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Automated/Manual Switching of Fuel Engine to Electric Motor

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ABSTRACT: A hybrid electric vehicle is the one, which uses fuel power and electric power to run the automobile. Sometimes necessity comes in so as to run a vehicle even on exhaustion of fuel, in which former hybrid electric vehicle models fail to satisfy the need. The proposed project model aims at satisfying such a need. Often, when the fuel level comes to a reserve, the driver has no other option than to refuel the vehicle. In such a case, the proposed model can be incorporated in vehicles so as to provide an uninterrupted driving by automatic switching from fuel engine to electric drive. The model also aims at providing an auxiliary braking system through eddy current braking (non-contact type braking).

KEYWORDS:.Hybrid electric vehicle, uninterrupted driving, eddy current braking.

I.INTRODUCTION

A hybrid electric vehicle uses both an electric motor with both a battery and a combustion engine with a fuel tank for propulsion and hence, a hybrid between an electric and a conventional vehicle. HEVs are of particular interest now, even as countries struggle with fuel quality. Hybrid vehicles can be categorized as Series Hybrid and Parallel Hybrid vehicles.

Series Hybrids have been referred to as Extended-Range Electric Vehicles (EREV). As the internal combustion engine turning a generator is mechanically disconnected from the driving wheels, it gives an advantage of isolating the engine from demand. The electric traction system and combustion engine generator operate independently with each operating at its maximum efficiency. This allows a vehicle with engine to operate as a second stage, only when needed to drive the vehicle with the electric battery energy storage. Fig. 1 shows the structure of a series hybrid vehicle.

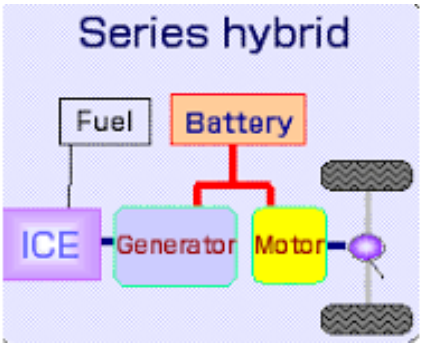

Fig. 1: Series Hybrid Vehicle

Parallel hybrid systems, which are most commonly produced at present, have both, an internal combustion engine and a coupled electric motor. If they are joined at an axis in parallel, the speeds at this axis must be identical and the supplied torques add together. With the cars, the two sources may be applied to the same shaft, the speeds thus being equal and the torques adding up with the electric motor adding or subtracting torque to the system as necessary. Fig. 2 shows structure of a parallel hybrid vehicle.

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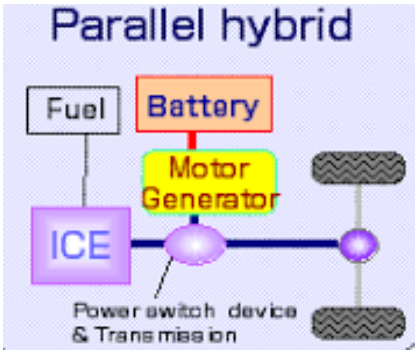

Fig. 2: Parallel Hybrid Vehicle

Hybrid electric vehicles combine the advantage of gasoline engines and electric motors. The key areas for efficiency or performance gains are regenerative braking, dual power sources and less idling. In order overcome the difficulties faced upon the exhaustion of fuel in a system of transport, a switching to electric motor system has been proposed.
Whenever there is exhaustion of fuel in a vehicle, there is no other option than refuelling it. In order to be on a smooth drive even after exhaustion of fuel, this system has been proposed where a switching takes place over to the electrical system from the petrol engine.

II.BLOCK DIAGRAM

The block diagram representation of the implemented model is shown in Fig. 3.

