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Button Operated Gear Shifting Mechanism for Two Wheelers

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CHAPTER NO.01 INTRODUCTION

1.1 Introduction

Chapter 1 INTRODUCTION

Mobility plays a vital role in the daily life of every individual. Two-wheelers are one of the most commonly used modes of transportation due to their affordability, fuel efficiency, and convenience in traffic conditions. However, conventional motorcycles are designed primarily for riders who have full control and use of both legs. In traditional gear-operated motorcycles, gear shifting is performed using a foot-operated lever. This requires proper coordination between the clutch, throttle, and foot movement. For handicapped individuals or riders who have one leg injured, operating such a system becomes extremely difficult, uncomfortable, or sometimes impossible.

The **Button Operated Gear Shifting Mechanism using Solenoid for Two-Wheeler** is developed as an assistive and innovative solution to overcome this limitation. The main objective of this project is to design a system that enables gear shifting without the need for foot operation. By replacing the conventional foot lever mechanism with a push-button operated system, the rider can change gears easily using hand controls mounted on the handlebar. This significantly improves accessibility and independence for physically challenged individuals and those recovering from leg injuries.The proposed system works on the principle of electromagnetic actuation. A solenoid, which is an electromechanical device, is used as the main actuator. When electrical current passes through the solenoid coil, it creates a magnetic field that moves a plunger linearly. This linear motion is then transmitted to the motorcycle's gear shifting shaft through a properly designed mechanical linkage arrangement. As a result, when the rider presses the "Gear Up" or "Gear Down" button, the solenoid activates and performs the gear shifting action smoothly and efficiently.

One of the major advantages of using a solenoid is its simple construction, quick response time, and reliable operation. The system is designed to ensure that the force produced by the solenoid is sufficient to shift gears without causing damage to the gearbox mechanism. Proper alignment, mounting brackets, and return spring mechanisms are incorporated to ensure smooth operation and automatic resetting after each shift. The entire setup is compact and can be integrated into existing two-wheelers with minimal

structural modification.This project focuses not only on technical functionality but also on social impact. Many handicapped individuals face mobility challenges due to the limitations of conventional vehicle designs. By introducing a button-operated gear shifting mechanism, the project promotes inclusive transportation and equal opportunity for independent travel. It empowers riders who cannot use one leg to operate motorcycles safely and confidently. Additionally, the system is beneficial for riders with temporary injuries, enabling them to continue using their vehicles during recovery.Safety and reliability are key considerations in this design. The electrical circuit is designed to prevent accidental shifting and ensure controlled activation. The mechanical linkage is carefully engineered to provide precise movement corresponding to the required gear shift stroke. The system is powered by the vehicle's existing battery, making it energy- efficient and practical for real-world use. Furthermore, the design emphasizes cost- effectiveness so that it can be affordable and accessible to a larger population.

The Button Operated Gear Shifting Mechanism using Solenoid is a practical, economical, and socially beneficial innovation in the field of automobile engineering. It combines principles of electromagnetism and mechanical design to develop a user- friendly solution for handicapped riders and individuals with one injured leg. This project not only demonstrates technical knowledge and engineering skills but also addresses a real-world problem by improving accessibility, comfort, and independence in two- wheeler transportation.

1.2 Problem Statement

1) Conventional two-wheelers use a foot-operated gear shifting lever.
2) Gear shifting requires proper coordination of clutch, throttle, and leg movement.
3) Handicapped riders or individuals with one injured leg face difficulty in operating the gear lever.
4) This limitation reduces mobility, independence, and confidence of physically challenged riders.
5) Existing solutions are often costly or require major vehicle modifications.
6) There is a need for a simple, reliable, and affordable system that eliminates foot operation.
7) The system should allow smooth and safe gear shifting using hand controls.
8) Therefore, the problem is to design a button operated gear shifting mechanism using a solenoid that improves accessibility and convenience in two-wheelers.

