



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 11, Issue 5, May 2022

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 8.118

9940 572 462

6381 907 438

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Fabrication of Voice Operated Gear Shifting Mechanism

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ABSTRACT : Gear shifting mechanism plays an important role in conservation of fuel and energy. In this project, we aim at developing easy gear shifting mechanism for transmission which will make motor bike rider's gear shifting very easy. Everyone desires for the smooth running of the vehicle whatsoever may be the speed of pickup of the vehicle a person is operating, but one of the most important system which every engineer is concerned about in vehicle is gear shifting system for ensuring smooth and desired ride on their two wheelers. Some simple mechanism is arranged with the servo motor and solenoid plunger which will help us to change the gear as per the desired torque. In this gear shifting mechanism, gear shifting is done with the help of two solenoid plungers. During this mechanism the clutch is operated by a servo motor which is controlled by the module feed in the Arduino Uno. The upshifting and downshifting of gears is done with the help two independent switches. These two switches are connected to solenoid plungers via Arduino and mosfet. Arduino Uno is an electronic modulator board which is used to take input from switches and potentiometer and control servo motor and solenoid plungers. This system will help us to change the gear as per desired speed with minimum efforts and reduces time delays. The advance technique in gear shifting mechanism leads to flexibility and easiness for human. Button operated gear shifting mechanism is more significant for physically handicapped users. This system gives more benefits and reduces time delay in gear shifting.

KEYWORDS - Four stroke engine, gear box, Servo motor, Arduino UNO, Rotary Potentiometer, Solenoid Plunger

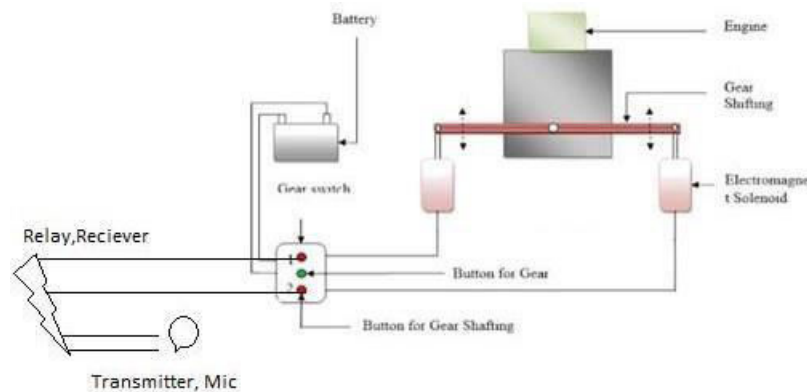
I. INTRODUCTION

The main objective of our project is to perform an automatic gear change control apparatus for an automobile and a method of controlling such apparatus. A rotational output of an internal combustion engine is connected to drive wheels of the automobile and a load device. When a gear shifting-up of an automatic transmission is to be effected, the load applied by the load device is increased, or the load is connected to an output rotation shaft of the engine via a selectively-connecting device, thereby reducing the rotational speed of the output rotation shaft of the engine to a required level. In this work, two electromagnetic coils are coupled to the gear rod of the two ends. The two buttons are used to activate the electro-magnetic coil so that the gear will be shifted.

An automatic gear change control apparatus for an automobile, comprising an internal combustion engine; an automatic transmission connected to an output rotation shaft of engine so as to transmit the rotational output of drive wheels through any selected one of gear ratios; apparatus comprising a load device for applying a load; means for connecting load device to output rotation shaft of engine and for generating a gear change control signal for selecting one of gear ratios of automatic transmission in accordance with one of operational conditions of automobile and said engine; and load control means for increasing the load of said load device when said gear change signal-generating means generates the control signal for shifting up the gear in automatic transmission. Increasing demands on performance, quality and cost are the main challenge for today's automotive industry, in an environment where every movement, component and every assembly operation must be immediately and automatically recorded, checked and documented for maximum efficiency.

Automotive technology has been developed in many areas, like ABS system, active steering system and other safety systems, which are implemented to increase the passenger safety and comfort. The development has concluded also the gearbox, which became much smoother and produces less noise. Gear shifting mechanism must For some drivers, the gear shifting can cause some confusing at driving specially at critical situations. A crowded road on a hill or a sudden

detour makes a lot of tension on the driver. One of the difficulties in this situation is to choose the right reduction ratio and engaging it at the right time.