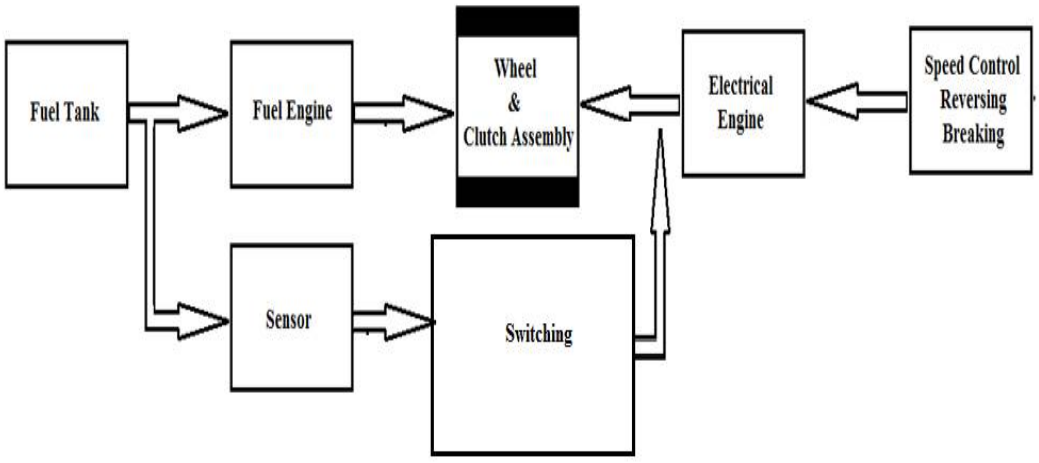

Fig. 3: Block Diagram

The block diagram describes the fuel engine being run by the fuel in fuel tank. The fuel engine is coupled to the wheel and clutch assembly to bring about the motion in the vehicle. A fuel level sensor senses the minimum level of fuel in the fuel tank and actuates a switching mechanism in the auto clutch to switch over to the electric operated system. The electrical engine then gets coupled to the wheels of the vehicle to bring in the same process of traction.

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III.CIRCUIT DIAGRAM

The circuit diagram of the proposed system is shown in Fig. 4.

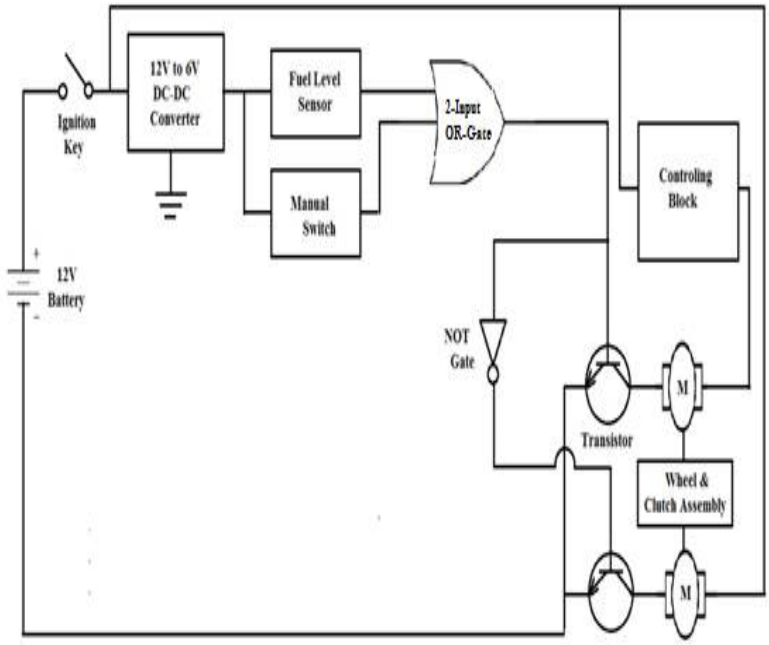

Fig. 4: Circuit Diagram of the switching model

The circuit consists of four basic blocks, being;

- Battery and voltage regulator circuits
- Electronic timer circuit
- A fuel level sensor (here, a water level indicator)
- Controlling and logic circuits

