FORM 2

THE PATENTS ACT, 1970
(39 of 1970)
AND
THE PATENTS RULES, 2003

COMPLETE SPECIFICATION

(See Section 10; rule 13)

TITLE OF THE INVENTION

A AUTONOMOUS ELECTRIC TRUCK INTEGRATED WITH SOLAR POWER

APPLICANT

The following specification particularly describes
the invention and the manner in which
it is to be performed

A AUTONOMOUS ELECTRIC TRUCK INTEGRATED WITH SOLAR POWER

OBJECTS OF THE INVENTION:

The principal object of the present invention is to provide a self - driven electric truck integrated with mono-crystalline solar panel.

Another object of the present invention is to provide a self - driven electric truck having a driving wheel coupled to the BLDC motor, receives torque from lithium ion battery to displace the truck.

Yet another object of the present invention is to provide a self - driven electric truck having a driven wheel is coupled to the truck and rotates as a result of the displacement of the truck.

Further, the present invention used the alternator to generate electricity by attaching them on driven wheel as well as driving wheel and this energy stored in lithium ion battery.

Field and background of the invention

Fuel being the non-renewable resource is depleting as the vehicle population is drastically increasing. Most promising low cost renewable energy is offered by solar power which can be made available for charging of electric vehicles as the cost of fuel is continuously increasing. But the availability of solar power round the clock is not possible hence a vehicle that is powered both by solar power and electric power is disclosed in this invention through solar panels and BLDC motors respectively which can be a solution to the problem of non-availability of fuel resource along with its high cost. Battery charging and its management

have to be considered as solar power is not available continuously to charge the battery of electric vehicle.

Renewable energy sources are replacing utility grid for effective performance of appliances. Power generated through these sources is stored in batteries for future usage. Electric Vehicles operates based on the charge of these batteries. Optimized performance of the electric vehicles depends on the management of these rechargeable batteries. Renewable energies can be commercialized and can be utilized for residential applications only when technical solutions are involved in evaluating the involved system in order to promote sustainability and energy efficiency.

Summary of the invention

This invention proposes a novel and smart powering technique where the combination of electric energy and solar energy is utilized to drive a truck efficiently. We also propose a novel technology for charging of battery other than solar power where the kinetic energy of the vehicle is utilized in an optimized manner. This truck will be a money saving model as the solar power is tracked in an autonomous way for increasing the battery charging using solar energy. Kinetic energy of the truck is generated whenever it is in motion. This kinetic energy can be converted into electrical energy such that it can be stored in the battery for future usage. Hence this system becomes a power triangle where the truck is continuously energized by some or the other means.

Solar tracking system orients the solar panel in horizontal direction during rainy and cloudy weather for increasing the output current generated from the solar panel. Whenever solar energy is available, it is utilized by the electric vehicle for charging, if solar power is not available then the utility grid is utilized where socket connections are provided for direct charging of the battery. This technique of powering the truck reduces the utilization cost for the users thereby increasing their margin of income.

Brief description of the system

- The self driven truck consists of electric BLDC motor, solar panel, a charging unit and two batteries. In this invention, the truck is powered by lithium ion battery which is charged through three ways.The driven wheel refers to a wheel of a truck that rotates freely, which is not coupled to an electric BLDC motor and rotates as a result of displacement of the truck.
- The alternator coupled to the driven wheel as well as to the driving wheel generates the electricity. Then this electricity is used for charge the lithium ion battery. The battery is charged through three methods 1. From alternator coupled with driven wheel as well as driving wheel, 2. Second method is through solar power where the truck provided with solar panel and 3. Third method of charging of battery is through Charger (DC – AC Charger or DC Fast Charger) at home or charging station.
- The lithium ion battery charging through solar panel, Wi-Fi, DC fast charging unit and alternator controls automatically through auto cutoff system of lithium ion battery. Alternator is coupled to the driven wheel to receive torque there from. Alternator is configured to facilitate conversion of

the received torque into electrical energy and then which is further stored in the lithium ion battery.

- The battery stores the electrical energy received from the alternator and supplies the same to the electric BLDC motor. The BLDC motor is configured to convert the electrical energy received from the lithium ion battery into torque which is further provided to the driving wheel to displace the bike.

