IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 3, Issue 2, April 2023
Impact Factor: 7.301

Development of Intelligent Safety System for Two-Wheeler Rider

Prashant D. Dahite[1], Nilesh K. Datir[2], Ashish L. Bhujbal[3], Vasudha V. Patil[4]
B.E Project Students, Department of Electronic and Telecommunication[1,2,3]
Assistant Professor, Department of Electronic and Telecommunication[4]
Rajiv Gandhi College of Engineering, Karjule Harya, Maharashtra, India

Abstract: *Two-wheelers are the most economical way of transport. Owing to this, there has been an increase in the number of two-wheelers especially on Indian roads which has led to an increase in the number of accidents. One of the reason is riding triple seat as well as taking sharp turns. Keeping in mind the above problems, an integrated system is designed which will ensure the safety of riders. The integrated design consists of automatic triple seat detection and continuous tracking of the tilt of the two-wheeler with respect to the road. The components are integrated in such a way that the engine of the two-wheeler will start only if the seat occupation is in a limited range. The tilt sensing device will sense the inclination of the vehicle with respect to ground and as soon as the level goes below the threshold value of the angle of inclination, a warning beep will ring, intimating the rider that the vehicle may slip.*

Keywords: Two-wheeler, Tilt, Seat Occupation, Angle of Inclination, Warning Beep, Indian Roads

I. INTRODUCTION

With the surging economy, the vehicle population expanded in the country during the last decade. Though road networks have also improved, mounting pressure on roads from the expanded vehicle population has aggravated safety issues. Credible data about road accidents are not available, still, preliminary reports indicate that Indian roads are witnessing a higher incidence of accidents. As per the Supreme Court-appointed Committee on road safety, nearly 150000 people die in road accidents in the country every year[2]. Another 5 to 7 lakh people are believed to be injured, leading to handicapped status. The government has made several efforts to enhance road safety in recent years. A major one was the appointment of the Committee on Road Transport and Traffic Management (Sundar Committee, 2007)[1].
In the field of automotive, if a vehicle is designed for a particular per-person riding capacity considering the aspects of safety[8], design and power exceeding those limits put the driver and pillion riders at considerable risk. With a step ahead, we are trying to detect and limit the number of persons sitting on a two-wheeler. As per the traffic rules in India, the maximum number of persons cannot exceed two, i.e. a driver and a pillion rider. Despite the ban, people tend to break the rule. Two Pillion Riding is also the root of a lot of accidents happening now-a-days.
In the account of this problem, the integrated circuit is designed which detect the triple seat. The integrated design consists of an automatic triple seat detection in such a way that the engine of the vehicle will start only when the seat occupation is in a limited range.

II. LITERATURE SURVEY

Commuting in any Indian city on two-wheeler is getting riskier day by day. In order to be safe on Indian roads, you need to be extra sensitive to ever changing scenarios around you.So, we think that, why shouldn't our bike to be able to detect any potential hazards and take measures accordingly? Bubble based tactile based sensors were developed and checked for triple seat detection application. An array of Bubble based Tactile sensors are placed on the seat that are most likely to encounter weights during multiple pillion riding. But as the economic condition is concerned it may not be feasible to assemble the high price technology in every bike in India. Hence, we switch to another way which should be cost effective as well as easily implementable.
The statistics of road accident shows that there are a lot of accidents due to tilting of vehicles at sharp turns. To encounter this problem Robert Bosch Stuttgart, Philipp Lehner and Muehlacker gives the solution on tilting of two-

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 3, Issue 2, April 2023
Impact Factor: 7.301

wheelers. The tilt of the vehicle is recorded with the help of the sensor and this recorded information is converted into angle i.e. the angle of inclination. The movement of the vehicle is then predicted on the bases of the angle of inclination and accordingly the rider will take actions.

Considering all the data from the above survey, we are designing a system for triple seat detection and tilt detection. This system is cost-effective and easy to implement.

During the literature review, we came across various journals and conference papers. The literature survey is given below.

