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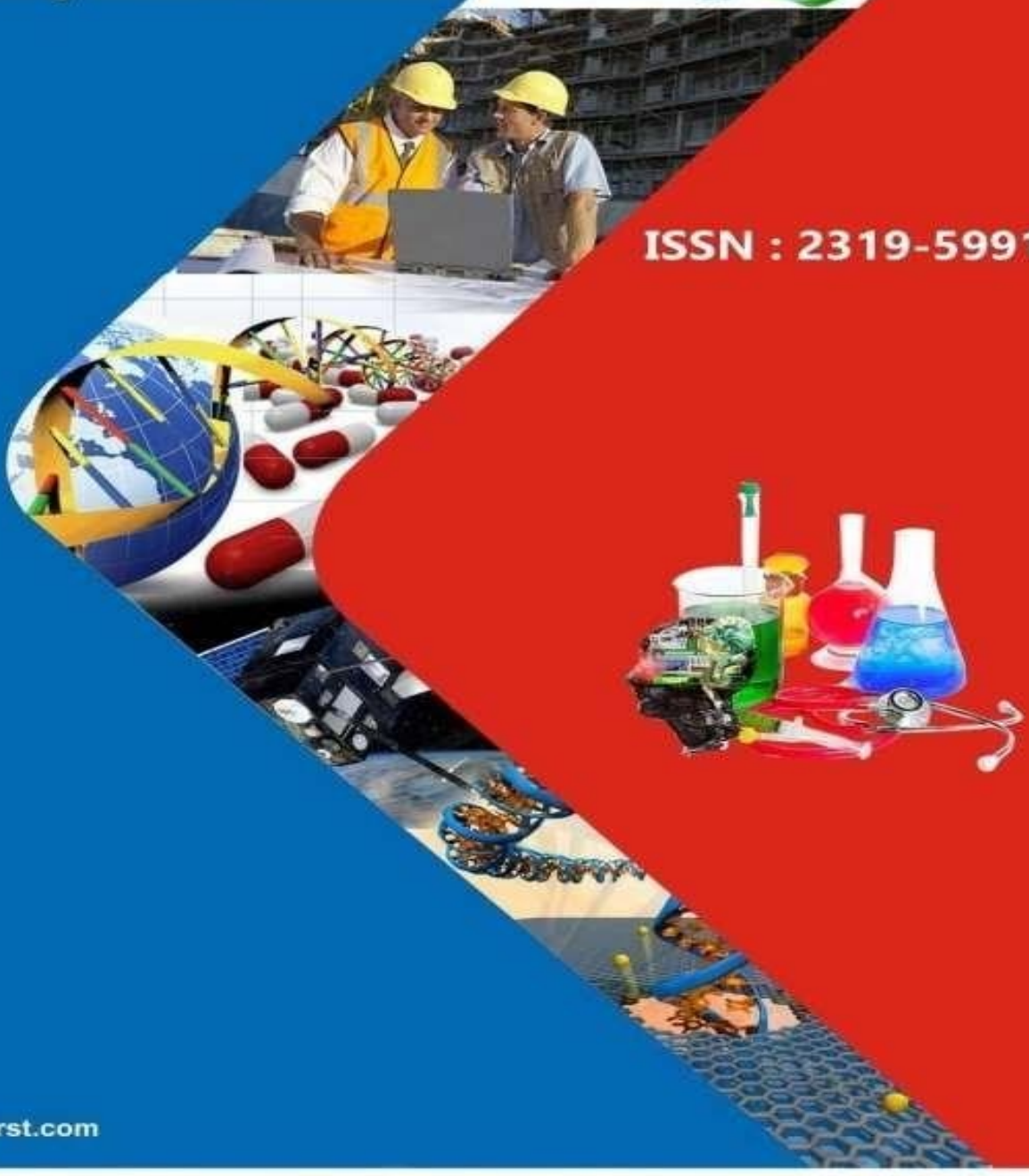

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Web-Based System for Detecting Heart Attacks and Monitoring Heart Rates

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ABSTRACT:

