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Development of Prototype of Automatic Clutch Gear Mechanism

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ABSTRACT: The recent survey shows that continuous variable transmission (CVT) are in demand compared to the gear featured bikes. CVT's do not have the concept of meshing of gear switch enhances a smooth ride, but the fuel efficiency is comparatively lesser when compared to the gear featured vehicles. The main objective of our project is to automate the gear transmission in a gear featured bike to ease the driving and also to maintain the efficiency of the bike. This mechanism is used in bike to smoothen the gear meshing and can be implemented in clutch featured bike. The aim is to develop of button operated transmission system which shifts the gears with respect to the speed of the wheel. Simplifying the transmission improving the fuel economy are the major objectives of our project. The main objective of this project is used to bring automation in gear shifter of two wheelers using servo motor. This is the new innovative model mainly used for the vehicles to control the vehicle. Here we are concentrating to design the automatic gear changing mechanism in two wheeler vehicles by using the components like servo motor, battery, microcontroller, gear lever, electronic switch etc. This is very useful and unique method for the gear changing mechanism in two wheeler vehicles. By using this we can easily control the bike through button which will give instruction to servo motor through programming we going to achieve to control motion.

I. INTRODUCTION

With the advent of automated gear transmission system ease of access to vehicles has increased over last 20 years. Generally in 2 wheelers, gear is shifted manually with the help of lever but this technique is not only 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. This can be achieved 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. With traditional manual transmissions, the driver can move from gear to gear, by moving the shifter to the appropriate position. A clutch must be disengaged before the new gear is selected, to disengage the running engine from the transmission, thus stopping all torque transfer. During manual transmission, shifting between gears in order to match acceleration and deceleration needs, drivers have to learn how to use a clutch, when to shift, and the proper timing required for operating a manual transmission effectively. So this project is to being thinking automatic transmission is one type of motor vehicle transmission that can automatically change gear ratios as the vehicle moves, freeing the driver from having to shift gears manually and to achieve efficient driving which reduces human efforts and fear while driving and easy driving.

II. CONCEPT

This system is advanced over manual, hydraulic, pneumatic and electromagnetic system. The gears are operated without any human interference. But when we require to change gears frequently then this system is not much useful also the cost is very high. So for avoiding this 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. This is the new innovative model mainly used for the vehicles to control the vehicle without human efforts. The main objective of this concept is used to apply the gear by using automation system in automobile vehicles. In this system, the two servo motors are used first is operating the clutch lever and another is to shift the gears. The system is semi-automated. The buttons provided are used for changing the gears. Servo-motors are programmed to turn at specific angle which in turns shift the gear. This system is also useful for handicapped persons, also the non-handicapped person get good driving

comfort and superior experience. As the equipment are reduced the setup cost as well as the space requirement is also reduced.

III. COMPONENTS USED

1. Servo Motor

A servomotor is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration. It consists of a suitable motor coupled to a sensor for position feedback. It also requires a relatively sophisticated controller, often a dedicated module designed specifically for use with servomotors. Servomotors are not a specific class of motor, although the term servomotor is often used to refer to a motor suitable for use in a close loop control system

A **servomotor** (or **servo motor** or simply **servo**^[4]) is a rotary or linear actuator that allows for precise control of angular or linear position, velocity, and acceleration in a mechanical system. It constitutes part of a servomechanism, and consists of a suitable motor coupled to a sensor for position feedback. It also requires a relatively sophisticated controller, often a dedicated module designed specifically for use with servomotors[5].

Servomotors are not a specific class of motor, although the term *servomotor* is often used to refer to a motor suitable for use in a closed-loop control system. Servomotors are used in applications such as robotics, CNC machinery, and automated manufacturing.



