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IoT-Enabled Adaptive Seating System for Monitoring Vital Signs and Detecting Diabetes in Individuals with Disabilities

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Abstract: *The IoT based smart chair for measuring vital parameters and detecting types of diabetes is an innovative solution to monitor the health status of individuals with diabetes. The chair is fitted with detectors to gauge vital signs like blood sugar, levels of oxygen, and your heart rate. Additionally, the chair is capable of detecting the type of diabetes that an individual has by analysing their glucose evels We implemented a prototype of Smart IoT chair combining six custom sensors a PIC, and a chair. In this system RF communication is used for when Person is used the smart chair. If one-time rea the RFID tag then the check the body conditions using health parameters. These collected sensors data fed to microcontroller and can be displayed on LCD display. If any sensor is abnormal means, alarm goes on using buzzer. Then sensors data are updated to IoT using cloud. Acetone sensor is used to sense the exhale air problem of diabetics and update IoT. Finally, UV lamp will be ON for remove the viruses. The smart chair can also be used in hospitals and clinics to monitor patients with diabetes and provide early intervention if necessary. The chair is created to be cosy and simple to operate, with a straightforward layout allowing people to quickly access their important data. In general, the Internet of Things (I smart chair for identifying different types of metabolic disease as recording important indicators has the ability to revolutionise diabetes care by real-time monitoring and feedback to individuals and healthcare professionals.*

Keywords: *Vital parameters, acetone gas sensor, IOT, Laser module, diabetes, PIC micro controller, heart beat sensor, LM3 temperature sensor, Respiration sensor*

1. INTRODUCTION

Smart chair monitoring healthcare using IoT is a cutting-edge technology that has revolutionized the healthcare industry. This technology is designed to monitor the healthof patients sitting in chairs, providing real- time information to healthcare providers. IoT,or the A system consisting of interconnected gadgets that can exchange data and talk to one another is known as the "Internet of Things." When it comes to smart chair monitoring, sensors and other devices are installed in chairs tomonitor critical indicators including oxygen saturation, rhythm of the heart, and blood pressure. Then, in instantaneous fashion, this data is sent to providers of healthcare. allowing for immediate intervention if necessary. The benefits of this technology are numerous. Patients can be monitored more effectively, and healthcare providers can respond more quickly to changes in theircondition. It also allows for remote monitoring, so Customers can get treatment in the convenience of their very own. homes. Overall, Smart chair monitoringhealthcare using IoT is an innovative and exciting technology that holds the capacity to enhance patient care outcome and revolutionize the healthcare industry. nearby people and will be update the IoT using Cloud.

2. EXISTING SYSTEM

In this project, recent progress in the management of chronic diseases with non-invasive monitoring methods is

discussed. The devices and methods for tracking the body's temperature, blood pressure, blood sugar levels, and heart rate are covered in particular. Additionally, this project makes use of Internet of Things (IoT) to send patient parameters by message to their mobile phones as well as via email to each individual's designated email address. The project's scope includes reduced manpower requirements, less time usage, a high database, a c y u r a c y c, and a system that is excessively patient-friendly. The advantage of this system is very Fast, high accurate, high efficiency, and safe (without any danger of electric shocks). The disadvantage of The disadvantage of system is cannot store the Data for future.

3. PROPOSED SYSTEM

Smart chair monitoring healthcare using IoTis a system that utilizes Internet of Things (IoT) technology to monitor the health ofindividuals who spend prolonged periods sitting in chairs, such as office workers or elderly people. The system is designed to provide real-time data on the user's health status, including their heart rate, temperature, and respiration. In this our proposed system “Smart Chair”. In this system consists of Heart beat, temperature,acetone, PIC controller, Liquid crystal, Lasermodule and RF communication. We are using PIC controller of main micro controller. RF ID card used to check the sitting person. If the RFID tag read the values then all sensors are continuously monitor the human body. If any up-normal means alert the nearby people and will be update the IoT using cloud. Acetone sensor is used to measure the typeof diabetic and finally UV lamp to ON the smartchair for clean the viruses. Heartbeat sensormeasure the heart rate and Laser sensormeasure glucose level. The smart chair is equipped with sensors that detect the user's vital signsand posture. The sensors are connected to am I c r o controller that collects the data and sends itto the cloud for analysis. The IoT gateway isa device that acts as a bridge between the smart chair and the cloud. It receives the datafrom the smart chair and sends it to the cloud for further processing. The cloud platform is where the data from smart chair is processed and analyzed. The mobile application is a user-friendly interface that allows the user to view their health data in real-time. It also provides. alerts and reminders to encourage the user to maintain good posture and take breaks when necessary.