One of the top killers on a global scale is cardiovascular illness, which includes heart attacks. Timely medical care greatly improves survival chances when problematic cardiac problems are detected early. The Heart Rate Sensor, DHT11 Temperature and Humidity Sensor, MQ2 Gas Sensor, Internet of Things (IoT) connection, and a buzzer alert system are all part of the proposed system for detecting and monitoring heart attacks using the Internet of Things.
The patient's pulse is constantly being monitored by the Heart Rate Sensor, which may identify irregular heartbeats that may suggest possible cardiac problems. In addition to measuring core temperature and relative humidity, the DHT11 sensor may provide valuable information about a person's overall health. Overconsumption may lead to cardiac problems, which is why the MQ2 gas sensor can identify toxic gas or alcohol levels in the circulation. Medical experts or caregivers may remotely view the patient's vital signs thanks to the system's connection to the internet of things (IoT), which enables real-time monitoring and data transfer to cloud platforms.
When anything out of the ordinary is discovered, a buzzer warning system goes out to let the patient and caregivers know that they need to take quick action. Furthermore, a GPS module is included into the system to communicate the patient's current position in the event of a medical emergency. The microcontroller, which is based on Arduino, analyzes the data from all the sensors, notifies the user, and sends the results to an internet of things dashboard.
For continuous heart health tracking that ensures early intervention and reduces fatal cardiac episodes, this smart health monitoring system offers a cost-effective, efficient, and scalable solution. The integration of wearable sensors, AI-driven emergency response systems, and machine learning algorithms for predictive analysis are all potential future improvements that might further enhance patient care.

EMBEDDED SYSTEMS

A computer system that is purpose-built to carry out a single or limited set of tasks, often under the restrictions of real-time computing, is known as an embedded system. As with other physical and mechanical components, it is often integrated into a whole device. A personal computer or other general-purpose computer, on the other hand, may be programmed to do a wide variety of functions. These days, many of the everyday items we use rely on embedded systems to function. Design engineers may improve the embedded system to decrease product size and cost while boosting reliability and performance since it is devoted to certain functions. Because of their mass production, certain embedded systems are able to take advantage of cost savings.
From small, handheld gadgets like digital watches and MP3 players to massive, permanently installed systems like those managing nuclear power plants, traffic lights, and industrial controls are all examples of physically embedded systems. From simple systems using a single microcontroller chip to complex systems housing several modules, peripherals, and networks in a massive chassis or enclosure, complexity may range greatly.
The phrase "embedded system" lacks a precise definition because the majority of systems have programmability in some form. While they share some components with embedded systems, such operating systems and microprocessors, handheld computers are not technically embedded systems as they enable the loading of multiple programs and the connection of peripherals.
Computer hardware and software, either fixed in capability or programmable, particularly intended for a certain sort of application device—this is what's called an embedded system. Embedded systems may be found in a wide variety of objects, including but not limited to: vehicles, medical devices, cameras, home appliances, aircraft, vending machines, toys, and, of course, cellular phones and personal digital assistants. A programming interface is given to programmable embedded devices, and programming for embedded systems is a niche field in and of itself. Embedded Java and Windows XP Embedded are two examples of embedded-specific operating systems and language platforms. On the other hand, certain budget consumer goods include integrated

International Journal of Engineering Research and Science & Technology

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Vol. 21, Issue 2, 2025

application and operating system components, employ very cheap microprocessors, and have limited storage space. Instead of being loaded into RAM (random access memory), as applications on personal computers are, in this situation the program is written permanently into the system's memory.

CHARACTERISTIC OF EMBEDDED SYSTEM

- Speed (bytes/sec): Should be high speed
- Power (watts): Low power dissipation
- Size and weight: As far as possible small in size and low weight
- Accuracy (%error): Must be very accurate
- Adaptability: High adaptability and accessibility
- Reliability: Must be reliable over a long period of time

APPLICATIONS OF EMBEDDED SYSTEMS

Here, in the Embedded World, we are living. The smooth operation of the various embedded goods that surround you is crucial to your day-to-day existence. In your living room, you have a TV, radio, and CD player; in your kitchen, you have a washing machine or microwave oven; and at your office, you have card readers, access controllers, and palm devices that let you do a lot. In addition to all of this, your automobile has a plethora of built-in controls that handle functions between the bumpers, most of which you probably don't give a second thought to.

- **Robotics:** industrial robots, machine tools, Robocop soccer robots
- **Automotive:** cars, trucks, trains
- **Aviation:** airplanes, helicopters
- Home and Building Automation
- **Aerospace:** rockets, satellites
- **Energy systems:** windmills, nuclear plants
- **Medical systems:** prostheses, revalidation machine.