The battery used here is12V, 1.2ah battery that runs all the power devices in the circuit which includes the motor and the transistors. The lead acid battery used here is a rechargeable one and is capable of providing a maximum current of 0.36A. The voltage regulator or the DC to DC converter circuit is a buck converter which is used to lower the voltage level from the battery of 12V to 6V. The water level indicator used here, is to actuate the electric motor once the water level (fuel level) comes to a minimum pre-set level. The indicator consists of floating circular contacts and two metal contacts at the bottom of the storage tank. A logic gate, diode and transistor are the components of the logic circuit. The inverter used here is a TTL family, 14 pin IC7404. TIP122 model transistor is used as a motor driver and is capable of handling 400mA of maximum current and a working voltage of about 65V. IN4007 model diodes are used in order to prevent reverse current to the low voltage level circuits.

IV.WORKING

The proposed model, as shown in Fig. 5 contains a storage tank, which has replaced the fuel tank. The storage tank is filled with water, which has been considered as the fuel in this case. A float type sensor is kept immersed in the tank in order to indicate the reserve level of water in the tank.
A PMDC motor has been used to portray the role of an internal combustion engine. This replacement has been done to avoid complexity in the design of the prototype. The PMDC motor of the said specifications is attached to one side of the freewheeling hub. This becomes the fuel engine drive of the system. When the water (fuel) is present in the tank, the hub runs with the rotation given in by the fuel engine drive.When the water level reduces to the minimum value, the

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sensor actuates a signal for switching and the switch over takes place to the electric drive system. The electric drive system consists of a PMDC motor connected to the hub as shown. During the movement of the hub upon switching to electric system, the fuel engine drive stops automatically. Reversing of the electric motor can be done by the use of the reverse switch provided which interchanges the polarities of the motor. The speed of this PMDC motor is achieved by armature voltage control method. A speed control knob has been provided which is nothing but a potentiometer. Apart from the automatic detection of the exhaustion of fuel and switching, a manual switch also has been provided, so that the electric drive mode can be achieved manually. To slow down the movement or stop the hub, eddy current braking method has been used. This method has no contacts, thus the wear and tear of brake shoes is avoided. A DC to Dc Buck converter has been used to reduce the voltage levels of 12V from the battery to 6V to run the lower voltage level devices. Transistors of the said specifications have been used to drive the motors.