- Hence electric power generated continuously by the truck whenever it is in motion. A driving wheel coupled to the BLDC motor, receives torque from lithium ion battery to displace the bike. A driven wheel is coupled to the truck and rotates as a result of the displacement of the bike. The self - driven electric truck comprising an electric BLDC motor, lithium ion battery, alternator, solar panel, controller and Single gear transmission.

- As indicated that the battery is charged through three methods. First method is through solar power where the truck is provided with solar panel at the top of the truck.

- But the solar panel will be able to generate electrical energy efficiently only if exposed to sun light directly hence the solar panel is fixed with solar tracker which is able to track the sun light continuously whenever available.

- The solar tracker fixed biaxially is equipped with two small solar modules additionally. First module is horizontally installed and the second module is installed biaxially in the solar tracker.

- Position of the solar panel is controlled by the Artificial Intelligence algorithm which takes input from prior data on sun trajectory through the year and also on output current generated from the solar panels.
- When sun light reduces due to clouds, then the current from small solar horizontal module will be more that of module oriented to the sun.
- Stepper motors are utilized for rotating the solar panel in space connected to the controller through drivers.
- Second method of charging battery is through kinetic energy which involves driving wheel and driven wheel. The wheel which is rotated by electric BLDC motor is termed as driving wheel, whereas the wheel that freely rotates is termed as driven wheel that is not connected to the to the BLDC motor hence rotates due to vehicle displacement. In conventional vehicles both vehicles are energized which is avoided here saving power.
- This truck consists of two batteries and a charging unit which is connected to the driven wheel such that the charging unit receives torque from the driven wheel. This torque in turn is converted into electrical energy to charge one of the batteries while charge from other battery drives the vehicle. Hence at any instant, one of the batteries is charging and the other battery is discharging when the vehicle is energized by electric power. Hence electric power is generated continuously by the vehicle whenever it is in motion.

- Third method of charging battery is through utility grid where socket is provided in the vehicle for direct charging process such that wherever charging booths are available, the user will be able to charge the battery. A DC stabilizer is provided in the charging system in order to allow stable flow of current through the battery, hence any voltage fluctuations in the grid system will not affect the current flow in the battery.
- In this invention, smart wireless charging system for electric vehicles using WPT technology is disclosed. WPT technique is able to charge the electric vehicle without any wires between the charging point and the vehicle. Transfer of power is possible by transmitter coil generating magnetic field as powered by alternating current. This magnetic field induces a voltage in the receiver coil for charging the battery of the electric vehicle.
- In the receiver section, received AC voltage is rectified into DC voltage which is then boosted and stepped up into high DC voltage sufficient enough to charge the battery by using a boost converter circuit. Two leds are connected to indicate the wireless power transfer, one of the LED indicates power transfer and the other LED indicates the power reception for charging.
- We have included 34 turns copper coil in the primary side windings and in that of secondary side, 22 turns of copper coil are involved for the power transmission to be efficient from primary to secondary side.
- The proposed invention utilizes the single phase utility power of 220 Volt Alternating Current as the preliminary operating voltage. This input voltage

undergoes reduction through a step down transformer, which is then rectified through a bridge rectifier for converting AC power to DC power. This DC power is utilized to operate a 555 timer which acts as an astable multivibrator producing an output of high frequency square wave pulse. This high frequency AC power is utilized for energizing the primary coil. Through Electromagnetic induction, the secondary coil takes up this power through wireless power transfer technology for charging the battery of electric vehicle.

- The power controller is involved in between battery and the BLDC motor which is able to control the parameters of the vehicle such as speed and acceleration. The DC current from the battery is converted into AC current by the power controller to energize the BLDC motor.
- If WIFI charging is not possible then provision is provided for wired charging for which the charging unit involves an alternator, a generator and a dynamo. A belt drive, a gear drive or a chain drive couples the driven wheel with the charging unit.
- This system is provided with a digital display in the cabin to visualize the charge available in the battery. The driver cabin is fully Air conditioned to facilitate driving. This truck is fitted with LED head lamps as they require less power to produce more light.

