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HYBRID TREADMILL TRICYCLE

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Abstract: This project introduces a novel concept of a treadmill electric tricycle (TET) equipped with dual-mode operation capabilities, offering users the flexibility to engage in both manual and electric modes of propulsion. The TET aims to combine the benefits of traditional tricycles with the health advantages of treadmill exercise, providing users with an innovative and efficient means of transportation while promoting physical fitness. The TET consists of a sturdy tricycle frame with a treadmill belt integrated into the design. It incorporates an electric propulsion system powered by a rechargeable battery, allowing users to switch seamlessly between manual and electric assistance modes allowing for effortless travel over long distances or challenging terrains.

Index Terms **– Treadmill cycle, electric vehicle, BLDC motor, Li-ion battery.**

I. INTRODUCTION

The need and importance of an electric treadmill cycle stem from several factors, including the evolving landscape of transportation, the growing emphasis on personal fitness, and the desire for eco-friendly solutions. Incorporating exercise into daily routines is crucial for maintaining good health. An electric treadmill cycle offers a convenient way to combine commuting or errands with physical activity, promoting cardiovascular heath, weight management, and muscle strength. With busy schedules becoming the norm, finding time for exercise can be challenging. An electric treadmill cycle allows individuals to multitask by commuting while exercising, thereby maximizing time efficiency and minimizing the need for separate workout sessions.

Having both manual and electric modes enables users to tailor their workouts according to their preferences and fitness goals. They can switch between modes based on their energy levels, desired intensity, or specific training objectives. The electric mode provides assistance when navigating uphill climbs or covering long distances, helping riders reach their destinations faster and with less effort. On the other hand, the manual mode allows users to walk at their own pace, promoting a more leisurely or recreational riding experience when desired.

By incorporating both manual and electric modes, hybrid treadmill cycles promote sustainability in urban mobility. Users can rely on human power for shorter trips or during peak hours when traffic congestion is high, reducing reliance on fossil fuels and contributing to cleaner air in cities. The electric mode provides a convenient backup for longer journeys or when additional assistance is needed, further supporting eco-friendly transportation practices.

The rest of the paper is organized as follows: II. Literature Survey, III. Proposed Methodology, IV. Results and Discussions V. Conclusion, and References.

II. LITERATURE SURVEY

In [3], they have developed a Multi-Purpose Treadmill E-Cycle, seamlessly blending exercise and transportation. Users walk on the treadmill, assisted by an electric motor, and diverse operational modes enhance versatility. The construction features a sturdy frame of mild steel hollow pipes meeting international standards, topped with mica-fitted ply for stability. Custom rollers facilitate belt rotation, connected to a motor driving the e-cycle's back tire. Key components include a brushless dynamo motor, clutch, and e-cycle gearbox, powered by two 12 V batteries.

In [6], the cycle's mechanism involves a belt and rollers moving anticlockwise, powered by the user's movement, with a safety braking system. Fabricated using materials like steel, aluminum, and rubber, the prototype aims to offer a new exercise method. Methodology involves converting user's linear motion on the treadmill into wheel rotation using gears and a motor mechanism, with the chassis comprising welded square pipes. Big rollers support the treadmill belt, transferring motion via belt, shafts, and gears to move the rear wheel. The prototype utilizes components like treadmill belt, shafts, frame, free wheels, gears, and chain-drive, enhancing exercise equipment options with a novel treadmill bicycle conversion.

In [8], they have introduced a novel approach to bicycle design, seamlessly integrating exercise and transportation. Their innovative gear system synchronizes walking speed with the bike's, utilizing treadmill movement to power the bicycle's mechanism while ensuring stability. The design aims for enhanced comfort and efficiency, allowing for faster travel with less effort. Human effort on the treadmill drives the belt, connected to the bike's propulsion mechanism via a chain drive. Future goals include establishing the treadmill bike as a fuel-free, affordable, and health-promoting transportation option, emphasizing its cost-effectiveness and time-saving benefits.

III. PROPOSED METHODOLOGY

The block diagram of the complete system is as shown in the figure 3.1. It consists of a treadmill tricycle with provision for mechanical pedaling and EV mode of operation, driver wheels, BLDC motor, brakes and 28 V 15 AH rechargeable Li-Ion battery. The table 3.1 shows the list of major hardware components used in the proposed system.

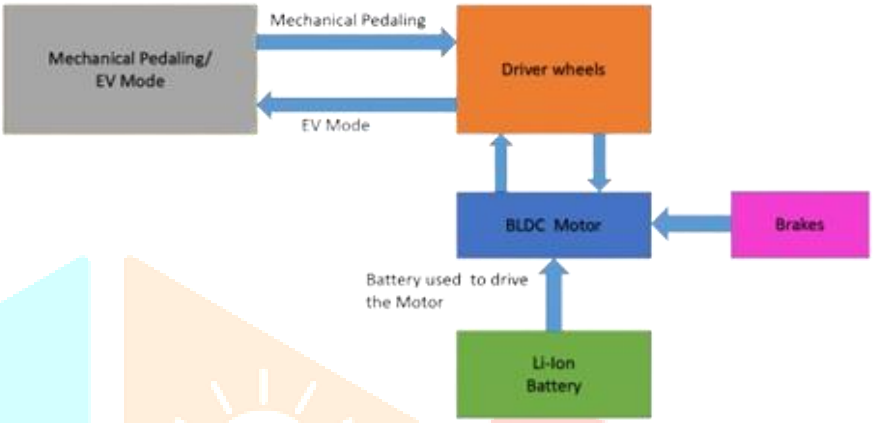

Figure 3.1: Block diagram of the proposed system

Table 3.1: List of hardware components

Components	Features
BLDC motor	1. No Load RPM: 3300 2. No Load Current: <2.2 Amps 3. Rated Wattage: 250W (0.33 Horsepower) 4. Rated Load RPM: 400 5. Torque (NM): 22 6. Rated Current: 13.4 Amps 7. Efficiency: 78% 8. Reduction Ratio: 9.78:1
BLDC Controller	Model:LB27 Rated voltage: DC24V Under voltage: 20 ±0.5V Rated power: 250W Current:25±1A Turn handle:1-4V
Lithium-ion battery	28-volt 15AH

