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Smart E-Scooter

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A B S T R A C T

The increase in the number of vehicles has led to environmental and energy problems. To address these issues, the automotive industry has explored multiple solutions, including hybridization and electrification. Electrically supported bikes, powered by rechargeable batteries, have emerged as a popular alternative. They can be classified as pedal help, throttle important, or speed pedelec. The proposed system is a smart electric vehicle with accident prevention systems, including helmet-based ignition, alcohol intoxication detection, and automatic side stage. These smart systems make the vehicle fully accident-proof.

Keywords: Mission EV, smart, automatic side stand, Alcohol, GPS, SMS, accident etc.

Introduction

Preface adding in the number of travelling vehicles has adding the problems similar as air pollution and to the use of petroleum. The mortal sensibility for the energetic and environmental problem is encouraging the exploration in indispensable results for the automotive field, as multiple- fueling, hybridization and electrification. At the same time the systems are modified considering the current problems. For this the result is the electrically supported bikes. The electrically supported bikes are typically powered by rechargeable battery, and their driving performance is told by battery capacity, motor power, road types, operation weight, control, and, particularly, by the operation of the supported power.

Electrical bike can be classified as

1 Pedal lift/ Pedelec: The most common type of electric bike is the pedal help or pedelec. The rider pedals the bike typically while a motor provides backing, adding the power transmitted to the hinder wheel. The pedaling takes far lower trouble than it typically would, indeed in high gears, which allows for advanced pets and royal climbing over steep hills. Settings can control the quantum of backing the rider solicitations but to be considered a Class 1e-bike in utmost of Europe, the system cannot give backing over 25 kilometers per hour(kph) or roughly 15 long hauls per hour. In the US this class is limited to roughly 32 kph or 20 mph. A class 1 designation allows these bikes to be used on utmost roads and paths where normal bikes are allowed and don't bear any fresh licensing.

2 Throttle important like a motorcycle or scooter, a throttle operated e-bike propels the bike forward without any fresh pedaling from the rider. utmost can give a variable quantum of power depending how far the throttle is pushed. These are much less common than their pedal help counterparts as numerous countries have laws that enjoin them entirely. The European Union requires ane-bike only give power while the pedals are moving forward, so garrote e-bike are most common in the United States and China where little legislation exists to limit their use.

3 Speed Pedelec The design of a speed pedelec is analogous to a standard pedelec but as the name implies, they allow for a advanced top speed of 45 kph or roughly 28 mph. In numerous areas this class of e-bike is considered a motor vehicle requires its riders to be certified.

Proposed system is smart electric vehicle with accidental safety systems. The proposed electric vehicle corresponds of smart systems which makes it unborn evidence and is incorporated with accident forestallment systems using smart technologies similar as helmet grounded ignition, Alcohol intoxication, automatic side stage and other smart systems which make the vehicle fully unborn evidence.

