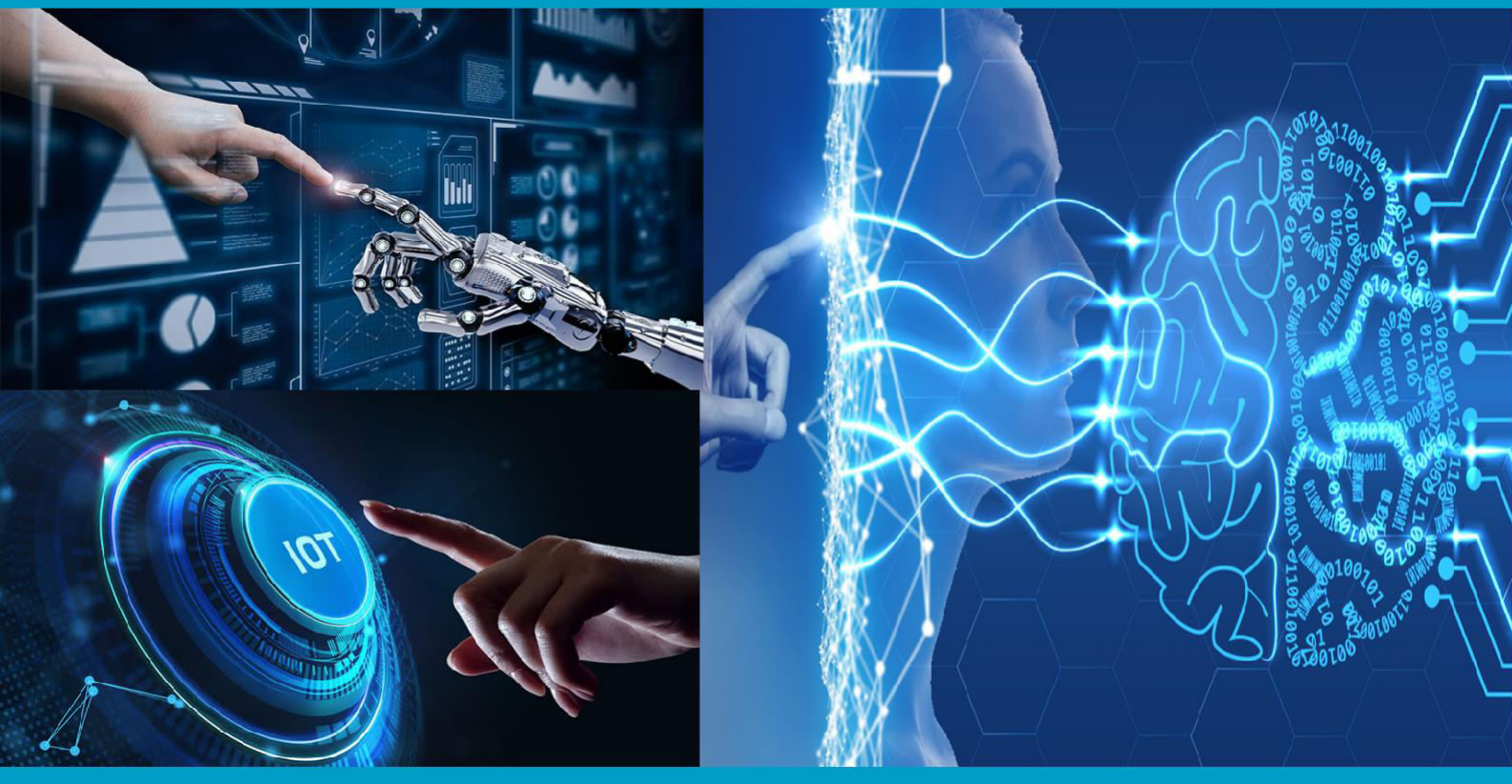
IJMRSETM

e-ISSN: 2395 - 7639



INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH

IN SCIENCE, ENGINEERING, TECHNOLOGY AND MANAGEMENT

Volume 10, Issue 4, April 2023

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 7.580

International Journal of Multidisciplinary Research in Science, Engineering, Technology & Management (IJMRSETM)

