Heart Function Monitoring and Prevention of Heart Attack using Internet of Things

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Abstract. Many people die of heart disease every year, as the hard tissue tightens and tightens the arteries, which can block the flow of blood through the arteries to the limbs and muscles, without causing complications. Heart disease is the leading cause of death. There are some medications that reduce heart rate and prevent fear of heart attacks such as Nitroglycerin, Beta-blockers, and immediate injections into a patient's body. If an adult is sleeping at home and a sudden heart attack occurs it will be a dangerous condition, if the doctor is not at home to help and provide immediate medical attention. As this project progresses, place more nerves to monitor the patient's environment and health, if the patient develops a heart attack and then the first stage of the heart is a sudden change in heart rate. As it gets too high or too low during this time, we get a heart attack using a pulse sensor and microcontroller, with the help of a microcontroller and a car the drug will be injected into the patient's body by controlling the amount of drug flow then the controlling a heart attack is quicker, easier, and more predictable.

1. Introduction
Cardiovascular disease in the elderly some changes occur normally when age increases, now these changes could be as in heart we have a natural pacemaker as aging occurs these natural pacemaker cells are replaced by fibrous tissue and there are fat deposits happening now natural pacemaker maintains the heartrate and heart rhythm[1] now because of these aging changes will happen in heart rate and heart rhythm they tend to develop arrhythmia especially at fibrillation or ventricular arrhythmia they can have slow heart rate like bradycardia, as heart size increases with age then heart wall thickens they can become stiff so in that case, the amount of blood the heart collects with each beat actually reduces the increased size in heart this reduces the cardiac and can lead to diastolic and systolic dysfunction[3,5,], the main artery of the heart that is the iota can become thicker and stiff as resulting in hypertension in elders and increased blood pressure in elder age then there are beryl cell receptors in our body which helps maintain the blood pressure levels, as the aging increases these barrels receptors become less sensitive leading to orthostatic hypotension in the elderly this means the patient can feel dizzy when they change their position from sitting or lying down to standing position they become dizzy because there will be less supply of blood to brain[6], so this is a few common cardiovascular complications occurring elderly the valvular heart diseases like regurgitation problems and hypertension. Aging can cause some changes in blood vessels.
and heart for example[7,8], as people get older the heartbeat as fast during physical activity or stress as it did when people are young, then the number of heart beats per minute will does not change with normal aging. Cardiovascular disease the most important cause of death among men and women. figure 1 shows a survey of people who died of cardiovascular disease.

2. Literature Survey
The Heart disease affects not only older people but younger people are showing the early signs of arterial disease with an inactive lifestyle and junk food, As people grow older, fats, sterol, and metallic elements will accumulate within the arteries and form plaque [4-6]. The structure of the plaque makes it tough for blood to flow to the arteries. Since this build-up is feasible within the body's arteries together with the legs, heart, and kidneys, it’ll cause an absence of blood and chemical elements in varied body tissues. Fractures of the crust can even break and cause blood clots. Left untreated, arteriosclerosis will cause heart failure, stroke, or heart disease thus this condition is extremely very dangerous and changes that happen with age increase a person’s heart disease[9]. The major of heart disease is because fatty in the walls of arteries over long time and need a real-time system that can monitor the elder people's condition.

![Figure 1](image_url)

**Figure 1.** effected by Cardiovascular disease.

3. Materials and Methodology
The Heart continuously to pump blood and oxygen into the lungs and the blood carries oxygen to all parts of the body through hemoglobin. We have two types of blood, one which is mixed with oxygen and the other the pureblood that is not mixed with oxygen[4-6]. The blood is mixed with oxygen and has a high volume, same of the amount of blood that can be mixed with oxygen have a small volume, thus once the guts pumps there's a rise in ventilated blood[2] once the guts relaxes the element content of the guts decreases knowing the time distinction between the increase and fall of the element level, the guts rate is decided thus there's a pursuit connected to pulse measuring system typically placed on the fingertips of hands or legs. the heartbeat measuring system has 2
semiconductor diodes at IR semiconductor diode and red LED, the sunshine passes from one finish of the finger to either through the skin with this blood element level will be calculated[16-19].

