Photo Voltaic Powered Hover Board

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Abstract - In this technical world peoples are always seeking for sophistication which demands for innovative solution which could possibly alter their lifestyle that would cozy them at its best. Such an innovative product is the self-balancing scooter which is called as Segway rider in the technical world and as hover board in common, whose purpose is to transport individually in a relaxed manner without letting them to strain their locomotive organs. The proposed system emphasizes the use of renewable energy to recharge the battery, PV panel are employed along with perturbation and observation MPPT for charging. The integration of photo voltaic cell with the hover board proves to be effective in both indoor and outdoor applications. The photonic energy of indoor artificial light sources are harvested by the PV modules, at the same time in outdoor it can be employed during day time where it can capitalize the solar energy, perturbation and observation MPPT gives a simple solution for maximizing the performance in charging the hover board, in addition added features such as it can charge automatically, it doesn’t demand a manual labour for driving it or charging it periodically makes proposed system to find its application in various situation when the person as a difficulty to walk or for the ones who are exhausted walking for longer hours. Besides it also helpful for physically challenged and aged persons. Under testing the proposed system has able carry up to 100 kg of load in a smooth manner at a speed of 3 km/hr. The proposed system will be fruitful for indoor application such as Super markets for carrying goods, Shopping Malls, Railway Stations, Airports, Large Industrial Plant and outdoor application such as Sub Station, Monumental places, Tourist Spots etc.

Keywords - Hover Board, photo voltaic, MPPT, P&O.

2. Research Background

Vecaro hover board a two wheeled self- balancing motorized scooter, which provides individual ferry uses a gyroscopic technology for self-balanced locomotion but the technology adopted increase the cost of the system [1].

The existing Segway electric vehicle serves the purpose, but in design aspect it owns a bulky frame and demands the use of hands for balancing [2].

Heelys are a one wheeled shoe facilitates the person roll over the floor, but this again requires the user to initiate the movement by moving the legs. Aged people and physically challenged people won't be comfortable with such system [3].

Battery operated car or truck for few numbers of people is very common in Railway Station, Tourist spot, Airport etc., but in this manual labour is required to drive and maintain the vehicle [4].

In all above existing system, one separate monitoring mechanism is required to charge the batteries periodically and power is consumed from external sources.

3. Proposed System

Proposed system seeks a solution for all drawbacks in the existing system. PV powered hover board doesn't need a separate mechanism for charging the hover board. As it charges continuously from the photonic energy from indoor and outdoor illumination, so there won't be any charging time lag it will be in continuous operation and also it gets charged from free energy. The running cost is almost zero.

As the design is very compact, it offers flexibility to mobilize even in a narrow path. So that, an individual can enjoy a hassle-free shopping in narrow aisle without affecting their privacy. The design also ensures a well-balanced smooth ride which serves the aged person and physically challenged people.

![Block Diagram for Proposed System](image-url)
As shown in Figure 1, P&O MPPT adapted enhance the power achieved among the other optimizing technique [5]. P&O MPPT was selected as it provides a very good balance between performance and simplicity [6].

Hover board is design with two wheels driven by two BLDC motor (B1&B2) which are controlled by two momentary switches (S1&S2) respectively. This switch is push buttons which engage the contactor when it is pressed. PV panel are mounted above the handle at an inclination of 45 degree to harvest maximum photonic energy and to avoid shadow on the panel.

Hover board accelerate smoothly and go for 360 degree of complete rotation, for forward motion if two switches (S1&S2) are pressed both BLDC motor drives the wheel in forward direction.

![Fig. 2: Movement for forward direction.](image)

As shown in Figure 2, for changing the direction of motion any one switch is pressed, if to rotate left switch S1 is left open and switch S2 is alone closed so B2 alone operate the wheel W1 moves forward and turn towards left.

![Fig. 3: Movement for left direction.](image)

As shown in Figure 3 and Figure 4, to rotate right switch S2 is left open and switch S1 is alone closed hence motor B1 alone operate wheel W2 moves forward and turn towards right.

![Fig. 4: Movement for right direction](image)

As shown in Figure 5, performance of P&O MPPT technique is studied using MATLAB Simulink model before implementing in hardware, test was performed for various insolation [7]. Keeping the ambient temperature as 25 degree Celsius [8]. Simulink model consist of three models first modelling of PV panel has per our hardware specification then second DC-DC buck Converter and third one P&O MPPT model [9].

![Fig. 5: Simulation for MPPT](image)

4. Product Realization

As shown in Figure 6, base of hover board houses two wheels, two BLDC motor and two lead acid battery, base and wheels are robust in design. So that it can be employed in both indoor smooth surface as well as rough outdoor condition. Base and wheels can withstand up to 150kg.

![Fig. 6: Base of hover board.](image)

As shown in Figure 7, Hover board is provided with handle which offers a best support and balance for the rider, 22w solar panel is mounted on the top of the handle.
5. Inferences of Results

PV powered hover board doesn't need a separate mechanism for charging the hover board. As it charges continuously from the photonic energy from indoor and outdoor illumination, so there won't be any charging time lag it will be in continuous operation. Under testing the proposed system as able carry up to 100 kg load in a smooth manner at a speed of 3 km/hr.

For studying the performance of proposed system with P&O MPPT technique following characteristic are taken for consideration referring to various similar works. V-I characteristics [10],[11] P-V characteristic for various insolation [12] and output power vs irradiation without MPPT as well as with MPPT [13].

![Fig. 8: V-I characteristics](image)

Figure 8, exhibits the V-I characteristics of PV module for various insolation keeping ambient temperature as constant 25 degree Celsius.

![Fig. 9: Power-voltage relation](image)

Figure 9, shows the power-voltage relation of the PV module for various insolation

In Figure 10, displace the theoretical and actual output power without MPPT technique are shown clearly. We can infer that actual performance of PV panel is deviating from theoretical value [14].

![Fig. 10: A proposed system without P&O MPPT](image)

Figure 11 shows that the system performance is enhance with P&O MPPT technic actual output power exactly match with the theoretical value [15].

It will be fruitful for indoor application such as Super markets for carrying goods, Shopping Malls, Railway Stations, Airports, Large Industrial Plant and outdoor application such as Sub Station, Monumental places, tourist spots etc.

6. Conclusion

Proposed system proves to be a cost-effective solution for the above discussed problems as it charges automatically from free photonic energy available in the environment running cost is zero.it also ensure 100% zero emission as it not consume power from any external power supply.

Compact design and less weight offer a greater flexibility to user. An individual can move freely as per their wish even in narrow passage which ensures their convenience and privacy.

Under testing the proposed system exhibit a convincing performance of well-balanced smooth acceleration in both indoor and outdoor condition. With all these features the product can serve people to a long distance in Airport, Malls, Super Markets, Railway Station, Substation, Monumental places, Tourist spots etc.
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