| ISSN: 2395-7639 | www.ijmrsetm.com | Impact Factor: 7.580| A Monthly Double-Blind Peer Reviewed Journal |

| Volume 10, Issue 4, April 2023 |

| DOI: 10.15680/IJMRSETM.2023.1004036

Smart Health Monitoring Room For Elderly People

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ABSTRACT: Physical or cognitive difficulties are becoming more prevalent among the elderly, especially following the introduction of the novel Corona virus. Using wearable medical sensors, modern communication and information technologies, smart homes enable remote monitoring of elderly health and wellbeing. Using this approach, users will enjoy more home-centric health care, an active and healthy aging process that is sustainable. This system is characterized by the alarm generation mechanism and the system for sending notification alerts if any health parameter crosses a threshold value. IOT-based health monitoring rooms for the elderly and disabled provide an efficient environment that encourages a better quality of life for them, increasing life expectancy and health care quality.

KEYWORDS: Home-centric healthcare, healthy ageing, wearable medical sensors, Smart homes

I. INTRODUCTION

India is third in the world in terms of highest number of COVID death cases due to late diagnosis and report to hospitals during the pandemic. Also, the pandemic had a huge impact on the elderly population over 65 years of age out of which, around 14-20% of the elderly citizens receive poor or no proper healthcare facilities. The effects of the pandemic could have been reduced to a minimum level if we had a proper and regular healthcare system backed up by IoT. A smart IOT based health monitoring room for elderly and disabled provides an efficient surrounding which promotes a better living condition which is expected to offer a secure and easy living condition and improves life expectancy and healthcare. Using wearable medical sensors, modern communication and information technologies, smart homes enable remote monitoring of elderly health and wellbeing, providing them a sense of independence even if they are physically or cognitively incapable. Avoiding diseases and encouraging healthy living is also a prime concern. IOT is a step forward in helping elderly complete these activities without physical presence of a caretaker, which also helps in minimizing their expenses. This will also help the caretaker to monitor and assist multiple elderly patients from a remote location using a smart phone. This paper explores the design, development and potential impact of the smart health monitoring room for elderly people.

II. LITERATUREREVIEW

[1] Dr. N. Dhanasekar “Smart Health Monitoring System using IoT: A Literature Review" research paper, International journal of Engineering Research & Technology (IJERT), ISSN: 2278- 0181, Year: 2018:
Description: This paper gives us the system that monitoring patient health by using heart beat sensor, blood pressure sensor, temperature sensor, glucose meter and humidity sensor. By this we can easily provide alert from users or patients critical condition send to the doctor at real time over internet. In the patient monitoring system based on Internet of things project, the real-time parameters of patients health are sent to cloud using Internet connectivity. These parameters are sent to a remote Internet location so that user can view these details from anywhere in the world. In IOT based system, details of the patient health can be seen by many users. The reason behind this is that the data needs to be monitored by visiting a website or URL. Whereas, in GSM based patient monitoring, the health parameters are sent using GSM via SMS.

[2] Md. Milon Islam, Ashikur Rahman & Md. Rashedul Islam "Development of Smart Health Monitoring Environment in IoT" European Journal of Molecular & Clinical Medicine, 1(3):185, 26 May 2020
Description: This paper proposes a smart healthcare system in IoT environment that can monitor a patient’s basic health signs as well as the room condition where the patients are now in real-time. In this system, five sensors are used to capture the data from hospital environment named heart beat sensor, body temperature sensor, room temperature sensor, CO sensor, and CO2 sensor. The error percentage of the developed scheme is within a certain limit (<5%) for each case. The condition of the patients is conveyed via a portal to medical staff, where they can process and analyze

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the current situation of the patients. The developed prototype is well suited for healthcare monitoring that is proved by the effectiveness of the system.

