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DESIGN AND DEVELOPMENT OF HYBRID VEHICLE SMART CONTROL SYSTEM WITH SOLAR CHARGING

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Abstract - In our country majority of the vehicles runs on petrol only limited number of vehicles runs on batteries. Because of this, there is a shortage of fuel and it also leads to environmental pollution. Almost all the developing countries face the superior problem such as air pollution. Due to the shortage of fossil fuels, automobile sectors have to find an alternative to replace the need for fossil fuel, due to its inadequateness. Vehicles emit more amount of CO2 so it leads to a path for finding new technologies like Hybrid Electric Vehicle (HEV). Through this paper, we wish to design a system which runs a motor by both batteries and also using internal combustion engine using petrol as fuel. The design includes a solar panel and a generator (coupled with wheel) for charging the battery. The system has three modes of operation and it is more efficient than other normal automobiles. In this system, the regenerative braking is implemented. Regeneration of energy in this system may lead to less fuel consumption, less charging time and also lower emission. The paper uses the combination of two sectors, mechanical and electronic system which clearly express the growth in fuel economy. This paper makes use of a smart energy management system with solar charging.

Key Words: Internal Combustion Engine, Electric motor, Hybrid electric vehicle, Fuel Economy

1. INTRODUCTION

Nowadays the usage of the hybrid vehicle becomes increased. A hybrid vehicle is a vehicle that combines more than one power to drive the vehicle. The energy crisis is one of the major in the modern world. This paper has the number of benefits by increasing the fuel economy by using alternative transportation mode. The pollution factor is less when compared to another transportation mode. The internal combustion engine provides better performance and better operating range but several problems will occur like less fuel economy, environmental pollutions. Emission of CO2 will also cause the global warming. By using the combination of an IC engine with an electric motor, the following are the benefits which we can achieve are less emission, higher fuel, and higher efficiency. In this paper, the hybrid electric vehicle is provided with the internal combustion engine and electric motor. The electric vehicle is suitable for the slow drive conditions i.e. low- speed drive like traffic signals, urban areas. The internal combustion engine is suitable for the long highway drive or hill climbing drives the vehicle. In India, the efficient scooter has to be designed and developed suitable for the urban status and the vehicle should be dynamic in nature.

2. LITERATURE REVIEW

In this literature review section, many papers are referred for the current knowledge as well as theoretical and methodological contributions for this topic.

The hub motor [1] on the front wheel is driven by the battery and the rear wheel is driven by the IC engine fueled by petrol. [2] Battery drive is used for low power application whereas for high power requirement gasoline engine is used. [3].By implementing this technology battery life issues can be solved. In this system, solar charging method makes it more effective. [7].This system has many advantages like lower fuel consumption, low emission, smaller engine size and long operating life. [16] Automatic selection of a driving mode by using relays. Charging of battery using solar power is easy and solar energy is free of cost and continuous. [17] This system has several characteristics like handling capacity, highly reliable and also compared with the other electric bikes in the market. When it is in electric mode, it is eco-friendly. [19] This system is designed to determine the self-sustaining hybrid vehicle for improving human efficiency [21] A balanced tire pressure monitoring system and an anti-crash warning system is provided with this system using a microcontroller.

3. EXISTING SYSTEM

Nowadays electric cycles and scooters are powered by using electricity. The electricity is gathered in a lead acid battery, which drives one or more electric motor. The charging time usually takes about eight hours to recharge.

3.1. Recharge time:

Vehicle recharge takes a longer time than that of filling a petrol tank, but this can be done overnight on a trickle charging.

3.2. Climatic condition:

During the cold season, battery power can be reduced up to 20%.

3.3. Sudden battery dead:

The battery can suddenly die out in the middle way of a journey. Warnings such as decreased power are not provided.

4. PROPOSED WORK

The components used in this proposed system are

4.1. RELAYS:

A Relay is an electromagnetic switch that can be operated by using a relatively small electric current for turning on and off. In this paper, the relay is used to change the modes of operation. Refer figure 1.

Fig -1: Relay

4.2. BLDC MOTOR:

A BLDC motor is a permanent magnet electric motor which is driven by direct current (DC) and it also consists of electronically controlled commutation system (commutation is the process of producing rotational torque in the motor by changing phase current through it). Refer figure 2.