The hybrid treadmill tricycle operates in two modes: Electric Vehicle (EV) mode and manual mode. The figure 3.2 shows the flow chart for the proposed system.

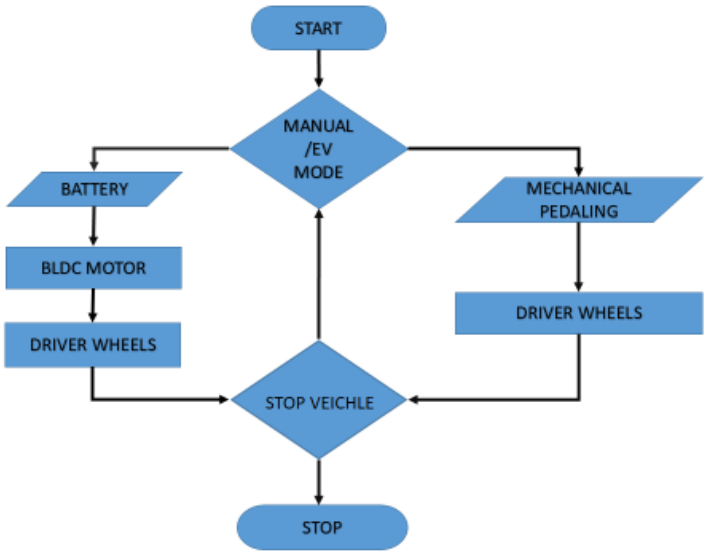

Figure 3.2: Flow chart showing the operation of the proposed system

In EV mode, the battery powers the Brushless DC (BLDC) motor, initiating its rotation. The motor's gears, linked to the wheel shafts are set in motion by the driving gear, causing the wheels to turn. During this phase, human effort is not required, allowing the user to remain at rest.

Conversely, in manual mode, human power propels the tricycle. The user walks on the treadmill mat, which rests on rollers for smooth movement. In this mode, the EV system is inactive, and the tricycle relies solely on human energy. The rollers are connected to the driving gear, which in turn rotates the driven gear connected to the wheel shafts. Consequently, the wheels spin, and the tricycle moves forward.

This dual-mode functionality allows users to alternate between electric assistance and manual propulsion, catering to their preferences and exercise needs.

IV. RESULTS AND DISCUSSION

The figure 4.1 shows the 3D model of the proposed system created using AutoCAD software. The figure 4.2 shows the hardware implementation of the proposed system.

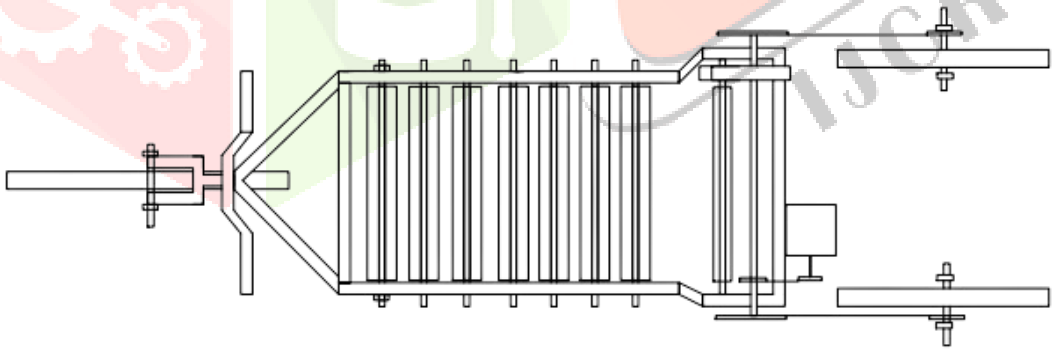

Figure 4.1: 3D model of the proposed system

The hybrid treadmill tricycle is built using Li-ion battery and BLDC motor. It approximately weighs around 40 kg. The treadmill cycle can run approximately a distance of 35 to 40 km with a fully charged battery at a speed of 25-30 km/hr.

Figure 4.2: Hardware implementation

V. CONCLUSION

In conclusion, the hybrid treadmill tricycle project offers a unique and versatile solution for transportation and exercise. By combining electric and manual modes of operation, it caters to a wide range of users, providing convenience, efficiency, and health benefits. The project demonstrates the potential for innovation in mobility and fitness, addressing the growing demand for sustainable and accessible transportation options.

Future iterations of hybrid treadmill tricycles could offer customizable features to cater to individual preferences and needs. Continued advancements in electric motor technology, battery efficiency, and sensor systems can further improve the performance and user experience of hybrid treadmill tricycles. Integration with smart devices and connectivity features can enhance functionality and provide users with valuable feedback on their workouts and commuting habits.

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