2. Structure

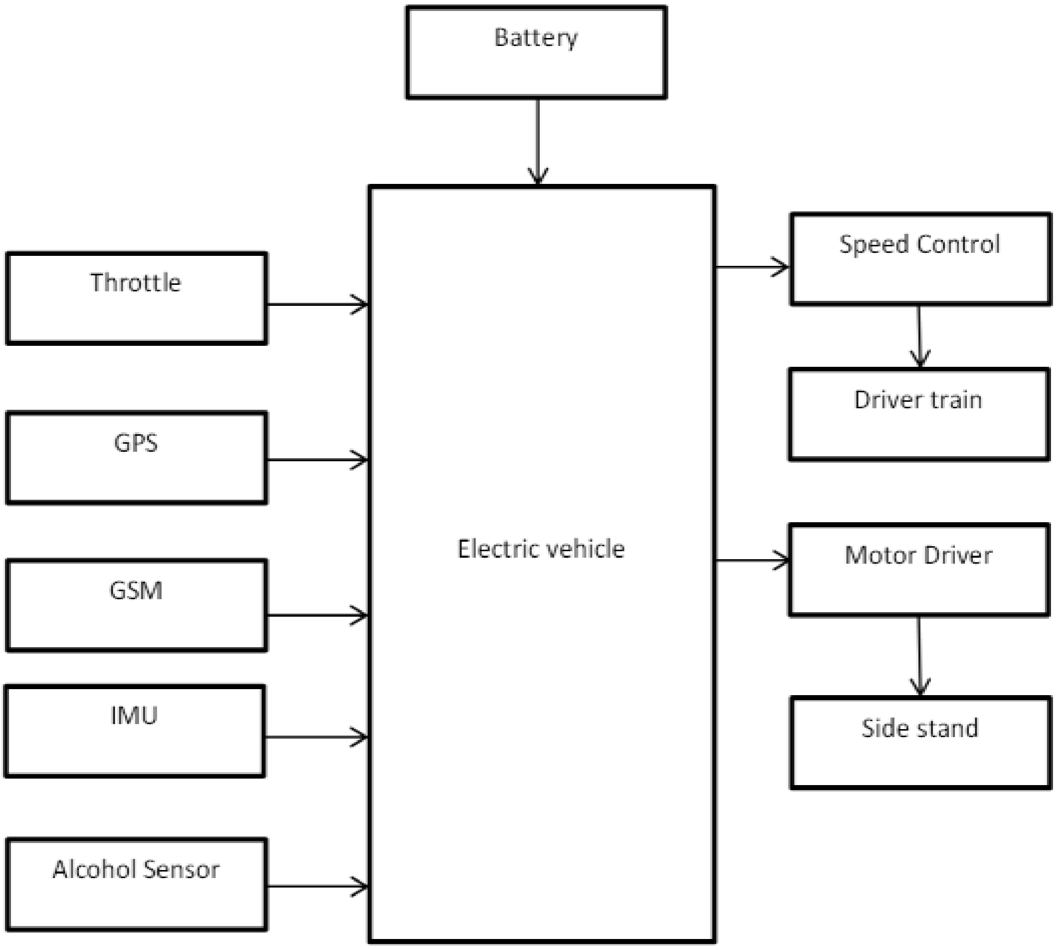
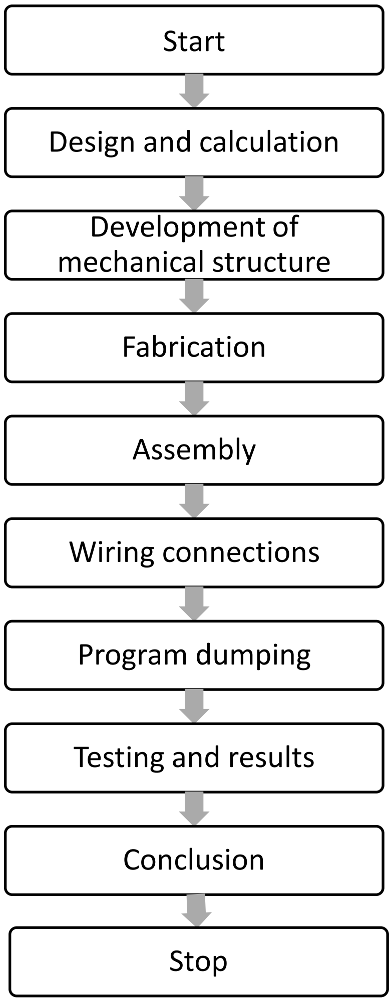


Fig 1.1: block diagram

As shown in the block diagram the project consists of development of smart electric vehicle with accident prevention systems. The project consists of fabrication of electric vehicle with smart systems. As shown in the block diagram the project consists of following parts. The electric vehicle, the Smart side stand system, the Alcohol intoxication system, the Helmet sensing system and accident notification system. The alcohol sensor senses the content of the alcohol and if the alcohol content is detected the bike ignition will be turned off. Similar is the case for the helmet-based ignition system. Ensuring the rider's safety is our top priority, which is why our vehicle has a cutting-edge feature that prevents it from starting unless the rider is wearing a helmet. The IMU sensor detects the accident and if accident is detected the family members of the person will be informed automatically using text message. The side stand gets activated automatically once the vehicle is turned off. The IMU sensor detects the accident and if accident is detected the family members of the person will be informed automatically using text message. The side stand gets activated automatically once the vehicle is turned off.