[3] Arti Pandit Marbade and Dr. R.M Deshmukh "IoT Based Smart Health Monitoring System for ICU Patients" International Journal of Advanced Research in Science, Communication and Technology (IJARSCT) Volume 2, Issue 3, May 2022.
Description: This paper proposes a model of IoT based health care taking prime importance on critical and elderly patients, as they should be monitored periodically, especially after the Covid pandemic. So, they propose an innovatory, revolutionary and cost-effective system which automates the monitoring of all the vital parameters of health like Blood Pressure, Blood oxygen level, body temperature, heart rate, room temperature, room humidity, level measurement in urine bag, ECG. The equipment uses a smart webserver to track patient health using this tracking system. In this project, an IoT-based patient health monitoring system using Node MCU ESP32 is presented. It can measure Heart Rate/Pulse (BPM) as well as Blood Oxygen Level (SpO2) using the MAX30100 /102 pulse oximeter sensor. Using a DHT11 Humidity and Temperature sensor, the patient needs is kept in a room having a certain temperature and humidity level. Hence, the patient does not feel uncomfortable in the room.

[4] R. Alkeya, Neelima Devi Boddeti, K. Salomi Monica and Dr. V. Venkatesh "IoT based Smart Healthcare Monitoring Systems" European Journal of Molecular & Clinical Medicine, Volume 7, Issue 11, 2020:
Description: This paper proposes research into health requests is immovable among the different requests of IoT. Healthcare requests generally reflect close attention to IoT techniques due to cost savings, ease of interpretation, and recovery of patients personal satisfaction. This paper helps to imagine how IoT can be incorporated into complex health care procedures. The "Mobile Healthcare Management System (HMS)" is one of the main IoT apps that link the Internet to mobile sensors, people, clinicians, networks and other connected devices. The failed method, the IoT-based smart HMS, has made it possible for clinicians to monitor their patients in remote areas on an ongoing basis. The Internet of Things cooperates with numerous technologies, such as the Wireless Sensor Network (WSN), which communicates with each other through Coap, 6LoWPAN, REST and other protocols, such as radio frequency data, smart mobile inventions and wireless sensor networks.

[5] Prema T Akkasalinger, Soumya Potnis, Shambhavi Tolnur "Review of IoT Based Health Monitoring" International Journal of Research in Advent Technology (IJRAT), 26 February 2019
Description: This paper proposes a health monitoring model based on the Internet of things which has provided opportunity and applications for medical patients. The IOT applications are key enabling technologies in medical service. It is important way for taking care of patient's health. IOT is consisting of communication and sensors which are suitable tools for IOT based health care monitoring system. The aim of this review paper is to summarize various health parameters of human body using sensors proposed by different authors. In recent years more powerful IOT applications are developed as well wide range of opportunities are provided. Health monitoring system has been challenges for researchers. The important application of IOT system is it helps to decrease health related problems of patients.

III. PROBLEM STATEMENT

In today's world, with the increase in pandemic conditions which has weakened the health conditions of the people globally as well as the absence of doctors during emergency conditions and for regular health monitoring, the elderly and the disabled patients are unable to get the basic medical care. Due to the non- availability of doctors and caretakers and inaccessibility to the healthcare systems, many health problems arise which are a major issue to be undertaken. Also with the increasing queues at the hospitals and the increasing number of patients and insufficient allocation of health sector, millions have died due to inaccessibility to proper and efficient healthcare.

