CORONA VIRUS DETECTION PARAMETERS USING ARDUINO

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Abstract: *Experts have predicted that COVID-19 may prevail for several months or maybe years before it is often completely eliminated. A significant problem in its cure is its early screening and detection, which is able to choose its treatment. Because of the fast contactless spreading of the virus, its screening is unusually difficult. Moreover, the results of COVID-19 tests may take up to 48 h. That's enough time for the virus to worsen the health of the affected person. The health community needs effective means for identification of the virus within the shortest possible time. During this study, we invent a medical device utilized consisting of composable sensors to watch remotely and in real-time the health status of these who have symptoms of the corona virus or those infected with it. The device comprises wearable medical sensors integrated using the Arduino hardware interfacing.*

Keywords: Covid-19, Virus, Composable Sensor, Arduino, Remotely, Real-time, Wearable Device, Monitoring.

1. Introduction

Corona virus could be a large group of viruses that may be pathogenic in animals or humans. The novel corona virus that was recently discovered is chargeable for the corona virus disease 2019 (COVID-19), which could be a contagious illness caused by the last discovered kind of corona virus, SARS-CoV-2[1]. COVID-19 is transmitted through respiratory droplets expelled from the nose or mouth when a unfortunate person coughs, sneezes, or talks. These drops are relatively heavy and don't cover large distances. Rather, they fall quickly on the bottom [2]. COVID-19 will be contracted if these droplets are inhaled. The detection of disease is just too difficult. Considering of these factors associated with the issue within the diagnosis of the corona virus and therefore the difficulty in its treatment because of its contactless spread within the patient's environment, it's highly desirable to plot an answer for detecting the presence of corona virus during a patient using non-invasive and remote methods with minimum involvement of the medical staff. During this proposed system we are using some sensors like temperature and oximeter to understand the temperature values and therefore the oxygen and heart rate of the person. The oximeter is connected to Node MCU to induce values and also the data coming from the sensor is given to the Arduino. The temperature sensor is connected to Arduino and also the data is given to the Arduino continuously. All the sensor values are displayed on the OLED which could be a display module.

Hardware Requirements

Arduino

Arduino Nano is a small, complete, and breadboard-friendly board based on the ATmega328 (Arduino Nano 3.0) or ATmega168 (Arduino Nano 2.x). It has more or less the same functionality of the Arduino Duemilanove, but in a different package. It lacks only a DC power jack, and works with a Mini-B USB cable instead of a standard one[3].

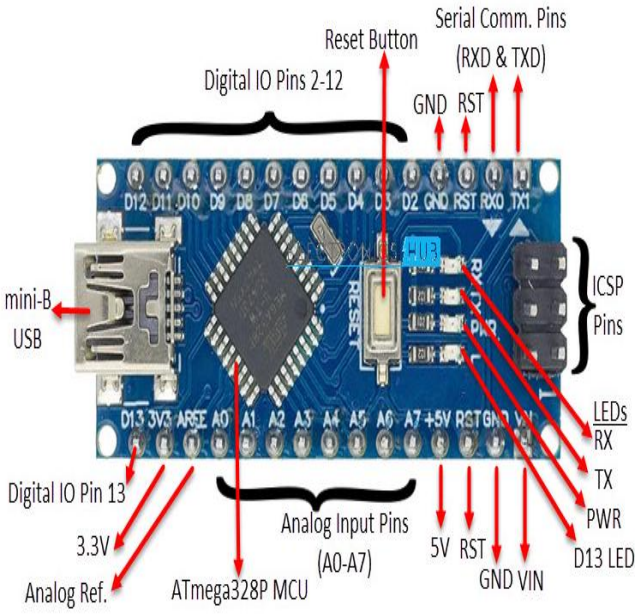


Fig 1: Arduino

Arduino Nano Physical Components

Microcontroller:

In Arduino Nano 2.x version, still used ATmega168 microcontroller while the Arduino Nano 3.x version already used ATmega328 microcontroller.

Advanced RISC Architecture:

Single Clock Cycle Execution, 32 x 8 General Purpose Working Registers, Fully Static Operation, Up to 20 MIPS Throughput at 20MHz, On-chip 2-cycle Multiplier.

The Serial Peripheral Interface (SPI) IN PINS 7, 8, 13, 14 and15 :

Serial Peripheral Interface (SPI) is a synchronous serial data protocol used by microcontrollers for communicating with one or more peripheral devices quickly over short distances. With an SPI connection there is always one master device (usually a microcontroller) which controls the peripheral devices. MISO (Master In Slave Out) - The Slave line for sending data to the master, MOSI (Master Out Slave In) - The Master line for sending data to the peripherals, SCK (Serial Clock) - The clock pulses which synchronize data transmission generated by the master and one-line specific for every device: SS (Slave Select) - the pin on each device that the master can use to enable and disable specific devices.

