Fabrication Of Electromagnetic Gear Changer In Two Wheelers (Button Operated) – A Review

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***Abstract*– The main objective of this project is to apply the gear by using automotive electromagnetic system in automobiles. This is an innovative model mainly used for the vehicles. In this project, we designed the button operated electromagnetic gear changing method in two wheeler by using the D.C guns. By using this system, we can easily control the vehicle and also avoid the wear and tear of the gear.**

***Keywords*— Electromagnetic system, Button operated, Gear changer, D.C guns, Avoid wear and tear.**

1. INTRODUCTION

The light vehicle's transmission is determined by the number of force applied to the gearshift. In recent years, most motorcycle gearshift assemblies have been fabricated with a foot pedal that is shifted upwardly and downwardly by using the bottom and top surfaces of the toe or foot. For some drivers, the gear shifting method can cause some confusing when driving specially at critical situations. A crowded road on a hill or a sudden detour makes a lot of tension to the driver. One of the difficulties in this situation is to choose the correct reduction ratio and engaging it at the right time. So, we planned to design a model by using electromagnet assembly for easy gear shifting.

The heart of the electromagnetic gear changer is the electromagnetic system. In earlier days, the gears shifted by hands in MIT Bajaj, in that bike accelerator and clutch in one side. Totally three gears are available and its lead to the tough handling. As a change in design and features, now-a-days we are using clutch in hands and gearing in the foot. Even though the system is comfort, there are some drawbacks found. To overcome the above mentioned drawbacks these are some modifications are suggested to be done using (button operated gear shifting for two wheeler) button type gearing. It enables gearshifts to be putted by pressing the buttons. The neutral gear can be shifted easily by momentarily pressing either the up or down buttons. In this system, the shifting action and its operating characteristics are designed similar to the human leg shifter system which ultimately results in perfect gearshift simulation. The button type gear shift system is electro-mechanical and there are no hydraulic or pneumatic parts. It is powered by the bike electrical system and there is no need for bulky air powered systems. It is dual acting for both up and down shifts, and is very fast and consistent.

In our project, two electromagnetic coils are coupled to the gear rod of the two ends. The proximity sensor is used to sense the wheel speed and this is connected with the microcontroller. The microcontroller is activate the relay depends upon the vehicle speed. There are two relays are used, one for gear increase and another one for gear down.

2. NEED FOR OUR PROJECT

- The main purpose of this project is to automate the gear changing mechanism in vehicles.
- This project is aimed at giving convenience to the driver for gear shifting.
- Gear shifting mechanism must be easy to handle and workable, these demands are very important especially for two-wheeler used by special needs people.
- In this project, we are doing the gear changing mechanism with the help of electronic D.C guns. This is very useful for the gear changing mechanism in automobile vehicles.

3. LITERATURE SURVEY

- The rider's foot heel portion is normally rests on the stationary stirrup of foot rest which bears most of the weight of the foot and leg of the rider, while the pedal mounted on the end of a foot rest at a location where the rider could just depress or lift the toe portion of his foot with pivotal movement about his ankle joint to shift the sequence of gears of the motorcycle (Herbert, 2005)(Bosch, 1975).
- In conventional transmission system, it has a mechanical linkage that connects the gear lever to the gear switching mechanism. The mechanism of gear changing for the transmission still remains the same that is the reliance towards the gear lever located on the left leg of the rider (Cengel et al. 2009).
- A normal healthy person wouldn't have any problem to carry out this action but the situation is vice versa for

the elderly and handicapped people. Hence, the research hopes to give the data and a new light so that people that fall into the previously mentioned category may also enjoy the pleasure of riding this economical means of transport (Steve, 2007).

- The size, weight and type of the transmission system are varied from one manufacturer to another. Nevertheless, its basic principle on how the system works remains constant although it is produced by different manufacturers. For the simplest form of this system, it will only consists of a centrifugal clutch attached to the crankshaft and then redirected to the sprocket via chain.
- When the engine speed increases, the clutch activates and propels the rear wheel (Jaap, 2000),(Molly and Pautot, 1992). This is a great example for a single speed transmission system which is consider to be the most efficient system available nowadays (Lin and Costello,1983),(Salonidis, 2001).
- A solenoid gear shifter or an solenoid electric shifter is an invention that is equipped onto motorcycle or car for the gear shifting process (Lee, 1995). This technology, mainly for motorcycle, is only used for clutchless shifting of the motorcycle by just pressing or pushing a button that is mounted on the handlebars of the selected motorcycle. It also includes with a solenoid mounting plate to ensuring that the solenoid is fasten securely to the motorcycle and a micro-switch which is used to be operable connected to the solenoid and the mounted motorcycles (Kevin, 2007).
- Solenoid gear shifting mechanism uses the magnet to move upwardly and downwardly (Gerald, 1996). This movement depends on the magnetic field that is produced by the magnet when power is supply through it. This paper is meant to provide a better understanding about the motorcycle transmission system and how the system could be simply or improve in order to ensure that elderly and handicapped (leg disabled) people could ride the vehicle. The component relation to the human safety is given more attention in order to avoid unnecessary expenses in the maintenance and repair works of the vehicle, This is due to mechanical failure during the test of this kind of technology could means fatality if no contingency plan present.

