

# **STRESS DETECTING SENSOR EMERGENCY PATIENT ALARM A PROJECT REPORT**

*Submitted by*

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**BONAFIDE CERTIFICATE**

Certified that this project report titled “STRESS DETECTING SENSOR, EMERGENCY PATIENT ALARM” is the bonafide work of **DURGA S (811721106024),RETHNAGAYATHIRI M(8117211061086), VISHALINI B (811720106124)** who carried out the project under my supervision. Certified further, that to the best of my knowledge the work reported here in does not form part of any other project report or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

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**INTERNAL EXAMINER**

**EXTERNAL EXAMINER**

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## **CHAPTER-1**

### **COMPONENTS**

#### **1.1 SENSOR**

A sensor is a device that detects and measures physical or environmental changes and converts them into readable signals or data. Sensors play a crucial role in modern technology, enabling automation, monitoring, and control across various applications. Common types include temperature sensors, pressure sensors, motion detectors, and proximity sensors. They are essential in electronics, healthcare, automotive, and telecommunications. In advanced systems like IoT (Internet of Things), their continuous development drives innovation, particularly in emerging technologies such as smart cities, autonomous vehicles, and wearable devices.



**Figure1.1 Sensor**

Sensors are widely classified based on the type of input they measure, such as thermal, mechanical, optical, magnetic, chemical, and biological sensors.

## **1.2 DIODE:**

A diode, a fundamental semiconductor device with two terminals known as the anode and cathode, plays a pivotal role in electronic circuits due to its unique electrical properties. The primary function of a diode is to control the flow of electric current by allowing it in one direction while blocking it in the opposite direction. This property is vital in rectification processes, especially in power supply circuits, where diodes are instrumental in converting alternating current (AC) to direct current (DC). The behavior of a diode is characterized by its voltage-current relationship, described by the Shockley diode equation, which exhibits an exponential relationship between the voltage across the diode and the current flowing through it.



Figure: 1.2 Diode

In addition to their crucial role in rectification processes, diodes exhibit a diverse array of types and applications, contributing significantly to electronic circuits and modern technology. One notable type is the Schottky diode, characterized by its rapid switching speed.

### **1.3 LED:**

Light Emitting Diodes (LEDs) represent a groundbreaking technology with wide- ranging applications across diverse industries. Functioning on the principle of electroluminescence, LEDs emit light as a result of electrons moving within a semiconductor material. The advantages of LEDs are manifold. They excel in energy efficiency by converting a significant portion of electrical energy into visible light, surpassing traditional incandescent bulbs that dissipate a substantial amount as heat. This not only contributes to lower electricity bills but also aligns with global efforts towards energy conservation.



Figure 1.3 LED

In the automotive industry, LEDs are extensively used in headlights and taillights, improving visibility and safety. The continual evolution of LED technology underscores its importance in shaping a more sustainable and technologically advanced future. As research and development in this field progress, LEDs are likely to play an even more central role in addressing global energy challenges and fostering innovation across a myriad of applications.

## **1.4 POWER SUPPLY:**

A battery stands as a fundamental component in the realm of portable electronics, operating as a versatile electrochemical device designed to store and deliver electrical energy through a controlled chemical reaction. Typically composed of one or more electrochemical cells, a battery consists of positive (cathode) and negative (anode) electrodes immersed in an electrolyte solution. The chemical interaction between these components, when a circuit is closed, triggers a reaction that results in the flow of electrons, generating electrical energy. Alkaline batteries, for instance, are ubiquitous in everyday devices due to their reliability and cost-effectiveness. Lithium-ion batteries, renowned for their high energy density and rechargeable nature, are prevalent in various applications, including smartphones and electric vehicles. Nickel-cadmium batteries, also rechargeable, find their niche in portable electronics, offering a balance between efficiency and longevity. Alkaline batteries are ideal for low-drain devices, while lithium-ion batteries shine in applications demanding compactness and high energy storage.



Figure:1.4 Battery

## **1.5 RESISTOR:**

A resistor is a fundamental electronic component that opposes the flow of electric current. It is a passive two-terminal device with the primary function of controlling or limiting the amount of current passing through a circuit. Resistors are crucial in electronics for adjusting voltage levels, protecting components from excessive currents, and defining time constants in various applications. Resistors come in various types, including fixed resistors with specific resistance values and variable resistors like potentiometers and rheostats that allow manual adjustment. The resistance of a resistor is measured in ohms ( $\Omega$ ) and is governed by Ohm's Law.



Figure:1.5 Resistor

Moreover, in setting bias points for active devices like transistors, resistors contribute to stabilizing and controlling the operation of these components. They are also employed in filters, oscillators, and numerous other applications where precise control of electrical parameters is necessary. Resistors are foundational components in circuit design, offering control and stability in the flow of electric current, contributing to the overall functionality and performance of electronic systems. In summary, resistors are foundational components in circuit design, offering control and stability in the flow of electric current.

## **1.6 CAPACITOR:**

A capacitor is a fundamental electronic component that stores and releases electrical energy in a circuit. It consists of two conductive plates separated by an insulating material called a dielectric. When a voltage is applied across the plates, an electric field is established, causing the accumulation of positive and negative charges on the respective plates. Capacitors are versatile components with various applications in electronics. They play a crucial role in smoothing voltage fluctuations, filtering signals, and providing energy storage in circuits. The ability to store electrical energy temporarily makes capacitors valuable in timing circuits, coupling AC and DC signals, and decoupling power supplies. Capacitors come in different types, including electrolytic capacitors, ceramic capacitors, and tantalum capacitors, each with specific properties suited to different applications. The capacitance of a capacitor, measured in farads (F), indicates its ability to store charge.



Figure:1.6 Capacitor

In electronic circuits, capacitors are essential for stabilizing power supplies, eliminating noise, and facilitating the proper functioning of various electronic components. power amplifiers, filters, and numerous other electronic devices, contributing significantly to the efficiency and performance of electrical systems.

## **1.7 INTEGRATED CIRCUIT:**

An Integrated Circuit (IC) is a miniaturized electronic circuit consisting of various components like transistors, resistors, and capacitors, all fabricated onto a single semiconductor chip, usually made of silicon. ICs have revolutionized electronics by replacing bulky, discrete components with compact, efficient, and reliable systems. They come in different types, including analog, digital, and mixed-signal ICs, each serving specific functions in electronic devices. Analog ICs process continuous signals, while digital ICs handle binary data, forming the foundation of microprocessors, memory chips, and logic circuits. Mixed-signal ICs combine both analog and digital elements, often used in applications requiring data conversion. ICs are essential in virtually all modern technologies, including computers, mobile phones, and communication systems, enabling advancements in speed, functionality, and miniaturization. The fabrication process involves sophisticated techniques like photolithography and doping, ensuring high performance and precision in electronic devices.



