



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

# IJRSET

International Journal of Innovative Research in  
**SCIENCE | ENGINEERING | TECHNOLOGY**



# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 13, Issue 5, May 2024

**ISSN** INTERNATIONAL  
STANDARD  
SERIAL  
NUMBER  
INDIA

Impact Factor: 8.423

 9940 572 462

 6381 907 438

 [ijirset@gmail.com](mailto:ijirset@gmail.com)

 [www.ijirset.com](http://www.ijirset.com)

# Automatic Electromagnetic Gear and Shifting Mechanism for Two Wheelers

**Pranay Darshale, Sairam Mehendale, Shritej Chitral, Roshan Tile, Prof. Prashant Ambhore**

Department of Automobile Engineering, Dr. D. Y. Patil School of Engineering and Technology, Dr. D. Y. Patil

Knowledge City, Pune, Maharashtra, India

**ABSTRACT:** This project presents an innovative electromagnetic gear shifting mechanism designed for two-wheelers, leveraging Arduino microcontroller technology. Utilizing solenoids for gear shifts and a servo motor for clutch actuation, the system is governed by real-time RPM data acquired from an optocoupler sensor attached to the wheel. When RPM thresholds are surpassed for a particular gear, the Arduino signals relays to activate the corresponding solenoid switch, ensuring smooth gear transitions. Concurrently, the Arduino manages the clutch servo motor to facilitate seamless upshifts. In the event of sudden speed reductions, detected by the sensor, the system triggers downshifts. Powered by a 12-volt automobile battery, this system achieves rapid and efficient gear changes, enhancing overall two-wheeler performance. Our approach prioritizes ride quality and safety through the integration of precise sensor data and computer-controlled mechanics.

**KEYWORDS:** Linear Actuator, Solenoid actuator, Arduino UNO, Servo motor, Gear shift lever, IR sensor.

## I. INTRODUCTION

In every vehicle, the transmission system plays a crucial role in transferring mechanical power from the engine to the wheels, thereby providing kinetic energy necessary for movement. The gearbox is integral to this system, responsible for varying torque to suit different driving conditions through manual gear shifting. Improper gear shifting is a significant factor contributing to motorcycle accidents. In traditional motorcycles, gear shifting is performed manually using a foot lever, and the complexity of clutch operation can make this process cumbersome and error-prone.

To address these issues, we have developed an automated gear shifting mechanism that utilizes an auto-clutch system powered by a servo motor. This innovation eliminates the need for manual clutch operation, ensuring smooth engagement and reducing wear on clutch plates during acceleration. The result is a seamless riding experience that enhances safety and reduces the likelihood of accidents caused by poor gear shifts.

Our proposed system employs an embedded system to automate gear shifting based on the motorcycle's speed. An optocoupler sensor measures the wheel's RPM and communicates this data to a microcontroller (MCU). The MCU processes the information and activates solenoids to change gears appropriately. This mechanism works both during acceleration and deceleration, ensuring optimal gear selection at all times. Additionally, by preventing engine 'knocking,' the system contributes to prolonged engine life and improved performance.

## II. RELATED WORK

**Y. D. Gujarati, I. R. Shaikh, S. U. Patil and I. B. Deshmukh., 2020. STUDY OF BUTTON OPERATED GEAR SHIFTING SYSTEM. Open Access Int J Sci Eng, 5(4), pp.48-51.**

The literature predominantly addresses solenoid-operated gear-shifting mechanisms for handicapped individuals, yet lacks exploration into fully automated systems; thus, this project aims to develop an automatic electromagnetic actuated gear shifting mechanism with Arduino control board and speed sensor integration to enhance accessibility universally.

**Gupta, R. and Mahajan, A., 2023. Accessible Attachment Technology for Handicapped Individuals: Developing an Automatic Clutch and Transmission System for Geared Bike. Int Res J Eng Technol, 4(9), pp.227-230.**

The existing literature neglects research on automatic electromagnetic actuated gear-shifting mechanisms tailored for two-wheelers, lacking exploration into integration with solenoid, Arduino control board, and speed sensor for RPM-based automatic shifting, along with automatic clutch mechanisms, emphasizing the need for further investigation into their practical implementation, reliability, and cost-effectiveness to enhance accessibility and convenience for all riders.

**Dinesh KK, Abishek S, Bala Ganesh M and Gokulkrishnan S. 2021 IOT ENABLED PNEUMATIC GEAR SHIFTING IN TWO-WHEELER.Int Res J Eng Technol,6(1), pp.314-318**

The current literature on gear-shifting mechanisms for automotive vehicles overlooks the exploration of automatic electromagnetic actuated gear shifting for two-wheelers, highlighting the necessity for research integrating solenoid, Arduino control board, speed sensor, and automatic clutch mechanisms to address efficiency, wear concerns, practical implementation, and cost-effectiveness, emphasizing the need to develop comprehensive automatic gear shifting systems for two-wheelers to prioritize convenience and safety for riders.

