JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Design and Development of IOT based Smart Switch for Two Wheelers

[1] **Prof. Jugal Jagtap,**

[2]Krupa Samadhan Patil, [2]Durvesh Prasad Utekar, [2]Vaibhav Kishor Dhawde, [2]Shantanu Sandeep Jaitapkar

[1] Project Guide
[2]Student
Department of Mechanical Engineering,
Rizvi College of Engineering, Mumbai, India

Abstract : In India we face major traffic issues in the metropolitan cities and we have to halt at many traffic signals throughout our journey. Even if we halt at the traffic signals, the engines of the bikes are running and they still emit a of greenhouse gases. To overcome this issue we can shut the engine automatically if the vehicle is stationary for more than 10 seconds. The vehicle can be started again when there are less than 10 seconds remaining for the signal to turn green. In this way we can cut of the carbon emissions and also save fuel.

This project focuses on the design and fabrication of an Internet of Things (IoT)-enabled smart switch for two-wheelers. The primary objective is to develop a switch mechanism that automatically turns off the engine after a predetermined idle time, typically between 5 to 10 seconds, and initiates engine start-up when the switch is actuated. The system leverages IoT technology to enhance the efficiency and safety of two-wheelers by reducing unnecessary engine idling, conserving fuel, and minimizing environmental emissions. The abstract outlines the key features, technologies, and benefits of this innovative smart switch for two-wheelers.

Keywords : **Traffic signals, emissions, two wheelers, fuel, greenhouse gases, Internet of Things**

I. Introduction

In the dynamic landscape of transportation, particularly in urban environments, two-wheelers stand as essential modes of mobility. Recent advancements in technology have catalyzed the evolution of these vehicles, leading to the conception of innovative solutions aimed at enhancing user experience while addressing environmental concerns. This project endeavors to create an IoT-based smart switch for two-wheelers, revolutionizing conventional expectations.

Central to this system is an intelligent switch that automatically halts the engine during brief idling periods, typically within 5 to 10 seconds, and reignites it upon engagement. Beyond this, the project incorporates a sophisticated fuel consumption tracking system. Through the integration of a microcontroller, the vehicle is interconnected with the digital realm, enabling remote monitoring and real-time data transfer to a dedicated mobile application.

This comprehensive approach empowers riders to monitor fuel usage patterns, facilitating informed decisions for cost-effective and sustainable commuting. By synergizing fuel efficiency with IoT capabilities, the project not only optimizes the riding experience but also contributes to a greener future. This marks a significant stride in the realm of two-wheeler innovation, heralding a future where technology aligns seamlessly with environmental consciousness.

II. Literature Review

In recent decades, the focus has shifted towards energy conservation and reducing greenhouse gas emissions. This has led to a growing interest in cutting energy consumption in public transportation, particularly heavy-duty vehicles. However, passenger and personal vehicles also play a significant role in emissions and fuel wastage during idling.

The content highlights the intricate relationship between vehicular traffic dynamics, fuel consumption, and CO2 emissions. Notably, traffic congestion can spike fuel consumption by up to approximately **80%**, leading to significant delays in travel times. Crucial variables such as velocity, acceleration, vehicle properties, engine characteristics, external conditions, and vehicle state are key determinants that affects fuel economy. The research reveals that daily fuel loss at specific signal intersections can reach as high as Rs **65,960.94**, indicating significant economic consequences. According to the researchers, on an average 30% of the fuel is consumed by a public vehicle during its standstill i.e., idling motion. Idling a vehicle for more than 10 seconds can consume more fuel than restarting the engine. This is because modern engines are optimized for fuel efficiency under load rather than during idle periods. Following the advice in the TATA operator manual to stop the engine and restart it if waiting for more than a minute, such as at traffic signals, is a practical method to conserve fuel and lower emissions. Furthermore, the transportation sector emits approximately 150 million tons of CO2, with road transport accounting for **87%** and CO2 emissions during idling represent about **9%** of the transport sector's total emissions and the CO and HC about 70% of total emissions. The Environmental Protection Agency (EPA) in the USA identifies six common air pollutants, including particulate matter, carbon monoxide, nitrogen oxide, and lead, with vehicle exhaust being a major source of these pollutants. This exhaust is linked to serious health issues like asthma, lung cancer, and debates, primarily due to nitrogen oxide and particulate matter emissions. The heavy reliability on petroleum-based energy sources, which are finite and non-renewable, leads this concern to detrimental effects on health and the climate.

