalt (LiCoO2) or manganese spinel (LiMn2O4) lithium-ion polymer batteries (LiPo battery), or lithium-ion batteries, LFP cells lose capacity at a slower pace (thus, have a long calendar life).

BMS (Battery Management System)

Any electronic device that controls a rechargeable battery (cell or battery pack), such as by safeguarding it from operating outside of its safe operating range, and keeping track of its condition, The environment is controlled, authenticated, and/or balanced by a battery management system, which also reports secondary data and calculates it. (BMS).

A battery management system and an external communication data channel were all built into a smart battery pack. A smart battery charger is required to recharge a smart battery pack. The cooling medium for battery thermal management systems can be air, liquid, or some other type of phase transition, and they can be passive or active. The simplicity of air cooling is a benefit. Such systems can be active, utilizing fans for airflow, or passive, depending merely on the convection of the surrounding air. Commercially, the battery systems of the Honda Insight and Toyota Prius both utilize active air cooling. The main drawback of air cooling is its lack of effectiveness. In comparison to active liquid cooling, the cooling system requires a significant amount of power to operate. Batteries used for transportation lose efficiency as a result of the added cooling system components' weight and bulky BMS. Since liquid coolants often have higher thermal conductivities than air, they offer a greater natural cooling potential than air cooling. The coolant can either directly contact the batteries or it can pass through the BMS without coming into contact with them. Because the cooling channels are longer with indirect cooling, there is a chance that the BMS will experience significant thermal gradients.

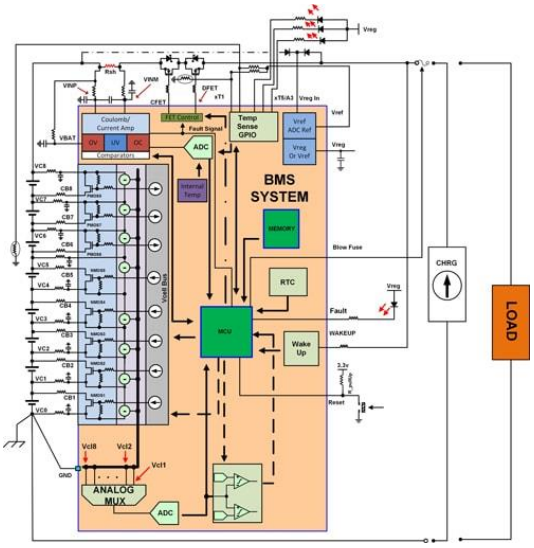
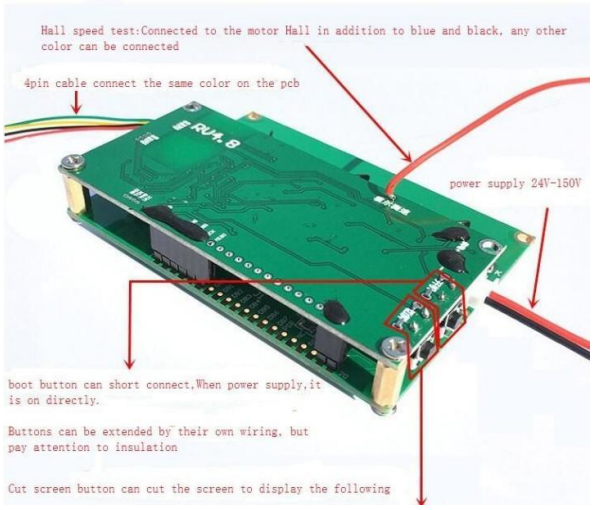


Fig 3: BMS (Battery Management System)



Importance Of BMS :

By preventing the battery from running outside of its safe operating range, a BMS can protect the battery from:

- Over-discharging
- Over-current during charging
- Over-current during discharge

- Over-voltage during charging, especially important for lead–acid, Li-ion, and LiFePO4 cells
- Under-voltage during discharging, especially important for Li-ion and LiFePO4 cells
- Over-temperature
- Charging while under low temperature
- Over-pressure (NiMH batteries)
- Ground fault or leakage current detection (system monitoring that the high voltage battery is electrically disconnected from any conductive object touchable to use like vehicle body)

Outside of the battery's safe operating range, the BMS may stop operation by:

- Including an internal switch (such as a relay) which is opened if the battery is operated outside its safe operating area
- Requesting the devices to which the battery is connected to reduce or even stop using or charging the battery.
- Actively controlling the environment, such as through heaters, fans, air conditioning, or liquid cooling

SPEED CONTROLLER

The controller is the electric vehicle's central processing unit. By utilizing the throttle, it offers the vehicle the needed speed while controlling the bldc motor speed. It uses the battery's electric current to supply the bldc motor, throttle, ignition, indicator, and light. We utilize the same 48-volt controller for our bike project and are thinking about adding a 48-volt bldc motor for transmission.