MICROCONTROLLER VERSUS MICROPROCESSOR

When comparing microprocessors and microcontrollers, what are the key differences? Any general-purpose microprocessor, such an 8086, 80286, 80386, 80486, or a Pentium from Intel, or a 680X0 from Motorola, etc., is considered a microprocessor. In addition to lacking on-chip I/O ports, these microprocessors also lack random-access memory (RAM). Because of this, they are often called general-purpose microprocessors. Designing a working system around a general-purpose CPU like the 68040 or Pentium requires the addition of extra components like as RAM, ROM, I/O ports, and timers. Though these systems are more costly and cumbersome due to the inclusion of external RAM, ROM, and I/O ports, they provide the benefit of being versatile in that the designer may choose the quantity of RAM, ROM, and I/O ports required for the work at hand. Microcontrollers are an exception to this rule. On a single chip, you'll find a microprocessor, random access memory (RAM), read/write (ROM), input/output (I/O) ports, and a timer in a microcontroller. So, since the CPU, random access memory (RAM), read/write memory (ROM), input/output (I/O) ports, and timer are all integrated into a single chip, the designer is unable to include any more memory, I/O ports, or timer into the product. Because of its set quantity of on-chip ROM, RAM, and number of I/O ports, microcontrollers are perfect for many applications where space and cost are important considerations. It is not necessary to have a 486 or even an 8086 CPU for many applications; for instance, a TV remote control. Typically, these programs will need some kind of input/output function in order to read signals and toggle bits.

INTRODUCTION

The heart is the most important organ in the human body. The heart pumps blood to every part of the body via the circulatory system, which includes veins and channels. The heart may be damaged by unhealthy eating habits and high blood pressure, leading to cardiovascular collapse. Predicting respiratory failure using a small battery of physical exams is now only possible for experts. Patients may find it difficult to visit the emergency clinic for their normal registration due to the lack of time in today's hectic environment. An unanticipated and potentially deadly respiratory collapse could result from this. The most common cause of mortality is heart disease, which is understandable given that the heart is the most sensitive organ in the body and requires constant care. With the help of the IoT, this automation should be feasible. In this context, "internetof things" (IoT) is the network that connects commonplace objects. This implies that technology is spread and may reach individuals in many different ways. People often utilize it. This paper proposes an Internet of Things (IoT) system that uses an Arduino UNO board and

International Journal of Engineering Research and Science & Technology

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Vol. 21, Issue 2, 2025

a heartbeat sensor to alert the patient when he is about to have cardiac failure, giving him time to prepare for the actual attack. Building is also discussed in this piece. Additionally discussed in this article is the development of a global positioning system that makes use of GPS sensors. An individual's topographical location must be identified and tracked over time before the framework can be implanted with them. Current Architecture

For patients at high risk of cardiac problems, traditional methods of detecting and monitoring heart attacks rely on manual checkups, electrocardiogram machines, and hospital-based monitoring, none of which are always accessible. It would be inconvenient, expensive, and time-consuming to make frequent trips to healthcare institutions only to have your heart rate measured. The ability to monitor vitals in real time is missing from many of the current devices that just record temperature or heart rate.

While wearables are a part of certain high-tech systems, it might be difficult to retrieve data remotely and integrate them with IoT platforms. Gas sensors like MQ2 can detect excessive alcohol levels that lead to cardiac problems, but most current monitoring systems do not contain them. The absence of automatic alarm systems is another drawback of conventional approaches that causes actions to be delayed during crises.

It is challenging to warn caretakers or emergency responders in the event of a medical emergency with most current systems due to the lack of buzzer notifications and GPS tracking. Patients at risk of heart attacks need a system that can continuously monitor them, notify them in real-time, and track their position. This solution should be built on the internet of things (IoT).

PROPOSED MODEL

To provide real-time health tracking and emergency alerting, the proposed IoT-based heart attack detection and monitoring system includes a buzzer alarm, IoT, Heart Rate Sensor, DHT11, and MQ2. In order to identify abnormalities like bradycardia and tachycardia, the Heart Rate Sensor tracks changes in pulse rate. In order to identify heat-related stress or fever—conditions that might affect heart health—the DHT11 sensor offers continuous monitoring of humidity and temperature.
In order to identify amounts of alcohol or harmful gas exposure—both of which may lead to cardiac issues—the MQ2 gas sensor is included. Through Internet of Things (IoT) connectivity, the system promptly notifies medical personnel and caregivers of any suspicious readings. The rapid notice provided by a buzzer alert enables prompt action to be taken.