1.3 Objectives

1) To design and develop a button operated gear shifting mechanism using a solenoid for a two-wheeler.
2) To eliminate the need for foot operation in gear shifting, making the vehicle suitable for handicapped riders and individuals with one injured leg.
3) To improve rider comfort and convenience by enabling hand-controlled gear shifting through push buttons.
4) To ensure smooth and reliable gear shifting using an efficient solenoid-based actuation system.
5) To design a cost-effective and compact system that can be easily installed in existing motorcycles without major modifications.
6) To enhance safety and control by reducing physical strain and improving ease of operation.
7) To promote inclusive mobility by providing an accessible transportation solution for physically challenged individuals.
8) To apply principles of electromagnetism and mechanical design in developing a practical and socially beneficial engineering project.

CHAPTER NO.02 LITERATURE REVIEW

Chapter 2 Literature Review

A literature review is a body of text that aims to review the critical points of current knowledge including substantive findings as well as theoretical and methodological contributions to a particular topic. Literature reviews are secondary sources, and as such, do not report any new or original experimental work. Most often associated with academic-oriented literature, such as theses, a literature review usually precedes a research proposal and results section. Its ultimate goal is to bring the reader up to date with current literature on a topic and forms the basis for another goal, such as future research that may be needed in the area. A well structured literature review is characterized by a logical flow of ideas; current and relevant references with consistent, appropriate referencing style; proper use of terminology; and an unbiased and comprehensive view of the previous research on the topic. In this case, most of the literature review will covers all the fact, design and technical discussion and invention to be evaluated and idea generate for the concept design. The main literature review will cover formula one transmission technology, new invention on motorcycle invention and material selection method. Most of the research done by reviews the journals, technical paper, books, and patent and internet source.

2.1 Current Design

The gear shift is the part of the gearbox which has the shift forks and allows the contact from the driver to the synchronization. Most of the time they are so much like the gear counter plus the reverse gear. And they make it possible to choose the gear (gear ratio) and to switch this in or out. The invention of the gear shift is attributed to Karl Benz. These are the parts for which it is possible to make automation. Further these parts can be designed so compact so that it is also possible to build a very modular transmission with less weight. The benefit of the compact build of the

shifting is not only the gain of modulation and less weight but also the time during the production and space in the whole drive train. Depending on the space around the whole drive train and type of car, for automatisation a hydraulic, pneumatic or electric actuator can be used. For personal cars, a hydraulic or electric actuator is most often used. Further, such a system also needs an electronic application. (Harbans, 2005) Based on the current Formula Varsity car gear shifter mechanism, most of the design was cable actuated or fully mechanical linkage mechanism. Normally the gear shifter will be located in the cockpit as the easy to driver to reach and to engage gear ration. Therefore, this will cause a limited space in the cockpit. Much than that, this cable actuated and mechanical linkage gear shifter easily has a failure at the certain time for the racing use. A test had been done to both mechanism and shows the result