Sr. No.	Title of the Paper/Article	Year of Publication	Methodology Used	Conclusion
1.	Bashir, E. and Patil, S., "Tactile Sensor Array Design for Triple Seat Detection and Control," SAE Technical Paper 2016-28-0258, 2016,https://doi.org/10.4271/2016-28-0258. Affiliated: Tata Elxsi, A R A I Pages: 4 Event: International Mobility Conference	2016	There is no sensor available that could detect the differential load over the larger area at an effective cost. To cater to this problem Bubble based tactile-based sensors were developed and checked for this application. An array of Bubble based Tactile sensors is placed on the seat that is most likely to encounter weights during multiple pillion riding, as per the number of persons seated the state of the switches will be read and monitored by a small Control Unit.	The mechanism to detect the number of seaters is done by detecting the concentration points, an algorithm is implemented that will detect a valid occupant on the seat. After the detection of overloading of the persons on the bike, the Control unit can disable the engine or set a warning light.
2.	United States Patent Application Publication Pub.No.:US2017/0162055 A1 Lehner Pub. Date: Jun. 8, 2017 INCLINATION DETECTION IN TWO-WHEELERS Applicant: Robert Bosch Stuttgart Inventor: Philipp Lehner, Muehlacker Appl. No.: 15/342,306 Filed: Nov. 3, 2016 O O	2017	A method for operating a vehicle equipped with a Surroundings sensor System is provided. In the method, at least one preceding and/or oncoming two-wheeler is detected at least as a function of data of the Surroundings sensor system. In addition, an angle of inclination of the two-wheeler is ascertained at least as a function of data of the Surroundings sensor system, and a movement path of the two-wheeler is predicted based on the ascertained angle of inclination. The operation of the vehicle takes place in this case based on the predicted movement path.	At least one preceding and/or oncoming two-wheeler is detected at least as a function of data of the Surroundings sensor system. In addition, an angle of inclination of the two-wheeler is ascertained at least as a function of data of the Surroundings sensor system, and a movement path of the two-wheeler is predicted based on the ascertained angle of inclination.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 3, Issue 2, April 2023
Impact Factor: 7.301

4.	Zhenghuan and ShaochengQu, "Design on self-balancing and track-searching cart," *2011 International Conference on Image Analysis and Signal Processing*, Hubei, 2011, pp. 586-589. doi: 10.1109/IASP.2011.6109112	2011	In this paper, a self-balancing two-wheel cart with a track-searching function is designed with the technology of a System on a Programmable chip (SOPC). The system checks the inclination angle of a vertical axis on the cart, and the two wheels are driven respectively with different angles and speeds to keep the cart balanced. After balancing, the system activates the camera for track-searching under the frame and the cart advances along a black line on a white background. PID algorithm is applied for keeping balance and an edge detection algorithm helps to identify the black line from the white background.	After testing and adjusting over and over, the cart achieves both functions of self-balance and tracksearching. No matter what angles the frame of the cart are placed at, the cart drives the two wheels respectively with different speeds and directions and it will maintain balance with slight vibration at the range of 10 after several adjustments Three seconds after balance, the track -searching function is activated. The cart moves along the black line on the white background.
5.	Y. Matsumoto, A. M. Asrulnizam and K. Nakamura, "Low-voltage signal conditioning circuit for fluid-based inclination switch," *SENSORS, 2008 IEEE*, Lecce, 2008, pp. 371-374. doi: 10.1109/ICSENS.2008.4716458	2008	A low-voltage signal conditioning circuit for a capacitive sensor was designed with 0.35mm CMOS technology. A charge balanced capacitance detection circuit and summing amplifier were designed with inverter amplifier, feedback resistance and capacitance which determines the gain and frequency response of the circuit. The oscillator and hold capacitance were also integrated in the chip size of 1 mm by 0.5 mm. The chip was packaged with a fluid-based inclination switch on a ceramic substrate, and the characteristics were evaluated.	A one-side fluid-based inclination switch has been fabricated on a ceramic substrate with the capacitance detection circuit designed with inverter amplifier. We successfully detected all four directions at supply voltage of 1.5V. The low-voltage sensor circuit makes it possible to directly connect to a digital circuit. And it can be integrated with the digital circuit on the same die to make simple and cost effective system.
6.	N. K. Kumbhar, R. A. Bandagar and M. U. Yelpale, "Electronic accident prevention system: Using high end tilt indicator,"	2016	This paper reports to design the tilt indicator in bikes and balancing it according to it. The goal of this project was to build a bike which will not fall or may indicate the amount of tilt which	Tilt sensors are devices that produce an electrical signal that varies with an angular movement. These sensors are used to measure slope and tilt within a limited range of