The stop-start vehicles require robust batteries and starter systems, they are more affordable than full hybrid vehicles. Europe has embraced this technology more vigorously due to stringent environmental targets and more rigorous regulations. The proposed micro-hybrid system comprises components like throttle position sensors, starter motors, and control circuits to ensure efficient stop-start functionality. It employs a sophisticated algorithm and embedded processor to optimize fuel efficiency. The benefits of this technology are particularly evident for vehicles spending considerable time idling at traffic lights or in congested traffic. It continuously monitors the vehicle's status, including ignition, engine speed, vehicle speed, and more, to determine when to stop and restart the engine. The logic behind the Start-Stop system considers conditions like idle engine status, neutral gear, speed, ignition, and brake/clutch positions to decide when to stop and start the engine.

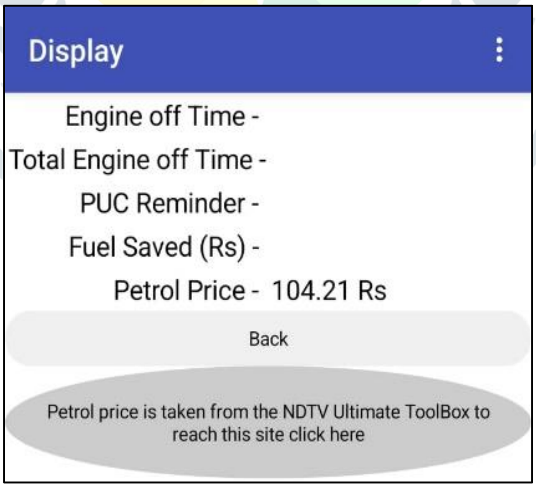
The microcontroller is the brain of the system since it receives the input signals from the sensors. All sensors make the system full-proof, and the microcontroller analyses the data collected them to take a decision. Embracing this approach can contribute to better fuel efficiency and reduced environmental impact in everyday driving situations.

III. METHODOLOGY

This project focuses on tackling urban emissions by developing an IoT-enabled smart switch for two-wheelers, automatically shutting off the engine after 5 to 10 seconds of idling to conserve fuel and reduce emissions. The system's core components include an Arduino Uno microcontroller, HC-05 Bluetooth module for remote control, and push buttons for manual override. Sensors monitor idle time, triggering engine shutdown to optimize fuel usage. Users can adjust idle time thresholds to balance efficiency and performance. The engine shutdown process is controlled via the ignition system, restarted manually through push buttons. IoT integration allows for remote monitoring via a mobile app, tracking fuel consumption and emissions. Fuel consumption is measured manually using a burette, providing data for analysis. Operational parameters are logged for evaluation. Bench testing ensures system functionality and safety. A user-friendly mobile interface enhances usability, providing real-time feedback on emissions and fuel savings, empowering users to make eco-conscious choices.

Fuel consumption is measured by feeding a known quantity of fuel (1 liter of petrol) into the system using a burette. Manual observation determines consumption rate, yielding a Fuel Constant of 160 ml/hr for a 100cc bike.

The following is the interface of the app interface:



3.1 Components

The following are the components used for the project.

3.1.1 Arduino Uno (Microcontroller)

The microcontroller is going to be the brain of our model. The board has regular innovation and a bug fix in the design of the board to make the board suitable for the project use.