A switch that connects a motor to a power supply, as in tiny appliances or power tools, is the most basic example. The switch can be manually turned on or off. To choose between several connections for the motor, the switch may have many positions. This might enable the motor to start at a lower voltage, control to reverse, or pick different speeds. Both alternating current and direct current motors can be controlled by motors. In addition to providing a way to connect the motor to the electrical power source, a controller may also provide overheating and overload safety for the wire and the motor.

A motor controller may also monitor the field circuit of the motor or identify issues like low supply voltage, an erroneous phase order, or a high motor temperature. By limiting the inrush starting current, some motor controllers enable the motor to accelerate the linked mechanical load and itself more gradually than with a direct connection. It is possible for motor controllers to be totally automatic, in which case internal timers or current sensors are used to accelerate the motor, or manual, in which case To speed up the load, an operator must sequence a beginning switch through various steps.

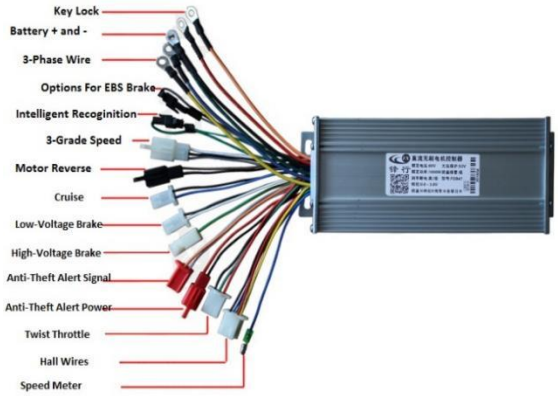


Fig 4: controller

TYPES OF DRIVE

There are three types of transmission drives:

CHAIN DRIVE

A chain is a collection of links that are linked together by steel pins. With this configuration, a chain is more durable, long-lasting, and effective in transmitting rotary motion.

Fig.6: Chain drive

Belt drives

Belt drives transmit power to the final drive using a belt and pulleys. Less frequently utilized and typically found on cruiser motorcycles are belt drives. Belt drives are considered to send power to the final drive more smoothly, which is why cruisers typically employ them. According to claims, a belt drive loses power between 6 and 9%. The belt drive does not require maintenance; but, when replacement is necessary, the belt is pricey.

Fig.7: Belt Drive

Shaft drive

A shaft and gears are used in shaft drives to transfer power to the final drive. Only a few specialized motorcycles employ the shaft drive, which is a system exclusive to motorcycles. An expensive transmission that requires little maintenance is the shaft drive. This transmission type is not further discussed in this document due to the uniqueness of its nature.

Fig.8: Shaft Drive

Conceptualizing and selecting components

In this sentence, decisions are taken on the parts and materials of the powertrain and the chassis.
components of a power train

Decided to use BLDC Motor

Because there are only a few manufacturers of high-quality hub motors and supplier dependence should be avoided, a 48-volt, 1000-watt BLDC motor for mid-drive applications was selected. The more accessible mid-drive motor is a superior solution with more options in supplier selection to reduce supplier dependence. A motorcycle with a mid-drive motor can also be built with a motor that is placed in a more flexible location.

Transmission choice

Three choices existed for the transmission drive:
1) chain drive
2) drive belt
3) Shaft drive

We chose a chain drive since it has standardized parts, which is why we did. When it comes to situating the motor in relation to the end drive, chain drives are a trustworthy and affordable transmission system. Although periodic maintenance is necessary for chain drives, it is inexpensive and simple to perform.

Power supply:

So, rather than using a lithium-ion battery, we chose to employ a lithium-phosphate battery. The 18650 li-phosphate cells are the most obvious option for battery cells. This is true due to factors including price, accessibility, and high battery capacity with the potential for huge discharge currents.

Chassis

A tubular frame structure was chosen due to its versatility in design, ease of prototyping, maturity in frame construction, and ability to be manufactured anywhere in the world. A tubular frame can be made with little trouble and uses common building profiles. Steel was chosen as the material because it has excellent weldability, a high strength-to-weight ratio, acceptable deformability, and is relatively inexpensive.

Fig.no. 8: chassis

ADVANTAGES OF ELECTRIC BIKE

- Environmentally friendly

The fact that electric motorcycles are environmentally benign is one of their main selling advantages. Because they don't produce smoke or burn fossil fuels, they lessen air pollution. However, this is up for discussion because the electricity needed to charge these scooters is primarily generated by burning coal, which is the main source of electricity in the nation. This could not be the greenest option until the government develops cleaner sources of electricity. However, compared to fuel-powered automobiles, electric vehicles are substantially more environmentally friendly.