Model of voice operated gear shifting mechanism

II. LITERATURE REVIEW

When the engine is ignited and cam shaft rotates the rotary motion of camshaft is transmitted to the crank shaft which act as driver unit and transmit its motion to gear unit or driven shaft of gear. A load device is also connected to the crank which senses the load on automobile. [1]

This paper is about Design and fabrication of a semiautomatic gear. Shifting mechanism for a racing car like Go Kart a. This gear shifting mechanism had been design to overcome issues like –gear shifting. problem while gear shifting, to eliminate fully manual gear shifting ,so that driver can give more attention to steering, to reduce the effort and timing of gear shifting which is more important racing basically where few milliseconds. Make you a winner or a loser. The idea of pneumatic shifter rose when there was some going on discussion on different mechanism for shifting gear .Performing some analysis on basic design and on available data design was bought onto existence. [2]

This paper explains the maximum and minimum reductions per stage of planetary gear pairs and also the advantages of using planetary gear pair system over the other systems. Also allows us to study on determination of reduction ratio of this planetary gearbox. On the basis of certain parameters like torque density weight and volume the comparison between planetary gears and helical gears is done . The detailed study of planetary gear trains helps us to determine reduction ratio for each stage. [3]

To automate the manual transmission in two wheelers hydraulic and pneumatic drives are used. But these equipment results higher weight of vehicle. Also the response of this system gives sluggish response and leakages issue. To avoid this AMT is used. Electromechanical device based on DC motors is used to automate the gear system in two wheeler. Instead of using log for gear shifting gear shifted automatically based on speed. This mechanism is reliable and quick as compare to hydraulic and pneumatic drive. The cost of this system is very low. Also it gives comfort to the rider.[4]

The automatic gear shifting mechanism takes advantage over manual gear shifting system. but in situation where we have to change gears frequently the fully automated system is not much useful. In such condition the electromagnetic gear shifting system is used. This system is much better than button operated hydraulic and pneumatic system. The weight of this system is much lower than hydraulic and pneumatic system because of less equipment. also here is no need of compressor .hence the weight of setup is decreases. In this system the gears are operated using electronic switch. these switch are connected to battery. The battery is connected to electromagnetic actuator. The electromagnetic actuator is work on LVDT principle. There are two coils are fitted around the magnetic bar. As we push the button the current is passes through the coils. Due to supply of current there is generation of magnetic field in the coils. These magnetic field attract the magnetic bar. There is generation of specific torque in the bar. This torque is used to shift the gears. Electromagnetic system is better than hydraulic and pneumatic system because of low weight and less space requirement. It also better than fully automated system because it can be used in traffic and urban areas where we need to change gears frequently. But the torque generated is very difficult to control. Also the availability of electromagnetic actuator is very low. But these system gives confidence to the driver [5]

In manual translation system the rider has to use clutch pedal to change the gear in two wheelers. It becomes difficult to understand to new rider. It also feel uncomfortable to the rider. In situation like traffic it becomes very difficult to change the gear frequently. To modify this and to give superior comfort to the rider AMT is used. Some cars like MARUTI, FERRARI already have this system but its not implemented in two wheelers because of bulky hydraulic and

pneumatic equipment. This equipment increase the weight of setup. The space required for hydraulic and pneumatic equipment is more. In AMT we make the gearing system totally electronically controlled. It uses various sensors for getting input signal. These sensors sense input signals like speed, gear position. After sensing the signal it is send to the microcontroller or PLC. PLC converts this signal with the help of programming and gives signal to the actuator. Actuator consist of stepper motor or DC motor. These actuators are connected to the gear pedal. After actuating it exerts particular torque based on gear box and the gear is shifted. The PLC is programmed such that after sensing particular speed it actuate the actuator. After proper speed the gears are automatically changed without any human interference. Automated gear shifter is very useful but situation like traffic or urban areas where we have to change the gear frequently this system becomes complicated .[6] In the present world of automobile, gear shifting system are manually and automatic. Gear shifting system is important and easy way of varying speed. but automatic gear shifting system is costlier than manually gear shifts system. Manually gear shifting system is difficult to operate for handicap people. There is involvement of physical efforts. to reduce this effort they have introduce touch screen based automatic gear shifting system. In that system by touch on touch screen panel gear is shift. By applying this gear shifting system it gives cost reduction in compare of automatic gear shift system. It also reduces the possibility of transmission error of manual gear system. The purpose of this idea is to reduce physical effort of human being and they can concentrate only in driving and prevent the accidents. In present report they have studied literature review based on this review and define transmission system and gear shifting mechanism to modify a manual gear shifting mechanism. [7] Supply Planetary gear trains are used for power transmission. This gear arrangement is fitted in the planetary gearboxes. This planetary gearbox plays an important role in lowering the speed of the motor also inertia matching and the torque is boosted by this arrangement. Also the gearbox provides sturdy Mechanical interface for mechanical components like pulley drums cams etc. [8]

