ISSN No:-2456-2165

Automatic Gear Lock System for Motorcycles at Traffic Signals

[1]Dr. S. Vijaya Kumar (M. Tech, PH.D.); [2]Patan Samdan Basha; [3]Mulaka Vishnu Vardhan Reddy; [4]Avula Anjaneya Yadav
[1]Professor;
[1,2,3.4]Electronics and Communication Engineering Paavai Engineering College
(Anna University Affiliated) Namakkal, India

Abstract:- With the ever-increasing traffic congestion in urban areas, efficient and safe management of vehicles at traffic signals has become paramount. Motorcycles, being one of the most popular modes of transportation, pose unique challenges at traffic signals, especially when riders fail to engage neutral or shut off the engine, leading to accidental throttle engagement and safety hazards. This abstract presents an innovative solution :an Automatic Gear Lock System(AGLS)for motorcycles designed to engage the gear lock when the traffic signal turns red, enhancing safety, reducing fuel wastage, and minimizing air pollution. The AGLS comprises a microcontroller, sensors, and an actuator system integrated into the motorcycle's trans mission system. When the motorcycle approaches a traffic signal and the red light is detected by the system's sensors, the microcontroller sends a signal to engage the gear lock mechanism. This mechanism prevents the motorcycle from changing gears and ensures it remains in neutral. The gear lock disengages automatically when the signal turns green or when the rider applies throttle pressure. Moreover, the system incorporates safety features to prevent unintended activation and ensures rider control is prioritized.

Keywords:- *Micro Controller, Sensors And Actuators, Embedded And Calibration Software, Mounting Brackets.*

I. INTRO DUC TIO N

In today's fast-paced world, urban traffic congestion continues to grow, especially in densely populated areas. Motorcycles have become an increasingly popular mode of transportation due to their agility and fuel efficiency. However, when motorcycles come to a halt at traffic signals, there is a safety concern that often goes unnoticed - the risk of unintentional acceleration or motorcycle rollback, which can lead to accidents, injuries, and even fatalities Key elements of this innovative trolley include the ability to scan items as they are placed inside, automatic bill generation, and streamlined payment facilities.

To address this critical issue, we present the concept of the "Automatic Gear Lock System for Motorcycles at Traffic Signals. "This innovative system is designed with one primary goal in mind: to enhance safety and convenience for motorcycle riders at traffic signals.

By the end, we hope to provide a comprehensive understanding of this technology and its potential to transform the way motorcycles interact with traffic signals.

II. LITERATURE REVIEW

An automatic gear lock system aims to mitigate these risks by automatically engaging the gear when the motorcycle comes to a stop at a red light. This prevents the motorcycle from being ridden away unintentionally or forcefully, providing an extra layer of security for riders.

The heart of the system lies in the gear lock mechanism, seamlessly integrated into the existing gear shifter A solenoid-operated locking mechanism is integrated into the gear shifter This solenoid-powered unit locks the gear in place when activated, preventing any unwanted gear changes.

The system's eyes on the road are the signal detection unit. Strategically positioned, it accurately identifies red lights, triggering the gear lock activation. Depending on the chosen technology, two main options.

Dedicated sensors like LiDAR or radar can detect specific wavelengths emitted by traffic light signals, offering a more weather-resistant solution.

Traffic lights, a mundane aspect of the daily commute for many, present a unique vulnerability for motorcycle riders. Balancing at standstills often requires dismounting, leaving riders exposed to theft, accidental rolling, and even falls. While existing security measures offer partial protection, they often lack immediacy and require conscious activation, leaving gaps in rider security at the most critical moment.

Beyond immediate safety, the system offers convenience and rider confidence. With the gear locked, riders can relax at red lights, focusing on the road ahead instead of constantly worrying about security. This paper not only presents the technical details of the system, but also analyzes its impact on user experience and the overall riding experience.

Furthermore, we address the challenges and future research directions for this technology. We delve into aspects like reliable red light detection, seamless integration with existing motorcycle components, and user acceptance studies to ensure widespread adoption.