4. COMPONENTS

power supply: The term "power supply" refers to an electrical power source. An apparatus or system that provides energy, either electromagnetic or otherwise, to an output load or set of loads is referred to as a power source. ower supply unit or PSU. Power supply circuit isused for regulating DC power to an electronic devices Here we are using 12V step down rans former for converting high voltage into low voltage.Then we are using Bridge rectifier to convert AC to pulsating DC. Then it will be given to the filter to convert pulsating DC into PureDC. Then Voltage regulator is used to regulate the pure 5 VDC voltage.

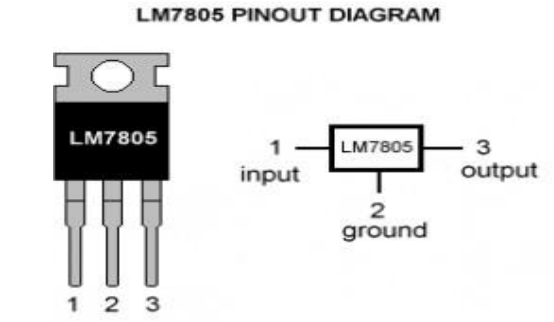


FIGURE 1. Pinout Diagram

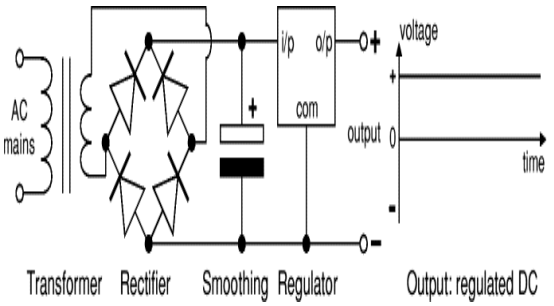


FIGURE 2. Output

Acetone Sensor: The MQ138 gas sensor is a low-cost sensorthat is highly sensitive to various organic gases such as toluene, acetone, alcohol, methanol, formaldehyde, and other volatile organic gases. It is commonly used in various applications that require monitoringof organic gases, including detecting acetone levels. The module comes with a level signal output and alarm signalindicators, making it easy to integrate into different systems. Additionally, the analog signal output voltage ranges from 0-5V, andthe low-level signal output is effective in driving the PNP triode. It can also connect to the single-chip IO port. The analog outputvoltage of the sensor module increases withthe concentration of organic gases, with higher concentrations resulting in higher voltage output. Overall, the MQ138 gas sensor is a reliable and affordable solution for various applications that require monitoring of organic gases.

FIGURE 3. Acetone Sensor

Lm35temperature Sensor: The asthmatic patient's temperature in the body is measured using a temperature sensor. With a power output corresponding to the surface temperature (inoC), the LM35 is a digital gauge that may be used to measure temperature. The LM35 gives an output voltage that is higher than that of a voltmeter and could not require that its resultant voltage been amplified.

Heart Rate Sensor: In this project, use reflectivity Use a PPG sensor to gauge your fingertip's pulsing activity. This technique can be very helpful in monitoring the patient's heart rate and detecting any irregularities or changes that could indicate a worsening of their condition. As you mentioned, PPG is a non – invasive method of employing a light source and an optical sensor to measure the changes in blood volume in tissues. This method can be used to determine the heart rate because a fluctuation in the volume of blood occurs simultaneously with each beat. It's important to note that while PPG is a useful tool for monitoring heart rate, it is not a substitute for medical advice or diagnosis from a qualified healthcare professional. The accuracy of PPG measurements can be affected by factors such as skin tone, ambient lighting, and motion artifact. It's important to follow best practices for PPG measurement and to interpret the results in context with other clinical information.

