PROJECT OF HYBRID MOTOR SYSTEM IN SCOOTER

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Abstract

A hybrid electric vehicle is a vehicle which combines a conventional propulsion system with an on-board rechargeable energy storage system to achieve better fuel economy than a conventional vehicle without being hampered by range from a charging unit like a battery electric vehicle, which uses batteries charged by an external source. Hybrid vehicles have a conventional engine (gasoline or diesel) as well as a large battery and an electric motor, so that the wheels of the vehicle are driven by both an internal combustion engine and an electric motor. There are various arrangements for these two motors. The article presented the construction solutions and parameters of this hybrid also included information about basic actions of hybrid motor system in the scooter, with two different sources of power. Designed and carried out motor system in scooter included internal combustion engine and electric engine installed in wheel. Explained how accumulator charging system can charge batteries from the gasoline motor while scooter is traveling at normal road speeds and also how can be connected to a standard 230V. Showed how calculate circle of power between engines with take advantage of microcontroller and how special microcontroller system can control all function in scooter (for example: active source of power, speed, brakes, lights, level of voltage). Explored how energy recuperation system is working during braking of machine. Article included also some important information about few achievements like increasing of vehicle range, bigger stock of power, reduction of gas consumption and reduction of CO2 emission to atmosphere.

Keywords: *hybrid, transport, electric, combustion engines, clean energy, ecology*

1. Introduction

The extra cost of an electric motor and battery in a hybrid vehicle make sense because the internal combustion engine in a conventional solution is very energy inefficient. Less than 20% of the energy of gasoline is actually used to drive the wheels of the vehicle; most of the rest is lost as waste heat. In a conventional vehicle, the engine is much more powerful than required to drive the vehicle at a constant speed of say 80 km/hr because extra power is needed for accelerating the vehicle in a reasonable time. Except when accelerating, this power is not really used, and most of the time, the engine operates inefficiently far below its capacity. The main losses of energy occur when the vehicle is idling, braking, and driving at low speeds.

In the hybrid scooter, the electric motor assists in acceleration, which allows for a smaller and more efficient internal combustion engine. In addition, the engine does not idle: it is stopped when the car is standing still and immediately started when required. Furthermore, the electric motor acts in reverse as a generator when the scooter is braking, recovering the braking energy and feeding it into the battery. At low speeds, the hybrid scooter often uses only the electric motor, which has efficiency of the order of 90%. At medium or high speeds, the internal combustion engine will operate (as required) at its most energy efficient point and produce more power than is needed by the vehicle at that moment. The extra energy is fed into the battery, to be used later when required.

2. Types of hybrid connections

We have three main types of hybrid connections: series, parallel and combined.

1. In a series hybrid vehicle, the internal combustion engine is not connected to the wheels of the vehicle - it is used only to generate electricity, which powers the electric motor which then goes through a wire to an electric motor that drives the wheels and is also fed into the battery at times when the car does not need all the energy produced. This internal combustion engine needs only to produce the average amount of power required by the car; it is much smaller than those in conventional cars, and it usually operates at its most efficient point and at constant speed.
2. Parallel configurations tend to be more flexible and powerful than series hybrids. But they are also more complex and can be more costly. In the parallel hybrid connection, both the conventional engine and the electric motor are attached to the driveshaft and the wheels of the vehicle.
3. Combined hybrid systems have features of both series and parallel hybrids. They incorporate power-split devices allowing for power paths from the engine to the wheel that can be either mechanical or electrical. The main principle behind this system is the decoupling of the power supplied by the engine (or other primary source) from the power demanded by the driver.

In a conventional vehicle, a larger engine is used to provide acceleration from standstill than one needed for steady speed cruising. This is because a combustion engine's torque is minimal at lower RPMs, as the engine is its own air pump. On the other hand, an electric motor exhibits maximum torque at stall and is well suited to complement the engine's torque deficiency at low RPMs. In a combined hybrid, a smaller, less flexible, and highly efficient engine can be used.

Combinations also can exist; for example, the front wheel is driven by an electric motor and the rear wheel by a conventional engine.

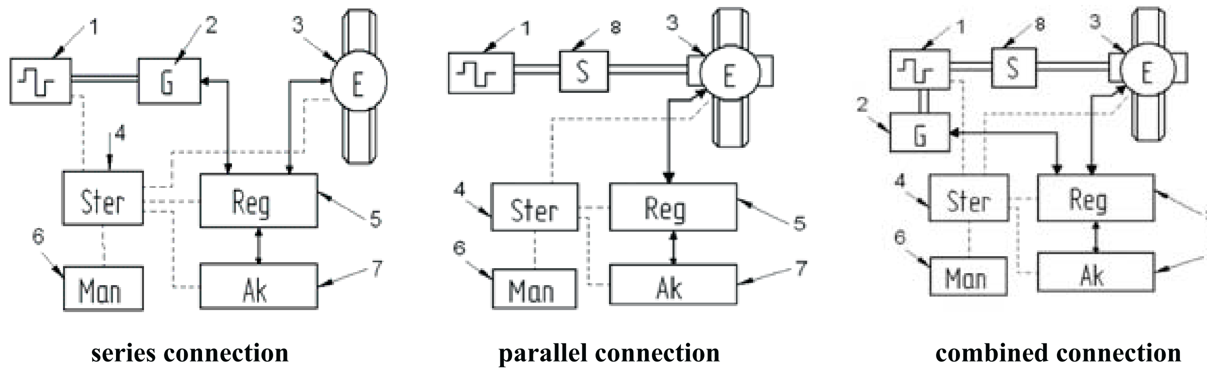

Fig. 1. The example of the hybrid connections in the scooter, where: 1-internal combustion engine, 2-electrical generator,3-electric engine (mounted in wheel), 4-controller, 5-power regulator, 6-lever, 7-battery, 8-clutch

3. Charging system

The electric batteries will be charged via regenerative breaking as with most other hybrids, but they can also be charged via a wall outlet, allowing for up to 45 kilometers of travel on electric power alone. The batteries can be fully charged in about four hours.