Fig. 1 Servo Motor

2. Battery

Lithium batteries are primary batteries that have metallic lithium as an anode. These types of batteries are also referred to as lithium-metal batteries. They stand apart from other batteries in their high charge density and high cost per unit. Depending on the design and chemical compounds used, lithium cells can produce voltages from 1.5 V (comparable to a zinc-carbon or alkaline battery) to about 3.7 V. Disposable primary lithium batteries must be distinguished from secondary lithiumion or a lithium-polymer, [1] which are rechargeable batteries. Lithium is especially useful, because its ions can be arranged to move between the anode and the cathode, using an intercalated lithium compound as the cathode material but without using lithium metal as the anode material. Pure lithium will instantly react with water, or even moisture in the air; the lithium in lithium ion batteries is in a less reactive compound. Lithium batteries are widely used in portable consumer electronic devices. The term "lithium battery" refers to a family of different lithium-metal chemistries, comprising many types of cathodes and electrolytes but all with metallic lithium as the anode. The battery requires from 0.15 to 0.3 kg of lithium per kWh. As designed these primary systems use a charged cathode, that being electro-active material with crystallographic vacancies that are filled gradually during discharge

Liquid Crystal Display (LCD)

A liquid crystal display (LCD) is a flat panel display, electronic visual display, or video display that uses the light modulating properties of liquid crystals. Liquid crystals do not emit light directly. LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images which can be displayed or hidden, such as preset words, digits, and 7-segment displays as in a digital clock. They use the same basic technology, except that arbitrary images are made up of a large number of small pixels, while other displays have larger elements. An LCD is a small low cost display. It is easy to interface with a micro-controller because of an embedded controller (the black blob on the back of the board). This controller is standard across many displays (HD 44780) which means many micro-controllers 14 (including the Arduino) have libraries that make displaying messages as easy as a single line of code.

LCDs are used in a wide range of applications including computer monitors, televisions, instrument panels, aircraft cockpit displays, and signage. They are common in consumer devices such as video players, gaming devices, clocks, watches, calculators, and telephones, and have replaced cathode ray tube (CRT) displays in most applications. They are available in a wider range of screen sizes than CRT and plasma displays, and since they do not use phosphors, they do not suffer image burnin. LCDs are, however, susceptible to image persistence.

A **liquid-crystal display (LCD)** is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals combined with polarizers. Liquid crystals do not emit light directly^[1] but instead use a backlight or reflector to produce images in color or monochrome[6]



Fig 2. Liquid Crystal Display(LCD)

Buzzer

A buzzer or beeper is a signaling device, usually electronic, typically used in automobiles, household appliances such as a microwave oven, or game shows. It most commonly consists of a number of switches or sensors connected to a control unit that determines if and which button was pushed or a preset time has lapsed, and usually illuminates a light on the appropriate button or control panel, and sounds a warning in the form of a continuous or intermittent buzzing or beeping sound. Initially this device was based on an electromechanical system which was identical to an electric bell without the metal gong (which makes the ringing noise). Often these units were anchored to a wall or ceiling and used the ceiling or wall as a sounding board. 15

The electric buzzer was invented in 1831 by Joseph Henry. They were mainly used in early doorbells until they were phased out in the early 1930s in favor of musical chimes, which had a softer tone[7]



Fig. 3 Buzzer

Arduino Nano Unit

The Arduino Nano is a small, complete, and breadboard-friendly board based on the ATmega328 (Arduino Nano 3.x). It has more or less the same functionality of the Arduino Duemilanove, but in a different package. It lacks only a DC power jack, and works with a Mini-B USB cable instead of a standard one.

7805 IC Voltage

sources in a circuit may have fluctuations resulting in not providing fixed voltage outputs. A voltage regulator IC maintains the output voltage at a constant value. 7805 Voltage Regulator, a member of 78xx series of fixed linear voltage regulators used to maintain such fluctuations, is a popular voltage regulator integrated circuit (IC). 16 7. Gear lever 8. Push buttons 9. Jumper wires 10. Resistor 11. Battery holder 12. Plywood 13. Nuts, bolts, screws.

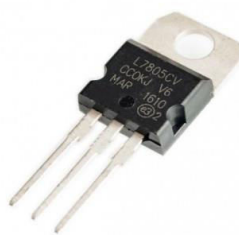


Fig. 4. 7805 IC Voltage

WORKING :