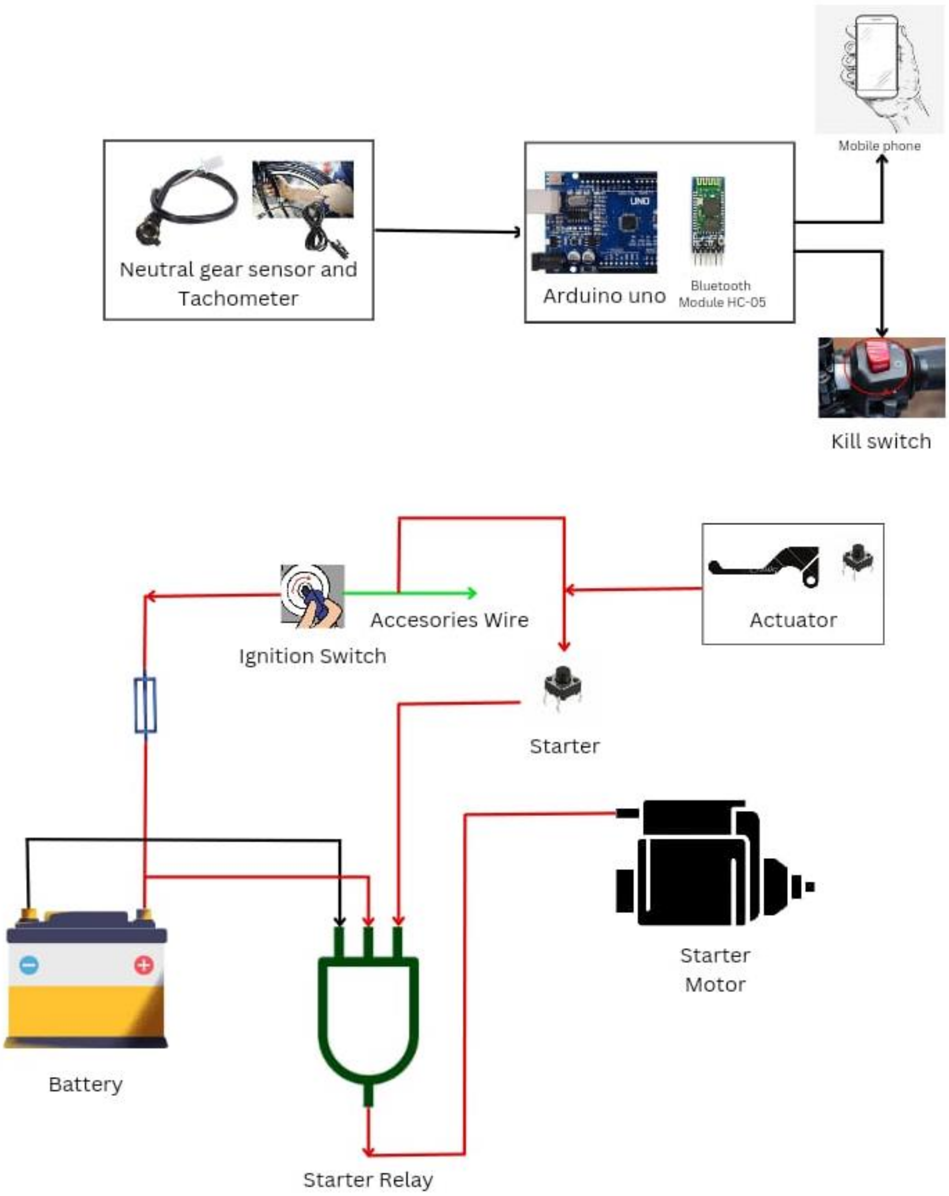
3.1.2 IR Sensor

IR sensor is an electronic device that emits light in order to sense some object of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion.Usually, in the **infrared spectrum**, all the objects radiate some form of thermal radiation. These types of radiation are invisible to our eyes, but infrared sensor can detect these radiations.