The fully automatic system is very costly and not afforded by middle class people. Also the semi-automatic gear system has advantage over fully automatic system and its cost is much lower than fully automatic system. In semi- automatic gear shifting the gears are operated with the help of electronic switch provided on the handle of bike. the two switch are provided to sift the gears. The electronic switch actuates pneumatic cylinders. The two pneumatic cylinders are fitted above the gear pedal for shifting the gear as the pneumatic cylinders actuate it gives forward or reverse stroke to the gear pedal and the gear is actuated. This system gives confidence to the rider. [9] At present the gear transmission is done manually through mechanical linkages from foot pedal. This technique takes time for gear shifting and sometimes the gear don't mesh properly due to which life span of gears are reduced. So to avoid this automatic transmission is done with the help of pneumatic gear transmission. This includes manual four speed gear box, two pneumatic double acting cylinders, Programmable Logic Controller (PLC), an electrical motor, limit switches, push buttons, bulbs, a table (holder) and power. [10]

They have used electronic devices for automatic gear changing in two wheeler which is very useful for the gear changing mechanism in automobile vehicles. And which can give more accuracy and simplicity in changing gear while driving. And also system will become friendlier. They have used various components are as follows 1) Two wheeler gear changing pedal 2) Clutch 3) D.C. Motor (Flywheel) 4) Regulator (Accelerator) 5) Control Unit 6) Speed sensor [11]

Stepper motors are electromechanical devices which converts electrical pulses into mechanical movements. In this paper we have used a micro stepper motor and a control system for two phase hybrid stepper motor. For improving the positioning accuracy we have used Im3s6965 arm processor which will divide the step to micro step for required number of steps of the stepper motor. The current in each winding of the stepper motor is adjusted by sine cosine micro stepping method. This paper explains running of motor at different speed changing the number of samples per rotation and position control by number of samples. Thus the experiment showed that the control system used for controlling the stepper motor is reliable.[12]

Among these studies, many were focused on modifying the transmission designs to keep the vehicle safe and controllable, and to make passengers more comfort introducing Mechatronic Systems in Automobile Transmissions. Mechatronics is the engineering discipline concerned with the construction of systems incorporating mechanical, electrical and information technology components. Today, mechatronics is an area combining a large number of advanced techniques from engineering, in particular sensor and actuator technology, with computer science methods. [13]

The previously used electronic gear shifting system the cost is very high. To reduce the cost the new electronic system is used. It consists of two motor. One is to automate the clutch and other is to automate the gear. The clutch wire assembly is also replaced by in this system these motors controlled by ATmega16 which enables gear shifting and clutch operation. The motors take power from batteries and actuated by an algorithm or program of different ICs to change the gear. [14]

In this paper the author used PLC and pneumatic actuator to change the gear of two wheeler as the speed increases the sensor sense the speed and change the gear of bike. Automatic gear system provides superior driving comfort over

manual gearbox. Both system have been used in this paper that's why name given is hybrid gear shifting.[15] The manual gear shifting process is must slower. To make it faster eccentric cam operated semi-automatic gear shifting system ids use. The electronic device is use to change gear automatically. To eliminate the disadvantage of manual gear changing system eccentric cam operation is use. This method is useful for reducing space required for the gear box it also reduce wear and tear by reducing setup equipment. The operation in this method is less noisy. The cost required for this setup is very low as compare to hydraulic semi-automatic system . As the equipment quantity is low and construction is simple the maintenance cost is also very low [16]

Gears in automobiles are used through which the vehicle gets motion & also it gives power & speed as the load on the engine is increased or decreased. In 2 wheelers the gear boxes are used that are operated with the help of foot pedal. This pedal is connected via linkages to the gear box due to which gear shifting is done. But due to this the gear shifting takes time and also sometimes proper meshing if gears are not done which leads to damage of gear. With the help of an automatic transmission of gear with the help of electro pneumatic, hydraulic, pneumatic systems this problem can be solved.[17]

In earlier day the shifting of gears was done through hand operated mechanism which was little bi complicated and also the rider does no feel comfortable with hand operated mechanism. In today's era the gear shifting is done automatically with the help of electro-pneumatic system. It include four speed gear box ,single pneumatic double acting cylinder, two position five way DCV , push button, compressor and power supply .[18]