- A huge improvement is provided by this system in wireless charging as the battery charging is based on magnetic resonant coupling with magneto plated copper wire hence resulting in fast charging.
- On the other hand torque is provided to the driving wheel by the electric motor through a gearbox. The torque from the driven wheel is received by the charging unit and is converted into electrical energy thereby stored in the battery. The electrical energy stored in the battery is utilized by the electric motor which converts the available electric energy to mechanical energy, supplied to the driving wheel in the form of torque.
- Additionally battery charging is also possible through solar power as the charging unit is also electrically coupled with the solar panel. Charging booth involves the components namely PV array, battery package, charging unit and inverter operating in bi-direction for load response where power flow between different units is controlled by bi-directional inverter.
- The inverter involves two DC ports and two AC ports. The two DC ports are connected to the PV panel and to the battery storage whereas the two AC ports are connected to the EV charger and to the utility grid.
- State of charging (SOC) of the buffer battery is optimized by the energy management system by introduction of electrical energy projection of solar PV and charging demand projection of Electric Vehicle in order to maximize the usage of PV electricity for the charging of EV also avoiding EV charging during peak hours to attain optimization.

- Parameters such as PV power, charging load of EV, cell voltage of each cell, grid power are registered during the charging process of EV.
- Operation of the system and that of battery are evaluated both from real time controller and the battery management system (BMS). Development of control strategy is done for optimization of PV power.
- PV is utilized by EV whenever available, any excess power required is utilized from utility grid. In case if no EV is plugged to the system then the PV energy is stored in the battery until the battery is fully charged.
- If the battery power is low during the peak hours then in order to bring the state of charge (SOC) of the battery to an optimal level, grid power is used.
- Computation of battery SOC is done based on projection of EV charging demand and estimation of PV electricity for the charging booths.
- As the proposed self powered truck is four wheeler, there need to atleast two alternators for generating electrical energy from the rotational torque as there is high demand for such innovative solution for the users in order to reduce the cost of operation to alleviate the increasing fuel prices.
- This vehicle opens new doors of innovative solution in automobile field. This invention focuses on machine learning technology for developing a self-reconfigurable, flexible and reliable model for battery management of electric vehicles. Firstly, Cyber Physical system (CPS) is utilized for managing the issues of battery management then a classical artificial

intelligence algorithm - support vector regression (SVR) algorithm is utilized for establishing a precise model of battery in cloud.

- Finally battery degradation quantification is done based on rain-flow cycle counting algorithm for dealing with issues related to aging of battery based on the model of the battery. Battery coolants are involved to exhaust heat.
- Once the battery is fully charged, auto-cut off of charging occurs to avoid aging of battery enhancing the life of battery.
- The invention is herein described, with the accompanying block diagrams. Wherein: Figure 1. Overall Block Diagram of Proposed Self Driven Electric Vehicle Figure 2. Flow Diagram of Proposed Self Driven Electric Vehicle
- Figure 3. Modules Involved in Proposed Self Driven Electric Vehicle

CLAIMS

We Claim:

1. This invention proposes an innovative solution of self driven truck to reduce cost of operation utilizing renewable solar power.
2. The electric truck is energized by two batteries whose charging depends on solar power, Self charging through driven wheel and WIFI charging to power to the BLDC motor.
3. The driven wheel rotates due to vehicle displacement generating torque which is converted into electrical energy by alternator.
4. Electrical energy generated by alternator is stored in turn in the battery for further usage through the charging unit.
5. Solar power is also generated to charge the battery whenever solar energy is available.

6. Utilization of fuel is totally avoided as this electric truck is operated only through battery charged through three ways.

Date and Signature:
Dated this 14th September 2024
Signature:

1.M.Thirumalai
2.T.D.Suresh
3.M.Ulagammai
4.R.Vinifa

ABSTRACT

This invention proposes a self powering vehicle which operates using electrical energy. This vehicle provides an option of self charging which involves electric motor, driving wheel, charging unit, driven wheel and two batteries. The electric motor utilizes the power from one of the battery for energizing the driving wheel, while the rotational torque from the driven wheel is converted into electrical energy by the alternator to charge the second battery through the charging unit. The driven wheel rotates automatically due to the vehicle displacement thereby producing rotational torque. Configuration of charging unit is such that it is able to convert the torque into electrical energy for further charging the battery. The solar panel at the top is fitted with a solar tracker

which is able to efficiently receive solar energy every time. The solar energy is again converted into electrical energy to charge the battery whenever sunlight is available. Also WIFI charging is possible along with electrical socket for direct charging from utility grids through charging booths. Battery management system optimizes the usage of battery life.