IV. METHODOLOGY

The main objective of this project is to create a smart room automation system that uses sensors and relays to monitor and control the environment of an elderly person's room. Specifically, the system will use a max30100 pulse oximeter sensor, mq series sensors (mq-2, mq-3, mq-6), a moisture sensor to measure the urine level in the patient's urine bag, an Arduino Uno, an esp8266 node mcu, and a 4-channel relay automation system. The sensors are connected to the Arduino Uno, which is used as a central hub for data collection and processing. The 4-channel relay automation system is also connected to the Arduino Uno. The esp8266 node mcu is connected serially to the Arduino Uno, and an OLED display is connected to the esp8266 node mcu. The setup can be done using wiring diagrams, pin configurations, and

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code snippets that show how the sensors and relays are connected and how data is transmitted between the Arduino Uno and esp8266 node mcu. The sensors will collect data related to the patient's vitals, room temperature, gas leaks, and moisture level in the urine bag. The data will be transmitted from the sensors to the Arduino Uno, which will process the data and transmit it to the esp8266 node mcu. The data will be formatted using a specific protocol and stored in the database. A mobile application will be developed for the user to control the system remotely. The application will communicate with a local server that processes user commands and controls the 4-channel relay automation system. The user interface of the application will display data collected by the sensors and allow the user to control the relay automation system.

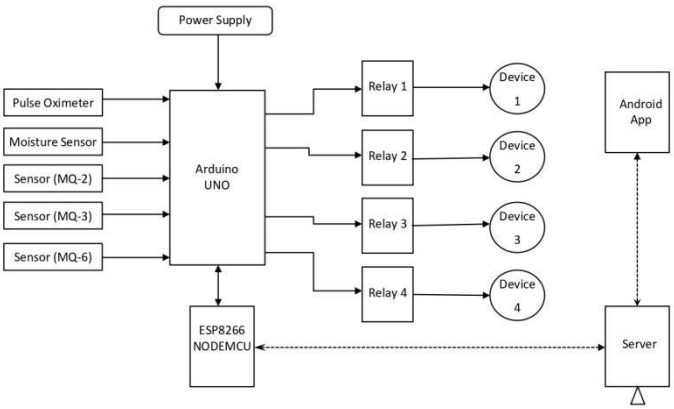

Fig.1 Block Diagram of Smart Health Monitoring Room

The system will be tested and validated to ensure that it meets the project objectives. This will involve testing the sensors and relay automation system in different scenarios and conditions to ensure that they are functioning properly. The mobile application and server will also be tested to ensure that they are communicating with the system properly. this project aims to create a smart room automation system for elderly people that uses sensors and relays to monitor and control the environment of their room. The system will collect data from the sensors, process it, and transmit it to the esp8266 node mcu, where it will be stored in the database. A mobile application will be developed to allow the user to control the system remotely. Finally, the system will be tested and validated to ensure that it meets the project objectives.

V. FUNCTIONAL PARTITIONING

1. Arduino UNO

Arduino UNO is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. Each of the 14 digital pins and 6 analog pins on the Uno can be used as an input or output, under software control (using pinMode(), digitalWrite(), and digitalRead() functions). They operate at 5 volts. Each pin can provide or receive 20 mA as the recommended operating condition and has an internal pull-up resistor (disconnected by default) of 20-50K ohm. A maximum of 40mA must not be exceeded on any I/O pin to avoid permanent damage to the microcontroller. The Uno has 6 analog inputs, labeled A0 through A5; each provides 10 bits of resolution (i.e. 1024 different values). By default, they measure from ground to 5 volts, though it is possible to change the upper end of the range using the AREF pin and the analogReference() function.

2. MAX30100 Pulse Oximeter Sensor

MAX30100 is an integrated pulse oximeter and heart-rate monitor sensor solution. It’s an optical sensor that derives its readings from emitting two wavelengths of light from two LEDs, a red and an infrared one then measuring the absorbance of pulsing blood through a photodetector. This particular LED colour combination is optimized for reading the data through the tip of one’s finger. It is fully configurable through software registers and the digital output data is stored in a 16-deep FIFO within the device.It has an I2C digital interface to communicate with a host microcontroller. The pulse oximetry subsystem in MAX30100 consists of ambient light cancellation (ALC), 16-bit sigma delta ADC, and proprietary discrete time filter.It can be used in wearable devices, fitness assistant devices, medical monitoring

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devices, etc. The MAX30100 operates from 1.8V and 3.3V power supplies and can be powered down through software with negligible standby current, permitting the power supply to remain connected at all times. Thus it combines two LEDs, a photodetector, optimized optics, and low-noise analog signal processing to detect pulse oximetry and heart-rate signals.