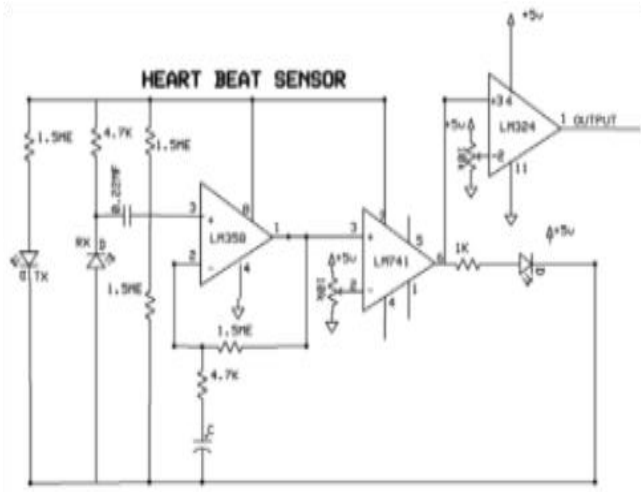


FIGURE 4. Heart Rate Sensor

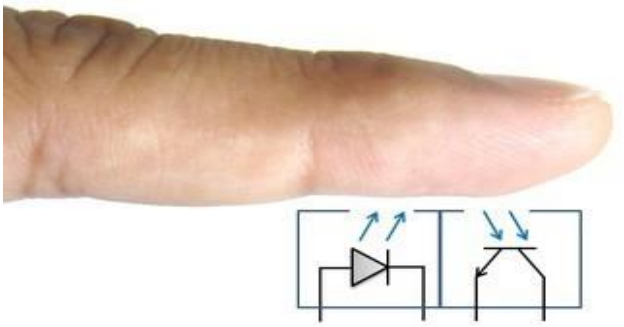


FIGURE 5. PPG measurement

Respiration Sensor: The Exhalation Sensor is a tool that is frequently utilised to assess the rate of breathing of a patient. It works by monitoring the movement of the chest or abdominal area during breathing. In addition to measuring the frequency of breathing, the sensor can alsoprovide information on the depth of breathing. This type of sensor is commonlyused in biofeedback applications such as stress management and relaxation training. By monitoring respiration, individuals can learn to regulate their breathing patterns, which can help to reduce stress and promote relaxation. To use the Respiration Sensor, it is usually placed in the abdominal area, just above the navel, and should be worn tightly enough to prevent loss of tension. For best results, it is recommended that there be only one or two layers of clothing between the sensor and the skin. Overall, the Respiration Sensor is a useful tool for monitoring respiration and promoting relaxation in a variety of settings.

FIGURE 6. Respiration Sensor

Pic Microcontroller: PIC Micro controller is where our system's heart is. The success of the system as a whole rest on this board. (PIC16F877A) PIC responds to the 5volt supply provided by the optocoupled and continues to count the supply before calculating the power and cost used. That users are able to check their consumption whenever they want. It even responds to the situation in accordance with the programming This information is permanently saved on the website, so ions like message sending during threshold value etc.

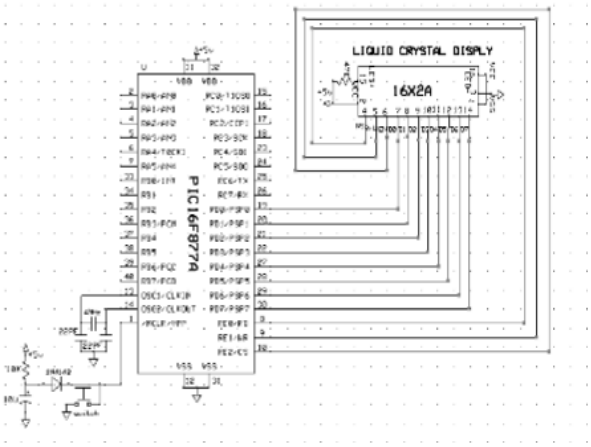


FIGURE 7. Pic Microcontroller

IOT: Node MCU IoT platform that is open source. It consists of hardware that relies on the ESP-12 module, as well as firmware that operates on Repressive Devices' ESP8266 Wi-Fi So C. By default, the firmware is referred to as "Node MCU" instead of the kits. The scripting language Lua is used by the firmware. It is constructed from the Repressive Non-OS SDK and is based on the Language project for ESP8266. Using IoT we can do monitor andcontrol the physical devices with the help ofinternet. It is used to connect the physical devices to Internet using ESP8266-12E module.