In addition, the system incorporates GPS tracking so that medical personnel may quickly access the patient's position in the event of an emergency. An Arduino microcontroller acts as the master, processing data from sensors and transmitting it to an Internet of Things (IoT) dashboard that may be accessed by a web interface or mobile app. The suggested system's main benefits are as follows: • The ability to monitor vital signs, temperature, and gas levels in real time. • Healthcare providers and caregivers may have remote access via the Internet of Things. Patients and caregivers may be immediately notified of urgent situations by buzzer alarms. In the event of an emergency, the device can be tracked using GPS.

Efficacious and extensible method for monitoring cardiac health.Reducing the likelihood of catastrophic cardiac episodes and allowing proactive healthcare management, this approach guarantees that patients get medical attention in a timely manner.

BLOCK DIAGRAM

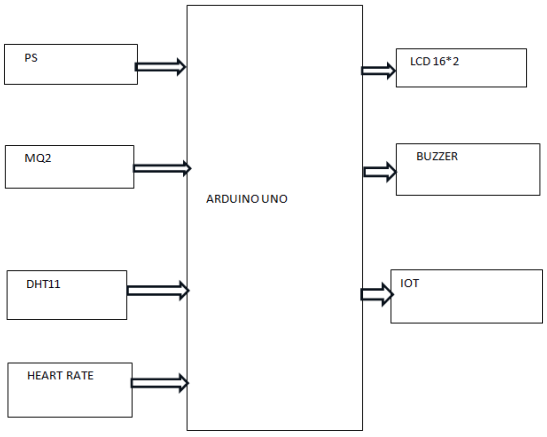

Figure 1: Block Diagram

Microcontroller:

A tiny controller, or microcontroller, as the name implies. Often used as a processing or controlling unit, they are similar to single-chip computers. For instance, microcontrollers that do decoding and other regulating operations are likely integrated into the control you are using. They find further use in vehicles, home appliances, microwaves, toys, and any other area requiring automation.

International Journal of Engineering Research and Science & Technology

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Vol. 21, Issue 2, 2025

Arduino Uno Microcontroller:

One such microcontroller board is the Arduino Uno, which uses the Atmega328 (datasheet). It has a 16 MHz crystal oscillator, 6 analogue inputs, 14 digital input/output pins (6 of which may be used as PWM outputs), a power connector, an ICSP header, a reset button, and a USB connection. All you need is a USB cable, an AC-to-DC converter, or a battery to get it going; it comes with everything you need to support the microcontroller.

A key difference between the Uno and all previous boards is the absence of the FTDI USB-to-serial driver chip. Rather of that, it has an Atmega8U2 that has been configured to convert USB to serial. To celebrate the impending release of Arduino 1.0, the name "Uno"—which means "One" in Italian—has been chosen. The Uno and Arduino version 1.0 will serve as the foundational versions for future Arduino releases. For a comparison with prior generations, see the index of Arduino boards. The Uno is the newest in a series of USB Arduino boards and the standard model for the Arduino platform.

ARDUINO UNO BOARD:

One board that uses the Atmega328 microprocessor is the Arduino Uno. A 16 MHz ceramic resonator, 6 analog inputs, 14 digital I/O pins (including 6 PWM outputs), 1 USB port, 1 power connector, 1 ICSP header, and 1 reset button are all part of it. All you need is a USB cable, an AC-to-DC converter, or a battery to get it going; it comes with everything you need to support the microcontroller.

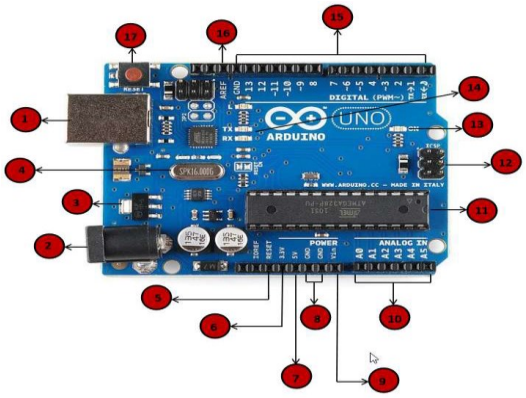

Figure 2: Arduino uno board

In contrast to all of its predecessors, the Uno does not have the FTDI USB-to-serial driver chip. As an alternative, it makes use of USB-to-serial converters coded into the Atmega16U2 (Atmega8U2 up to version R2).

