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Automation of Gears in Bicycle

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Abstract: ***The project is automation of the shifting of gears on the bicycle. It will enhance the riding experience of the cycler on different terrains. It is a step towards modernizing the bicycle in 21st century. This project can be merged in electric cycles for making it more efficient. Our aim is to replace the motorcycles with bicycles by bringing such developments in the market for eco-friendly travel. πsensor for sensing the speed of the cycle and then shifting the gears using high torque of servo motor. The servo motor will shift the gears through code logic. There will be an LCD will display the speed and current gear position. The code is encoded through Arduino ide.***
Keywords: Eco Friendly, hall effect sensor, servo motor, LCD, and Arduino software

I. INTRODUCTION

So, we came across the idea came of our project while riding a bicycle. While shifting the gears the idea arose that why not automate the gears of bicycle to make cycling more interesting, thrilling and fun. So, we researched and explored more about gear automation in electromechanics systems, the research we came across was insufficient. We thought of auto shifting of gears through the controller provided on the cycle itself and built the mechanism. This had to be done in a unique way since the position of the controller was complicated to do some mechanical configurations on it. So we had to slightly displace the controller for our ease. The controller has a push and pull mechanism for shifting of gears. For making it automated, we used two high torque servo motors for the push-pull mechanism. For making it completely automated we have to provide accurate logics for shifting the gears according to the speed. Detection of speed was important, which was not possible through any sensor. So the sensing of speed was done by detecting the number of revolutions per second of the rims. Hence, magnets were attached on the rim of tires and hall-effect sensor was fixed adjacent to the tyer on the body of the cycle. Hence, we got the rps which was used to control the servo motors.

II. METHODOLGY/EXPERIMENTAL

A. *Components*

1) *Arduino Uno:* It was used to control the servo motors, sensor and LCD through encoding.
2) *Magnet:* Magnets were used for getting the revolution per second.
3) *Hall Effect Sensor:* Hall Effect sensor was used to sense the magnet on the rims for getting the rps of the bicycle.
4) *Servo Motor:* Servo motor was used to push and pull the gear controllers of the bicycle.
5) *LCD:* LCD was used to display the speed and current gear position.
6) A DC motor with pulley mechanism.
7) I2C module to reduce the number of pins of LCD.
8) Three Li-ion cells of each 3.7v overall giving 11.1V voltage regulator (7805) to convert the 11.1 v to 5v.
9) Jumper wires.
10) A zero PCB board for making the circuit.
11) A 9v battery to power the Arduino board.

B. *Theory*

Here's the main role of magnets and hall effect sensor. The magnets are attached to rims and the sensor senses the magnets and gives the output digitally in the form of 0 and 1.
When the sensor senses the magnet, the output is given as 1 and when the magnet is not detected the output is given as 0.
This reading is collected by calling a interrupt and including a ISR function which would calculate the time difference between the 1 and 0. This concept is used to calculate the time period of a revolution of the tyre. Since, our main focus is to find the speed of the bicycle we must know the circumference of the so formed circle formed by the magnet. As the radius is fixed we can calculate the distance by using the formula Circumference= $2*\pi*r$. And in this case the radius is 8cm.

Now since we have both distance, time we calculate speed by dividing distance by time. As the peddling gets faster, the speed of the cycle will increase. Therefore we can use this parameter of speed to form conditional statements. Under these conditional statements we can define and decide the gear which we have to select. In these conditional statements we can write the code to target a specific gear. This can be achieved by using loops inside these conditional statements. We can use Arduino functions to move the motor in direction we want and hence the shifting of the gear can be achieved. The current gear position and the speed is displayed on the LCD.

III. RESULTS AND DISCUSSION

After making the gear shift mechanism, setting the hall-effect sensor, and the power supply the gear becomes totally automatic. Initially the cycle is at rest and requires high torque to get the pickup and it is obtained at gear 1, so the motors shift the gears to 1 irrespective of their initial position. After getting the pickup the gears shift to 2 and so on. At maximum speed the gears are at position 7. The speed and the current gear position is displayed on the LCD at every moment.

IV. FUTURE SCOPE

In future we can extend our project by including the automatic mechanism on the front gears as well as and control the both gears simultaneously. Also we can include a automatic charging system for the battery by attaching a generator motor on the rear wheel. We can isolate the whole system for making it water proof so that the cycle can be used in rains. Whole servo motor system can be made removable so that the whole project can be used in any geared cycles and can also be made as a product in cycle market.