3.1. MAX30100 Heart rate sensor

The MAX30100 is a pulse oximetry and heart rate monitor sensor[10]. The Pulse oximeter that will measure our blood oxygen concentration and heart rate. here we will use the MAX30100 pulse oximeter module So spo2 that is the blood oxygen concentration is measured in percentage and bpm. (heartbeat per minute will be measured as bpm)
This is a MAX30100 breakout board from maxim semiconductor and it has two LED’s, first LED which emits red light and it also has IR LED which emits infrared light for measuring pulse rate IR LED is used and for measuring oxygen level both red and IR LED is used.

![MAX30100 Pulse Oximeter](image)

**Figure. 1.** MAX30100 sensor.

The relation between Hb and HbO2 that is hemoglobin and oxyhemoglobin.

- This graph is generated, wavelength and light absorbance of the pure and oxygen-filled blood.
- The Partial pressure of the oxygen dissolved in arterial blood is termed as PaO2.
- The Percentage of oxygen-bound in the hemoglobin in arterial blood is termed as SaO2.
- When this is measured by a pulse oximeter, SaO2 is called SpO2.

So SpO2 is the percentage of oxygen in the blood and BPM is the rate at which the heart beats in a minute.
3.2. ULN2003

The ULN2003 devices are high-voltage, high-current Darlington transistor arrays, and seven NPN Darlington capable of discharging 500 mA, by changing the inductive loads of standard flyback cathode.

![ULN2003 Driver](image1.jpg)

**Figure 2.** ULN2003 driver.

The current rate of a single Darlington collector is 500 mA. Two of Darlington can be compared to the current high power. The application includes transmission of logic buffers, hammer, lamp, display, and line drivers [3].

![ULN2003 Schematic](image2.jpg)

**Figure 3.** Schematic diagram of ULN2003.

**Applications:**

- It used as a touch sensor for Arduino
- High current LED’s can be driven
- Used to drive current loads using digital circuit
- It can also be used to drive stepper motors.

3.3. ESP32 Board

ESP32 is a less cost and low power system. It consists of integrated Wi-Fi capabilities and dual-mode Bluetooth, unlike Arduino UNO which has only gypio pins. Compared to Arduino, It is fast, large memory, and also supports RTOS.
Here are some of the features difference between Arduino and ESP32 are:

- ESP32 is a single board while Arduino has different types of boards.
- ESP32 has wireless connectivity such as Wi-Fi and Bluetooth while most of Arduino boards don’t have wireless connectivity.
- ESP32 has a frequency of 160-240MHz and most of Arduino boards have a frequency of 16MHz.

3.4. Arduino UNO

Arduino is a microcontroller-based opensource electronic prototyping board, is designed with associate degree easy-to-use Arduino IDE, physical circuit, and software package circuit [8]. The Arduino IDE uses a simplified version of C++ and it makes it straightforward to be told and UNO is one among Arduino’s in style boards.

4. Design and implementation

Heart function monitoring and prevention of Heart Attack are two modules. Monitoring using ESP32 and prevention using Arduino.

4.1. Design 1

In the first phase of IoT-based health protection using Arduino. The heartbeat sensing element (MAX30100) are connected to the patient’s body, causation the guts rate and SpO2 to the microcontroller [4]. The microcontroller can monitor and show details on the LCD thus if the info is traditional the background light-weight of the LCD are blue or it'll be red, with a explosion or decrease in vital sign then the buzzer can begin noisy and also the motor can management the drug can mechanically activate and
suppress drug flow within the patient's body. In extreme cases, the patient will use the emergency button [7-9].

Figure 6. System design of MAX30100 sensor.