The vehicle will drive and work just likes a conventional hybrid. The decision of whether or not to plug it in or not is simple economics. In our area, plugging it in will cut your fuel costs by almost 90% for the first 40-60 kilometers. This is well within most people's daily commute. The only time it will need to run gasoline will be for long trips. The rest of the time it will simply fill up at home or work by plugging it in each nigh.

4. The electric installations of prototype hybrid scooter

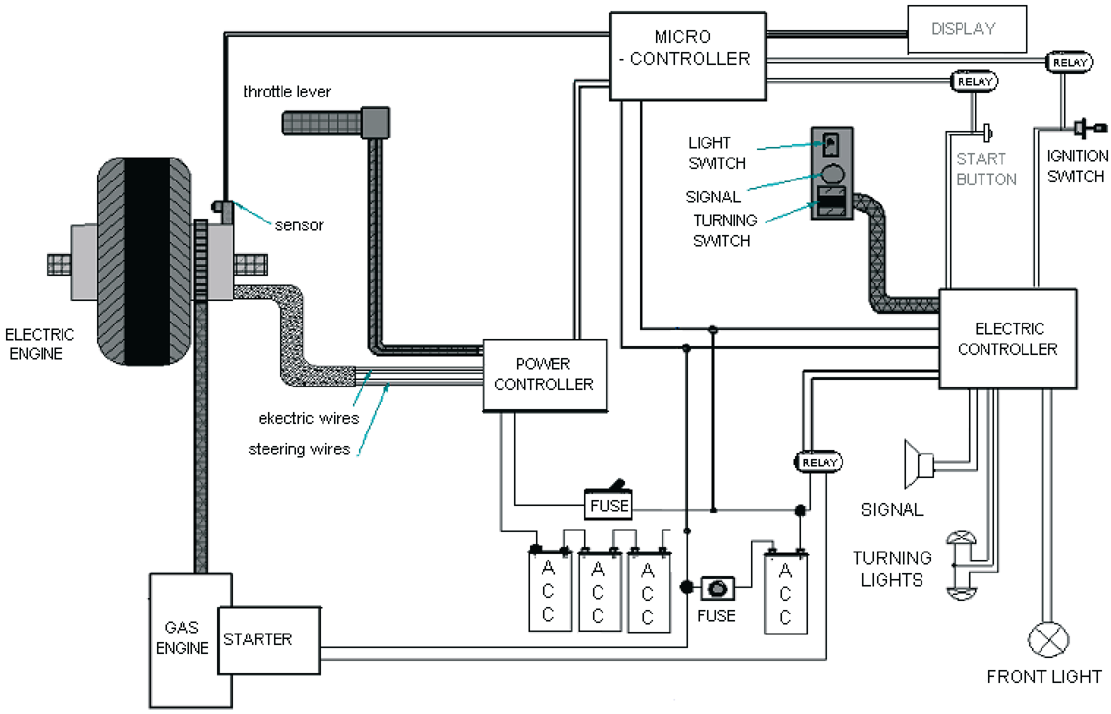

Fig. 2. The example of the electric installation

The main controller is responsible for choosing the correct engine.

The scooter can be run in one of three hybrid settings, allowing for various levels of acceleration or efficiency, and the scooter can also be run in a much less powerful all-electric mode. When used in concert with the gasoline engine, the electric engine boosts acceleration by 85%.

5. Parameters

5.1 The frame construction

- height - 1 [m]
- length - 1.5 [m]
- wide - 0.5 [m]
- max loading - 250 [kg]

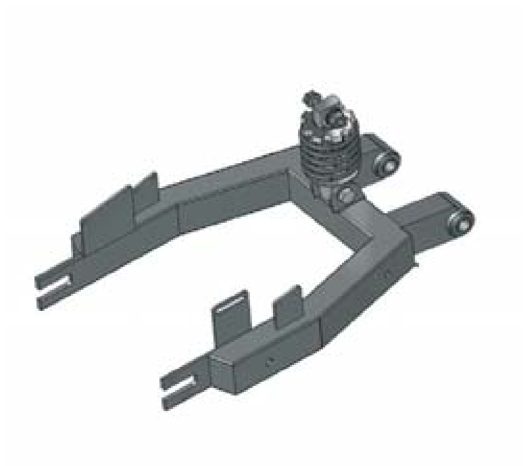

Fig. 3. The 3D model prepared before manufacturing

Fig. 4. The ready frame for scooter

5.2 The hybrid drive modes

Manual mode:
- electric drive,
- internal combustion drive,
- hybrid drive.

Automatic mode:
- electric drive,
- internal combustion drive,
- hybrid drive.

5.3 Drive parameters

Maximum speed:
- electric drive – 40 km/h,
- internal comb. drive – 75 km/h,
- hybrid drive – 85 km/h.

Gas consumption:
- internal comb. drive - 1.7 L/100km,
- hybrid drive - 1.1 L/100km.

6. Main achievements

- Increase of vehicle range -the new hybrid system, can operate in full electric mode with a range of around 40 kilometers,
- bigger stock of power (better acceleration) - energy is going from both sources,
- reduction of gas consumption - 30% (hybrid modes),
- reduction of CO_2 (carbon dioxide) emission to atmosphere - 65% (hybrid modes).

References

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