First of all a base of 10 by 10 is take i.e. of 16 mm thick plywood on one side of the flat plate a vertical plate of 8 by 10 is mounted with support, on the top of this plate horizontal plate of 6 by 3 is of fixed. On the top plate of Servo motor is attached and on the vertical plate another servo motor is mounted. The top servo motor is converted to a Cranel with a connecting shaft of length 9 cm. This servo motor converting and Cranel represents the clutch of a two wheeler. While the vertical plate Servo motor is connected to during gear shifter using a 7.5 cm long connecting shaft and the gear shifter is mounted on the vertical plate with the help of nut and bolt. So, during operation of project this Servo motor are connected to batteries and microcontroller unit. The battery are 3.7 volt Li-ion battery there are of two batteries connected in series there by obtaining 7.4 volts through a voltage regulator of 7805 IC the supply for battery is given to the Servo Motor is converted to microcontroller unit. There are two push type of buttons those are also connected to the microcontroller unit. These buttons are used to up shift and down shift the gear shifter pedal. A two line display merit is also attached to the microcontroller. The display unit is used to display the number of gears that in activated and the microcontroller unit display merit are contained in a plastic box. There in a main ON/OFF buttons to make the project ON and OFF. 22 When the project is made to run a welcome message is displayed on the display unit and the automation unit makes the vehicle in neutral gear. When the operator push the plus button, the automation unit operates as the clutch and then shift the gear pedal and the release the clutch whole procedure is repeated until the gear is shifted to 4th gear then not allowed the gear shifted ascend. On the other hand, of the operator push the minus button, the system operate the clutch down shift the gear and release the clutch. The whole procedure is repeated unit the set up in shifted to neutral no more descend of the gear is allowed. Clutch Actuation: Now in order to shift the gear, the switch is used which actuates the clutch first and the clutch disengages. The command is given through the microcontroller to the servo. The clutch once disengaged must be engaged slowly so that the power transfer from engine to gearbox is smooth. In manual transmission the clutch is being actuated manually. Also a delay time is to be given in the program as the clutch has to be disengaged before the gear is shifted. 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. This is how the project is constructed and works



Fig 5 PROTOTYPE OF AUTOMATIC CLUTCH GEAR MECHANISM

FOUR BAR MECHANISM

A four bar mechanism is used to transmit motion from one rotary link to another link which can either rotate or slide depending upon the type of joints used in the mechanism. There are 3 different types of four bar mechanism, namely: Planar quadrilateral linkage, Slider-crank linkage, Double Slider linkage. For our purpose, we implemented planar quadrilateral linkage[8]. There are four links and four revolute joints in the planar quadrilateral linkage. One link in this type of linkage is always fixed and it is called as ground link. Other two links which rotate are called crank and rocker arm. The remaining link which joins crank and rocker arm is called as coupler. Planar quadrilateral linkage is used to transmit the motion of DC servo motor to gearshift lever so that gear is shifted. In this linkage, crank (small link) acts as input link which is attached to the DC servo motor, while rocker arm (big link) is the gear shift lever used to rotate the shaft which is coupled to rocker arm. [9] [10]

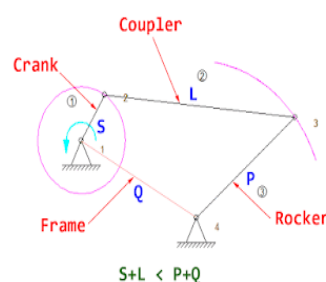


Figure 6: Line Diagram of four bar Mechanism

IV. CONCLUSION

From this research work, we conclude following points. This research is most useful for handicap persons those who cannot drive the two wheelers because due to gear shifting problem. Hence the gear shifting mechanism is developed and modified according to their requirement. The application of this gear shifting mechanism leads to make the driving process for driver easier, reduces the risk of destabilizing, the chance of miss shifting. Due to this mechanism driver can concentrate on road rather giving concentration of gear shifting and easily drive in traffic areas. The system is cheap and can be implemented in any bikes available in market. Smooth rides in all city conditions. No need for

internal modification in bikes. Less human intervention in riding bike. Gear limits can be changed by optimizing the program in microcontroller. The vehicle can be switched to automated as well as manual by easy switch. Due to its low cost and easy manufacturing, companies can implement this system and increase their sales.

FUTURE SCOPE : → The research work would can be implemented in Mopeds for fuel efficiency, in Bike for ease of riding, in three wheeler and in modified vehicles for handicapped peoples.

ADVANTAGES : It requires simple maintenance. The safety system for automobile. Checking and cleaning are easy, because of main parts are screwed. Easy to handle, Low cost automation project and Repairing is easy.

DISADVANTAGES : Initial cost is required and Programming is the task in this system.

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