HARDWARE COMPONENTS

POWER SUPPLY UNIT

The power supply for this system is shown below.

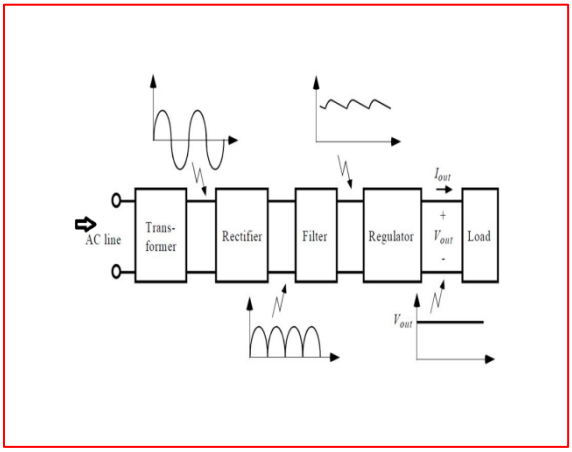

Figure 3: power supply

Diodes:

Only one path of electrical current may pass through a diode. Current may flow in either direction, as shown by the arrow in the circuit symbol. Originally termed valves, diodes are essentially an electrically enhanced version of the mechanical component.

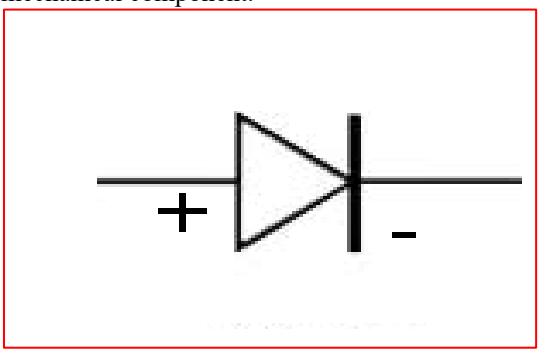

Figure 4: Diode Symbol

One kind of electrical component that restricts current flow is the diode. A voltage loss of around 0.7V will be the sole influence on the signal when the diode is "forward-biased" in this way. No current will flow through a diode that is "reverse-biased" when the current is applied in the other direction.

Rectifier

A rectifier's job is to change the phase of an alternating current (AC) waveform so that it appears as a direct current (DC) waveform. Both "half-wave" and "full-wave" rectifiers are used for

International Journal of Engineering Research and Science & Technology

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Vol. 21, Issue 2, 2025

rectification. Diodes are used in both devices to convert AC current into DC current. The Half-Wave Resettable
The graphic shows that the half-wave rectifier is the simplest rectifier type since it only employs one diode.

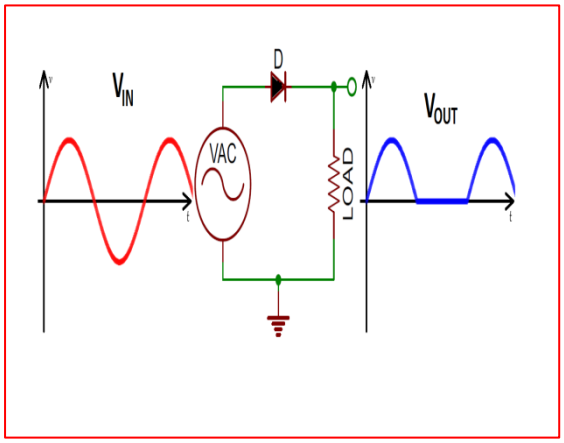


Figure 5: Half Wave Rectifier

LIQUID CRYSTAL DISPLAY

An array of color or monochrome pixels arranged in front of a light source or reflector makes up a liquid crystal display (LCD), a thin, flat display device. Two polarizing filters, with their polarity axes perpendicular to one other, and a column of liquid crystal molecules hanging between two transparent electrodes make up each pixel. Light would not be able to travel through them if the liquid crystals weren't interposed. To make light flow through two filters, the liquid crystal changes the polarization of the light entering the first filter.
A program's ability to communicate with the outside world depends on its input and output devices, which in turn rely on human communication. An LCD display is a typical accessory for controllers. 16X1, 16x2, and 20x2 LCDs are among the most popular types of displays that are often linked to the controllers. Which works out to sixteen characters on a single line. The first set has 16 characters on each line while the second set has 20 characters on each line. The use of "smart LCD" displays allows for the visual output of information by many microcontroller devices. Affordable, user-friendly, and capable of producing a readout utilizing the display's 5X7 dots plus cursor, LCD displays built on the LCD NT-C1611 module are a great choice. They use mathematical symbols and the usual ASCII set of characters. The display needs a +5V power and 10 I/O lines (RS, RW, D7, D6, D5, D4, D3, D2, D1, D0) for an 8-bit data bus. The only additional lines needed for a 4-bit data bus are the supply lines and six more (RS, RW, D7, D6, D5, D4). The data lines are tri-state and do not affect the microcontroller's function when the LCD display is disabled.

