

IoT Based Remote Health Monitoring and Alert System

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Abstract: *Since they are isolated in their later years, most people are still forgotten and powerless in medical crises. To deal with this, we've devised a potential Remote Health Monitoring and Warning System (RHMAS). Heart attacks in the elderly are linked with complications such as body temperature changes, elevated blood pressure, profuse sweating, and an abnormal cardiac rhythm, among others. Our approach is to include sophisticated sensors capable of detecting and tracking these signs in order to warn family members, kin, family practitioner, and health care in the event of an emergency. Since most gadgets for this reason are wired, a wireless interface does not obstruct the user's movement. The suggested device includes a Photo-Plethysmography (PPG) dependent pulse sensor to identify arrhythmia, a temperature sensor to continuously track their body temperature, a pressure sensor to sense blood pressure ranges, and a heartbeat sensor. If the controlled data deviates from the nominal body state, an ESP 8266 module can give a message to the next of kin. If the tracked data hits emergency thresholds, health providers can send a message to her kin as well as a buzzer to a consent user.*

Keywords: GPS, Sensor, Cloud, LCD Display and Health Care

I. INTRODUCTION

New medical and health-care technologies are being developed as a result of advancements in wireless network technology. The use of these modern technologies and software also improved the productivity of medical professionals. Patients, both young and old, as well as smart homes with cameras and information technology, are all up for debate. Patients carry monitors to track vital signs, which are also reported in real time to their physicians, improving the level of treatment and still saving money. In order to provide a scalable implementation in the future, we created a prototype of medical supervision for elderly people utilising many technology such as REST, Jess rule driver, and Android in our work. The current scheme does not provide citizens with protection. Heart attacks are still the most common cause of death in our world. However, after causing a heart failure, a heart attack is expected. From time to time, People are severely affected by heart attacks. After affecting this problem, cardiac attack is expected. People did not have easy access to first aid at the moment. As a result, the majority of these individuals are wounded. These are the system's primary flaws [1]-[5].

In order to attract enough participants to complete large-scale sensing activities of high accuracy, mobile crowd sensing needs a reward mechanism. Previous reward mechanisms aimed to measure participants' contributions to sensing efficiency and offer direct benefits to them. We present a novel solution called the social reward system in this paper, which, interestingly, incentivizes the social friends of the participants who conduct the sensing tasks. The fundamental premise is to use participants' social relations to foster global cooperation. Since a participant's reward is primarily dependent on the actions of his or her social peers, participants are motivated to influence their friends' behaviours by their social interactions in order to achieve a higher payoff. This method can be used in a variety of contexts where the inputs of different actors to the efficiency of sensing are interdependent, such as data aggregation. A case study has been presented to demonstrate that the social reward system is more cost-effective than conventional incentive mechanisms [6]-[10].

The electrodes are implanted in the patient's body and detect the patient's temperature and pulse. Two more sensors are installed at home to monitor the humidity and temperature of the patient's bed. All sensors are connected to a control device that adds up the values of all four sensors. These measured values are then sent to the base station through an IoT cloud. The values are then retrieved by the doctor at some other point from the base station. Thus, depending on the temperature, heart rate, and room sensor values, the doctor will determine the patient's condition and take corrective precautions [11]-[15].

II. PROPOSED METHOD

When a patient arrives at the healing centre, sensors detect physiological symptoms, which are then converted to electrical signals. Then the basic electrical flag is upgraded to an advanced flag (computerised data) and stored in RFID. The Zigbee Protocol is used to transfer computerised data to a local server. Zigbee is an apt convention for this system. There are the most cell hubs in this region. It is preferred for devices that are smaller in size and use fewer energy. Information is sent to the therapeutic server via WLAN from a nearby server. When the data is sent to the therapeutic registry, it scans to see whether the patient has a previous medical background, so the server applies the latest data to the record and sends it to the doctor. If the patient has no previous therapeutic records, the server generates a new ID and saves the details in its database. This detail is sent to an expert for evaluation. IoT data transfer in its entirety. The microcontroller is used to calibrate the values of the body temperature sensor, pulse rate sensor, room temperature sensor, and humidity sensor. The full prototype of the health monitoring device with sensors, showing the measured and shown performance values of the sensors on an LCD panel, so that these values are noticeable even to the user is shown in Figure 1.

