



Semi-automatic gear shifting mechanism in two wheeler

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Abstract—this paper is used to bring semi automation in two wheeler by using of DC motor and microcontroller. It is a new innovative model mainly used for the vehicles. We are concentrate to design the semi-automatic gear changing mechanism in two wheeler by using the components like gear box, DC motor, microcontroller, battery, push button etc. This is very useful and easy method for changing the gears in two wheelers. In this mechanism we can easily control the bike through button and which will give instruction to DC motor through programming (microcontroller). It will operate forward and backward by using DC motor.

Keywords—DC motor (Direct Current), Gear Box, Micro Controller, Battery, Push Button.

I. INTRODUCTION

Generally in two wheelers, gear is shifted manually with the help of lever but this mechanism is not suitable for handicapped people and also non handicapped people can get a maximum comfort level while riding. So, we are in a process of making it more friendly and convenient to use. It will be achieved by using motors and some modification in lever shaft. Nowadays, a manual transmission or sequential type is a type of transmission used on motorcycles and Two Wheelers, where gears are selected in order, and direct access to specific gears is not possible. In manual transmissions, the driver can move from gear to gear, by moving the shifter to the desired position. A clutch is disengaged before the gear is shifted, to disengage the running engine from the transmission, thus stopping the torque transfer. In manual transmission, shifting between gears in order to accelerate and decelerate needs, drivers know how to use a clutch, when to shift, and the proper timing required for effectively operate a manual transmission. So this paper is to being semi-automatic

transmission is one type of motor vehicle transmission that can push button operated.

A clutch is disengaged before the gear is selected, to disengage the running engine from the transmission, which is very confusing and fear able. After manual gear transmission system the hydraulic and pneumatic were invented using these systems the gear can be changed using electronic switch or button you can say this system uses hydraulic and pneumatic actuators which requires compressor [1]. This system is much better than manual gear transmission but this concept is not implemented yet in reality because weight of these systems is more than usual also it has got drawback of space availability [2]. The semi-automatic gear shifting system is much advanced than hydraulic and pneumatic system. In this gear shifting will working with DC motor and push button to shift the gear. In this gear shifting does not have compressor as needed in hydraulic system. Also the torque generated is difficult to control to advance this concept semi-automated was invented. In this semi-automatic gear shifting have DC motor, push button, and microcontroller. Etc. while change the gear we push the button in this signal going to microcontroller and the controller will send the signal to the DC motor and the gear will be changed.

In this system was advanced over manual, hydraulic, pneumatic system. The gears will be operated with any human interference without high effort [4]. But when we require changing gears frequently then this system is very useful. We have design and develop such a system which can be installed in any two wheeler vehicles that run on roads so that it can overcome drawback of manual transmission. The main objective of this concept is

used to apply the gear by using semi-automation system in automobile vehicles. The gear shifting mechanism is semi-automated. This push button actuates DC motor which is connected to spur gear. In this spur gear will be connected to the pedal of the gear box. DC motor is programmed to turn at specific angle which in turns shift the gear [5].

II. LITERATURE REVIEW

The main objective of this concept was used to apply the gear by using automation system in automobile vehicles. In this system the stepper motor was used to shift the gears. The gear shifting system was semi-automated. The button provided which was used to changing the gear. This button actuates the stepper motor which was connected to cam operating shaft instead of pedal of gear. Stepper motor was programmed to turn at specific angle which in turns shift the gear. [1]

A centrifugal clutch have no. of shoes inside the rim were mounted on the hub. The shoes were free to move radically outward in guides and hold against the spider on the driving shaft by means of a spring. The spring exerts radically inward force, which was constant. Due to mass of the shoes, while they were rotating, the centrifugal force acts on the shoes. When the speed would increase on the centrifugal force exceeds and it overcomes the spring tension and it wedges the outer rim. With frictional grip, it starts rotating the outer rim and power was transmitted, thus the vehicle moves. [2]

The solar panels were used to generate power transferring the charges through the solar charge controller on to the batteries. The batteries were allowed to supply a required amount of charges following through the power controller and the BLDC motor starts to rotate. It was the unique design to hold the powerful gearbox at the base on the above motor was placed which on beside were placed batteries at the rear side of the vehicle or car. [3]

The compressor send the pressurized air into the solenoid valves through the hoses whereas the solenoid valve acts as temporary storage of air and acts as passage. The air from the solenoid valves passes to the pneumatic cylinders which act as working medium for actuating cylinders. When the air enters into the cylinders the pistons starts reciprocating that was extraction and retraction. The retraction was done manually by operating switches on the solenoid valves by closing the air inlet. On the

other hand the relays send the precise signals to the solenoid valves. The shifting of gear was done by altering the speeds by rotating the rotor in the speed regulating board. [4]

