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Sunstroke Detection System

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ABSTRACT: The Sunstroke detection system designed to monitor environmental conditions and a user's health (Body temperature) to prevent sunstroke and other heat-related illnesses. When the user's body temperature or water level exceeds the safety limit, the system sends emergency alerts. This device will be useful for the outdoor workers, athletes, travelers and hikers, elderly old people. The sunstroke detection system consists of two sensors for analyzing the range of major causing factors such as GUVA-S12SD UV sensor and DHT11 sensor. Benefits of this device is personalized monitoring and early warning system which is used to Alerts users to dangerous conditions before they develop symptoms of heatstroke. This Sunstroke Detection System is a practical tool for safeguarding health in hot environments, helping users stay hydrated, cool, and safe.

KEYWORDS: Sunstroke Detection; UV Sensor; Temperature sensor

I. INTRODUCTION

In a world of facing lots problems related to human health, the less familiar disorder but causing intrinsic effects to the human body and their health is Stroke. The range in numbers in which the people who affected by stroke is mainly due to heat and dehydration, which is technically known as Sun -Stroke / Heat Stroke. There is not much equipped system proposed specifically for sunstroke detection. Even certain systems were proposed for its detection, the mode/aspect of detection is very important. Outdoor runners are exposed to this high-risk environment.

Moreover, the mortality rate of heat stroke can be up to 70%, which is higher than some other diseases. Here, we have searched for the cause of sunstroke and identified its major causing factors. Temperature of a human body and the environment, Humidity level and water level in the human body, exposure to UV rays are the certain major causes for sunstroke. So, we have proposed an idea of making Sun-Stroke detection system in which it considers the major causing factors for its detection.

These physiological and environmental data are then used to predict the risk of heat stroke, and provides the user with the necessary action to take. So that the detection accuracy might be quite higher than the other proposed systems. Monitoring these major causing factors may results in avoiding the risk of sunstroke. The sunstroke detection system consists of two sensors for analyzing the range of major causing factors such as GUVA-S12SD UV sensor and DHT11 sensor. This detection system is a hardware with software embedded system. This sunstroke detection system might result in creation of enhanced sunstroke detection system in future. It might act as a base if the future enhancing systems.

II. OVERVIEW

The Sunstroke detection system designed to monitor environmental conditions and a user's health (Body temperature) to prevent sunstroke and other heat-related illnesses. when the user's body temperature or heart rate reaches dangerous levels, the system sends emergency alerts. This device will be useful for the outdoor workers, athletes, travelers and hikers, elderly and vulnerable people. benefits of this device are personalized monitoring and early warning system which is used to Alerts users to dangerous conditions before they develop symptoms of heatstroke.

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This Sunstroke Detection System is a practical tool for safeguarding health in hot environments, helping users stay hydrated, cool, and safe. These systems are typically equipped with sensors to measure body temperature, Humidity level in our body and intensity of UV rays in Nanometer(nm).The detection system detects the amount of heat rays passing in our body and amount of water level in our body and if the heat rays or UV rays are higher than the regular time , the user is alerted using an alarm with the help of sensors and the heat rays or UV rays are detected as harmful or higher than the regular time by checking the safety conditions and precautions conditions provided by the developer. The user then receives message in their wearable device and also in their apps. Refer Fig 1 and Fig 4 for the real time statistics.