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 3, Issue 2, April 2023
Impact Factor: 7.301

	2016 International Conference on Communication and Electronics Systems (ICCES), Coimbatore, 2016, pp. 1-5. doi: 10.1109/CESYS.2016.7889841		may avoid the accident. This bike is able to drive and also come to a complete stop without losing its balance. In order to maintain balancing, the rider as to maintain tilt of bike according to the reference point considered for the bike. Sensor data is fed into a control system which outputs a balancing torque to a motor spinning the reaction wheel.	motion. This experiment simply supports Newton's Second Law of Motion, and when the angle of incline increases the acceleration of the object increases. So we can say that the acceleration of the object is directly proportional to the angle of an incline at which the object is accelerating.

III. METHODOLOGY

The block diagram of the system consists of two pieces of circuitry, the triple seat detection circuit, and the tilt detection circuit as shown in the figure. The output of the triple seat detection circuit is connected to the PIC microcontroller. Depending on the status of the switch the microcontroller will send the pulse to the relay. The relay is turned ON if the limit exceeds, due to which the circuit between the engine and the ignition breaks. In continuation with triple seat detection, tilt detection is done with the help of a tilt sensor. Whenever the vehicle is tilted beyond a specific limit, a LED indication is given and the message will get displayed on LCD accordingly.

3.1 Power Supply Block

The main components in the power circuit design are (shown in Fig. 2):

1. Transformer selection.
2. Rectifier design.
3. Filter design.
4. Regulator design.

Fig.1.Block diagram of power supply

- **Transformer:** A 0-12V/1A transformer is used for this purpose. The primary of this transformer is connected to the main supply through an on/off switch & fuse for protection from overload and short circuit protection.
- **Rectifier:** The secondary is connected to the Rectifier to convert 12V AC to 12V DC voltage.Full wave rectification converts both polarities of the input waveforms to DC and is more efficient. For this bridge rectifier is used.
- **Filter:** A filter capacitor is used in order to remove ripples from the pulsating DC and convert it to unregulated DC.
- **Voltage Regulator (LM7805):**These voltage regulators are monolithic integrated circuits designed as fixed–voltage regulators for a wide variety of applications including local, on–card regulation. These regulators employ internal current limiting, thermal shutdown, and safe–area compensation. With adequate heat sinking they can deliver output currents in excess of 1.0 A. Although designed primarily as a fixed voltage regulator, these devices can be used with external components to obtain adjustable voltages and currents.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 3, Issue 2, April 2023
Impact Factor: 7.301

