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Intelligent Inertial Control Unit for Electric Vehicles to Boost Battery Backup

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ABSTRACT: The government of India has launched "MISSION EV" to make all the vehicles electric as soon a possible. However the major drawback faced by the Automobile manufacturers and government is the hurdle of battery life and setting up of charging stations. The proposed project deals with the concept of Inertial control unit in electric vehicles to maximize battery life to maximize the battery life. The proposed project involves development of model of electric vehicle drivetrain with intelligent inertial control unit. The inertia is controlled using the on board inertial measurement units, and if the system is capable of sustaining the motion at present speed, the intelligent system becomes active. The intelligent system controls the battery consumption by breaking the battery circuit from time to time thereby saving diagram. When the inertia drops below self-sustenance level the system deactivates giving continuoussupply from battery.
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KEYWORDS: Mission EV, battery life, inertia, battery circuit, self-sustenance etc.

I. INTRODUCTION

Increasing in the number of travelling vehicles has increasing the problems such as air pollution and to the use of petroleum. The human sensibility for the energetic and environmental problem is encouraging the research in alternative solutions for the automotive field, as multiple-fueling, hybridization and electrification. At the same time the systems aremodified considering the current problems. For this the solution is the electrically assisted bikes. The electrically assisted bikes are normally powered by rechargeable battery, and their driving performance is influenced by battery capacity, motor power, road types, operation weight, control, and, particularly, by the management of the assisted power.

Electrical bike can be classified as 1: Pedal Assist / Pedelec

The most common type of electric bike is the pedal assist or pedelec. The rider pedals the bike normally while a motor provides assistance, increasing the power transmitted to the rear wheel. The pedaling takes far less effort than it normally would, even in high gears, which allows for higher speeds and effortless climbing over steep hills. Settings can control the amount of assistance the rider desires butto be considered a Class 1 e-bike in most of Europe, the system cannot provide assistance over 25 kilometers per hour (kph) or approximately 15 miles per hour. In the US this class is limited to approximately 32 kph or 20 mph. A class 1 designation allows these bike to be used on most roads and paths where normal bikes are allowed anddo not require any additional licensing.

2: Throttle

Much like a motorcycle or scooter, a throttle operated e-bike propels the bike forward without any additional pedaling from the rider. Most can provide a variable amount of power depending how far the throttle is pushed. These are much less common than their pedal assist counterparts as many countries have laws that prohibit them entirely. The European Union requires an e-bike only provide power while the pedals are moving forward, so throttle e-bike are most common in the United States and China where little legislation exists to limit theiruse.

3: Speed Pedelec

The design of a speed pedelec is similar to a standard pedelec but as the name implies, they allow for a higher top speed of 45 kph or approximately 28 mph. In many areas this class of e-bike is considered a motor vehicle requires its riders to be licensed.

Proposed system is combination electric hybrid vehicle with could connection. This system is designed to save the battery life and also to monitor the bike state and health. for the emergency case the

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GPS module is used.

II. LITERATURE STUDY

Before arriving at the problem definition a number of research papers form national and international journals were studied and then the problem definition was arrives based on this the objectives of the project were formulated. Some of the notable ones are given below.

1. C. Abagnalea, "Design and Development of an Innovative E-Bike"

Author presents the electric motor position; the new mechanical transmission; the low cost measurement system of the driving torque; the special test rig. Differently from a common approach, in which the electric motor is located on one of the three hubs of the bicycle, the idea of the pedelec prototype consists of an electrical motor in the central position that, by means of a bevel gear, transmits the torque on the central hub.

2. Mr. Mragank Sharma1, " Design and Fabrication of Regenerative Electric Bike" Regenerative braking refers to a process in which a portion of the kinetic energy of the bike is stored for a short term by the storage system. To gain the power, they assemble the brushed dc motor, l-clamp iron bar and frictional pulley clamp above the hub of front pulley. As the rider apply brake, system actuate the fractional pulley meshed with the centre hub of wheel which rotates frictional pulley in opposite direction of the wheel due to which the armature of dc motor rotates and convert mechanical work into useful electrical energy (charge) which is stored in the battery. Additional energy increases the discharging time of battery so that electric bike can move long distance. Hence efficiency of the bike is improved.

3. Soniya.K.Malode, "Regenerative Braking System in Electric Vehicles"

In this system they have proposed easy and useful method of regenerative braking in electric vehicle. The main aim of the author is to focus on having influence on brake energy regeneration that is usable is discussed.

4. Nitipong Somchaiwong, "Regenerative Power Control for Electric Bicycle"

In this system they have used PM brushless dc motor on electric bike. Also they have described a studying and designed regenerative power control for an electric bicycle.

5. P. Spagnol, "A Fully Hybrid Electric Bike: How to Increase Human Efficiency",

The main idea, borrowed from the more explored 4-wheel world, is to use the possible energy fluxes between cyclist and motor in order to improve the efficiency of the primary engine (the human body) being completely self-sustaining and grid- independent (differently to all the other EPACs). Collected biometric data that lead to the algorithm design are presented in detail focusing particularly on human metabolic efficiency measurement.

