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AI-Driven Stress Monitoring for Older Adults: A Wearable IOT Solution

Komal Mishra 21ec144@jssaten.ac.in
Department of Electronics and Communication Engineering, JSS Academy of Technical Education, Noida, Gautam Budh Nagar, 201301, Uttar Pradesh, India.

Gaurav Bhushan 21ec107@jssaten.ac.in
Department of Electronics and Communication Engineering, JSS Academy of Technical Education, Noida, Gautam Budh Nagar, 201301, Uttar Pradesh, India.

Amit Kumar Ahuja amit.ahuja@jssaten.ac.in
Department of Electronics and Communication Engineering, JSS Academy of Technical Education, Noida, Gautam Budh Nagar, 201301, Uttar Pradesh, India.

B.P. Mishra bpmishra435@gmail.com
Department of Electronics and Communication Engineering, JSS Academy of Technical Education, Noida, Gautam Budh Nagar, 201301, Uttar Pradesh, India.

Tanishk Prakash Dubey tanishkdubey.02@gmail.com
Department of Electronics and Communication Engineering, JSS Academy of Technical Education, Noida, Gautam Budh Nagar, 201301, Uttar Pradesh, India.

Corresponding Author: Tanishk Prakash Dubey

Abstract

Stress is a state of increased physical and psychological tension that can significantly affect an individual's health and well-being. Various physiological, psychological, environmental, and emotional factors contribute to stress, and poor management can lead to serious health consequences. If not addressed well on time, stress may lead to different neurological disorders which can be detrimental to human health. This paper reviews existing research on stress detection and reduction, examining different methodologies and technologies in the field. Despite advances in stress monitoring solutions, most studies focus on younger populations, workplace settings, or general healthcare, with limited attention to elderly individuals in residential care. To address this gap, this paper proposes an IoT (Internet of Things)-enabled wearable wristband designed for the unique needs of elderly residents in care facilities. The device integrates multiple physiological sensors, including Galvanic Skin Response (GSR), skin temperature, Heart Rate Variability (HRV), accelerometer, and gyroscopic sensors, for real-time stress detection using an adaptive fuzzy logic algorithm. Unlike conventional methods, this system offers personalized interventions such as guided relaxation, breathing exercises, music therapy, and light physical activities, tailored to the user's real-time physiological state. The user-centric design prioritizes comfort, ease of use, and effective stress management for elderly users. By bridging the gap between existing

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stress management technologies and the specific needs of elderly individuals, this approach aims to enhance mental well-being and improve quality of life. Future work will focus on further developing the proposed system, including rigorous testing and evaluating its effectiveness in real-world scenarios to ensure reliability, adaptability, and optimal stress management outcomes.

Keywords: Stress, Stress reduction, Stress management, Older adults, Residential care, Quality of life, Internet of things, Machine learning, Artificial intelligence in healthcare, Neurological disorder.

1. INTRODUCTION

Hans Selye described mental stress as the physical, emotional, and intellectual responses of humans to excessive pressure or stimuli known as stressors [1]. Mental stress is closely linked to cognition and overall well-being [2]. As one of the most prevalent health challenges, stress increases medical visits and imposes a significant burden on healthcare systems worldwide. Identifying stress thresholds is critical for enhancing health, quality of life, and well-being [3].

Lazarus and Folkman, in their seminal work on stress, appraisal, and coping, defined stress as a "particular relationship between the person and environment," emphasizing the dual influence of external stimuli and personal characteristics on psychological and physiological responses [4]. Elderly individuals, particularly those in institutional care settings, face heightened risks of chronic stress due to factors such as declining health, social isolation, and reduced autonomy. Chronic stress among older adults can exacerbate physical illnesses, weaken immune function, and negatively impact their overall quality of life [5, 6].

Stress responses include both physiological and psychological reactions, mediated by complex interactions involving the hypothalamic-pituitary-adrenal (HPA) axis, autonomic nervous system (ANS), metabolic processes, and immune functions [7]. The brain plays a central role in stress, initiating hormonal responses and bodily adaptations to manage stressful events [8]. Acute stress promotes adaptation and survival through responses involving neural, cardiovascular, autonomic, immune, and metabolic systems [9]. However, prolonged exposure to stressors is linked to severe consequences, such as sudden cardiac death (SCD), substance use disorders, and other long-term health complications [10]. Individual variability in stress responses challenges the development of accurate stress detection models. Person-independent models often have low accuracy, and individual-specific data collection may require extensive monitoring [11]. Addressing these challenges necessitates innovative approaches tailored to the needs of vulnerable populations.

