iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 12 **Issue:** V **Month of publication:** May 2024

DOI: https://doi.org/10.22214/ijraset.2024.61885

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 12 Issue V May 2024- Available at www.ijraset.com

Intelligent Helmet System for Prevention of Accidents

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Abstract: ***India, like, has a huge number of road accidents almost every year. The accidents may be due to like many reasons like by drinking and driving, driving like rashly, exceeding the speed limit, etc., you know. Sometimes, the person who like gets injured might not be like responsible for the Accident, you know what I mean. It might be the fault of some other vehicle rider, maybe. But overall, both riders will get like affected, kind of. Due to a lack, you know, of first aid and emergency medical services on time, the riders may like die, which is kind of sad, you know. Some deaths are occurred due to the ambulance not reaching the desired location on time, which is, like, bad, you know. In case of an accident, to save time and inform the concerned person, a system is proposed like which can made sure that the rider gets the required attention in a short time, you know. In, like, India, many people use two-wheeler vehicles as compared to four-wheeler vehicles because of its, you know, low which is kind, like, interesting, you know what I mean. In many accidents, the rider gets injured mainly on the head, kind of, you know. A helmet kind of plays a very important role in saving the life of the ridden, you know what I mean. So to encourage people to wear helmets and to avoid accidents, a design is proposed that synchronizes the, you know, module present in the bike, which is kind of cool.***

Keywords: Intelligent Helmet, Accident Prevention, Smart Sensors, Real-time Monitoring, Wearable Technology, IOT Integration.

I. INTRODUCTION

The project addresses three main issues: riders not wearing helmets, drunk driving, and delayed medical attention after accidents. The helmet uses sensors to detect that the helmet is worn and if the rider's alcohol level is above the limit. If either condition is not met, the bike won't start!! An accelerometer on the bike unit detects falls to identify potential accidents an accident is detected, system send a message to emergency contacts with the rider's location. This can get the rider medical attention faster and improve their chances of survival.

The project's goal is to use technology to make biking safer and reduce the number of motorcycle accidents and deaths in India. The alarming number of motorcycle accidents in India, where many deaths could be prevented with better safety measures. It proposes a smarter helmet with features to tackle this problem. While mandatory helmet laws exist, the helmet itself can be bypassed. This project addresses by using a sensor to ensure that the helmet is worn before the bike starts. It also tackles drunk driving with an alcohol detection sensor. Looking beyond preventing accidents, the helmet can also improve response times in the case of crashes. By using an accelerometer to detect falls, the system can send emergency messages with the rider's location, getting them medical attention quicker. This project offers a technological approach to curb motorcycle fatalities in India, aiming to make riders think twice before compromising their safety.

II. WORK

The alarming rise in motorcycle accidents, particularly in India, has spurred significant research into improving rider safety. Traditional methods like enforcing helmet laws have limitations. To address this gap, intelligent helmet systems are emerging as a promising technological solution.

The smart helmet that is made to be fitted with different sensors responsible for detection. There are two main units in the project. Each unit will uses a microcontroller. Signal transmission between the helmet unit and the bike unit is done using a RF module. In the last decade, improvements in smart helmet has been more than ever yet a significant number of serious road accidents after still occur all over the world. The Main reasons for road accidents are caused by human mistakes, violating traffic rules, usage of mobile phone, eating and drinking while driving.

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A. Enforcing Helmet Use and Preventing Drunk Driving.

One key core function of intelligent helmets is ensuring the proper helmet use at all times. Several projects, including the one described in this document, utilize sensors integrated with the motorcycle's ignition system. These sensors effectively prevents the bike from starting unless the helmet was correctly worn. This approach clearly tackles the issue of riders who might neglect to wear helmets despite the existing laws. In another critical area of importance is the deterrence of drunk driving. Here, intelligent helmets may incorporate breathalyzer-like sensors that are able to analyze the rider's alcohol level. Should the level exceed the legal limit, various action can been taken by the system. Some systems could potentially disable the bike completely, thus preventing a potentially disastrous situation. Others might even send alerts to authorities or designated contacts, which would then allowed for intervention**.** In summary**,** these intelligent helmets serve **to** enhance the safety measures for riders by promoting helmet use and deterring drunk driving through innovative sensor technology.