A Shiftronic transmission can operate just as a conventional automatic transmission, but it also allows the driver to override the automatic mode by moving the shift lever into a second shift gate equipped with two spring-loaded positions: "up shift" and "downshift". Once in this gate, the driver takes over most of the shifting decisions ordinarily performed by the transmission's computer, permitting, for example, the delaying of an up shift for increased acceleration or to increase the braking effect of the engine (Crouse and Anglin 1993). For a manual transmission, gear shift mechanism comprises a lever- receiving structure disposed on the engine/transmission structure. The lever-receiving structure includes a mechanical or with cable actuated. A manual transmission gear shift mechanism has a plurality of shift rods, each of which is provided with a shift fork and at least two of which are coaxially disposed, a control rod having at least two select arms which selectively engage with the shift rods, and a shift lever for sliding control rod so as to place the transmission into any one of a plurality of gears. The select arms are disposed on the control rod either at specified axial separations along an axis of rotation of the control rod or at specified angular separations around an axis of rotation of the control rod. This is the same of the cable actuated gear shifter. Besides automatics, there are also other types of automated transmissions such as continuous variable transmissions (CVTs) and semi-automatic transmissions that free up the driver from having to shift gears manually by using the transmission's computer to change gear, if for example the driver were redlining the engine. Despite superficial similarity to other automated transmissions, automatic transmissions differ significantly in internal operation and driver's "feel" from semi-automatics and CVTs. An automatic uses a torque converter instead of clutch to manage the link between the transmission and the engine, while a CVT uses a belt instead of a fixed number of gears, and a semi-automatic retains the clutch like a manual but activates the clutch through electro hydraulic means. Formula One cars use semi-automatic sequential gearboxes, with regulations stating a maximum of seven forward gears and one reverse gear, using rear wheel drive. The gearbox is constructed of carbon fiber or titanium, and is bolted onto the back of the engine. Full automatic gearboxes and systems such as launch control and traction control, are illegal, to keep driver skill important in controlling the car. The driver initiates gear changes using paddles mounted on the back of the steering wheel and electro-hydraulics perform the actual change as well as throttle control. Clutch control is also performed electro- hydraulically, except to and from standstills, when the driver operates the clutch using a lever mounted on the back of the steering wheel. As of the race season, all teams are using seamless shift transmissions, which allow almost instantaneous changing of gears with minimum loss of drive. Shift times for Formula One cars are in the region of 0.05 seconds UTeM Formula Varsity is a student racing competition that challenges students to design, manufacture and race their single seat open-wheel formula style racing car in real track condition. Therefore, there are a few systems to design for example engine and transmission. Each the design and fabrication must be following by the rules specification to ensure each team racing has the almost same race car design and capability. One of the rules specifications is transmission and gearbox and the most popular gear shifter for the formula varsity race car are cable actuated and mechanical linkage. These two designs are the most common design and easily to fabricated to the formula varsity race car. Simply, a lever mounted in cockpit with attach to the cable or link arm it will actuated transmission shaft. A motorcycle engine with capacity up to 135 cc will be use as the power generate to the race car. This moped bike engine come completed with variable gear ratio or gear box and need a gear shifter to engage and disengage the gear to transmit the torque to the tire For the further design, a new system call FVTRONIC is design to eliminate fully mechanical gear shift and shifting the gear simply by pressing a shift button on the steering wheel. This is because of the, the older design had a weakness such as shifting delay and easily deformed after a few usage. This new system needed a forces and motion to operate the transmission shaft that can be supplied by electromagnet mechanism. This electromagnet mechanism has helped the size and light weight. Much than that, this system will be offer a quick gear shift response and maximize the cockpit size – eliminate gear lever.

CHAPTER NO.03 SCOPE OF THE PROJECT

Chapter No. 03 SCOPE OF THE PROJECT

1) Design and Development

- To design a button operated gear shifting mechanism using a solenoid for two- wheelers.
- To develop a compact and efficient mechanical linkage system for gear actuation.

2) Assistive Mobility Solution

- To provide an accessible riding solution for handicapped individuals and riders with one injured leg.
- To improve independence and confidence in operating motorcycles.

3) Modification of Existing Vehicles

- The system can be retrofitted to existing gear-operated motorcycles without major structural changes.
- Suitable for small and medium capacity two-wheelers.

4) Performance and Reliability Testing

- To test smoothness, response time, and durability of the solenoid mechanism.
- To ensure safe and accurate gear shifting under normal riding conditions.

5) Cost-Effective Implementation

- To design a low-cost system that is affordable and practical for common users.
- To minimize maintenance and power consumption.

6) Future Enhancements

- Scope for integration with advanced electronic control systems.
- Possibility of adding safety interlocks and automation features.