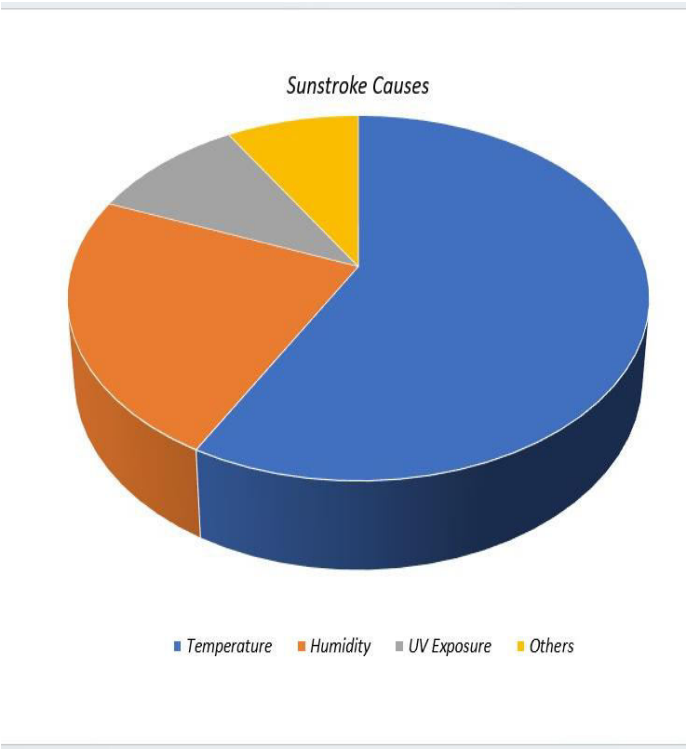

Fig 1: Real-Time data of reasons of sunstroke causes

III. COMPONENTS

1) GUVA-S12SD SENSOR: The S12SD sensor, more specifically the GUVA-S12SD, is an ultraviolet (UV) sensor designed for detecting UVA radiation (wavelength range 240–370 nm). It's commonly used for applications requiring measurement of UV exposure or intensity, such as environmental monitoring, UV index detection, and industrial processes involving UV light.

2) DHT11 SENSOR: The DHT11 sensor is widely utilized for measuring temperature and humidity in various applications due to its affordability and ease of integration. In home automation systems, it plays a crucial role in monitoring indoor climate conditions, allowing users to maintain optimal comfort levels by controlling heating.

SOFTWARE SPECIFICATION:

1) Arduino IDE
2) C++

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IV. EXISTING SYSTEM

The idea of the existing system is that the developer created a wearable device that detects heat and alarm the user, this basic idea is implemented by artificial intelligence (AI) and internet of things, the wearable device maybe watches or patches and These solutions detect sunstroke symptoms, monitor vital signs, and provide alerts for heat-related illnesses. and moreover, there is no perfect existing solution for sunstroke detection system and the previously existing system only detects the heart rate and body temperature.

V. PROPOSED SYSTEM

A. ABBREVIATIONS AND ACRONYMS

1) DHT11 SENSOR - Digital Humidity and Temperature sensor model 11.
2) UV rays - Ultra Violet rays.
3) Gallium Ultraviolet A - S12SD (model designation).

B. OBJECTIVE

- Real-Time Monitoring: Continuously monitor body temperature, Humidity level in the body and environmental factors like humidity, UV rays' range(index) and temperature.
- Early Detection: Use sensors to detect early symptoms of sunstroke, such as high body temperature and abnormal level of humidity content in the body to prevent severe health risks.
- Alert Mechanism: Provide timely alerts to individuals or medical personal when critical thresholds are reached to prompt immediate action.
- Integration with Other Systems: Optionally integrate with mobile apps or smartwatches to provide real-time feedback, guidance, and emergency communication.
- Portable: Can be used in anywhere and handy.

C. METHODOLOGY

The Sunstroke Detection System continuously monitors environmental and health parameters using a wearable device equipped with sensors. The system collects data on UV exposure, body temperature, humidity level. This data is processed in real-time by the micro-controller onboard the device.

When the system detects that the user is at risk of sunstroke based on preset thresholds (such as high UV exposure, dehydration, elevated body temperature, and high ambient heat), it triggers an onboard alarm (buzzer or vibration) to immediately alert the user.

Additionally, the system sends SMS notifications to the user's phone or pre-designated contacts (such as family members or emergency services). These SMS alerts will include critical information about the user's condition, such as:

- UV exposure levels
- Humidity level
- Body temperature

This SMS-based system allows for real-time notification even in remote areas where internet access may be limited. The wearable device ensures personalized and proactive sunstroke prevention, with the SMS alerts acting as a crucial tool for notifying others in case the user is in immediate danger.

