Journal of **N**onlinear **A**nalysis and **O**ptimization
Vol. 15, Issue. 1 : 2024
ISSN : **1906-9685**

ANTI SLEEP ALARM AND HEALTH MONITORING ALERT SYSTEM

Talluri Praveen Kumar[1]
praveenkumarece2008@gmail.com

Thota Anitha[2]
thotaanitha124@gmail.com

Vakada Vamsi[3]
vakadavamsi2003@gmail.com

Chinthala Ravi Hemanth[4]
chinthalaravihemanth17@gmail.com

Shaik Riyaz[5]
shaiklyriyaz@gmail.com

Devarakonda Phanindra[6]
devarakondaphani93@gmail.com

[1] *Assistant Professor,* [2 3, 4, 5,6] *UG Students*
[1, 2, 3, 4, 5, 6] Dept. of ECE, Bapatla Engineering College, Bapatla
Andhra Pradesh, India

Abstract :
This invention introduces a vigilant anti-sleep alarm and health monitoring alert system aimed at enhancing road safety by detecting and alerting drowsy drivers. The system begins by first identifying and monitoring the driver 's eye movements and blinking patterns. It then continuously monitoring vital physiological parameters such as heart rate, SpO2 levels, and body temperature using an array of devices. These devices include the Arduino UNO, an LCD display for real-time alerts, the MAX30102 sensor for health data, the NEO-6M-0-001 GPS Module for location tracking, a buzzer for auditory alerts, and a motor driver connected to a wheel for physical feedback .Additionally, a Telegram bot, which is installed on the driver 's phone ,friends and family, is integrated for remote communication, allowing for the capture and transmission of the driver 's photo along with location data and display health parameters. This comprehensive approach ensures a timely response to prevent accidents caused by driver fatigue, thereby contributing to safer driving conditions.

Keywords: Arduino UNO, LCD Display, MAX30102 Sensor, Buzzer,L298NMotor,Driver, DC Motor, NEO-6M-0-001 GPS Module , Wheel.

1.INTRODUCTION :

Drowsy driving is a significant public health issue, with the National Safety Council attributing approximately 100,000 crashes, 71,000 injuries, and 1,550 fatalities annually to driver fatigue. To address this critical safety concern, the "Anti-Sleep Alarm and Health Monitoring Alert System" project has been developed. This innovative IoT-based solution is engineered to detect early signs of driver drowsiness and monitor vital health parameters such as SpO2, heartbeat, and temperature, ensuring drivers remain vigilant and reducing the risk of accidents caused by sleepiness.

The system employs an Arduino UNO microcontroller to process data from various sensors, including the MAX30102 for health monitoring, and a webcam for drowsiness detection through eye movement analysis. The integration of these components, along with a GPS module, buzzer, and LCD display, creates a comprehensive safety mechanism. When signs of fatigue or health anomalies are detected, the system activates multiple responses: it sounds an alarm, halts the vehicle's wheel, displays an alert message, captures a photo of the driver, and sends this information to designated contacts via a Telegram bot.

This journal article will delve into the design, implementation, and potential impact of the "Anti-Sleep Alarm and Health Monitoring Alert System," highlighting its role in enhancing road safety and preventing accidents due to driver drowsiness and sudden health issues.

1.1 Internet of Things:

The Internet of Things (IoT) is a revolutionary concept that has redefined the boundaries of digital connectivity, extending it to a vast array of devices and appliances beyond conventional computing equipment. IoT embodies the integration of the physical world with advanced digital systems, creating a comprehensive network that facilitates communication and data exchange through the Internet.

In the context of our project, the "Anti-Sleep Alarm and Health Monitoring Alert System," IoT is instrumental in knitting together diverse components to form a unified safety net for drivers. It empowers the system to monitor, analyse, and respond to real-time data concerning the driver's health and alertness levels. By leveraging the Arduino UNO microcontroller, the project utilizes IoT to process inputs from the MAX30102 sensor and a webcam, orchestrating a coordinated response in the event of detected drowsiness or health irregularities. This includes activating alarms, halting the vehicle, and communicating critical alerts to emergency contacts via a Telegram bot.

This project serves as a testament to the potential of IoT in enhancing the quality of life and safety standards. It demonstrates how IoT can be innovatively harnessed to address pressing issues such as road safety, showcasing its ability to transform everyday objects into smart, interconnected components of a larger, life-saving information system. This project showcases the power of IoT in revolutionizing road safety by seamlessly integrating smart technology with everyday objects, systems and real-time data.

