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Button Operated Gear Shifter in Two Wheeler using Stepper Motor

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***Abstract*—** The main objective of this paper is used to bring automation in gear shifter of two wheelers using stepper 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 gear box, stepper motor, battery, 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 stepper motor through programming we going to achieve to control motion i.e. Clockwise or anticlockwise by some specific angle.

Keywords- AMT (AUTOMATED MANUAL TRANSMISSION), PLC (PROGRAMMABLE LOGICAL CONTROL)

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 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. In 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, 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 system is more than usual also it has got drawback of space availability[2]. The electromagnetic gear shifting system is much advanced than hydraulic and pneumatic system. It uses electromagnetic actuator to shift the gear. This system does not need compressor as needed in hydraulic system. But the electromagnetic actuator is not easily available. Also the torque generated is difficult to control to advance this concept fully automated was invented. In this system the various speed sensors like speed sensor and gear sensor are used. This sensors sense the speed and if there is necessity of shifting gear then the signal is send to PLC and then PLC actuate the actuator. This actuator generate the specific torque which is require for shifting the gear[3].

This system is advanced over manual, hydraulic, pneumatic and electromagnetic system. The gears are operated without any human interference[4]. 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 stepper motor is used to shift the gears. The system is semi automated. The button

provided are used for changing the gear. This button actuate stepper motor which is connected to cam operating shaft instead of pedal of gear. Stepper motor is programmed to turn at specific angle which in turns shift the gear[5]. This system is also useful for handicapped person. Also the no 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.

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 semi-automatic 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. Also 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. So 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 lm3s6965 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]

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IV. REFERENCES

[1] A.A.Shingavi1,Tagad Sham Annasaheb,Pagare Sagar Balasaheb,Pawar Prashant Jayram,Khose Satish Bhau,"Electro-Pneumatic Gear Shifter",. *International Journal for Scientific Research & Development*, vol. 4, Issue 1, 2016.

[2] Tanmay J Wadgaonkar, Madhur R Pawar, Swapnil V Vaidya," Design and Manufacturing of Pneumatic Gear Shifter for Go-Kart",*International Journal of Engineering Research & Technology*, Vol. 5, Issue 8, 2016.

[3] Rahul Sharma, Avichal Agarwal, Udit Sharma," Design of semi-automatic electronic gear shifting mechanism ",*International Journal of Research in Engineering and Applied Sciences*, Vol. 5 , Issue 8, 2015.

[4] A. A. Jagatap, S. D. Lokhande,"Automated manual transmission for Two wheelers", *International Engineering Research Journal*,special Issue 2, Page No.40–45, 2015.

[5] Reenu George, Manoj G, S. Kanthalakshmi ," Design and Implementation of PWM Stepper Motor Control Based On 32 Bit Arm Cortex Processor",*International Journal of Advanced Research in Electrical*, Vol. 3 , Issue 7, 2014.

[6] Abhijith B., Basil Mathew , Dolphin Dev , Vishnu S, Ms. Bibi Mohanan 5," Automated Manual Transmission for Two wheelers", *International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering*, Vol. 5 , Issue 3, *2016*

[7] K. J. Purohit, H. J. Prajapati, D. D. Patel, M. B. Patel, K. J. Parekh," A Review Paper on Development of Automatic Gear Shifting Mechanism*", International Journal for Scientific Research & Development*,Vol. 3, Issue 12,2016.

[8] Mankar N.A. , Mr. Keshar S. D. ,Minde R.R.,Mr. Khaja Abulfaiz A. H. ,BarheS.E. ," Electro-pneumatic Gear Shifting Mechanism", *International Research Journal of Engineering and Technology* , Vol. 3, Issue 3 ,2016.

[9]P.Amuthakkannan,V.Manikandan,S.Muthuram,Pankajkuar, "Eccentric cam operated semi automatic gear shifting system for two wheeler", *International Journal of Advances in Engineering Research*, Vol. 10, Issue 4,2015.

