Self Driving Tricycle

Kavithadevi C.S.[1],Manasvi.V[2], Sannidhi.M.G.[3], Shamthini.S.[4], Vaishnavi.R.Vaidya[5]
[1]Asst. Professor, Dept of ECE
[2, 3, 4, 5]Dept of ECE
[1, 2, 3, 4, 5] Dr.Ambedkar Institute of Technology, Bangalore, Karnataka, India.

Abstract- *This project presents the performance and analysis of autonomous vehicles. An autonomous vehicle is capable of sensing its environment and navigating without human input. This project aims to develop a bicycle which can be run through battery and can be controlled through voice commands and other control modes which makes a bicycle a self-driving vehicle which doesn't need any human aid. Autonomous vehicles are gaining attention as they promise to make driving a far safer activity. Our main concern is to develop a vehicle which is eco-friendly and affordable. This cycle also helps to analyze the performance of autonomous vehicle. This vehicle is eco-friendly and also ensures safety. Kids, old age people, handicap people can easily use this vehicle to meet their daily needs. This vehicle is built on Arduino, which acts as mediator between hardware and software components. Sensors such as, Ultrasonic and PIR sensors are used to detect and avoid the obstacles. Bluetooth module is used to control the system through voice commands. It controls the direction of wheels also start and stop by controlling motor drivers which are attached to wheels. The speed such as fast and slow movements of the vehicle can also be monitored.*

Keywords- Autonomous vehicle, Self-driving bicycle, Eco-friendly and affordable, Sensors, Bluetooth module, Motor drivers.

I. INTRODUCTION

Bicycles are very popular transport around the globe and also in our country. Bicycle is a common form of transportation, recreation, and also can be a medium in exercising which have been used for years of many people. Actually it is popular due to its energy efficiency, compact design, convenience and attractive look. Bicycle also can serve to provide physical therapy, as they are a low impact form of exercise that can train balance, strength, stamina and coordination. Though one may consider riding a bicycle to be a fairly simple task, this is not the case for many people especially for young children, and adults who never learned to ride a bicycle, injured people, or people suffering from developmental or cognitive disabilities. A system that could provide balancing assistance to a bicycle rider without otherwise affecting the experience of riding a bicycle couldprovide great benefit to these groups of individuals. Such a system could be used both as a teaching tool, and as a physically therapeutic device. Recently, many investigations have been done regarding to the problems of controlling two wheeled self-balancing robot, which are widely taken into applications in the field of autonomous robotics and intelligent vehicles. Self-balancing bicycle use sensors to detect the roll angle of the bicycle and actuators to bring it into balance as needed, similar to an inverted pendulum where it is an unstable nonlinear system and can be implemented in several ways. These automated systems have less manual operations with high reliability and accuracy. Intelligent bicycles are very much helpful for severely impaired and physically disabled people who have difficulties in driving standard powered cycles. It employs the use of electromechanical components which can be used as a means of transportation for a single person. This project presents a vehicle in which all components (electrical and mechanical) have been designed from ground up, produced, coupled together and tested. This vehicle can be viewed as ecological, battery, smartphone, and sensor operated and very easy to be used as system. Here we are concerned about the bicycle movement without the help of the driver by following the commands through Bluetooth or voice commands. For balancing we are using additional wheel at the front since it is difficult to balance vehicle. The various sensors like PIR sensor and ultrasonic sensors are installed in order to recognize the obstacle and automatically stop the motors for the movement of the vehicle.

1.1 PROBLEM DEFINITION

- To develop a system which is cost-friendly, different, which basically serves the purpose, motorized electric tricycle for children, disabled people for use in day-to-day life.
- A motorized tricycle which should be designed and fabricated for people to perform the functions like navigating the tricycle to the desired destination with the help of voice control and some other control functions with it.