2.HARDWARE REQUIREMENTS :

2.1 Arduino UNO:

The Arduino Uno is a microcontroller board based on the ATmega328 . It has 14 digital input/output pins (of which 6 can be used as PWM outputs),6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter. "Uno" means one in Italian and is named to mark the upcoming release of Arduino 1.0. The Uno and version 1.0 will be the reference versions of Arduino, moving forward. The Uno is the latest in a series of USB Arduino boards, and the reference model for the Arduino platform. The Arduino Uno can be powered via the USB connection or with an external power supply. The power source is selected automatically. External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery

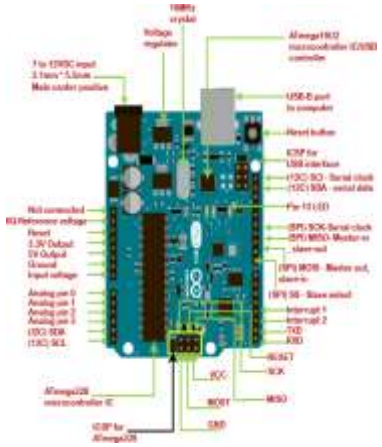

Fig 1. Arduino UNO

2.2 MAX30102 Sensor:

The **MAX30102** sensor is a versatile module used for various applications. It combines heart rate monitoring and pulse oximetry capabilities. The pulse oximeter consists of Light emitting diodes and an IR sensor. Signal processing unit to improve the quality of the output signal .It works on the input voltage of 1.8V to 3.3V.

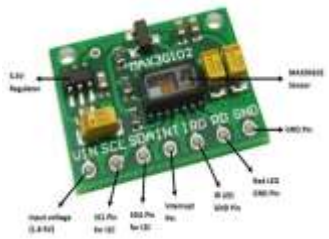

Fig 2. MAX30102 Sensor

2.3 NEO-6M-0-001 GPS Module:

A GPS (Global Positioning System) module is a device that receives signals from a network of satellites to determine its precise location on Earth. The NEO-6M GPS module is a GPS receiver that can locate all locations on Earth as it is able to track approximately 22 satellites. It consists of a high-performance u-blox 6 positioning engine. Measuring 16 x 12.2 x 2.4 mm, its compact architecture along with its low power consumption makes it a good choice for IoT projects.

Fig 3. NEO-6M GPS Module

2.4 LCD Display:

An LCD is a flat-panel display technology that uses liquid crystals to create images or text. It consists of a grid of tiny pixels that can be individually controlled to display characters, numbers, or custom graphics. LCDs are widely used in various applications, including IoT devices, consumer electronics, and industrial equipment. LCDs use liquid crystals to modulate light and create images. They don't emit light directly; instead, they rely on a backlight or reflector. LCDs can display images in color or monochrome.

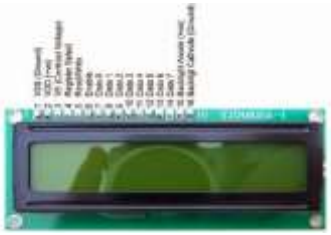

Fig 4. LCD Display

2.5 L298N Motor Driver Module:

The L298N Motor Driver Module is a versatile motor control board commonly used for driving DC motors and stepper motors. The L298N module allows you to control the speed and direction of two DC motors simultaneously. It can handle high voltage and high current requirements, making it suitable for various applications. The L298 is a popular dual H-bridge motor driver integrated circuit (IC) that is widely used to

control DC motors, stepper motors, and other inductive loads in various electronic applications.

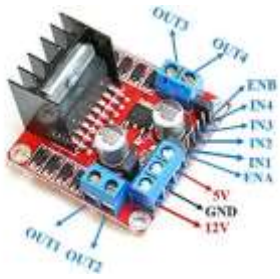

Fig 5. L298N Motor Driver

2.6 DC Motor:

A DC motor is an electrical machine that converts electrical energy into mechanical energy. In a DC motor, the input electrical energy is the direct current which is transformed into the mechanical rotation. It operates on the principle of the Lorentz force law, where a current-carrying conductor placed in a magnetic field experiences a force. DC motors are widely used in various applications due to their simplicity, ease of control, and ability to provide precise speed and position control.