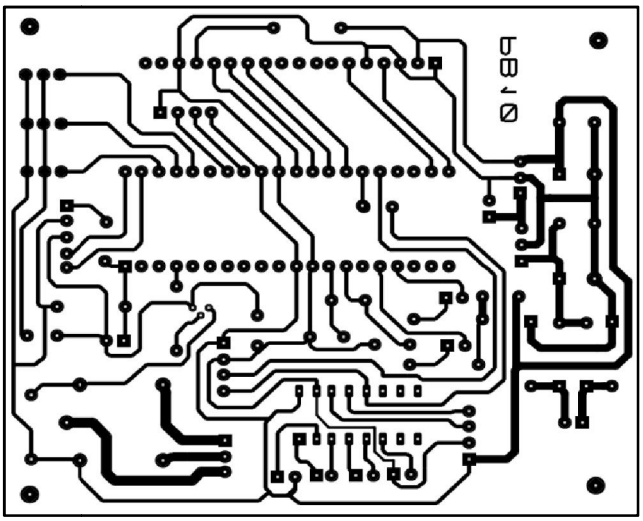

Fig. 2 Triple seat detection PCB layout

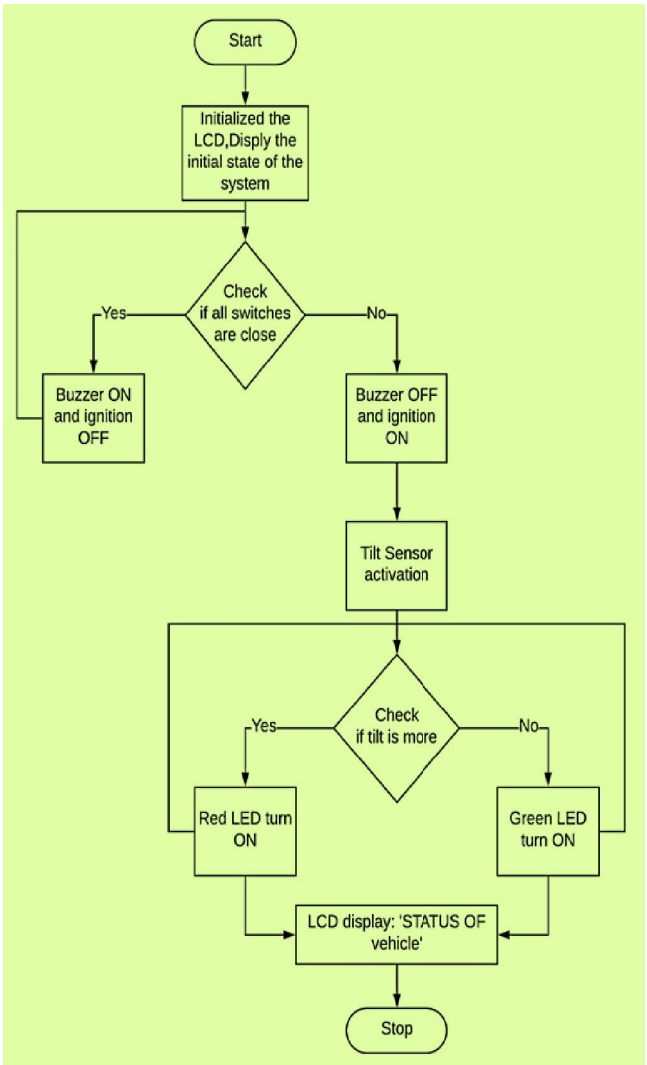

Fig.3 Flow Diagram of System

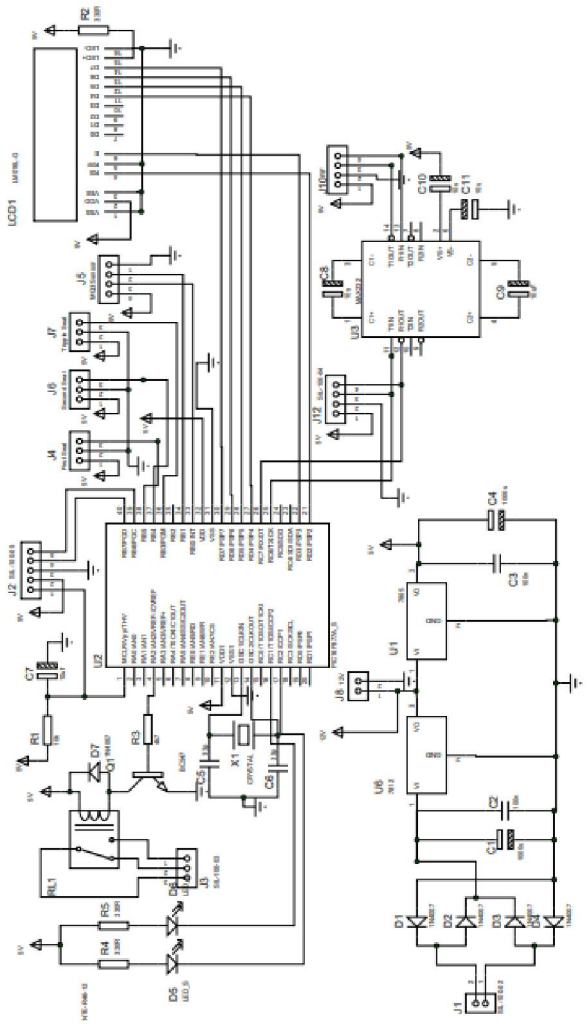

Fig.4 Power Circuit Diagram of System

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 3, Issue 2, April 2023
Impact Factor: 7.301

3.2 Technical Details

Hardware Specifications

1. PIC16F877A

Features:

- Flash memory: 14.3 Kbytes (8192 words).
- Self-reprogrammable under software control.
- Watchdog timer with on-chip RC oscillator.
- Programmable code protection.
- Power-saving Sleep mode.

2. Relay

Features:

- RW Series Relay covers switching capacity by 10A in spite of miniature size to comply with user's wide selection.
- RWH is approved by C-UL & TÜV safety standards.
- The employment of suitable plastic materials is applied under high-temperature conditions and various chemical solutions.
- Complete protective construction is designed to form dust and soldering flux. If required, a plastic-sealed type is available for washing procedures.
- 12A at 120VAC for RW & 12A at 240VAC for RWH are UL approved.

3. LED

Features:

- Good optical to mechanical alignment.
- Mechanically and wavelength matched to the TO-18 series phototransistor.
- Hermetically sealed package.
- High irradiance level.

4. 16 x 2 Character LCD

Features:

- 5 x 8 dots with cursor.
- Built-in controller (KS 0066 or Equivalent).
- + 5V power supply (Also available for + 3V).
- 1/16 duty cycle.
- B/L to be driven by pin 1, pin 2 or pin 15, pin 16 or A.K (LED).
- N.V. optional for + 3V power supply.

5. LM78XX: Series Voltage Regulators:

Features:

- Output current in excess of 1A.
- Internal thermal overload protection.
- No external components are required.
- Output transistor safe area protection.