With the help of pneumatic system along with PLC gear shifting can be done easily and fast. With the speed variation gears can be automatically shifted this will help in proper meshing of teeth o gears at proper time. for finding such automated manual transmission the proper torque is required.[19]

In automatic gearboxes various techniques are used for shifting gear which are mechanically controlled. This present paper have discussed the gear shifting using an embedded system has small dimensions, economical and low maintenance cost. there is no any human interference in shifting gear microcontroller does it all according to the speed of vehicle. As per comparison between manual and automated transmission, manual transmission don't want much maintenance cost and support to save fuel. In automated transmission there is more comfort during driving situation and minimize daily normal driving difficulties which arrive in hills, traffic or situation where we required rapid gear shifting . In this paper an experimental setup is designed and calculated the characteristic performance on different load condition. Different methods are discussed herein for power loss reduction in gearbox. No load losses can be reduced especially of low temperature and part load conditions. Low loss gears can contribute substantially to load dependent power loss reduction in the gear mesh. Since these ratios differ between gears in a fixed gear ratio transmission, the speed of the vehicle could change suddenly during shifting process. [20]

As the name suggest Automated manual transmission done manually with gear & clutch operating automatically with the help of electro pneumatic or hydraulic system. Providing sensors to the speedometer the gears are shifted according to the increase in speed. This will help in reduction of energy consumption of vehicle. It also provides comfort to the rider & increases the performance of the vehicle without harming the environment.[21]

This paper introduces how the energy can be save in shift schedule so that efficiency of torque converters efficiency high. The author focuses on the further study of saving energy shift theory. At the same time, This paper explains how one can use this theory what ways and shows various control methods for saving shift schedule energy and further author also explains the how to use delayed shift so the problem like shift cycle eradicate to increase accuracy of automatic shift control[22]

Due to slow response of manual gear shifting system the fully automated system has advantage over manual gear shifting system. Fully automation is very useful in two wheelers. The automation is apply using embedded system

i.e. using microcontroller. The several programs are used to sense the speed of the vehicle according to which the input signal is generated if there is necessity of changing gear. The generated signal is send to the PLC .PLC gets the signal and after analyzing the signal PLC convert it into proper electronic signal. .this signal is sent to the actuator to actuate the gears.as the speed increases higher the gear is selected. All the process is done without any human interference.[23]

Steeper motors are electromechanical devices that convert electrical pulses into mechanical movements. Applications of stepper motors are seen in many areas of industry like business machines, computer peripherals, robotics, silicon processing, IC bonding and many more. In the mentioned applications controlling the stepper motor is necessary. This paper deals with the use of DTMF (dual-tone multi-frequency) technology for the purpose of communication using radio frequency to control the stepper motor. Through the use of mobile phone network the angular position of stepper motor can be controlled remotely in any part of the world as DTMF technology implements acoustic communication for that purpose. The needed value of angular position signals in terms of DTMF tones are generated using a mobile phone. The control algorithm is implemented by the use of a microcontroller after receiving the DTMF tone. Here the overall system used for operating stepper motor is very simple, rugged and cost effective and also no other device for signal transmission other than mobile phone is required. The results of the whole experiment show that the system has high resolution, repeatability and error is also within the tolerance limit.[24]

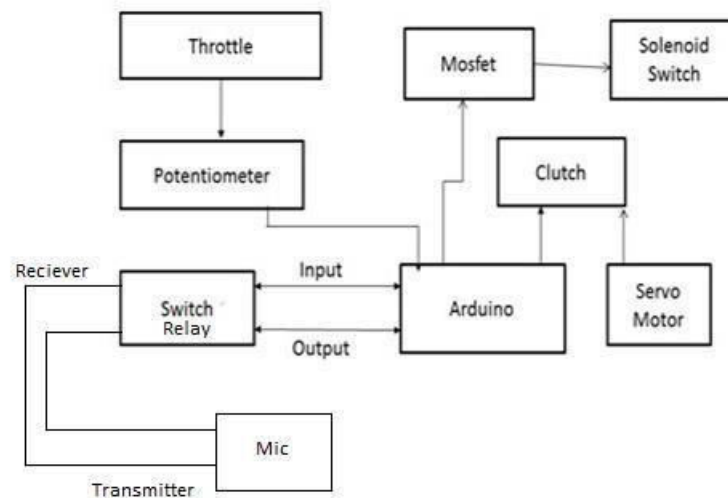
In this study project, a gear shifting mechanism was planned and applied to make the gear shifting process faster and effortless for the driver. For that new device must be reliable, low construction and low maintenance cost. This paper study aims to improve made easy gear shifting process using devices as: a manual four speed using gear box of two wheeler, four pneumatic double acting cylinders, four pneumatic two position five ways directional control valves, Programmable Logic Controller (PLC) unit, an electrical motor, an electrical clutch, a belt, two pulleys, limit switches, push buttons, bulbs, a table (holder) and power supply. According to suggested gear shifting method the driver can select the transmission gear ratio without any efforts from the steering wheel by putting the gear shifting push buttons on the steering wheel. Using this method leaves the driver to the excitement of choosing this automatic shifting mechanism[25]