[10] Vishnu P R ,Vishnu R,Ratish R,Vinoth kumar G, "Pneumatic Gear Transmission for Two Wheeler", *International Journal of Emerging Technology in Computer Science & Electronics* , Vol. 2 , Issue 1,2016.

[11] Thorat Arati.C1,Tate Pranaya.A2, Desai Shraddha.N, "Automatic Gear Changer in Two Wheeler using PIC*",International Journal for Scientific Research & Development*, Vol. 3 , Issue 8,2015.

[12] Romesh Makwana, Prof. Rajnish Katarne," Analysis of Auto-Gear Shifting Mechanism on different Load Conditions", *International journal of engineering sciences & research technology*, Vol. 3, Issue 8,2014.

[13] Prabhakar Vitthal Pawar, P.R. Kulkarni," Design of two stage planetory gear train for high reduction ratio",*International Journal of Research in Engineering and Technology*, Vol. 4, Issue 6, 2015.

[14] Dhruv Tanwar, Abhishek Sharma, Sahil Sharma, Shantanu Bansal," Development of Low Cost Electronic Gear Shifting System with Clutch Operation for Sequential Gearbox",*International Journal of Aerospace and Mechanical Engineering*, Vol. 2 , Issue 3, 2015.

[15] Shivaprasad N,Dr A N Hari Rao ," Power assisted hybrid gear shifting System in automobile*", Iinternational journal of advances in production and mechanical engineering*, Vol.1 , Issue 5 ,2015.

[16] Akshyakumar. Puttewar,Pratik Kadu,Narendra Sontakke,Sanket Mahulkar,Sumit Bawaria,"Design and Fabrication of Hand Operated Gear Shifting Mechanism", *International Journal for Scientific Research & Development*, Vol. 3, Issue 2, 2015

[17] P. Sarath Babu, "Analysis of Developing New Smart Systems in Automobile Transmissions",*The International Journal Of Science & Technoledge*, Vol. 3, Issue 1,2015.

[18] Muthu raj.M, Bharath R, Kirupahar P, Manigandan G, Manikandan T," Design and fabrication of button operated electromagnetic gear changer for four stroke petrol engine two wheeler vehicle", *The International Journal Of Science & Technology*, Vol. 2 , Issue 3,2016.

[19] D.Mangeelal1, P. Ravikanth Raju, K. Nagendra Kumar, P.Amani,"Button operated electro-magnetic gear shifting system", *International Journal of Computer Science information and Engg*. , Vol. 2 , Issue 4,Series 2, 2014.

[20] S vijay, P Nithesh Reddy, P Masoom Basha ,"Fabrication of Pneumatic gear changer ",*IOSR Journal of Mechanical and Civil Engineering* , Vol. 11, Issue 3,2014

[21] M. S. Kumbhar,Proffessor, D. R Panchagade,"A Literature Review on Automated Manual Transmission (AMT)", *International Journal for Scientific Research & Development*, Vol. 2 , Issue 3, 2014.

[22] Hua Li, Jiahua Han, Jin Yao, Yongjing Huang, "Hybrid intelligent gearshift control of technical vehicles based on AGA-NN ",*International Journal of Control and Automation* , Vol. 6, Issue 4, 2013.

[23] P.Alexander, T.Sudha, M.Omamageswari, automatic "Gear transmission in two wheelers using embedded system", *International Journal of Advanced Research in Engineering and Technology* , Vol. 3, Issue 2,2012.

[24] Sagarika Pal, Niladri S. Tripathy, " Remote Position Control System of Stepper Motor Using DTMF Technology",*International Journal of Control and Automation*, Vol. 5 , Issue 2, 2011.

[25] Muntaser Momani, Mohammed Abuzalata, Igried Al-Khawaldeh and Hisham AlMujafet, "Pneumatic,PLC Controlled, Automotive Gear Shifting Mechanism",*Research Journal of Applied Sciences, Engineering and Technology* , Vol. 2, Issue 3, 2010.