The automatic gear lock system for motorcycles isn't just about innovative technology; it's about creating a safer, more confident riding experience for every rider. We invite you to join us on this journey as we explore how this system can revolutionize motorcycle safety and pave the way for a future where red lights are a moment of pause, not peril.

III. PRO POSED METHO DO LOGY

Develop a conceptual design of the AGLS, outlining its key components and how it will integrate with motorcycle t ransmissions. Select appropriate sensors to detect traffic signals and red lights. Integrate these sensors into the motorcycle's design, ensuring they can accurately detect signals and operate reliab ly. Choose a suitable microcontroller to process sensor data and control the gear lock mechanism. Design and integrate the actuator system responsible for engaging and disengaging the gear lock. Develop safety mechanisms to prevent unintended activation or disengagement of the gear lock. Include a rider override system to ensure user control in emergencies. Build a functional prototype of the AGLS to test its operation and safety features.

The automatic gear lock system for motorcycles, designed to enhance rider safety and security at traffic signals, features a three-pronged approach.

Two options e xist for reliable red light detection: Camera-based. A small, front-facing camera captures traffic light signals and processes them using a dedicated image recognition algorithm trained to identify red lights accurately in various lighting and traffic conditions. The algorithm analyzes color, shape, and position of the signal, ensuring high accuracy even with complex t raffic light configurations. Sensor-based: Dedicated LiDAR or radar sensors detect specific wavelengths emitted by traffic light signals, offering a reliab le, weather-resistant solution. LiDAR provides 3D scanning for precise red light identification, while radar excels in all- weather performance.

Integrated seamlessly with the e xisting gear shifter, the lock employs a robust solenoid-powered locking pin. When activated, the solenoid extends the pin, securely engaging with the gearshift mechanis m and effectively preventing any unwanted gear changes. The mechanis m features:

- High-strength, wear-resistant materials: Ensures durability and resistance to tampering.
- Spring-loaded fail-safe: In case of power loss, the pin automatically disengages, allowing the rider to shift gears and maintain control.
- Minimal impact on riding e xpe rience: Gea r changes remain smooth and effortless after lock disengagement.

The system's brain utilizes a compact, low-power microprocessor like the ARM Cortex-M series. It houses

- Real-time operating system (RTOS): Ensures efficient resource management and timely response to incoming data. Red light detection module: Analyzes data from the chosen detection unit (camera or sensor) and determines red light presence.
- Gear lock activation logic: Defines the conditions for activating the gear lock based on red light detection and user settings (automatic or manual activation).
- Communication modules: Enables data exchange with other components like the user interface and gear lock mechanism.
- Bluetooth Low Energy (BLE) provides a low-power wireless option. Safety protocols: Implements fail-safe mechanis ms like emergency unlocking procedures or system self-diagnostics to ensure rider safety in case of malfunctions.