V. CONCLUSIONS

Hence, the project was completed and the results were satisfactory. The motors were able to push the controller and the gears were shifting smoothly. The speed was fluctuating a bit which can be corrected from the code itself. LCD was working fine and hence the project was completed

VI. ACKNOWLEDGMENT

We would like to express our special thanks to our robotics teacher Mr. Rajesh Raikwar for their able guidance and support in completing this project. Secondly we would like to thank our friends from college and hostel who helped us in figuring out problems and fixing them with innovative solutions. It helped us acquire better knowledge and develop skills which ultimately turned this project into a success..

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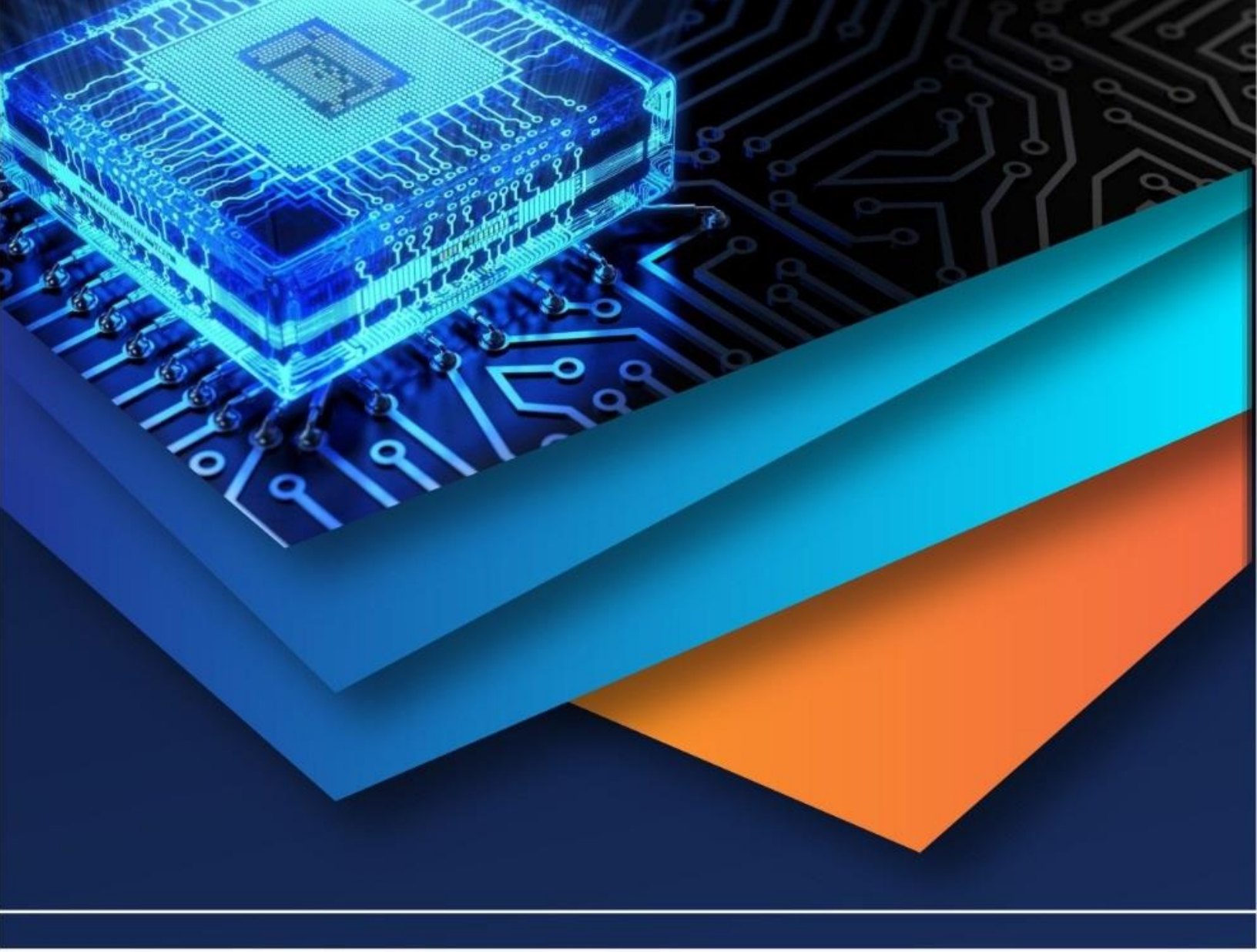

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