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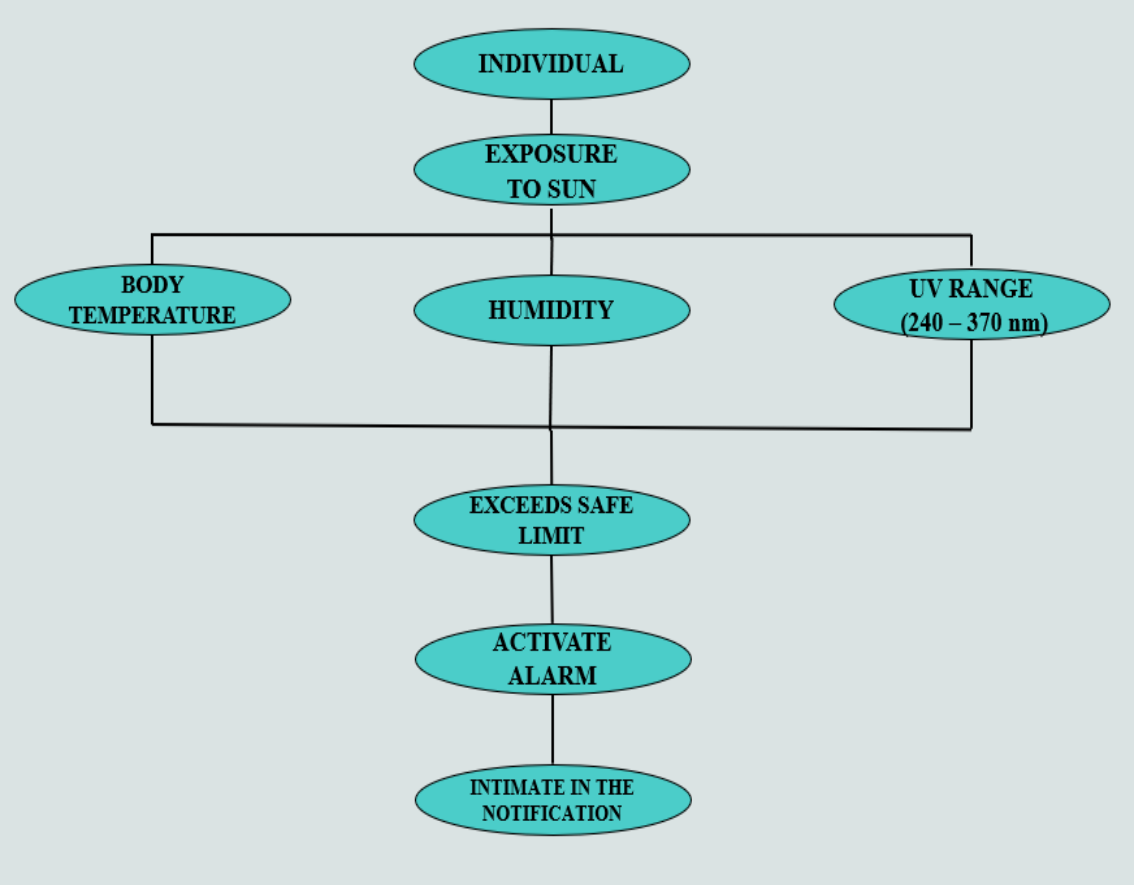

Fig 2: System modules

VI. IMPLEMENTATION OF PROJECT

The first step in implementing the Sunstroke Detection System involves integrating the sensors, particularly the GUVA-S12SD UV sensor and DHT11, with a microcontroller using C programming. These sensors will gather data on UV exposure, humidity levels, and other environmental and physiological factors. Additional sensors can be added to measure body temperature and humidity, all of which contribute to assessing sunstroke risk. The microcontroller will handle data collection and pass it on for further processing.

Once data is collected from the sensors, C++ will be used to analyze and process it in real-time. Predefined thresholds, such as high UV exposure, elevated body temperature, and low hydration levels, will be set to detect when the user is at risk of sunstroke. When the system identifies that these thresholds have been exceeded, it triggers the next phases alerting the user and designated contacts about the potential danger.

The Arduino Nano (V2.3) is a compact, breadboard-friendly microcontroller board based on the ATmega328 chip, widely used in embedded systems and small-scale projects. It operates at 5V and offers 14 digital input/output pins, six of which can function as PWM outputs, as well as 8 analog input pins. It measures the sensor's output voltage, which corresponds to the UV intensity. The data can be processed and displayed via the Serial Monitor, making the Nano ideal for projects involving sensor integration.

The SIM800L GSM Module is a versatile tool used to add cellular communication capabilities to electronic projects. It enables devices to send and receive text messages (SMS), make and receive phone calls, and connect to the internet. This

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makes it ideal for applications such as remote monitoring, where data from sensors can be sent to a server or cloud via cellular networks. It provides reliable communication in areas without Wi-Fi makes it a popular choice for IoT project.