The ADC converts the temperature sensor attached to the analogue pin of the Arduino controller into a digital value. The controller uses the equation $\text{temperature } (^{\circ}\text{C}) = [\text{raw ADC value} * 5/4095 - (400/1000)] * (19.5/1000)$ to transform the digital data into the physical temperature value in degrees Celsius. The photo phlethysmography theory underpins the heartbeat sensor. It tracks the difference of blood flow through every organ of the body that results in a shift in the strength of light passing through that organ (a vascular region). The digital pulses are sent to a microcontroller, which uses the formula to calculate the heat beat rate: $\text{BPM (beats per minute)} = 60 * f$, where f denotes the frequency of the pulse. Both moisture and air temperature are sensed, measured, and recorded by a humidity sensor (or hygrometer). Humidity sensors track variations in electrical currents or temperature in the environment to determine humidity levels. The following formula is used to measure relative humidity: $\text{Percent relative humidity} = (\text{Voltage} - 0.958) / 0.0307$; $\text{Voltage} = (\text{ADC Value} / 1023.0) * 5.0$;

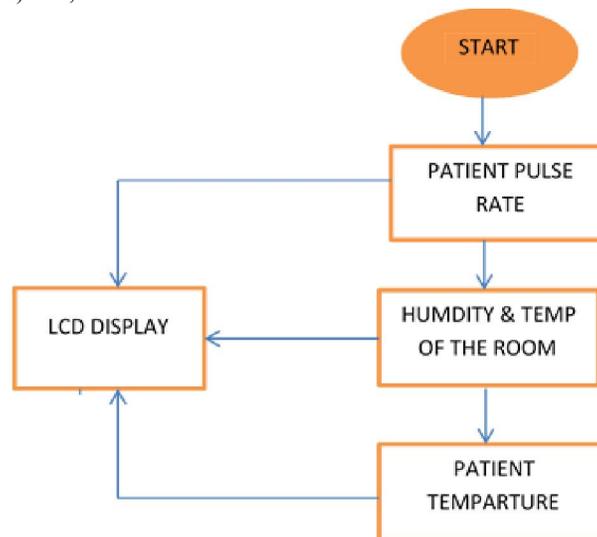


Figure 1: Flow Chart of Proposed System

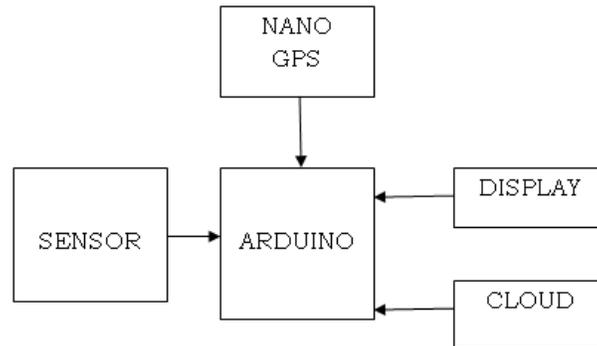


Figure 2: Block Diagram of Proposed System

The C Standards Committee created Embedded C as a series of language extensions for the C programming language to resolve commonality problems that occur between C extensions for various embedded systems. In order to accommodate improved microprocessor capabilities including fixed-point arithmetic, several distinct memory banks, and simple I/O operations, embedded C programming usually necessitates nonstandard additions to the C language. The C Standards Committee expanded the C vocabulary in 2008 to provide those features by establishing a general specification that all implementations would follow. Fixed-point arithmetic, called address spaces, and simple I/O hardware addressing are among the functionality not present in standard C. Embedded C programming is the heart of the processor that powers any embedded device we encounter in our everyday lives, such as our phones, washing machines, and digital cameras. Embedded software is paired with each processor. The embedded programme, which determines how the embedded device works, is the first and foremost consideration. The embedded C language is the most commonly used programming language for microcontrollers is shown in Figure.2.

