

Automatic Gear Shifter in Go-kart Vehicle

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Abstract - A Go-kart, through definition, has no suspension and no differential. They are generally raced on scaled-down tracks. Aim of the project is to design and fabricate a Go-kart with an increased performance, maneuverability, efficiency along with complete safety to compete with the commercial karts and provide an alter view of the karting experience. Hence for the better results the Go-kart will also be equipped with an automatic gear shifting device. The reason being, present karts available in commercial market possess less power to weight ratio along with less torque and less accelerations at higher speeds and the automatic gear shifting technology is one of a kind. Performance and efficiency of the karts is considerably low to compensate with safety measures.

Key Words: Arduino, Gearbox, Gear Transmission System, Go-kart, Potentiometer, Servo motor.

1. INTRODUCTION

A Go-kart, through definition, has no suspension and no differential. They are generally raced on scaled-down tracks. However, they are on occasion pushed as leisure or as a hobby by non-professionals. Karting is generally perceived because the stepping is proven to the better and extra high-priced ranks of motorsports. Go-kart is an easy four-wheeled, small engine, single sealed racing automobile used particularly in the United States. They have been to begin with created within side the 1950s. Art Ingles is usually every day to be the daddy of Karting. He constructed the primary kart in Southern California in 1956. From them, it's far being famous throughout America and additionally Europe. Kart racing is usually every day because of the top financial shape of motor recreation available. As a free-time activity, it could be finished through nearly everyone and allowing certified racing for everybody from eight onwards. Kart racing is generally used in a low-price and comparatively secure manner to introduce drivers to motor racing many human beings accomplices it with younger drivers. However, adults also are very lively in Karting. Karting is taken into consideration because the first step in any critical racer's career. It can put together the driving force for excessive pace wheel-to-wheel racing through expanding manual reflexes, precision automobile manipulation, and decision-making skills. In addition, it focuses on the numerous parameters that may be altered to attempt to enhance the competitiveness of the kart that still exists in different varieties of motor racing.

1.1 Objective

- 1) To design and analyze the Go-kart structure.
- 2) To design an efficient, high performance Go-kart.
- 3) To apply engineering knowledge, concepts for manufacturing of Go-kart.
- 4) To fabricate the Go-kart with minimum cost.
- 5) To test its performance under Static and Dynamic condition.
- 6) To design and manufacture a convenient and easy way to shift gears through implementation of a mechatronics system which includes usage of servo motor and Arduino as main components.

2. LITERATURE REVIEW

Idrees Rajgahwala, Shivam Kanungo, Mufaddal Burhanpurwala, Yash Pathak [1] says consciousness on growing clean equipment moving mechanism for transmission that allows you to make motor motorcycle rider's equipment moving very clean. Everyone's goal for the easy walking of the automobile in any respect can be the rate of pickup of the automobile someone is operating. However, one of the maximum crucial machines each engineer is involved approximately in an automobile is a piece of equipment moving machine for making the sure easy and preferred journey on their wheelers. An easy mechanism is organized with the servo motor and solenoid plunger that allows you to assist us in alternating the equipment in line with the preferred torque. In this equipment moving mechanism, equipment moving is completed with the assist of solenoid plungers. During this mechanism, the grasp is operated through a servo motor managed through the module feed within the Arduino Uno. This mechanism's software ends in making the using method easier, reduces the chance of destabilizing the car, the lap/level time, and the threat of omitting to move. The task provided has worried the improvement and implementation of automatic transmissions for motorcycles. The motivation of these paintings is to put in force this concept in grasp featured motorcycles with an appropriate understanding manipulate and easy moving of gears in diverse applications.

