

# Survey on Gear Shifting Strategies in the Vehicles

Aashish Magar<sup>1</sup>, A. R. Suryawanshi<sup>2</sup>

<sup>1</sup>PG Scholar, Department of Electronics and Communication Engineering, Pimpri Chinchwad College of Engineering, Pune, India.

<sup>2</sup>Associate Professor, Department of Electronics and Communication Engineering, Pimpri Chinchwad College of Engineering, Pune, India.

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**Abstract** - In last few years, automobile manufacturers are improving performance of transmission system thereby improving gearshift quality. This also includes reducing the amount of clutch operations and repeated gear shifting efforts in manual transmission. Automated transmission systems are developed which has advantage over a Manual Transmission (MT). They are more efficient than manual transmission. Therefore, automated gear shifting system not only reduces accidents, but also increases engine and fuel efficiency. With improved technology for refinement, gear shifting quality has become one of the most important design criteria for any transmission system, reducing gear shifting efforts and ensuring smooth transmission. The gear paddle and the clutch are actuated using the microcontroller system. The engine does not need to be modified because the whole arrangement is placed outside the system. This automated principle is working on the acceleration of the bike. As the acceleration increases, the sensor will detect and count the revolutions per minute. The embedded system determines which gear is preferred for the smooth drive of the vehicle according to the number of sensors and the gear is displayed by the system. It may also increase the life span of the engine. Thus, automating the gear transmission in a gear featured bike, facilitating driving and also maintaining the efficiency of the bike can achieve it. The main purpose of this paper is to study the different research work done to improve manual shift quality as well as automated manual transmission.

**Key Words:** Manual Transmission, Automatic Transmission, Gear Position Sensor

## 1. INTRODUCTION

A manual transmission is a form of transmission used on motorcycles and vehicles where gears are chosen in order and there is no immediate access to particular gears. The driver can switch from gear to gear with traditional manual transmissions by shifting the shifter to the suitable place. Before the new gear is selected, a clutch must be disengaged to disengage the running engine from the transmission, thus stopping all torque transfer whereas the Automatic Manual 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 achieving efficient driving [1].

The craze for automatic transmission has increased significantly in recent times. Many people are drawn to two

wheeler automatic transmission. But it did not reduce the sale of two wheeler manual transmission. Many two wheeler manufacturing companies have produced two wheelers for both automatic and manual transmission. A transmission essentially transfers the power to drive shaft and wheels from a bike engine. The gears in the transmission change the speed and torque of the drive wheel in relation to the speed and torque of the engine (pulling power), lower gear ratios help the engine build up enough power so that it can easily accelerate from a stop. The transmission is a device connected to the engine's back and transmitting power from the engine to the wheels of the drive.

Automatic transmissions tend to be bigger and more voluminous and are generally not regarded as effective than MT's. However, a lot of job has been performed over the previous few years and the recent generation of automatic transmissions is highly effective owing to the addition of variable ratios as well as dual clutches (DCT) which makes them change between gears at effective points based on certain engine parameters as well as the driver regulated throttled input. However, due to the fundamental architecture of an automatic gearbox that has the bulky "torque converters" that contain the transmission fluid to allow gear adjustments, the addition of extra gears and clutches makes them bigger [1].

Let's look individually at the basics of manual and automatic transmission

### 1.1 Manual Transmission

Manual transmission, also known as manual gearbox, stick shift, or standard transmission, is one type of transmission used in motor vehicle applications. It uses a driver-operated clutch mounted and disengaged by a hand lever of motorcycle to control the torque transfer from the engine to the transmission; and a gear stick operated either by foot of motorcycle.



Fig -1: Manual Transmission [11]

There is no doubt that a manual adds driving fun due to gear change but also increases driving complexity and requires more concentration. In urban driving, especially as in India where there are mammoth traffic jams, a manual gearbox could prove tried to shift in every next moment.