Previously, assembly level programming was used to create multiple embedded programmes. They did not, however, have portability. The introduction of high-level languages such as C, Pascal, and COBOL alleviated this drawback. The C programming language, on the other hand, gained widespread recognition for embedded systems and continues to do so. The C code is more dependable, modular, and compact, as well as much simpler to comprehend. Dennis Ritchie developed the C programming language in 1969. It is made up of one or more tasks, each of which is made up of statements that perform a particular purpose. The C programming language is a middle-level language since it can handle both high-level and low-level programmes. Before diving into the basics of embedded C programming, it's important to understand how RAM memory is organized.

Windows, Apache, MySQL, and PHP (WAMP) are acronyms for Windows, Apache, MySQL, and PHP. It is a programme stack, which ensures that running WAMP on your operating system installs Apache, MySQL, and PHP (Windows in the case of WAMP). Despite the fact that they may be installed individually, they are normally packaged together, and with good cause.

It's worth noting that WAMP is derived from LAMP (the L stands for Linux). The main distinction is that WAMP is used for Windows and LAMP is used for Linux-based operating systems. Let's take a brief look at what each letter stands for. There is a "W" for Windows, a LAMP (for Linux), and a MAMP (for Mac OS X) (for Mac). The letter "A" stands for Apache. The site server programme Apache is in charge of hosting web sites. When you ask Apache to bring you a website, it grants your request over HTTP and displays the site. MySQL is represented by the letter M. MySQL's function is to act as your server's database management framework. It saves all related material, such as the site's content, user accounts, and so on. PHP is abbreviated as "P". WordPress was written in PHP, which is a programming language. It serves as a glue for the whole computing stack. PHP communicates with MySQL and runs in parallel with Apache. A liquid-crystal display (LCD) is a flat-panel display or other electronically modulated optical system that utilises the light-modulating properties of liquid crystals paired with polarizers to create colour or monochrome images. Liquid crystals do not emit light directly, often utilising a backlight or reflector.

LCDs can show random images (as in a general-purpose computer display) or fixed images with low information material that can be shown or obscured (as in a digital clock), such as preset phrases, numbers, and seven-segment

displays. They all use the same fundamental hardware, but arbitrary representations are created using a matrix of tiny pixels, while most displays use larger components. Depending on the polarizer arrangement, LCDs can be turned on (positive) or off (negative). A character positive LCD with a backlight, for example, would have black lettering against a backlight-colored backdrop, while a character negative LCD would have a black background with letters that are the same colour as the backlight. Optical filters are used to lend white and blue LCDs their distinctive look.

The ESP-01 processor, produced by a third-party producer Ai-Thinker, first brought the chip to the attention of Western makers in August 2014. Using Hayes-style instructions, this tiny module helps microcontrollers to link to a Wi-Fi network and create basic TCP/IP connections. However, there was absolutely no English-language literature available at first for the chip and the commands it might accept. Many hackers were drawn to the module, chip, and applications on it, as well as to translate the Chinese documents, because of the low price and the fact that there were few external components on the module, which meant that it might ultimately be quite inexpensive in amount. The ESP8285 is an ESP8266 with 1 MiB of flash built in, enabling single-chip computers to link to Wi-Fi. The ESP32, which was announced in 2016, is the successor to these microcontroller devices.