3. OLED Display

An organic light-emitting diode (OLED), also known as organic electroluminescent (organic EL) diode, is a light-emitting diode (LED) in which the emissive electroluminescent layer is a film of organic compound that emits light in response to an electric current. This organic layer is situated between two electrodes; typically, at least one of these electrodes is transparent. OLEDs are used to create digital displays in devices such as television screens, computer monitors, and portable systems such as smartphones and handheld game consoles. OLED is fundamentally different from LED which is based on a p-n diode structure. In LEDs doping is used to create p- and n- regions by changing the conductivity of the host semiconductor. OLEDs do not employ a p-n structure. Doping of OLEDs is used to increase radiative efficiency by direct modification of the quantum-mechanical optical recombination rate. Doping is additionally used to determine the wavelength of photon emission. An OLED display works without a backlight because it emits its own visible light. Thus, it can display deep black levels and can be thinner and lighter than a liquid crystal display (LCD).

4.ESP8266 NodeMCU

NodeMCU is a low-cost open source IoT platform. It initially included firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which was based on the ESP-12 module. Later, support for the ESP32 32-bit MCU was added. The ESP8266 NodeMCU CP2102 board has ESP8266 which is a highly integrated chip designed for the needs of a new connected world. It offers a complete and self-contained Wi-Fi networking solution, allowing it to either host the application or to offload all Wi-Fi networking functions from another application processor. ESP8266 has powerful on-board processing and storage capabilities that allow it to be integrated with the sensors and other application-specific devices through its GPIOs with minimal development up-front and minimal loading during runtime. Its high degree of on-chip integration allows for minimal external circuitry, and the entire solution, including the front-end module, is designed to occupy minimal PCB area.

5. MQ 135 Gas Sensor

The MQ-135 Gas sensor can detect gases like Ammonia (NH3), sulfur (S), Benzene (C6H6), CO2, and other harmful gases and smoke. Similar to other MQ series gas sensor, this sensor also has a digital and analog output pin. When the level of these gases go beyond a threshold limit in the air the digital pin goes high. This threshold value can be set by using the on-board potentiometer. The analog output pin, outputs an analog voltage which can be used to approximate the level of these gases in the atmosphere. The MQ135 air quality sensor module operates at 5V and consumes around 150mA. It requires some pre-heating before it could actually give accurate results. The MQ135 is one of the popular gas sensors from the MQ series of sensors that are commonly used in air quality control equipment. It operates from 2.5V to 5.0V and can provide both digital and analog output.

6. MQ131 Ozone Gas Detector Sensor

The MQ-131 is a low concentration Ozone gas sensor from Winsen. The sensing material for the MQ-131 is WO_3. It will have lower conductivity in clean air and higher conductivity when the ozone concentration rises. This sensor has high sensitivity to ozone, and also has sensitivity to strong oxide such as Cl_2, NO_2 &etc. When the ozone gas exists, the sensor's conductivity gets lower along with the gas concentration rising. Users can convert the change of conductivity to correspond output signal of gas concentration through a simple circuit.

MQ131 ozone gas sensor has high sensitivity to ozone, and also has sensitivity to strong oxide such as Cl2, NO2 &etc. It responses oppositely to organic interference gases.