CHAPTER NO.04 METHODOLOGY

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4.1. Block Diagram

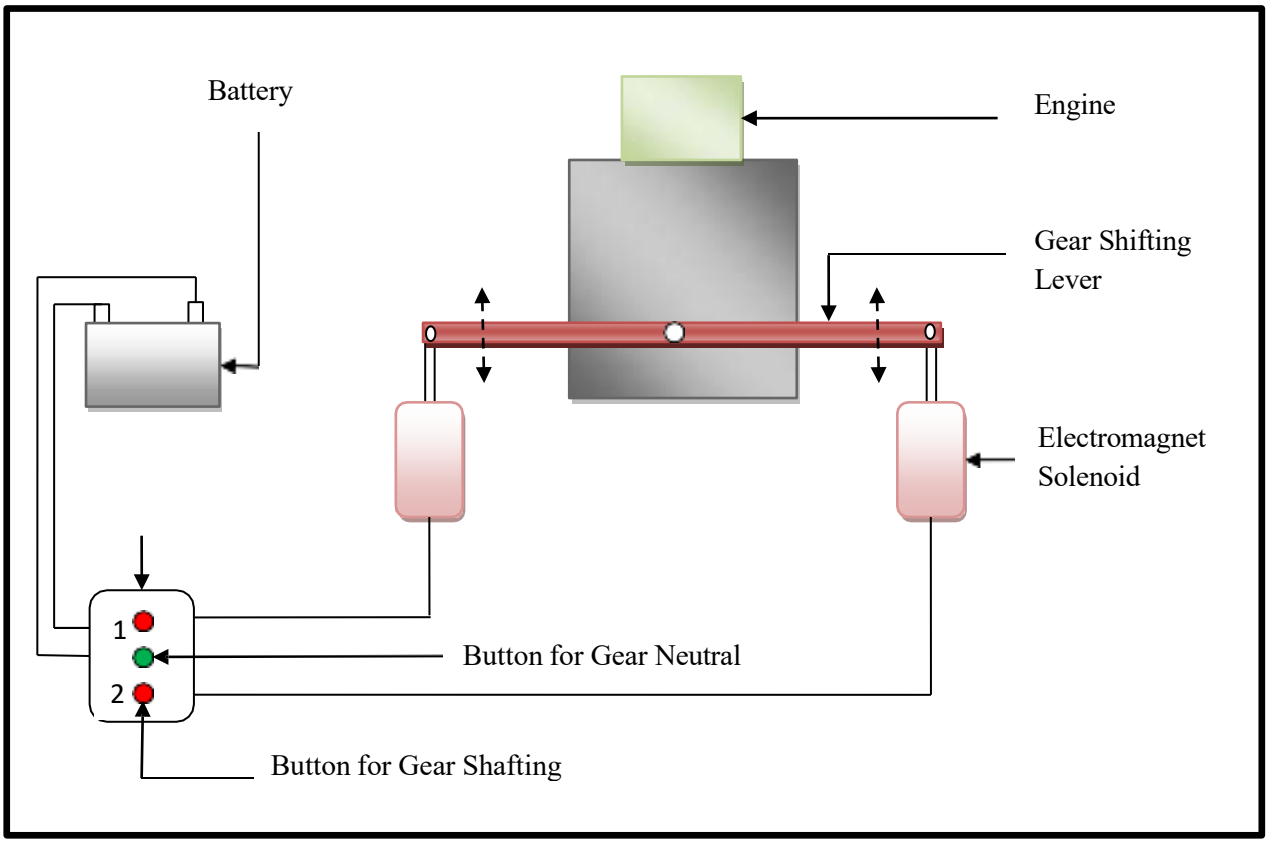

Figure: Model of button operated gear mechanism

4.2 Parts/Components:-

1) Battery
2) Engine
3) Gear shifting lever
4) Electromagnetic solenoid
5) Gear shifting switch

Design Consideration and Selection of the Parts:

1. Battery:

Selection of the Battery regularly used in the two wheeler

Voltage: 12 Volt D.C.

Current: 7 Ampere or 9 ampere

2. Engine:

Selection of the engine: Implementation of the any two wheeler engine

3. Gear shifting lever:

We required the minor modification on the shifting lever like the lever is straight positin

4. Electromagnetic solenoid:

Selection of the Electromagnetic solenoid worked on the battery available in two wheeler Current rating of Electromagnetic solenoid: 12 Volt D.C.