Figure:1.7 Integrated  
Circuit

## **1.8 BUZZER:**

A buzzer, a straightforward yet essential component in electronics, functions as an audio signaling device designed to produce sound when an electrical current is applied. Operating as a transducer, the buzzer converts electrical energy into audible sound waves, making it a valuable component for providing alerts and notifications in various electronic devices. The basic construction of buzzers typically involves a vibrating element, which could be a diaphragm or a piezoelectric crystal, and an electromagnetic coil. When an electric current flows through the coil, it generates a magnetic field. This magnetic field interacts with the vibrating element, causing it to vibrate and produce sound waves. The vibration frequency determines the pitch or tone of the sound emitted by the buzzer. Buzzers serve a wide range of applications, finding use in alarms, timers, notification systems, and any scenario where an audible alert is necessary.



Figure: 1.8 Buzzer

In electronic circuits, the operation of buzzers is often controlled by oscillators or timer circuits. These circuits dictate the frequency at which the buzzer vibrates, resulting in distinct tones for different purposes. For instance, in an alarm system, a buzzer might be designed to emit a continuous, attention-grabbing tone.

## 1.9 POTENTIOMETER

A potentiometer is a versatile and fundamental component in electronics, serving as a variable resistor or voltage divider. It plays a crucial role in controlling electrical devices, allowing users to adjust parameters such as volume in audio equipment, brightness in lights, or position in servo motors. The potentiometer's simple yet effective design consists of a resistive element, typically made of carbon or conductive plastic, and a movable contact called the wiper. As the wiper slides along the resistive track, it varies the resistance between the terminals, thereby adjusting the output voltage or current. This functionality makes potentiometers indispensable in various applications, from basic circuits to complex electronic systems.



Figure 1.9 Potentiometer

There are three main terminals on a potentiometer: two are connected to the ends of the resistive element, and the third is attached to the wiper. When a voltage is applied across the outer terminals, the output voltage from the wiper varies proportionally to its position on the resistive track. This allows the potentiometer to function as a voltage divider, where the output voltage is a fraction of the input voltage.

## **1.10 TRANSISTOR:**

A transistor, a pivotal semiconductor device, stands as a cornerstone in the world of electronics due to its remarkable ability to amplify signals and act as a switch. Representing a fundamental building block in electronic circuits, transistors offer versatility and are integral to a broad spectrum of applications, ranging from amplifiers and oscillators to digital logic circuits. The two primary types of transistors are bipolar junction transistors (BJTs) and field-effect transistors (FETs), each with its own variations. BJTs, categorized as NPN (negative-positive-negative) and PNP (positive-negative-positive), involve the movement of charge carriers between two semiconductor materials. On the other hand, FETs encompass types like MOSFETs (Metal-Oxide-Semiconductor Field-Effect Transistors) and JFETs (Junction Field-Effect Transistors), relying on the modulation of conductivity within a channel. This ability to amplify signals is harnessed in various devices, including audio amplifiers that drive speakers, radio-frequency amplifiers in communication systems, and operational amplifiers in instrumentation.

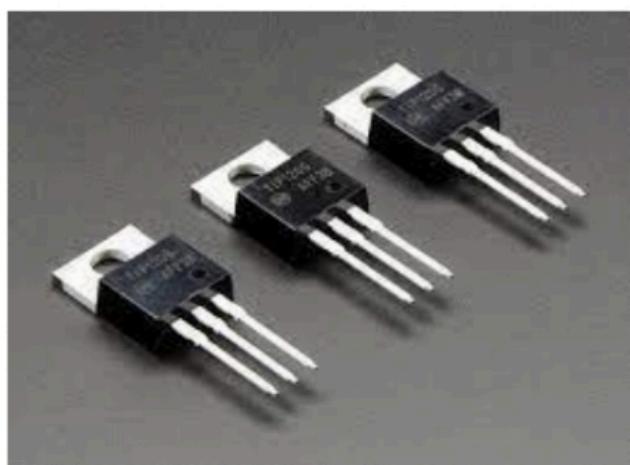


Figure:1.10 Transistor

The compact size, low power consumption, and reliability of transistors have been instrumental in the miniaturization and advancement of electronic technology. The continued refinement and integration of transistors into electronic circuits underscore their enduring importance in shaping the landscape of modern technology.

## **1.11 CONNECTING WIRES:**

Connecting wires form the indispensable infrastructure of electronic circuits, serving as the vital conduits that establish electrical pathways and facilitate the seamless flow of electric current. These wires, typically composed of conductive materials like copper or aluminum, play a fundamental role in ensuring the proper functioning of circuits, both on breadboards and within complex electronic systems. The primary function of connecting wires is to link various components within a circuit, creating the necessary electrical connections for the circuit to operate as intended. Their conductivity allows for the transmission of electrical signals between different elements, forming the essential links that enable communication and cooperation among circuit components. Beyond their basic role in establishing electrical connections, connecting wires contribute significantly to the organization and structure of circuit layouts. Their flexibility allows for the creation of specific signal paths, aiding in the systematic arrangement of components.



Figure:1.11 Connecting wires

In essence, connecting wires are not just functional components; they are integral to the design, organization, and functionality of electronic circuits. As technology advances, the importance of well-designed and well-organized connecting wires remains paramount in the pursuit of innovation and progress in the field of electronics.

## 1.12 Relay Module

A relay module is an electrically operated switch that uses a low-power signal to control a high-power device. When the module receives a signal, it activates an electromagnet, which opens or closes internal contacts, switching the connected circuit on or off. This allows microcontrollers to safely control high-voltage or high-current devices like motors or lights. It consists of an electromagnet, switch contacts (normally open or normally closed), a diode for protection against voltage spikes, and a driver circuit that amplifies low-power signals.

This mechanism enables the relay to control high-voltage circuits while electrically isolating the low-voltage control side from the high-power load side, which is essential for protecting sensitive components. Relay modules are widely used in automation, industrial controls, and safety systems due to their ability to manage high-current loads and prevent damage to control circuits. Different types of relays, such as electromechanical relays (EMRs), solid-state relays (SSRs), and reed relays, offer varying capabilities, making them suitable for a wide range of applications.

A small control voltage is applied to the relay's coil, it generates a magnetic field that either opens or closes the switch contacts inside the relay.



