IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

INTELLIGENT HELMET

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Abstract - An ingenious concept introduces an intelligent helmet aimed at significantly enhancing motorcycle safety. It incorporates multiple features to prevent a vehicle from starting without the presence of a helmet or if the rider is under the influence of alcohol. Moreover, it boasts an outstanding accident detection function and utilizes a GSM-based system to proactively notify a specific individual, via SMS, about the motorcycle's location and speed prior to any potential accident. This facilitates swift rescue operations for the affected rider. To implement this system, all the essential sensors are seamlessly integrated into the helmet, enabling the wireless transmission of gathered data to a module connected to the motorcycle's motor. The intelligent helmet system comprises two main modules: the helmet-side module and the bike-side module. The helmet module encompasses an alcohol sensor and a helmet sensor (switch), while the bike module includes a vibration sensor and a GSM module. Both modules leverage an Arduino microcontroller and establish wireless communication using an RF transmitter and receiver.

Keywords- Intelligent Helmet using MQ-3 Gas Sensor; Intelligent Helmet using Vibration Sensor (SW420) and GSM sim900a module; Intelligent Helmet using RF- Transmitter and Receiver (433MHz).

I.INTRODUCTION

Traffic accidents continue to pose a persistent problem, as studies indicate that a considerable number of drivers opt not to wear helmets without any valid rationale. Major factors contributing to traffic accidents include speeding, driving under the influence, and inadequate infrastructure. Furthermore, the global incidence of traffic accidents remains alarming. Survey findings reveal that over 70% of motorcyclists choose to forgo helmet usage without providing a specific justification. High-speed driving, impaired driving, and insufficient infrastructure are key contributors to the occurrence of traffic accidents. Additionally, a significant proportion of drivers tend to underestimate traffic regulations, resulting in counterproductive actions. In 2017, negligent motorcyclists, particularly those who disregard helmet usage due to a lack of awareness or disregard for traffic laws, were responsible for a substantial number of fatalities on highways, leading to severe road accidents [1]. Moreover, there is a prevalent underestimation of traffic regulations among drivers, leading to counterproductive behaviors. Negligent motorcyclists, particularly those who choose not to wear helmets due to a lack of legal awareness and adherence to traffic rules, continue to dominate the statistics of fatalities on highways. Applied electronics encompasses the integration of technologies such as sensors, actuators, and communication software into various objects and devices, including hardware networks, household appliances, and vehicles. This integration enables these objects to connect and exchange data, facilitating functions like object detection and remote control through existing network infrastructures. The objective of this project is to develop a prototype helmet safety system that addresses the aforementioned issues and enhances the safety of motorcycle riders. Consequently, the design of intelligent motorcycle safety helmets based on applied electronics focuses on incorporating wireless modules, along with GSM transmitters and receivers mounted on the helmet, to enable seamless communication and data exchange. Two-wheeler users pose the highest risk on the road, accounting for 34.8% of the total fatalities in India in 2016. This percentage increased by 3.3% compared to the previous year. Within this group, 3.7% of the total accidents were attributed to alcohol consumption. The report emphasizes that intoxicated driving plays a significant role in the escalating number of road fatalities. A large portion of accidents that occur outside urban areas result from drunk driving, with limited assistance readily available to these riders following an accident. [2].The introduction of this

intelligent helmet aims to address this problem by effectively reducing the daily accident rate and lowering the fatality rate. In countries like India, where cycling is prevalent, a significant number of individuals lose their lives due to negligence regarding motorcycle helmet usage. Despite ongoing efforts by government agencies to raise awareness about helmets and seat belts, a large majority of drivers disregard these crucial safety measures. The increasing reliance on transportation, particularly motorcycles, in Indonesia has contributed to a rise in criminal activities. The incidence of vehicle thefts and robberies has been steadily increasing in Indonesia, with the Police Headquarters Operations Management Center recording 18,557 cases of vehicle theft in 2020. [3].The primary motivation for most individuals wearing conventional helmets is to avoid potential encounters with traffic police rather than prioritizing their own safety. Consequently, these helmets do not offer a reliable assurance of the wearer's safety. While helmets serve as fundamental protective gear for cyclists, it does not guarantee that riders will adhere strictly to traffic regulations. To address this issue, the utilization of smart helmets presents a viable solution. The intelligent helmet has two operating section one is receiver and other is transmitter. The transmitter part is embedded in the helmet itself, but the receiver part can be built into any bike. Therefore, wireless communication takes place between the two modules. In the transmitter module, the pressure signal is recorded by a pressure transducer inside the helmet. The comparator converts the analog signal to a digital signal and passes it as a logic level 1 to the input of the transmitter, and the converter provides the output. When the user removes the helmet, the output of the converter goes to zero and the input of the transmitter goes to logic level 0. Also, an MQ-3 gas detector (alcohol sensor) is used to detect alcohol concentration in the driver's breath. It can be easily spotted as it can be placed right under the face shield. When the driver gets drunk, the resistance value decreases and the voltage value changes abruptly. This value is sent to the microcontroller to prevent the bike from catching fire in this case. In the receiver module, until the rider puts on the helmet, a high level digital output is obtained via the output pin, this signal activates a digital relay which closes the circuit in the bicycle ignition unit. When the rider removes the helmet, the relay opens and disconnects the circuit. If someone is unfortunate enough to have an accident, the vibration sensor will detect it and a message will be sent via the GSM module to the operating number.