Fig 6. DC Motor

2.7 Buzzer:

A buzzer is an electronic device that produces a buzzing or beeping sound when an electric current is passed through it. It is a simple and widely used component in various applications for generating audible alerts, notifications, or alarms. A 5V buzzer is a type of buzzer designed to operate with a 5-volt power supply.

Fig 7. Buzzer

2.8 Wheel:

The wheel is a crucial component that simulates the movement of a vehicle. It's connected to the DC motor, which is controlled by the L298N Motor Driver. The use of the wheel in this context Safety Mechanism: In the event that the system detects driver drowsiness or abnormal health parameters, it can halt the wheel's movement. This action serves as a safety measure, simulating the process of stopping a vehicle to prevent potential accidents. Essentially, the wheel is part of the system's physical interface that interacts with the real world, demonstrating the project's capability to intervene and enhance driver safety.

Fig 8. Wheel

3.SOFTWARE REQUIREMENTS:

3.1Arduino IDE:

The Arduino Integrated Development Environment (IDE) is an open-source software used to write and upload code to Arduino-compatible boards. It offers a simple yet powerful editor that supports features like syntax highlighting, brace matching, and automatic indentation, making it accessible for beginners and efficient for experienced users. The Arduino Integrated Development Environment (IDE) is a cross-platform application (for Windows, macOS, Linux) that is written in functions from C and C++. It is used to write and upload programs to Arduino compatible boards, but also, with the help of third-party cores, other vendor development boards. The source code for the IDE is released under the GNU General Public License, version 2. The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub main() into an executable cyclic executive program with the GNU toolchain, also included with the IDE distribution. The Arduino IDE employs the program avrdude to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware. By default, avrdude is used as the uploading tool to flash the user code onto official Arduino boards. Arduino IDE is a derivative of the Processing IDE, however as of version 2.0, the Processing IDE will be replaced with the Visual Studio Code-based Eclipse Theia IDE framework. With the rising popularity of Arduino as a software platform, other vendors started to implement custom opensource compilers and tools (cores) that can build and upload sketches to other microcontrollers that are not supported by Arduino's official line of microcontrollers.

Fig 9. Arduino Symbol

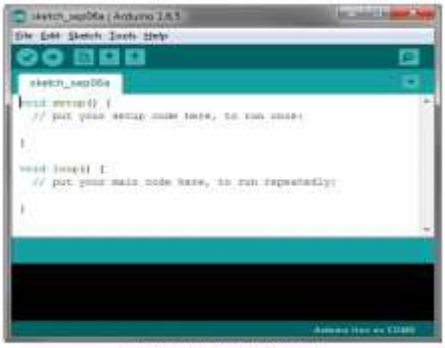

Fig 10. Arduino IDE Window

3.2 IDLE (Python 3.6 64-bit) :

Python's IDLE for version 3.6 64-bit is an integrated development environment that's part of the Python distribution, tailored to be straightforward and accessible, particularly for those new to programming. It includes an interactive interpreter, which is a Python shell that allows you to write and test your code on the fly. This shell is quite helpful as it color-codes different parts of the code, such as inputs, outputs, and errors, making it easier to read and debug. The code editor in IDLE is another key feature. It supports syntax highlighting, which means it displays different elements of the Python language in different colours. This not only makes the code more readable but also helps in identifying syntax errors. The editor also automatically indents new lines of code correctly, which is crucial in Python since indentation is used to define the structure of the code. Additionally, the editor offers code completion, which can speed up coding by suggesting completions for partially typed words IDLE is designed to be lightweight and simple, using the Tkinter GUI toolkit, which is why it's coded in 100% pure Python. This makes it an excellent choice for those who don't need the complexity of more advanced IDEs. It's also cross-platform, meaning it can be run on Windows, Unix, and macOS, providing a consistent experience across these operating systems.