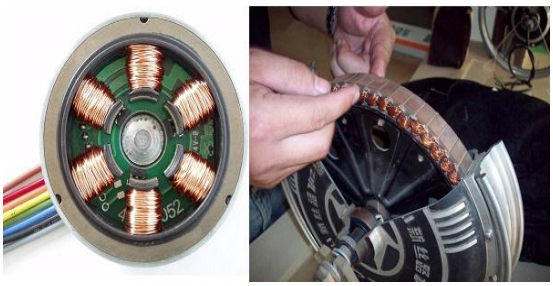

Fig -2: BLDC motor

4.3. PIC 16F877A MICROCONTROLLER:

The PIC16F877A features 256 bytes of data memory, self-programming, an ICD, 2 Comparators, 8 channels of 10-bit Analog-to-Digital converter, capture/compare/PWM functions, the synchronous serial port can be configured as either 3-wire Serial Peripheral Interface (SPI) or the 2-wire Inter-Integrated Circuit (I^2C) bus and a Universal Asynchronous Receiver Transmitter (USART). Refer figure 4.3

Fig -3: PIC 16F877A

4.4. BACKUP BATTERY 6V:

A battery is an electrochemical cell (or enclosed and protected material) that converts chemical energy into electrical energy. Refer figure 4

Fig -4: Backup Battery

4.5. MAIN BATTERY:

The lead-acid battery is the main battery. The lead-acid battery uses the constant current-constant voltage (CC/CV) charge method. A regulated current raises the terminal voltage until the upper charge voltage limit is reached, at which point the current drops due to saturation. The charge time is 12–16 hours and up to 36–48 hours for large stationary batteries. With higher charge currents and multi-stage charge methods, the charge time can be reduced to 8–10 hours; however, without full topping charge. Lead acid is sluggish and cannot be charged as quickly as other battery systems. Refer figure 5.

Fig -5: Main battery

4.6 SOLAR PANEL:

The solar panel is fast becoming a very attractive renewable option, which could end up being incredibly beneficial to the environment. The process of converting sunlight into electrical energy is one that has improved dramatically over the last few decades and is now more efficient than ever.

5. MODES OF OPERATION:

They are three modes of operations in this proposed system,

5.1. MODE 1: BATTERY MODE

This mode operates only on battery, if the vehicle runs at any speed only using motor it is referred as Electric vehicle. This battery mode is employed for low speed applications and high traffic situations.

This mode also consumes low fuel. In this mode the battery circuit is turned ON by a high signal send from microcontroller to the relay.

5.2. MODE 2: ENGINE MODE

Similar to the battery mode, the motion of the vehicle relies on the IC engine. The self-starter motor is linked to a terminal of 3-way switch. In engine mode, self-starter motor started in order to start the engine.

In this mode a low signal is send to relay from the microcontroller at a speed of 750 ms. Power is cut off to the motor and the engine is turned ON through the starter.

5.3. MODE 3: AUTOMATIC MODE

This is the most significant and effective mode. This system works using both IC and electric. If the vehicle starts using battery mode, the battery is cut off by microcontroller programming and engine is started at a certain battery level conditions (low battery level). The relay automatically switches to petrol mode and turns on the ignition when the battery is low.

6. BLOCK DIAGRAM:

This is the visual representation of this paper that uses the simple block to understand the concept. Refer figure 6.

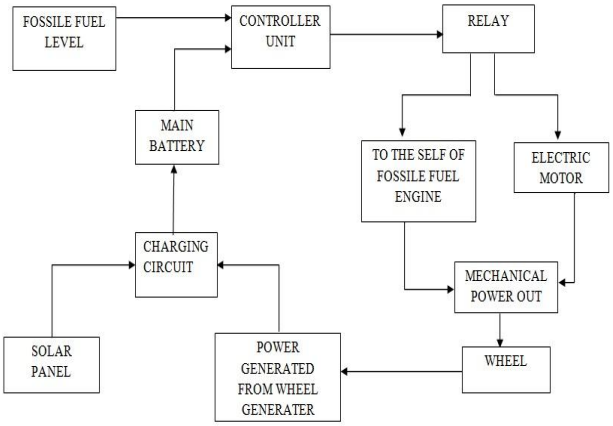

Fig -6: Visual representation

6.1. DESCRIPTION:

6.1.1. CHARGING CIRCUIT

The battery can be charged by using two different energy conversion systems. They are

i. Solar energy

ii. Regenerative braking

I. Solar Energy:

A photovoltaic (PV) module is a package connect assembly of typically 6×10 photovoltaic solar cell. This PV module generates and supplies solar electricity to the battery.