Stress involves the body's physiological, neuroendocrine, behavioral, and emotional responses to new or threatening stimuli and is a natural defense response [1]. Chronic or severe stress, however, can induce psychological and pathological damage [1]. Chronic stress affects the risk of mild cognitive impairment and Alzheimer disease [2]. Evidence suggests that those with mild to moderate brain injuries or neurological illnesses typically exhibit extreme dysfunction and are extremely susceptible to chronic stressors during acute, subacute, and recovery phases [3]. A number of neuropsychiatric conditions like PTSD, major depressive disorder, anxiety, and schizophrenia are directly related to stress, and it also influences the onset and development of a range of neurological disorders, including neurodegenerative disorders [3].

This review explores current technologies and strategies for effective stress reduction, emphasizing the potential of personalized, evidence-based interventions to improve the quality of life for at-risk populations.

2. STRESS DETECTION TECHNOLOGIES

Stress and anxiety are virtually omnipresent in today's world, affecting almost every aspect of our daily lives [12]. Early detection will reduce the costs associated with the condition and prevent it from becoming chronic [13]. The aim of a stress detection system is to accurately detect stress, offer a cost-effective commercial solution, and operate under daily life conditions without negatively affecting the individual's life.

FIGURE 1 provides an overview of stress detection technologies, illustrating the integration of physiological sensors, data preprocessing techniques, and different classification methods. It highlights

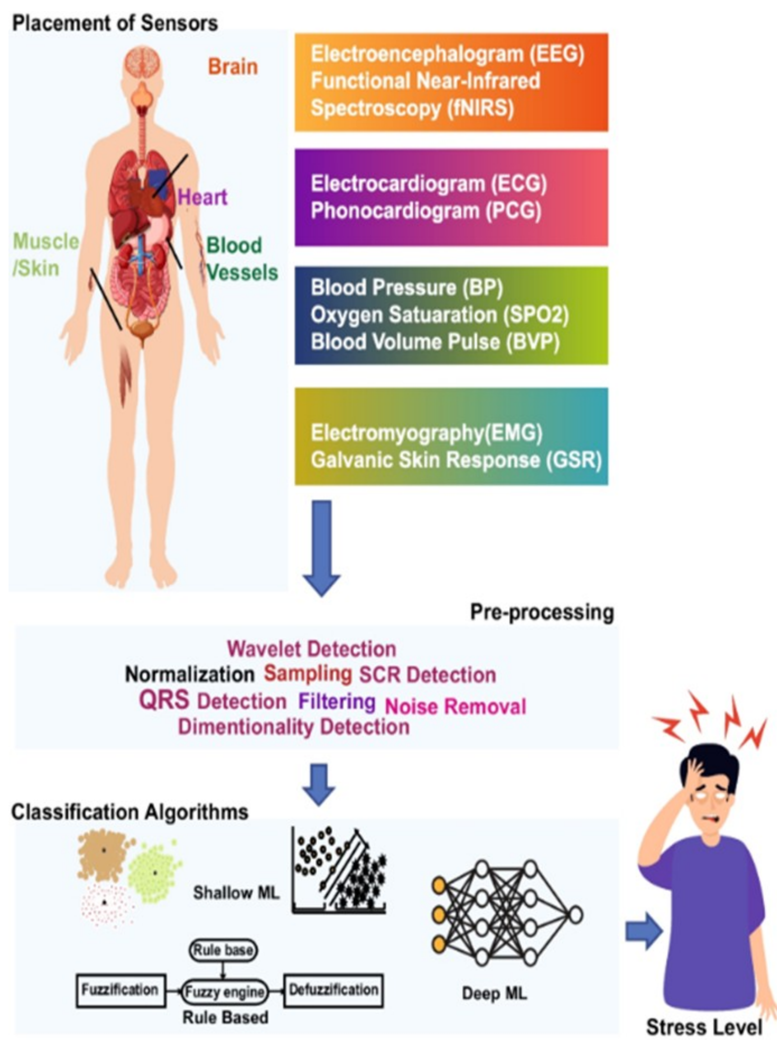

Figure 1: AI framework for stress prediction from multi-modal sensor data [14].

the placement of sensors on different body regions to capture relevant physiological signals, which are then processed using various techniques to enhance signal quality. The refined data is analyzed using different classification algorithms, to determine stress levels. This framework emphasizes the role of advanced signal processing and AI-driven classification in assessing and monitoring stress.

The study in [15], provides a comprehensive review of recent progress in stress detection, emphasizing both physiological and behavioral indicators. Stress, being a multifaceted phenomenon, manifests through various measurable factors that can be monitored using modern sensing technologies. TABLE 1 presents a summarized classification of these stress-related factors along with their corresponding measurement methods as discussed in [15].

