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SMART CHANNEL SELECTION FOR HYBRID VEHICLES

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ABSTRACT: With ever-increasing rise in inflation, fuel costs and taxation, we endeavor to design and fabricate a fuel-efficient bike, which is of low cost and high efficiency. It is proposed to overcome the drawbacks of internal combustion engine and electric motor. So, our proposal is 'Smart channel selection for Hybrid vehicle' is an electrical and mechanical system which consists of two phases. In the first phase, it works as an Electric bike which is eco-friendly and reliable and in second phase it works on an IC Engine. The second phase is used when motor speed is greater than 40km/hr and load is more on electric motor

Keywords— BLDC Motor; BMS; Hybrid; IC engine; Arduino Uno;

I. INTRODUCTION

A hybrid bike is a vehicle that has two power sources: an electric motor to propel its wheels, and an IC engine to recharge the vehicle's electrical storage system. The main feature of that bike is we take the advantages of Internal Combustion engine and Electric motor drops the disadvantage of these two systems and which is used for efficient working of Bike. The working of this bike has two phases. In the first phase, it runs on an electric motor. In the second phase, it runs on an internal combustion engine. The use of these two phases is depend on speed of bike. And the use these two phases is shown in Simulation model for observing the characteristics of controller and BLDC Motor.

II. LITERATURE REVIEW

This Paper [1] studies about Hybrid electric vehicles (HEVs) and observed that they provide large potential to save energy and reduce emission, and smart vehicles bring out great convenience and safety for drivers. Their research concluded that by combining these two technologies, vehicles may achieve excellent performances in terms of dynamic, economy, environmental friendliness, safety, and comfort. For researching the topic, they selected a platform based on hybrid electric vehicle, they combined the two methods of Adaptive cruise control (ACC) and Energy Management strategy (EMS) to achieve the concluded Model predictive control (MPC) results. The paper [2] essentially centers around the electrical motorcycle design, their main aim was to investigate how to design a simple, cost effective model of electrical motorcycle with intelligent control system.

In paper [3] they studied about the various aspects of the Brushless Direct Current Motor (BLDC) and presented tab them in their paper. They elaborated about the advantages and disadvantages of various aspects and cited their suggestions for the same. They have also designed a motor controller circuit for the BLDC motor. They have achieved the working calculations and results using the microcontroller circuit based on the Arduino Uno Board. The programming was done such that the desirable parameter monitoring and control was easily achieved and the results were stored and calculated based on the reference theory. The Purpose of paper, "Hybrid Electric Bike with Three Speed Transmission System an Energy efficient bike for next generation", [4] is that the hybrid electric bike having three speed transmission system and cited that the

presence of three speed transmission system (gear) in a hybrid electric bike makes for effective speed control of the motor as well as the Internal combustion (IC) engine of the bike. They concluded based on their study that these types of bikes which are hybrid would be the thing of the next generation. They have backed their future scope with a necessary data pertaining to the points cited. The paper [5] has design and developed a simulation model for the Brushless Direct Current Motor (BLDC). They have designed a simulation-based model of BLDC motor using a Proteus simulation software. They designed a hub motor which is very sleek in design and also is very light in weight. So, they conclude the paper by saying that the motor designed by them would be very useful in practical application due to its light weight and compact size.

III. DESIGN OVERVIEW

To design the hybrid bike, we considered the various objectives to get better performance and smooth transmission between two channels Such ideologies are,

- Solution for modification of existing motorbike
- Ease for manufacturing
- Safety
- Low Weight

All the topics presented in this report has been supported well by Simulation on Proteus, Calculations and charts.

Individual subtopics have been separately discussed under subtopics that require them.

