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Review Paper on Smart Regenerative Braking in E-Vehicle using Microcontroller

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Abstract: *This paper presents a discussion regarding regenerative braking of vehicles. The paper is created with a purpose to tell in an exceedingly taciturn method the essence of regenerative braking and totally different strategies, used to accumulate recuperated energy. Vehicles are a broad however terribly exciting and quickly spreading topic regarding the subsequent wants and factors: to lower emissions within the surroundings, to use inexperienced energy sources, redoubled energy demand and consumption etc. Regenerative braking may be a method of speed of an electrical vehicle (plug-in or hybrid) by changing energy to electrical via generator operation of its motor. Regenerative braking will improve energy usage potency and may prolong the driving distance of vehicles. an ingenious sensible regenerative braking system (SRBS) is given during this paper.*

Keywords: Arduino, Regenerative Braking, Electric Vehicle

I. INTRODUCTION

Regenerative Braking System is the way of slowing vehicle by using the motor/generator as brakes. Instead of the surplus energy of the vehicle being wasted as unwanted heat, the generator returns little amount of it to the Main battery. The regenerative braking happening on the vehicle could be a thanks to get additional potency, rather than changing K.E. to thermal energy through resistance braking, the vehicle will convert a good fraction of its kinetic energy back into charge in the battery, using the principle as generator.

II. CONCEPT OF ENERGY REGENERATION SYSTEM

Regenerative braking system proposed in this sheet works on the electromagnetic clutch-based mechanism. Thus, regenerative braking is activated when vehicle is in decelerating motion. When vehicle decelerate in the range 25kmph – 35kmph speed, activation signal is automatically sent to electromagnetic clutch through Arduino and rpm sensor, thus clutch plates engages due to magnetic attraction between solenoid and plate. Due to such engagement of clutch, input torque and rpm is passed to the spur gear which are at the output of the clutch output shaft. Spur gears with suitable gear ratio converts input torque and rpm into a suitable output which is required to the generator. Thus, generator produces electrical energy as the output. Hence input kinetic energy is transformed into electrical energy using generator. This output voltage of generator is step-up using boost converter and further used to store the electrical energy in the main battery

III. LITERATURE SURVEY

Bo Long, Shin Teak Lim, Jemaah Islamiyah Hyoung Ryu and Kill Chong describes Regenerative braking provides a good method of extending the practice range of battery supercharged electrical vehicles. This paper Associate in Nursingalyses the equivalent power circuit and operation principles of a heat unit exploitation regenerative braking management technology throughout the braking amount, the change sequence of the facility convertor is controlled to inverse the output torsion of the three-phase brushless direct- current (DC) motor, so the braking energy are often coming to the battery. Compared with the bestowed strategies, this technology can do many goals: energy recovery, electrical braking, ultra-quiet braking and lengthening the practice range.

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H. Seki, K. Ishihara and S. Tadakuma, describes a unique capacitor regenerative braking in electric powered wheelchairs for efficient driving on downward slopes. "Electric powered wheelchair" that generates the drive force by electric motors is expected to be used as a movability support system for elderly people and disabled people, however, the energy efficiency has to be moreover improved as it is driven only by the battery energy.

Sebastien Glaser, Olivier Orfila, Lydie Nouveliere, Roman Potarusov, Sagar Akhegaonkar, Frederic Holzmann describes Electric vehicles have been attracting unprecedented attention in light of the volatile market prices. and prospect of diminishing supplies of fuel. the vehicle speed is controlled automatically either to keep up a given clearance to a forward vehicle, or to keep up the driving force for desired speed, whichever is lower. We define how we are able to optimize both mode and what is the impact, in term of safety and strategy, together with the information of the long run of the road, integrating a navigation

IV. Specification Of Components

4.1 Arduino Uno

Arduino is associate ASCII text file natural philosophy platform supported easy-to-use hardware and computer code. Arduino unit able to browse inputs - on a detector, a finger on a button associated switch it into an output-activating a motor, turning on associate semiconductor diode, business one thing on-line. you'll be able to tell your board what to try and do by causation a group of directions to the microcontroller on the board.