Table 1: Stress factors and their measurements [15].

Stress Factors	Measurement Method
Biological Signal	• **Heart rate:** Heart rate rises during acute stress as the body demands more oxygen and faster carbon dioxide elimination, making it a key physiological stress indicator. • **Temperature:** Temperature, particularly skin temperature, is frequently used alongside other physiological measures for stress detection. Changes in skin temperature can also indicate the intensity of acute stress. • **Blood oxygen saturation:** Stress and anxiety can alter respiratory rate, which in turn affects blood oxygen saturation levels, making it a useful physiological marker for stress assessment. • **Blood pressure:** Blood pressure reactivity, often observed alongside other physiological changes, is consistently linked to stress responses. • **Brain activity:** The hypothalamus regulates stress responses via the autonomic nervous system, with brain activity measured through EEG (Electroencephalography) or NIR (Near-infrared)-based wearable devices. These signals reflect emotional and cognitive stress, enabling effective stress monitoring. • **Dermal and Muscle Activity:** Stress activates the sympathetic nervous system, leading to changes in skin conductance (measured via EDA (Electrodermal activity)) and increased muscle activity (measured via EMG (Electromyography)). These physiological responses serve as reliable indicators for assessing stress levels. • **Breathing rate:** Stress typically increases breathing rate, often resulting in shallow and rapid breaths. This change serves as a key physiological indicator of stress. • **Eye dynamics:** Stress activates the sympathetic system, causing pupil dilation—measured through pupillometry—as a response to cognitive or emotional load. Additional eye indicators like blinking, gaze, and movement can also aid in stress evaluation.
Physical Secretion-Biomarkers	• **Sweat:** Sweat, secreted mainly by eccrine and apocrine glands, contains stress-related biomarkers like cortisol and glucose. Wearable sensors enable real-time, non-invasive monitoring of these indicators for stress assessment.

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Table 1: Continued

Stress Factors	**Measurement Method**
	• **Tear:** Tear fluid, produced by lacrimal glands, includes electrolytes, proteins, and stress hormones like cortisol. Smart wearable devices (e.g., contact lenses) can track these markers, offering a promising method for emotional and stress monitoring. • **Saliva:** Saliva contains key stress biomarkers like α-amylase, cortisol, and glucose, making it a valuable non-invasive fluid for stress assessment. α-Amylase responds rapidly to stress via the autonomic nervous system, offering immediate detection compared to slower cortisol responses. • **Urine:** While more suited for chronic stress monitoring, urine can reflect stress-related biomarkers like glucose, which may correlate with blood levels. Wearable sensors originally developed for diabetes show promise in adapting urine analysis for stress detection. • **Interstitial fluid (ISF):** ISF, which shares similarities with blood plasma, holds potential for stress-related biomarker detection such as glucose and cortisol. Wearable, minimally invasive devices using microneedles or iontophoretic extraction are emerging for ISF sampling, offering promising advancements in stress monitoring.
Body Movements	• Stress, especially psychological or social stress, often triggers involuntary body movements such as tremors, muscle tension, or restlessness due to increased sympathetic nervous system activity. Wearable devices using accelerometers and gyroscopes can detect these subtle movements and postural changes, making them effective tools for identifying stress-related physical responses
Speech	• Speech production involves multiple organs coordinated by the brain, and stress can significantly alter vocal features such as tone, flow, and volume. These changes occur due to autonomic nervous system activation during speech and are useful for detecting stress
Body Posture	• Stress can alter posture, and conversely, poor posture can increase stress by affecting physical and physiological functions. Wearable technologies like smart clothes and motion sensors are used to monitor posture for stress evaluation.
Hand Tremor	• Hand tremors may indicate stress, among other causes such as anxiety, fatigue, or neurological conditions.Wearable devices like smartwatches with sensors and AI can detect tremors and support stress assessment when combined with bio signals and biomarkers.

To accurately detect and monitor stress levels, a wide range of stress detection technologies—both commercially and scientifically validated—have been developed. These technologies utilize various physiological and behavioral modalities to gather and interpret stress-related data from the human body. TABLE 2 outlines the principal stress detection technologies, their corresponding techniques, and the body measurement approaches as highlighted in [15].

Table 2: Stress detection technologies [15].