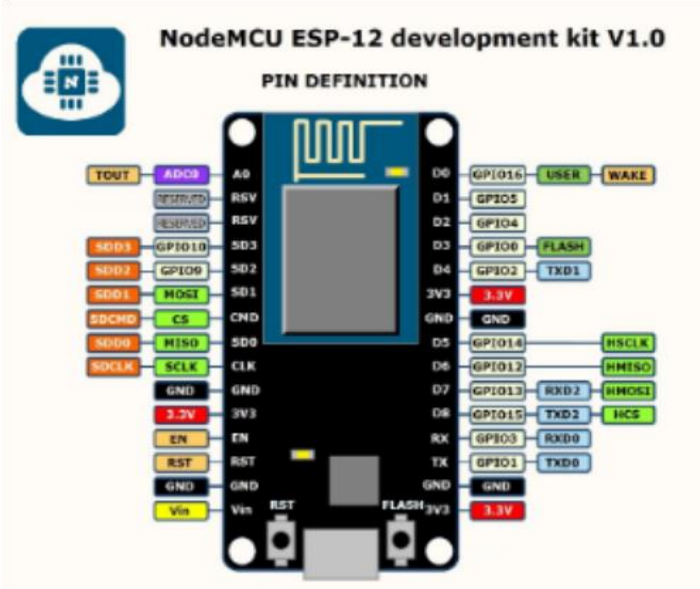


FIGURE 8. Node MCU IoT platform

LCD DISPLAY: A common digital display module found in many different gadgets and circuits is the liquid lcd showing, or screen with LCD technology. Another of the LCD displays with a 16x2 size most basic modules and is frequently used in different projects due to its low cost and versatility. As the name suggests, the Two lines of 16 characters each can be displayed on a 16x2 LCD. There are 224 distinct words and symbols as can be printed in total because each character is presented in a 5x7 pixel matrix. The commandeer register as well as corresponding Data memory are the two variables on the 16x2 LCD register.

FIGURE 9. LCD displays

5. ADVANTAGES

In-invasive*:* The smart chair offers a non- invasive way of monitoring critical indicators include arterial blood pressure, insulin levels, even the rate of your heart. This means that patients do not have toundergo painful procedures such as pricking their fingers for blood glucose testing.

Real-time monitoring*:* The smart chair provides real-time monitoring of vitalparameters, allowing for early detectionand intervention in case of anyabnormalities.

Convenience: The smart chair offers aconvenient way of monitoring vital parameters as patients do not have to visit a hospital or a clinic for regular checkups.

Early detection of diabetes: The smart chair can detect the type of diabetes apatient has based on their blood glucose levels, allowing for early detection and treatment.

Improved management of diabetes: The smart chair provides patients with continuous monitoring and feedback, which can help them better manage their diabetes and make informed decisions about their diet and lifestyle.

Better quality of life*:* The smart chair may help those suffering from diabetes live better lives by empowering them to monitor theirvital parameters and detect any abnormalities early on, thereby reducing the risk of complications.

Cost-effective*:* The smart chair can be acost-effective way of monitoring vitalparameters as it eliminates the need for frequent visits to a hospital or a clinic.This can be especially helpful for people who operate in rural locations or have a difficult time accessing medical facilities

6. APPLICATION

Remote Patient Monitoring: The smart chair can be used to monitor patients remotely and continuously, allowing healthcare providers to detect changes in vital signs such as sugar levels, breathing, and hypertension are real-time. This can help in identifying any abnormal fluctuations or patterns, which may indicatethe onset of a health issue.

