

Automatic Gear Shifter for Two Wheelers

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Abstract— According to reports shown in feb-2018 the production of manual transmission have fallen to 30% and while the modern automatic transmission have increased to 70% of its production. As the demands of gearless bikes has been increased. This paper aims to introduce one such kind of automatic transmission which is Pneumatic Gear Shifter. It is system which will change the gear automatically with help of Microcontroller Unit, Control Unit, Pneumatic Cylinders, Hoses and Sensors.

Key words: Microcontroller, Pneumatic Cylinder, Solenoid Valve, Proximity Sensor

I. INTRODUCTION

This paper relates to control mechanism or more often the mechanism for shifting the gears at correct gear ratio, the required gear ratio is selected logically with microcontroller unit, other aspects of this gear shifting mechanism is that the process is much faster with optimum work also is less destructible and rider friendly. Which means for some drivers the gear shifting is somewhat confusing while driving especially at critical situations like crowded road, on a hill or a sudden detour brings a lot of tension on the driver, so on this situation it is necessary to choose right reduction ratio and engaging it at the right time. This system also minimizes the human errors in operating the gears with automatic technology.

This system is different from modern automatic transmission which has planetary gear system in four wheelers, which is fully mechanical and having high efficiency but the cost is high. When it comes towards two wheelers it has (CVT) continuously variable transmission system which does not have the concept of meshing of gears which enhances a smooth drive but the fuel efficiency is comparatively lesser as compared to geared featured bikes.

The current scenario in automobile industry is that the systems are moving towards automation, when it comes towards transmission system which is been converted to automatic transmission and also towards gearless transmission, so the new systems which are more effective should be invented or should be brought into practice like (AMTs) Automatic Manual Transmission, (ADV) Automatic Drive Vehicle or (HEVs) Hybrid Electric Vehicles.

The Pneumatic Gear Changer is a system which shifts the gear up and down pneumatically just likes the human rider by sensing the speed of vehicle by using proximity sensor. What actually we are doing is that replacing the function of a driver by programmed Microcontroller except for the brakes. This is a fare attempt towards automation at low cost and high accuracy without compromising the safety of vehicle.

II. LITERATURE REVIEW

Luigi Glielmo, Francesco Vasca (2006) they have discussed a gearshift control strategy for modern automated manual transmissions (AMTs) with dry clutches is proposed. They have discussed about operation of a clutch on system based on its five stages from initial application to final application that means how the clutch will be applied through automation system with the help of electro-hydraulic actuator, speed of vehicle and power transmission, through feedback system [1].

Alexander .P, Sudha .T (2012) In this study, a gear shifting mechanism was designed and applied on an auto clutch featured bike to make the gear transmission process faster and less destructible for the diver using Embedded System and 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 [3].

Vijay Kumar, Nithesh Reddy (2014) the aim of their paper was to improve gear shifting method with use of several components like microcontroller, pneumatic cylinders and solenoid. To automate the functions of gear shifting method without interruption of rider to have smooth and effortless drive. Using this method we can have automatic transmission at low cost [4].

Mangeelal. D. (2015) in this paper they discussed the effect of gear shifting on automatic transmission drive. They showed us how load affects the system on its drive, for different loads the system operates differently without affecting the drive. They also shown speed of output shaft can be controlled with the help of electro-magnetic coils and to shift gears with the help of that coil.

By studying various papers it shows that the pneumatic gear changer for two wheelers have not been studied by using double acting cylinder and electro-hydraulic actuator. So the aim of paper is pneumatic gear shifter in two wheelers to perform gear shifting operation using microcontroller unit, sensing unit, pneumatic cylinder and control unit.

III. OBJECTIVE

The recent survey shows that CVTs are in demand compared to geared feature bikes due to manual gear shifting. To eliminate the gear shifting method manually and invent an improvised gear shifting technology that is automatic manual transmission (AMTs) in which the gear shifting takes place automatically without interruption of rider. It will work just like CVTs with smooth drive and improved speed variations and high efficiency.

IV. COMPONENTS

A. Manual 4-Speed Gear Box

This is synchromesh type gearbox having helical gears, which is having one driving shaft and other driven shaft through which the power is transmitted. The gear ratio is obtained by means of gearbox.

1) Pneumatic Cylinder

Pneumatic cylinders are mechanical devices which use the power of compressed gas to produce a force in a reciprocating linear motion it is also known as air cylinders. The pressure is of 4 bars due to leakage takes place so to avoid pressure loss in cylinders, Pneumatic Cylinders can be divided into two types.