3. Methodology:



The given flow chart outlines the various steps involved in the process of building a mechanical and electrical system. The first step, design and calculation, forms the foundation of the project, as it involves extensive planning and research to determine the feasibility of the project. The next step involves the development of a mechanical structure that is capable of fulfilling the desired functions of the system. After designing the structure, fabrication takes place where the components are created. Once the various components are ready, assembly takes place, where they are put together to form the final product. The wiring connections and program dumping provide the system with electrical capabilities. After completion, the system undergoes extensive testing to ensure that it functions as intended.

3.1 Working: The process begins by turning on the switch, which activates the power supply and initiates the operation of the vehicle's microcontroller. This microcontroller is designed to receive signals from various sensors. Among these sensors, it first detects the NONC switch positioned on top of the helmet and also senses the signal from the alcohol sensor located at the front of the helmet. The data collected from these sensors is then transmitted to the microcontroller for further analysis and processing.

Upon receiving the data, the microcontroller performs an analysis specifically focused on detecting the presence of alcohol. If alcohol is detected, an alert is generated, and the relevant information is displayed on the LCD screen. Additionally, the microcontroller prompts the user to present an RFID-enabled license. Failure to present a valid license result in the ignition remaining inactive as a safety measure.

Once all the necessary parameters have been successfully verified, the ignition is enabled. This information is then relayed to the microprocessor or microcontroller, depending on the specific system design. The microprocessor processes the data accordingly and subsequently sends a signal to the servo motor responsible for lifting the stand of the vehicle. This action allows the vehicle to be driven once the stand is properly lifted and secured.

4. Components used:

Hub motor: A hub motor with a power output of 350 watts is a relatively low-powered motor that is commonly used in electric bicycles and other electric vehicles. This type of motor is typically mounted in the hub of the wheel and provides direct drive to the wheel, eliminating the need for gears and other mechanical components. While 220 watts may seem low, it can still provide enough power to propel an electric bike at speeds of up to 20 miles per hour on flat terrain, with a range of up to 20 miles on a single charge.

Fig 4.1: hub motor

Microcontroller: The ESP-WROOM-32 is a Wi-Fi module that features the ESP32-D0WDQ6 processor and 32Mbit of built-in flash memory. It also comes with an onboard PCB antenna and supports a range of peripheral interfaces such as UART, GPIO, ADC, DAC, SDIO, PWM, I2C, and I2S. The module supports the IEEE 802.11 b/g/n Wi-Fi protocol and Bluetooth 4.2, and operates within a frequency range of 2.4G to 2.5G (2400M to 2483.5M). It supports three Wi-Fi modes: Station, Soft AP, and Soft AP + Station. The module requires a 5V power supply and operates at a logic level of 3.3V. Its dimensions are 48.26mm x 25.4mm.

Fig 4.2: ESP-WROOM-32

Battery: The battery used in this design is 12 V 14AH sealed supereminent acid battery. The project used 2 Batteries to power the entire system. The batteries used in the project are 12V Batteries.

Fig 4.3: 12v battery

IMU sensor: The MPU6050 sensor module is a 6-axis motion tracking device that combines a 3-axis gyroscope, a 3-axis accelerometer, a digital motion processor, and a temperature sensor in a single integrated circuit. The module can also accept inputs from other sensors such as a 3-axis magnetometer or pressure sensor using its auxiliary I2C bus. If an external 3-axis magnetometer is connected, it can provide complete 9-axis motion fusion output. A microcontroller can communicate with the module using the I2C communication protocol, and various parameters can be found by reading values from addresses of certain registers using I2C communication.