Ambar Gupta, Kundan Kumar, Abhishek Swarup, Abhisar Rana [2] Says Motorcycles are broadly used around the arena,

specifically in INDIA. The gear shifting device of the motorcycle conventionally guides. This report covers the improvement of an indigenous gear shifting /converting device for the standard motorbike. By this device, the manual mechanical gear- transferring will continue to be unchanged because an extra electromechanical device is located at the pinnacle of the lever to shift the tools and robotically manipulate the grasp. So, the device has each choice guide in addition to automatic. The device uses low-price microcontrollers to make the correct selection for transferring the tools up and down via way of looking at the speed, and it controls the grasp transmission wherein necessary. The entire hardware and software program had been examined and verified the functioning of the automated tools transferring device. The system is bendy and may be used with any motorbike starting from 50 to two hundred ccs. This device is pliable and may be applied on a bike to the Indian marketplace with no change. The motorbike production can also use the device of their cars because it could be without problems suited to the motorbike and there's no want of inner change of the tool's device, by putting in this low-price device of their motorbike. Companies can also be capable of boom their sale.

Prof.Prashant Vavhal, Prof.Sateesha Patil [3] says in worldwide the bike is that the solely engine-based vehicle that is employed on giant scale significantly in INDIA. bike is additionally varied in 2 large section gear transmission & CVT transmission. The recently conducted survey shows that CVT are in demand compared to the gear featured bikes. CVT's don't have the idea of meshing of gears which reinforces a sleek ride, however the fuel potency is relatively lesser when put next to the gear featured vehicles. Automation of gears transmission may be achieved by embedded system. Embedded system could be a special purpose pc system. Embedded system is preferred as a result of it will cut back the quantity of electrical elements and likelihood of failure is minimum. Either a microchip or a microcontroller is employed all told the embedded systems. The cryptography is completed by victimization appropriate software package for writing assembly level language in microcontroller that is hold on in ROM of microcontroller. Embedded 'C' language is used to write in code microcontroller or microprocessor. when achieving the specified gear shifting technology, we tend to ever ready to get a sleek ride in all town conditions. we've found that there's an improvement within the fuel efficiency. This gear shifting technology has jury-rigged the auto-clutch featured bike into transmission system vehicle. the whole gear dynamic mechanism has been controlled by the acceleration of the bike. The vehicle may be employed in manual mode by change off the ability offer to the electrical components. A switch has been provided for this nonmandatory mode.

3. METHODOLOGY

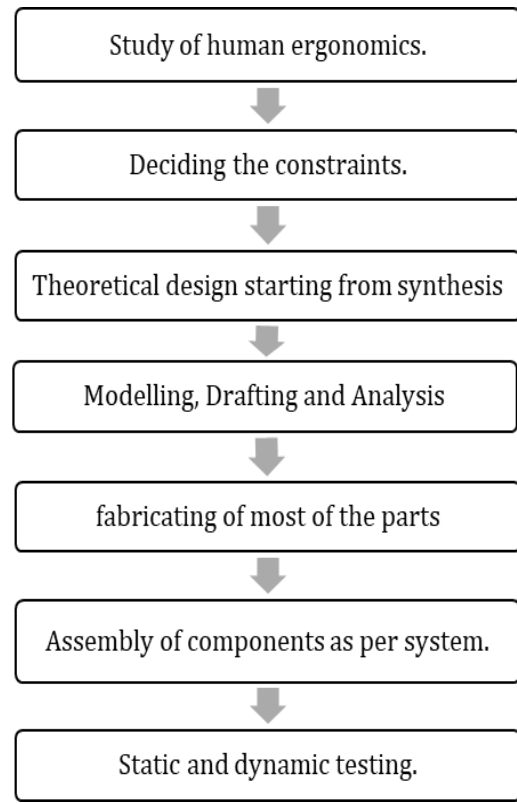


Fig. 1. Flowchart of Methodology

When a gear transferring of an automated transmission is to be affected, the weight implemented with the aid of using the weight tool is increased, or the importance is hooked up to an output rotation shaft of the engine through a selectively connecting device, thereby lowering the rotational velocity of the output rotation shaft of the motor to a required level.

In this work, electromagnetic coils are coupled to the tools rod of the two ends. The buttons are used to spark off the electromagnetic waves so that the tools can be shifted. An automotive era has evolved in lots of areas, like ABS machines, lively steorage machines, and different protection systems, which can be carried out to boost sender protection and comfort.