Fig 11. Python IDLE 3.6

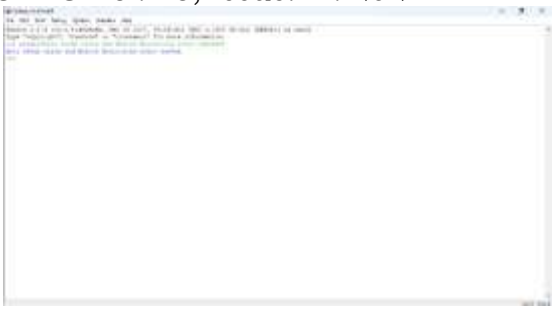

Fig 12. Python IDLE Editor

3.3 Telegram BOT:

Telegram bots have become a vital component in the realm of IoT projects, offering a seamless communication channel between users and their devices. These bots, which operate within the Telegram app, can be programmed to perform a variety of tasks, from sending commands to IoT devices to providing users with timely updates and notifications. For example, a user could use a Telegram bot to remotely control smart home devices, such as adjusting the thermostat or checking the status of a security system.

The versatility of Telegram bots lies in their ability to be customized for specific functions, making them an ideal choice for IoT applications. They can handle real-time data transmission, allowing for immediate interaction and control over connected devices. Moreover, the security features of Telegram ensure that the communication between the user and the IoT system is encrypted and secure, which is crucial when dealing with potentially sensitive information.

In practice, setting up a Telegram bot for an IoT project involves creating the bot through Telegram's BotFather, obtaining a unique token, and then programming the bot to interact with the IoT devices using the Telegram API. Once configured, the bot acts as a bridge, translating user commands into actions and providing feedback from the devices. This level of interaction simplifies the management of IoT systems and enhances the overall user experience by making device control more accessible and efficient. Whether it's for monitoring energy consumption, receiving alerts about system statuses, or controlling lighting and temperature, Telegram bots provide a powerful tool for integrating advanced communication capabilities into IoT projects**.**

Fig 13. Telegram BOT

4. BLOCK DIAGRAM:

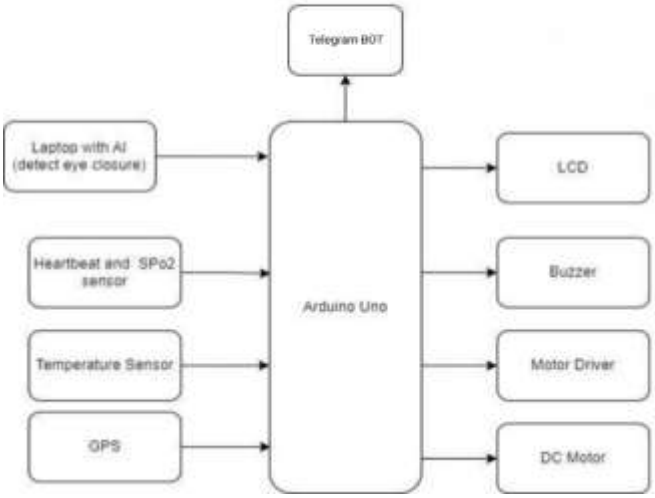

Fig 14. Block Diagram

The system depicted in the block diagram is an integrated Anti-Sleep Alarm and Health Monitoring Alert System designed to enhance user safety. It employs a combination of hardware and software components to monitor various health parameters and alertness levels. At the heart of the system is an Arduino Uno, which serves as the central processing unit. It receives input from several sensors, including a Heartbeat and SpO2 sensor that tracks the user's pulse and blood oxygen saturation, and a Temperature Sensor that measures body temperature. These sensors provide real-time health monitoring, which is critical for detecting any potential health issues promptly. Additionally, the system includes a Laptop with AI that is programmed to detect when the user's eyes are closed. This feature is particularly useful for preventing accidents caused by drowsiness, making it ideal for individuals who need to remain alert, such as drivers or machine operators. The Arduino Uno processes the data from these sensors and, based on predefined criteria, decides when to issue alerts. Alerts can be visual, via an LCD that displays the sensor readings; auditory, through a Buzzer that sounds when immediate attention is needed; or tactile, using a Motor Driver connected to a DC Motor to provide a physical stimulus. For remote monitoring, the system is equipped with a Telegram BOT. This enables the transmission of notifications and alerts to a smartphone or other devices, ensuring that the user or a caretaker is kept informed about the user's health status or alertness level, even from a distance. Lastly, a GPS module is included for location tracking, which can be vital in emergency situations where the user's location needs to be known. The integration of health monitoring and alert systems in this device aims to provide a comprehensive solution for user safety and well-being.

5.DESIGN METHODOLOGY:

5.1 Working:

The main motive of the anti-sleep alarm and health monitoring alert system project is to enhance road safety by preventing accidents caused by driver drowsiness. The system typically uses sensors to monitor signs of fatigue or health issues in drivers and triggers alarms to alert them. This proactive approach aims to reduce the risk of accidents related to sleepiness or sudden health problems while driving.

