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Carelink Emergency Smart Helmet

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Abstract: Road accidents are one of the major causes of injuries and fatalities among motorcycle riders. In many cases, the delay in providing medical assistance increases the severity of the situation. To address this problem, a Smart Helmet System is proposed that integrates various sensors and communication technologies to enhance rider safety and enable rapid emergency response. The system is developed using an Arduino microcontroller as the central processing unit and incorporates sensors such as the MAX30100, ADXL335 accelerometer, and a tilt sensor, along with GSM and GPS modules. The MAX30100 sensor is used to monitor the rider's physiological parameters, including heart rate and blood oxygen saturation (SpO□), providing basic health monitoring while riding. The ADXL335 accelerometer detects sudden impacts, rapid acceleration, or abnormal motion that may indicate a collision or crash. Additionally, the tilt sensor helps determine whether the helmet has fallen or tilted abnormally, which further assists in confirming an accident condition. These sensors continuously send data to the Arduino, which processes the information in real time. When the system detects a potential accident through abnormal acceleration or helmet tilt, it automatically activates the emergency alert mechanism. The GPS module retrieves the precise geographical location of the rider, including latitude and longitude coordinates. This location information is then transmitted through the GSM module as a text message to predefined emergency contacts such as family members, friends, or emergency services. This immediate notification enables faster rescue and medical assistance. The proposed Smart Helmet System is designed to be compact, cost-effective, and easy to implement.

Key Words: Smart Helmet System, Arduino Microcontroller, Accident Detection, Motorcycle Rider Safety, MAX30100 Sensor, Heart Rate Monitoring, SpO Monitoring ,ADXL335Accelerometer,Tilt Sensor

A. INTRODUCTION

In today's era, especially in the young generation, the craze to ride bike is rapidly increasing. The middle class families prefer to buy two-wheeler over four-wheeler because of their low price. As the number of two-wheeler on the road are increasing, road mishaps a real so increasing day by day. In the event of an accident, lack of timely medical attention to the injured person may lead to death. Thus, there is a need for a system which ensures safety of rider by enforcing rider to wear helmet as per government guidelines and also assist in providing the rider for a medical assistance in the event of an accident

B.LITERATURE REVIEW

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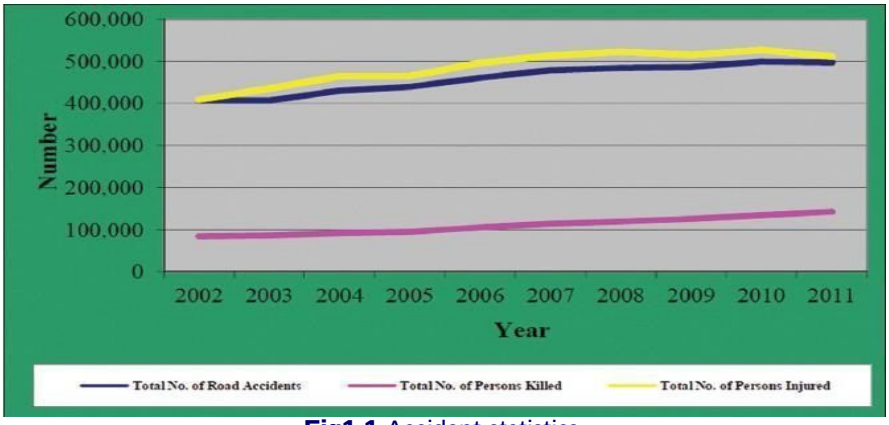

Fig1.1 Accident statistics

C. METHODOLOGY

1. SYSTEM INITIALIZATION

When the helmet is powered ON, the Arduino microcontroller initializes all the connected modules and sensors. These include the MAX30100 health monitoring sensor, ADXL335 accelerometer, tilt sensor, GPS module, and GSM module. The Arduino checks whether all modules are working properly and starts continuous monitoring.

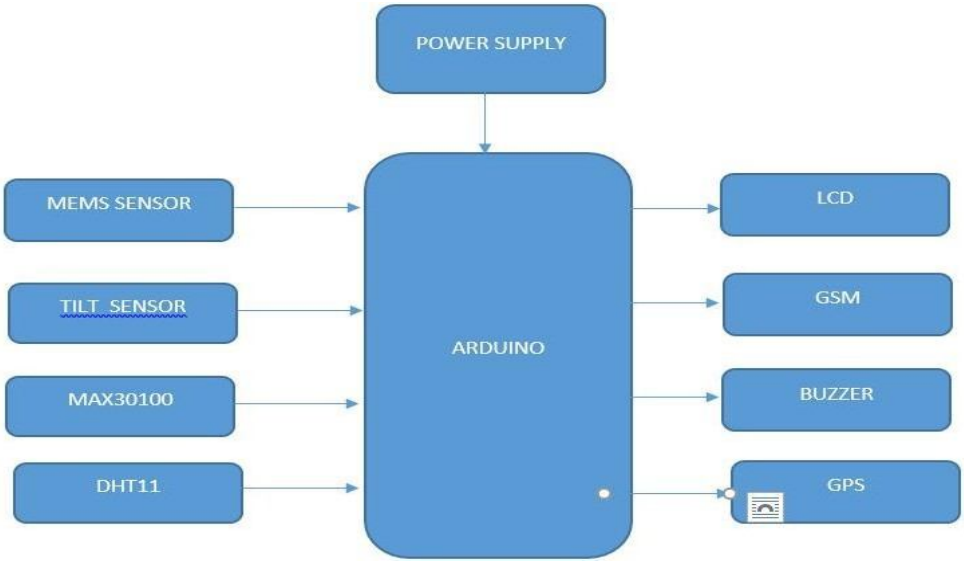

Fig1.2 Block Diagram

2. CONTINUOUS SENSOR MONITORING

After initialization, the Arduino continuously reads data from all sensors.