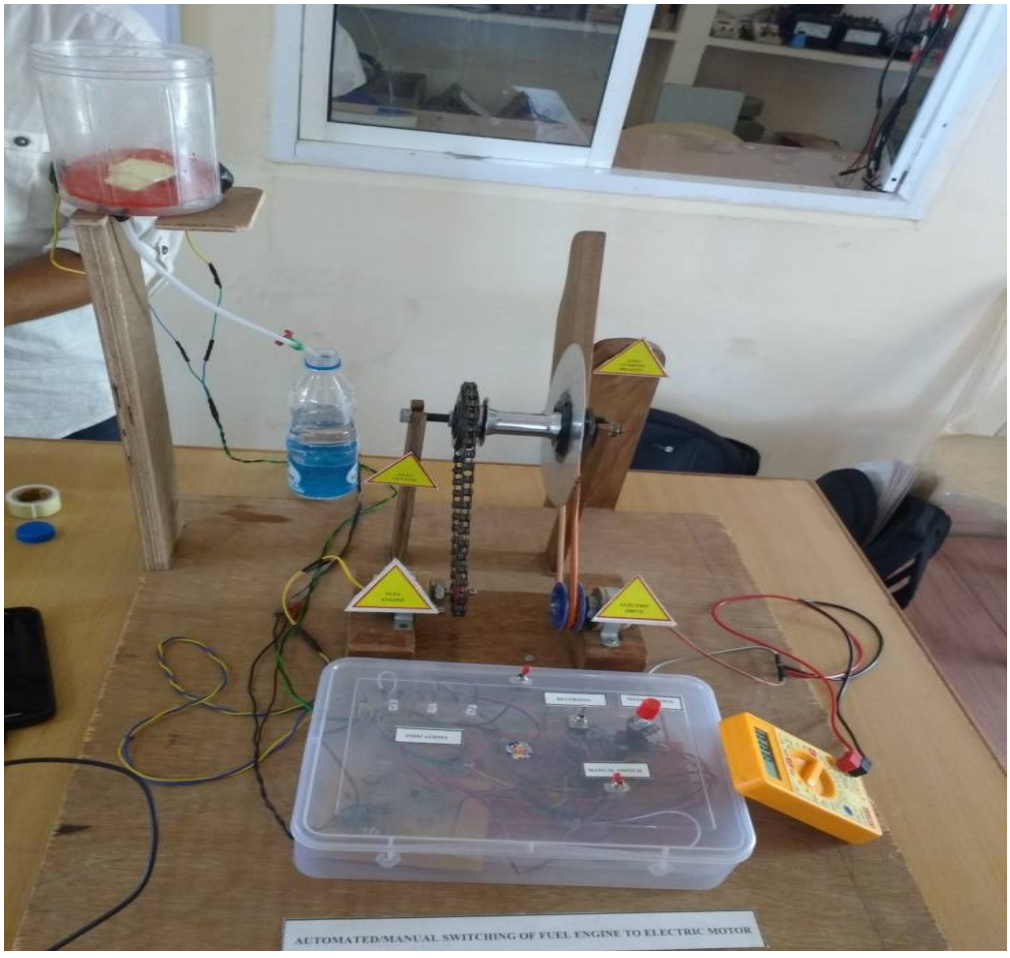

Fig. 5: Working Model of the Proposed System

V. ANALYSIS OF THE SOFTWARE

Software is designed to give an approximate projection of stopping distance of a vehicle, based on data entered. In an electric vehicle stopping distance of the vehicle at any instance depends on two quantities

- Amount of energy left in battery and
- Speed at which vehicle is moving

Taking above two quantities as an input, this software calculates the distance the vehicle can cover. This software is designed in Visual Basic language using Visual Studio software. Visual Basic is a third-generation event driven

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programming languageandintegrated development environment(IDE)from Microsoft for its COM programming model first released in 1991 and declared legacy in 2008.

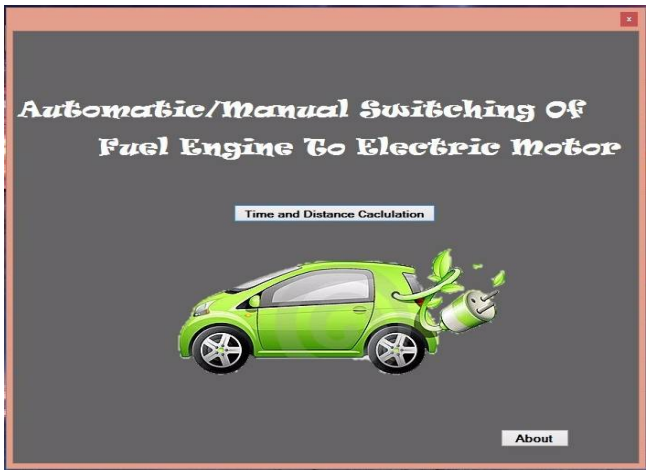

Fig. 6: Screenshot of Main Screen of the Software Developed

VI.CONCLUSION

Hybrid electric vehicle technology for both light and heavy duty applications is commercially available today and demonstrates substantial reductions in tail-pipe emissions and fuel consumption, even when compared to other available low emission technologies. HEVs are particularly effective for urban travel, significantly lowering pollutant emissions. In such a scenario where there is a need for an alternative, the proposed system can be of a great help. This prototype can be further extended to real time vehicles considering all the requirements and specifications. The proposed system provides a method of switching over from the conventional fuel systems to the electric system upon the requirement of the user. Apart from switching, reversing and eddy current method of braking is also provided.

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