Method	Techniques
Optical	• **Photoplethysmography (PPG):** PPG is a noninvasive optical technique that uses LED light to measure heart rate, HRV, respiratory rate, and SpO2 by detecting blood volume changes. It is also being developed for continuous blood pressure monitoring using methods like PWTT, bioimpedance, and AI. • **Infrared (IR), Near IR (NIR) Spectroscopy (NIRS), Functional NIR Spectroscopy (fNIRS):** Infrared (IR) and near-infrared (NIR) light are used in wearable, noninvasive devices to measure oxygen saturation (pulse oximetry), skin temperature (IRT/IRTM), and brain activity (fNIRS), aiding in stress and cognitive assessments. • **Visual Observation – Imaging:** Visual observation using cameras (e.g., CCD or CMOS sensors) can detect health indicators such as eye movements, skin color changes, and facial cues. Wearable devices with AI-powered facial recognition and imaging (thermal, hyperspectral, broadband) have been used for emotional and cognitive stress detection.
Electrical	• **Electroencephalography (EEG):** EEG is a noninvasive method that records brain activity from the scalp and is used to monitor conditions like epilepsy and sleep disorders. It detects brain waves (e.g., Beta waves linked to stress and alertness). EEG, especially when combined with other metrics like HRV and EDA, is widely used to detect stress. Wearable EEG devices are increasingly used for real-time stress monitoring in daily and work environments. • **Electrocardiography (ECG):** An electrocardiogram (ECG) records the heart's electrical activity over time and displays characteristic waveforms. It helps diagnose conditions like arrhythmias and tachycardia. Key metrics such as heart rate (HR) and heart rate variability (HRV) can be derived from ECG data and are widely linked to stress detection. Many wearable devices now offer ECG functionality, some with medical-grade accuracy. • **Skin Conductance Response (SCR) – Galvanic Skin Response (GSR):** Skin conductance increases with psychological or physiological arousal and is measured using two electrodes. Stress is detected by analyzing changes in conductance—distinguishing baseline (tonic) from rapid (phasic) responses. This method is often combined with EEG or ECG for more accurate stress assessment. • **Electromyography (EMG):** EMG records electrical signals from muscles and neurons to detect abnormalities. It is used to assess stress, with the trapezius muscle often serving as an indicator. EMG is commonly combined with methods like EEG, ECG, or HRV for enhanced stress detection. • **Bio-Impedance:** It measures the body's resistance to electrical current, useful for assessing body composition and blood flow. Techniques like EIS enable cuffless blood pressure estimation via cardiac pulse volume and PTT. Wearables (e.g., patches, watches) use bioimpedance to monitor cardiac output and blood pressure, aiding indirect stress evaluation.

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Table 2: Continued

Stress Factors	Measurement Method
Electromechanical	• Electromechanical sensors in wearables convert motion into electrical signals to monitor posture, tremors, and heart activity. Using BCG (Ballistocardiogram) and SCG(Seismocardiogram), they help estimate heart rate and cuffless blood pressure via body vibrations, typically measured at the chest or wrist.
Biochemical - Electrochemical	• Biochemical biomarkers—such as sweat, saliva, and VOCs—can indicate stress through hormones and metabolites. Wearable biochemical-electrochemical sensors convert these signals into electrical data, enabling noninvasive, real-time stress monitoring with wireless transmission.
Bio-Kinetic	• Movement analysis using accelerometers and gyroscopes is a recent method for stress detection. Hand tremors, changes in typing rhythm, and nervous body movements can all indicate stress.

3. REVIEW OF STRESS REDUCTION TECHNIQUES

Stress can be relieved by many different techniques, from listening to music, to engaging in mindfulness activities. Some of the techniques have been reviewed and briefed in the following section.

3.1 Walking

Daily exposure to various stressors often prompts individuals to seek effective coping mechanisms and relaxation techniques. Nature-based experiences have gained attention for their calming effects and therapeutic benefits [16].

Sensory elements in green spaces elicit positive psychophysiological responses, contributing to mental restoration and stress reduction [17]. Walking, particularly in natural environments, is increasingly recognized as a highly effective stress-relief strategy with both physiological and psychological benefits. Regular walking has been shown to reduce stress, alleviate anxiety and depressive symptoms, lower cortisol levels, enhance endorphin production, and improve overall mood. Nature walks offer additional advantages by promoting mindfulness and fostering a connection to the environment, further enhancing emotional well-being. Group walks amplify these benefits by integrating social support, reducing isolation, and building resilience [18–20].

Physical exercise, including walking in natural settings, is also being advocated as an innovative approach to mental illness prevention and overall health promotion. Evidence suggests that physical activity can improve cognitive function, elevate mood, and reduce symptoms of depression and anxiety, making it an effective strategy for enhancing mental health [21].

