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## AN ELEMENTARY ELECTROMAGNETIC AUTOMATIC GEAR TRANSMISSION IN AUTOMOBILES

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### ABSTRACT:

In this paper of An Elementary Electromagnetic Automatic Gear Transmission in Automobiles we aim to develop a simplistic gear transmission mechanism replacing manual gear transmission which will make automobile rider's gear shifting simple. The main objective of the paper is to automate the gear transmission system so that the technology can be utilized by abled as well as differently-abled people with low fuel consumption resulting in low carbon emission and more efficient vehicle. The technology consists of a proximity sensor which counts the RPM of the wheel and the input is fed to a microcontroller which leads to the gear shift by activating the respective clutch and changes the speed of the vehicle without any manual handling.

**Keywords:** Automatic gear Transmission, Clutch, Microcontroller, Electromagnetic relay, Arduino, DC motor

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### INTRODUCTION:

The need for automatic gear transmission was realized in the beginning of 20th century and the engineers started working on the technology with a slow progress but in the past 25 years several technologies came into existence supporting automatic gear transmission systems including CVT, DCT, etc. In this model we tried to increase the level of comfort of the driver by automating the gear transmission using the sensors, microcontrollers, actuators, electromagnetic relays, etc.

Nowadays, manual gear transmission is a complex technology which leads to a lot of accidents due to lack of confidence as transmission requires a lot of practice to master it, also needs the knowledge of clutch, timing, and speed by the driver. This process is needed to be done every time when there is a difference in speed more than approximately 20km/h which is a hectic task. Only after proper knowledge and adequate practice the transmission system can be used smoothly.

This work shows change in gears ratios in milliseconds which is far too fast than the human. The automatic transmission gives the driver the advantage to focus on steering and driving than to focus on the gear shifting mechanism which reduces complexity. The technology is highly useful especially in the case of heavy traffic in which the driver needs to continuously operate the clutch and gear lever. The technology eliminates the clutch which results in two pedal operation of the vehicle. The technology also offers more torque in less fuel resulting reduction in emission gases like CO<sub>2</sub>, CO etc. The gear transmission takes place via microcontroller. The proximity sensor attached to the wheel counts the pulses and gives the input to a microcontroller which leads to the gear shift by activating the respective electromagnetic relay resulting in change in gear ratio and the speed of the vehicle changes.

### **Elucidation:**

1. The gear automatic transmission technology makes the driving experience simpler for abled people and manageable for differently abled people as it leads to elimination of clutch pedal and manual gear transmission by hand.
2. The technology leads to conservation of fuel as the gear transmission takes place faster at adequate speed which leads to greater torque resulting in low fuel consumption.
3. The technology leads to low carbon emission as it consumes low fuel, also the elimination of clutch leads to smooth functioning of engine pistons resulting in no burning of mobile oil.
4. The automatic gear transmission introduces simplicity in driving experience leads to less confusion in emergency conditions reducing critical accident cases.

The technology contributes towards vehicle automation as it reduces the human involvement in driving.

### **LITERATURE SURVEY:**

The authors Simmer D. et al., found that the transmission system of a vehicle plays an vital role in decreasing the fuel consumption by the vehicle. There are many factors which leads to the fuel efficiency of the vehicle due to transmission of gear. Some of them are-

- Losses in transmission due to parasitic loss in gear transmission.
- Losses in power at chain, gear, etc.
- The effect of rotational inertia of gear transmission.
- The effect of hardware of transmission.

The idea of the research directly helps in reducing the fuel consumption by the vehicle due to the transmission [11].

The authors Lucente G. et al., explored the importance of automatic transmission system like reduction of fuel means fuel efficient, given free mind to the driver to concentrate on roads, improvement of driving comfort and gear transmission accuracy. There are a number of factors that can be combined for getting high performance gear shifts like non linearity, complexity of transmission, driveline etc. Also, the development of driveline models requires full description of actuators [12].