### 1.2 Automatic Manual Transmission

An AMT consists of a dry clutch, a gearbox, and an integrated dedicated control system that utilizes electronic sensors, processors, and actuators to control gear changes on the driver's command. An automatic transmission is a type of motor vehicle transmission that can change gear ratios automatically as the vehicle moves, freeing the driver from having to manually shift gears. Most automatic transmissions have a defined set of gear ranges, often featuring a parking pawl that locks the transmission stroke face's output shaft. The Automatic Transmission automatically performs the job depending on the speed and here a hydraulic torque converter takes the place of clutch plate mechanism saving you from the trouble of pressing a clutch. Fig. 2 shows the automatic transmission technology.

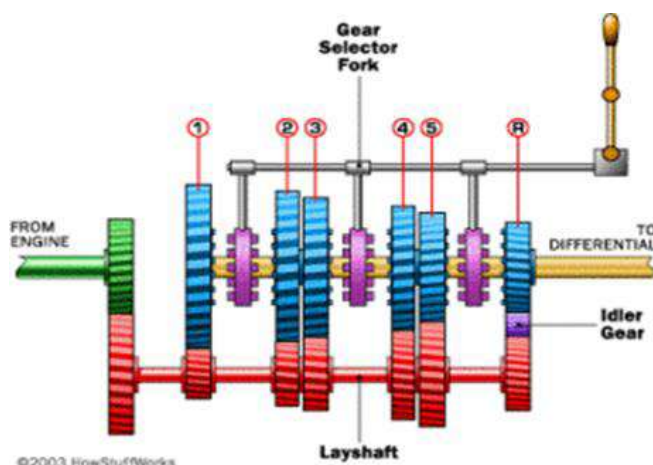


Fig -2: Automatic Transmission technology [3]

## 2. LITERATURE SURVEY

A transmission is an essential component of any vehicle regardless of its implementation. The automotive industry began with a manual gearbox in which the driver supplied the clutch inputs and gear adjustments. This implies that the

driver must physically couple and decouple the transmission from the shaft of the engine drive. Coupling a gear means both the transmission and the engine are turning at the same moment, thereby "transmitting" the energy produced by the engine to the wheels via the transmission.

The rider must use the clutch pedal in the manual translation system to change the gear in two wheelers. New rider becomes hard to understand. It also makes the rider feel uncomfortable. It becomes very difficult to change the gear frequently in situations such as traffic. It is used to modify this and give the rider AMT superior comfort. Some cars like MARUTI, FERRARI already have this system, but due to voluminous hydraulic and pneumatic equipment it is not implemented in two wheelers. This equipment increases the setup weight. More space is also needed for hydraulic and pneumatic equipment. In AMT we have complete electronic control of the gearing system. For receiving the input signal, it uses different sensors. These sensors sense signals of input such as speed, position of the gear. It is sent to the microcontroller or PLC after the signal has been sensed. Using programming, PLC converts this signal and gives the actuator a signal. The actuator is made up of either stepper motor or DC motor. These actuators are linked to the pedal of the gear. Once it is actuated, particular torque is exerted on the basis of the gearbox and the gear is moved. The PLC is programmed in such a way that it actuates the actuator after sensing specific speed. So the gears are changed automatically without any human interference after proper speed. Automated gear shifter is very useful, but this system is often complicated in situations such as traffic or urban areas where we have to change gear [1].

The mechanism for automatic gear shifting benefits from the manual gear shifting system. But the fully automated system is not very useful in situations where we need to change gears frequently. The electromagnetic gear shifting system is used in this condition. This system is much better than the hydraulic and pneumatic system operated by the button. Because of less equipment, this system's weight is much lower than hydraulic and pneumatic systems. There is also no need for a compressor. This reduces the weight of the setup. The gears are operated with an electronic switch in this system. The switch is connected to the battery. The electromagnetic actuator connects the battery. The electromagnetic actuator is based on the principle of LVDT. The magnetic bar is fitted with two coils. The current passes through the coils as we push the button. The magnetic field is generated in the coils due to the supply of current. These magnetic fields attract the bar of the magnet. Specific torque is generated in the bar. Using this torque to shift gears. Due to low weight and less space requirement, the electromagnetic system is better than the hydraulic and pneumatic system. It is also better than fully automated system because it can be used in frequently changing gears in traffic and urban areas. But it's very hard to control the torque generated. Electromagnetic actuator availability is also very low. However, this system gives the driver confidence [2].

