Photovoltaic Powered Automated Health Monitoring System

Mrs.K.Deepthi[1],Mrs.A.Aruna[2],P. Prudhvi Raju[3],R. Sadhvika[4], B.Uday kiran[5],I. Siva Koushik[6]
[1, 2]Assistant Professor, Dept of Electronics and Communication Engineering
[3, 4, 5, 6]Dept of Electronics and Communication Engineering
[1, 2, 3, 4, 5, 6] Gayatri Vidya Parishad College for Degree and PG Courses(A), Visakhapatnam, Andhra Pradesh, India

Abstract- *With the increasing need for effective healthcare solutions for the elderly, real-time health monitoring has become essential. Existing home-based healthcare systems often face limitations such as power dependency and restricted monitoring capabilities. This paper proposes the design and implementation of an Arduino-based health monitoring system that measures key health parametersheart rate, body temperature, and oxygen saturation (SpO2). To ensure uninterrupted operation, the system incorporates a solar panel for continuous power supply, making it suitable for remote and off-grid areas. The collected data can be displayed on an integrated screen or transmitted to a mobile application, enabling real-time monitoring by caregivers and healthcare professionals. By providing continuous health tracking, this system aims to improve elderly healthcare, facilitate early detection of health issues, and reduce the need for frequent hospital visits.*

Keywords- Arduino Mega(2560), Spo2(peripheral cap-Illary oxygen saturation) .

I. INTRODUCTION

Taking care of elderly people is becoming more important as their number is increasing. Many of them find it hard to visit hospitals regularly due to problems like difficulty in moving, high medical costs, or the lack of someone to help them. Because of this, a system that can check their health from home is needed. This project presents a health monitoring system using Arduino, which can measure important body details heart rate, body temperature, and oxygen level (SpO2). These details help in knowing a person's health condition and detecting healthA special feature of this system is its solar-powered operation, which keeps it running without interruptions, even in places where electricity is not always available. The system has an LCD display that shows the health readings, and the data can also be sent to a mobile application so that doctors and caregivers can check the health status from anywhere. This helps in quick medical attention and reduces emergencies.

II. EXISTING AND PROPOSED SYSTEM

The earlier system for checking health could only measure body temperature and heart rate. While these details are important, they do not give a full picture of a person's health. If someone had other health problems, this system would not be able to detect them early. Another issue with the earlier system was that it depended only on direct electricity. If there was a power cut, the system would stop working, making it unreliable in many situations The improved system adds more features to check a person's overall health in a better way. It can now measure oxygen levels (SpO2). A pulse oximeter sensor helps in checking oxygen levels in the blood, which is important for detecting breathing problems. To make sure the system works all the time, a solar **panel** with a battery is used as a powersource.

A. Solar panel

A 12V solar panel is used to change sunlight into power, which helps run different devices. It has many small units that take in sunlight and turn it into electricity. This type of panel is useful for charging batteries and giving power to systems that need 12V to work. It is often used in homes, outdoor setups, and small machines that need steady power without depending on direct electricity. When connected with a battery, it stores energy so that devices can work even when there is no sunlight.

B. MLX90614 Sensor

The MLX90614 is a sensor that can measure temperature without touching the object. It works by detecting infrared rays coming from a surface and converting them into a temperature reading. This sensor has a built-in processor that processes the data and sends it to a microcontroller. It is commonly used in health monitoring systems to measure body temperature and can also be used in industrial and environmental applications. The sensor gives accurate readings and works well even from a distance.

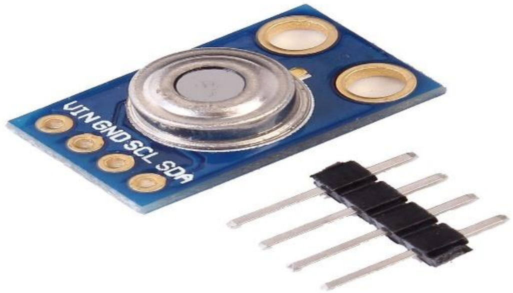

Fig.1.DiagramofMLX90614 Sensor

C. MAX30102 Sensor

The MAX30102 is a sensor that helps measure the amount of oxygen in the blood and the rate at which the heart beats. It does this by shining light through the skin and checking how much light is absorbed. The sensor has small lights and detectors that work together to get the readings. It is often used in health devices to track oxygen levels and heart activity. The sensor is small, works with little power, and gives quick results, making it useful for wearable health systems.