The authors Heath R. P. G. et al., suggested that the gear transmission can take place in zero seconds which he proved by his research and design. This is a new design of manual transmission and got patented. The technology is easy to manufacture also require less investment of money creating a better alternative to old technology of torque conversion of automatic transmission. This Zeroshift technology of transmission provides fuel efficiency and best possible torque giving more acceleration power to the vehicle. If we compare this technology to existing transmission, it provides continuous torque and acceleration to the vehicle, that is uninterrupted power by the engine without any interruption while transmission [13].

### **MOTIVE:**

1. To make the transmission system automatic.
2. To reduce the labor work while driving makes driving a cheerful experience.
3. To reduce the wiring in the transmission system using Arduino.
4. To develop a system that can be easily handled by abled as well as differently abled people.
5. To increase fuel efficiency of vehicle.
6. To reduce the carbon emission by vehicles.

**CIRCUIT DIAGRAM:**

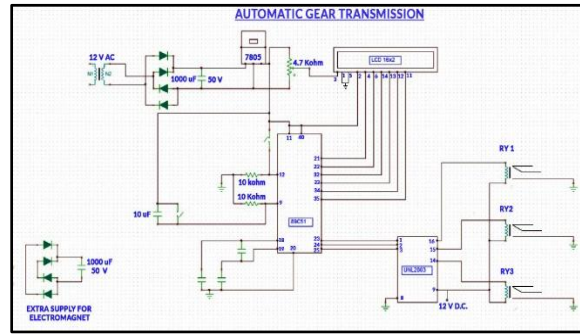


Fig 1: Circuit Diagram of Automatic gear transmission

The circuit diagram consists of many components like 89c51 micro-controller which is a simple 8-bit micro-controller derived from the Atmel family. This utilizes the 8051 architecture which is used in most of the micro-controller and widely used. It has a 40 pin IC having 4Kb of flash memory. Micro-controller has four ports, and all together has the sum of 32 Programmable GPIO pins. It also has a 5V Voltage Regulator that regulates the output voltage to 5V output for different ranges of input voltage provided to the circuit also known as IC 7805. It acts as an excellent component against fluctuations of input voltage for circuits and provides an additional safety precaution to the circuitry. It is low priced, easily accessible and very popularly used. The ULN2003 IC is used as Motor driver IC which is one of the most commonly used IC. This IC utilized when there is a need to drive high current loads utilizing digital logic circuits. In this condition we are using it for the efficient functioning of relays used. Circuit diagram also consists of LCD. An LCD also known as Liquid Crystal Display. It is an electronic display component and has a lot of applications. We have used 16x2 LCD display in our project. This LCD can display 16 characters in each line and there are 2 lines in it. Other than this we have used 3 electromagnets in our project in the form of relay. An electromagnet is a type of magnet that works by electricity. The strength of this type of magnet can be changed easily by regulating the amount of current flow through it. We have also used a 12 V AC transformer. A center-tapped transformer also called two phase three wire transformer is used for rectifying circuits.

**Block Diagram:**

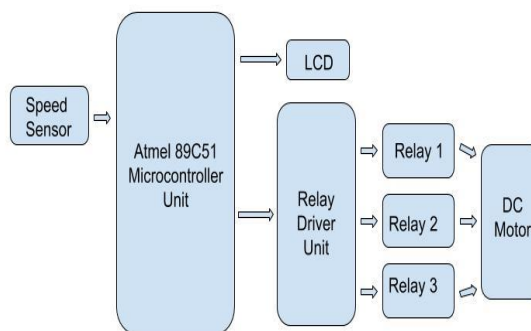


Fig 2: Block Diagram of system design

The potentiometer acting as an accelerator is rotated resulting in power supply variation which drives the wheel and as we rotate it more the speed increases. The speed sensor is attached to

wheel and used to count the RPM of the wheel and sends data to the Atmel 89c51 microcontroller unit. The microcontroller unit then evaluates the speed of the vehicle after numerous calculations present in the code and converts RPM to speed. The microcontroller then activates the corresponding relay resulting in gear transmission as instructed in code saved in the microcontroller. The decision of which relay should be activated is done by limiting the speed range of different relays and the present speed is compared with different speed ranges of relay, the range in which the speed lies leads to the activation of relay. The activated relay drives the DC motor and the DC motor drives the corresponding actuator attached to it.