The gear shifting system is manual and automatic in the current automotive world. The gear shifting system is important and easy to change speed, but the automatic gear shifting system is more expensive than the manual gear shifting system. Manual gear shifting system for people with disabilities is difficult to operate. Physical efforts are involved. In order to reduce this effort, they introduced an automatic gear shifting system based on the touch screen. In this system, the panel gear is changed by touching the screen. By using this gear shifting system, compared to the automatic gear shift system, it provides cost reduction. It also reduces the potential for manual gear system transmission error. The purpose of this idea is to reduce human being's physical effort and they can focus only on driving and preventing accidents. Based on this review, they studied literature review in this report and defined transmission system and gear shifting mechanisms to modify a manual gear shifting mechanism [3].

The mechanism for shifting gears plays an important role in fuel and energy conservation. Through the pneumatic button operated gear shifting mechanism, all this can be achieved. The focus of this study is on the pneumatic system and its gear shifting mechanism design. There are different methods of the button-operated gear shifting mechanism, but the study compares the methods used in the pneumatic button-operated gear shifting operated by the pneumatic system in which air is the working fluid, and another method is the electro-magnetic button-operated gear shifting operated by the electromagnet principle. These two systems will thus help us to change the gear with minimal effort as per desired speed and reduce time delays. The advancement technique in the mechanism of gear shifting leads to human flexibility and ease. Button operated mechanism for gear shifting is more important for users with physical disabilities. This system provides more advantages and reduces gear shifting time delay. But it has some disadvantages like its initial cost is very high, Complicated for Physically challenged people, Need extra battery backup, there is chances of gear breaking [4].

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 [5].

They observe the difficulty the physically challenged person faces while riding a vehicle in the journal [6]. Removing the vehicle from parking to riding position is difficult. By using the additional gearbox and wheels to solve the problem. Additional gearbox combined with vehicle

gearbox in this project. The manual operated lever was fixed with the engine for gear shifting. The vehicle moves in either forward or reverse direction based on the position of a lever.

They studied the use of the embedded system in journal to make the gear transmission faster and less destructible for the driver in the vehicle equipped with the auto clutch. Makes driving easier and driving efficiently by using this gear transmission. According to the method of gear shifting selection of gear transmission according to the speed of the microcontroller-controlled vehicle without human interference. It is possible to achieve fuel efficiency and make driving easier by using this application as well [7].

In the journal they referred to several researches that is going on about the automobile, in which they introduce automation in an automobile that means implementing automatic gear shifting mechanism in the vehicle without human intervention by means of an embedded gear control system that automatically controls this automation using the microcontroller and the necessary sensors and actuators. Once the desired gear shifting technology has been equipped, you will be able to get a smooth ride on road and off road conditions [8].

They explained about an automobile in the journal that gears are used to transmit the power from the engine to the wheel, and these gears are used for manual control. The two-vehicle gearbox is used with foot pedal operation. This type of manual connection, gear shifting takes time, during driving it can make a decisive factor. Rather than using an electronically actuated system, the gear changing time factor can be reduced. This aimed at semi-automatic design that will be used for future race car projects [9].