The improvement has concluded additionally the gearbox, which has become a good deal smoother and produces much less noise.

Gear transferring mechanism ought to be clean to apply and workable. Those needs are very critical, mainly for small vehicles utilized by unique wishes people. For a few drivers, the tools transferring can motive a few complicated at riding, mainly at essential situations. A crowded street on a hill or an unexpected detour makes plenty of anxiety at the driver.

One of the problems in this example is to pick out the proper discount ratio and attractive it at the appropriate time.

4. MECHATRONICS SYSTEM

4.1 Solenoid

Automotive generation has been advanced in lots of areas, like ABS device, energetic guidance device and different protection systems, which might be carried out to growth the passenger protection and comfort. The improvement has concluded additionally the gearbox, which have become lot smoother and produces much less noise. Gear moving mechanism need to be smooth to apply and workable, those needs are very crucial particularly for bodily challenged and unique wishes people. For a few drivers, the equipment moving can reason a few puzzling at using specifically at crucial situations. A crowded 3d street on a hill or an unexpected detour makes a variety of anxiety at the driver. So, our task is decided to provide rider a hassle-loose ride. Gasoline engines broaden beneficial torque over a constrained engine-pace variety. To be capable of use the to be had torque over the variety of car pace, gears are had to lessen or growth the engine pace accordingly. The traditional guide transmission makes use of a driver-operated clutch, normally operated through a pedal or lever.

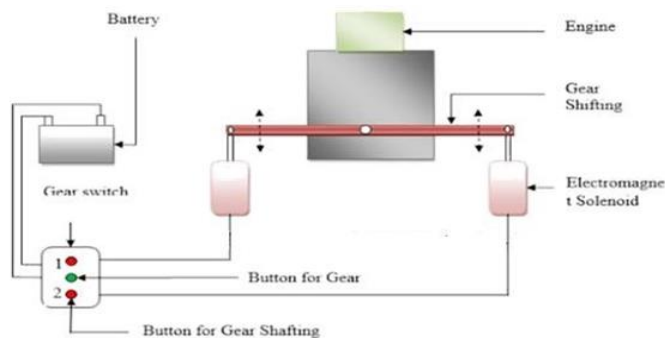


Fig. 2. Circuit Diagram of Solenoid

4.2 Servomotor

The whole device works primarily at the three components, namely, actuators, microcontrollers, and buttons. The clutch actuator and the tools moving actuator carry out the accurate mechanical functioning of the device. But an Arduino Uno microcontroller controls those actuators with the assist of the feed program, consistent with the acquired enter signals. DC servo motor works as an actuator for grab actuation in addition to tools moving. Also, push-button switches are supplied for upshifting and downshifting of gears which can be hooked up at the dashboard, so the driving force can use it to ship the instructions for actuation. Similarly, there's a four-bar linkage in the area to attach the DC servo motor and the tools lever to carry out the tools moving.

4.2.1 Clutch Actuation:

The transfer is used to shift the tools, which actuates the clutch first and disengages. The command is given thru the micro-controller to the servo. As liberated, the clutch needs to be engaged slowly to smooth the electricity switch from the engine to the gearbox. In guide transmission, the clutch is being actuated manually. Also, a postponed time is to receive within the software because the snatch must be disengaged earlier than the tools are shifted.

4.2.2 Gear Actuation:

When clutch is disengaged, microcontroller Arduino-Uno sends a signal to the gear shifting servo. This signal actuates the DC servo motor and it rotates. Since the motor is connected to a gear shift lever through four bar linkage, that lever rotates with the motor. This shifter exerts a force to shift the gear up or down. When the gear is shifted the motor needs to stop as the gear lever comes back to its original position. The gear shift indicator will generate a signal once the gear is shifted and that is given to microcontroller as the input. Thus, microcontroller gives an output signal which stops the motor from rotating by cutting off its supply. As motor is in rest condition the reverse motion of the gear lever is not resisted and it comes back to its original position. Once the gear is shifted the clutch is engaged back into its original position. While downshifting of the gear again first the clutch is disengaged and the gear is shifted by rotating the motor in opposite direction.