3.2 Yoga

Yoga is widely recognized as a holistic and effective approach to stress management, offering physical, mental, and emotional benefits. Studies have consistently demonstrated its ability to reduce stress significantly across diverse populations [22]. As the most widely utilized intervention in complementary medicine, yoga is increasingly popular for its therapeutic potential. Complementary medicine encompasses treatments used alongside standard medical practices but not classified as conventional [23].

The psychological benefits of yoga have been well-documented, showing effectiveness in addressing depression, anxiety, and self-efficacy. A 2004 systematic review explored yoga's role in treating anxiety and anxiety disorders, affirming its positive impact [24]. Another comprehensive review analyzed 12 studies examining yoga and yoga-based interventions for stress management and remission, covering various practices such as Hatha, Bikram, Kundalini, Sudarshan Kriya, Kripalu, and Yin yoga [24].

Mind–body interventions like yoga are particularly beneficial for stress-related mental and physical challenges, promoting relaxation and reducing anxiety and stress levels [25].

3.3 Breathing Exercises

Breathing exercises are highly effective for stress reduction, utilizing controlled patterns to regulate the autonomic nervous system and enhance psychological well-being. Techniques such as diaphragmatic breathing and paced breathing are particularly effective in lowering heart rate and blood pressure, fostering relaxation and calmness. For instance, cyclic sighing, which focuses on extended exhalations, has shown greater stress reduction benefits than mindfulness meditation, making it a fast and efficient intervention [26].

Research suggests that deep breathing influences interoceptive signaling pathways, reducing anxiety by balancing sympathetic and parasympathetic activities [27]. Techniques like alternate nostril breathing and breath awareness are also proven to manage anxiety and improve mood, although their effectiveness may depend on the specific method and individual familiarity [28]. Slow-paced breathing activates the parasympathetic nervous system and enhances HRV (Heart Rate Variability), a key marker of physiological resilience. This practice improves the body's ability to react to stress, offering both immediate and long-term benefits. In contrast, uncontrolled rapid breathing is often associated with heightened stress and anxiety, while slow-paced techniques are linked to relaxation and overall well-being [29].

3.4 Music Therapy

Music, as a collection of sounds, profoundly impacts mood, emotions, stress levels, health, and physical activity. It has become an increasingly significant tool in medical treatments, particularly in addressing mental health challenges. Music therapy, supported by technologies such as data mining and robotic assistance, is evolving rapidly. By monitoring metrics like blood pressure, stress levels can be assessed and alleviated through targeted music interventions. Studies reveal that specific musical compositions, including Indian ragas, can influence physiological parameters, such as heart rate, promoting relaxation and stress reduction [30, 31].

Research highlights that listening to music enhances alpha brainwave activity, which is associated with relaxation and stress relief. These findings underscore the therapeutic potential of music in inducing a state of calm and improving overall well-being [6, 32, 33].

3.5 Hugging a Pillow

A paper derived, among the five methods it experimented on, i.e., alpha music, bubble wrap popping, watch a video, stress ball and hugging a pillow that hugging a pillow is used to be the most stress-relief method amongst the five methods [34, 35].

3.6 Mindfulness-Based Stress Reduction (MBSR)

Reviewed findings consistently demonstrated that MBSR significantly reduced stress levels compared to no treatment (waiting list) in healthy individuals, indicating a notable nonspecific effect. Additionally, our results suggest that MBSR may also have a distinct specific effect, as evidenced by a study comparing MBSR to a structurally equivalent nonspecific treatment. This comparison controlled for factors such as instructor attention, session frequency and duration, and course format, highlighting the unique benefits of MBSR beyond general therapeutic engagement[36].

3.7 Social Engagement

Social support is strongly associated with healthier “biological profiles” across systems linked to disease prevention, as supported by epidemiological evidence. Emerging research highlights immune-mediated inflammatory processes as key integrative physiological mechanisms linking social support to improved health outcomes [37].

The biological benefits of social engagement are rooted in the activation of the parasympathetic nervous system, which triggers a “relaxation response.” This response mitigates the “fight or flight” state, leading to reductions in heart rate, blood pressure, and respiratory rate, thereby alleviating stress [38].

Group activities such as volunteering, sports, and community events enhance feelings of purpose and self-worth, further buffering daily stressors [39]. Workplace social engagement programs have been found to improve job satisfaction, mental health, and reduce burnout among employees [40]. Social engagement offers an effective, low-cost strategy for stress management by fostering emotional support, strengthening interpersonal connections, and promoting relaxation. It is effective across various settings, including face-to-face interactions and digital platforms, with positive impacts on family dynamics, community involvement, and workplace environments.

