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Kilter (Intelligent Diagnostic System Using Iot)

T Bharat Kumar*[1], S Udayprasad*[2],
K Vijay*[3],S Latha*[4],Gksv Sai Shravanth*[5]

[1,2,3,5]Student,Department of electronics and communication,sreendihi institute of science and technology hyderabad, Telangana,india

[4],Assistant professor Department of electronics and communication,sreendihi institute of science andtechnology hyderabad, Telangana,india

Corresponding Author: T BHARAT KUMAR,Student,Department of electronics and communication,sreendihi institute of science and technology hyderabad, Telangana,india

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ABSTRACT: Monitoring specific parameters of our body is becoming more essential these days. But one hasto buy many products to keep their health record on the track and this will be a tedious task for individuals and difficult for the doctors to know about the track of their patient's health.So we came up with the idea of designing a system that can help monitor, analyze, andstore the individual's health record through IoT. Our system can monitor the pulse rate, ECG, body temperature of the user, analyze the user's condition, display the current readings, and storethem.We can Monitor the health record remotely at any place on earth. The device can identify abnormalities in the health parameters and intimates it to the hospital staff and to the concerned persons via a messaging app. This system is also equipped with an emergency button, that is useful to send the emergency signal physically by the user. This will be a one- stop solution for monitoring all the health records and will be very beneficial for older people and for people who live individually.

KEYWORDS: Monitoring, Analyzing, IoT, Pulse rate, ECG, Body Temperature, Emergency button.

I. INTRODUCTION

Health is one of the global challenges for humanity. In the last few years healthcare has drawn a considerable amount of attention due to the pandemic. The prime goal was to develop a reliable patient monitoring system so that the healthcare professionals can monitor the patients, who are either hospitalized or executing their normal daily life activities.Recently, Due to the advancement in technology, the realization of an accurate patient monitoring system has become more practical. So, we have the necessity for a modernized approach to monitor the health parameters. In the traditional approach the healthcare professionals play the major role in monitoring their health parameters.

They need to visit the patient’s ward to perform necessary diagnosis. There are two basic problems associated with this approach.Firstly, the healthcare professionals must be present on site of the patient all the time and secondly, the patient remains admitted in a hospital, bedside biomedical instruments, for a period. To solve these two problems, the patients are given knowledge and information about disease diagnosis and prevention. Secondly, a reliable and readily available patient monitoring system is required. In order to improve the above condition, we can make use of technology in a smarter way.

In recent years, health care sensors have played a vital role. Wearable sensors are in contact with the human body and monitor a person’s physiological parameters. We can buy a varietyof sensors in the market today such as ECG sensors, temperature sensors, pulse monitors etc.

The cost of the sensors varies according to their size, flexibility and accuracy.The NodeMCU is a cheap, flexible, fully customizable and programmable board that brings the advantages of a PC to the domain of sensor network. In our system we decided to include the sensors that measure the necessary parameters to assess the condition of the patient. ECG, Temperature, Heart rate, Pulse sensors are used in our Diagnosis system.

II. BACKGROUND THEORY

The cost of healthcare is rising at a tremendous rate. Over the past 30 years expenditure on healthcare has risen much faster than the cost increases reported in other sectors of the economy, and health care is now one of the largest sectors in most developedcountries. Medical advancements and demographic changes will continue the upward pressure on costs. Recently after the pandemic, the usage of healthcare devices are rising as well as the cost of the devices are rising. At the same time the resources available for health care are limited.

The health monitoring system is employed as the method to measure the observation data. The experimental modal analysis is one of the effective health monitoring systems for the case where the modal parameters such as natural frequencies are adopted as the observations. Many people have inequitable access to adequate health care, and many governments are unable to provide such care universally.

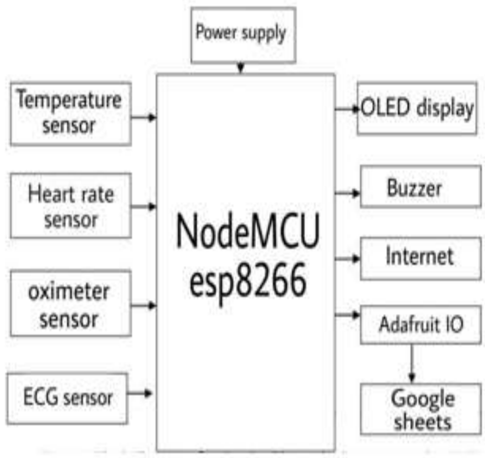
In addition there is a large variation in availability and use of health care by geographical area and point of provision. Due to time constraints, people are not visiting hospitals, which might and possibly lead to a lot of health issues in one instant of time. Predominantly most of the healthcare systems have been developed to predict and diagnose the health of the patients by which people who are busy in their schedule can also monitor their health at regular intervals. With the increasing use of technology, there is an urgent need to have such a smart health monitoring system that can communicate between network devices and applications whichwill help the patients and doctors to monitor, track and record the patient's sensitive data containing medical information

Availability tends to be inversely related to the need of the population served. Another force for changeis consumerism. The expectations of members of the public have led to greater concerns about the quality of the services they receive—from access and equityto appropriateness and effectiveness.