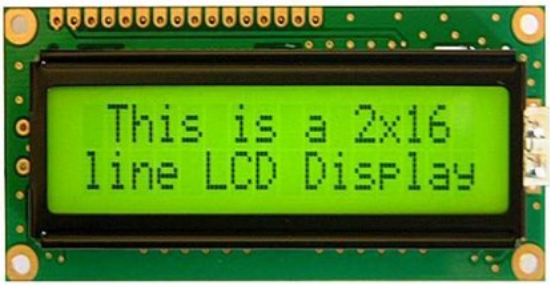
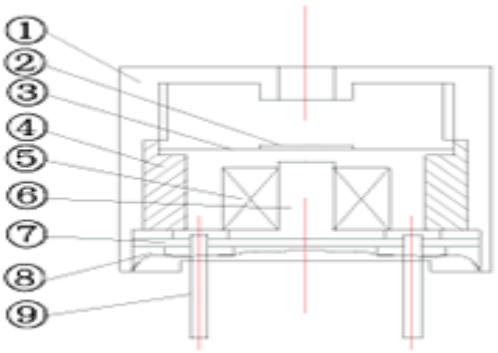


Figure 6: 2x16 LCD Display

BUZZER

In a magnetic transducer, the circuitry includes an iron core, a yoke plate, a wound coil, a permanent magnet, and a vibrating diaphragm that can be moved. The magnet's field gently draws the diaphragm up nearer the core's surface. A positive alternating current (AC) signal causes the diaphragm to move up and down, which in turn vibrates the air. This is achieved by the current passing through the excitation coil, which forms a fluctuating magnetic field. A resonator, which is composed of a cavity and one or more sound holes, may amplify vibrations in order to generate a loud sound.



ESP8266 Wi-Fi Module

This project revolves on this. Because the project relies on WIFI control of appliances, the module is a crucial part of it.
One remarkable feature of this tiny board is the integrated MCU (Micro Controller Unit), which allows for the control of I/O digital pins via a simple programming language that is almost pseudo-code like. Another benefit is that the ESP8266 Arduino compatible module is a low-cost Wi-Fi chip with full TCP/IP capability. The

International Journal of Engineering Research and Science & Technology

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Vol. 21, Issue 2, 2025

Chinese company Es press if Systems is situated in Shanghai and makes this gadget. In August 2014, this chip made its debut in the ESP-01 version module manufactured by the third-party company AIThinker. The MCU can establish basic TCP/IP connections and connect to WiFi networks with the help of this little module. He was His tiny size and cheap pricing (1.7–3.5$) enticed a lot of hackers and geeks to look into it and utilize it for all sorts of projects. Because of its enormous success, Espressif now offers a wide variety of models with varying size and technological specs. Its replacement includes ESP32.

RELAYS:

Industrial controls, automotive systems, and home appliances all make extensive use of electrically controlled switches called relays. By using a relay, two independent voltage sources may be isolated from one another; in other words, a little quantity of voltage or current on one side can manage a big amount of current or voltage on the other side, and vice versa.

Inductor

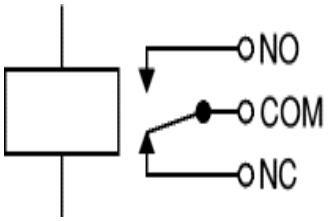


Fig7 : Circuit symbol of a relay

DRIVING A RELAY:

Two of the SPDT relay's five pins are used by the magnetic coil, one serves as the common terminal, and the other two are typically closed and normally connected. The coil is activated when a current passes across it. At the beginning, when the coil is deenergized, the usually closed pin and common terminal will be connected. A new connection will be formed between the common terminal and usually open pin when the coil is activated, breaking this connection. Therefore, the relay will be activated whenever the microcontroller sends an input signal to it. You may drive the loads connected between the common terminal and typically open pin while the relay is on. Consequently, the high-current loads are driven by the relay, which receives 5V from the microcontroller. This means the relay may be used as a means of isolation. The microcontroller and digital systems do not have enough current to operate the relay. In contrast to the 10 milliamps required to activate the relay's coil, the microcontroller's pin can only provide 1 or 2 milliamps. This is why the microcontroller and the relay are separated by a driver, like ULN2003, or a power transistor. By connecting ULN2003 to the relay and microcontroller, it is possible to activate many relays simultaneously.