1.2. Literature Review

History of e-bike: On 19th September 1895,a patent application for an 'electrical bicycle' was filed by Ogden Bolton Jr. of Canton Ohio. The bicycle ran on 10V battery power, in which the motor could draw power up to 100 amperes. The hub motor was used placing in the back wheel[1]. On 8th Nov 1895, Hosea W. Libbey of Boston used double electric motor were integrated within hub of the rear wheel [3][4]. John Schhepf tried a back wheel friction 'roller-wheel' style drive electric bicycle and similar cycle with torque sensors and power controls were developed recently in 90s [2]. Jiajia Chan, university of science and technology china, Hefei, china described autonomous vehicle as a proficient component in vehicle energetic structure to decrease traffic accidents dramatically. In this point, LIDAR and sensor are used to identify the speed of the vehicle moving in front so that vehicle can calculate the necessary space to pass that vehicle safely [5]. Widyotriatmo, Pusan National University, Busanstatesan autonomous vehicle has the ability toswitch multiple operations when they need, such as scheduling to lead the vehicle from astarting point to an aim confirmation, escaping obstacles and resolution sbuilding to selectan optimum action policy [6]. TatyasoGarande, et al. [9], discusses about the vehicle for physically handicapped people for long and short distance travel. Systematic comparison of wheelchair, automatic wheelchair, Smart wheelchair,retrofitted vehicles, tricycles, modified cars [8]. Ghostrider [7] developed for DARPA Grand Challenge, an autonomous vehicle competition sponsored by the Department of Defense, the Ghostrider robot is a fully autonomous riderless motorcycle. The Ghostrider makes use of stereo video image processing and GPS navigation. To remain upright, the Ghost Rider uses a 6 axis gyroscope to detect it's orientation in space as well as tocalculate it is angular velocity acceleration.Murata Boy [12]: Murata Boy is a small bipedal humanoid robot designed to ride a miniature bicycle. The bicycle ridden by Murata boy is functionally equivalent to a normal bicycle, only scaled down. All of the balancing is performed by the Murata Boy robot through the use of gyroscopic sensors to determine its position and tilt [10]. F. Leishman, et al. [11]Described the implementation of assistance to the driving of a smart wheelchair through a deictic approach.

1.3 FIELD SURVEY

In order to get a basic idea of the day-to-day problems faced by children and disabled people for conveyance and transportation. Some input collected from the survey are:

- Vehicles should be cost effective.
- Vehicles should be easy to operate.
- Manual effort required should be minimum.
- Functional controls of the vehicle should be within the reach.
- Vehicle should be stable while climbing.

WORKING OF PROPOSED SYSTEM:

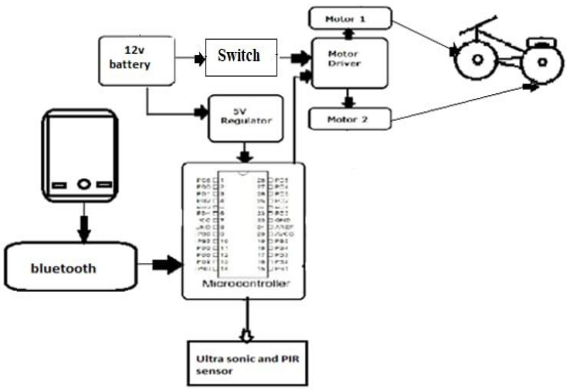

Fig-1:Block diagram of proposed system.