- **Lower Running Cost**

Electric motorcycles and scooters cost slightly more up front than conventional two-wheelers, but over time, you will save money on fuel, making this a highly cost-effective choice. Due to their lower running costs and the rising cost of petroleum, more and more people are choosing to drive electric vehicles.

- **Maintenance**

The absence of any complicated processes is one of the main benefits of electric scooters. As a result, compared to ordinary cars, the maintenance costs of such motorcycles are significantly lower.

- **• Storage Space**

Storage Space Compared to normal bikes and scooters, electric scooters don't have as many moving parts. As a result, they have a sizable storage area that may be utilized to convey various items.

- **• Low Sound**

Most cars generate a lot of noise when they are being driven. When you step outdoors into a busy street, you may hear many cars generating noise. The fact that electric bikes scarcely create any noise is another benefit on the list.

- **Lightweight**

Compared to ordinary motorcycles, electric scooters are mechanically simpler and have fewer parts. They are hence small and convenient to park. Since driving a heavier vehicle is more challenging, the car's small weight also makes driving easier for the driver. You can keep your scooter inside during the rain thanks to the lightweight and compact design of the e-bike.

Disadvantages of Electric Bike:

There are two sides to every coin. E-bikes have a number of advantages, but they also have some drawbacks. Here are a few of them:

- **Battery Life**

Once they are damaged or no longer offer a good range, electric batteries must be changed. Depending on the rating, brand, quality, and guarantees, batteries can range in price from Rs. 13,000 to Rs. 20,000 and typically last for a year.

- **Range of the E-bike**

The range of an electric scooter is the distance that it covers on a single charge. The top electric scooter models in India typically have a range of around 100 kilometres. In addition, the range gets shorter as battery life gets longer. Long-distance travel might not be the best use for it because it takes roughly 5 hours to recharge the battery.

- **Repair and Maintenance**

Due to the scarcity of repair shops and suppliers of replacement components for this novel form of transportation, e-bike repairs might be a source of anxiety. However, as e-bikes become more popular, more repair facilities will crop up and be more easily available.

- **Lack of Infrastructure**

There are charging facilities every few kilometers in many affluent nations where electric vehicles are the norm. At the charging stations, people can pause and charge their electric vehicles or bicycles. Nevertheless, India hardly has any such infrastructure, making it challenging to travel far in an electric vehicle.

- **Power**

First debuted in India, electric cars had very little power and were incapable of being driven at high speeds. E-bikes and e-scooters have eventually become faster, but they still can't match the top speeds of two-wheelers fueled by fuel. An electric scooter's slow driving speed is one of its biggest drawbacks.

BIKE PARAMETERS

Sr.no.		
1.	BLDC Motor	48volt 1000watt
2.	Battery	48volt 24Ah(24000Mah)
3.	Battery Charger	48 volt 6A
4.	Range	65-70 km
5.	Charging Time	3 hours
6.	Max Load Capacity	330lbs(150kgs)
7.	Controller	48volt 1000watt (Max output 50amp)
8.	Throttle	Half twist throttle
9.	Bike weight	65kgs
10.	Ride Height	165cm-190cm
11.	Top Speed	70 km/hr
12.	Battery weight	11kgs
13.	BLDC Motor weight	5 kgs

Tool Operation Principles

a) In order for the motor to rotate, the battery's electrical energy must be supplied.

b) The controller, which controls the current requirements needed by the motor, must be used before the electric current is given to the motor.

c) In addition, the controller regulates the flow of electricity to all required components.

d) After that, the battery also has a connection or port for using a power generator to charge it.

Planning Calculation Analysis

The calculation analysis carried out is an analysis of riders who weigh 60 kg, 65 kg, and 70 kg. The result of the analysis is as follows:

Sr. No.	Rider weight	Top speed	Bike range
1	65 kgs	70 km/hr	70 km
2	70 kgs	68 km/hr	70 km
3	75 kgs	65 km/hr	70 km

IV. CONCLUSION

Regular bikes and electric bikes have many characteristics, and there are approximately equal numbers of advantages and disadvantages for each. Riding a bicycle is an option for a more wholesome and environmentally responsible mode of transportation, not a contest between motors or the strength of your legs.

Therefore, the electric motor, which aids in pedalling and makes riding an electric bike easier, is obviously its biggest advantage over a traditional bike. From 40 to 75 miles can be covered on a single charge.

The larger weight and higher price are the biggest drawbacks.

Future studies on electric bicycles should take into account the DC generator's role as a charger when the wheels are rotating.

ATTACHMENT :