IV. BLOCK DIAGRAM

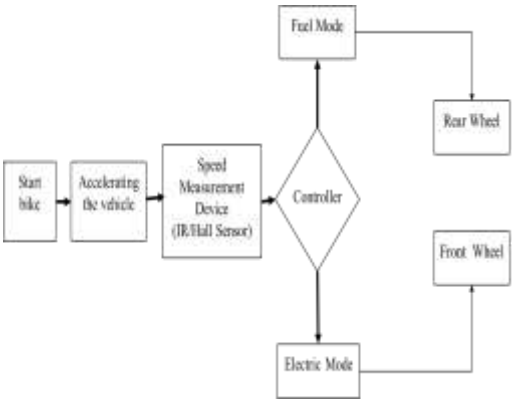

Figure 1: Block Diagram of smart channel selection for hybrid vehicle

For the functioning of vehicle, the power switch is turned ON. Then the operator will select the mode of operation i.e., manual mode or automatic mode, manual mode consists of only fuel power mechanism while in automatic mode the power mode operation either fuel or electric will be selected based on speed of motorcycle. After selecting automatic mode, the operator starts the vehicle by accelerating the power mechanism. The sensing device (hall or IR sensor) gives the analog information to the controller. The controller compares the real-time information with the programmed information, on that basis the channel selection is done. If the input sensor value is less than or equal to predefined value then controller communicate with actuator. Then the actuator drives the electric motor (Hub Wheel) with the proportion of accelerator. If the input sensor value is greater then, the predefined value then controller communicate with starter motor or spark plug and that will turn ON IC engine and which will drive the rear wheel of bike with proportional to accelerator.

V. SELECTION OF BIKE AND BLDC MOTOR

i Bike Specification

Model	Hero Honda CD100 Deluxe
Displacement	97 cc
Maximum Power	4bhp@6000
Maximum Torque	7.2 NM@5000rpm
Ground Clearance	135.00 mm
Weight	116 kg
Fuel Tank Capacity	12.80 litres

ii BLDC Motor Specifications

Rated Power	2000W
Rated Voltage	48V
Max. Efficiency approx.	92%
RPM at no load	1100 RPM
Wheel Diameter	18 inch
Torque	17.36 NM
Rated Current	42 Amp
Weight	15 kg

VI. COMPONENTS REQUIRED

i Controller

The Arduino Uno has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers. The Atmel ATmega328 provide UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX). An FTDI FT232RL on the board channels this serial communication over USB and the FTDI drivers provide a virtual com port to software on the computer. The Arduino software includes a serial monitor which allows simple textual data to be sent to and from the Arduino board. The RX and TX LEDs on the board will flash when data is being transmitted via the FTDI chip and USB connection to the computer.

ii Actuator

The electric vehicle actuator is the electronics package that operates between the batteries and the motor to control the electric vehicle speed and acceleration much like a carburetor does in a gasoline-powered vehicle. It regulates the energy flow from the battery. Unlike the carburetor, the actuator will also reverse the motor rotation, so the vehicle can go in reverse, and convert the motor to a generator, so that the kinetic energy of motion can be used to recharge the battery when the brake is applied. This capability commonly known as "Regenerative Braking" also helps the electric vehicle to improve its range by storing energy back in batteries at each instance of braking.

iii Battery

Calculation for Battery Selection:

Motor rating: 48 Volt, 2000 Watt

Rated current of Motor = 42 Amp.

If motor takes 2000-watt power and battery efficiency is 80%, then

Requirement of Battery:

Watt-hour = 2000W x 1.2 = 2400 WH

Amp-Hour = 2400WH / 48V = 50 AH

So, we use two set of battery of 48V, 25AH Lithium-Ion battery

Advantage of Two Battery set over Single Battery:

We can mount that battery at separate location.

If one battery is damaged then the cost required for replacement is low.

Time required for charging the batteries is less compare to charge the single battery.