B. Accident Detection and Response

While, in ideal situations, avoiding accidents is a primary goal; nevertheless, smart helmets can additionally hold a critical role in the post-accident phase, which is imperative. By inserting accelerometers into the helmet, the system can identify abrupt motion changes indicating a possible crash. If a potential crash is detected, the helmet can activate a pre-set emergency reaction. This could potentially involve transmitting automatic messages to emergency services, which would include the whereabouts of the rider. This vital data can significantly decreases responses times and potentially protect lives. While preventing accidents is ideal, intelligent helmets can also plays a crucial role in the aftermath of a crash. By embedding accelerometers within the helmet, the system can detect sudden changes in motion indicative of an accident. Upon detecting a potential crash, the helmet can trigger a pre-programmed emergency response. This may involve sending automated messages to emergency services, including the rider's location data. This crucial information can significantly reduces the response time and potentially save lives. The importance of ethical considerations and enforcement practices must be emphasized throughout the project's development and implementation**.**

C. Advanced Features for Enhanced

Advanced Features for Enhanced. Research into intelligent helmets expands beyond core functionalities. Advanced systems explore features like drowsiness detection. Sensors monitor physiological signs that indicate rider fatigue, prompting audio or visual warnings to encourage the rider to stop and rest. Moreover, some systems incorporate lane departure warning systems is that utilize cameras or other sensors to detect unintentional lane changes and alert the rider. Blind-spot monitoring is another potential feature, using sensors to warn riders of approaching vehicles in their blind spots. Ethical considerations, privacy protection, and the responsible use of data are paramount throughout the project's development and implementation.

III. METHODS AND EXPERIMENTAL DETAILS

Intelligent helmet systems (IHS) for accident prevention are revolutionizing motorcycle safety through a combination of innovative methods and rigorous testing procedures. One core method involves helmet wearing enforcement. Here, a pressure or magnetic sensor embedded in the helmet transmits its state (worn/not worn) to the motorcycle's ignition system. This creates a crucial link, ensuring the engine only starts when the sensor confirms proper helmet use. Another method tackles the issue of drunk driving through alcohol detection. A breathalyzer-like sensor integrated within the helmet detects the rider's Blood Alcohol Content (BAC). The system then takes pre-programmed actions when BAC exceeds the legal limit. These actions can be ranged from disabling the motorcycle to sending alerts or triggering in-helmet warnings for the rider. Finally, accidents detection and response utilize an accelerometer placed within the helmet. This sensor measures changes in motion, and a sophisticated algorithm analyzes this data to identify crash patterns. Upon detecting a potential crash, the system initiates a pre-programmed emergency response. Developing these functionalities requires meticulous attention to detail. Hardware selection focuses on choosing high-accuracy sensors that are compact, lightweight, and energy-efficient for optimal system function.

A. Helmet Wearing Enforcement

1) *Sensor Integration:* A sensor, usually of the magnetic or pressure-based type, is strategically integrated within the helmet and the motorcycle's ignition system. This sensor effectively relays the helmet's current state (worn/not worn) to the ignition system, establishing a pivotal communication link.
2) *Ignition Control***:** The motorcycle's ignition system is intricately connected to the sensor integrated within the helmet. The engine will exclusively start if the sensor verifies that the helmet is being worn correctly, ensuring maximum safety measures.

B. Alcohol Detection

1) *Breathalyzer Integration:* A specialized sensor that mirrors a breathalyzer's functionality is harmoniously embedded within the helmet's design. This sensor is designed to accurately detect the rider's blood alcohol content (BAC), enhancing the system's safety features significantly.
2) *Action on Intoxication:* In scenarios where the rider's BAC surpasses the legal limit, the system is programmed to execute pre-determined actions. These actions may include disabling that the ignition of the motorcycle, notifying emergency contacts or authorities, and activating audible or visible warnings for the riders to take prompt action.

C. Time series Analysis

1) *Accelerometer Integration:* An advanced accelerometer is strategically positioned within the helmets to capture the various motion changes, including acceleration, deceleration, and potential impacts, enhancing the overall safety parameters.
2) *Crash Detection Algorithm:* A sophisticated algorithm is meticulously designed to meticulously analyze the accelerometer data, carefully identifying any abrupt motion patterns indicative of a potential crash scenario. This pre-emptive approach significantly increases the system's responsiveness to critical situations.
3) *Emergency Response Trigger:* Upon detecting a possible crash scenario, the system promptly triggers a pre-defined emergency response mechanism. This may include sending automated messages to emergency services with detailed GPS location data or notifying designated emergency contacts to ensure timely assistance.