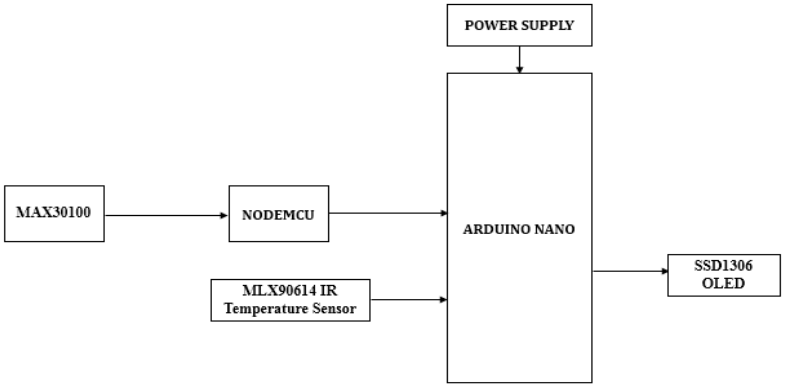


Fig 2: Block diagram of corona virus detection device

Node Mcu

Introduction to Node MCU:

Node MCU is an open-source firmware and development kit that plays an important role in designing your own IoT product employing a few Lua script lines. Multiple GPIO pins on the board allow you to attach the board with other peripherals and are capable of generating PWM, I2C, SPI, and UART serial communications. The interface of the module is principally divided into two parts

including both Firmware and Hardware where former runs on the ESP8266 Wi-Fi SoC and later relies on the ESP-12 module. The firmware is predicated on Lua – A scripting language that's easy to be told, giving an easy programming environment layered with a quick scripting language that connects you with a widely known developer community.

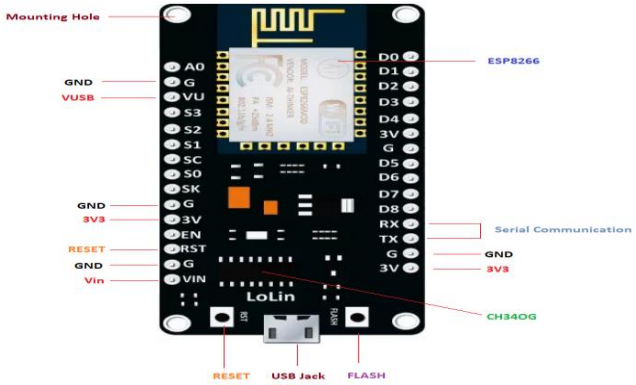


Fig 3: Node MCU

And open source firmware gives you the flexibleness to edit, modify and rebuilt the present module and keep changing the complete interface until you reach optimizing the module as per your requirements.USB to UART converter is added on the module that helps in converting USB data to UART data which mainly understands the language of serial communication. Rather than the regular USB port, Micro USB port is included within the module that connects it with the pc for dual purposes: programming and powering up the board. The board incorporates status LED that blinks and turns off immediately, providing you with the present status of the module if it's running properly when connected with the pc. The flexibility of module to determine a flawless Wi-Fi connection between two channels makes it a perfect choice for incorporating it with other embedded devices like Raspberry Pi.

Features:

- Arduino-like hardware
- Status LED
- Micro USB port
- Reset/Flash buttons
- Interactive and Programmable
- Low cost
- ESP8266 with inbuilt Wi-Fi
- USB to UART converter
- GPIO pins
- *Applications for Node MCU V3.*
- Internet Smoked Alarm
- VR Tracker
- Octopod
- Serial Port Monitor
- ESP Lamp
- Incubator Controller
- IoT home automation
- Security Alarms

Temperature Sensor

As mentioned earlier, the MLX90614 sensor can measure the temperature of an object with none physical contact with it. this can be made possible with a law called **Stefan-Boltzmann Law,** which states that every one objects and living beings emit IR Energy and therefore the intensity of this emitted IR energy are directly proportional to the temperature of that object or living being. Therefore the MLX90614 sensor calculates the temperature of an object by measuring the number of IR energy emitted from it.

Fig 4: Temperature sensor

MLX90614 Temperature Sensor Specifications

- Operating Voltage: 3.6V to 5V (available in 3V and 5V version)
- Supply Current: 1.5mA
- Object Temperature Range: -70° C to 382.2°C
- Ambient Temperature Range: -40° C to 125°C
- Accuracy: 0.02°C
- Field of View: 80°
- Distance between object and sensor: 2cm-5cm (approx.)

Pulse Oximeter Sensor

MAX30100 is an integrated pulse oximeter and heart-rate monitor sensor solution. It's an optical sensor that derives its readings from emitting two wavelengths of sunshine from two LEDs – a red and an infrared one – then measuring the absorbance of pulsing blood through a photograph detector. This particular LED color combination is optimized for reading the info through the tip of one's finger. It's fully configurable through software registers and therefore the digital output data is stored during a 16-deep FIFO within the device. It's an I2C digital interface to speak with a bunch microcontroller.