III. BLOCK DIAGRAM

The above block diagram is an abstract representation that explains the IoT Based Patient Health Diagnostic System using ESP8266 Wifi module. Pulse Sensor measures BPM. The IR temperature sensor measures the body temperature. The ECG (ElectroCardiogram) sensor records the electrical signal from your heart to check for different heart conditions.

Electrodes are placed on your chest to record your heart's electrical signals that represent your heart beat. The signals are shown as waves on an attached computer monitor. . The oximeter sensor measures the oxygen saturation of a patient's blood. This device consists of a red infrared light source and photo detectors to measure the oxygen saturation.



BLOCK DIAGRAM

IV. SOFTWARE REQUIRED

ARDUINO IDE: The **Arduino Integrated Development Environment (IDE)** is a cross- platform application (for Windows, macOS, Linux)that is written in functions from C and C++. It is used to write and upload programs to Arduino compatible boards, but also, with the help of third-party cores, other vendor development boards. The source code for the IDE is released under the GNU General Public License.

The NodeMCU processes the code displays it to OLED Display. The NodeMCU instantly connects

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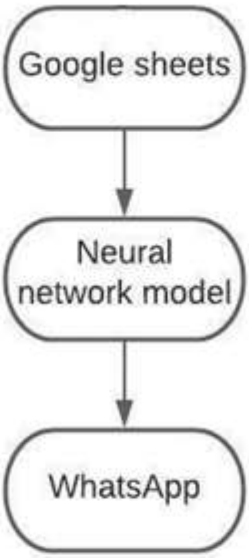
to Wi-Fi and sends the data to the IOT device server.At the same time the sensor data is also sent to the google sheets using the internet which is used by a neural network model to find the type of illness present. Later after processing the neural network model, the result is sent to our WhatsApp .



The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User- written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub main() into an executable cyclic executive program with the GNU toolchain, also included with the IDE distribution.The Arduino IDE employs the program avrdude to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board bya loader program in the board's firmware. By default, avr dude is used as the uploading tool to flash the user code onto official Arduino boards. Arduino IDE is a derivative of the Processing IDE, however as of version 2.0, the Processing IDE will be replaced with the Visual Studio Code-based Eclipse IDE framework. With the rising popularity of Arduino as a software platform, other vendors started to implement custom open source compilers and tools (cores) that can build and upload sketches to other microcontrollers that are not supported by Arduino's official line of microcontrollers.

Users can also customize JupyterLab to fit their workflow. Built-in viewers exist for image, textand CSV files, for instance, but users can build custom components as well. These could display things such as genomic alignments or geospatial data. An attendee on a course taught by Pérez even created a component to display 3D brain-imaging data.

"This is a completely [neuroscience] domain- specific tool, obviously — the Jupyter team has no business writing these things. Two additional tools have enhanced Jupyter's usability. One is JupyterHub, a service that allows institutions to provide Jupyter notebooks to large pools of users.

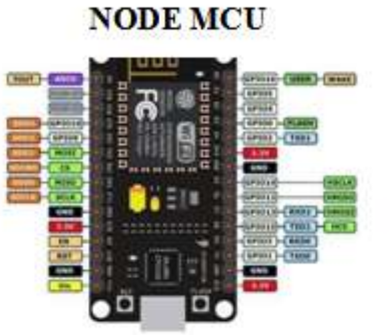
The proposed Intelligent diagnostic system monitors a patient's health parameters using Node MCU microcontroller. After connecting the internet to the Node MCU it acts as a server. Then the server automatically sends data to the website.

If these parameters go abnormal it will automatically send an alert to the doctors and relatives. In this project we have temperature, ECG, oxygen levels and heartbeat readings which are monitored using NodeMCU. Here the patient's body temperature, blood pressure , ECG and heart rate is measured using respective sensors and it can be seen on the OLED screen. The specifications of the hardware components are explained in detail below.