4.2 MPU 6050

MPU 6050 could be a measuring device that is AN electronic sensing element that measures the acceleration forces working on AN object, so as to see the object's position in area and monitor the object's movement. Acceleration, that could be a vector quantity, is the rate of change of an velocity. There area unit 2 varieties of acceleration forces: static forces and dynamic forces. Static forces area unit forces that area unit perpetually being applied to the thing (such as friction or gravity). Dynamic forces area unit "moving" forces applied to the thing at numerous rates (such as vibration).
This is often why accelerometers area unit employed in automobile collision safety systems, as an example. once a automotive is acted on by a strong dynamic force, the accelerometer (sensing a speedy deceleration) sends AN sign to AN embedded pc, that successively deploys the airbags.

4.3 Ultra Sonic Sensor

An ultrasonic sensing element is AN instrument that measures the gap between object and sensing element by using ultrasonic sound waves. High-frequency sound waves reflect from boundaries of object to produce distinct sound patterns. (echo)

4.4 Hall Effect Sensor

A Hall result detector that detects the presence and magnitude of a field of force using the Hall result. The output voltage of a Hall detector is directly proportional to the strength of the field. Hall sensors are used for sensing positioning, speed detection of moving object, and current sensing applications. To measure RPM the hall effect sensor is used

4.5 Motor Driver

The most commonly used actuator in any electronic device will be motors next to solenoids, pneumatics and hydraulics. from a straightforward vibration motor within a portable to advanced stepper motors in CNC machine, these DC machines are often found all over. to regulate a motor employing a Microcontroller or processors we'd like one thing known as a Motor Driver or Motor Controller need of proposed System

4.6 Limit Switch

In technology, a limit switch could be a switch operated by the motion of a machine part or the presence of associate object. A limit switch are often used for controlling machinery as a part of a control system, as a security interlock, or as a counter enumerating objects passing some extent

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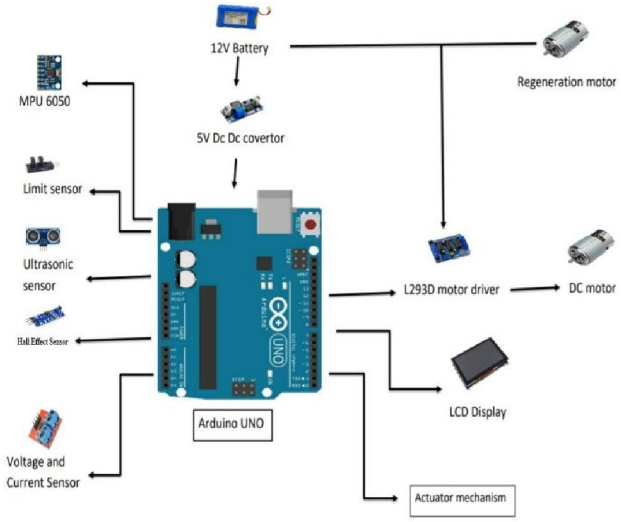
Limit switches ar utilized in a range of applications due to their toughness, easy installation, and reliableness of operation. they will determine the presence, passing, positioning, associate degreed finish of travel of an object. They were 1st used to define the limit of travel of associate object, thus the name "limit switch

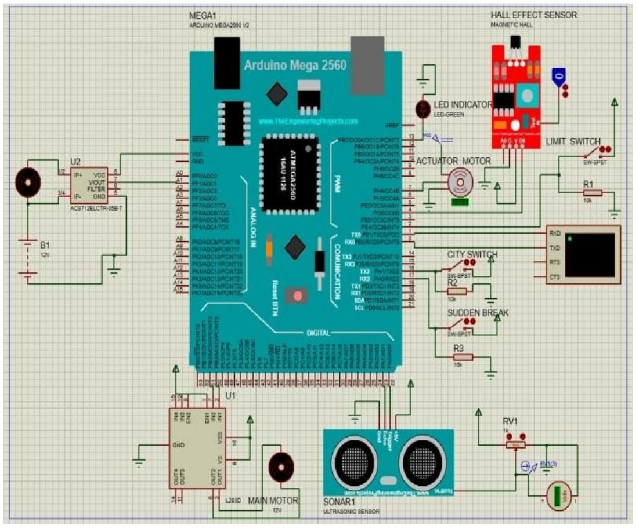
V. Need of Proposed System

Regenerative braking turns your vehicle kinetic energy into electricity to charge its battery and boost efficiency. Nowadays we are shifting towards the electric automobile industry because lack of conventional energy sources, but there are some challenges in newly developing and its one of challenges is that to cover maximum distance in single charge, That's why there is need to things get done advanced or get innovative so we introduce this system.