III. SYSTEM ARCHITECTURE

As shown in the block diagram the project consists of the concept intelligent inertia control system for electric vehicles. As shown in the block diagram, the system consists of smart inertial measurement system which will continuously monitor the inertia, speed and acceleration of the system. If the system reaches a stage where it has got inertia capable of self-sustenance, the smart intermittent battery triggering circuit will be activated which will break the battery circuit intelligently from time to time saving or boosting the battery backup in electric vehicles. The proposed system is demonstrated on the frame using all the drive components of an electric vehicle.

Components used in this system are:

- **Battery**: To give the power to entire system/circuit.
- **Arduino** Nano: It is a microcontroller used to monitor and control the system. All sensors are connected to Arduino. Arduino reads data from all sensor and process the output.
- **Joystick:** It is used to simulate the entire system.
- **IMU Sensor**: It is used to measure the inertia.
- **Speed Sensor:** It used to measure the speed of vehicle.
- **Battery auto cutoff circuit:** To cut the power supply from battery when the inertia reaches threshold.
- **LCD Display:** It is used to display information regarding system operations.
- **Motor Driver:** It acts as interface between motors and controller. Using this we can control motor speed and direction.

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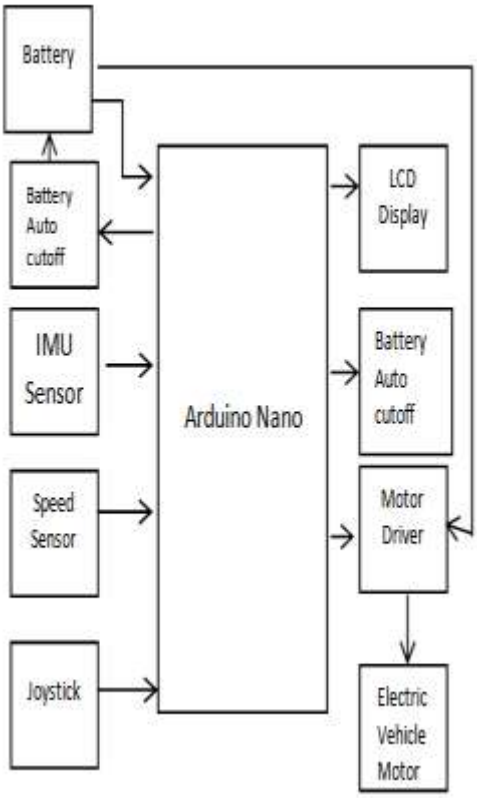

IV. APPLICATIONS AND ADVANTAGES

1. The proposed system can help bring an economical electric vehicle to the market
2. The proposed project can help solve the major hurdle in Electric vehicle implementation which is Battery backup
3. The proposed project Supports India's Electric Mobility mission
4. The Proposed project implements hybrid intermittent triggering system, which will save our battery to larger extent.

V. HARDWARE AND SOFTWARE USED:

1. Arduino nano

The microcontroller board.

The microcontroller board is required on the transmitter side as well as receiver side. The transmitter side is to read the data from the joystick and send it wirelessly to the robotic vehicle. The receiver side is to take appropriate decisions of the robot.

Thus two microcontroller boards are used in this project.

A **microcontroller** (sometimes abbreviated **µC**, **uC** or **MCU**) is a small computer on a single integrated circuit containing a processor core, memory, and programmable input/output peripherals. Program memory in the form of Ferroelectric RAM, NOR flash or OTP ROM is also often included on chip, as well as a typically small amount of RAM. Microcontrollers are designed for embedded applications, in contrast to the microprocessors used in personal computers or other general purpose applications.

Microcontrollers are used in automatically controlled products and devices, such as automobile engine control systems, implantable medical devices, remote controls, office machines, appliances, power tools, toys and other embedded systems. By reducing the size and cost compared to a design that uses a separate microprocessor, memory, and input/output devices, microcontrollers make it economical to digitally control even more devices and processes. Mixed signal microcontrollers are common, integrating analog components needed to control non- digital electronic systems.

2. Electric Drive Train:

The drive train is nothing but the transmission system of the Robot which makes it move forward.While selecting the type of drive train, load and speed was the major decision criterion. The movement of the Robot can be done by using actuators. There are two type of actuators, I.C engines and electric motors. As I.C engine is not econocmic and feasible we decided for electric actuators.

The two main kinds of DC motors are,

- DC motors with brushes: This particular motor is capable of generating a swinging current in the armature or the wound rotor using a split ring commutator ore a magnet stator.
- DC motors without brushes: In this motor there is a mechanical rotating switch or external electronic switch placed just in the motor's place.

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3. IMU sensor

The IMU sensor stands for intertial measurement unit. It is responsible for measuring the inertia of the system and trigger the inertia intermittent triggering system. It is used in combination of Inductive proximity sensor to measure the speed as well. MPU 6050 IMU sensor is used in this project. The MPU6050 is a Micro Electro- Mechanical Systems (MEMS) which consists of a 3-axis Accelerometer and 3- axis Gyroscope inside it. This helps us to measure acceleration, velocity, orientation, displacement and many other motion related parameter of a system or object. This module also has a (DMP) Digital Motion Processor inside it which is powerful enough to perform complex calculation and thus free up the work for Microcontroller.