1 NODE MCU Microcontroller (ESP8266):

NodeMCU is an open source firmware for which open source prototyping board designs are available. The name "NodeMCU" combines "node" and "MCU" (micro-controller unit). The term "NodeMCU" strictly speaking refers to the firmware rather than the associated development kits. Both the firmware and prototyping board designs are open source.The firmware uses the Lua scripting language. The firmware is based on the eLua project and built on the Espressif Non-OS SDK for ESP8266. It uses many open-source projects, such as lua-cjson and SPIFFS.

Due to resource constraints, users need to select the modules relevant for their project and build a firmware tailoredto their needs. Support



The prototyping hardware typically used is a circuit board functioning as a dual in-line package (DIP) which integrates a USB controller with a smaller surface-mounted board containing the MCU and antenna. The choice of the DIP format allows for easy prototyping on breadboards

1. Pulse Oximeter Sensor

Pulse oximetry is a noninvasive method for monitoring a person's oxygen saturation.

Peripheral oxygen saturation (SpO2) readings are typically within 2% accuracy (within 4% accuracy in the worst 5% of cases) of the more desirable (and invasive) reading of arterial oxygen saturation (SaO2) from arterial blood gas analysis.[1] But the two are correlated well enough that the safe, convenient, noninvasive, inexpensive pulse oximetry method is valuable for measuring oxygen saturation in clinical use.The MAX30102 operates on a single 1.8V power supply and a separate 3.3V power supply for the internal LEDs. Communication is through a standard I2C-compatible interface.

The module can be shut down through software with zero standby current, allowing thepower rails to remain powered at all times. It is widely used in wearable devices, fitness assistant devices, smartphones and tables.The most common approach is transmissive pulse oximetry. In this approach, a sensor device is placed on a thin part of the patient's body, usually a fingertip or earlobe, or an infant's foot.Fingertips and earlobes have higher blood flow rates than other tissues, which facilitates heat transfer.[1] The device passes two wavelengths of light through the body part to aphtotodetector

2 Infrared Thermometer Sensor (MLX90614):

An infrared thermometer is a thermometer which infers temperature from a portion of the thermal radiation sometimes called black- body radiation emitted by the object being measured. They are sometimes called laser thermometers as a laser is used to help aim the thermometer, ornon-contact thermometers or temperature guns, to describe the device's ability to measure temperature from a distance.

Pulse Oximeter

By knowing the amount of infrared energy emitted by the object and its emissivity, the object's temperature can often be determined within a certain range of its actual temperature.It can be used to measure the temperature of a particular object ranging from -70° C to 382.2°C. Infrared thermometers are characterized by specifications including accuracyand angular coverage. Simpler instruments may have a measurement error of about ±2 °C or ±4F.The sensor uses IR rays to measure the temperature of the object without any physical contactand communicates to the microcontroller using the I2C protocol.
The distance-to-spot ratio (D:S)is the ratio of the distance to the measurement surface and the diameter of the temperature measurement area. For instance,

3..**ECG**:The AD8232 is an integrated signal conditioning block for ECG and other biopotential measurement applications. It is designed to extract, amplify, and filter small biopotential signals in the presence of noisy conditions, such as those created by motion or remote electrode placement. This design allows for an ultralow power analog-to-digital converter (ADC) or an embedded microcontroller to acquire the output signal easily. The AD8232 can implement a two- pole high-pass filter for eliminating motion artifacts and the electrode half-cell potential. This filter is tightly coupled with the instrumentation architecture of the amplifier to allow both large gain and high-pass

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ECG

filtering in a single stage, thereby saving space and cost. An uncommitted operational amplifier enables the AD8232 to create a three-pole low-pass filter to remove additional noise. The user can select the frequency cutoff of all filters to suit different types of applications.Heart Rate Monitor Kit with AD8232 ECG Sensor Module. The AD8232 is an integrated front-end for signal conditioning of cardiac bio electrical signals for heart rate monitoring. This is a low-power, single-lead, heart rate monitor for a wide range of vital signs monitoring applications. AD8232 ECGSensor Module ECG also known as Electrocardiogram is a noninvasive medical procedure to measure the electrical activity of the Heart.

4. OLED I2C Display:

SSD1306 is a single-chip CMOS OLED/PLED driver with a controller for an organic / polymer light emitting diode dot-matrix graphic display system. It consists of 128 segments and 64commons. This IC is designed for Common Cathode type OLED panels. The SSD1306 embeds with contrast control, display RAM andoscillator,

OLED DISPLAY

which reduces the number of external components and power consumption.It has 256-step brightness control. It is suitable for many compact portable applications,such as Smart watches. Real-time image display of camera on smart car.Battery management device etc.