**Flow chart:**

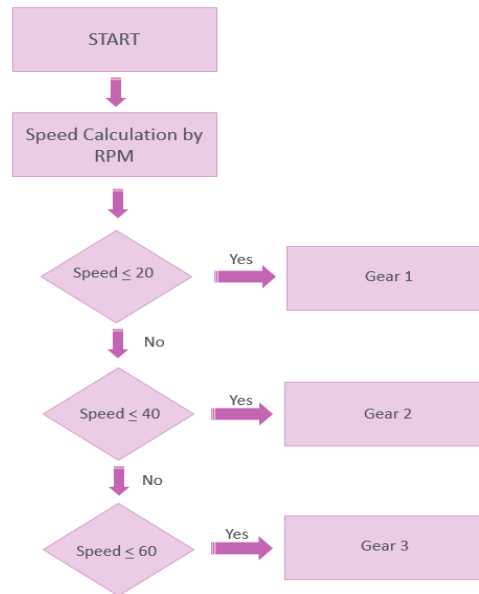


Fig 3: Working of Automatic gear transmission

Working can be divided in four major sections:

**POWER SUPPLY WITH DC MOTOR SPEED CONTROLLER:**

This will change the speed of the DC motor (geared) connected to the main shaft of assembly. A read sensor will detect the same and send the signal to the microcontroller circuit.

**MICROCONTROLLER BASED RPM COUNTER WITH RELAY ACTIVATION:**

This circuit works on 5V dc provided from a power supply with voltage regulation circuit. The microcontroller is working here as a RPM counter to read this at LCD. The sensor at the main shaft will provide input to this circuit and it counts the no of pulses coming from it. If the speed of the shaft is 00-20, this will actuate relay 1 as gear 1 activation and 20-40 for 2<sup>nd</sup> gear and 40-60 for 3<sup>rd</sup> gear.

**ELECTROMAGNETIC CLUTCH DRIVE WITH SHAFT LINK:**

The working of this section is very important as it shifts the power from the shaft to the chain drive unit using three electromagnetic clutches. The electromagnetic clutch locks the shaft with corresponding gear attached to it. As its coil gets energized with 12V from the relay unit, this locks the corresponding gear and shifts the power to the main shaft through chain drive. If no

electromagnetic clutch is energized, the shaft moves freely, and no power is transferred from this.

**POWER TRANSMISSION FROM THIS TO GEAR ARRANGEMENT TO TYRES:**

This section linked from clutch drive shaft to main tyre shaft using a chain drive link mechanism. In the model, these tyres are connected to a common shaft of 8 mm diameter with matching bearings 8mm with wooden supports to ensure its free motion.

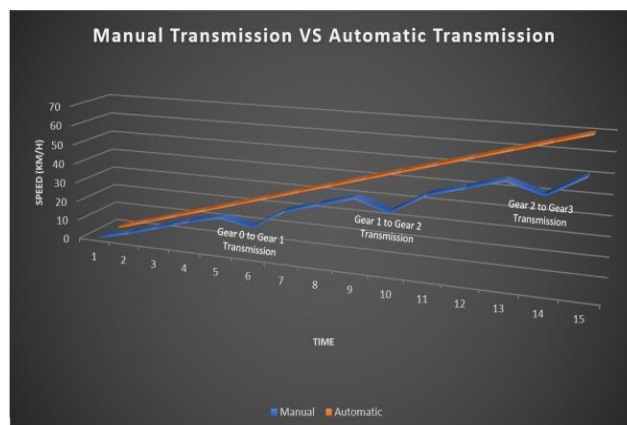
**OBSERVATION:**

S.NO.	GEAR	PULSES/SEC(X)	SPEED(KM/H)
1.	NEUTRAL	0	0-0
2.	FIRST	$0 < X \leq 4$	0-20
3.	SECOND	$4 < X \leq 8$	20-40
4.	THIRD	$8 < X \leq 12$	40-60