### 3. COMPARATIVE ANALYSIS OF MANUAL AND AUTOMATED TRANSMISSION

**Table -1:** Comparison

Sr. No.	Manual Transmission	Automatic Transmission
1	Driver is responsible for shifting gears.	Gear shifting is automatic.
2	More concentration is required	Less attention results in accident inducing behavior
3	Fuel efficiency is low	Fuel efficiency is high
4	Transmission repairs are less costly	Repair costs are high
5	Complicated to change gears frequently	Easier to use
6	Depend on manually	Less manually



	transmission	restrictive
7.	Challenging to work	Easy to work
8	Stalling is complicated	Reduced risk of stalling
9	Gear shift is located on the floor	Gear is in the steering column or floor

Comparison of Manual and Automatic Transmission Fuel Economy in Vehicles which have Both Options, Model Years 1980-2014:

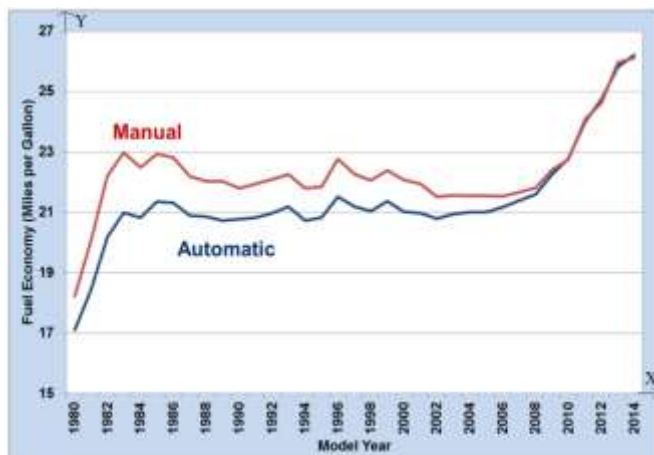


Fig -3: Comparison of manual and automatic transmission fuel economy in vehicles [10]

Manual transmissions produced better fuel economy than automatic transmissions. Improvements in the effectiveness of automatic transmissions, however, have closed this gap in latest years. Improved designs and enhanced amount of gears used in automatic transmissions have led to the enhanced fuel economy of cars equipped with automatic transmissions. Automatic engines have added gears faster than their manual counterparts.

#### 4. PROPOSED SYSTEM

By this proposed system the manual mechanical gear shifting will remain unchanged because an additional electro-mechanical system consist of gear position sensor is mounted externally on the gear box of the motorcycle. The gear position sensor detects the present gear shift position, such as first or second place, and sends the information to the ECU (Electronic Control Unit) as an electrical signal and display the gear position on the dash indicator of vehicle. This system shifts the gear up and down electro-mechanically like the human rider by sensing the gear shift position, which produces the smooth gear changing sequence. The system therefore has both manual and automatic options.

As the shift drum rotates integrated magnet in a gear position sensor attach to the shift drum also rotates. Gear

position sensor is a hall effect sensor. The voltage will be generated by the hall effect sensor that operates on the hall effect principle. This voltage will be sent to the ECU when the magnetic field passes perpendicular to the field and, depending on the situation, ECU will give commands to the actuator.

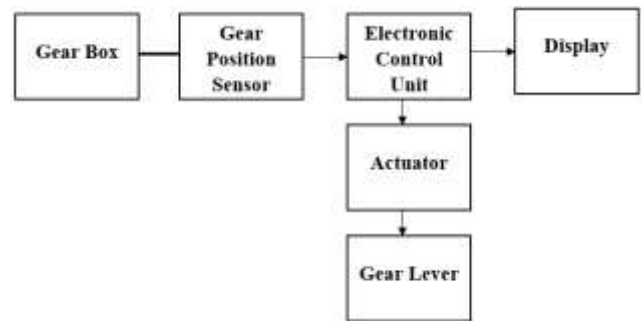


Fig -4: Block Diagram of Proposed Work

#### 5. CONCLUSION

The various research works shows that it becomes very difficult to change the gear frequently in situations such as traffic. Automatic transmission is used to modify this and give the rider superior comfort, reduce human effort and improve the efficiency of the vehicle as well. By the proposed system, shifting of the gear system is more flexible and more system becomes reliable.

#### 6. FUTURE SCOPE

People are easily applied gear without more effort with the assistance of the touch screen. It is also possible to use a touch screen in two wheel vehicles. An general approach aimed at enhancing gear shift quality. This reduces the driver's effort and provides convenience and ease. Future work with optimized control approach should basically concentrate on low price scheme.

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