4. Joystick

The joystick module is used to control the land mine detection robot. The joystick in the pictureis nothing but two potentiometers that allow us to measure the movement of the stick in 2-D. Potentiometers are variable resistors and, in a way, they act as sensors providing us with a variable voltage depending on the rotation of the device around its shaft.

The kind of program that we need to monitor the joystick has to make a polling to two of the analog pins. We can send these values back to the computer, but then we face the classic problem that the transmission over the communication port has to be made with 8bit values, while our DAC (Digital to Analog Converter - that is measuring the values from the potentiometers in the joystick) has a resolution of 10bits. In other words this means that our sensors are characterized with a value between 0 and 1024.

Software Used:

1. Arduino IDE

The software used to program the microcontroller is the arduino IDE. Arduino is an open-source computer hardware and software company, project and user community that designs and manufactures kits for building digital devices and interactive objects that can sense and control the physical world. Arduino boards may be purchased preassembled, or as do-it-yourself kits; at the same time, the hardware design information is available for those who would like to assemble an Arduino from scratch.

The project is based on a family of microcontroller board designs manufactured primarily by SmartProjects in Italy, and also by several other vendors, using various 8-bit AtmelAVR microcontrollers or 32-bit Atmel ARM processors. These systems provide sets of digital and analog I/Opins that can be interfaced to various extension boards and other circuits. The boards feature serial communications interfaces, including USB on some models, for loading programs from personal computers. For programming the microcontrollers, the Arduino platform provides an integrated development environment (IDE) based on theProcessing project, which includes support for C andC++ programming languages.

The arduino board is connected to pc and the program is burnt onto the microcontroller board. The figure below shows the arduino integrated development environment for compiling and uploading the programs to arduino board.

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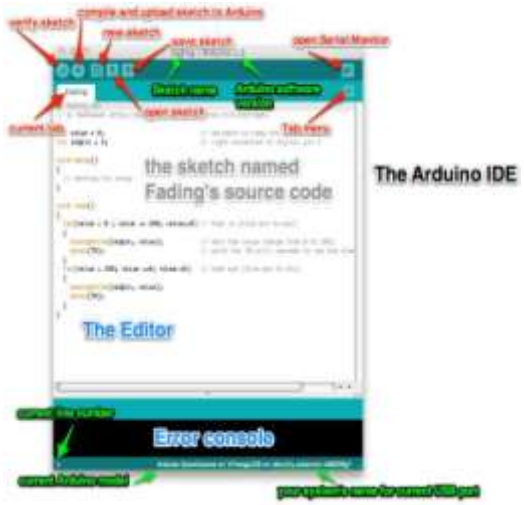
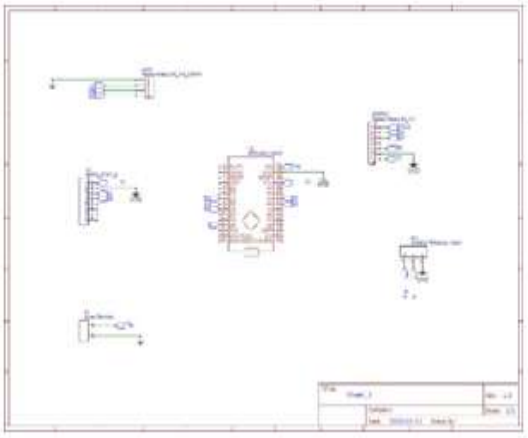


The arduino IDE Schematic design



REFERENCES

[1]. C. Abagnalea , M. Cardoneb , P. Iodicea, R. Marialtoc , S. Stranoa , M. Terzoa , G. Vorraro, Design and Development of an Innovative E-Bike, 71st Conference of the Italian Thermal Machines Engineering Association, ATI2016, 14-16 September 2016, Turin, Italy

[2]. Mr. Mragank Sharma , Anshul Verma , Gaurav Tiwari , Sunny Singh , Mohd Nadeem, Design and Fabrication of Regenerative Electric Bike, International Journal of Engineering Science and Computing, May 2016

[3]. SONIYA.K.MALODE, R.H.ADWARE, REGENERATIVE BRAKING SYSTEM IN ELECTRIC VEHICLES, International Research Journal of Engineering and Technology (IRJET), Mar-2016

[4]. Nitipong Somchaiwong' and Wirot Ponglangka2, Regenerative Power Control for Electric Bicycle, SICE-ICASE International Joint Conference 2006

[5]. P. Spagnol ; G. Alli ; C. Spelta ; P. Lisanti ; F. Todeschini ; S. M.Savaresi ; A. Morelli, A Fully Hybrid Electric Bike: How to Increase Human Efficiency, 2012 American Control Conference (ACC), 27-29 June 2012