In this project we have used Arduino UNO Atmega328P MAX30102 Sensor, NEO-6M-0-001 GPS Module, Buzzer, LCD Display, L298N Motor Driver, DC Motor, Wheel, Arduino IDE and IDLE (Python 3.6 64 bit), Telegram BOT, basically it is a IOT based project. The project aims to develop a drowsiness detection system using Python code executed in IDLE. This system monitors a driver's eye movements and blinking patterns through a webcam. The setup includes an LCD display, GPS module, buzzer, motor driver, wheel, and a MAX30102 sensor connected to an Arduino.

The system continuously observes the driver's eyes. If the driver's eyes remain closed beyond a predetermined threshold, it triggers several responses. The buzzer sounds an alarm to alert and awaken the driver. The vehicle's wheel is halted to prevent any potential accidents. A "Driver Sleeping" alert message is displayed on the LCD. The system captures a photo of the driver at the moment of detection. Additionally, the captured photo, along with an alert message and the vehicle's tracking location, is sent through a Telegram bot. This bot is installed on the smartphones of the driver's family and friends, ensuring they are immediately informed of the situation.

In addition to this we implemented another application which is health monitoring alert system. The health monitoring alert system is an innovative application designed to enhance driver safety. It utilizes the MAX30102 sensor to measure vital parameters such as heartbeat, SpO2 level, and body temperature. The system is programmed to issue alerts when these parameters deviate from the normal ranges, which are:SpO2: 92% to 100%,Heartbeat: 60 to 100 beats per minute for adults, Temperature: 97°F to 99°F (36.1°C to 37.2°C).If any of the three parameters falls below or exceeds a certain threshold and when an anomaly is detected—such as values falling below or rising above these thresholds—the system responds by: Emitting an alarm through the buzzer, displaying the current readings on the LCD, stopping the vehicle's wheel to prevent accidents, capturing a photo of the driver at the moment of the alert, sending the captured photo and the vehicle's tracking location via the Telegram Bot app to the driver's contacts.

To ensure the system reacts to abnormal vital signs, conditional statements are incorporated into the code. These statements check the sensor readings against the set thresholds. If the readings are outside the normal ranges, the buzzer is activated with digitalWrite(buz, HIGH);, and deactivated with digitalWrite(buz, LOW); when the readings return to normal. This proactive approach aims to promptly alert and protect the driver by closely monitoring health indicators and responding swiftly to potential health risks.

It not only serves as a proactive measure against the perils of driving under fatigue but also acts as a guardian monitoring the health of the driver. With its ability to detect and respond to critical situations swiftly, it sets a new standard in automotive safety systems, potentially reducing the incidence of road accidents and safeguarding lives. This project exemplifies the pivotal role of technology in creating a safer driving environment and highlights the importance of

continuous innovation in the realm of public safety.

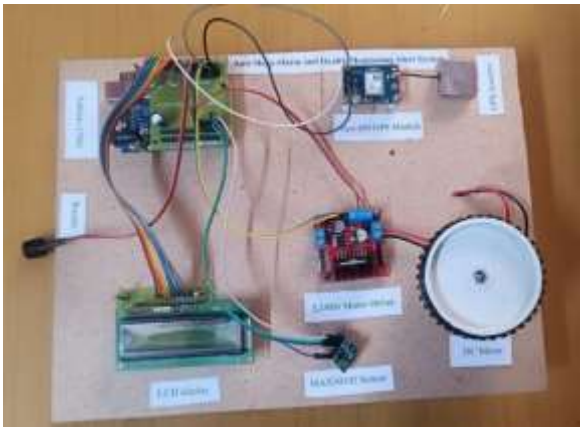

Fig 15.Prototype of the device.