This project aims to improve the gear shifting process with a suitable control mechanism to implement in clutch featured bikes. According to the suggested gear shifting method, the microcontroller selects the transmission gear as per the speed of the vehicle without any human interference. The head light control is designed which dims and dips if any vehicles comes opposite with high beam. This is a safety feature installed to avoid accidents caused due to high beam lights having blinding effect on drivers coming from the opposite direction. [5]

III. PROBLEM STATEMENT

Now a day, in modern vehicles, such type of gear shifting mechanism is used for power transmission. Working type of the push button operated gear shifting mechanism has been tested for its functionality for the entire range of gear shifting. It can be easily incorporated to four wheelers for shifting gears with minimum alternation and the gear position can be displayed. As further improvement, the output speed of the gearbox can be measured and used as an input for transmission control.

OBJECTIVE

In manual transmission gear can be selected according to road load and driving conditions. It requires human efforts, accuracy and skills to select particular-gear under different conditions. Under city driving condition, it would be difficult to shift the gear frequently while negotiating traffic. Shifting effort and shifting frequency differs with different age group and genders. It may lead wear and tear of the gear if it is not properly operated. The above difficulties alternative arrangement is essential and one such is the push button operated gear shifting mechanism. This kind of gear shifting mechanism is very useful in four wheelers for special purpose vehicles.

IV. CONSTRUCTIONAL DETAILS

A. Worm Gear Motor DC



Fig. 1 Worm Gear Motor

This 12 volt heavy duty worm gear drive motor and gear box is capable of moving up to 20nm of torque between 100-150(load dependant) rpm to intended application. The worm drive gearbox itself is extremely tough and can handle forces up to 30 nm.

It ran both forward and reverse directions. It will have good torque and decent speed which is proven for a variety of different applications. It can mount a load to either side of the worm drive gearbox due to its hollow gearbox output shaft , though it only be fixed from one side.

Rated voltage	DC 12V
Output speed	6500/100 rpm
Motor rotary speed	6500 rpm
Motor spins number	2
Gear box shaft speed	100 rpm
Box shaft size	6 X 14 Mm / 0.24×0.55 (D×L)
Gear box size	45×30×25 mm / 1.2×1 (L×W×T)
Motor Body Size	30 × 25 mm / 1.2 × 1
Gear box size	45 × 30 25 mm / 1.8 × 1.2 x 1 (L x W x T)
Thread diameter	2.5 mm / 0.1
Material	Metal

B. Microcontroller

It is a small computer on a single integrated circuit. In modern world terminology, it was similar to, but less sophisticated than, a system on a chip or SoC. It contains one or more CPUs along with memory and programmable input/output peripherals. It used in automatically controlled products and devices, such as automobile control systems, implantable medical devices, remote controls...etc.. Programmable Integrated Circuit is a family of microcontrollers made by microchip technology. In this project we use PIC16F873 type microcontroller.

Core features of PIC16F873

- a. High performance RISK CPU
- b. Only 35 single word instructions to learn
- c. Operating speed: DC – 20 MHz clock input
- d. Direct, indirect and relative addressing modes
- e. Power-On Reset (POR)
- f. Power –up timer (PUT)
- g. Oscillator start – up timer (OST)
- h. Watch dog timer(WDT)with its own on-chip RC oscillator for reliable operation
- i. Programmable code-protection
- j. Power saving sleep mode
- k. Selectable oscillator options
- l. Low-power, high speed CMOS FLASH/EEPROM technology
- m. Fully static design
- n. In-circuit serial programming via two pins
- o. Single 5V in-circuit serial programming capability
- p. In-circuit debugging via 2 pins
- q. Processor read/write access to program memory
- r. Wide operating voltage range: 2.0V to 5.5V
- s. High sink/source current:25mA
- t. Commercial and industrial temperature ranges
- u. Low- power consumption;

C. Power Supply

The power supply circuits consist of filters, rectifiers, and the voltage regulators. It starting with an AC voltage, a steady DC voltage is obtained from rectifying the AC voltage, then filtering to a DC, and finally regulate and to obtain a desired fixed DC Voltage. The regulation is usually obtained from an AC voltage regulator unit, which takes a DC voltage and provides a somewhat lower DC voltage varies, or the output load connected to the DC voltage changes. The circuit diagram of power supply is shown in fig below.