Figure:1.12 Relay Module

## **1.13 PRINTED CIRCUIT BOARD:**

A printed circuit board (PCB) is a vital component in modern electronics, serving as a robust and organized platform for the interconnection of electronic components. Typically composed of a substrate material, such as fiberglass-reinforced epoxy, the PCB hosts a complex network of conductive pathways. More intricate electronic devices often utilize multilayer PCBs, where multiple layers of conductive pathways are stacked atop each other. This design allows for more compact and sophisticated circuits, essential for advanced electronics. The fabrication process of a PCB involves several steps. Initially, the circuit design is created using computer-aided design (CAD) software, specifying the arrangement of components and the layout of conductive pathways. They replace traditional point-to-point wiring, reducing the risk of errors and enhancing the overall reliability of the system. Additionally, the compact design of PCBs contributes to the miniaturization of electronic devices, making them more portable and efficient.

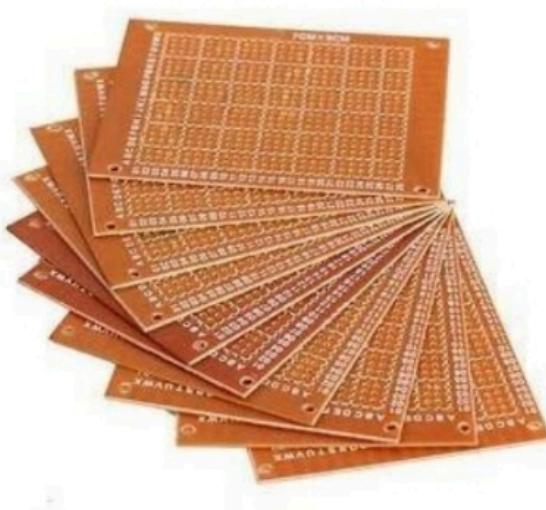


Figure:1.13 Printed Circuit Board

## **CHAPTER 2**

### **STRESS DECTING SENSOR**

#### **2.1 ABSTRACT:**

This project introduces a stress detection sensor. Stress has significant effects on workplace productivity, public health, and human-machine interaction, it has become a crucial field of study. Numerous health problems, such as heart disease, mental health conditions, and cognitive decline, are associated with long-term stress. This study explores the creation and application of an advanced stress detection sensor intended to offer precise, in-the-moment stress level monitoring. To provide a complete picture of a person's stress level, the sensor system uses a variety of physiological indications, including skin temperature, cortisol levels, heart rate variability (HRV), and galvanic skin response (GSR). The association between these biomarkers and the autonomic nervous system, which is extremely sensitive to stress, is well known.

Through the use of sophisticated signal processing methods and machine learning algorithms, the sensor converts unprocessed physiological data into insightful stress evaluations that can differentiate between acute and chronic stressors. Wearable, flexible electronics with micro-electromechanical systems (MEMS) integrated for comfort, portability, and durability make up the sensor system's core. Because of their non-intrusive design, these wearables provide continuous monitoring without interfering with the user's daily schedule. The sensor's acquired data is sent to a cloud-based platform via Bluetooth or other wireless communication protocols, where it is processed in real time. This feature is very helpful in telemedicine, where patients can be monitored remotely.

#### **2.2 INTRODUCTION**

Stress is a ubiquitous issue that affects people in many facets of life, from personal well-being to professional performance, in today's fast-paced world. Long-term or chronic stress is a major cause of many health problems, such as immune system weakness, mental health disorders, and cardiovascular diseases. The need for

efficient methods to track and manage stress is rising as society becomes more conscious of its negative effects. Conventional techniques for measuring stress, including self-reported surveys or clinical interviews, frequently have subjectivity issues, don't provide real-time feedback, and don't account for the physiological changes brought on by stress. As a result, there is growing interest in creating sophisticated stress detection devices that can offer continuous, objective, and real-time monitoring. Stress is a physiological and psychological response to external or internal stressors, involving complex interactions between the nervous system, endocrine system, and cardiovascular system. During stressful situations, the body undergoes a series of changes, such as elevated heart rate, increased sweating, and the release of cortisol, commonly known as the "stress hormone." These changes serve as measurable biomarkers that can be captured using modern sensor technology. The integration of such sensors into wearable devices has opened new avenues for non-invasive, real-time stress detection. This technological advancement not only enhances personal health management but also offers transformative applications in fields such as healthcare, occupational safety, education, and human-machine interaction.

### **2.3 COMPONENTS USED**

- PCB
- LED.
- Diode.
- Pizzo Buzzer
- Capacitor
- Integrated Circuit.
- Trimpot Transistor
- Connecting Wires -As required

- Touch board. 1
- Resistor.