Machines Required

Following are the machines which will be used;

1. Drilling machine
2. Cutting machine.
3. Welding machine.
4. Soldering machine

Machining requirement:-

Following are the machining process required;

1. Drilling- To drill the gear shifting lever.
2. Cutting- To cuts the raw material.
3. Welding- To weld the frame and other parts.
4. Soldering- To solder the electric wire connection.

Materials

1. Raw Material:-

Mild steel C channel

2. Material To be Purchases:-

a. Electric solenoid

b. Gear switch panel

c. Battery

d. 100CC engine

Required machining processes:-

a. Drilling- Drilling machine used for the drill the gear shifting lever.

b. Cutting- Cutting the raw material parts.

c. Welding- weld the raw material and other parts.

d. Soldering- Soldering the electric wiring.

CHAPTER NO.05

DESIGN, WORKING & PROCESSES

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DESIGN, WORKING & PROCESSES

5.1.Components used

1) Solenoid

Fig. no. 5.1. Solenoid

Working

The button-operated gear shifting system replaces the conventional foot-operated gear lever with an **electrically actuated mechanism**. The system uses a **solenoid** to perform gear shifting when a push button is pressed.

Step-by-Step Working:

1. **Power Supply ON**

When the ignition of the two-wheeler is turned ON, electrical power is supplied from the vehicle battery to the gear shifting circuit.

2. **Button Press Action**

Two push buttons are provided on the handlebar:

- **Up-shift button** (for higher gear)
- **Down-shift button** (for lower gear)

3. **Solenoid Energization**

When a button is pressed, current flows through the solenoid coil. This creates a **magnetic field** inside the solenoid.

4. **Linear Motion Generation**

Due to the magnetic field, the **plunger (rod)** of the solenoid moves linearly (forward or backward depending on the design).

5. **Mechanical Linkage Movement**

The solenoid plunger is mechanically connected to the **gear shifting lever or selector shaft** using a linkage mechanism.

6. **Gear Engagement**

The linear motion of the solenoid is converted into rotational or angular motion of the gear shaft, resulting in **gear change**.

7. **Return to Initial Position**

Once the button is released, the solenoid de-energizes.

A **return spring** brings the plunger back to its original position, ready for the next operation.

2) Relay

Fig. no. 5.2. Relay

1. Purpose of Relay in the Project

- The solenoid requires high current (large power).
- Push buttons cannot directly handle high current.
- The relay acts as an electrical switch to safely control the solenoid using a small control signal.

2. Main Parts of Relay Module

- IN pin – Input signal from push button
- VCC & GND – Power supply (5V)

- COM (Common terminal)
- NO (Normally Open)
- NC (Normally Closed)
- Indicator LEDs

3. Step-by-Step Working in Your Project Step 1: Button Press

- Rider presses Gear Up or Gear Down button.
- A small electrical signal is sent to the relay input (IN pin).

Step 2: Relay Activation

- The relay coil gets energized.
- An internal electromagnet pulls a metal contact.

Step 3: Circuit Switching

- The contact moves from NC to NO.
- Battery power is connected to the solenoid.

Step 4: Solenoid Operation

- The solenoid gets energized.
- It pushes or pulls the gear lever.
- Gear shifts accordingly.

Step 5: Button Release

- Relay coil de-energizes.
- Contact returns to original position.
- Solenoid power cuts off.
- Spring resets the plunger.