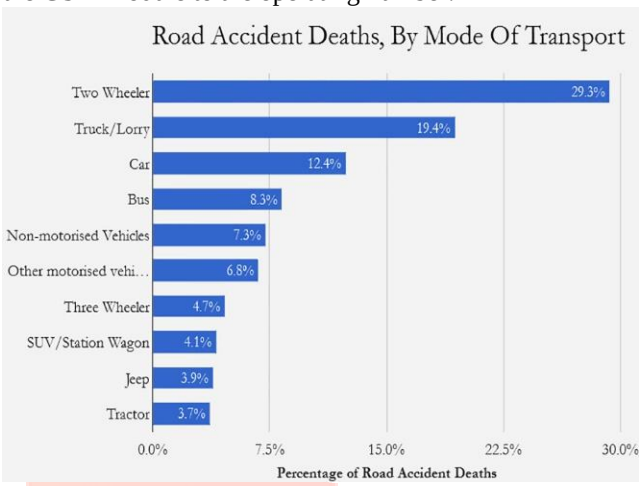


Fig1.1: The fatality count caused by road accidents [4]

II. OBJECTIVES:

The project "Intelligent helmet" is perfectly suited to fulfill the following goals -

1) THE CURRENT CONDITION OF THE RIDER'S HELMET USAGE: Many people now a day's dose not wear helmet while riding so for that we put this feature that the motor will only initiate if the rider is wearing the helmet and activates the switch. In the absence of a helmet, the motor will not engage.

2)TEST FOR THE ALCOHOL CONTENT LEVEL: Now a days accident are happening due to drink and drive , people take excess intake of alcohol and then drive on roads which is very risky for not only him/her also for other people on roads. The limit of Illegal consumption of alcohol at the time of driving is 0.08mg/L as per govt. act. But for demonstration purpose it is programmed to the threshold limit 0.04 mg/L. If the sensitivity of MQ-3 is more than 0.04mg/L in breath of rider then the driver can't drive the bike.

3) IDENTIFICATION OF ACCIDENT: Many a times accidents happens and the victim does not get help on time for that reason we put this feature. A variety of frequencies are generated based on the vibrations resulting from accidents or obstacles. If the frequency exceeds a predefined threshold value, the vibration sensor transmits signals to the microcontroller, which in turn sends an accident notification message through the GSM module. The message transmission continues to multiple saved SIM numbers until the power supply is deactivated.

III. METHODOLOGY:

A proposed project introduces an innovative helmet that incorporates smart technology to ensure the safety of bike riders. This helmet features a unique mechanism that prevents the bike from starting unless the rider is wearing it, using a wireless connection that requires the key and helmet to be present. Additionally, the helmet is equipped with an alcohol sensor that automatically deactivates the bike if the rider is detected to be intoxicated by measuring their exhaled breath. To further enhance safety, GSM technology is utilized to create a more secure driving environment. The helmet also includes vibration sensors strategically placed at key impact areas. These sensors are connected to a microcontroller board, allowing them to capture and relay data in the event of a fall where the helmet makes contact with the ground. When the recorded data exceeds the predefined threshold, the GSM module is triggered to send an alert message to both emergency services and the rider's family, promptly notifying them of the situation. By employing these advanced features, the smart helmet ensures a safer and more reliable biking experience for riders.

Integrated Component and their block diagram:

Transmitting circuit includes a micro-controller (M), alcohol sensor and rf-transmitter as shown below:

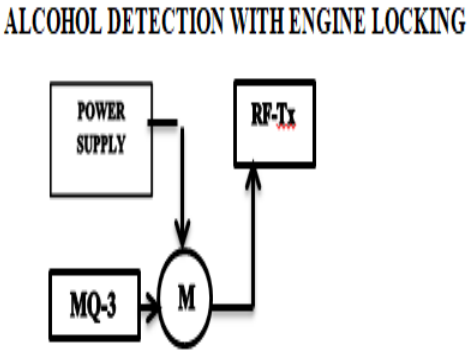


FIG: Transmitting Circuit

Receiving circuit includes a micro-controller (M), rf-receiver and dc motor as shown below:

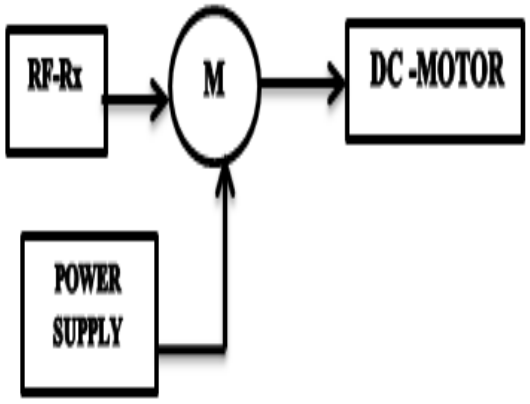


FIG: Receiving Circuit

Accident Detection circuit includes a micro controller (M), GSM module and vibration sensor as shown below:

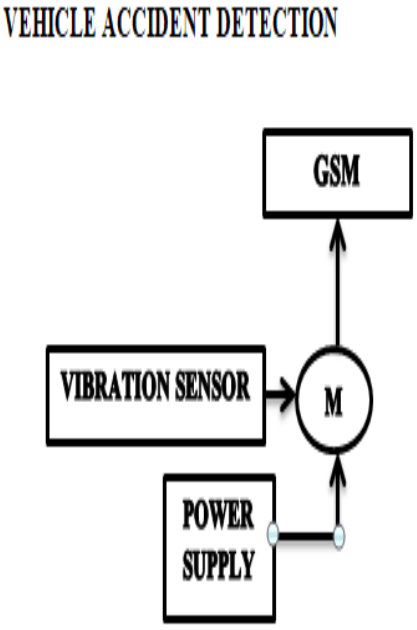


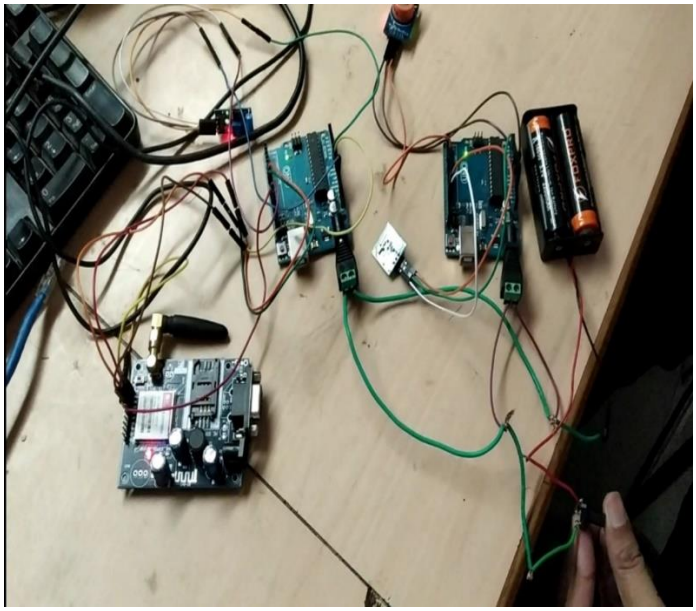
FIG: Accident Detection Circuit

Transmitter section:

When the helmet switch is activated after being worn, a logic level 1 signal is transmitted to the transmitter input through the RF-transmitter. Meanwhile, the MQ3 alcohol sensor detects the presence of alcohol and produces a logic level 0 output. This logic level 0 signal is received by the receiver system. [5].

Receiver Section:

Once the rider dons the helmet and toggles the switch, the receiver captures a high-level logic signal (logic level 1) that is decoded and prompts the microcontroller to activate the motors. In the event alcohol is detected, a low-level logic signal (logic level 0) is received, leading to the engine being immediately halted. Moreover, when the vibration sensor is triggered as a result of an accident, the GSM system is activated, and a text message (SMS) is promptly dispatched [6].



Microcontroller (Arduino Board) and Accident Detection Circuit:

The motor is engaged when the microcontroller receives a logic signal 1. Upon activation of the vibration sensor, the microcontroller is triggered. Subsequently, the GSM module is initiated, and a message is transmitted to the designated contact number [7].

