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### Design and fabrication of semi-automatic gear shifting mechanism for physically challenged persons vehicle with reverse motion

A. Karthy<sup>1</sup>, L. Aravindh<sup>2</sup>, V. Arun<sup>2</sup>, A. Boopathi<sup>2</sup>, K. Divakar<sup>2</sup>

<sup>1</sup>Assistant Professor, Department of Mechanical Engineering, Nandha Engineering College, Erode-638 052

<sup>2</sup>UG Students, Department of Mechanical Engineering, Nandha Engineering College, Erode-638 052

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#### ABSTRACT

We believe that our project definitely helps the physically challenged people for driving vehicles. The physically challenged people cannot drive the gear vehicles due to regular change of gear as per the speed of vehicle. So we implement the semi-automatic gear shifting in two wheelers with reverse motion to help the physically challenged people. In our project we used push buttons, and solenoid to change the gear by implementing new gear shifting mechanism for reverse motion. We introduce solenoid and push button to shift the gear as per the speed of the vehicle by the person. Due to implementing of solenoid and new gear shifting mechanism the fuel efficiency is increased.

**Keywords:** Push buttons, Semi-automatic transmission, Solenoid

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#### INTRODUCTION

Basically the semi-automatic gear shifting mechanism consists of a shifting unit. The shifting unit is used to shift the gear as per the speed of vehicle by the person. On the way that we also introduce the semi-automatic gear shifting mechanism with reverse motion for comfortable and easy transportation of physically challenged people. Normally now a days physically challenged people also start to use the vehicles without help from others partially. By implementing our project the physically challenged people can also use the gear vehicles without help from others. The physically challenged people cannot move the vehicles backward without help from others. But in our project they can move the vehicle backward also without help from others.

#### TERMINOLOGIES

##### Push buttons

A push-button is a simple switch mechanism for controlling some aspect of a machine or a process. Buttons are most require a spring to return to their un-pushed state.

##### Semi-automatic transmission

To change the gears on a bike an electronic gear shifting method is used, which enables to shift the gear with push buttons and solenoid instead of using levers. Push buttons connected with solenoid and battery with help of wires. Use of this system is to change the gear faster, it may require less maintenance.

##### Solenoid

Solenoid is the generic term for a coil of wire used as an electromagnet. It also refers to any device that converts electrical energy to

mechanical energy using a solenoid. The device creates a magnetic field from electric current and uses the magnetic field to create linear motion.

## LITERATURE REVIEW

In journal [1] they referred about the problems faced by the physically challenged people while using the vehicles on road ways, parking, rush areas. In this journal they explained about the easy way of moving the vehicle with reverse motion with the help of hand operated lever for engage and disengage of reverse gear with the power gear. The project consists of a gear box with an idle gear having smaller size and less teeth compared to normal gear of vehicle to convert the clockwise rotation of gear to anti-clockwise rotation. The concept of the project is moving the vehicle both forward and reverse direction with same gear setup. This will be done by using an intermediate gear between the gear setup. This intermediate gear converts the direction of rotation of gear. By referring it the driven gear and the driver gear 1 is same in size. The driver gear 2 in small sizes compared to driven and driver gear 1 the idle gear is the small gear compared to overall gear box. The various sizes used to obtain the same speed. The output of gear box is given to the driver gear. The driven gear was attached to wheel. If the driven and driver gear meets means the wheel rotate in one direction. The driven and driver gear meets with the help of idle gear means the wheel rotate in opposite direction.

In journal [2] they referred about the backward motion of two wheelers. They used a lever to shift the gear for backward direction. The lever operated by the driver of vehicle. The lever is hand operated. The lever moving the gear both forward and backward direction. On the paper the authors identified about the existing vehicles problems faced by the users like steering problems, abnormal tire wear, brake inefficient, since the support wheels to not have brake, traction problems in non-paved surfaces suspensions either being too hard or too soft resulting in body pain, poor mileage characteristics of both engine and fuel, no reverse gear option making it difficult to use with people having disadvantaged leg functions, etc., problems listed by technicians

like, the fitting not easy for technicians to enable access to vehicle and engine, transmission parts, imperfect design of suspensions resulting in engine foundation damage, tendency to lose alignment perfection which causes steering system damage, extra fitting supports gets welded on sensitive chassis portion resulting in loss of chassis flexibility and results in breakage of the same, etc., in this paper they explained about the specifications of vehicle. The hand operated reverse gear mechanism transmits the power from the gear box to the rear wheel. The gear box setup consists of two shafts which having two gears on different end and different sizes. The different size of gear was having contact with each other. If one gear set in contact means another in non-contact. If one set gear in contact means vehicle moves forward direction and another set gear in contact means the vehicle moves reverse direction. The different gear set doesn't in contact at same time. If one set in contact means another one doesn't in contact.