Date and Signature:
Dated this 14th September 2024
Signature:

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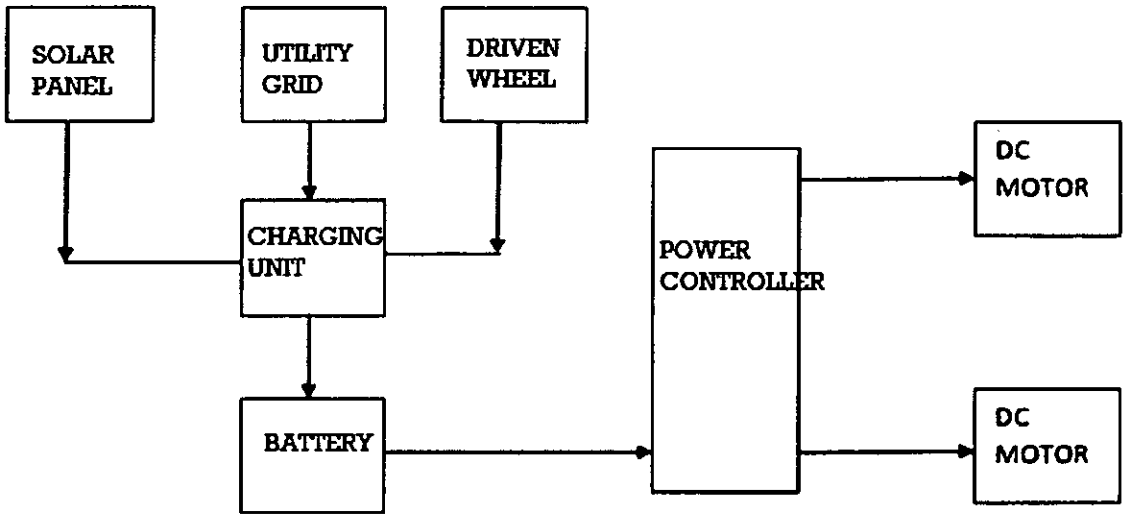