The working of our tricycle is divided into three major parts:

a. **Motion of the cycle**: For the motion part we are installing a 12V, 7.2A Brushed DC motor having a torque of about 15Kg, 5 units of AA alkaline battery of 1.5V,2.8Ah each for power supply, which is also a rechargeable battery, a motor driver to drive the motor, in addition to this there is a switch which helps in controlling the DC motor for ON/OFF the system.An external power supply battery setup consists of a AA alkaline battery of 1.5V, 5 units connected in series which is rechargeable. There is a switch implied to the battery so that our tricycle can be ON and OFF as the user intends too. There is a motor driver [L293D] used as an interface between the motor and the control circuit that is the microcontroller. By taking the low current control signal it connects it to a higher current signal that is used to drive the motor. The placing of DC motor is at the back of the seat in between the two back wheels of the cycle and the battery mounted near the tricycle seat with the other components.

b. **controlling the motion through commands**: For the controlling part of the tricycle we use another DC motor which is having the same specification as the DC motor mounted at the back wheel and with the same motor driver too. This DC motor at the front wheel only used to move the front wheel for left, right and reverse directions. Incase of Bluetooth module [HC-05]

it acts as an server for android app and the Arduino Uno, with help of which voice commands given on the android phone is passed to the DC motor via Arduino. We need to change the Bluetooth module specification to baud rate 9600, data bit to 8 stop bit to 1 and NO parity for communication to take place. The voice command is converted into a text [speech-to-voice format] form by the android app and transfer the text to the connected Bluetooth device.

c. **Integrating sensors**: Coming to the sensor part of the project we are integrating two sensors that is Ultrasonic sensor and PIR sensor to the Arduino Uno. The Ultrasonic sensor [HC-SR04] which is called distance sensor. It mainly works on the principle of "SONAR SYSTEM". It transmits the sound waves in air with the speed of 330m/s [which is speed of air]. Programming for this sensor are coded in such a way that if an obstacle is in less than 200cm there will be a message sent to the DC motor through Arduino to stop the forward motor of the vehicle.

PIR sensor[HC-SR501] which also called as Passive Infrared radiation. Used in detecting living beings like human or animal in its range of view. It works on the principle of measuring the infrared lights radiating from the object in its field of view. Programming for PIR sensor are coded in such a way that if a living being is less than 200cm there will be an alert message sent to the DC motor through the Arduino UNO microcontroller to stop the movement of the vehicle. These two sensors are integrated at the front wheel to encounter the obstacles in the way.

Arduinouno: The Arduino UNO is an 8-bit ATmega328p microcontroller with 14 I/O pins with 32kb flash memory, clock pulse of 16 MHz, USB connection, power barrel jack, reset button and so on. The Arduino UNO is the main microcontroller binding all the other componentsand stream of communication between all of them and the power supply. For all the connections male-to-female, female-to-female and multistrand wires have been soldiered.

II. RESULT ANALYSIS

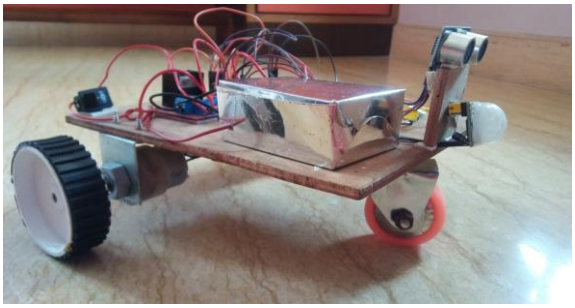

Fig-2: Prototype of proposed system

The result analysis is done with hardware design and coding is analyzed with simulation.The main objective of this project is to develop a cost effective cycle for children and handicaps. Firstly we need to download the android application for arduino voice control in our smartphone, then automatically connect the Bluetooth device(HC-05). Once the pairing is done then click on the microphone to give commands. Through the voice commands the cycle movements are controlled i.e right, left, forward and stop. And whenever an obstacle comes in the way the cycle automatically stops and starts to move only when the obstacle is lifted. The following figure shows the different positions of the cycle corresponding to command

III. CONCLUSION AND FUTURE SCOPE

In this project, we have made a attempt to design and fabricate tricycle which is finished with the view to give greatest conceivable offices to its client especially to the incapacitated individuals like handicap, children and adults with disorders. It is an Arduino based, self driving tricycle, which can communicate with involvement of hardware and software components. Where the Bluetooth module is used to control the vehicle movement to the direction the user desires to travel. Through the voice commands, the user can control the vehicle motion Commands like right, left, forward, reverse, stop can be given. Obstacle detection is done by sensors like ultrasonic sensor – used to detect objects and PIR sensors – used to detect living beings. Whenever any vehicle or any animals or any other object tries to hit the vehicle, the distance will be sensed by the sensorsand communicates with the microcontroller which in turn stops the vehicle there itself. After the obstacle is cleared, the vehicle canbe restarted. In this way it helps in avoiding the chance of accidents.