Fig.2.Daigram of MAX30102 Sensor

III. SCHEMATICDIA GRAM ANDRESULTS

A.SchematicDigram

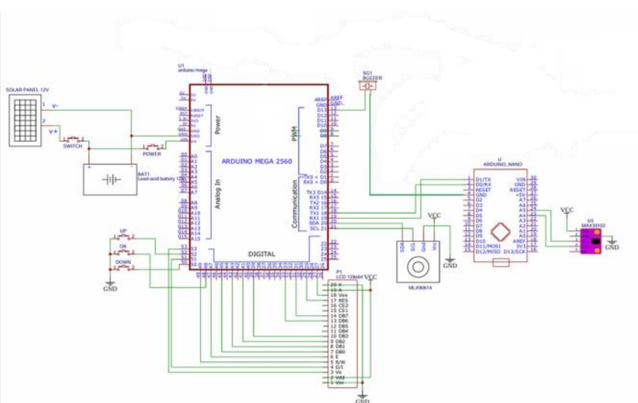

Fig.3.Schematicof health monitoring system

The setup consists of a main board that processes information from different parts, including a heart rate and oxygen sensor, a temperature sensor, and weight sensors. A power system using a solar panel and a rechargeable battery ensures it keeps running without interruption. The height measurement is done using a sensor that calculates distance. The collected data is displayed on a screen, allowing users to see their health readings in real-time. The system also includes buttons to navigate and confirm choices. All components work together to provide health tracking in a simple and automated way.

B. Results

Fig.4.Outputs Health Monitoring System

The image focuses on a bright screen with numbers that tell about the body's inner state. The top number shows how much air is in the blood. The middle number shows how fast the heart moves. The last number shows the skin's warmth. A hand is pressing a small part next to the screen. This touch is likely making the system collect the body's details. Below the screen, there are small round parts, which is used to change settings

Fig.5.Outputs of health monitoring system

The setup captures key body readings using a stand-alone structure. A person stands under the frame while sensors collect details. The system takes values like height, weight, air level in blood, heart movement speed, and body warmth. A small screen shows these numbers in real time. A touch-based part allows the system to collect extra details when pressed. The buttons below the screen might help with adjusting or resetting the readings. The setup works without large tools, making it easy for quick body checks.

Fig.6.Outputsof Health Monitoring System

The setup in the first capture demonstrates an embedded framework designed for real-time evaluation of physiological metrics. The system integrates sensing modules interfaced with a microcontroller unit, responsible for data acquisition and processing.The second capture focuses on a closer view of the device, where a screen displays values related to weight, height, and other physical details. A fingertip is pressed against a sensor, possibly collecting data for analysis. The setup appears to be an automated system for checking health indicators as show in figure9.

IV. VISUALIZAT

A. Body Mass Index

The image focuses on a bright screen with numbers that tell about the body's inner state. The top number shows how much air is in the blood. The middle number shows how fast the heart moves. The last number shows the skin's warmth.A hand is pressing a small part next to the screen. This touch is likely making the system collect the body's details. Below the screen, there are small round parts, which is used to change settings.

Fig.8.Outputs of health monitoring system

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IV. VISUALIZATION, AND ANALYTICS