Diabetes Management: The smart chair can detect different types of diabetes by analyzing the changes in the user's bodytemperature, heart rate, and blood glucose levels. This can help in managing diabetes by providing personalized recommendationsfor diet, exercise, and medication.

Elderly Care: The smart chair can be used in elderly care facilities to keep an eye on locals' health, particularly in respect of people with chronic diseases such as diabetes. The chair can provide real-time alerts to the nursing staff when vital parameters deviate from normal levels, enabling them to take prompt action.

Workplace Wellness: The smart chair can be used in the must keep an eye on workers' health and look out for indicators of stress or weariness. That may help in reducing workplace injuries and improving employee productivity.

Sports and Fitness: The smart chair can be used by athletes and fitness enthusiasts to monitor their vital parameters during training and competition. This can help in optimizing their performance and preventinginjuries.

7. CIRCUIT DIAGRAM

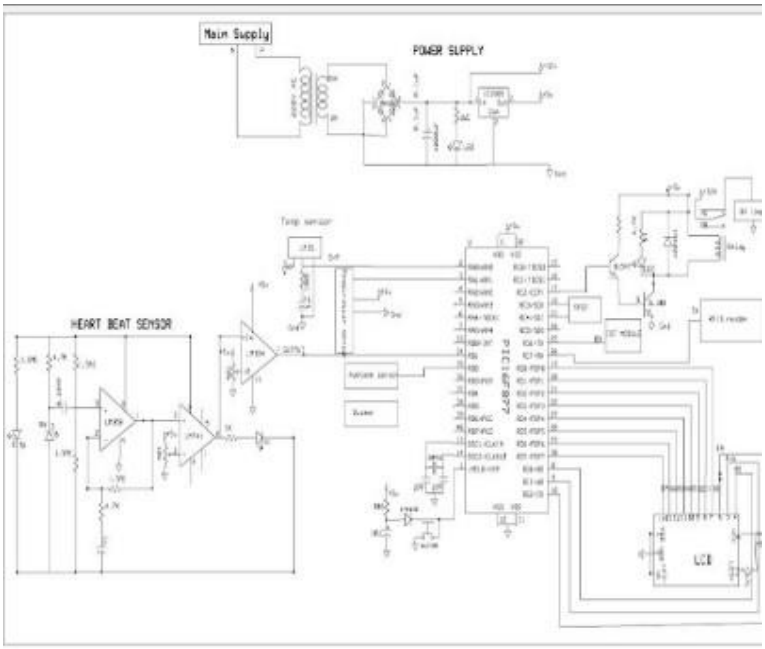


FIGURE 10. Circuit Diagram

8. BLOCK DIAGRAM

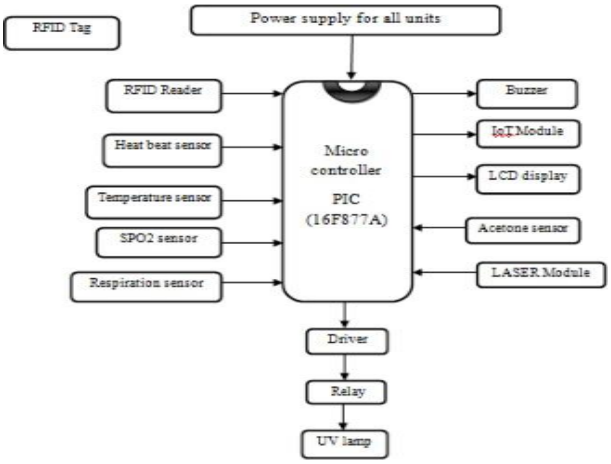
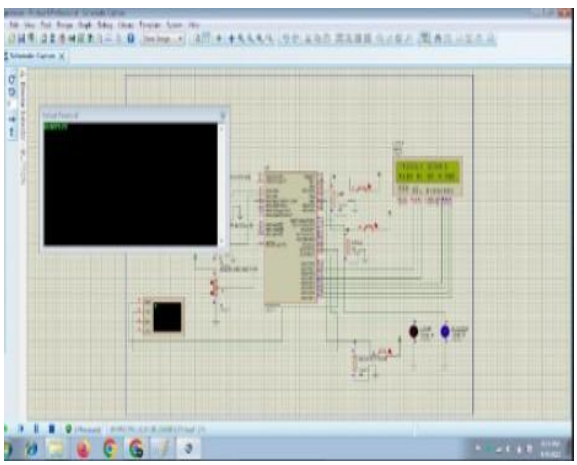