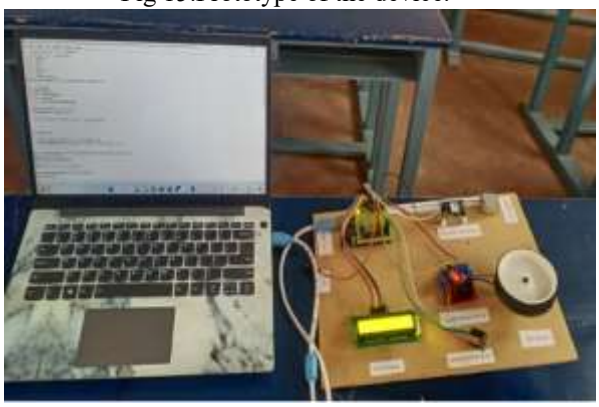

Fig 16.Real time implementation of the system

6.RESULTS AND DISCUSSION:

Python code implemented in the IDLE environment for the operation of the proposed Anti-Sleep Alarm and Health Monitoring Alert System likely includes features such as monitoring driver behaviour, detecting signs of fatigue, and issuing timely alerts to keep drivers awake and attentive.

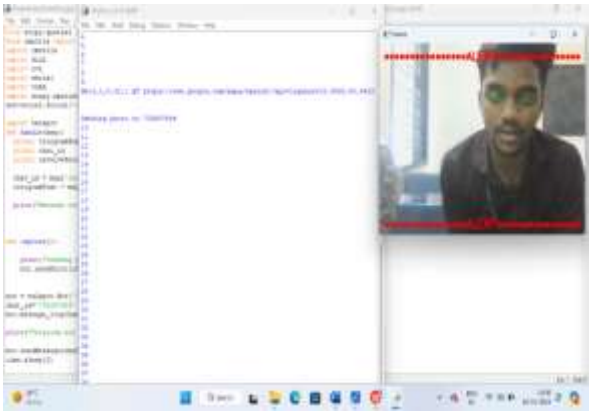

Fig 17. Monitoring and sending the driver sleeping message with location and photo to the app.

Fig 18.Alert message in the LCD display

Figure 17 and Figure 18 shows that when the code is executed, the camera initiates monitoring. In the console, a message indicating that the Telegram bot is ready will be displayed. Concurrently, the system tracks and displays the blink count, updating it continuously. If the system detects that the eyes are closed beyond a predefined threshold, it triggers a Driver Alert (DA). This alert, along with the current location, is shown on the console. Additionally, a photo is sent to the specified chat ID (705697904). Simultaneously, an alert message stating 'Driver Sleeping' is exhibited on the LCD display.

Fig 19.Receiving driver alert with location and photo.

The above figure demonstrates that once the console displays the 'Telegram bot is ready' message, the phone receives a 'Bot started' notification. When a driver alert is triggered, the console shows the alert along with the current location and indicates that a photo is being sent to the chat ID. At the same time, the Driver Alert (DA), including the current location and the captured photo, is transmitted to 'becvhbot,' which is the designated bot name in the phone.

Fig 20.Alert message in the LCD display

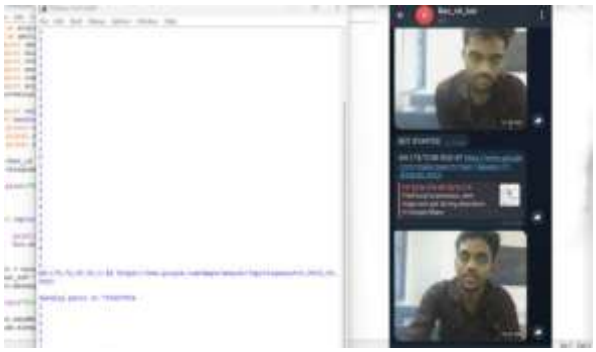

Fig 21. Sending abnormal health alerts with location and photo to the phone.

Fig 22.Receiving abnormal health alerts with location and photo.

Figures 19,20 and 21 depicts the health monitoring alert system where sensors are actively measuring temperature, heart rate, and SpO2 levels. If any of these parameters deviate from their normal ranges, the system first displays the current values on the LCD display. An 'Abnormal Health (AH)' warning is then shown on the same display. The subsequent steps are identical to those previously described. Instead of a Driver Alert, the console will show the abnormal health parameter values. The process for tracking the location and capturing a photo remains unchanged. On the phone, notifications include the 'Abnormal Health (AH)' parameter values, along with the tracking location and the captured photo.

7. FUTURE SCOPE:

Voice-Activated Controls: Introducing voice commands to enable drivers to interact with the system hands-free, ensuring their focus remains on the road.

Real-Time Health Monitoring: Extending the system to monitor for signs of acute health conditions like heart attacks or strokes can facilitate immediate medical intervention, potentially saving lives.