## 2.4 CIRCUIT DIAGRAM

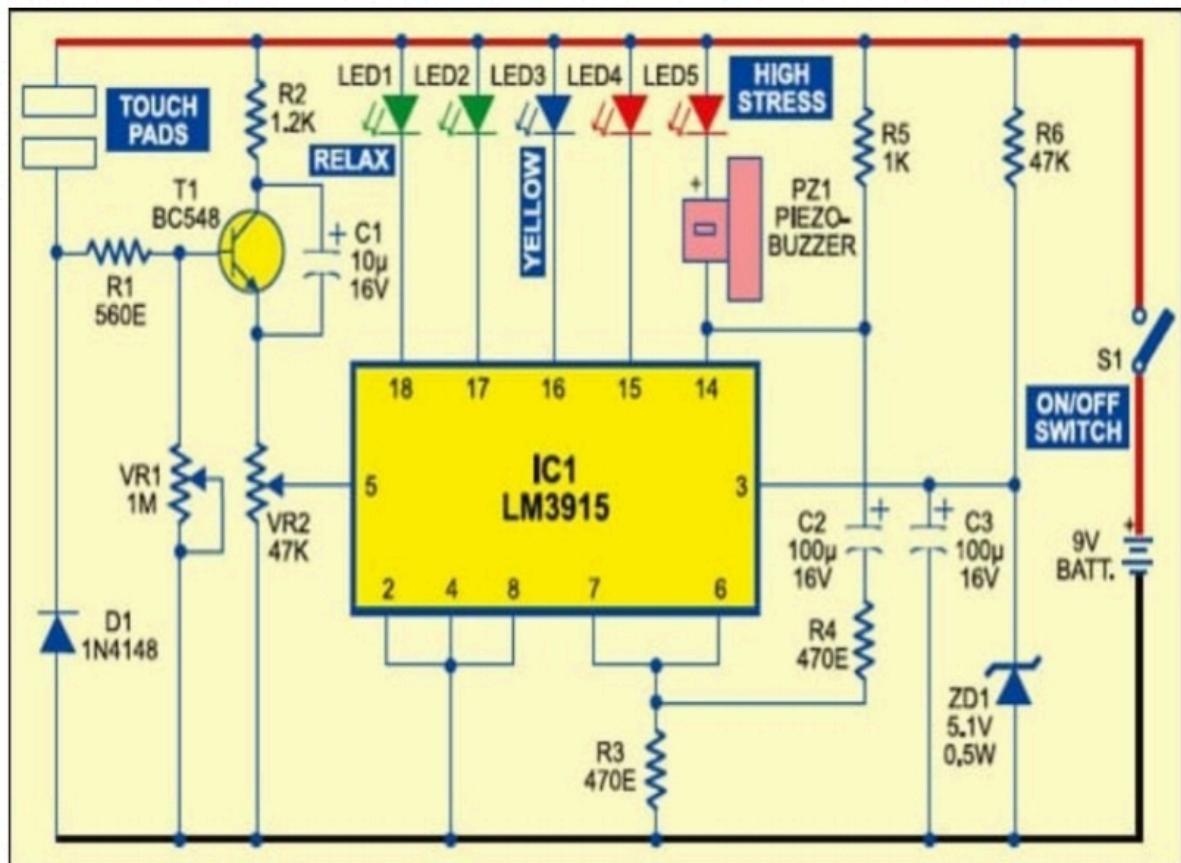


Figure 2.4 Circuit Diagram for Stress Dectecting Sensor

## **2.5 WORKING MODEL:**

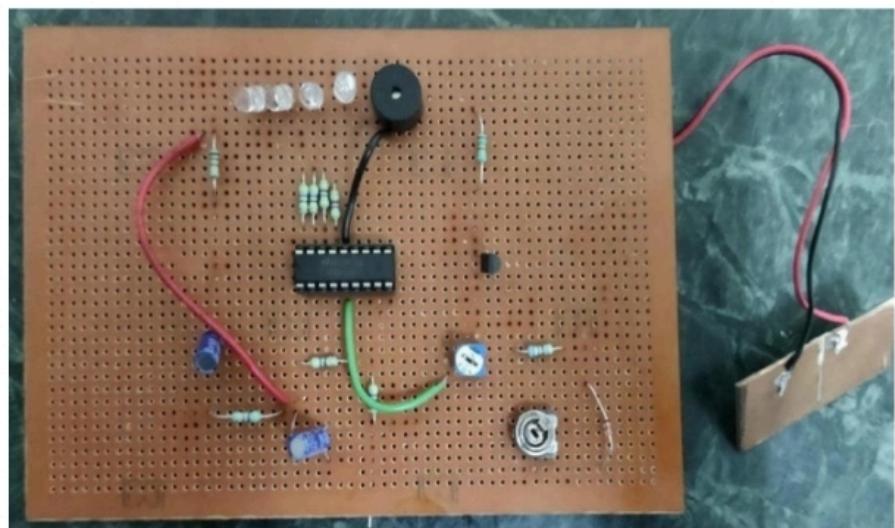


Figure:2.5 Working  
Model

The working procedure of the Stress detecting system aims to monitor and evaluate an individual's stress levels by analyzing various physiological and environmental parameters. These systems typically combine hardware sensors with advanced dataprocessing techniques to detect subtle changes in bodily responses that indicate stress. The core of the system begins with data acquisition through specialized sensors designed to capture key biometric signals. Commonly employed sensors include heart rate monitors, galvanic skin response (GSR) sensors, and voiceanalysis microphones. Heart rate variability (HRV) is a crucial indicator, as the variability between successive heartbeats tends to decrease under stress. GSRsensors, on the other hand, measure the electrical conductance of the skin, which rises with increased sweating—a natural response to stress. These sensors are often integrated into wearable devices such as smartwatches or fitness bands, enabling continuous and non-invasive monitoring. Once data is collected, it undergoes preprocessing to remove noise and artifacts, ensuring that only meaningful signals are analyzed. Filtering techniques, such as low-pass or band-pass filters, are applied to clean the raw data, and normalization ensures that the signals are scaled to a standard range for consistency. Feature extraction follows, where key metrics like HRV time-domain measures (e.g., RMSSD) and frequency-domain ratios (LF/HF) are

computed. For GSR, peaks in skin conductance levels are detected, as these correlate with emotional arousal. In parallel, voice analysis can be performed by extracting features such as pitch, tone, and speech rate, which tend to alter under psychological stress. An accelerometer may also be used to capture physical activity data, helping distinguish stress-induced changes from those caused by exercise or movement. The heart of the system lies in its stress detection algorithm, which processes the extracted features to determine the user's stress level. Machine learning models, such as logistic regression, support vector machines (SVM), or more advanced deep learning models like convolutional neural networks (CNNs) and long short-term memory networks (LSTMs), can be trained on annotated datasets. These datasets contain labeled examples of physiological responses under various stress conditions, allowing the model to learn patterns indicative of stress. Alternatively, a rule-based system may be employed, using predefined thresholds for heart rate variability or skin conductance to classify stress levels. This approach offers simplicity but may lack the adaptive capabilities of machine learning models, which can continuously improve with new data.

Once the system computes a stress score, it generates output through various interfaces. This score might be presented as a percentage or categorized into low, medium, and high-stress levels. Users may receive alerts through visual indicators, such as a change in the color of a wearable device's display, or through haptic feedback, like vibrations. Mobile applications or dashboards provide a more detailed analysis, offering real-time monitoring and historical trends. This data can be invaluable for individuals seeking to manage their stress proactively, as well as for organizations aiming to support employee well-being. Data privacy and storage are critical considerations, particularly when dealing with sensitive biometric information. Stress detection systems must ensure that all collected data is encrypted and stored securely, whether locally on the device or in the cloud. Compliance with regulations such as the General Data Protection Regulation (GDPR) or the Health Insurance Portability and Accountability Act (HIPAA) is essential, especially in healthcare or workplace applications.