In journal [3] they referred about the semi-automatic gear shifting mechanism in two wheeler. They used micro controller, dc motor (worm gear motor), battery, pushbutton, etc., to complete the gear shifting mechanism. They try to implement the reverse motion on vehicle. On this paper they referred about the problems faced by the drivers while driving the vehicle. They made a connection from a power source to the motor through the controller. The controller controls the motor to shift the gear as per the speed of vehicle. The circuit of this project is starts in push button and ends in spur gear. The push button connect to the battery for power and connected to the micro controller. The micro controller connected with motor. The motor is connected with spur gear and it connected to engine and gear box. When the push-button was pressed means the micro-controller energize the motor and shift the gear. The worm gear motor connected with spur gear. The spur gear connected with engine gear box with a mechanism to change the gear. They explained about how we can develop the project.

In journal [4] they referred about the reverse motion technique in two wheeler. They try to eliminate the difficulty of reverse motion in two wheeler. They mentioned that their main objective

is comfort ability and safety of physically challenged people. The reverse gear mechanism is used mainly for helping the physically challenged people. They mentioned that their main need of their project is to eliminate the partiality and complexity nature over the handicap peoples from the society, to improve the tendency and ability of challengers to live with confidence and without considering the illness and disability of them, to get back the hopeful of handicap to show the strength of them to society. The reverse direction was obtained by using an idle gear between two gear rods. In the gear box a shaft with two gear was connected to engine shaft and another shaft was connected to rear wheel via toothed wheel and chain. In this journal they explained about the properties of shaft used for transmission.

In journal [5] they used embedded system for gear transmission in two wheelers. They done automatic gear shifting and automatic clutch at the time of gear engage. They mentioned that this process is faster and less destructible for the driver. They also done automatic headlight control as per dims and dips of light if the opposite vehicle with high beam. They explained about the transmission of power from engine to rear wheel. They done the connections from inductive speed sensor to dc motor through the components microcontroller relay driver unit to control the motor as per the speed of vehicle to change the gear. They used inductive proximity sensor to sense the speed of vehicle and microcontroller to control the whole setup. The configuration of microcontroller is AT89s52. They also use the liquid crystal display, relay driver unit, relays, DC motor, photo detectors, and power supply. The connections all are starting from microcontroller and ends in separate equipment's. The sensor sense the speed of wheel and sent the data to controller the control receives the signal and measure the speed and energies the motor through relay driver unit and relay sets and ignition coils. The motor runs as per the instructions from the microcontroller. The controller having conditions wrote by the instructor. The conditions control the DC motor and whole setup.

In journal [6] they used the microcontroller as control unit and arduino as a data logger. The data logger record the data's like pressure, temperature,

voltage and many more physical parameters conditioning those signals and also the parameters like engine speed, vehicle speed throttle position, clutch position and brake position. All sensors used in this project was connected to controller. The sensors used in this project like gear position sensor for find which gear was connected to transmission shaft, engine speed sensor for measuring the speed of engine to change gear, brake position sensor for sense the position of brake, vehicle speed sensor used to measure the speed of vehicle, throttle position sensor used to find the position of throttle on vehicle, clutch position sensor used to find the engage and disengage of clutch plate. This project almost convert the two wheeler fully automated if some modifications innovated. This project only get details about the components which having sensors. The sensors sent the information about the components to the controller and record the data for future purposes and researches.

In journal [7] they use the components for gear shifting sensors, microcontroller, and actuator as main parts. They used sensor to sense the speed of vehicle, microcontroller as controlling unit and actuator as gear shifting unit. The sensor senses the speed of vehicle and sent the details as digital output to the microcontroller and the microcontroller actuate the actuator to shift the gear as per the speed of vehicle. The actuator needs a setup or mechanism to change the gear.