The Arduino Uno is an open-source microcontroller board designed by Arduino.cc and built on the Microchip ATmega328P microcontroller. The board has a number of optical and analogue input/output (I/O) pins that can be used to connect to different extension boards (shields) and other circuits. The board has 14 digital I/O pins (six of which are capable of PWM output), 6 analogue I/O pins, and is programmable using a type B USB cable using the Arduino IDE (Integrated Development Environment). It can be operated by a USB cable or an external 9-volt charger, with voltages ranging from 7 to 20 volts. It's almost comparable to the Arduino Nano and Leonardo microcontrollers. The hardware reference architecture is accessible on the Arduino platform under a Creative Commons Attribution Share-Alike 2.5 licence. Some models of the hardware have layout and production files accessible as well.

The Italian term "uno" means "one" and was chosen to represent the first release of Arduino Software. The Arduino Uno board is the first of a sequence of USB-based Arduino boards; it, along with version 1.0 of the Arduino IDE, served as the reference version of Arduino, which has since been superseded by newer updates. The ATmega328 on the board is preprogrammed with a boot loader, allowing it to be configured without the use of an external hardware programmer. Although the Uno interacts using the initial STK500 protocol, it does not use the FTDI USB-to-serial driver chip, unlike all previous boards. Instead, it employs a USB-to-serial adapter based on the Atmega16U2 (Atmega8U2 up to version R2).

A CPU, another Arduino/Genuino board, or other microcontrollers may all be communicated with using the Arduino/Genuino Uno. On optical pins 0 (RX) and 1 (TX), the ATmega328 supports UART TTL (5V) serial communication (TX). This serial connectivity is channelled over USB by an ATmega16U2 on the board, which appears to software on the device as a virtual com port. There is no requirement for an additional driver since the 16U2 firmware uses normal USB COM drivers. On Windows, however, a.inf file is needed. A serial display is included in the Arduino Software (IDE), allowing basic textual data to be transmitted to and from the board. As data is transferred through the USB-to-serial chip and USB link to the device, the RX and TX LEDs on the board can glow (but not for serial communication on pins 0 and 1). All of the Uno's digital pins may be used for serial contact with the aid of a Software Serial library. The Arduino/Genuino Uno board is built in such a way that it can be reset by software operating on a linked device, rather than involving a manual press of the reset button before an upload. A 100 nanofarad capacitor connects one of the ATmega8U2/16U2's hardware flow control lines (DTR) to the ATmega328's reset thread. The reset line declines long enough to reset the chip while this line is claimed (taken low).

Heart rate monitoring is important for athletes and patients since it measures the health of the heart (just heart rate). Heart rate may be measured in a variety of ways, the most accurate of which is with an electrocardiogram. A Heartbeat Sensor, on the other hand, is a more convenient way to keep track of the heart rhythm. It appears in a variety of shapes that sizes and can be used to calculate the pulse in real time. Wrist watches (Smart Watches), smart phones, chest belts, and other devices all have heartbeat sensors. The pulse is counted in beats per minute (bpm), which measures how many times the heart contracts or expands in a minute. Photoplethysmograph is the concept behind the Heartbeat Sensor's use. The increases in the amount of blood in an organ are determined by the changes in the strength of light

flowing into the organ, according to this theory. In most heartbeat sensors, the light source is an IR LED, and the detector is a Photo Detector such as a Photo Diode, an LDR (Light Dependent Resistor), or a Photo Transistor. We may organise these two elements, a light source and a detector, in two ways: a Transmissive Sensor and a Reflective Sensor.

The light source and detector are next to each other in a reflective sensor, and the person's finger must be positioned in front of the sensor. A sensor and a control circuit make up a basic Heartbeat Sensor. An IR LED and a Photo Diode in a clip make up the sensor portion of the Heartbeat Sensor. An Op-Amp IC and a few other elements make up the Control Circuit, which connects the signal to a Microcontroller. The Heartbeat Sensor's activity can be best described by looking at its circuit diagram. The volume of blood in the finger varies with each pulse, as does the light from the IR LED flowing through the finger and hence being observed by the Photo Diode is shown in Figure.3.