## 2.6 BLOCK DIAGRAM:

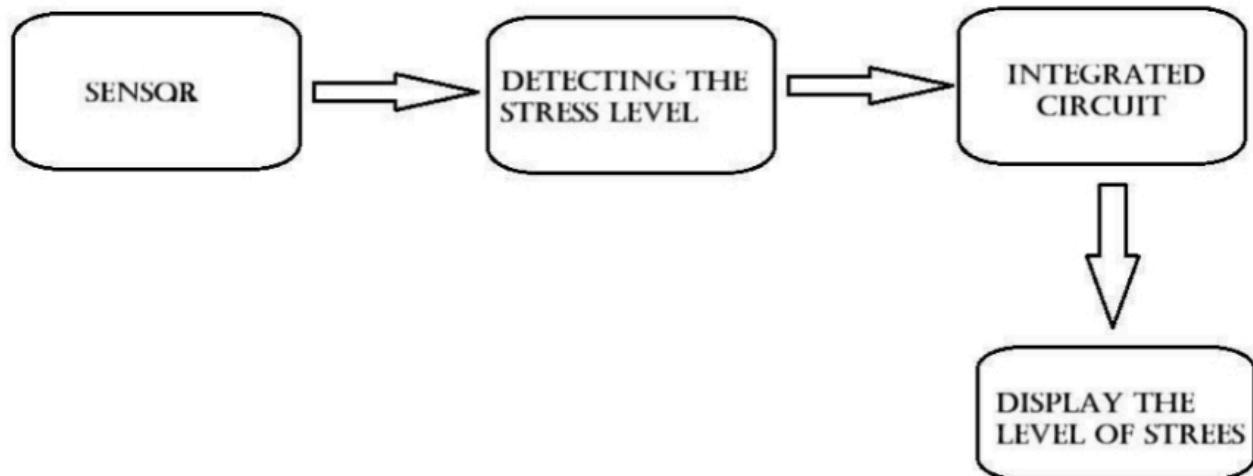


Figure:2.6 Block

Diagram

**Sensor:** In a piezoelectric sensor, this deformation generates an electric charge due to the piezoelectric effect, where certain materials produce an electrical potential when subjected to mechanical stress. The magnitude of the generated charge is proportional to the applied stress. In a strain gauge sensor, the mechanical deformation alters the electrical resistance of the strain gauge. This change in resistance is measured using a Wheatstone bridge circuit and is converted into an electrical signal.

The sensor's output signal, usually in the form of voltage or current, is processed by a microcontroller or an analog-to-digital converter (ADC). The processed signal is then compared against predefined stress thresholds. If the signal exceeds a high threshold, it indicates significant stress, triggering an alert (like blinking multiple LEDs). Conversely, if the signal is below the low threshold, it indicates minimal stress, activating only a single LED. This conversion from mechanical stress to electrical output allows real-time monitoring and visual feedback, helping users assess stress levels effectively.

**Detecting The Stress Level:** A stress-detecting sensor measures mechanical stress by converting it into an electrical signal, which is then processed to determine the stress level.

The key steps involve detecting the physical deformation, converting it to an electrical output, and interpreting this output to classify the stress level as high or low. This process involves several essential components, each playing a specific role in stress detection.

### **Integrated Circuit:**

A stress-detecting sensor, the IC processes signals from the sensing element, amplifies and filters them, and converts analog data to digital form. It compares the signal against predefined thresholds to determine stress levels and controls outputs, such as LEDs or alarms. Essentially, the IC acts as the system's brain, ensuring accurate detection and real-time monitoring of stress.

**Display the level of stress by LED:** Under low-stress conditions, the signal remains below the low threshold, causing only one LED to blink, indicating minimal stress. Conversely, when the stress level exceeds the high threshold, the sensor outputs a stronger signal, triggering four LEDs to blink simultaneously. This visual representation through LED blinking patterns provides a clear and immediate indication of the stress level, with more LEDs activated under higher stress, facilitating real-time monitoring and easy interpretation of stress intensity.

### **2.7 ADVANTAGES:**

- Stress detection sensors can continuously monitor physiological parameters such as heart rate, skin conductance, and cortisol levels. This allows for the early detection of stress before it escalates into more severe mental or physical health issues.
- Helps in monitoring physiological parameters such as muscle activity, heart rate, and blood pressure.
- Enhances safety by detecting stress levels on aircraft structures under different operating conditions.
- Improves vehicle safety and performance by identifying potential points of failure.

- Enables precise force feedback, essential for delicate operations.
- Provides enhanced functionality for flexible and wearable technology.
- Ensures operational safety in high-pressure environments, such as oil pipelines or nuclear reactors.
- Detects stress in natural materials or ecosystems to monitor environmental changes.
- Ensures product reliability by monitoring stress during manufacturing processes.
- Operates effectively in harsh conditions (e.g., high temperature, radiation, underwater).
- Converts mechanical stress into electrical energy for low-power devices.
- Provides real-time feedback on physical stress and posture to improve performance and reduce injury.
- Enables the analysis of material behavior under various stress conditions.

## **2.8 APPLICATION:**

- Wearable Devices: Monitor physiological signs (e.g., heart rate variability, skin conductivity) to detect emotional or physical stress.
- Posture Monitoring: Identify musculoskeletal stress in patients, aiding in physical rehabilitation.
- Driver Monitoring Systems: Detect driver stress and fatigue, improving road safety.
- Aircraft Structural Integrity: Monitor stress on critical components like wings or fuselage to prevent structural failures.
- Space Missions: Measure material stress in extreme environments, ensuring spacecraft durability.
- Pipeline Safety: Monitor stress and pressure in pipelines to prevent leaks or bursts.

- Athlete Performance Monitoring: Track physical stress levels in athletes to optimize training and prevent injuries.
- Smart Fabrics: Embedded sensors can monitor body stress and provide feedback for medical or athletic applications.
- Wind Turbines: Monitor blade stress to enhance performance and prevent failures.

## **CHAPTER – 3**

### **EMERGENCY PATIENT ALARM**

#### **3.1 ABSTRACT:**

This project introduces An Emergency Patient Alarm System is a crucial innovation in modern healthcare, designed to enhance patient safety and ensure timely medical intervention. In hospital environments, where the efficient allocation of resources and prompt responses to patient needs are paramount, this system serves as a lifeline for patients requiring immediate assistance. It operates on a simple yet highly effective principle: when a patient touches a strategically placed sensor, it triggers an audible buzzer in the immediate vicinity and simultaneously sends a digital notification to the designated healthcare provider, such as a doctor or nurse. This dual-alert mechanism ensures that medical staff are promptly informed of any emergency, facilitating a rapid and targeted response. Simultaneously, the design of the Emergency Patient Alarm System prioritizes ease of use, particularly for patients who may be in a state of distress or have limited physical mobility. Unlike traditional call buttons that require precise pressing, the touch-sensitive sensor can be activated with minimal effort, accommodating patients with varying levels of strength and dexterity. This feature is especially beneficial for elderly patients, those with physical disabilities, or individuals recovering from surgery, who may find it challenging to operate conventional devices. The sensor is typically positioned within easy reach of the patient, such as on the bed railing or bedside table, ensuring that help is always within arm's length. Moreover, the system fosters a sense of security and reassurance for patients and their families. Hospital stays can be stressful, particularly for individuals dealing with serious health conditions or undergoing complex treatments. Knowing that they can summon help with a simple touch provides patients with a greater sense of control and autonomy. This psychological benefit is particularly important for vulnerable populations, such as the elderly or those with chronic illnesses, who may feel isolated or anxious in a clinical setting. For families, the system offers peace of mind, knowing that their loved ones have immediate access to assistance in an emergency.