In journal [8] they use electronic system to change the gear. It is a semiautomatic gear shifting. This semiautomatic gear shifting having an actuating mechanism to change the gear. It consists a metallic disc attached to an electric motor. The metallic disc connected to a rod and change the gear. It is a hand operated gear shifting. If the driver press the button or lever (driver wish to have push button or lever fixed to change the gear) the gear was changed. This setup consists of two pushbutton or lever to increase or decrease the gear

In journal [9] they made a connection all are starts from the components and ends with the transmission control unit/master control unit. The components used are rpm sensing unit, clutch control unit, clutch actuation motor, gear control motor, acceleration control motor, speed sensing

unit, gear shifting unit, function switches, display. The main parts are rpm sensing unit, gear shifting unit, clutch actuation unit and transmission control unit. The rpm sensing unit senses the speed of vehicle and sent the data's to the transmission control unit. The transmission control unit receives signal from the rpm sensor and actuate the gear shifting to change the gear. At the time of gear the clutch actuation unit also actuated to change the gear smoothly to avoid the damage of gear.

## SUMMARY OF LITERATURE SURVEY

### From the literature

- In manual gear shifting it is difficult to shift gears for physically challenged person's. Physically challenged persons can shift gears very easily in semi-automatic gear shifting.
- Using of reverse gear mechanism makes easy for parking for physically challenged person's.
- Using of this type of gear shifting method, it reduces overall engine efficiency.

## PROBLEM STATEMENT

Recent days, in modern vehicles, some type of gear shifting mechanism is used for power transmission. Working type of the push button operated gear shifting mechanism has been tested for its functionality for the entire range of gear shifting. By using this gear shifting mechanism physically challenged person can drive two wheelers easily. It can be easily incorporated to four wheelers for shifting gears with minimum alternation and the gear position can be displayed. As further improvement, the output speed of the gearbox can be measured and used as an input for transmission control.

## DESIGN CALCULATION

### Gear 1

Outside diameter of Gear 1 (OD) = 47 mm  
 Number of teeth on Gear 1 (N) = 24  
 $Pitch = (OD \times N) / N+2 = 47 \times 24 / 24 + 2 = 43.38 \text{ mm}$   
 Module = Pitch Dia / No. Of teeth  
 $= 43.38 / 24$   
 $= 1.8$

### Gear 2

Outside diameter of Gear 2 (OD) = 35.5 mm  
 Number of teeth on Gear 2 (N) = 21  
 $Pitch = (OD \times N) / N+2 = 35.5 \times 21 / 21 + 2 = 37.89 \text{ mm}$   
 Module = Pitch Dia / No. Of teeth  
 $= 37.89 / 21$   
 $= 1.8$

### Gear 3

Outside diameter of Gear 3 (OD) = 50 mm  
 Number of teeth on Gear 3 (N) = 26  
 $Pitch = (OD \times N) / N+2 = (50 \times 26) / 26 + 2 = 46.42 \text{ mm}$   
 Module = Pitch Dia / No. Of teeth  
 $= 46.42 / 26$   
 $= 1.77$

### Gear 4

Outside diameter of Gear 4 (OD) = 47 mm  
 Number of teeth on Gear 4 (N) = 24  
 $Pitch = (OD \times N) / N+2 = 47 \times 24 / 24 + 2 = 43.38 \text{ mm}$   
 Module = Pitch Dia / No. Of teeth  
 $= 43.38 / 24$   
 $= 1.8$

Forward direction:

Gear ratio =  $24/21 = 1.142 = 1$

Gear ratio =  $21/24 = 0.875 = 1$

Therefore overall gear ratio =  $1.14 \times 0.875 = 0.999$   
 $= 1$

Reverse direction:

The gear ratio = driver/driven =  $29/24 = 1.20$

## DESIGN



(Design of side wheel setup)



(Design of gear box)

## WORKING

### Forward direction

This project works with the help of solenoid for gear shifting. With this project switches are connected in the right hand side of vehicle. When the driver press the switch means the gear was changed. To decrease the gear another switch was added. If the driver press decrease switch means the gear was decreased. By manual changing we can get efficiency more than automatic.

### Reverse direction

In our project we added an additional gear box for reverse motion. If the driving gear was engage with same size gear means the vehicle moves in forward direction. If it engage with the driven gear

with the help of idle gear means the vehicle moves in reverse direction.

Our project ensure that the moving of vehicle both forward and reverse direction. In our project we arrange a setup (shown in figure 2) to change the gear

## CONCLUSION

In our project we implement electrical based actuators to shift the gear from one position to other. And also reverse motion is implemented to reduce the difficulty to take reverse direction of vehicle especially from parking for physically challenged person's vehicle. Due to semi-automatic gear shifting mechanism the overall performance of the engine is improved.

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