Table 1: Observation Table of model

The above table has four columns and the data is representing the actuation of different relay activating different gear at different frequency of pulses given to the microcontroller by the sensor and the microcontroller then decides the actuation of relay according to code, which leads to the variation in speed of the wheels i.e. speed. The phenomenon of change in speed happens as gears have their own different gear ratios resulting in acceleration.

**Graph:**



Graph1: Comparison graph of Manual Transmission & Automatic Transmission

The above graph is conveying a major advantage an automatic transmission system has against the manual one. The orange curve is representing the change of speed of the vehicle with time in automatic transmission system and the blue curve is representing speed change with time in manual transmission system. As one can see that the automatic transmission system is smoother as well as fuel efficient and have a great power efficiency too.

### REALISTIC ILLUSTRATION:

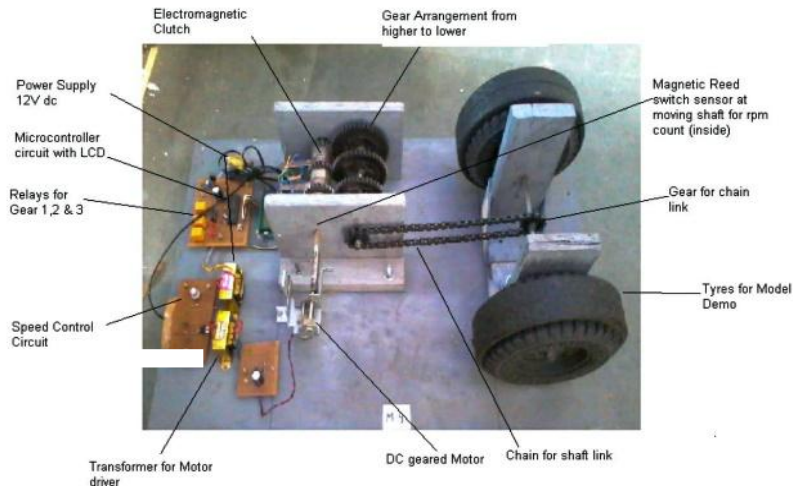


Fig 4: Realistic illustration

The above is the picture of the working model with every component labelled for understanding and encapsulating the paper in a simpler manner. The picture consists of gears, wheels, gear chain, sensor, microcontroller, relay, motor, transformer, potentiometer, etc.

### FUTURE SCOPE:

Converting a manual gear transmission system into an automatic contributes towards future i.e. vehicle automation or a driverless car which are going to run everywhere in roads in coming years. The automatic gear transmission decreases the human involvement in driving hence providing a better driving experience. It can be used in many places like factories where gear transmission is used, it can be used in trucks and cranes as they travel a lot. Furthermore, the accuracy of the system can be increased by using better microcontrollers. The system can be made wireless by using Bluetooth or any other wireless protocol hence reducing wires and vulnerability of the system.

### CONCLUSION:

In this paper, we can conclude that this type of automatic gear shifting mechanism allows the driver to have an effortless wonderful experience and makes driving manageable for differently abled people. The model also reduces the emission of harmful gases like CO<sub>2</sub>, CO, etc. The torque required by the vehicle is delivered without lag hence no loss of generated power. This model which is Arduino driven is cost-effective. The driver does not need to operate the clutch manually, it eliminates the clutch. This model is fuel-efficient, low carbon emitting. The chances of the driver suffering from fatigue due to driving are lowered down. The shocks and jerks experienced due to the release of the clutch are not experienced. It provides differently abled people an opportunity to become independent in case of travelling as it makes the vehicle two pedal controlled.

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