Figure 1. Block Diagram of Self Powered Electric Truck

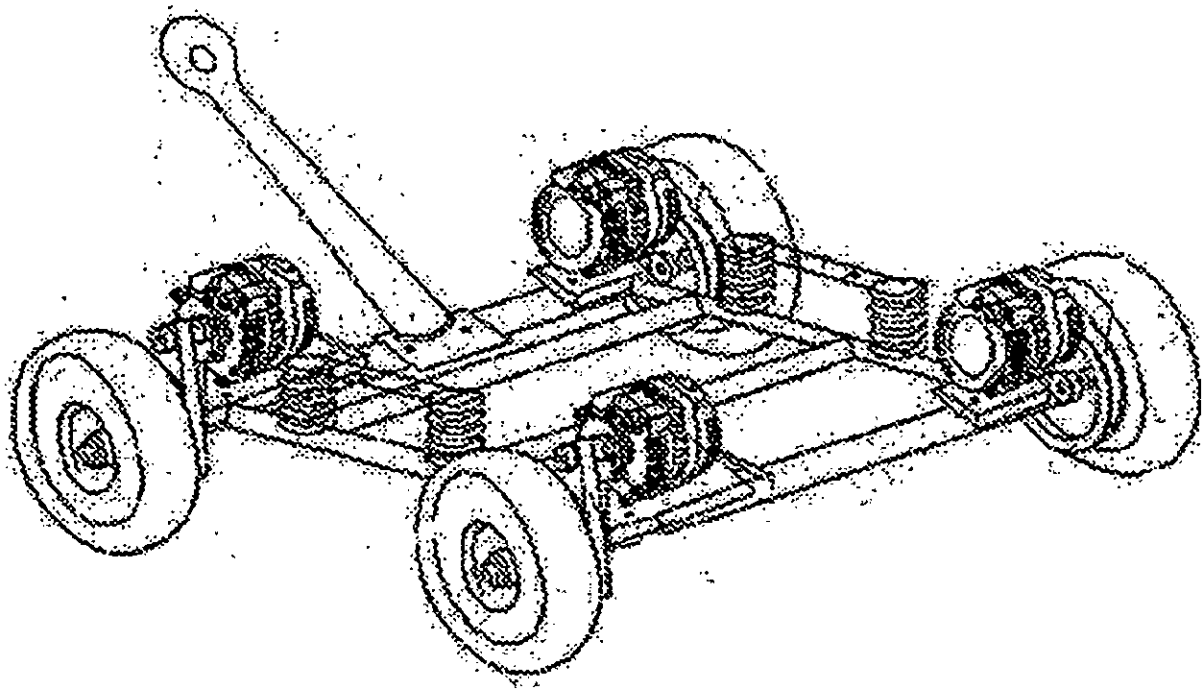

Figure 2. Design of Chassis of Self Powered Electric Truck

1. [M.THIRUMALAI]

2. [T.D. SURESH]

[MAULAGANMAS]

4. [R. vinitaj]

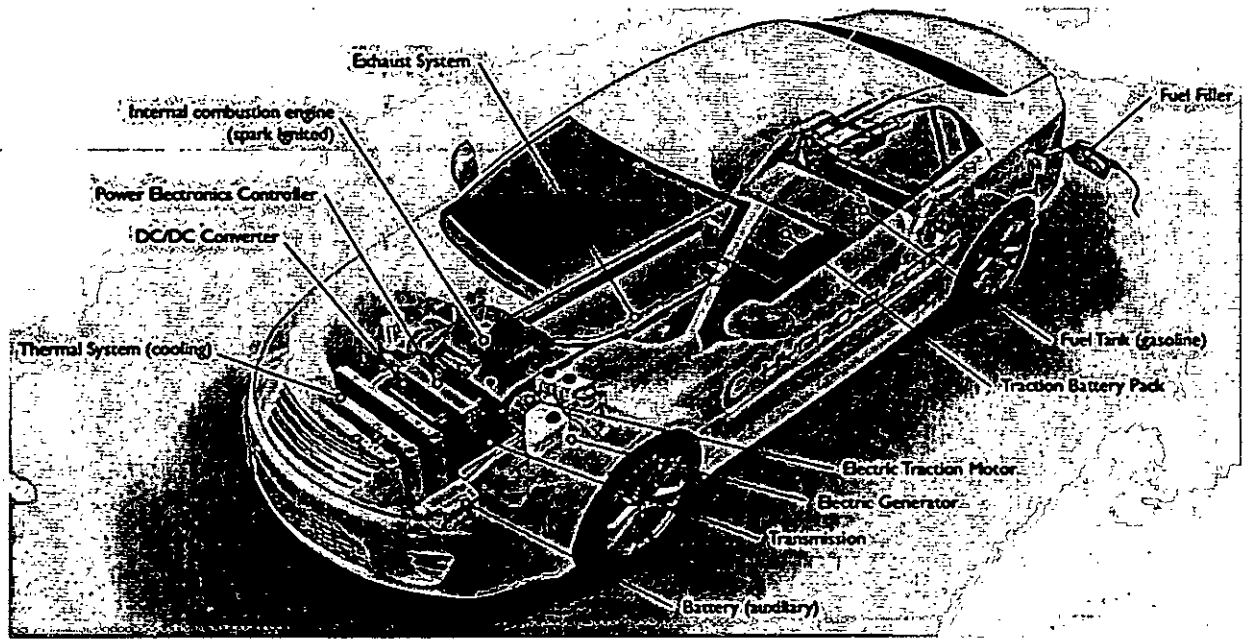

Figure 3. Architecture of Hybrid – Fuel & Electric based Vehicle

1. [M. THIRUMALAI]

2. [T. D. SURESH]

3. [M. ULAGAMMAI]

4. [R. Vinita]