**Gikwad.R ,Ambhore.M,Dhore.R and Patil.H., 2024.Development of Prototype of Automatic Clutch Gear Mechanism.International Innovative Res Sci Eng Technol,13**

The project addresses the demand for automated gear transmission in gear-featured bikes through integration of servo motors, batteries, microcontrollers, and electronic switches, aiming to enhance driving convenience and fuel economy, yet emphasizes the lack of research on automatic electromagnetic actuated gear shifting mechanisms for two-wheelers, indicating the need for comprehensive exploration in this domain to improve accessibility and efficiency.

### III. OBJECTIVE

The primary objective of our research is to develop and validate an electromagnetic automatic gear shifting mechanism for motorcycles, leveraging solenoids for gear shifting and servo motors for clutch operation. Our goals include:

1. Enhancing Safety: Reducing the risk of accidents caused by improper manual gear shifting.
2. Improving Riding Experience: Providing a smooth and efficient gear shifting process that reduces rider fatigue and enhances comfort.
3. Extending Engine Life: Minimizing engine wear and preventing 'knocking' by ensuring optimal gear shifts.
4. Easy Implementation: Designing a system that can be easily retrofitted to existing motorcycles without internal engine modifications.
5. Versatility: Ensuring the system is compatible with a wide range of motorcycle models, particularly those with engine capacities between 50cc and 200cc

### IV. METHODOLOGY

Our project, an electromagnetic two-wheeler gear shifting mechanism, employs a microcontroller called the Arduino to manage servo motor clutch actuation and solenoids for gear shifts. An optocoupler sensor records the wheel's RPM, which determines how the system operates.

The Arduino communicates relays that activate the solenoid switches when the RPM for the particular gear exceeds a threshold that has been set. Smooth gear changes are made achievable by Arduino, which simultaneously operates the upshift solenoid as well as the clutch servo motor. On the other hand, if the sensor detects a sudden reduction in speed, the mechanism triggers a downshift by switching on the relevant solenoid. A 12-volt automobile battery powers the entire system. This happens quickly, delivering effortless and efficient gear changes that enhance the two-wheeler's overall performance. Our approach optimises gear shifting for better ride quality and safety by using precise sensor data and computer-controlled mechanics

### V. COMPONENTS

#### IR sensor

An IR sensor, is a non-contact device that identifies objects using optical methods and provides electrical isolation between its input and output. to track the motorcycle wheel's rotational speed. The sensor consists of a photodetector and an illumination device (LED). It detects when an item interrupts through the light beam across the two components and generates an electrical signal, which enables precise RPM measurement. IR sensors are excellent for the accurate, quick detection necessary in our automatic gear shifting system. They are cost-effective highly sensitive, and operate well over relatively short distances (less than 10mm).

#### Relays

Relays are the type of switches that operate electromagnetically. It focuses on the process of opening and closing of an electronic circuit's circuit connections. The components that make up the relays are illustrated in the schematic



diagram. The gears are shifted through two switches, one for each at 5V and 10A. The gears are switched up and down using the first and second relays, accordingly. The relays are controlled by Arduino"

**Arduino UNO r3**

Arduino is an electronic platform available as open-source hardware and software. By reading various inputs, such as light from a light sensor or a finger hitting a switch, and converting them into outputs, like switching on a motor or switching on an LED, the device allows users to create interacting projects. A bios is already programmed into Arduino microcontrollers, allowing the process simpler to upload new programmers to the embedded flash memory. Since a serial connection to a computer is usually used for this, the development procedure is simple. The platform supports creative thinking and innovation in electronics by offering a broad range of applications, which makes it user-friendly for rookies and robust enough for advanced users.

**Solenoid actuator**

An inductive coil envelope the plunger, a moveable steel or iron armature, in electromechanical solenoids. In order to engage the plunger, the solenoid requires an additional current, known as the pull-in current. After the plunger activates, the current is reduced to hold current, approximately 30% of the standard current, in order to maintain the plunger in position. By doing this, power dissipation is lowered and coil overheating can be prevented, assuring that relays, contactors, or valves function as expected. Instead of using conventional DC stepper motors for gear shifting, our invention utilizes a solenoid-based methodology. These solenoids precisely control the movement of the gear lever as they receive signals transmitted by the microcontroller. Integrated with the existing gear pedal with minimal adjustments, they operate on a 12V power supply, ensuring quick and precise shifts. Solenoid motors move linearly rather than continuously, like stepper motors. Gear engagement is made possible in both clockwise and anticlockwise movements using two relays. Seamless gear changes are achieved by the solenoid's output shaft moving in synchronisation with the movement of the gear lever.