4.2.3 Four bar mechanism:

A four-bar mechanism is employed to transmit motion from one rotary link to a different link which may either rotate or slide depending upon the sort of joints utilized in the mechanism. There are three different types of 4 bar mechanisms: Planar quadrilateral linkage, Slider-crank linkage, and Double Slider linkage. For our purpose, we implemented planar quadrilateral linkage. There are four links and four revolute joints within the planar quadrilateral linkage. One link during this sort of linkage is usually fixed, and it's called the ground link. The other two links which rotate are called crank and valve rocker. The remaining link, which joins the crank and valve rocker, is named the coupler. Planar quadrilateral linkage is employed to transmit the motion of the DC servo motor to the gearshift lever so that gear is shifted. During this linkage, crank (small link) acts as input link attached to the DC servo motor, while valve rocker (significant link) is that the gear shift lever to rotate the shaft coupled to valve rocker.

5. COMPONENTS USED.

5.1 Engine and Gearbox

Engine used Bajaj Discover 125ST DTS-i

Engine	Bajaj Discover 125
No. of Cylinders	1
Capacity	124.6 cc
Max. Torque	10.8 N-m @7000
Power	12.88bhp @9000

Table no. 1 Engine Specification

Transmission type	Manual
Gear box type	Sequential constant mesh
Number of gears	5
Drive	Chain

Table no. 2 Gearbox Specification

5.2 Servo Motor

A servo motor is a rotary actuator or linear actuator that uniquely manipulates an angular or linear function, pace, and acceleration. It includes an appropriate engine coupled to a sensor for function feedback. It additionally calls for an enormously state-of-the-art controller, regularly a devoted module designed in particular to be used with servo motors. The motor is paired with a few forms of an encoder to offer function and velocity feedback. In the most compelling case, simplest, the placement is measured. The measured function of the output is compared to the command function, the outside entrance to the controller. If the output function differs from that required, a blunders sign is generated, which then reasons the motor to rotate in both directions, as had to deliver the output shaft to the ideal function.

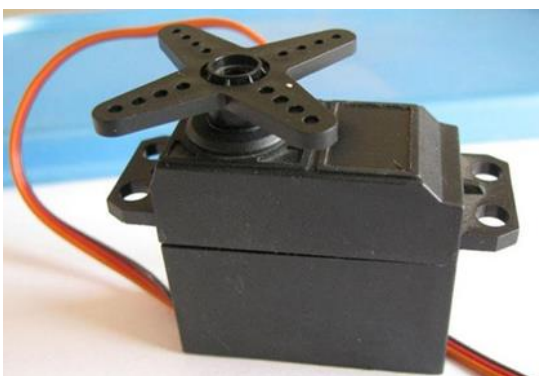


Fig. 3. Servo motor

5.3 Arduino

Arduino board designs uses several microprocessors and controllers. The boards are prepared with virtual and analog input/output (I/O) pins that can be interfaced to diverse expansion boards (shields) and different circuits. The panels function serial communications interfaces, including Universal Serial Bus (USB) on a few models extensively utilized to load private computer packages. The micro-controllers have usually programmed a dialect of capabilities from the programming languages C and C++. In addition to

the usage of conventional compiler device chains, the Arduino task offers an integrated improvement environment (IDE) primarily based totally on the Processing language project.



Fig. 4. Arduino Board

5.4 Potentiometer

A Potentiometer is a three-terminal resistor with a sliding or rotating contact that forms an adjustable voltage divider. If only two terminals are used, one end and the wiper, it acts as a variable resistor.