II. Regenerative Braking:

Regenerative braking system acts as energy recreation system which slows down the wheels of the hybrid electric vehicle by converting its kinetic energy into a form of electric energy which can be either used immediately or stored in the battery. During the slow drive when the brake is applied the motor fixed in the rear wheel acts as a generator and convert the mechanical energy into electrical energy. The electrical energy produced by the regenerating braking is also stored in the battery for the future purpose.

6.1.2. CONTROLLING CIRCUIT

The controlling circuit has some of the components like microcontroller, relays, battery level indicator and also fuel level indicator. The heart of the controlling circuit is said to be a microcontroller. For this system PIC, 16F877a microcontroller is used. The battery level indicator continuously monitors the level of charge in the battery if the battery level is below 25% then the microcontroller sends a signal to the relay. Then the relay changes its position from normally closed to normally open due to switching operation IC engine turns on and then the vehicle will run in the fossil fuel mode.

6.1.3. MECHANICAL CIRCUIT

In the electrical mode, the electric motor is driven by the electric battery which can be charged in two ways (solar charging and regenerative braking) and the brushless DC motor is used.

In the engine mode, the internal combustion engine is used to drive the vehicle. In addition to that alert system is also provided. The fossil fuel can be conserved and energy will be regenerated by using this system.

7. RESULTS:

For the regenerative braking, the mechanical setup simulation is done in the CATIA V5. It is designed in the surface design. Refer figure 7.

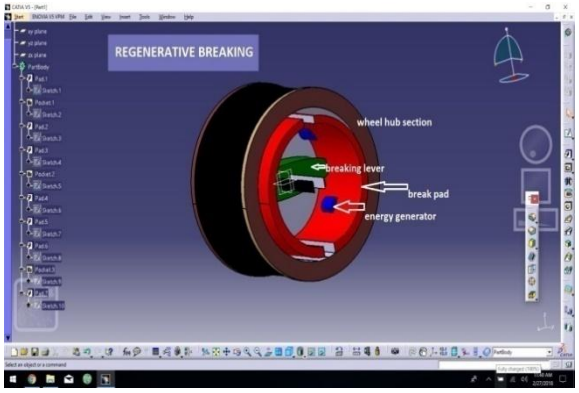

Fig -7: Mechanical simulation for Regenerative Braking

For the electrical modes the simulation is done in the PROTEUS 7 Professional and the program was written in Embedded C language. The modes of operation are designed and simulated in this PROTEUS software. Refer figure 8 for the battery mode.

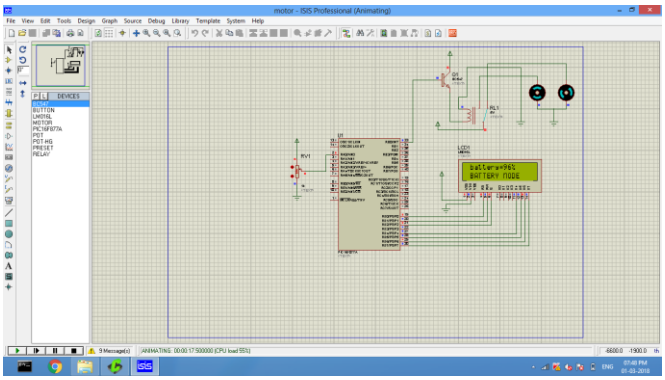

Fig -8: PROTEUS simulation for battery mode

The simulation for the engine mode refers the figure 9.