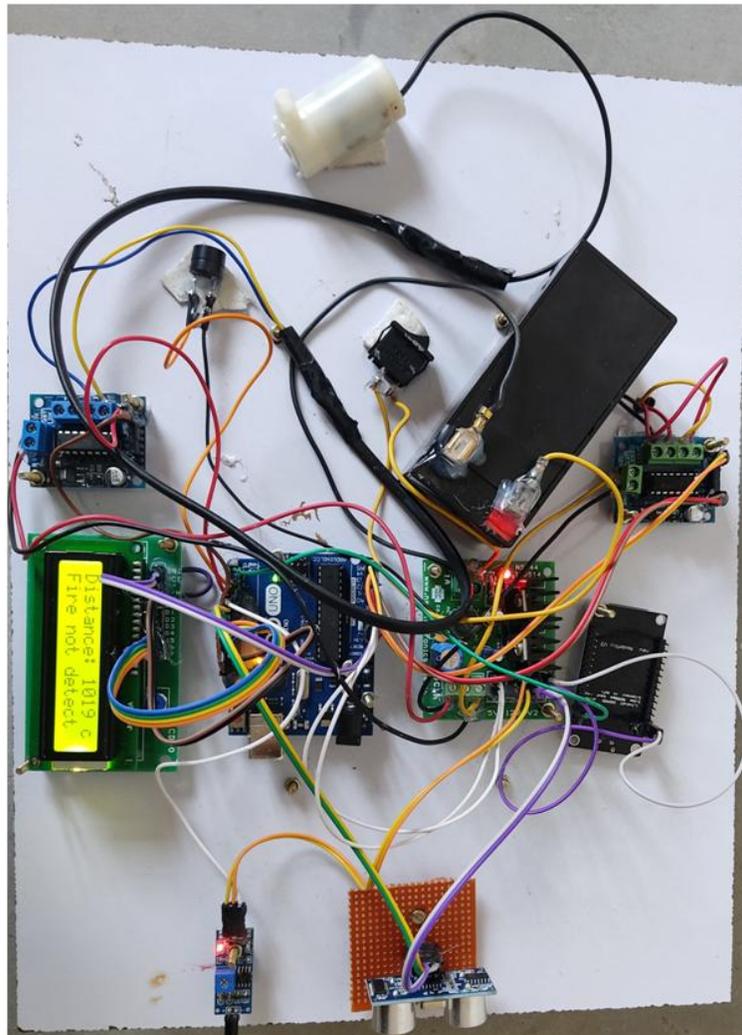


Figure 3: Hardware Kit of Proposed System

The picture diode's output is fed into the first op-non-inverting amp's input through a capacitor, which blocks the signal's DC components. The first op-amp cat is used as a non-inverting amplifier with a 1001 amplification factor. One of the inputs to the second op – amp, which functions as a comparator, is the output of the first op – amp. The second op-output amp's activates a resistor, which sends the signal to a microcontroller like Arduino. The LM358 Op-amp is used in this circuit. On the same unit, there are two op-amps. A BC547 transistor is also used. As the pulse is sensed, an LED attached to the transistor blinks.

III. CONCLUSION

In this research, an effective method for predicting people with heart disease is developed using the dataset and healthcare sensors. To track, detect, and diagnose cardiac disease, an efficient Cloud and IoT-based disease diagnosis model was created in this study. In addition, classification algorithms are used to identify patient data in order to detect heart failure. The classification algorithm begins by going through the training phase, which uses the heart disease dataset to train the classifier to determine whether or not there is heart disease present. The professional classifier is then able and put the incoming patient information to the test to see whether the patient has cardiac failure. Via the web portal, abnormal data is sent to a consenting user's family members, Kins, and physicians. The buzzer is often used to warn the individual who has given their permission. As a result, all of the inhabitants are rescued until they have a heart attack.

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