4. PROBLEM IDENTIFICATION

- Whenever a project is successfully carried out, there is a reason behind it. The existing two wheelers now pose some problems for the drivers. In the Manual Transmission bikes, the main problem for the drivers is the gear shifting.
- But the engineering concept behind this kind of transmission paves way for higher power transmission efficiency, Moreover the mileage of the bike and life is also more. These two wheelers do not give much of comfort for the drivers in the terms of using the gear pedal.
- Also, it occupies a major area in the bottom part of the bike resulting in the space congestion. These are the problems in the Manual Transmission bike.
- In the Automatic Transmission category of cars, the gear shifting is easy; we just have to select the drive band, which is already fixed. This selection may be either of lever type or a set of buttons.
- But there is a concession for power transmission and mileage. As the gear selection is by a fluid power is required to drive it, so the engine performance is greatly reduced. So the problem here is mileage drop, power less and also it is costly.
- The need of the hour, combining the position of both Manual Transmission and Automatic Transmission, a mechanism has to be created for provide better mileage and comfortable gear shifting. This is the objective of the project. So a bike with this project provides ease of gear shift as in Automatic Transmission without a compromise in gear box set up.

5. METHODOLOGY

- The electromagnetic gear changer requires a very precise precision and accuracy so that it will not fail during the real working condition.
- Each of the specification used in this phase will be taken serious consideration and any flaw in the system during this phase will be boost or otherwise change by a new part.
- Theoretical calculations also will be taken into consideration as it will help to further understand how the system actually works and it fault was detected, it can be solve in a fast pace.
- Two D.C guns are used in this system, One for increasing the gear and another one for reducing gear.
- These two D.C guns are controlled by the microcontroller based Control circuit for the proper functioning of sequence of shifting the gear.
- Gear shifting sequence is controlled with the help of the Control circuit which comprises of electrical components for effective controlling of gears.
- Also, the overall functioning of this gear shifter is done by the electrical energy supplied by battery.

6. OBJECTIVES

- The major objective of this system is to minimize the human errors in operating the gears with the help of automatic technology.
- Other objectives comprise optimum gear ratios, reducing wear and tear of the gears, shifting the gear effectively, optimum performance of the gear box, optimum force exert by the cylinders to move the shifting levers (pedals).

7. MACHINE COMPONENTS

The electromagnetic gear changer in two wheeler is consists of the following components to full fill the requirements of complete operation of the machine.

- Control unit
- D.C gun
- Gear system

Control Unit

It is the electric circuit comprises of various electrical components with integrated circuit board to control the overall functions of electromagnetic gear changer. It actuates the D.C guns when switched to increase or decrease the gears by using increasing and decreasing buttons.

D.C Gun

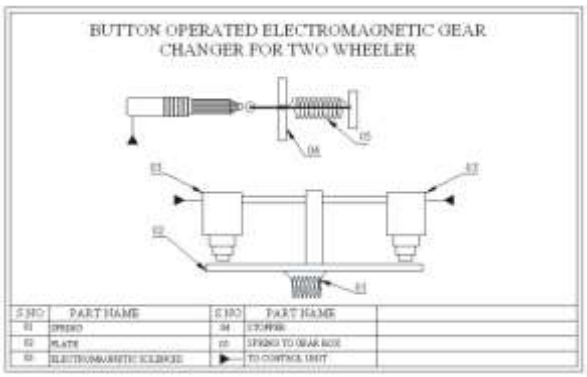
It is connected with the electrical circuit to actuate the gears. It converts the electrical energy into magnetic flux. The produced magnetic flux will actuate the pedals to operate the gear system.

Gear System

In the gear system, there is no any difference between this electromagnetic gear changing system and the ordinary system. It is same as the ordinary vehicles. But, the difference is only in the handling of gears to increase or reduce the gears as per the required speed.

8. DESIGN AND DRAWING

The drawing for the electromagnetic button operated gear changer is given below.