A. Body Mass Index

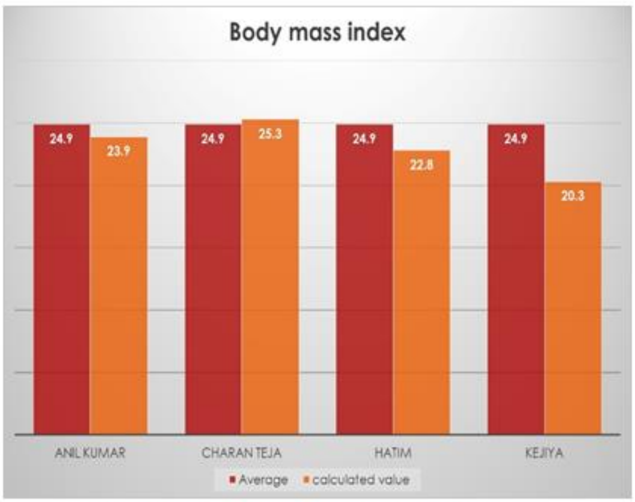

Fig.9. Comparison of Body Mass Readings

The image shows a bar chart with body mass readings for four individuals. Two types of values are displayed: a standard value and a measured value. The standard value remains the same for all, while the measured value changes for each person.as shown in figure 11.

B. Body Fat Percentage

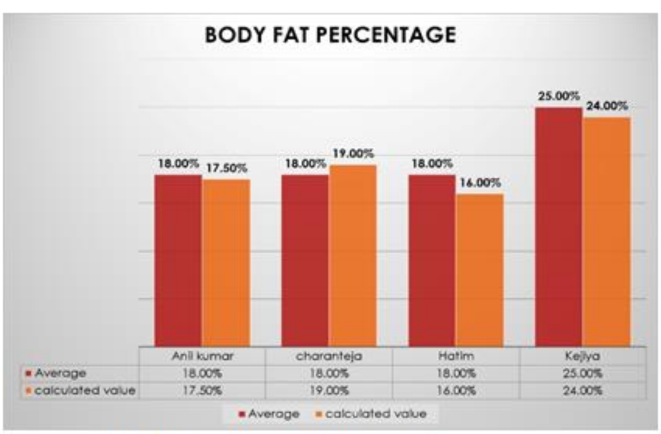

Fig.10.Comparison of body fat percentage

The figure represents a bar chart displaying body fat values for four individuals. Two sets of values are shown a common value and a measured value. The common value stays fixed for all, while the measured value varies for each person.

C. Body Temperature

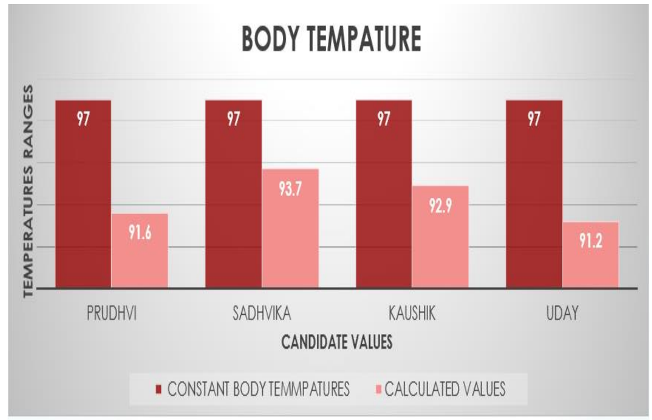

Fig.11.Comparison of Body Warmth Readings

The figure represents a bar chart comparing body warmth levels for four individuals. Two sets of values are displayed: a fixed value and a recorded value. The fixed value remains unchanged at 97 for all individuals, while the recorded values vary.This comparison helps in understanding differences in body warmth levels among individuals. The data can be useful in tracking changes due to external conditions, personal health, or other influencing factors. The setup provides an easy way to monitor such readings for health assessments and general well-being checks.

D.Heart Beat

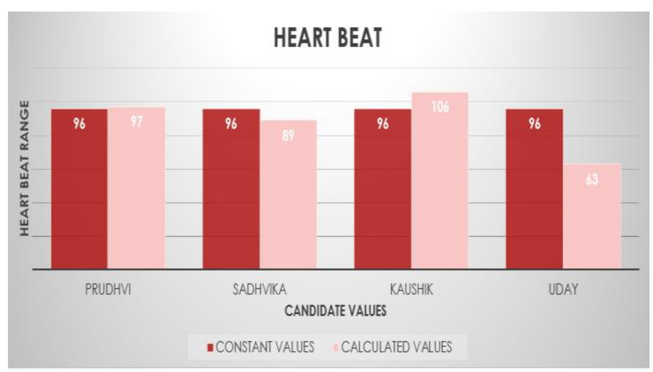

Fig.12.Comparison of Body Warmth Readings

Figure presents a bar chart showing a comparison between fixed and recorded heartbeat values for four individuals. The fixed value is consistent at 96 beats per unit time, while the recorded values vary for each person.This comparison helps in understanding variations in heartbeat patterns among individuals. Such readings can be useful for identifying irregularities, assessing overall wellness, and analyzing physical conditions under different circumstances. The data can also contribute to tracking changes over time and detecting unusual fluctuations.