### **3.2 INTRODUCTION:**

In modern healthcare settings, patient safety and timely medical response are of paramount importance. To address this critical need, the Emergency Patient Alarm System has been developed to provide patients with an intuitive and reliable method for seeking immediate assistance. This system features a touch-sensitive sensor strategically placed within the patient's reach, allowing them to activate the alarm effortlessly in times of distress or emergency. Once the patient touches the sensor, a series of actions are initiated: a loud buzzer sounds within the vicinity to alert nearby medical personnel, while a digital notification is simultaneously transmitted to the assigned doctor or nurse through an integrated communication system.

This dual-alert mechanism ensures that healthcare staff are promptly informed of the patient's need, enabling a rapid and efficient response. By empowering patients to communicate their emergencies quickly, this system reduces response time and enhances patient autonomy. It also alleviates the pressure on healthcare staff by providing clear and immediate notifications, thus improving overall workflow efficiency. The Emergency Patient Alarm System ultimately contributes to a safer hospital environment, fostering better communication between patients and caregivers, and ensuring that critical situations are addressed without delay. This sound is designed to be loud enough to capture attention without causing undue alarm to other patients. In addition to the buzzer, the system's integration with hospital communication networks ensures that a digital notification is sent to the assigned caregiver's device.

The benefits of the Emergency Patient Alarm System extend beyond the immediate response to emergencies. By improving communication between patients and caregivers, the system contributes to a safer and more efficient healthcare environment. It reduces the likelihood of overlooked or delayed responses, a common issue in busy hospital settings where staff may be attending to multiple patients simultaneously. The system also alleviates the pressure on healthcare providers by streamlining the alert process, ensuring that critical situations are prioritized appropriately. This targeted approach minimizes response time and optimizes resource allocation, enhancing overall patient care. Furthermore, the system promotes a

sense of security and reassurance for patients and their families. Knowing that they can easily summon help in an emergency fosters a more positive hospital experience and reduces anxiety. This psychological benefit is particularly important for vulnerable patients, such as the elderly or those with chronic conditions, who may feel isolated or fearful in a clinical setting.

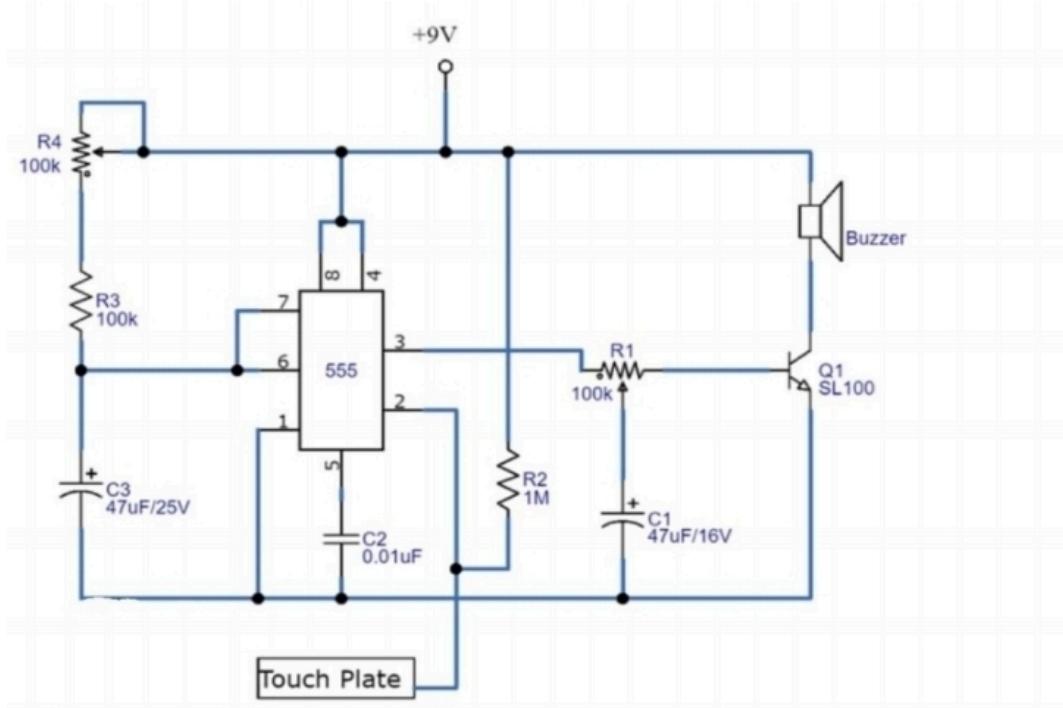
For healthcare providers, the system offers peace of mind, knowing that they can rely on a dependable alert mechanism to identify and address emergencies promptly. This notification typically includes the patient's room number and bed location, providing critical information that enables a swift and targeted response. The development and adoption of such systems reflect a broader commitment to improving patient safety and care quality. As healthcare continues to evolve, technologies that enhance communication and responsiveness will play an increasingly important role. The Emergency Patient Alarm System represents a significant step forward in this regard, offering a simple yet powerful solution to one of the most pressing challenges in healthcare: ensuring that patients receive timely and appropriate care when they need it most. This innovation is a valuable addition to any healthcare facility committed to delivering high standards of patient care and safety.

### **3.3 COMPONENTS USED:**

- Base Board
- Buzzer
- Relay Module
- Battery
- Connecting Wires
- Transistor

### 3.4 CIRCUIT DIAGRAM

Using a relay module instead of resistance in an emergency patient alarm system significantly enhances its performance, reliability, and safety. A relay, an electrically operated switch, allows the system to control high-power devices, such as buzzers and sirens, with a low-power signal from the control circuit. This approach provides critical electrical isolation, ensuring that sensitive components are protected from voltage spikes and reducing the risk of electrical interference. The relay's ability to handle higher current loads means it can activate multiple devices simultaneously, such as visual LED indicators and auditory buzzers, ensuring a comprehensive alert system. Additionally, relays are highly reliable and suitable for critical applications like healthcare, where precise and consistent operation is paramount. When a patient presses the emergency button, the relay receives a signal, closes its internal contacts, and energizes the alarm devices, instantly alerting medical staff. This mechanism not only enhances the system's functionality but also ensures that patients can easily and effectively summon help, fostering a safer and more responsive healthcare environment.