This project provides scope to add advancement in various aspects of working and mechanism for future development. A possible extension to this project is to combine GPS module to track the vehicle, and attaching

cameras to detect the traffic lights as well as persons and their activities, other vehicle activities, to decide whether to stop or start the vehicle can be added. This enhances the avoidance of accidents more. And also advance the applications like better perimeter following, following the traffic lights and rule

IV. ACKNOWLEDGEMENT

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REFERENCES

[1] Ogden Bolton Jr and his 1895 Hub Motor E-bike, presented 'a battery-powered bicycle' with "6-pole brush-and-commutator DC hub motor mounted in rear wheel", U.Spatent.

[2] 'The Electric Bicycle: Worldwide Research Trends' by Esther Sameron-Manzano and FranciscoManzano-Agugliaro.

[3] Peine, A.; van cooten, V,;Neven, L.Rejuvanating design: Bikes, batteries, and older adopters in the diffusion of e-bikes. Sci. Technol. Hum. Values2017,42,429-459.

[4] Parker, A.A; Alan, A. The Electric Power Assisted Bicycle: A Clean vehicle to Reduce Oil Dependence and Enhance the Mobility of the Elderly. In proceedingsof theInternational Conference on Sustainability Engineering and Science, Auckland, New Zealand, 6-9 July 2004. Availableonline: http://www.thesustainabiltysociety.org.nz/conference/2004/session5/43%20parker.pdf(accessed on 15 June 2018).

[5] Jiajia Chen, University of Science and Technology of China, Lane change path planning based on piece wise Beziercurve for autonomous vehicle, 'IEEE conference on Control, Automation and Systems (ICCAS)' held on 28-30 July 2013 at Dongguan: IEEE

[6] Pierre-Jean Rigole, Master of Science Thesis, Stockholm, Study of a Shared Autonomous Vehicle, Industrial Ecology Royal Institute of Technology,2014

[7] Widyotriatmo, A, School of Mechanical Engineering, Pusan National University, Busan, Decision Making framework for autonomous vehicle navigation, SICE Annual Conference, 2008 at Tokyo:IEEE

[8] U. of California-Berkley, "Ghostrider motorcycle," April 2010.http://journalism.berkeley.edu/projects/mm/zack/thebike.html.

[9] Design of an innovative retrofitted tricycle for a disabled person Ajit A. Mohekar1, SavitaV.Kendre, TanmayN.Shah, Prof.P.D.Sonawane4,Prof.Dr.S.T.Chavan Department of Mechanical Engineering, Maharashtra Institute of Technology, Pune, Maharashtra, (India)

[10] Tatyaso A. Garande, Prof. P. D. Sonawane, Prof. Dr. S. T. Chavan, and Prof. G. S. Barpande, Review of Motorized Tricycle for the Disabled Person, International Journal ofScienceandResearch(IJSR)ISSN(Online):2319-7064,2013-2014,Vol4,Issue2, February 2015, 316-320.

[11] Design of an Active-Assistance BalancingMechanism of a Bicycle, Degree of Bachelor of Science in Robotics Engineering by Sam Kaplan Approved, Dr TaskinPadir, Aaron Fineman

[12] F. Leishman, O. Horn, G. Bourhis, Smart wheelchair control through a deictic approach , Robotics and Autonomous Systems 58 (2010) 1149-1158,2010.