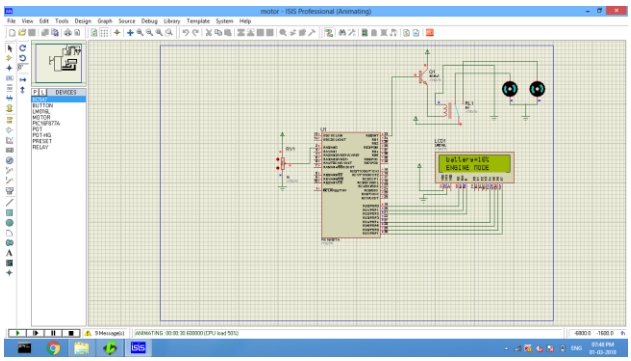

Fig -9: PROTEUS simulation for battery mode

Thus the HVE uses the two different sources battery and fossil fuel. For the slow drive, the battery is used and the regenerative braking is employed whereas the IC engine is suitable for the high-speed drive but the chance of

regenerative braking is less in the engine mode. When compared to the normal electric vehicle the proposed system is efficient. The recharging time of the battery will be decreased. The emission of carbon will also be less. Solar charging of the proposed system makes it efficient.

REFERENCES

[1]. P. Ruthvik, P.Sankar, N.Sagar, J. Sarthak and P. Shubham. "Design and Development of Smart Hybrid Two Wheeler," Toraskar International journal of innovative research in science engineering and technology, 2017.

[2]. H.Kishore and S.Sanketh, "Design and Fabrication of Two Wheeler Hybrid Vehicle", International Journal of Science and Research, 2015.

[3]. Sharada Prasad and Nataraj "Design and Development of Hybrid Electric Two-wheeler with Solar Charging Methodology", International Journal of Scientific and Engineering Research, Vol.5, Issue.11.

[4]. Ying Yang, "Integrated Electro-Magnetic Transmission Systems in Hybrid Vehicles", IEEE McMaster University, Hamilton, Canada, 2011.

[5]. C.C. Chan, "The State of The Art of Electric", Proceedings of the IEEE 95.4 (2007): 704-718.

[6]. C.Shen, P.Shan, T.Gao, "A Comprehensive Overview of Hybrid Electric Vehicle", International journal of vehicular technology, 2011.

[7]. Paul Walker and M. Holger roster, "Energy Consumption and Cost Analysis of Hybrid Electric Powertrain Configurations for Two Wheeler", University of Technology, Sydney, 2012.

[8]. M.Kebriaei, A.H.Niasar, B.Asaei, "Hybrid Electric Vehicles" Connected Vehicles and Expo (ICCVE), 2015 International Conference on (pp. 299-305). IEEE.

[9]. Y.Gao and M.Ehsani, "A Torque and Speed Coupling Hybrid Drivetrain Architecture Control and Simulation", IEEE transactions on power electronics, 21(3), 741-748, 2014.

[10]. B.Asaei and M.Habibidoost (2013). "Design, simulation, and prototype production of a through the road parallel hybrid electric motorcycle" Energy conversion and management, 71, 12-20.

[11]. K. Vignarooban, "State of Health Determination of Sealed Lead Acid Batteries under Various Operating Condition", University of Jaffna, Srilanka, 2016.

[12]. X.Jonathan Weinert, X.Andrew burke and wei shanghai, "Lead Acid and Lithium-Ion Batteries for the Chinese Electric Bike Market and Implications on Future Technology advancements", China Journal of Power Sources, 2007 .

[13]. Manu Jain and S.Sheldon, "Suitability Analysis of In - Wheel Motor Direct Drives for Electric and Hybrid Electric Vehicles", IEEE, power electronics and energy research, Canada, 2009.

[14]. P.Spagnol, G.Alli, C.Spelta, P.Lisanti, F.Todeschini, Savaresi, and S.M.Morelli, "A full hybrid electric bike: How to increase human efficiency", A American Control Conference (ACC), 2761 -2766, 2012 .

[15]. K. Vanchinathan and K. R. Valluvan, "A Metaheuristic Optimization Approach for Tuning of Fractional-Order PID Controller for Speed Control of Sensorless BLDC Motor" Journal of Circuits, Systems, and Computers, Vol. 27, Issue 8, pp 1850123-1 to 1850123-19, 2018.

