

Hardware (Sensors) For E- Bicycles

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Abstract: *We're living in the future. Everything around us is changing, Major reason for this is the technology which has improved our lives, whether is for medicines, renewable energy or new ideas around sports to keep us active and live longer. One of these changes is the electric bicycle. Electric bicycles are one of the most efficient and easy means of travelling. Traffic has been an enormous issue which has become a daily challenge to face. The bicycle can be a solution for solving this problem. On the better side, Electric bicycles are introduced to seek a solution where people can feel the exhaustion from riding them to a faraway place. The paper discusses various sensors and their interfacing being incorporated into the overall electrical system of the e-bicycles. Sensors are used for monitoring, controlling and safety of our bicycles. When and how much support and power you receive from the battery is determined by the sensor on your e-bike. Sensors like The cadence sensor which determines if you are pedalling is more like a switch. It gives a signal to the motor to activate when you start pedalling and will turn off when pedalling stops. It will apply power based on the pedal assist level. Another sensor which we have used is a tilt sensor which is a type of position sensor which are used to measure the angle and the slope of the object. Along with this Hub motors, GPS tracker, Alarm system, Bluetooth connectivity, touch screen display, Electronic Break Lever, and LCD Display are also interfaced with the Arduino Microcontroller. Our goal in using various sensors and other interfaces in e-bicycle is to create a more comfortable, easily accessible transport alternative that can overcome heavy traffic, provide a more friendly way by helping reduce pollution, and make a change in the fitness world.*

Keywords: E- Bicycle, Sensors, Cadence Sensors, Tilt Sensors, Alarm System, LCD Display.

1. INTRODUCTION

In transportation field a lot of modification have been done using high technology For travelling, we have quite a lot of the range of hi-tech vehicles still the importance of Bicycles cannot be neglected. Bicycles are easy to use, lightweight, environment-friendly, and do not cost a lot to operate as it doesn't consume fuel. It is very efficient to travel small distances but travelling for a long distance on a bicycle can be difficult. Moreover, it has less prone to heavy casualties, thereby making it safer transportation. Besides this, it has health benefits, just the same way as any physical exercise. Similar to this, e-bicycles are the modified version of the same. To make the ride smooth, the difference between a normal bicycle and an e-bicycle is the application of the motor system and the use of the controller

to control the motor system. The motor is used to give external power to make the ride comfortable. E-bicycles are better than normal bicycles as the rider gets additional power when it is required. In this rider has the choice when to switch on the motor like on an uphill or strenuous long road, he can switch on the battery, and thereby activate the motors. Then the motor compensates for the required power and this way the ride becomes smoother all the way. It is up to the rider when he wants to switch on the power. He can choose a motor to propel for his support or use it when he actually needs it. There are various modes which the rider can choose depending on the condition of the road, and the amount of speed the rider is desired in riding.

1.1 Problem Statement

Everyone around us uses a normal bicycle which has its own benefits but it has some issues like while riding on a terrain where it gets difficult to ride, For long-distance travel, it is not possible to travel on a normal Bicycle which can be solved by using Motor Bike but a Motor Bike is not environment friendly as they consume Fuels. With increasing pollution, traffic in urban cities, Fuels prices hiking there is a need for E-bicycle. By implementing different Sensors onto our E-bicycle we can make our ride smooth, environment-friendly and feasible to travel for long distances.

1.1 Objectives

- The main objective of building an E-Bike is to go eco-friendly, eliminate the use of fuel contributing to reducing the environmental pollution, cost-effective and easy for anyone to purchase.
- It will be built in a way to require less time to charge efficiently, and modified using hi-tech to give customers more features and user-friendly experience.
- E-Bikes will be integrated with multiple features which will make the ride smoother and rider safe from accidents.

2. Literature Review

Table1. Comparison of different models made in the Research of E-Bicycle.

Sr. no	Year of Publication	Author Name & Paper Title	Focused on	Hardware/ Software	Conclusion
1	2015	Chris Kiefer, Frauke Behrendt Smart e-bike monitoring System	SEMS is a platform for the real time acquisition of usage data from electrically assisted bikes. [1]	Mainly 3 components- An Android phone, an open Hardware interface board and a custom power board.	SEMS is a stable platform for collecting, analysing and sharing data about a fleet.

2	2018	Ranjan Kumar, Munna Kumar Pradyumn Sah, Mustaim Alam Prof. Dr. M. Asok Raj Kumar. Design and fabrication of Electric Bicycle	Harnessing the various energy and use it in today's existence of human life [2]	DC Motor, Speed Controller basic, E brakes. Motor Controller Circuitry, Chain and Sprocket.	Electric bicycle is a Hybrid so it can run electrically and can also be pedalled.
3	2017	Christian Gorenflo, Ivan Rios, Lukasz Golab, and Srinivasan Keshav Usage Patterns of Electric Bicycles: An Analysis of the We Bike Project	we analysed e-bike usage and battery charging data from the E-Bike field trial. [3]	E- Bike, GPS Android based Samsung Galaxy S3 Smart phone. Data Processing Methodology .	In the Conclusion we saw We did not see evidence of range anxiety, in that a significant fraction of charging events happened at a low state of charge.
4	2019	Renny Rakhmawati, Iranito, Fatimah Taqwa Ruwano Implementation of Fuzzy Logic Control for Soft Starting Method Brushless DC Motor at Electric Bicycle	Fuzzy logic control is used to control the input signal from the potentiometer which is manipulated because of the gas pressure at the throttle to match the desired set point. [4]	Battery 48V 10 Ah, Current sensor, voltage sensor, MCB, Three phase inverter, BLDC motor, Hall sensor, LCD Display, STMF4.	This proves that setting the speed so that it can be constant also affects the motor current which becomes smaller or can be said to be soft-start.