- Single Acting Cylinder
- Double Acting Cylinder

2) Double Acting Cylinder

Double-acting cylinders use the force of air to move in both the way extraction and retraction strokes. There are two ports, one for air inlet and other for outlet for first condition and reverse of it for second condition.

B. Microcontroller

A microcontroller (MCU) is a small computer on a single integrated circuit containing a processor core, memory, and programmable input/output peripherals and a small amount of RAM. Microcontrollers are designed for embedded applications. In this paper the type of microcontroller used is AT89C52. Specifications of microcontroller is, Atmel's 8051 family having 8 bit of size, 8 kb of ROM, 256 bytes RAM and can be read/write to 1000 times. The microcontroller is programmed with help of Keil v5 Vision software; programming is done via willar programmer website as per required basis whose input is speed via proximity sensor.

C. Proximity Sensor

The proximity sensor emits the electromagnetic radiation which creates an electromagnetic field around it and as any metal object comes towards its face the change in field takes place The magnetic field is created when a metal is detected it cuts the flux which is recorded as 1 pulse this is how it is used as speed measuring device.

D. Electric Motor

The function of motor is to convert electric energy into mechanical energy. Operation of electric motor is based on simple electromagnetism; a current is passed through coils and due to which magnetic field is created rotor starts to rotate and force is exerted on external field.

E. 4-Way Solenoid valve

4-way solenoid valves are generally used to operate DAC or actuators. They have 4 or 5 pipe commonly called ports. Solenoid valves are used on automotive transmissions. We are using 4-way solenoid valve.

V. DESIGN OF SYSTEM

A. Block Diagram

The presented paper is aimed to perform operation such as automatic gear transmission; here the speed is the input to the microcontroller unit. As shown in (fig 1) is representation of

block diagram that how actual working takes place with help of several components used in automatic manual transmission.

The gear shifting takes place with help of several units such as microcontroller unit, direction control unit, pneumatic cylinders and sensing unit.

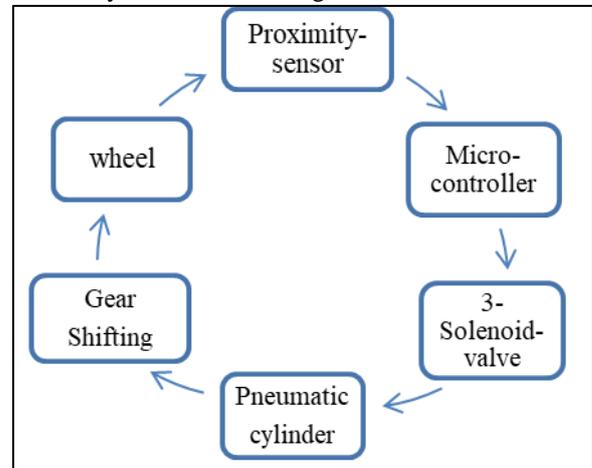


Fig. 1: Block Diagram of Pneumatic Gear Changer

B. System Working

The piece of metal object is attached in the wheel on one of the spokes (which may be in front wheel or rear wheel) and proximity sensor is also installed on same wheel as of the metal piece, as wheel starts to rotate the system gets on, the proximity sensor is set to send signal at every 5 pulses or 10 pulses as the signal of speed is send to microcontroller unit which is capable of controlling system logically hence it decides the correct gear ratio required for the specific speed by controlling the direction through solenoid valve. The solenoid valve is responsible for flow of air whether to retract or extract it also acts as temporary air storage device before entering into pneumatic cylinders which will response as required to apply the clutch and gear is changed (it may be shifting the gear up or down) and clutch is released.

The power is supplied with 12V battery to start the system working, we have to use 2 Microcontroller units one for applying clutch and other for shifting gears the pneumatic cylinders, though the system looks very messy but the working time of this system is less than a second, which is much faster as compared to manual transmission systems.

VI. SUMMARY

This paper presented will give an intro on an advanced way of shifting the gears automatically or we can also say pneumatically with the help of microcontroller unit which is the heart of the system and the sensing unit as the brain of the system, which is quite similar as the human (rider) works while riding a bike. Developing and implementing the automatic transmissions system in bikes. The application of this mechanism leads to the gear shifting process easier. This system is flexible and can be implemented on any motorcycle available in the market without any major changes. Manufacturing companies can also apply this concept.

VII. FUTURE SCOPE

This automatic transmission system can be applied in any bikes; the automated gear shifting mechanism can be obtained in any auto-clutch featured bike by installing the necessary electrical circuit and by fabricating it. This system can also be used in four wheelers and light weight vehicles. Our concept of automatic gear shifting, in bikes, was with respect to the speed of the wheel. The proximity sensors can be replaced by the torque sensor as another approach towards automatic transmission system.

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