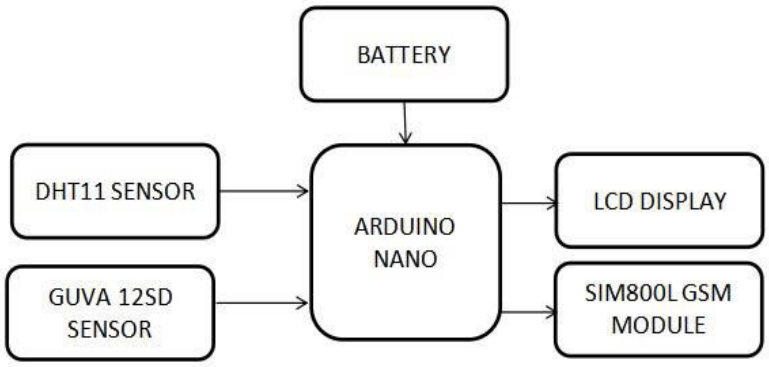

Fig 3: Architecture diagram

REAL-TIME STATISTICAL DATA:

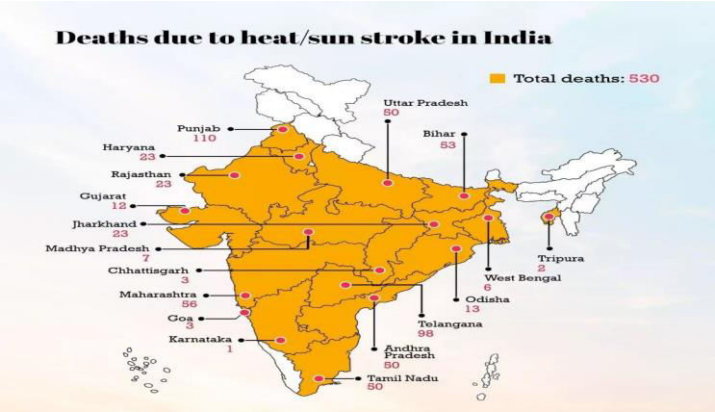

Fig 4: Deaths rate due to heat/sun stroke in India

There were at least 80 deaths due to sun strokes, including both confirmed and suspected cases, reported across the country in May, according to the Health Ministry's data on heat-related illnesses and deaths. In fact, there have been 56 confirmed deaths due to heat strokes between March and May, of which 46 occurred in May alone.

As of 2023, wearable health devices have seen rapid growth, with the global market for such devices expected to reach over $70 billion by 2025. Surveys show that about 60% of consumers are now using wearable devices for health monitoring, with a significant rise in demand driven by increased awareness of health risks due to extreme weather conditions. Devices focusing on heat-related illnesses are gaining traction, particularly in regions experiencing hotter summers. A study in the U.S. revealed that heat-related deaths could rise by 200% by 2050, prompting a growing interest in wearable solutions that help monitor and prevent conditions like sunstroke.

In parallel, the integration of IoT in healthcare is expanding, with over 70% of healthcare executives indicating plans to invest in It-enabled health monitoring systems by the end of 2023. Real-time alerts and data-driven health solutions, like sunstroke detection systems, are becoming essential in this context. With rising global temperatures and frequent heatwaves, demand for these solutions is expected to grow, particularly in outdoor-intensive industries like agriculture, construction, and sports. This shift is paving the way for innovations heat-related health risks.

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VII. ADVANTAGE

- Early warning of sunstroke risk by monitoring temperature, humidity and UV exposure.
- This system monitors the real-time data of a person's vital such as body temperature, humidity levels to detect the symptoms of sunstroke.
- This system safeguards farmers health while working in the agricultural land.
- Though the system is a wearable device it is convenient to use.
- Continuous monitoring enables swift action to ensure timely medical attention.
- Early detection and timely intervention can prevent fatal heat strokes.
- Monitoring the real-time data will help the farmers to optimize their work schedules and take regular breaks.

VIII. FUTURE WORK

1) **Machine Learning and AI Integration**:

Predictive Algorithms: Incorporating AI and machine learning models to predict the likelihood of sunstroke based on patterns in temperature, UV exposure, and user-specific factors such as age, skin type, and hydration levels. **Personalized Alerts:** Using AI to tailor alerts based on individual user profiles, considering their health history, activity level, and environmental factors.

2) **User-friendly Interfaces and Mobile Apps:**

Enhanced User Experience: Developing user-friendly mobile apps with simple interfaces for monitoring sunstroke risks. These apps could offer insights, recommendations, and early warnings to reduce the risk of sunstroke. **Gamification and Engagement:** Encouraging users to maintain healthy behavior through gamified experiences that reward proactive measures against sun exposure.

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