Battery Selected:

VII. A) VARIOUS MODES OF OPERATION BASED ON SPEED

Speed of Motorcycle	Speed Identity	Mode of operation
0	Braking condition	Battery
	Start	Battery
1-40	Acceleration mode	Battery
40-60	Cruising mode	Fuel power
60 & above	Racing mode	Fuel power

VII. B) Simulation model:

For the software basis Operation, we define the i/o pins on virtual hardware pin configuration as per the Arduino uno ATMEGA 328. Also, the system consists of one controller that is Arduino uno, one 16×2 lcd display panel, indicators, one variable knob which functioning same as the accelerator function, two NPN transistor, relay, two dc motors one for electrical mode and other one for IC engine mode instead of spark plug.

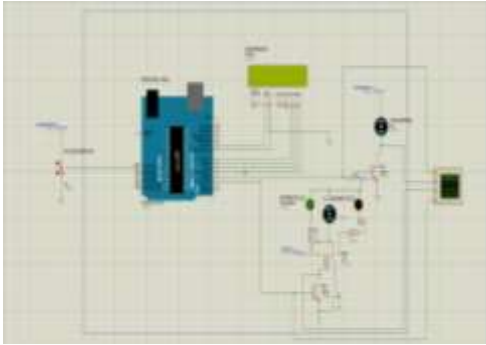

Figure 2: Simulation model of smart channel selection of hybrid vehicles

this are the software blocks available in PROTUS are used in this electric hybrid vehicle simulation. There functioning is explained below at starting we select mode of operation (Electric mode, IC mode, and Auto selection mode) by selecting the selector switch.

For our preferred mode that is auto select mode's operations: at staring we turn ON the switch then controller get the input from potentiometer (variable knob) and turn on the electric hub motor for electric mode of operation through the NPN transistor and normally open relay. as the acceleration increases the speed of vehicle also increases and it will get real time monitored by our controller.by putting the specific speed of electric mode operation in program that is 40kmph is specified. we can also change it by entering the required speed in the program hex file.

In between 1 and 40 kmph the hub motor rotates as per the variation done by the operator through the knob. after that speed, the IC engine that is fuel mode is taking its duty and turn on the second dc motor which is takes part instead of the spark plug. The relay changes its position and complete the circuit of IC mode. as per the operation our lcd display panel shows the speed of vehicle operation of mode and also indicator shows the mode of operation. Green led shows electric mode of operation and red shows the fuel mode.

In other hand the only electric mode only operates the hub motor in operation and only IC mode operates IC engine likewise conventional bike.

VIII. DISCUSSIONS OF RESULT

At initial condition, speed is zero and both IC engine and Hub motor is off.

Figure 3:Characteristics at initial condition Speed= 00 km/hr

At Speed less than or equal to 40 km/hr then, hub motor gets supply and it turns ON. At same time IC engine is OFF.

Figure 4: Characteristics at Speed <= 40

At speed is greater than 40 km/hr then, Spark plug/ starter motor gets supply and because of that IC Engine turns ON. While Hub motor supply is OFF.

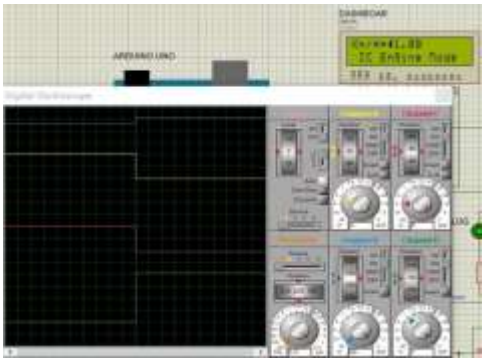

Figure 5:Characteristics at Speed > 40

IX. CONCLUSION

we have successfully planned and executed a working model prototype of the smart channel selection for the hybrid electric bike. We were successfully able to program the microcontroller such that it would measure the speed and switch between the consumption mode accordingly. The vehicle would operate on battery mode during braking phase and switch to the fuel consumption mode at top cruising speed. The dashboard would display the speed of the vehicle and mode selected accordingly.

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