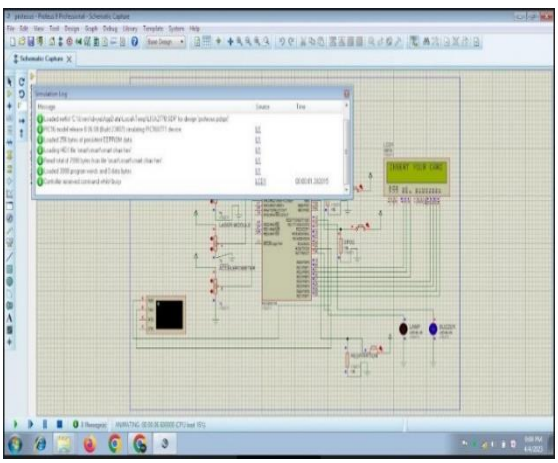
FIGURE 11. Block Diagram

9. HARDWARE SETUP

FIGURE 12. Hardware Setup

10. SIMULATION RESULT





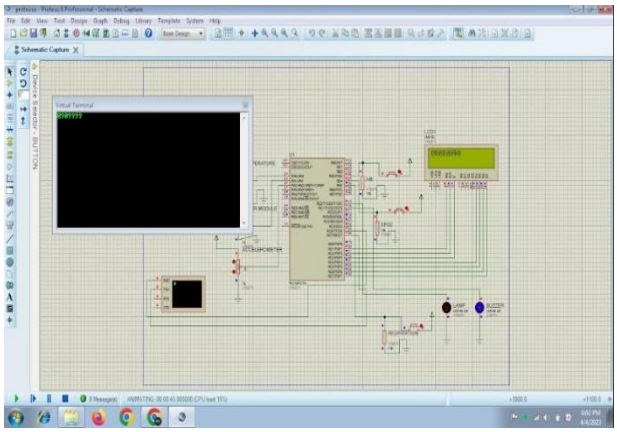


FIGURE 13. Simulation Result

11. RESULT

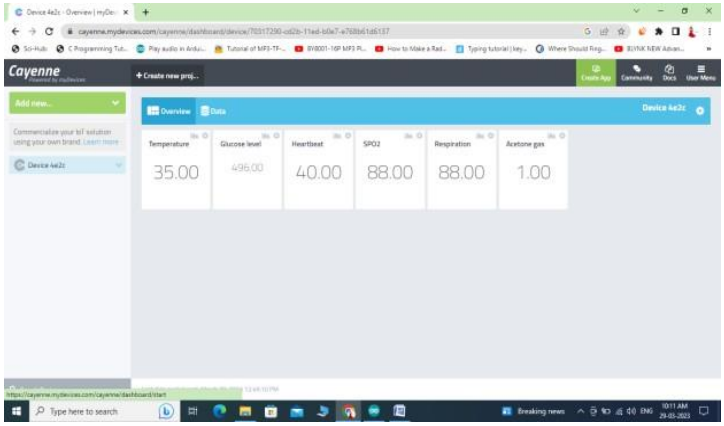


FIGURE 14. Final result

12. CONCLUSION

In conclusion, Smart chair monitoring in healthcare using The Internet of Things (IoT) has the power to completely change how we provide medical care. With the use of this equipment, the conditions of patients can be continuously monitored and movements, which can provide early detection of health problems and allow for timely intervention. Additionally, the data collected from smart chairs can be examined for patterns and indicators, allowing medical professionals to make better judgements on treatment of patients. This may result in better medical results for patients as efficiency in healthcare delivery. However, there are also some challenges to the implementation of smart chairs in healthcare, including data privacy concerns and the need for integration with existing healthcare systems. Overall, smart chair monitoring using IoTtechnology has the potential to greatly improve healthcare outcomes and shouldcontinue to be explored and developed.

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