5	2020	Snigdha Islam, Rabib Ibne Hossain, Sams Shafiul Amin, AKM Ferdous, Dr. AKM Abdul Malek Azad Implementation of Torque Sensor Technology in Electric Bicycle with Solar Charging Kit.	The torque sensor technology being incorporated into the overall electrical system of the bike. [5]	E- Bike, torque sensor, Solar panel, Solar Charging kit, Renewable Energy technology.	Introducing the torque sensor technology, it reaffirms the minimization of the energy consumption from batteries by the load.
6	2021	Jayanthvikram Chekkalal, Anushka Chalke, Arnold Dsouza, Omkar Barge, Ganesh Lohar Building a smart electric bicycle to solve problems faced in transport.	For our project “Smart electric bicycle” we wish to embed many sensors and monitoring system for improving the rider experience. [6]	E- bicycle, Hall sensor, Microcontroller, Ultrasonic Sensor, GPS, DC Motor, Battery, BMS.	we have come up with a durable and low-cost E-bicycle which makes it easy for city people to travel
7	2019	Lorenzo Stilo, Diana Segura-Velendia, Paul P.Conway, Andrew A. West Electric Bicycles, next generation low carbon transport system.	Data were analysed to rank the importance of desired functionality to improve the uptake of cycling within urban environment.	E-Bike, Qualitative data analysis, Pedelecs, Electric Motor, Motor Controller and sensor, Automatic Locking heated hand areas.	Survey showed a balanced interest in both safety and convenience features. Brake Lights & Indicators, Built-in Camera and Blind Spot Warning to Drivers were

					the most preferred safety features.
8	2021	Tejal Deshpande, Yogita Labde, Nevil Rego, Bhavesh Yadav, Mohammad Umer Baig A review paper on Embedded E-bikes	The goal of executing this project is to provide a low-cost, more efficient embedded E-bike system with numerous aspects such as GPS tracking, heart rate monitoring, recharging, a speed display screen, and collision detection for a better user experience. [8]	Embedded System, E-Bike, GPS Tracking, Object Detection, SEMS.	The paper gives a brief analysis of how one can modify a normal bicycle into efficient embedded e-bike system with a variety of functions like GPS tracking, heart rate monitoring, recharging, and speed display using various techniques.

3. Limitations

- This subject matter is simple, but not so simple that it can be done without doing any practical analysis/ work, but for that reason we need equipment, and lots of e-bike components of different sizes and capacities to test their characteristics. But that is not possible to do in limited possibilities it is only possible at the industry level, either for financial reasons or of the extensive component requirements as usual in research work. That is the reason why we rely on the experiments which are done earlier, and on the industry, data provided.
- As E- bicycles battery only lasts for 2-3 years it can actually toll your finances. Over it, battery charging time is also more. Moreover, maintenance and repair are very costly.

4. Conclusions

The aim of this research paper is to make the use of sensors for making our Bicycles for travelling smoother and safer plus making it faster and environment friendly to travel. We came around various types of sensors while working for this project with their specifications and in the end list out the one which are required. All the sensors/hardware used to make this e-bicycle are the efficient and reliable one specifically chosen for the features we want in our E- Bicycle. The hardware uses Microcontroller integrated with all the sensors and other hardware system to make the E-Bike work. We have also added Alarm System feature for security reasons in our E-Bike. It Performs very well in all types of road/terrain. The battery is efficiently managed through all the electronic components in the bike.

5. Future Scope

We are going to use a Raspberry Pi 4B Model which is more improved model than microcontroller in terms of Computing of sensors and interfacing of all the hardware. More features can be added in the e-bike to make it more efficient than the one we have build. We can also add a Solar Panel to the bike for the battery management. It will take power from the sun in daylight and store the energy in the battery while the bike will use power from the battery and in night the stored energy from the solar panel will be used to drive the E-Bike.

7. References

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[7] International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 08 Issue: 06 | June 2021 www.irjet.net p-ISSN: 2395-0072 © 2021, IRJET | Impact Factor value: 7.529 | ISO 9001:2008 Certified Journal | Page 275 Building a smart electric bicycle to solve problems faced in transport. Jayanthvikram Chekkala¹, Anushka Chalke¹, Arnold Dsouza¹, Omkar Barge¹, Ganesh Lohar² ¹B Tech Student, School of Mechatronics, Symbiosis Skills and Professional University, Pune. ² School of Mechatronics, Symbiosis Skills and Professional University, Pune.

[8] A Review Paper on Embedded E-Bike Tejal Deshpande¹, Yogita Labde², Nevil Rego³, Bhavesh Yadav⁴, Mohammad Umer Baig⁵ ¹Assistant Professor, Dept. of Electronics and Telecommunication, Xavier Institute of Engineering, Mumbai, Maharashtra, India, Student, Dept. of Electronics and Telecommunication, Xavier Institute of Engineering, Mumbai, Maharashtra, India.