Fig 4.4: IMU sensor

GSM modem: The SIM800L GSM cellular chip from SimCom is the core component of a GSM modem module used for wireless communication The operating voltage of the chip is from3.4 V to4.4 V, which makes it an ideal seeker for direct LiPo battery force. This makes it a good choice for bedding into systems without a lot of space. All the necessary data legs of SIM800L GSM chip are broken out to a0.1 ″ pitch heads. This includes legs needed for communication with a microcontroller over UART. The module supports baud rate from 1200bps to 115200bps with bus- Baud discovery to connect to a network, a GSM modem module requires an external antenna. The module generally comes with a spiral Antenna and solders directly to NET leg on PCB.

Fig 4.5: GSM modem

LCD Display: LCDs (Liquid Crystal Displays) are used in bedded system operations for displaying colourful parameters and status of the system. TV 16x2 is a 16- leg device that has 2 rows that can accommodate 16 characters each. TV 16x2 can be used in 4- bit mode or 8- bit mode. It's also possible to produce custom characters. The GSM modem has 8 data lines and 3 control lines that can be utilized for various control purposes.

Fig 4.6: LCD display

5. DESIGN CALCULATIONS

Gross vehicle weight GVW = 170 KG (Considering person weight of 120 Kg plus max vehicle weight of 50 kg)

= 170*9.81

= 1667.7 N

Weight on each drive wheel (WW) = 1667.7/2

=833:8…5N

Radius of wheel/tire (RW)= 0.22 m

Desired top speed (Vmax)=25 Kmph=6.94 m/s

Desired acceleration time (ta)= 40 sec

Maximum incline angle = 2 degrees Working surface= concrete (good)

Total tractive effort (TTE) requirement for the vehicle: TTE = RR + GR + FA

Where:

TTE = Total Tractive Effort [N]

TTE = Total Tractive Effort [N]

GR = Force required to Climb a Grade [N]

FA = Force required to accelerate to final velocity [N]

The components of this equation will be determined in the following steps.

Calculation of Rolling Resistance:

Surface type to be encountered by the vehicle should be factored into the equation. Rolling Resistance (RR) is the force necessary to propel a vehicle over a particular surface.

RR = GVW x Crr

=1667.8 x 0:01 (good concrete) = 16.67 N

= 1667.8 x 0.37 (mud) = 617.08 N

= 1667.8 x 0.37 (mud) = 617.08 N

= 1667.8 x 0.60 (sand) = 1000.68 N

Where:

RR = Rolling Resistance [N]

GVW = Gross Vehicle Weight [N]

Crr = Surface Friction (value from Table below)

Contact Surface	Crr
Concrete (good / fair / poor)	.010 / .015 /.020
Asphalt (good / fair / poor)	.012 / .017 / .022
Wood (dry/dusty/wet)	.010 / .005 / .001
Surface Snow (2 inch / 4 inch)	.025 / .037
Dirt (smooth / sandy)	.025 / .037
Mud (firm / medium / soft)	.037 / .090 / .150
Grass (firm / soft)	.055 / .075
Sand (firm / soft / dune)	.060 / .150 / .300

Calculation of Grade Resistance:

Grade Resistance is the amount of force necessary to move a vehicle up a slope or grade. This calculation must be made using the maximum angle or grade the vehicle will be expected to climb in normal operation.

To convert incline angle, to grade resistance.