3.1.3 HC-05 Bluetooth Module

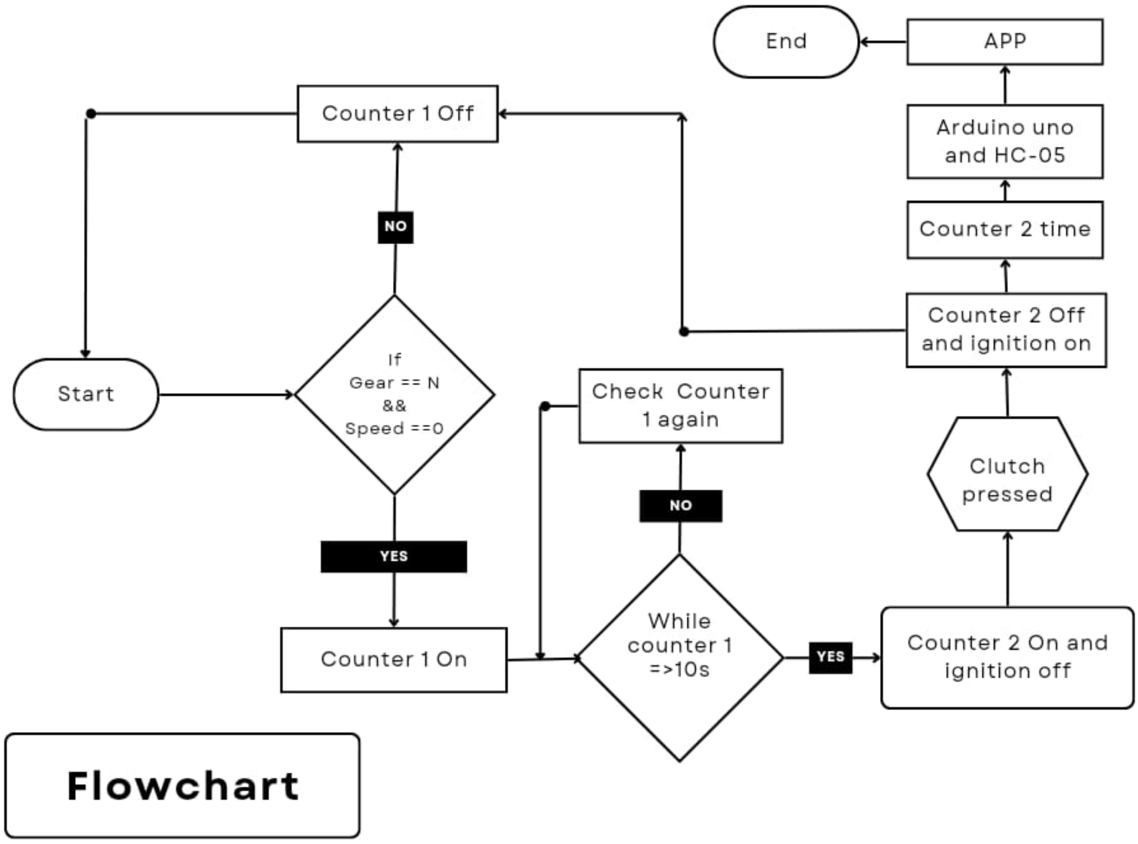
HC-05 Bluetooth Module is an easy-to-use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. Its communication is via serial communication which makes an easy way to interface with controller or PC. HC-05 Bluetooth module provides switching mode between master and slave mode which means itable to use neither receiving nor transmitting data.

3.2 Block Diagram



BLOCK DIAGRAM

3.3 Flowchart



FLOWCHART

IV. RESULTS AND DISCUSSION

The IoT smart switch for two-wheelers stands at the forefront of a transformative shift in transportation paradigms. Its ability to optimize fuel consumption represents a significant step towards reducing carbon emissions and mitigating environmental impact. By leveraging real-time data analysis and intelligent regulation of engine performance, this innovation not only minimizes fuel wastage but also fosters a more sustainable mode of mobility.

In essence, the IoT smart switch for two-wheelers represents more than just a technological innovation it symbolizes a commitment to sustainability and a vision for a smarter, greener transportation ecosystem.

The following is the observational reading and its calculations:

	ROUTE	DISTANCE (km)	TOTAL TIME FOR THE TRIP (sec)	IDLING TIME (sec)
TRIP 1	COLLEGE-PRABHADEVI	7.7	2160	497
	PRABHADEVI-COLLEGE	7.7	1980	541
TRIP 2	COLLEGE-ANTOP HILL	8.1	2280	847
	ANTOP HILL-COLLEGE	8.1	2100	690
TRIP 3	PRABHADEVI-ANTOP HILL	6.8	1320	440
	ANTOP HILL-PRABHADEVI	6.8	1345	435

OBSERVATION TABLE

Idling Time(sec)	Fuel saved (Liter)	Money Saved(Rs)
497	0.019	2
541	0.021	2.19
847	0.033	3.44
690	0.027	2.80
440	0.017	1.78
435	0.0169	1.77

RESULT TABLE

References

[1] How Much does Traffic Congestion Increase Fuel Consumption and Emissions? Applying a FuelConsumption Model to the NGSIM Trajectory Data
Martin Treiber (corresponding author), Arne Kesting, Christian Thiemann Submission for the Annual Meeting of the Transportation Research Board 2008,Submission date: August 1, 2007, Revision date: November 15, 2007.