4. Why Relay is Used?

1) Protects push buttons from high current
2) Provides electrical isolation

3) Ensures safe and reliable switching

4) Low cost and easy to install

3) Adjustable voltage regulator

Fig. no. 5.3. Voltage Regulator

The module shown in the image is a DC–DC buck converter, commonly used to step down voltage efficiently from a higher level to a lower level. In a button operated gear shifting system for a two-wheeler, this module plays an important role in providing a stable and regulated power supply to the electrical components. Since a two-wheeler battery typically provides 12V, certain components such as push buttons, driver circuits, and control units may require a lower and constant voltage like 5V or 6V. The buck converter reduces the 12V battery supply to the required level without significant power loss and maintains steady output even if battery voltage fluctuates. It operates using a switching regulator IC, an inductor, capacitors, and a fast switching diode to efficiently convert and filter the voltage. By using this module, the gear shifting system becomes more reliable, safe, and efficient, ensuring proper operation of the electrical circuit and smooth functioning of the solenoid actuator used for gear shifting.

Power Flow Example:

Battery (12V)

↓

Buck Converter (12V → 5V)

↓

Button Circuit / Driver Circuit

↓

Solenoid Actuator

↓

Gear Shifting Mechanism

Why It Is Needed in Your Gear Shifting Project

In a two-wheeler:

1) Battery voltage = **12V**

2) Solenoid may require **12V**

3) Push buttons may require **5V**

4) Sensors (if used) may require **5V**

5) Control circuits need regulated voltage

This module helps to:

1. Provide stable 5V supply
2. Protect components from voltage fluctuations
3. Improve system reliability

4) Push Button

Fig. no. 5.4. Push Button

In your button operated gear shifting mechanism, the push button acts as an input device to change gears without using the traditional foot lever.

- **Step-by-Step Working:**

1. **Gear Shift Button Pressed**

- When the rider presses the UP or DOWN push button, an electrical signal is generated.

2. **Circuit Activation**

- The push button completes the circuit (Normally Open type).
- Current flows from the battery to the solenoid.

3. **Solenoid Operation**

- The solenoid gets energized.
- It converts electrical energy into mechanical movement.

4. **Gear Lever Movement**

- The solenoid pushes or pulls the gear shifting lever.
- The gear changes accordingly.

5. **Button Release**

- When the button is released, the circuit opens.
- The solenoid returns to its original position using a spring mechanism.

Role of Push Button in the Project:

- Acts as a control switch.
- Sends command for gear up / gear down.
- Reduces physical effort.
- Helpful for physically handicapped riders or riders with leg injury.
- Provides smooth and quick gear shifting.

CHAPTER NO.06 RESULTS & APPLICATIONS

Results

CHAPTER NO.06 RESULTS & APPLICATIONS

The button operated gear shifting system successfully shifts gears smoothly using push buttons and a solenoid mechanism. It provides easy operation, reduces rider effort, and ensures reliable performance with stable power supply. The system is especially helpful for handicapped persons or riders with leg injuries.

Applications

1) Used in two-wheelers for easy gear shifting
2) Helpful for handicapped riders
3) Useful for riders with leg injuries
4) Can be used in modified bikes
5) Applicable in electric two-wheelers
6) Suitable for training vehicles for beginners
7) Can be implemented in racing bikes for quick shifting

CHAPTER NO.07 CONCLUSION AND FUTURE SCOPE

Conclusion

CHAPTER NO.07 CONCLUSION AND FUTURE SCOPE

This project is most useful for handicap persons those who cannot drive the two wheelers because due to gear shifting problem. Hence the gear shifting mechanism is developed and modified according to their requirement. The application of this gear shifting mechanism leads to make the driving process for driver easier, reduces the risk of destabilizing, the chance of miss shifting. Due to this mechanism driver can concentrate on road.

Future Scope

1. Integration with fully automatic transmission systems.
2. Use of smart sensors for smoother and faster gear shifting.
3. Wireless or touch-based gear control system.
4. Application in electric and hybrid two-wheelers.
5. Compact and lightweight design improvement.
6. Integration with mobile app for monitoring performance.
7. Use of advanced actuators for higher efficiency and durability.
8. Commercial production for specially-abled riders.

CHAPTER NO.08

COST ESTIMATION AND HARDWARE

Sr. No	Name of components	Price
1	Ele.solenoid Coil	2500*2
2	Gear switch panel	400
3	Battery	1250
4	Raw steel material	500
	Total=	8150

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