- The foot pedal of the two wheeler is pivoted at its centre for balancing purpose.
- Two D.C guns are fixed at either end of the pedal (Both Front and Back).
- Two electromagnetic solenoids are fixed above the either D.C guns for proper functioning when these are actuated.
- One spring is fixed at the bottom of the foot pedal (exactly centre) to compress and elongate as per the changing sequence of the gear.
- Also, the gear sequence is controlled with the help of electric circuit as per the achieved speed by controlling the increasing and decreasing button switches provided with the circuit arrangement system.

9. WORKING PRINCIPLE

- Here we have two electromagnetic solenoid arrangements which are arranged on either side of the vehicle pedal rest for applying the gear.
- The electromagnetic solenoid is fixed at the end of the flat pedal rest. The plate rest is pivoted at the center.
- The solenoids are operated with the help of electric power supply and it is controlled by the control unit.
- One of the solenoid is used to apply the gear and another one for reducing the gears. A button is placed which gives the output signal to the control unit.
- Depending up on the signal the clutch and gears will changed with the help of the control unit. The arrangement is clearly shown in the diagram.
- When we need to shift the first gear, one of the D.C gun which is fixed at the opposite direction (front pedal) will attracts the pedal to moves upward the front pedal and also the same time, the back pedal will moves downward.
- The second gear, third gear and top gear are shifted same as this.
- When we need to reduce the gear, one of the D.C gun which is fixed at the opposite direction (back pedal) will attracts the pedal to moves upward the back pedal and also the same time, the front pedal will moves downward.
- Thus, the gear shifting is done by the magnetic flux which is produced in the D.C guns as per the increasing and reducing speed.

10. DESIGN OF SPRING

We have formula for deflection

$Y = 8PD^3n/Gd^4$

Where,

Y=deflection of spring

P=load acting on the spring

D=Diameter of spring

d= Diameter of spring coil

n=no of coils in the spring

G=modulus of elasticity of spring material

$G=2*10^5$ N/mm^2

D=3.5 cm

d=0.4 cm

P=30 Kg

Y=1.5 cm

No of coils in the spring,

$n = YGd^2/8PD^3$

$=(1.5*2*105*0.44*100)/(8*30*9.81*3.53)$

$=7.463\approx$**8.**

Therefore, the number of coils in the spring is 8.

11. PROCESS PARAMETERS

The required pressure and force for applying the gear to increase (engaged) and decrease (disengage) is given in the following table 1.

Gear n	Gear 1		Gear 2		Gear 3		Gear 4	
Action	Engage	Disengage	Engage	Disengage	Engage	Disengage	Engage	Disengage
Force (N)	48.46	34.73	49.93	34.43	48.36	32.57	49.44	33.75
Pressure (Pa)	5.19	3.72	5.35	4.01	5.18	3.49	5.30	3.61

Table 1.Pressure and Force for all gears

The above given values for the pressure and force are mostly approximated to apply the gears.

12. MERITS

- A clear substitute for Auto Transmission this, is much cheaper and user friendly with more features.
- Ease of operation, by the use of spike touch buttons
- A boon for the handicapped, the car can be driven even with only one hand since buttons are used for changing gears
- Gear shift is sequential, so no problem of wrong gear selection
- It requires only simple maintenance cares
- The safety system for automobile
- Checking and cleaning are easy
- Easy to Handle
- Very Smooth gear shifting.
- Quick response is achieved
- Simple in construction
- Easy to maintain
- Continuous action is possible without stopping.

13. DEMERITS

- It may increase weight of the vehicle slightly.
- We need to alter gear shifter which may increase the vehicles weight and will reduce drivers comfort
- Cost of unit is little high.
- Since the project is specially made, it requires a skilled technician to assemble the set up in the two wheelers, considering the space constraints. Besides, the driver should be well trained in using the system to avoid malfunction.

14. APPLICATIONS

- It is applicable in all type of two wheelers which has gear transmission.
- It is very much useful for Auto-garages.

15. CONCLUSION

The project done by we made a magnificent task in the field of automobile field. It is very useful for driver while drive the vehicle at any places without any difficulty. This project has also reduced the cost involved in the concern. Project has been designed to achieve the entire requirement task which has also been provided. The application of this mechanism leads to create the driving process easier, reduces the risk of destabilizing the bike, the lap/stage time, and the chance of miss shifting. Also the project is a boon for physically challenged persons. The present condition of the project is promising for further developments. Lot of inputs are also got from the bike specialists and academicians for its improvement. This idea can be transformed to a real time fitment on further development.

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