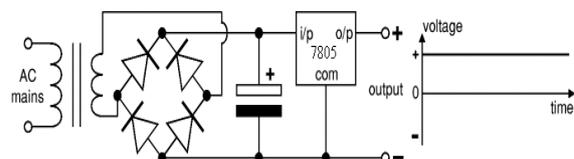


Fig. 2 Circuit Diagram of Power Supply

D. Battery



Fig. 3 Battery

It is a 12V maintenance-free rechargeable, sealed lead acid battery. Applications include alarms, UPS and medical equipment. It was an irregular battery used in specific electronic applications. Of all the types of batteries, the 12 volt battery is one that looks very different depending on its use. In some ways, it is one of the most diverse of all batteries. It can be large or small, heavy or light. In some cases, they may look nearly like regular AA batteries. One of the most common uses of a 12 volt battery is for transportation applications, such as in cars and boats. In these cases, the battery may be able to be recharged as current is only needed to start the vehicle. After that, the alternator takes over and runs the electrical system, if it is functioning properly. The alternator also puts a charge back into the battery. The size of 12 volt batteries vary widely based on the amp hours they are designed to produce. They can be very heavy and large, such as those found in cars. They can also be relatively small, such as batteries found in some electrical children's vehicles that run in the front yard.

V. DESIGN AND CALCULATION

Material Selection:

Spur gear material -Non ferrous alloys

Worm gear motor -12V DC motor

Calculation:

Spur Gear

Number of worm gear = 8
teeth

Diameter of worm gear = 20 mm
teeth

Number of spur teeth = 32

Diameter of spur gear = 67 mm
teeth

Driver ratio = spur gear teeth/worm
gear teeth

$$= 32/8$$

$$= 4$$

The driver ratio is 4, which means that the pinion gear will turn 4 times, while the spur gear turns 1 time.

Speed ratio = pinion gear (input gear)
teeth / spur Gear (output
gear)

$$= 8 / 32$$

$$= 1 / 4$$

The pair of gears would have a speed ratio of 4 to 1.

Worm Gear Motor

Motor Type: 12V DC

Speed of the Motor: 100 rpm

Here,

Gear will be shifted by using spur gear motor.

Gear shifting time (t) = 0.2 sec

Speed of the motor (s) = 100 rpm

Speed of gear shifting = t (min) x s

Time taken of gear shifting in min = 0.2 / 60

$$T (\text{min}) = 3.33 \times 10^{-3} \text{ min}$$

Speed of the gear shifting (S) = $3.33 \times 10^{-3} \times 100$

$$S = 0.33 \text{ rpm}$$

The gear will shifted by using the spur gear motor in 0.33rpm. The speed is same for all forward gears and also the reduction or backward gears.

VI. WORKING PRINCIPLE

Normally, bike will started through the ignition of engine. In this project compiles the gear shifting through push button by using the worm gear motor which is controlled by the microcontroller. Semi-automatic gear shifting method is used to shift the gear easily. Working principle of the project is when ride in a bike the gear will be shift by push button. The push button is the major part to shift the gear it will send a signal to the microcontroller. Then, the microcontroller sends a signal to the worm motor.

The motor have a pinion wheel it will rotates the gear shaft will connected by a spur gear wheel. The pinion will rotate then the spur gear rotates. Three teeth will rotate in the spur gear wheel automatically one gear shifted the previous statement is same for all gear shifting. The motor will rotates forward and reverse. It is also same for providing the reduction of all gears. In this type gear shifting is easy to ride a bike to the rider. It will help to comfort ride of the rider.

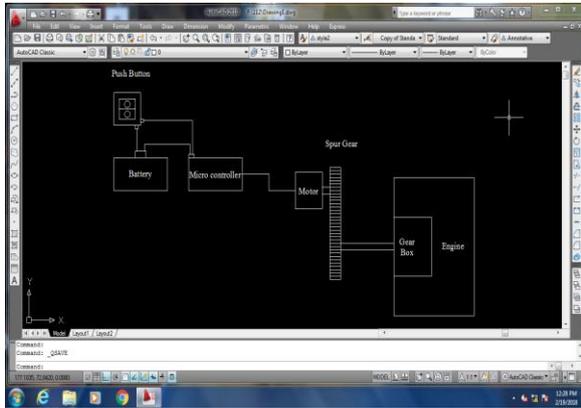


Fig. 4 Block diagram of semi-automatic gear shifting
FUTURE SCOPE

As we know there are no limits for improvements in any kind of work. Scope is always in the present work. In this semi-automatic gear shifting, further modifications that can be carried out are as listed below:

1. The mechanism will be fully in automation by using of sensors.
2. Gear indication

VII.CONCLUSION

Through this paper, we aimed to design a semi-Automatic gear shifting mechanism which will be used to drive a two wheeler comfortable ride to a rider. This will allow us to improve the efficiency and minimize rider fatigue to improve the overall performance of our vehicle. It has lower weight and higher efficiency with respect to other transmission system. Moreover, since semi-automatic gear shifting is directly derived from the manual transmission. The cost of the semi-automatic gear shifting is very less compare to Automatic transmission system.

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