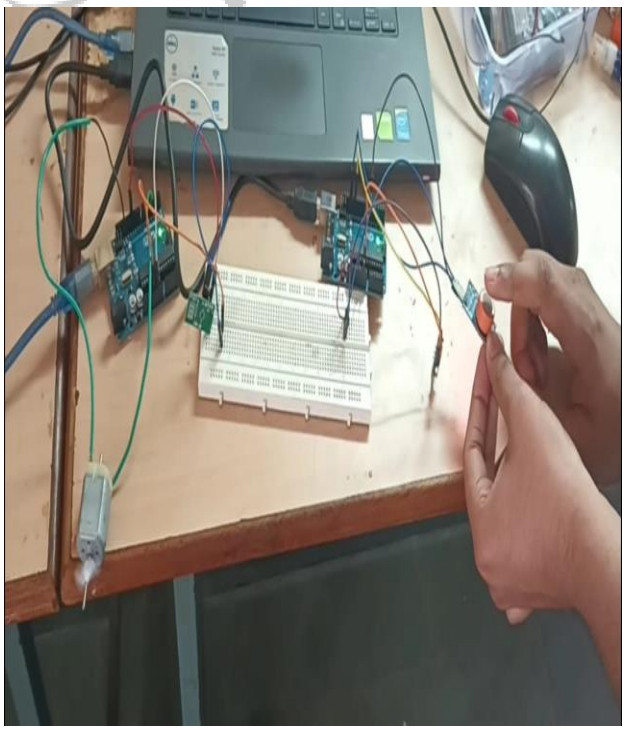
IV. RESULTS:

1) Rider's helmet usage:

When the driver puts on his helmet and presses a switch, the engine starts. The engine will not start without a helmet.

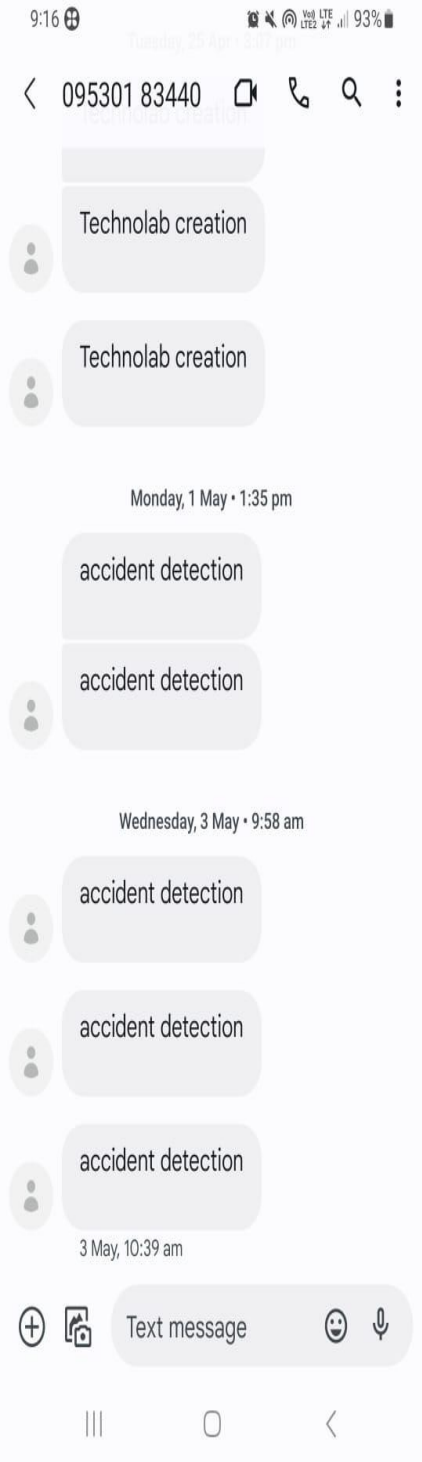
2) Alcohol content test:

In accordance with governmental regulations, the permissible limit for alcohol consumption while driving is set at 0.08 mg/l. However, for the purpose of demonstration, the programmed threshold has been adjusted to 0.04 mg/L. A rider is unable to operate a motorcycle if their sensitivity to MQ-3 sensor readings exceeds 0.04 mg/L during inhalation.



3) Accident detection test:

The range of frequencies generated in response to vibrations caused by accidents and obstacles. If the frequency is above the threshold, the vibration sensor sends a signal to GSM via the microcontroller to send an accident report. It keeps sending messages to save the SIM number until it powers off.



V. CONCLUSION:

An innovative project introduces an intelligent helmet designed to ensure that the bike cannot be started unless it is worn by the rider. Furthermore, upon activating the ignition, an alcohol sensor incorporated into the helmet measures the alcohol content in the rider's exhaled breath, and if intoxication is detected, the bike is automatically turned off. To enhance safety during driving, GSM technology is implemented. Inside the helmet, a vibration sensor is installed, and in the event of an accident, it transmits a signal to the GSM module via the microcontroller. This triggers the transmission of an accident detection message to the rider's family. The system is controlled by a microcontroller, which effectively manages the functionalities. As the helmet is seamlessly integrated with the motorcycle engine, the engine can only be started when the rider is wearing the helmet, emphasizing the importance of helmet usage for motorcycle riders. In scenarios where a crime or robbery occurs on the road and the helmet is separated from the bike, the engine will automatically shut off. Simultaneously, the GSM module will promptly send an emergency message to the designated contacts.

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