GR = GVW x sin (ϴ)

= 1667.8 x sin 20 = 58.20 N

Where:

GR = Grade Resistance [N]

GVW = Gross Vehicle Weight [N]

α = Maximum Incline Angle [degrees]

Calculation of the acceleration Force:

Acceleration Force (FA) is the force necessary to accelerate from a stop to maximum speed in a desired time

FA = GVW x Vmax / (9.81 x ta)

= 1667.8 x 6.94 / (9.81 x 40) = 29.49 N

Where:

FA = Acceleration Force [N] GVW = Gross Vehicle Weight [N]

Vmax = Maximum speed [m/s]

ta = time required to achieve maximum speed [s]

89Calculation of total tractive effort:

The Total Tractive Effort (TTE) is the sum of the forces calculated in steps 1, 2, and 3. (On higher speed vehicles friction in drive components may warrant the addition of 10 to 15 percent of the total tractive effort to ensure acceptable vehicle performance.)

TTE = RR + GR + FA

= 16.67 N + 58.20 N + 29.49 N = 104.36 N

Determination of Wheel Motor Torque:

To verify the vehicle will perform as designed in regards to tractive effort and acceleration, it is necessary to calculate the required wheel torque (TW) based on the tractive effort.

TW = TTE x RW x RF

= 104.36 x 0.22 x 1.1 = 25.25 N.m

Where:

TW = wheel torque [N-m]

TTE = Total Tractive Effort [N]

RW = radius of the wheel/tire[m]

RF = Resistance Factor [-]

The resistance factor accounts for the frictional losses between the caster wheels and their axles and the drag on the motor bearings. Typical values range between 1.1 and 1.15 (10 to15%)

5.1 Existing system:

The existing system of electric bikes or scooters has come a long way since the first models were introduced. These vehicles run on an electric motor that powers the wheels, instead of using fuel. They are eco-friendly, quiet, and require minimal maintenance. Electric bike manufacturers have introduced models with a range of up to 100 miles per charge and top speeds that can reach 28 mph. As for electric scooters, they are ideal for commuting in urban areas, especially for short distances. Many models have a range of up to 15 miles, and they can achieve speeds of 15-20 mph. With the ongoing advancements in battery technology, manufacturers are also working to develop efficient, lightweight, and long-lasting batteries that can power electric bikes and scooters for longer periods. Overall, the existing system of electric bikes and scooters is revolutionizing the way people commute, and they are a more sustainable alternative to traditional modes of transportation, especially for short distances within urban areas.

5.2 Comparison between existing system and proposed work:

Criteria	**Existing system**	**Proposed project work**
Alcohol detection	Not present	Present
Stand indictor	Present	Present
Accident SOS calling	Not present	Present
Auto speed reducing	Not present	Present
License identification	Not present	Present
GPS system	Present	Present
Regenerative braking	Not present	Not present

6. Results:

- Upon starting the bike, the LCD display will show a smart electric vehicle notification.
- The initialization process for the hotspot or Wi-Fi connection will take place during this time.
- The ignition status will be displayed on the LCD screen, and if any alcohol or fragrance is detected with the help of MQ3 sensor within the helmet.
- The LCD display will show a notification indicating the alcohol detection.
- Once the alcohol detection is cleared, the system will prompt for a valid vehicle run license with the help of EM-18 module.
- If a valid license is provided, the display will confirm its validity.
- The bike will enter the running mode, which will be indicated by an online status on the display.
- While in running mode, the bike can be accelerated to a maximum speed of 25 km/h, with the RPM reaching a maximum of 600.

Conclusion:

In conclusion, the integration of advanced technological features in electric scooters has significantly enhanced their safety, efficiency and user experience. The proposed work, which includes alcohol detection, stand indicator, accident SOS calling, automatic speed reduction, license identification, and GPS system, would undoubtedly take electric scooters to a whole new level. The alcohol detection feature would thwart drunk driving, while the automatic speed reduction feature would drastically reduce the occurrence of accidents. The accident SOS calling, license identification, and GPS system would ensure prompt recovery and identification of the vehicle or rider in case of an accident. Finally, the stand indicator feature would help curb haphazard parking, thereby minimizing accidents. Overall, the proposed work would revolutionize the electric scooter industry, making them safer and more convenient for riders.

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