### 3.5 WORKING MODEL

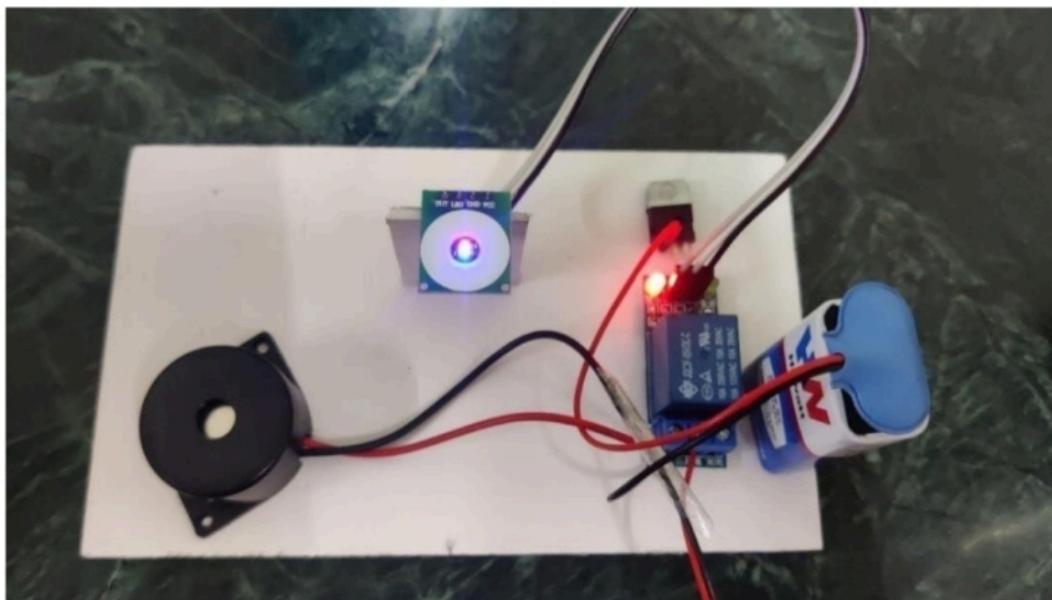


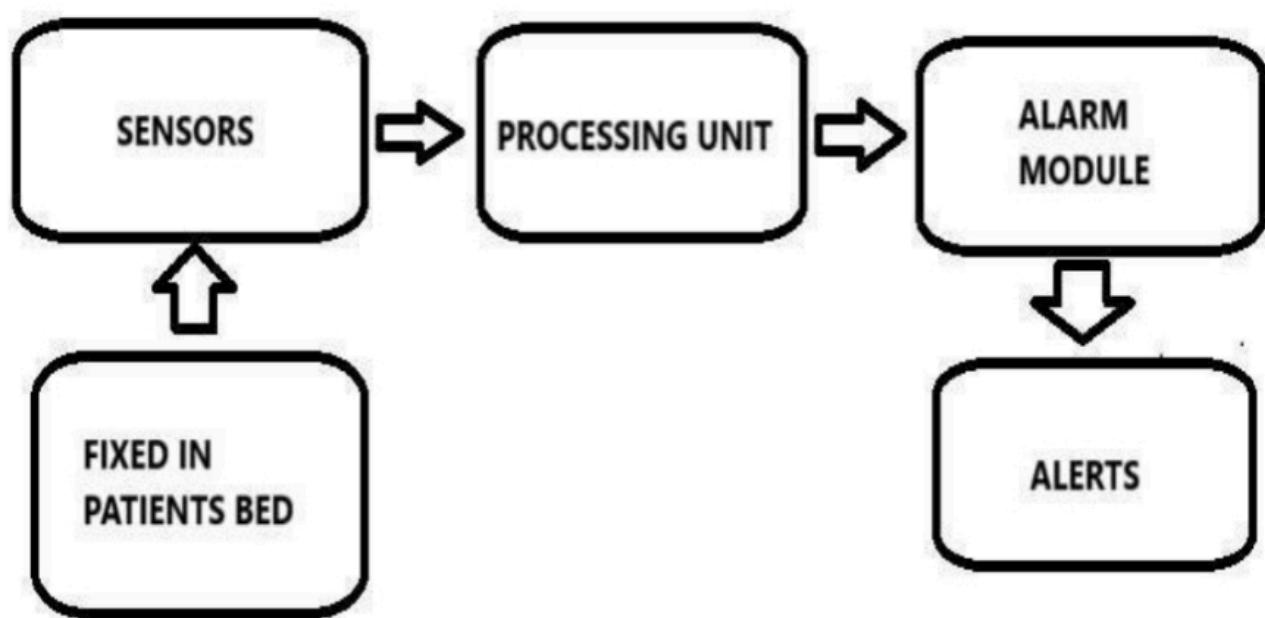
Figure:3.5 Working Model

This circuit employs the primary element of the Emergency Patient Alarm System is the touch-sensitive sensor, which is strategically placed within the patient's reach—typically on the bedside table, bed railing, or even integrated into wearable devices. This sensor is designed for maximum accessibility and ease of use, ensuring that patients with limited mobility or dexterity can activate it with minimal effort. The sensor's touch-sensitive technology operates using capacitive or resistive sensing, which detects the presence of a human touch through changes in electrical properties. Unlike traditional mechanical buttons, these sensors do not require significant force to activate, making them suitable for patients with physical disabilities or weakened conditions. Simultaneously, the microcontroller activates an audible buzzer located in the patient's room or ward. This buzzer is typically a piezoelectric device that emits a loud, distinct sound to immediately alert nearby healthcare personnel. The buzzer's sound level is carefully calibrated to be noticeable without causing panic or discomfort to other patients. This immediate auditory alert serves a critical purpose: it ensures that medical staff within earshot are promptly aware of the emergency, enabling a quick, localized response. The buzzer's activation also provides reassurance to the patient, signaling that their distress call has been registered by the system. The

working model of the Emergency Patient Alarm System represents a significant advancement in healthcare technology. By combining touch-sensitive sensors, audible alarms, the system ensures that patients can easily communicate their needs and receive timely assistance. Its design

emphasizes reliability, accessibility, and integration with existing hospital infrastructure, making it a valuable tool in modern healthcare environments. As technology continues to evolve, the system's capabilities are likely to expand, offering even greater benefits for patients and caregivers alike.