**VI. CALCULATIONS**

For the proper gear shifting we need to calculate the RPM and gear relationship of the wheel as our system works on RPM to shift the gear

For the calculations, let us assume the bike has 4 shifting which are the first gear 0-20 km/h, the second gear 20-45 km/h, the third gear 45-70 km/h and the fourth gear 70-95 km/h.

Gears	Down shift speed (km/h)	Down shift RPM	Up shift speed (km/h)	Down shift RPM
1	-	-	21	245
2	19	220	46	534
3	44	511	71	824
4	69	801	-	-

**VII. CONCLUSION**

1. The electronically operated gear shifter mechanism is a groundbreaking innovation that has the potential to improve the mobility and independence of handicapped people in India.
2. By providing a simple and efficient way for handicapped individuals to shift gears on their two wheelers, this mechanism can enhance their overall riding experience and make transportation more accessible for them.
3. This technology has the potential to significantly improve the quality of life for handicapped people, allowing them to participate more fully in society and engage in activities that were previously difficult or impossible for them.
4. It is our hope that this presentation has shed light on the importance of this innovation and the positive impact it can have on the lives of handicapped individuals in India

**REFERENCES**

1. Y. D. Gujarati, I. R. Shaikh, S. U. Patil and I. B. Deshmukh., 2020.STUDY OF BUTTON OPERATED GEAR SHIFTING SYSTEM. Open Access Int J Sci Eng, 5(4), pp.48-51.
2. Gupta, R.and Mahajan, A., 2023. Accessible Attachment Technology for Handicapped Individuals: Developing an Automatic Clutch and Transmission System for Geared Bike. Int Res J Eng Technol, 4(9), pp.227-230.

3. Patil, D., Patil, H., Pandit, K. and Dhoot, S.B., 2019. Automatic transmission for the geared bikes. *Int Res J Eng Technol*, 6(11), pp.276-279.
4. C.P. Venkatesh, U. Rajesh, N. Hari Sudhan, Sugin Elankavi. R, Pavan Kumar. K. B. and Little Prasanna Soundari. A. 2018 REVIEW ON MODIFIED VEHICLES FOR DIFFERENTLY ABLED PEOPLE. *Int Res J Eng Technol*, 5(10), pp.1550-1558
5. Dinesh KK, Abishek S, Bala Ganesh M and Gokulkrishnan S. 2021 IOT ENABLED PNEUMATIC GEAR SHIFTING IN TWO-WHEELER. *Int Res J Eng Technol*, 6(1), pp.314-318.
6. Ranavare, v. Patale, s. and Mane k. 2021 Button Operated Electromagnetic Gear Shifting System in Two Wheeler. *Artificial Intelligence Journalism and Reporting*, ISSN 2582-3922, pp.166-172.
7. R.Mohan Kumar, E.Vivek bharathi ,A.Gobinath and L.S.Gokul. 2020 Voice Operated Electromagnetic Gear Shifting Mechanism. *International Innovative Res Sci Eng Technol*, 9(6), pp.4907-4912.
8. Gikwad.R ,Ambhore.M,Dhore.R and Patil.H., 2024. Development of Prototype of Automatic Clutch Gear Mechanism. *International Innovative Res Sci Eng Technol*, 13
9. P.RUTH PRIYANKA, R.DIVYA BHARATHI., 2019. FABRICATION OF BUTTON OPERATED ELECTROMAGNETIC GEAR SHIFTING IN TWO WHEELER. *journal of eng sci*, 10(10), pp.375-380.
10. Shitole A, Kotari P, Magdum P, Sutar O, Toraskar S and Patil.R, 2018. Solenoid Operated Gear Shifting Mechanism for Two Wheeler. *Asian Journal of Recent Trends in Mechanics*, 3(2), pp.1-5.
11. Shitole A, Kotari P, Magdum P, Sutar O, Toraskar S and Patil.R, 2018. Solenoid Operated Gear Shifting Mechanism for Two Wheeler. *Asian Review of Mechanical Engineering*, 7(2), pp.9-11.
12. Oza H, Vachheta J, Shah Y, Prof. Shah J and Prof. Patel C, 2020. AUTOMATIC GEAR SHIFFTING MECHANISM FOR TWO-WHEELER AUTOMOBILE. *International J Creative Res Thoughts*, 8(3), pp.1160-1165.



INTERNATIONAL  
STANDARD  
SERIAL  
NUMBER  
INDIA



# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

 9940 572 462  6381 907 438  [ijirset@gmail.com](mailto:ijirset@gmail.com)



[www.ijirset.com](http://www.ijirset.com)

Scan to save the contact details