4. REVIEWS OF SOME EXISTING TECHNOLOGIES IN STRESS MANAGEMENT

Stress management helps in adapting to stress and reduce its negative impact on health. Some of the work done related to stress management has been reviewed below.

4.1 SKINTRONICS [41]

This paper presents SKINTRONICS, a wearable, wireless, and stretchable device designed for real-time stress monitoring and management during daily activities. It continuously measures skin temperature and GSR (Galvanic Skin Response) using skin-conformal nanomembrane electrodes and wireless circuits placed on the inner wrist, reducing motion artifacts and enhancing comfort. Built with standard microfabrication and soft-material packaging techniques, SKINTRONICS offers high signal-to-noise ratio, mechanical durability, breathability, and long-term reliability. Its accuracy has been validated against a clinical-grade device. However, initial testing was limited to two healthy volunteers, indicating the need for broader population studies.

4.2 SaYoPillow [42]

SaYoPillow is a smart, fully automated, and non-intrusive pillow designed to enhance sleep quality and comfort without manual input. It monitors the connection between stress and sleep, aiming to reduce stress through real-time interventions such as adjusting room temperature, dimming lights after 15 minutes, and playing soothing music via smart device integration. While effective in promoting relaxation, the system faces limitations, including hardware constraints for real-time processing, cybersecurity concerns, and potential user reluctance. Its measurement accuracy is also influenced by external factors.

4.3 CortiWatch [43]

CortiWatch is a smartwatch-like device designed to monitor cortisol levels in real time through passive eccrine sweat collection. It detects cortisol within physiologically relevant ranges, requiring only minimal sweat and incorporating a design that prevents sample evaporation. The sensor is disposable yet reusable, making it suitable for daily self-monitoring and proactive stress management. However, the system has limitations, including the need for frequent recalibration, variability in sweat production across users, and sensitivity to environmental factors like temperature and humidity. Additionally, the 9-hour reading cycle limits responsiveness to rapid cortisol fluctuations, raising concerns about cost, sustainability, and real-time accuracy.

4.4 SELF-CARE [44]

SELF-CARE is a context-aware analysis technique designed for wearable health sensors to improve stress classification through adaptive sensor fusion. It adjusts noise detection based on sensor placement—using accelerometer data for wrist-worn devices and EMG for chest-worn ones—to enhance accuracy. The system employs a late fusion approach, combining multiple machine learning outputs with a Kalman filter to factor in temporal dynamics. While effective, SELF-CARE depends on sensor quality and placement, and is sensitive to motion artifacts and environmental noise. It also faces challenges with real-world applicability, power consumption, and computational demands for continuous monitoring.

5. PROPOSED WORK

Based on the gaps identified in the reviewed literature—particularly the lack of real-time, elderly-friendly, multi-sensor solutions—this section proposes a practical and personalized system tailored for older adults in care facilities.

Despite recent advancements, most existing wearable devices focus primarily on heart rate monitoring and often overlook other important physiological indicators such as skin conductance, body temperature, heart rate variability, and motion patterns. Additionally, many commercially available stress-relief applications offer generalized interventions with interfaces that are not user-friendly for elderly individuals, limiting adoption and long-term effectiveness.

To address these limitations, we propose an IoT (Internet of Things) -based wearable device that integrates multiple physiological sensors to detect stress in real time and deliver tailored interventions. The overall layout of the system is presented in FIGURE 2, which illustrates the device's architecture, including sensor integration, data processing via cloud, and a feedback-based intervention mechanism.