Type	Rotary
Electrical angle	170°
Resistance	5kΩ
Applied voltage	<12V
Operating temperature	-55°C to +125°C
Shaft starting torque	60 gm-cm
Weight	38gm

Table 3. Potentiometer Specification

6. Observation and Calculations

6.1 Observation

Max. Force = 3 kg

Length of Liver to down shift the gears = 14 cm

Length of Liver to up shift the gears = 11.5 cm

6.2 Calculations

Thus, Torque required to down shift the gear,

$$3\text{kg} \times 14\text{cm} = 42\text{kgcm.}$$

Torque required to up shift the gear,

$$3\text{kg} \times 11.5\text{cm} = 34.5\text{kgcm.}$$

Therefore,

Max., torque required = 42 kg cm.

Therefore, we are selecting servo motor of 35 kg cm.

The lever required of lower the gear = 1.25 cm.

The lever required to up the gear = 1 cm.

Results:

The program was created and run on Arduino IDE software. The process was carried as follows:

Create a servo object to control a servo

Initial angle set for servo at 90° and angleStep at 5°

Assign Pin 12 connected to the left button

Assign Pin 2 connected to the right button

Attaches Servo on Pin 9 to servo object.

Move the servo at the desired angle

Wait for the servo to get there

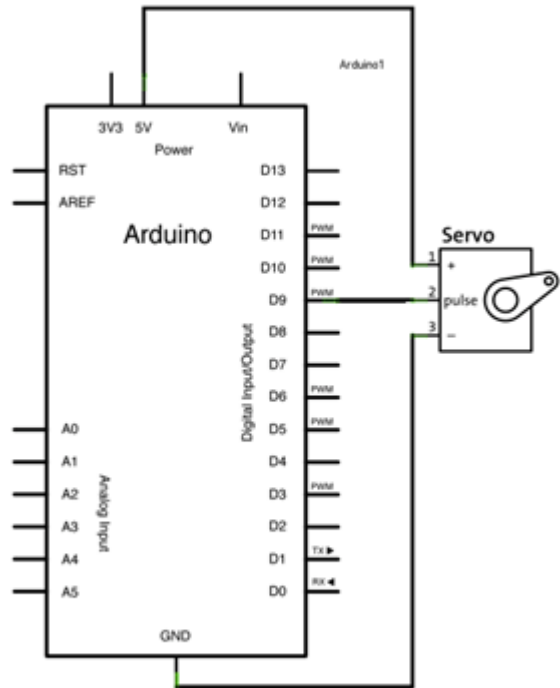


Fig.6 Arduino Pin Configuration

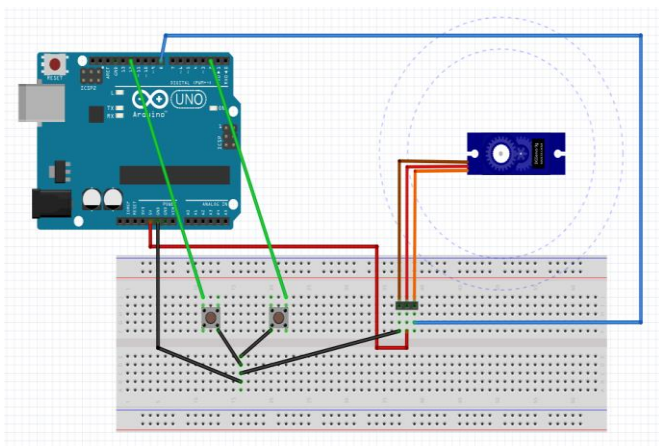


Fig. 5 Arduino Setup

SR. NO.	Components	Specifications	Price
1.	Servo motor	Ultra-torque metal gear 35kg cm, coreless steel pinion.	₹2655
2.	Arduino	Arduino UNO R3 based 20A robot control board	₹1593
3.	Switches	3A 250 V off on non-locking momentary button switch	₹113
4.	Battery	12V Amaron battery	₹1300
5.	Lever	MS with laser cut	₹500
	TOTAL		₹6161

Table 4. Cost Report

Conclusion:

We have studied various ways in which we can solve our problem and then selected the most efficient and economical and less bulky way that is by using servo motor to change the gears.

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