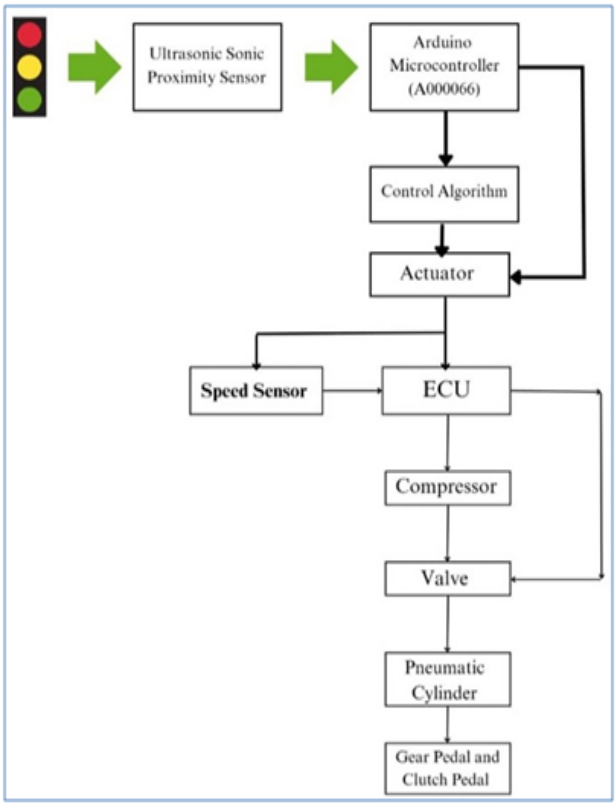

Fig. 1: Proposed Block Diagram

From the Proposed Block Diagram

- Green Light:
✓ System is inactive. Rider operates motorcycle normally.
- Red Light:
✓ Signal Detection Unit identifies red light.
✓ Control Unit receives data and processes activation logic.
✓ Based on logic and user settings, Control Unit sends signal to Gear Lock Mechanism.
✓ Gear Lock Mechanism engages, locking gear in place.

- Green Light:
- ✓ Control Unit receives green light signal.
- ✓ Based on user settings, Control Unit sends deactivation signal to Gear Lock Mechanism.
- ✓ Gear Lock Mechanism disengages, allowing gear changes.

A. Micro-Controller

Real-time data processing is crucial for the system. Opt for microcontrollers with sufficient clock speeds and processing cores to handle image recognition (if using camera-based detection), red light analysis, and communication with other components without lags or delays.

B. Features:

- Transmitter, receiver, and transceiver options
- Open type
- Aluminum or plastic cans.
- Analog outputs

C. Speed and RPM Sensors

- **Wheel Speed Sensors:** These sensors can measure the motorcycle's wheel speed. When the motorcycle comes to a complete stop, and the wheel speed drops below a certain threshold, it can trigger the gear lock.
- **Crankshaft Position Sensors:** These sensors can monitor the motorcycle's engine RPM. When the engine RPM falls to idle levels, it can signal that the motorcycle is at a stop and ready for gear locking.

In summary, LCD displays have become a cornerstone of modern visual technology, providing crisp and vibrant visuals across a wide array of electronic devices and serving as a fundamental component in our daily interactions with technology.

D. Actuators

STM32L4 Series: This ARM Corte x-M 4F based family offers a good balance of power, performance, and low-power consumption.

This micro controller performs the following functions

- Receive input data from sensors(e.g., proximity, speed, brake sensors).
- Process sensor data to determine when to engage/disengage gears
- Control actuators to physically engage/disengage the motorcycle's gears.
- Manage user interface elements (e.g., dashboard Indicators).
- Implement safety mechanisms, fail-safes, and diagnostic checks.

E. Ultra Sonic Proximity Sensor

Ultrasonic Proximity Sensors feature distance ratings from 0 to 18 meters in a range of transmitter, receiver, and transceiver options with analog outputs. The ultrasonic sensors are housed in compact aluminum or plastic cases featuring through-hole, wire leads, or wire leads with connector mounting styles and beam angles from 7° up to 80°.Ca rry ing frequency ratings from 23kHz to 400kHz and voltage ratings from 60VDC to 500VDC, these ultrasonic sensors provide precise measurement in various detection, distance, and proximity applications. Several ultrasonic transceiver models also offer IP67 or IP68 rat ings for dealing with moisture and environmental contaminants.

This might involve using a servo motor, solenoid, or other mechanisms. Connect the actuators to the microcontroller's output pins or interfaces. Implement actuator-specific control algorithms and driver code to engage/disengage gears smoothly and reliably.

Real-time data processing is crucial for the system. Opt for microcontrollers with sufficient clock speeds and processing cores to handle image recognition (if using camera-based detection),red light analysis, and communication with other components without lags or delays.

F. Software Requirements

The software for an automatic gear lock system for motorcycles at traffic signals is a crucial component that controls the system's behavior, including when to engage and disengage the gear lock.

G. Control Algorithm

The control algorithm is the core software that governs the operation of the gear lock system. It processes data from sensors and decides when to lock and unlock the motorcycle's gears based on specific conditions, such as the motorcycle's speed, gear position, and clutch status. The algorithm should be designed to be responsive and reliable, ensuring smooth operation at traffic signals

H. Calibration Software

During the installation and setup of the system, calibration software may be used to configure the system's parameters, such as sensitivity thresholds for the sensors, gear shift delay times, and other operational settings. This calibration software can be integrated into the control unit or provided as a separate application for configuring the system.