In the initial one, the MAX30100 pulse rate detector are going to be connected to associate Arduino with 12C protocol, and therefore the pulse rate is 3V, the Arduino works with each 5V and 3V however the Grove crystal rectifier operates with 5V 12C protocol. To unravel this drawback we want A level of understanding between the Arduino and therefore the MAX301000 [1], as we tend to use the 12C protocol then the SCL and SDA cables from the MAX30100 attend the conception level convertor and therefore the Arduino cable to -TXO conception convertor. HV are going to be connected to 5V, LV to 3.3V, and GND to Arduino GND. Then create the solder on the MAX30100 and therefore the long wire along. As we tend to currently connect another a part of the long wire along to the opposite finish of the wire on the board, as we will use the MAX30100 faraway from the feed board [2-6]. different connections like the step of the automobile ar connected to the driving force ULN2003 and therefore the VIN of the driving force within the 5V of Arduino and GND to GND and IN of one, 2, 3, 4 pins on the digital pins a pair of, 3, 4, 6 of -Arduino, a Grove liquid crystal display connected to the 12C protect, Buzzer are going to be connected to the D8 of the Arduino protect and therefore the bit button detector are going to be connected to the D4 of the Arduino protect [13-18].

Figure 7. System performance and experiment.
By controlling the amount of medicine that will be injected into the patient’s body and using a step motor [7] that will act as a dialysis pump and this pump operates by pushing the liquid in the hose by pressing it.

![Dialysis pump](image)

**Figure 8.** Dialysis pump.

### 4.2 Design

As in this circuit here use IoT-based patient health watching victimization the ESP32 net server. this can be done as a result of within the 1st case the doctor won’t be able to sight the patient's heartbeat and vital sign thus keeping track of the patient's health reception is incredibly troublesome thanks to the busy activities of the country [1-3]. As we tend to grow old, patients can suffer additional from health issues and wish additional care and watching from time to time, sensible Health pursuit System uses net Server[3-6].

In this case, victimization the MAX30100 detector to live pulse rate (BPM) and blood atomic number 8 level (SpO2) we are going to use the DS18B20 temperature detector to live the patient's vital sign [2]. we tend to additionally would like an explicit temperature and wetness to create the patient comfy and speedy recovery. therefore, use DTH11 wet and warmth wetness.

![Circuit diagram](image)

**Figure 9.** Circuit diagram for interfacing MAX30100, DHT11 & DS18B20 with ESP32.

As the MAX30100 is a 12c sensing element thus connect its SDA & SCL pin to GPIO21 & GPIO22[7]. All sensors connect their VCC to a three.3V power offer and connect GND to GRD[10]. Connect the INT pin GPIO19 of ESP32 because the output pin of DHT11 is connected to the GPIO18 of ESP32, like the output pin of the DS18B20 connecting to GPIO5. The output pin and VCC pin of the DS18B20 between them have connected the four.7K pull-up resistance [4-7].
After the connections go to the tools and select the right board, once the board is selected then upload to the controller and press reset button of ESP 32 then there will a screen display all the parameters like BPM, ROOM TEMPERATURE, HUMIDITY, SpO2, and BODY TEMPERATURE. So all the parameters can be observed on serial monitor[3-5].

To check this value on web server, we need an IP address of a local wave server[8]. So again press the reset button of ESP32 then we will get an IP address on a serial monitor and copy that IP address and simply paste it in a web browser as once pasting is done, it will get data from ESP32[9] and it will display room temperature, body temperature, room humidity, blood oxygen and heart rate from respective sensors MAX30100, DHT11 & DS18B20.

5. Future scope
This research is forword step in the complex process, As the future work of the project focuses, to make proper and simple communication between Doctor and patients without the need to go the hospital, As to design a special app for health care, to communicate between doctor and patients and to prevent sudden heart attack deaths, working to make a special chip that will be inserted in the patient body. As if there is a sudden heart attack then it will make the heartbeat normal.
6. Conclusion
Internet of things (IoT) has been within the thick of things since the inception of its concept. The benefits of IoT beyond questions and experts are convinced about the positive potential of IoT in every aspect of the healthcare and human lives[5], as in fact the healthcare is possibly the only industry which is collecting remote data even before IoT and It is more flexible and cheaper than a commercial solution[3] with varieties of project and Arduino has brought custom home automation to everyday life.

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