III. DISCUSSION

When a gear shifting-up of an automatic transmission is to be effected, the load applied by the load device is increased, or the load is connected to an output rotation shaft of the engine via a selectively-connecting device, thereby reducing the rotational speed of the output rotation shaft of the engine to a required level. In this work, two electromagnetic coils are coupled to the gear rod of the two ends. The two buttons are used to activate the electro-magnetic coils so that the gear will be shifted.

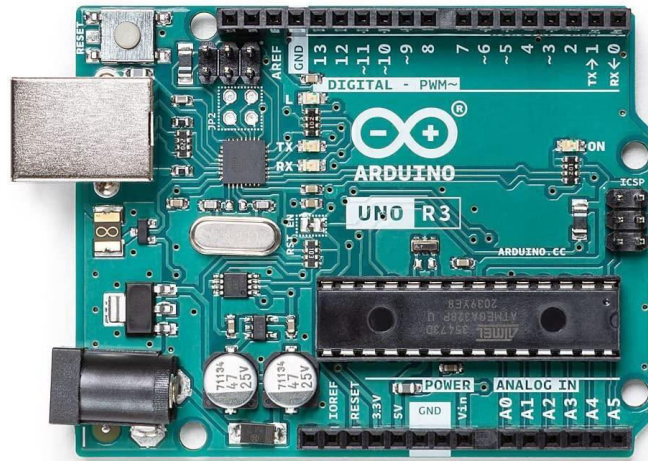
Automotive technology has been developed in many areas, like ABS system, active steering system and other safety systems, which are implemented to increase the passenger safety and comfort. The development has concluded also the gearbox, which became much smoother and produces less noise. Gear shifting mechanism must be easy to use and workable, these demands are very important especially for small cars used by special needs people.

For some drivers, the gear shifting can cause some confusing at driving specially at critical situations. A crowded road on a hill or a sudden detour makes a lot of tension on the driver. One of the difficulties in this situation is to choose the right reduction ratio and engaging it at the right time.



Working circuit

In this circuit, throttle is attached with the potentiometer. At starting the position of throttle is at zero and current in the potentiometer is low. As the throttle increases, current in potentiometer increase and the output of potentiometer is feed into the Arduino modulator board. It is programmed according the current of the potentiometer. When the current decreases, then Arduino board operates servo motor which in turn operates clutch lever and then clutch is disengaged. When the current increases, then Arduino board operates servo motor in reverse direction and then the clutch is engaged again.



Two switches for upward and downward shifting are also connected with Arduino modulator board. When the switch for upward gear is pressed then the Arduino passes the command to servo motor by which servo motor will rotate in forward direction and clutch disengages and when clutch got fully disengaged Arduino board will pass the command to mosfet through which solenoid actuates and gear will be shifted in forward direction.



After the solenoid have actuated, Arduino board will again pass the command to servo motor to rotate in reverse direction so that clutch will get engaged again.



When the switch for downward gear is pressed, Arduino again passes the command to servo motor by which servo motor will rotate in forward direction and clutch disengages and when clutch got fully disengaged Arduino will pass the command to mosfet through which solenoid actuates and gear will be shifted in forward direction. After the solenoid have actuated, Arduino board will again pass the command to servo motor to rotate in reverse direction so that clutch will get engaged again.

IV. CONCLUSION

Based on comprehensive literature review of various aspects in developing voice operated gear shifting mechanism, the following conclusions have been drawn. This voice operated gear shifting mechanism is very flexible due to its

reaction time. This system having quick response due to its simple mechanism and it is comfortable for physically handicapped people and also from women's point of view. Due to its simple mechanism and quick response it has very good performance in gear shifting. It is very easier to operate over feet operated gear shifting.

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