For OLED-SSD1306, a more elaborate and beautiful screen than LCD, with more functions High contrast, thus supporting clear display with no need of backlight Working voltage: 2.7V - 5.5V; PCB size: 2.8 x 3.2cm Standard double- sided printed circuit board, 1.16mm thick, with an elegant layout, 3-mm holesmonitoring.This is a low-power, single-lead, heart rate monitor for a wide range of vital signs monitoring applications. AD8232 ECG Sensor Module ECG also known as Electrocardiogram is a noninvasive medical procedure to measure the electrical activity of the Heart.measurement area.

For instance, if the D:S ratio is 12:1, the diameter of the measurement area isone-twelfth of the distance to the object.A thermometer with a higher ratio of D to S is able to sense a more-specific, narrower surface at a greater distance than one with a lower ratio.

5. Infrared Thermometer Sensor (MLX90614):

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Infrared Thermometer Sensor (MLX90614):

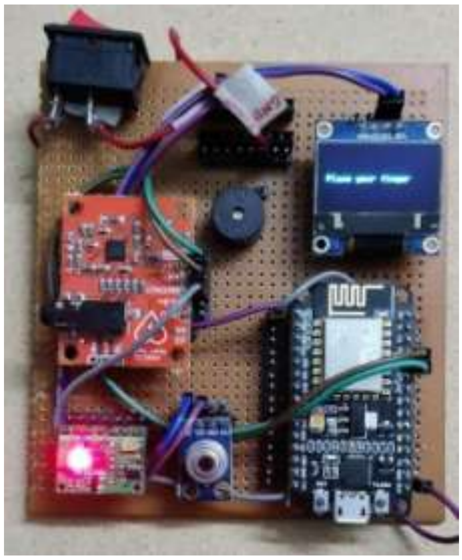
V. HARDWARE IMPLEMENTATION ANDWORKING

In this project we have temperature, ECG, heartbeat, and oxygen percentage readings which are monitored using a Microcontroller, NodeMCU. These sensor signals are sent to NodeMCU whenever we turn on the circuit. Here patients' body temperature, blood pressure, ECG and heart rate is measured using respective sensors and it can be monitored in the OLED screen present in the circuit, which displays all the current readings of the person. In the next step, NodeMCU interacts with the internet and sends the sensor data.After connecting to the internet it acts as a server.

Then the server automatically sends data to thecloud, Adafruit IO. By logging in to the cloud account, anybody can monitor the patient's health status anywhere in the world using laptops, tablets and smartphones. Parallelly we are sending the data to the google forms. From thegoogle forms the data is sent to the neural network model which uses Jupyter notebook as IDE. Now that neural network model uses a previous data set and processes it with the current data and finds whether the person is sick or not.

VI. PROJECT RESULTS

Within a few moments, the OLED asks us to place our fingers. At the same time the NodeMCU connects with the wifi assigned already. After supplying the power to the board, an LED glows in the ECG and the oximeter sensors



Now we have to attach the ECG electrodes to our body, and we have to place our index finger onthe oximeter sensor and our middle finger on the IR thermometer sensor for a few seconds until the OLED displays the respective values.

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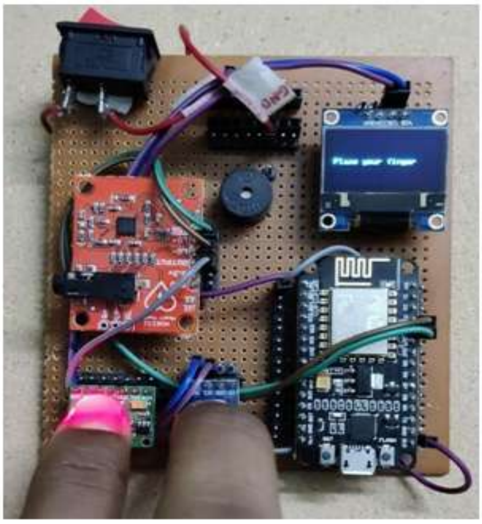
In the next step, the sensor values are displayed on the OLED and the data is sent toAdafruit IOas well as google forms.



The sensor data is stored in the Adafruit IO cloud. Now we can access the data from anywhere inthe world using the internet. The adafruit IO displays the data collected until now and also displays the data graphically

The data from the google sheets is sent tothe neural network model and after processing, theresult is sent to our WhatsApp.

VII. CONCLUSION

In this project, we have analysed Microcontroller based health monitoring system using IoT. Any abnormalities in the health conditions can be known directly and are informed to the particular person via the internet. The proposed system is simple, power efficient and easy to understand. It acts as a connection between patient and doctor. percent. By using this project one can easily monitor the patient data remotely which avoids threats in many emergency cases. This project alsopredicts the health condition of the patient with an accuracy of about 70 percent. The hardware for the project is implemented and the output results are verified successfully.

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