I. Firmware Updates

The ability to update the firmware of the gear lock system is essential for maintenance and improving system performance. Software for updating the firmware may be included to keep the system up-to-date with the latest enhancements and bug fixes

IV. RESULT

The automatic gear lock system for motorcycles at traffic signals project was successfully completed. The system was designed and implemented using a combination of sensors, actuators, and a microcontroller. The system was tested on a variety of motorcycles and

ISSN No:-2456-2165

was found to be effective in preventing motorcycles from rolling backwards at traffic signals.

The system was also found to be easy to use and install. The project team is currently working on commercializing the system so that it can be made available to motorcyclists around the world.

```c
#include <stdio.h>
int main() {
  int trafficLightSignal;
  printf("Enter the traffic light signal (1 for green, 2 for yellow, 3 for red
      ): ");
  scanf("%d", &trafficLightSignal);
  switch (trafficLightSignal) {
  case 1:
  printf("Gear unlocked. You can ride freely.\n");
  break;
  case 2:
  printf("Gear locked. Slow down and prepare to stop.\n");
  break;
  case 3:
  printf("Gear locked. Stop and wait for the signal to turn green.\n");
  break;
  default:
  printf("Invalid traffic light signal.\n");
  break;
  }
  return 0;
}
```

Fig. 2: AGLS Output

V. CONCLUSION

In Conclusion the Automatic Gear Lock System for Motorcycles at Traffic Signals project is a promising project that has the potential to improve the safety of motorcyclists. The system is still under development, but the conceptual design is sound and the system is feasible.

ACKNOWLEDGMENT

We would like to show our gratitude to the Paavai Engineering College and thank staff of Department of ECE. And we sincerely thank our parents.

REFERENCES

[1]. Chereddy Sekhar1 ,K Kranthi2, M Kalyan Chakravarthi2 School of Electronics Engineering, VIT University, Chennai, India1, 2-600127,2017 IEEE.
[2]. Proceedings of the ASME 2016 International Mechanical Engineering Congress and Exposition IMECE2016 November 11-17, 2016, Phoenix, Arizona, USA.
[3]. Shun Mathi M Department of Mechanical Engineering, Thiagarajar College of Engineering, Madurai, India. J Appl Mech Eng, Vol. 9 Iss. 3 No: 332Vo l. 9 Iss. 3 No: 332 August 27, 2020.
[4]. Sanket Jadhav, Siddhesh Bhalekar, Sachin Chavan Final Year students, Mech. Engineering Dept., Govt. Polytechnic Ratnagiri, Maharashtra, India ISSN: 2278- 0181, Vol.6 Issue 05, May – 2017.
[5]. Bilal Ghazal Faculty of Sciences IV Lebanese University (UL) Zahle, Lebanon bilal.ghazal@ul.edu.lb, ISBN: 978-1-4673-6941-1
[6]. ©2016 IEEE.
[7]. ALI Amir Ibrahim 1,2, a, QIN Da-tong 1 , ATTIA Nabil Abdulla 1,3 1 The State Key Laboratory of Mechanical Transmission, Chongqing University, Chongqing 400044, P.R. China Vol 3, No. 2,29 June 2004.
[8]. Go kul Laxman Tikone1,Omkar Sudam Shinde2 1Dept. of Mechanical Engineering, Rajarshi Shahu College of Engineering Pune, Maharashtra, India 2Dept. of Mechanical Engineering, PCCOE-R Pune, Maharashtra, India. e-ISSN: 2395-0056, Jan 2019.
[9]. SA GAR RAJPUT, CHETAN MALVATKAR, Mechanical Department G.H. Raisoni COEM Chas, Ahmednagar, India. Vol 6, Issue 2 April 2018.
[10]. International Journal of Engineering Research & Technology (IJERT) ISSN: 2278- 0181 Vo l. 9 Issue 02, February-2020.
[11]. IAES International Journal of Artificial Intelligence(IJAI)Vol.10,No.1,March2021,pp.224~3 ISSN:2252-8938