7. TVOC Gas Sensor

TVOC (Total Volatile Organic Compound) sensor is equipped with a miniature ADC chip that converts the readings into I2C for gas resistance output and parts-per-billion (ppb). This resistance can be correlated with ambient volatile organic compounds (TVOC) - higher ppb means more organic compounds in the air. It's a simple sensor and doesn't perform any additional filtering or calculations but it's also inexpensive and small. TVOC combined with CO2 is used to measure indoor air quality or IAQ. CO2 is produced by human respiration, and VOCs come from construction materials (paint, carpet, etc), machines (copiers, processes, etc), and people (breathing, cigarettes, etc). Thus a TVOC sensor is used to detect Total Volatile Organic Compounds in your environment. It does this by identifying vapours of gases given off by volatile compounds.

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VI. ADVANTAGES

- This system enables real time health monitoring and controlling via connected IOT devices.
- By this system smart sensors can analyse health and environment conditions with safety alerts.
- This system offers an affordable system reducing medical costs and helps in chronic disease management.
- This system allows accessibility of electronic medical records allowing evidence-based care, minimising the human work and effort, saving time and effort.
- By this project, a simple design is proposed which can be interfaced with other systems for future applications.

VII. RESULTS

As the title suggests, the result of smart Health Monitoring room for elderly people a promising solution for monitoring and controlling various aspects of their health and environment. Here are some possible results reported:

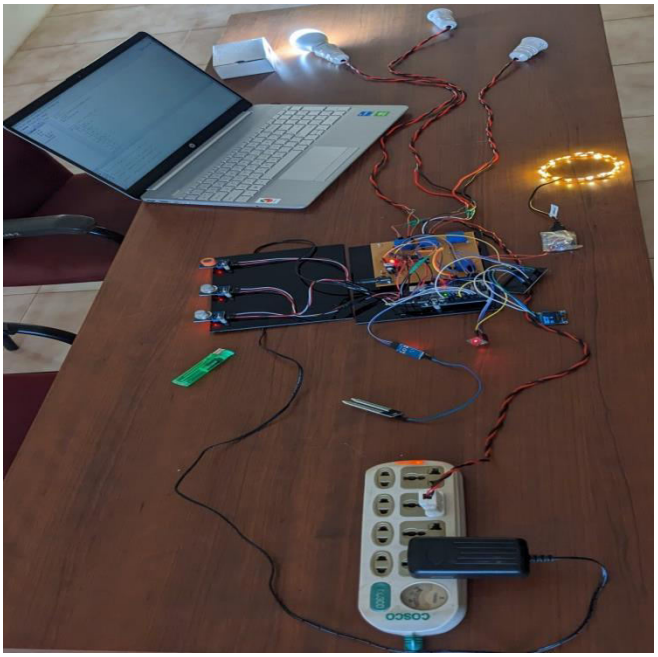

Fig.2 Overall setup for Smart Health Monitoring Room

The sensors used successfully collected data on a range of health and environmental parameters in the room. The data are then processed using filtering and preprocessing techniques to extract meaningful information. The 4 channel relay automation system is able to effectively control various devices in the room, based on the sensor data collected.

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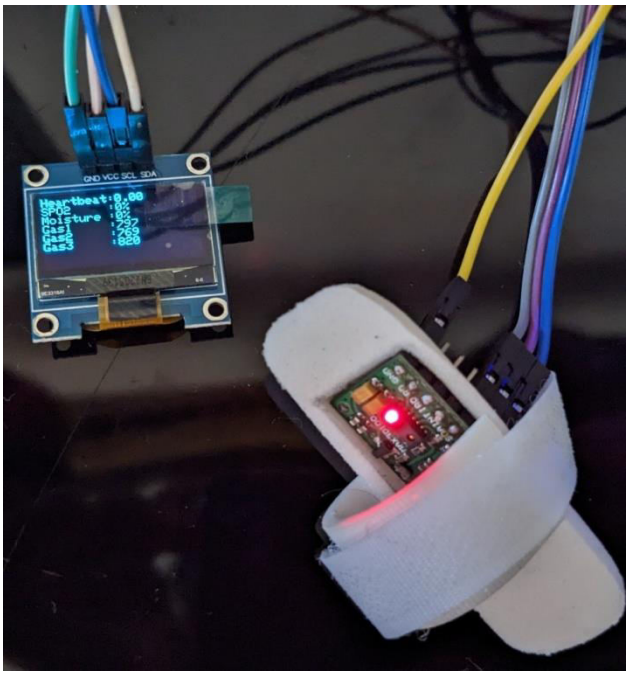