Broader Sensor Range: Incorporating additional sensors to assess factors like driver posture and steering grip can provide a more comprehensive understanding of the driver's condition.

Multi-Vehicle Communication: Enabling the system to communicate with nearby vehicles about a driver's condition can improve overall road safety.

Automated Vehicle Control: In critical situations, the system could take control of the vehicle to bring it to a safe stop if the driver is unresponsive.

7.1 Use Cases:

- Long-Haul Trucking: For truck drivers who often drive long distances, the system can provide crucial alerts to prevent accidents caused by fatigue.
- Public Transportation: Bus and taxi drivers, who work in shifts, can benefit from the system to ensure they remain alert throughout their duty.
- Private Vehicle Owners: Individuals who drive for extended periods, especially at night, can use the system to stay safe on the road.
- Fleet Management: Companies managing a fleet of vehicles can install the system to monitor the health and alertness of their drivers, improving overall safety.
- Medical Transport: Ambulances and medical transport services can utilize the system to ensure that their drivers, who often work in high-pressure situations, do not suffer from fatigue.
- Ridesharing Services: Rideshare drivers can use the system to maintain high safety standards and reassure passengers of their commitment t o safety.
- Driver Training Schools: The system can be used as a training tool to educate new drivers about the importance of alertness and health monitoring while driving.
- Insurance Companies: Insurers can offer incentives for vehicles equipped with such systems, as they can reduce the risk of accidents and claims.
- Health Monitoring for Elderly Drivers: The system can assist in monitoring the health of elderly drivers, who may be more susceptible to health issues while driving.

7.2 Dependancy:

We are not willing to terminate our project as prototype. but, make our project to be in the real time market to replace the lower end jobs of mankind. For that, still economical support and technical support from experts is required.

8.CONCLUSION:

The anti-sleep alarm and health monitoring alert system stands as a beacon of innovation in the realm of road safety. This comprehensive system vigilantly monitors the driver's alertness through eye movement and blinking patterns, while also keeping a close watch on vital health indicators such as heart rate, SpO2 levels, and body temperature. As a testament to the power of IoT in enhancing vehicular safety, this project is a pioneering step towards integrating technology into our daily lives to protect and preserve human well-being. Its real-time applications are multifaceted, offering not just accident prevention through fatigue detection but also a proactive approach to health monitoring. It is especially advantageous for long-distance travellers and nocturnal drivers, for whom the dangers of drowsiness are most pronounced. Furthermore, it serves as an early warning system for any abnormal health

conditions, prompting drivers to take necessary medical actions. In crafting a safer future on the roads, this project does more than just prevent accidents; it acts as a vigilant guardian, ensuring that drivers remain alert and healthy behind the wheel Ultimately, this project is not just a technological achievement; it is a lifesaving innovation that promises to redefine the standards of driving safety.

9.REFERENCES:

[1] MS. V. Manochitra, "SLEEP SENSING AND ALERTING SYSTEM FOR DRIVERS", Vol. 4, Issue 6, June 2017 Impact Factor(23490322) Associated Asia Research 5.489 ISSN.

[2] Mohammed Moinulla Shariff, Syed Abu Anas, Faizan Shariff N., Manasa E., Gloriya Priyadarshini "Driver's Anti Sleep Device"ISSN: 2349- 5162 | ESTD Year : 2014 Volume 10 | Issue 4 | April.

[3] Rau P. Drowsy Driver Detection and Warning System for Commercial Vehicle Drivers: Field Operational Test Design, Analysis, and Progress. National Highway Traffic Safety Administration; Washington, DC, USA: 2005

[4] Pawan Singh , "INTERNET OF THINGS BASED HEALTH MONITORING SYSTEM: OPPORTUNITIES AND CHALLENGES", Volume 9, No. 1, January-February 2018 International Journal of Advanced Research in Computer Science.

[5] Haider Mshali, Tayeb Lemlouma, Maria Moloney, Damien Magon, "A Survey on Health Monitoring Systems for Health Smart Homes", International Journal of Industrial Ergonomics, 2018.

[6] Shahriyar, R., Bari, M. F., Kundu, G., Ahamed, S. I., & Akbar, M. M. (2009, September). Intelligent mobile health monitoring system (IMHMS).In International conference on electronic healthcare , Springer, Berlin, Heidelberg, 5-12.