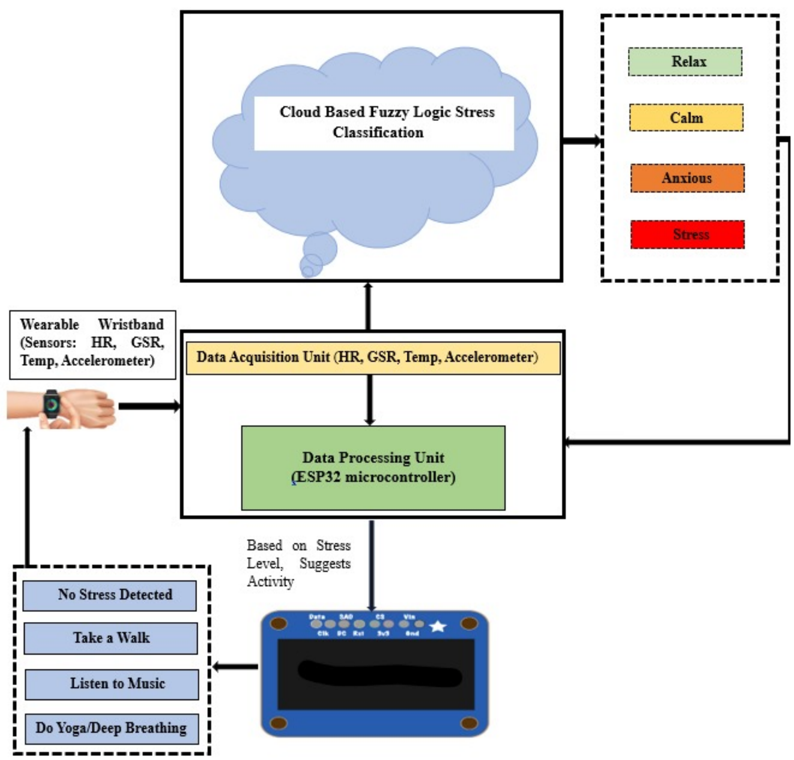

Figure 2: System Architecture for Stress Detection and Management Device.

The device is built around a compact ESP32 microcontroller, which collects data from the following sensors:

- GSR sensor to monitor changes in skin conductance related to perspiration.
- Temperature sensor to track body temperature fluctuations.
- HRV sensor to evaluate variability in heart rhythm.
- Accelerometer and gyroscope to detect motion or restlessness.

The collected data is securely transmitted from the ESP32 to the cloud using end-to-end encryption, ensuring that it remains protected during transmission and inaccessible to unauthorized parties. This approach helps safeguard user privacy and reduces the risk of data being intercepted or misused. Utilizing cloud infrastructure enables more advanced processing, long-term trend analysis, and the ongoing refinement of decision-making strategies, allowing the system to adapt more effectively to individual user needs over time. Furthermore, cloud integration enables the display of critical data and key insights on the dashboard of doctors or other stakeholders, facilitating monitoring and timely action.

These physiological signals are transmitted securely to a cloud server, where they are analyzed using a Fuzzy Inference System (FIS)—a core component of the stress detection process. Unlike traditional systems that rely on strict numerical thresholds, the FIS mimics human-like reasoning, making it capable of interpreting ambiguous or overlapping physiological data, which is especially relevant for elderly users whose baseline readings can vary largely due to age or health conditions.

The FIS operates in three stages: fuzzification, rule evaluation, and defuzzification, as illustrated in FIGURE 3. In the fuzzification stage, crisp sensor inputs (e.g., HRV, GSR, temperature and motion) are converted into qualitative categories such as low, medium, high, and very high. These categories reflect intuitive interpretations rather than fixed values, allowing more flexible decision-making.

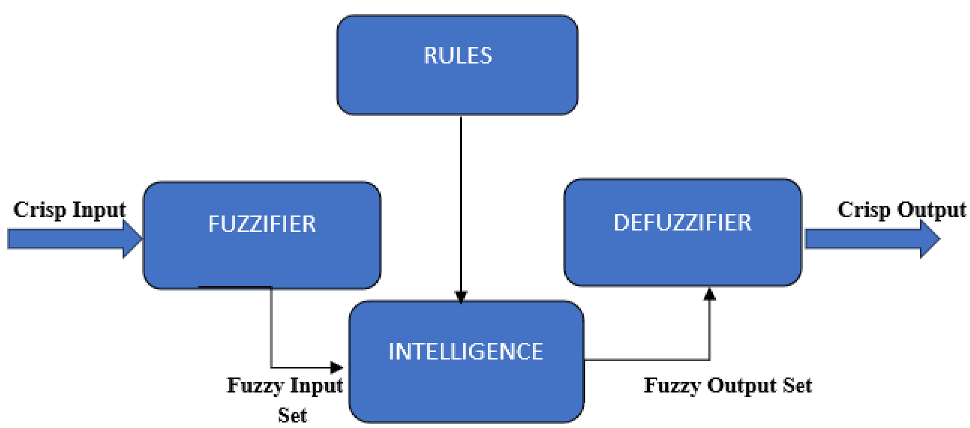

Figure 3: Fuzzy inference System.

During the rule evaluation stage, a set of if–then rules is applied to assess the combination of input values. For example, if the user is physically still, but the heart rate is high, GSR is very high, and temperature is low, the system infers a case of psychological stress. In contrast, if motion is detected with a high heart rate, but GSR and temperature remain within medium levels, the system is likely to classify the condition as physical activity, not emotional stress.

In the defuzzification stage, the fuzzy outcomes are translated into one of four crisp classifications: relaxed, calm, anxious, or stressed. This output determines the appropriate intervention strategy.