[2]Estimation of Carbon Footprint of Fuel Loss Due to Idling of Vehicles at Signalised Intersectionin Delhi
Kirti Bhandaria, Purnima Paridab, Pragya Singh 2nd Conference of Transportation ResearchGroup of India (2nd CTRG).

[3]Fuel consumption evaluation of SI engine using start-stop technology
M.A. Abas1, W.S. Wan Salim, M.I. Ismail, S. Rajoo1 and R. Martinez-Botas
Low Carbon Transport Research Centre, Universiti Teknologi Malaysia 81310 Johor Bahru,Johor, Malaysia Journal of Mechanical Engineering and Sciences ISSN (Print): 2289-4659; e- ISSN: 2231-8380 Volume 11, Issue 4, pp. 2967-2978 December 2017 © Universiti Malaysia Pahang, Malaysia

[4]Fuel Efficient Two Wheelers Using Micro-Hybrid Technology & Smart Embedded System
V. N. Supe, V.P.Waghmare, N.B.Chopade International Journal of Technical Research and Applications e-ISSN: 2320-8163, www.ijtra.com Volume 2, Issue 2 (March-April 2014), PP. 42- 47

[5]Automatic Start Stop System for Two Wheelers To Improve Fuel Economy
Sanjay T. Kadam and Supriya O. Rajankar lobal Journal of Mechanical Engineering and Computational Science– ISSN 2249-3468, GJMECS Vol.1 (3), Research Paper: Kadam and Rajankar, 2011: Pp.22-24

[6]Opportunities and challenges of smart mobile applications in transportation Saidi Siuhi, Judith Mwakalonge
Journal of traffic and transportation engineering (English edition) 2016; 3 (6): 582 e592

[7]Exploring Trip Fuel Consumption by Machine Learning from GPS and CAN Bus Data Weiliang ZENG, Tomio MIWA, Takayuki MORIKAWA
Journal of the Eastern Asia Society for Transportation Studies, Vol.11, 2015

[8]Updating of a Travel Demand Model Based on Fuel Consumption Data
Ali Hakimelahib, K.V Krishna Raoa , S.L. Dhingraa , Farideddin Peiravianb World Conference on Transport Research - WCTR 2019 Mumbai 26-31 May 2019

[9]Technology Options for Control of Emissions in Two Wheelers
S. Govindarajan, Ucal Fuel Systems Limited, Chennai, milnadu, India Copyright ©2001 Society of Automotive Engineers, Inc. (2001-28-0043)

[10]Automatic Engine Start-Stop and Automatic Headlight Dimming Modular System.
ISSN: 2278-0181; IJERTV9IS070155
[Ajay Sreekumar (UG Scholar), Jonathan Joseph Cleetus (UG Scholar), Shinoj Philip John (UGScholar), Sajeevan R S (UG Scholar), Dr. Nisha G K (Professor)] Dept of Electrical and Vol. 9 Issue 07, July-2020, International Journal of Engineering

[11]Vehicle Monitoring using IoT and Automatic Stop - Start System
Vikram Chekuri, Akilesh SK, Firas Ahmed, Sharath SK, Shivakumar Somasagar Volume: 07 Issue: 06 | June 2020 www.irjet.net p-ISSN: 2395-0072 © 2020, IRJET |Impact Factor value: 7.529 | ISO 9001:2008 Certified Journal | Page 6883 | e-ISSN: 2395-0056.

[12]Motorcycle Engine Shut-off Device
Philip D. Geneta, George Adrian L. Cay, Hazel Joy B. Magnaye, Bryan H.
Oliverio (Batangas State University Rosario College of Industrial Technology BarangayNamunga, Rosario, Batangas, 4225 Philippines).
ISSN: 2456-9992 | Volume 3 Issue 5, May 2019 | www.ijarp.org

[13]Energy & Cost-Efficient Auto Start/Stop Kit System for Motor Bikes: An Eco-FriendlyTechnology
Muhammad Usama Qamar, Usman Munawar, Dr.Muhammad Mahmood Aslam Bhutta, Dr.Suhail Aftab Qureshi
Nov 2017, DOI: 10.1109/EI2.2017.8245289
Conference: 2017 IEEE Conference on Energy Internet and Energy System Integration