D. Advanced Features

1) *Drowsiness Detection:* Advanced physiological sensors, including EEG and ECG monitors, are integrated to detect potential rider fatigue. When fatigue is detected, the system alerts the rider through auditory or visual cues, prompting them to take necessary rest breaks.
2) *Lane Departure Warning:* Sophisticated cameras and sensors track the rider's position concerning lane markings, ensuring optimal safety measures. In case of unintentional lane departures, the system issues timely warnings to the rider, enhancing overall safety protocols.
3) *Blind-Spot Monitoring:* Specialized sensors like radar and LiDAR effectively detect any vehicles approaching from the rider's blind spots, improving overall awareness and safety precautions.

E. Warning System

An audible or visual alert warns the rider of approaching vehicles.

IV. RESULTS AND DISCUSSIONS

Research on intelligent helmet systems (IHS) for accident prevention shows promising results, but discussions around widespread adoption and remaining challenges continue.

A. Simulation Result

The simulation results are shown below:

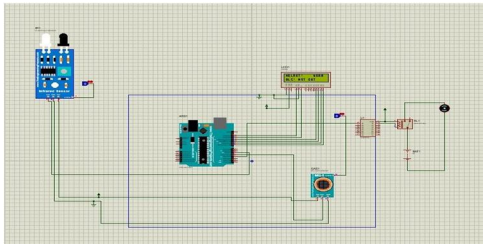


FIG: Simulation

When we don't give any input to the logic state, we can see the LCD displaying the following:

1) Helmet: not wear
2) Alcohol: not detected

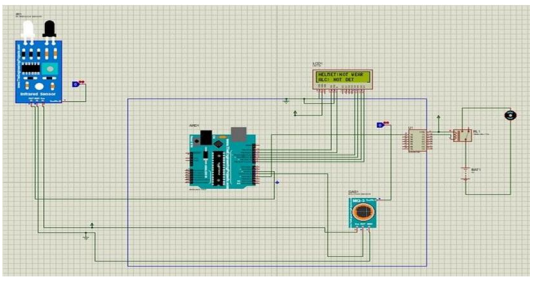


FIG. Simulation when there is no input

When we give an input to the logic state, we can see the LCD displaying the following:

1) Helmet: wear
2) Alcohol: not detected

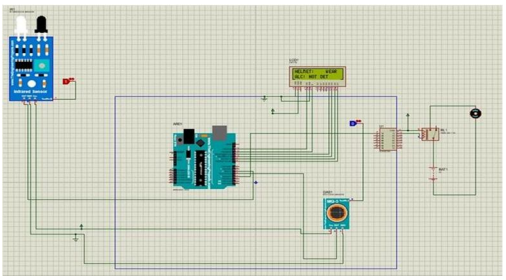


Fig. Simulation no alcohol detected

V. FINAL RESULT

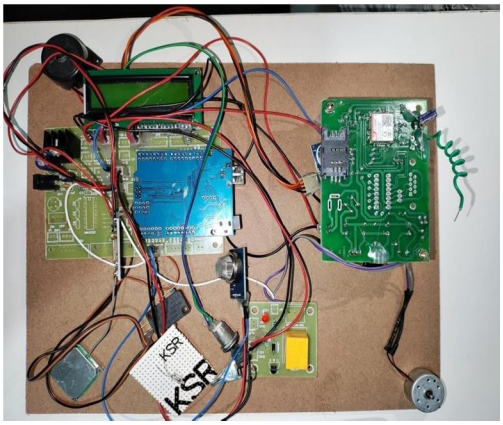


Fig: Circuit connection smart helmet

1) Displays Latitude and Longitude Coordinates



Fig. Latitude and longitude coordinates

when we insert the sim on to the GSM module, we see a light blinking then see the latitude longitude coordinates in the LED.

2) Displays Wear Helmet Ignition off

Now when the number is registered, we have to start the ignition of the bike but if we don't wear the helmet the ignition will stop and wear helmet msg will be displayed as shown below



Fig: Displays wear helmet ignition off

3) Displays Alcohol Detected Ignition off

In a similar way if alcohol is consumed the bike won't start and alcohol detected msg will be displayed.