Once a stress level is classified—into one of four categories: relaxed, calm, anxious, or stressed—the device responds with suitable, non-intrusive interventions. These are displayed on a simple OLED screen and may include visual relaxation cues, calming music, or guided breathing instructions. The system is designed for ease of use, requiring no interaction from the user beyond wearing the device.

To ensure effectiveness, a timer manages the duration of each activity, while a feedback loop re-evaluates the user's stress state after the intervention. This adaptive feature helps personalize future responses and makes the system more responsive over time.

The overall operation—from sensing to analysis to intervention and feedback—is illustrated in FIGURE 4, which presents the flow of information through each stage of the stress management cycle. This structured, closed-loop approach aims to create a reliable, comfortable, and intelligent companion for elderly users in the need of stress monitoring and relief.

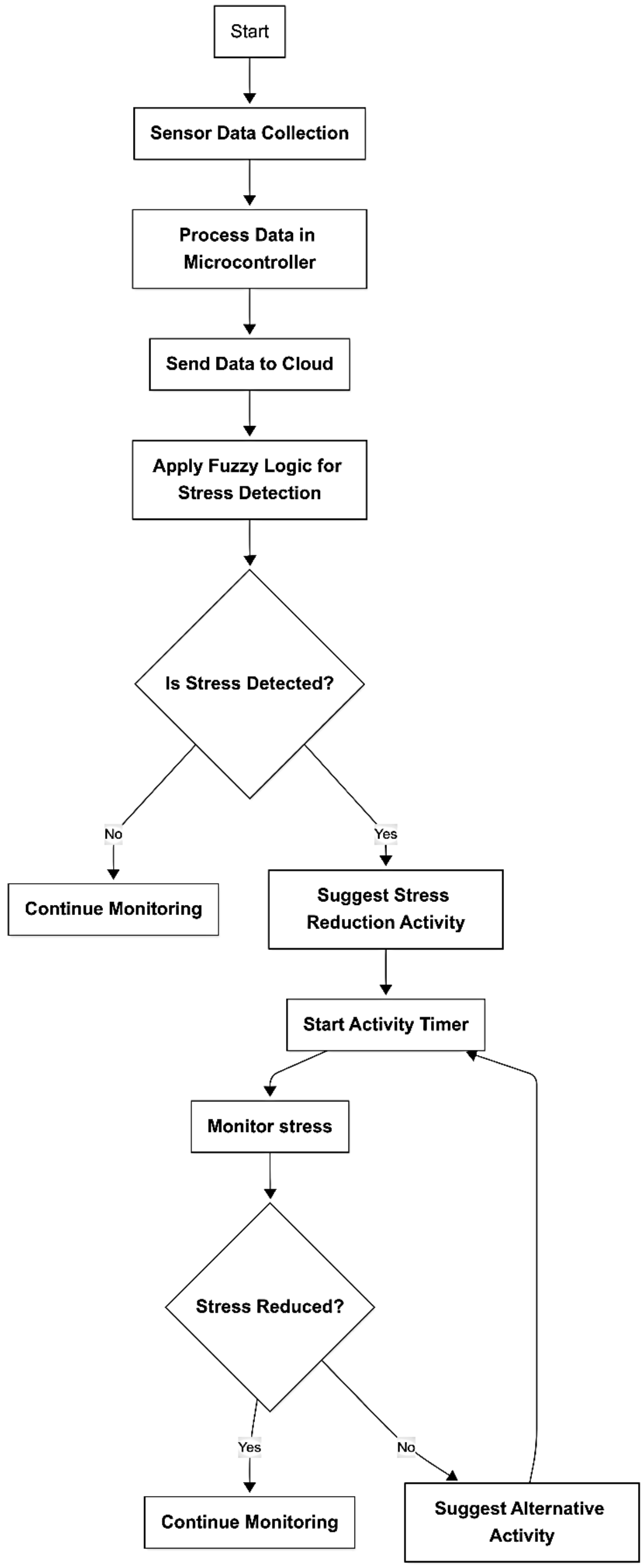

Figure 4: Flowchart of Proposed Stress Detection and Management System.

6. CONCLUSION

The use of automated stress analysis combined with real-time monitoring from advanced sensors in wearable devices has transformed how stress is diagnosed, monitored, and treated. Even though enhanced technologies including EEG, PPG, GSR, and motion sensors are aimed at improving accuracy, some of the existing gaps, such as high computation requirements, issues with data privacy, and a lack of focus on elderly care facilities, are still prevalent. To fill these gaps this paper proposes an IoT-based wristband for residents of old age home that combines stress detection with guided meditation, breathing exercises, and music therapy. In subsequent activities, the focus will be on personalization, ease of use, and algorithm modifications that permit practical assistance with stress in the residents of old age home.

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