[16]. Yamuna, S., M. Chitra, and C. Gokul "Microcontroller–Based Modified SEPIC Converter for Driving Lamp with Power Factor Correction." International Journal of Engineering Research and Applications 4.7 (2014): 96-100.

[17]. G.Loganathan, et al. "An enhanced time effective particle swarm intelligence for the practical economic load dispatch." Electrical Energy Systems (ICEES), 2014 2nd International Conference on. IEEE, 2014.

[18]. R. Senthilkumar., D. Rajkumar, and A. Mariya Sindhuja "Sepic Based Multi-Stack Voltage Equalizer For Partially Shaded PV Modules Using Fuzzy Logic Controller." I-Manager's

Journal on Power Systems Engineering 4.2 (2016): 38.

[19]. G.Loganathan, and D. Rajkumar "Comparison of Results among Three Optimization Algorithms Applied to an Economic Load Dispatch Problem"

[20]. P.Vignesh, et al. "Solution for economic load dispatch problem with generator constraints using QPSO." Int. Res. J. Eng. Technol. 3.3 (2016): 625-630.

[21]. P.Rajasekaran, and K. Vanchinathan. "Improved performance of four switch three phase brushless dc motor using speed-current control algorithm." International Journal of Computer Applications 68.11 (2013).

[22]. C.Gokul et al. "Firefly and Modified Ant Colony Optimization Technique for Test Scheduling and Reduction of Testing Time for Core based System-on-Chip (SoC)" TAGA JOURNAL OF GRAPHIC TECHNOLOGY, 14 (1), 1-9, 2018.

[23]. G. K.Jenira, S. Uma Maheswari, and V. Kalaaranjini. "Smart Android Application for Tank Level System." Fuzzy Systems 9.6 (2017): 105-108.

[24]. Sreedhar, M., & Venkatesh, C. (2013). IMPULSE RADIO ULTRA WIDE BAND BASED MOBILE ADHOC NETWORK ROUTING PERFORMANCE ANALYSIS. American Journal of Applied Sciences, 10(4).

[25]. Natheem, S. A., Dhanalakshmi, T., Gokilambigai, D., & Praveena, M. J. Human Interaction Intelligent Robot for Personal Assistance.

[26]. Gowrishankar, V., Manoranjitham, D., & Jagadeesh, P. (2013). Efficient FIR filter design using modified carry select adder & Wallace tree multiplier. International Journal of Science, Engineering and Technology Research, 2(3), pp-703.

[27]. Subramani, M., & Kuppusamy, S. (2011). Improving congestion control performance and fairness in multihop ad hoc network. International Journal of Networking and Virtual Organisations, 9(1), 86-101.

[28]. Parimaladevia, M., Sharmilab, D., & Kowsikaa, L. (2016). A survey on the performance analysis of 6t sram cell using novel devices. South Asian J. Eng. Technol, 2(18), 71-77.

[29]. Ravikumar, P., Bharathiraja, E., Tharani, V., Yamuna, R., & Yamunarani, T. (2011). Design and analysis of coronary stent. International Journal of Healthcare Technology and Management, 12(5-6), 447-456.

[30]. Brindha, P., & SenthilKumar, A. (2014). NETWORK INTRUSION DETECTION SYSTEM: AN IMPROVED ARCHITECTURE TO REDUCE FALSE POSITIVE RATE. Journal of Theoretical & Applied Information Technology, 66(1).

[31]. Jayanthi, N., & Valluvan, K. R. (2018). Hybrid routing algorithm for improving path selection in sustainable network. Cluster Computing, 1-12.

[32]. Ashok, V., Rajan, S., & Nirmalkumar, A. (2010). Statistical Analysis of Diabetic Mellitus on Dynamic Human Blood Flow by Noninvasive Laser Doppler Technique in Real Time. International Journal of Computer Science and Network Security, 10(1), 137-143.

[33]. Tamilselvan, K. S. (2012). Design of Compact Multiband Microstrip Patch Antennas. Journal of Global Research in Computer Science, 3(11).

[34]. Sakthivel, P., NirmalKumar, A., & Mayilsamy, T. (2012). Low transition test pattern generator architecture for built-in-self-test. American Journal of Applied Sciences, 9(9).