SOFTWARES

The Arduino platform is an open-source, user-friendly hardware and software environment for prototyping. It is comprised of a programmable circuit board (also called a microcontroller) and an Integrated Development Environment (IDE) called Arduino that is pre-made for writing and uploading code to the physical board. The main characteristics are:

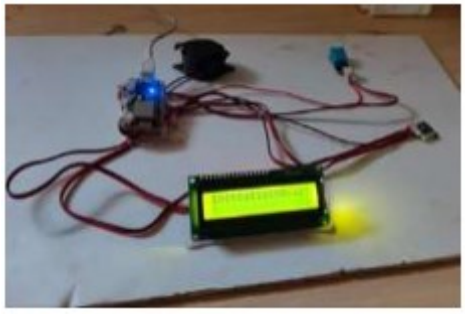
• Many sensors can send signals in digital or analog formats to Arduino boards, which may then be used to activate motors, control LEDs, establish connections to the cloud, and much more.

• The Arduino IDE (also called "uploading software") allows you to command your board's operations by communicating with the microcontroller on the board.

• A separate device, known as a programmer, is not required to load fresh code into an Arduino board, in contrast to most prior programmable circuit boards. The usage of a USB connection is all that is required. • The Arduino IDE employs a streamlined version of C++, which facilitates programming learning. Last but not least, Arduino offers a standardized form factor that simplifies the microcontroller's tasks.

Now that we know what the Arduino UNO board is and how it works, we can go on to setting up the Arduino IDE. As soon as we figure this out, we can upload our software to the Arduino board.

RESULTS



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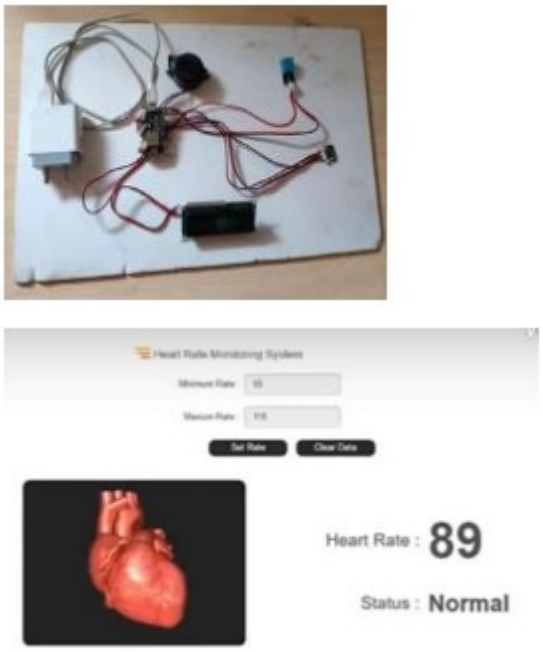
Vol. 21, Issue 2, 2025



Output

CONCLUSION

An intelligent and efficient method of monitoring cardiovascular health is provided by the IoT-based system that detects and monitors heart attacks. A buzzer alarm, Internet of Things (IoT) connection, a heart rate sensor, a temperature sensor, a MQ2 gas sensor, and other sensors allow for remote access to critical patient data, real-time health monitoring, and emergency alarms. This innovative approach ensures that medical intervention is done quickly and effectively by providing continuous health tracking and timely alerts, unlike standard monitoring systems. The integration of the Internet of Things (IoT) with GPS tracking technology significantly improves accessibility and the effectiveness of emergency response. Predictive analytics powered by artificial intelligence, anomaly detection driven by machine learning, and the integration of wearable sensors for even higher precision are all potential areas for future advancement. A huge leap forward in heart health monitoring, this scalable and inexpensive method drastically reduces the likelihood of heart attacks and deaths caused by cardiac issues.

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