- Internal short circuit current limit.
- Available in the aluminum TO-3 package.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 3, Issue 2, April 2023
Impact Factor: 7.301

6. Diode 1N4007

Features:

- Low forward voltage drop.
- Low leakage current.
- High forward surge capability.
- Solder Dip 260 °C, 40 seconds.

7. TRANSFORMER (0-12V/1A):

Features:

- Output current:1A.
- Supply voltage: 220-230VAC.
- Output voltage: 12VAC.
- Soft Iron Core.
- 1 Amp Current Drain.

3.3 Software specifications

1. Proteus:

The Proteus Design Suite is a Proprietary software tool suite used primarily for electronic design automation. The software is used mainly by electronic design engineers and technicians to create schematics and electronic prints for manufacturing printed circuit boards. The Proteus Design Suite is a Windows application for schematic capture, simulation, and PCB layout design.

Features:

- Real-time data across an organization or enterprise from underlying sources.
- Extremely secure with full user and database security layers.
- One source for editing, analysis, and verification of data from multiple sources.
- Extends the functionality of the underlying application.

2. MPLAB

MPLAB is a proprietary freeware integrated development environment for the development ofembedded applications on PIC microcontrollers and is developed by Microchip Technology. MPLAB supports project management, code editing, debugging, and programming of Microchip 8-bit, 16-bit, and 32-bit PIC microcontrollers.

Features:

- Full-speed USB support using Windows standard drivers.
- Real-time execution.
- Processors run at maximum speeds.
- Supports how voltage to 5 volts(1.8V to 5.0V range).
- Read/write program and data memory of the microcontroller.