E.SpO2

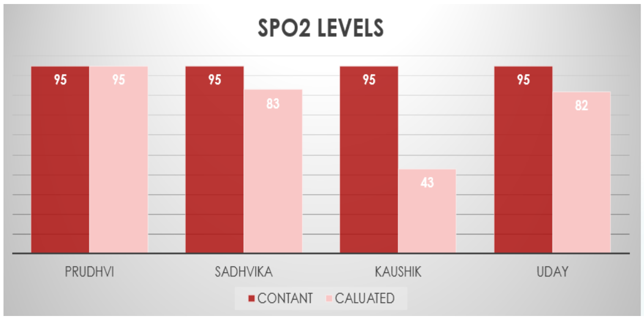

Fig.13.Comparison of Oxygen Saturation Levels

The Figure illustrates a bar chart representing the comparison between fixed and recorded SpO2 (oxygen saturation) values for four individuals. The fixed value is set at 95 for all, while the recorded values show variation. This comparison highlights the fluctuations in oxygen levels among individuals. Such variations can be significant in assessing overall wellness, identifying potential concerns, and monitoring physical conditions.

TABLEI. Comparison Body Temperature Ranges

NAMES	CONSTANT VALUES		CALCULATED VALUES	CLASSIFICATION	DESCRIPTION
	MIN	MAX			
PRUDHVI	< 95°F		91.6	Hypothermia	Dangerously low; can lead to organ failure if untreated
SADHVIKA	95°F	97°F	93.7	Hypothermia	Dangerously low; can lead to organ failure if untreated
KAUSHIK	97°F	99°F	92.9	Hypothermia	Dangerously low; can lead to organ failure if untreated
UDAY	100.5°F	104.5°F	91.2	Hypothermia	Dangerously low; can lead to organ failure if untreated

TABLEII. Comparison Heart Beat Ranges

NAMES	CONSTANT VALUES		CALCULATED VALUES	CLASSIFICATION	DESCRIPTION
	MIN	MAX			
PRUDHVI	Below 60 bpm	-	97	Normal (Resting HR)	Healthy range for most adults at rest
SADHVIKA	60	100	89	Normal (Resting HR)	Healthy range for most adults at rest
KAUSHIK	101	120	106	Mild Tachycardia	Elevated HR; could be due to stress, fever, or dehydration
UDAY	-	Above 120 bpm	63	Normal (Resting HR)	Healthy range for most adults at rest

TABLEIII. ComparisonSpO2 Ranges

NAMES	CONSTANT VALUES		CALCULATED VALUES	CLASSIFICATION	DESCRIPTION
	MIN	MAX			
PRUDHVI	95	100	95	Normal	Healthy oxygen levels; no concern
SADHVIKA	91	94	83	Severe Hypoxemia	Emergency situation; requires immediate oxygen or hospital care
KAUSHIK	86	90	43	Severe Hypoxemia	Emergency situation; requires immediate oxygen or hospital care
UDAY	< 85	-	82	Severe Hypoxemia	Emergency situation; requires immediate oxygen or hospital care

V. CONCLUSION AND FUTURESCOPE

The developed system effectively integrates multiple sensors and microcontrollers to enable real-time data collection and processing for various applications. By combining an ultrasonic sensor, load cells, a temperature sensor, and a pulse oximeter with Arduino Mega 2560 and Arduino Nano, the system ensures accurate measurements and efficient communication. This setup enhances monitoring capabilities in areas such as health tracking, load measurement, and environmental sensing. Future improvements can focus on adding wireless connectivity for remote access, incorporating intelligent data analysis for predictive insights, optimizing power consumption for longer operation, and expanding sensor compatibility to increase its scope in industrial automation, healthcare, and smart systems.

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