Fig.3 Testing of Smart room monitoring section

In testing, the smart room automation system was able to accurately monitor the pulse rate, blood oxygen level, and gas levels in the room, as well as the moisture level in the patient's urine bag. All these values are regularly monitored and displayed on the OLED display. The system was also able to respond quickly to changes in the sensor data and adjust the devices accordingly.By monitoring and controlling various aspects of health and environment, the system has been found with the potential to provide a more comfortable and healthful living space. The system also provided real time monitoring and remote control using mobile application.

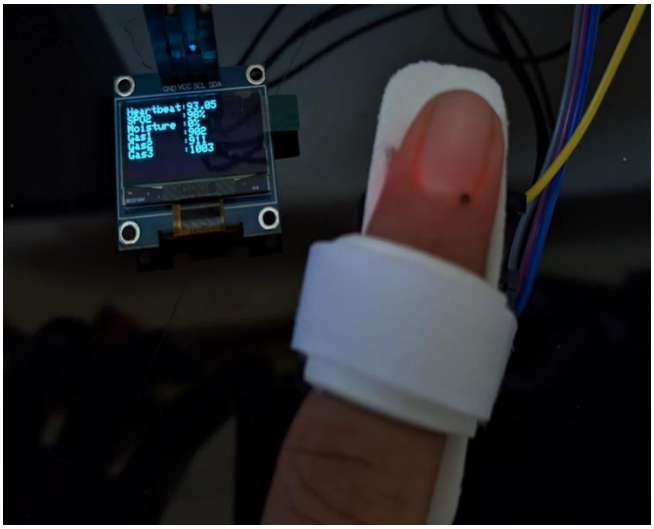

Fig.4 Testing of Pulse oximeter section

Video on the working of the proposed system:
https://drive.google.com/file/d/1RIYsu2awajgJtePA81Yd3u-efcVLfp3X/view?usp=drivesdk

Overall, the smart health monitoring room project has been found as a promising solution for improving the quality of life for elderly people. By monitoring and controlling various aspects of their health and environment, the system has the potential to provide a more comfortable and healthful living space.

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VIII. CONCLUSION

Physical or cognitive difficulties are becoming more prevalent among the elderly, especially following the introduction of the novel Corona virus. Elderly people prefer to live in an environment where they can easily perform different activities of their daily life along with the regular monitoring of their healthcondition. Smart Homes incorporate environmental and wearable medical sensors and modern communication and information technologies, which can enable continuous and remote monitoring of elderly health and wellbeing at a low cost. This reduces human intervention, promises new solutions that enables users to have a more home-centric health care, a sustainable active and healthy ageing. The aim of the technological advancement for elderly is to provide them a sense of independence even if they are physically or cognitively incapable. Avoiding diseases and encouraging healthy living is also a prime concern. IOT is a step forward in helping elderly complete these activities without physical presence of a caretaker, which also helps in minimizing their expenses. This will also help the caretaker to monitor and assist multiple elderly patients from a remote location using a smart phone. The unique part of this system is the alarm generation and the scheme of sending notification alert if any health parameter crosses the threshold value. Elderly can live longer and safer if they stayed in their own home environment. Smart homes can provide automation of domestic tasks, easier communication, higher security and are adaptive to modern human as well as social needs. Thus, a smart IOT based health monitoring room for elderly and disabled provides an efficient surrounding which promote a better living condition which is expected to offer a secure and easy living condition and improves life expectancy and healthcare.

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