IV. CONCLUSION

The aim of the system is to provide safety to the bike rider. It will protect the Bike rider's life.It will reduce the number of accidents due to slipping of the bike and riding triple seats. The is cost-effective and easily implemented in any type of two-wheeler. The system should be able to detect the triple seat and gives the notification accordingly. In accordance with that system should be able to detect the inclination of vehicles with respect to the road.

V. ACKNOWLEDGMENT

All project students are thankful to project guide HOD & Assi. Prof. Vasudha Patil madam for the guidance during the project work.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 3, Issue 2, April 2023
Impact Factor: 7.301

REFERENCES

[1]. https://www.sae.org/publications/technical-papers/content/2016-28-0258/
[2]. https://www.indianeconomy.net/splclassroom/what-are-the-measures-taken-for-road-safety-in-india/
[3]. Safety Tips - Motorbikes India, Articles related to motorbike safety. http://www.motorbikesindia.com/category/safety/
[4]. Nios II Software Developer's Handbook. http://www.altera.com.
[5]. R. Yang, H. Bao, S. Zhang, K. Ni, Y. Zheng, and X. Dong, "Simultaneous Measurement of Tilt Angle and Temperature With Pendulum-Based Fiber Bragg Grating Sensor," in IEEE Sensors Journal, vol. 15, no. 11, pp. 6381-6384, Nov. 2015.doi: 10.1109/JSEN.2015.2458894
[6]. M. Devy, A. Giralt and A. Marin-Hernandez, "Detection and classification of passenger seat occupancy using stereovision," Proceedings of the IEEE Intelligent Vehicles Symposium 2000 (Cat. No.00TH8511), Dearborn, MI, USA, 2000, pp. 714-719. doi: 10.1109/IVS.2000.898433
[7]. B. George, H. Zangl, T. Bretterklieber and G. Brasseur, "Seat Occupancy Detection Based on Capacitive Sensing," in IEEE Transactions on Instrumentation and Measurement, vol. 58, no. 5, pp. 1487-1494, May 2009.doi: 10.1109/TIM.2009.2009411
[8]. B. George, H. Zangl, T. Bretterklieber and G. Brasseur, "A Combined Inductive–Capacitive Proximity Sensor for Seat Occupancy Detection," in IEEE Transactions on Instrumentation and Measurement, vol. 59, no. 5, pp. 1463-1470, May 2010.doi: 10.1109/TIM.2010.2040910
[9]. S. Shi-jun, Q. Cai-feng and W. Ji-yong, "The study on tower crane foundation slope model
[10]. based on inclination feature," 2011 International Conference on Consumer Electronics, Communications and Networks (CECNet), XianNing, 2011, pp. 900-907.doi: 10.1109/CECNET.2011.5768489
[11]. S. Luczak, W. Oleksiuk and M. Bodnicki, "Sensing Tilt With MEMS Accelerometers," in IEEE Sensors Journal, vol. 6, no. 6, pp. 1669-1675, Dec. 2006. doi: 10.1109/JSEN.2006.881433
[12]. P. N. Zanjani and A. Abraham, "A Method for Calibrating Micro Electro Mechanical Systems Accelerometer for Use as a Tilt and Seismograph Sensor," 2010 12th International Conference on Computer Modelling and Simulation, Cambridge, 2010, pp. 637-641. doi: 10.1109/UKSIM.2010.121
[13]. S. Zhou, J. Chen, X. Wang, L. Zhou, B. Zhen and J. Cui, "Inclination gradient-based fall detection algorithm for wrist-worn device," 2015 IEEE International Conference on Consumer Electronics - Taiwan, Taipei, 2015, pp. 148-149.doi: 10.1109/ICCE-TW.2015.7216825
[14]. Automatic Helmet Detection on Public Roads Maharsh Desai, Shubham Khandelwal, Lokesh Singh, Prof. ShilpaGite "Automatic Helmet Detection on Public Roads", International Journal of Engineering Trends and Technology (IJETT), V35(5),185-188 May 2016. ISSN:2231-5381. www.ijettjournal.org. published by seventh sense research group.