### 3.6 BLOCK DIAGRAM



#### Sensors:

In an emergency patient alarm system, a touch-sensitive sensor can play a crucial role in alerting medical staff. When a patient touches or presses the sensor, it completes an electrical circuit, triggering an immediate response from the system. This activation sends a signal to a connected control unit, which processes the input and initiates an alarm sequence. The system then activates a buzzer or sound alarm, alerting nearby healthcare providers to the patient's need for assistance. This touch-based mechanism is particularly useful for patients who may be unable to speak or

move extensively but can still signal distress through a simple touch. The quick response ensures that help can be provided promptly, enhancing patient safety and care in critical situations.

### **Relay Module:**

In an emergency patient alarm system, a relay plays a crucial role in bridging the low-power sensing circuit with the high-power alarm mechanism. When a patient touches the sensor, it generates a low-voltage signal, which by itself is not sufficient to directly power devices like buzzers or sound alarms. This is where the relay comes into action. The sensor signal is sent to the relay's control coil, which energizes an internal electromagnet. This electromagnetic activation causes a mechanical switch inside the relay to either close or open, depending on its design (normally open or normally closed). When the switch closes, it completes a separate, higher-power circuit connected to the buzzer or alarm system.

This design is essential because it allows the low-power sensor to safely control a larger electrical load without direct interaction, preventing potential risks such as electrical shocks or sensor damage. Additionally, the relay provides electrical isolation between the sensor circuit and the alarm circuit, protecting sensitive electronic components from surges or interference. As soon as the relay activates, it allows current to flow from the power supply to the buzzer, triggering an audible alert that can be heard by medical staff or caregivers. This ensures that the alarm system promptly notifies personnel of the patient's need for assistance, even if the patient cannot communicate verbally. The reliability and quick response of this relay-based mechanism are vital for enhancing patient safety in critical care environments, ensuring that help arrives without delay.

### **Alarm Module:**

Alarm module act as a buzzer In an emergency patient alarm system, the buzzer is a key component designed to produce a loud, audible alert when activated, ensuring that medical staff or caregivers are promptly notified. When a patient touches the sensor, it sends an electrical signal to the system's control unit or relay, which then directs power to the buzzer circuit. The buzzer typically operates on a low-voltage DC supply and works through

electromagnetic or piezoelectric mechanisms. In an electromagnetic buzzer, the incoming electrical signal energizes a coil, creating a magnetic field that moves a diaphragm back and forth, generating sound waves. In a piezoelectric buzzer, the signal causes a piezoelectric material to vibrate, producing a high-pitched sound.

### **3.7 ADVANTAGES:**

- **Rapid Alert Activation:** The system allows patients to summon assistance instantly by simply touching a sensor. This ensures that emergencies are communicated without delay, reducing response time and improving patient outcomes.
- **24/7 Monitoring:** Patients have constant access to an emergency alert system, providing peace of mind that help is always available. This is particularly crucial in critical care units, elderly care facilities, and post-operative recovery rooms.
- **Reduction in Critical Incidents:** By enabling quick intervention, the system helps prevent minor issues from escalating into serious medical emergencies, thereby reducing the risk of complications or fatalities.
- **Patient Autonomy:** Patients can independently alert staff when needed, fostering a sense of control and dignity, which is especially important for those with chronic conditions or in long-term care.
- **Integration with Hospital Systems:** The alarm system can be integrated with hospital management software and electronic health records (HER), providing caregivers with essential patient information and enabling informed decision-making.
- **Adaptable to Various Settings:** The system can be customized to suit different healthcare environments, such as hospitals, nursing homes, rehabilitation centers, and outpatient clinics. Sensors can be placed strategically based on patient needs and facility layouts.

- Reliability and Redundancy
- Cost-Effective Solution
- Customizable and Scalable
- User-Friendly Design

### **3.8 APPLICATION:**

- General hospital wards, the alarm system allows patients to quickly summon assistance for routine needs or emergencies. This ensures that issues such as sudden discomfort or medical complications are addressed promptly.
- In ICUs, where patients are often in critical condition, the alarm system provides a vital link to healthcare providers. Immediate alerts enable rapid response to changes in patient conditions, which can be life-saving.
- Patient Monitoring: During physical rehabilitation, patients may experience sudden pain or difficulty. The alarm system allows them to notify staff immediately, ensuring that their recovery process is closely monitored and supported.
- Support for Vulnerable Patients: In outpatient settings, elderly or disabled patients may require extra support. The alarm system ensures that they can call for assistance if they feel unwell or need help navigating the facility.
- Child-Friendly Support: In pediatric wards, the alarm system can be designed with child-friendly interfaces, allowing young patients to easily call for help. This ensures that their needs are met promptly, reducing anxiety for both children and their parents.
- Elderly Care in Residential Settings

- Lone Worker Protection: Employees working alone in remote or hazardous areas(e.g., maintenance workers, field technicians) can use portable alarm systems to call for help in case of emergencies such as injuries, equipment failures, or threats.

## **CONCLUSION:**

The stress-detecting sensor utilizes advanced physiological monitoring technology to assess a patient's stress levels in real-time. It measures key indicators such as heart rate variability, skin conductivity, and perhaps even cortisol levels, translating these data points into a simple yet effective visual display. The LED system offers an intuitive method for both patients and healthcare providers to gauge stress levels at a glance. When light stress is detected, a single LED blinks, providing a subtle but clear indication. This early warning allows for immediate self-care or intervention, potentially preventing the escalation of stress into more serious health concerns. It encourages patients to practice relaxation techniques, engage in calming activities, or seek support from caregivers before their stress levels become unmanageable. Moreover, the sensor can be integrated with other healthcare technologies, such as wearable devices or remote monitoring systems, to provide continuous data collection and analysis. This integration enables long-term tracking of a patient's stress patterns, offering valuable insights into their overall well-being. Such data can inform personalized treatment plans, ensuring that each patient receives care tailored to their unique needs.

The emergency patient alarm is another essential component of this system, designed to provide immediate assistance in critical situations. Activated by a simple touch, the alarm triggers an audible buzzer that alerts nearby nurses or caregivers. This functionality is particularly valuable for patients with limited mobility, cognitive impairments, or those recovering from surgery, who may find it difficult to communicate their needs verbally or through conventional means.

Whether a patient is experiencing sudden pain, discomfort, or distress, the alarm offers a reliable and straightforward method to call for help. This rapid response capability

can significantly reduce the time it takes for medical staff to address emergencies, potentially preventing complications and improving patient outcomes.

In addition to its primary function, the alarm system can be integrated with hospital communication networks, ensuring that alerts are relayed not only to nearby staff but also to centralized monitoring stations. This connectivity ensures that no emergency goes unnoticed, even during busy periods or when staff members are attending to other patients. It also allows for the logging and analysis of alarm activations, providing valuable data that can inform hospital protocols and improve overall patient care strategies.

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