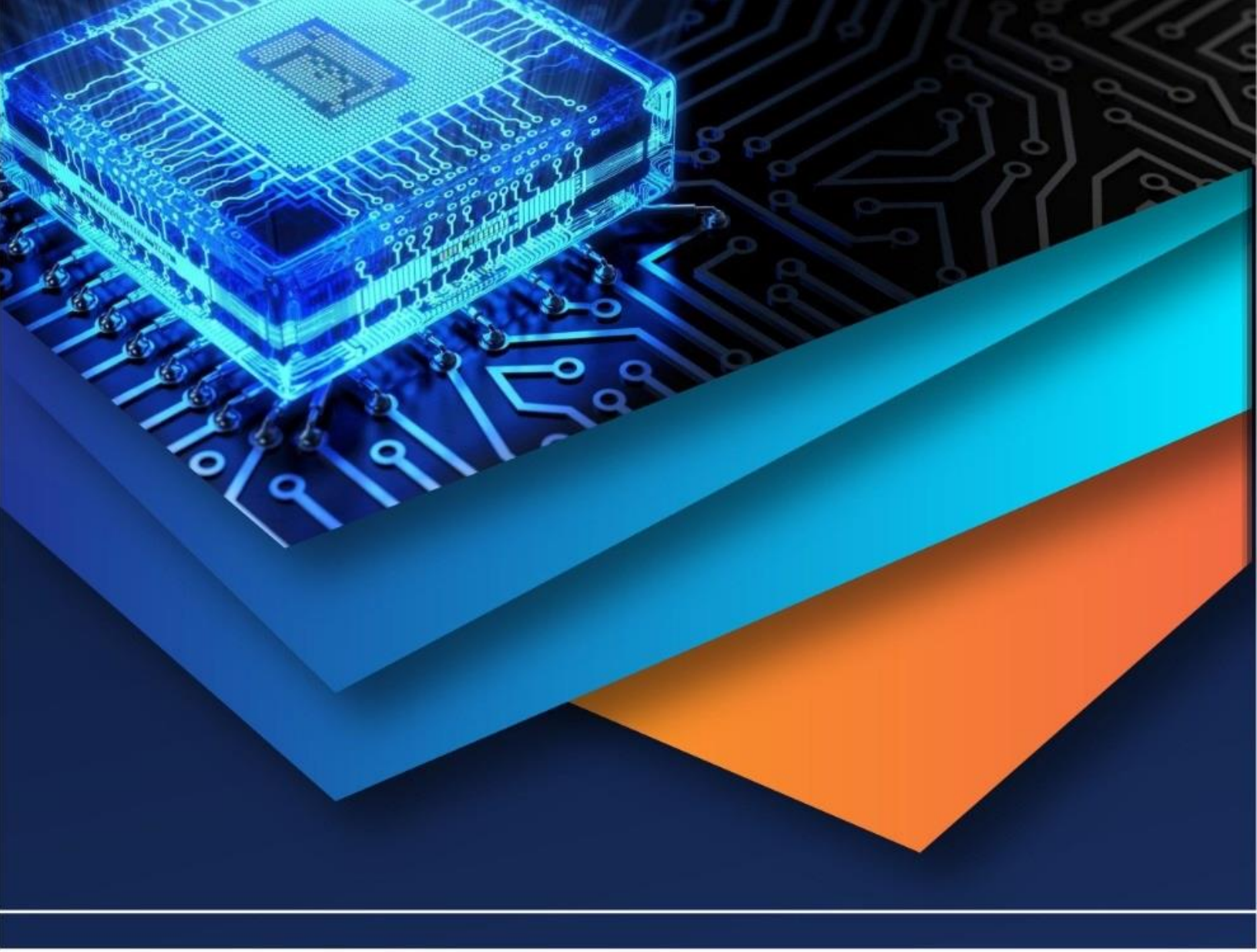
Fig: Displays Alcohol Detected Ignition off

VI. CONCLUSION

The developed system efficiently ensures. Rider is wearing helmet throughout the rider. Rider should not be under influence of alcohol, Accident detection &theft protection. By the implementing this system, a safe two-wheeler journey is possible which would decrease the head injuries during accidents and also reduces the accidents rate due to driving bike after consuming alcohol. A helmet is not being 100% foolproof but it definitely the first line of defense for the riders in case of an accident to prevent fatal brain injuries. The proposed approach makes it mandatory for the ruder to use this protective guard in order to drive a two-wheeler vehicle and ensures the safety of human brain and therefore reduces the risk of brain injuries and deaths in case of accidents. Besides the developed system prevents the theft of two-wheeler.

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