MAX30100–HealthMonitoring

The MAX30100 sensor measures the rider's heart rate and blood oxygen saturation (SpO).

- The rider places a finger on the sensor inside the helmet.
- The sensor uses infra red light to detect blood flow.
- The Arduino reads the values and checks whether they are within a normal range.

If abnormal values are detected (for example, extremely low heart rate), the system can trigger an alert.

ADXL335–Accident Detection

The ADXL335 accelerometer detects sudden changesin motion or impact.

- It measures acceleration along X,Y,andZ axes.
- During normal riding, acceleration values remain within a safe rang

In the even to facrash or sudden fall, the acceleration value suddenly exceeds a predefined threshold.
When the threshold is exceeded, Arduino suspects that an accident has occurred.
Tilt Sensor Helmet Orientation Detection
The tilt sensor detects whether the helmet has fallen or tilted abnormally.

- Under normal conditions, the tilt sensor remains stable.
- If the rider falls or the helmet is tilted sharply, the sensor changes its state.
- This helps confirm the accident detected by the accelerometer.

3. ACCIDENT CONFIRMATION

To reduce false alarms, the system checks both sensors:

1. ADXL 335 detects sudden impact
2. Tilt sensor confirms abnormal helmet position

4. GPS LOCATION RETRIEVAL

Once an accident is detected:

- The GPS module activates.
- It communicates with satellites to obtain the rider's current latitude and longitude coordinates.
- The GPS sends the location data to the Arduino.

D. FEATURES & REGULATORS

1. Output Current upto1A
2. Output Voltagesof5,6,8,9,10,12,15,18, 24V
3. Thermal Over load Protection
4. Short Circuit Protection
5. Output Transistor Safe Operating Area Protection

The KA78XX/KA78XXA series of three-terminal positive regulator are available in the TO-220/D-PAK package and with several fixed output voltages, making them useful in a wide range of applications. Each type employs internal current limiting, thermal shut down and safe operating area protection, making it essentially indestructible.

E.RESULT

The designed Smart Helmet is used to ensure that the bike rider is properly wearing the helmet or not and it is also used to verify that the rider has not consumed the alcohol more than the acceptable range limit. This design is used to stop the vehicle if the rider is not properly wearing the helmet and for alcohol consumption. The system also helps in efficient handling of the aftermath of accidents by sending a SMS with the location of the rider to the family members and an emergency contact. This ensures that the victim get proper and prompt medical attention if he/she met with an accident. The system can be extended to implement various bioelectric sensors on the helmet to measure various activities. The system can also be interfaced with a communication device from one vehicle to another vehicle.

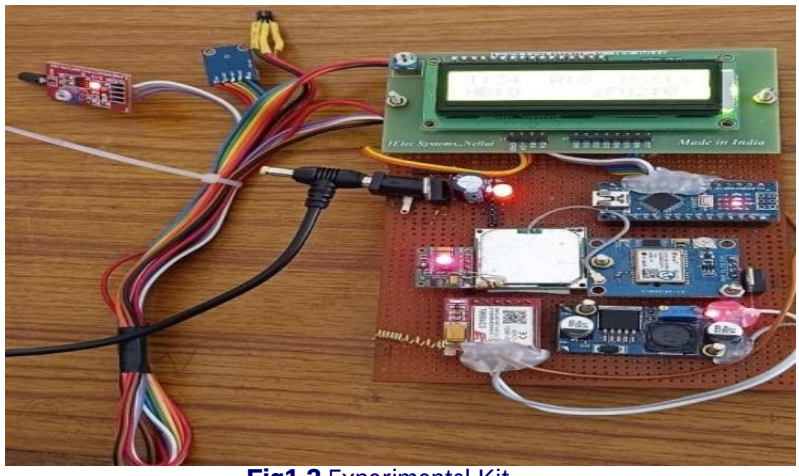

Fig1.3 Experimental Kit

F. CONCLUSION & FUTURE SCOPE

AI-based Health Monitoring In the future, Artificial Intelligence can be integrated to analyze workers' health data such as heart rate, body temperature, and oxygen level.AI can predict health risks and alert supervisors before an emergency occurs. Integration with IoT Platforms The helmet can be connected to an Internet of Things (IoT) platform to monitor multiple workers in real time through a centralized dashboard. This will help companies track safety conditions across large workplaces. Improved Sensor Technology Advanced sensors can be added to detect toxic gases, air quality, and environmental temperature. This will improve safety in industries like mining, construction, and chemical plants.

Mobile Application Integration A dedicated mobile app can allow supervisors and emergency teams to receive alerts, track locations, and monitor worker health from anywhere. Cloud Data Storage and Analytics Helmet data can be stored in the cloud for long-term analysis. This helps companies improve safety policies and reduce workplace accidents.

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