VI. Block Diagram



VII. Circuit Diagram



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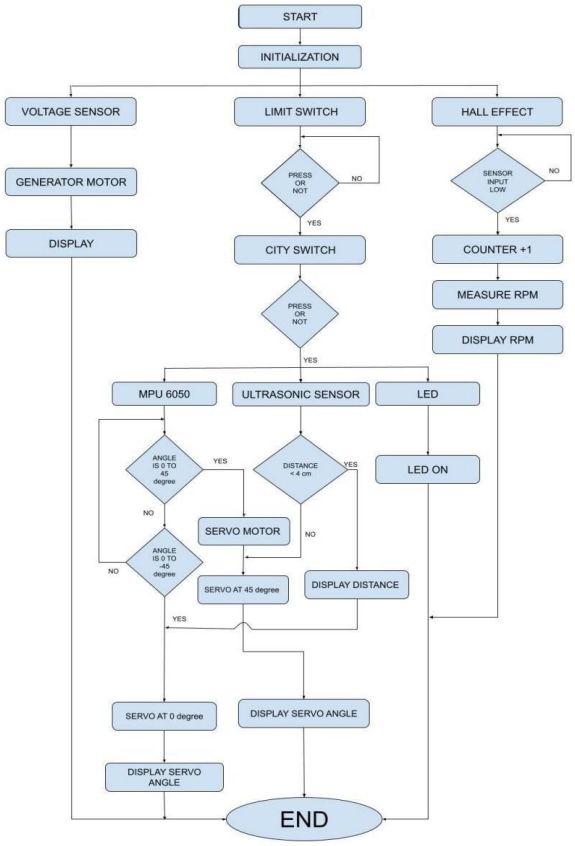
VIII. FLOW CHART



IX. CALCULATION

Calculation

Transmitted power:

$Pa = T \times w = 0.56556$ KW

Input maximum speed (n) = 270 rpm

Safety factor= 2

Output power= P

Mass Moment of inertia (I) = $Own\ moment\ of\ inertia + additional\ moment\ of\ inertia$

Mass Moment of inertia (I) = 0.000849 Nm

Output Power from generator (P): 400 W Input speed (N) = 600 rpm

$$Load\ torque(T) = \frac{P \times 60}{2 \times \pi \times \text{input speed}}$$

$$= \frac{40 \times 60}{2 \times \pi \times 600} = 6.365372 \text{ Nm}$$

Selection of electromagnetic clutch:

Drive torque (M_A) = $9550 / Pa \times n$

$M_A = 20.00406$ Nm

Required Torque (M_{erf}) $\geq k \times Ma$

$M_{erf} \geq 40.00813$

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Switchable Torque (M_S): >=Merf

M_S= 40 Nm

Thus according to table the clutch size that satisfy the switchable torque at given speed ie. n= 270 rpm is size 4.

Acceleration torque of clutch (M_a):

$M_a = M_S + M_L = 40 + 6.365372 = 46.365372$ Nm

Acceleration Time (t_a):

$$t_a = \frac{I}{9.55 M_a} \times \text{input speed}(n) + t1$$

t_a = 0.065 sec

t1 (switch on time of clutch), M_a,

Ieig are the values taken from technical datasheet and table shown atbottom. Friction work per acceleration (Qa):

Qa= I×n2×Ms = 0.292736 J 182.4×Ma

Number of switching until re-adjustment (Zn):

$Z_n = Q1 \times (an - a)$

Qa =409925666

switching. Number of switching untilwear limit (Z):

$Z = Q_{ges} = 25 \times 107$

Qa 0.292736

Z = 854011805 switching.

X. Objective of Proposed System

The objectives of this project are:

To increase efficiency by smart regenerative system prove mechanical / electrical energy transmission system that can be applied in every application

XI. Conclusion

The aim is to design and implementation of this system that is directly targeted to the conventional vehicle so that the systems become stable, smart. Also efficiency of system will increase. Regenerative braking is one of the important systems in electric vehicle, since it has the ability to save the waste energy up to 8-20%. In this system three are we use some sensor like ULTRA SONIC SENSOR, HALL EFFECT, LIMMIT SENSOR, etc which helps the system to become smart

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