Fig 5: Pulse Oximeter

The pulse oximetry subsystem in MAX30100 consists of ambient light cancellation (ALC), 16-bit sigma delta ADC, and proprietary discrete time filter. It's an ultra-low-power operation which makes it ideal for battery operated systems. MAX30100 operates on a supply within the range of 1.8 to 3.3V.It may be employed in wearable devices, fitness assistant devices, medical monitoring devices, etc. The MAX30100 operates from 1.8V and 3.3V power supplies and may be powered down through software with negligible standby current, permitting the ability supply to stay connected in any respect times.

Specifications and Features of MAX30100 Pulse Oximeter Heart Rate Sensor Module

- It is an integrated pulse oximetry and heart rate monitor sensor solution.
- Integrated LEDs, Photo Sensor, and High-Performance Analog Front -End
- Complete Pulse Oximeter and Heart-Rate Sensor Solution Simplifies Design
- Measures absorbance of pulsing blood
- I2C interface plus INT pin
- Tiny 5.6mm x 2.8mm x 1.2mm 14-Pin Optically Enhanced System-in-Package
- Ultra-Low-Power Operation Increases Battery Life for Wearable Devices

- Programmable Sample Rate and LED Current for Power Savings
- Ultra-Low Shutdown Current (0.7µA, type)
- Advanced Functionality Improves Measurement Performance
- High SNR Provides Robust Motion Artifact Resilience
- Integrated Ambient Light Cancellation
- High Sample Rate Capability
- Fast Data Output Capability

Ssd1306 OLED Display

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

Fig 6: SSD1306 OLED Display

The **OLED displays** are one of the most attractive displays available for a microcontroller. It has a good view angle and pixel density which makes it reliable for displaying small level graphics. Interfacing this IC with MCU can either be done using IIC or using SPI hence helps to save some pins as well. So if you are looking for a slim, attractive and efficient display module to
Make your project look cool with graphics then this module might be the right choice for you.

Implementation

Stage 1:

Considering the issues of existing methods and giving solution to it problem by considering the fundamental requirements for our proposed system.

Stage 2:

Considering the hardware requirement for the proposed system for this we want to pick the below components:

1. Microcontroller
2. Inputs for the proposed system (ex: sensors, drivers etc..,)
3. Outputs (ex: relays, loads)

Stage 3:

After considering hardware requirements, now we'd like to test out the software requirements. Supported the microcontroller we select there exists different software for coding, compiling, debugging. We want to write down ASCII text file for that proposed system supported our requirements and compile, debug the code therein software. After finishing all the wants of software system and hardware we'd like to bring each along to figure our system [4]. For this we'd like to burn our ASCII text file into microcontroller, when burning our ASCII text file to microcontroller then connect all input and output modules as per our demand.

Bringing software and hardware together for embedded system

To make software to work with embedded systems we need to bring software and hardware together .for this purpose we need to burn our source code into microprocessor or microcontroller which is a

hardware component and which takes care of all operations to be done by embedded system according to our code. Generally we write source codes for embedded systems in assembly language, but the processors run only executable files. The process of converting the source code representation of your embedded software into an executable binary image involves three distinct steps:

i. Each of the source files must be compiled or assembled into an object file.
ii. All of the object files that result from the first step must be linked together to produce a single object file, called the re-locatable program.
iii. Physical memory addresses must be assigned to the relative offsets within the re-locatable program in a process called relocation.

The result of the final step is a file containing an executable binary image that is ready to run on the embedded system.

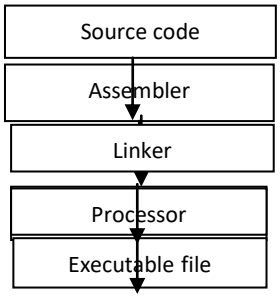
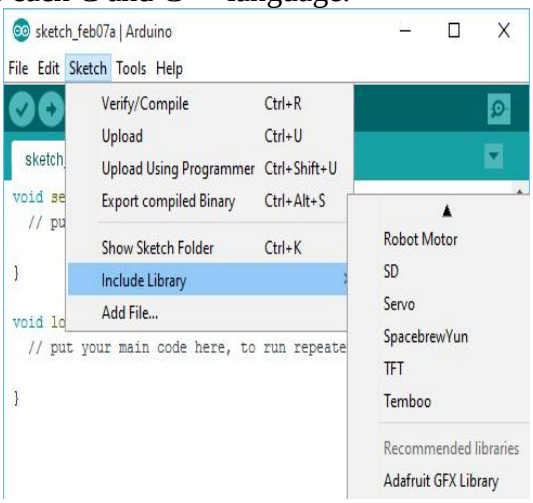


Fig 7: Flow of burning source code to processor

Arduino ide

Arduino IDE is open supply software system that's in the main used for writing and aggregation the code into the Arduino Module. It's official Arduino software system, creating code compilation too straightforward that even a typical person with no previous technical information will get their feet wet with the training method. It's simply offered for operative systems [7] like Macintosh, Windows, and UNIX and runs on the Java Platform that comes with intrinsic functions and commands that play an important role for debugging, redaction and aggregation the code within the setting. A variety of Arduino modules offered as well as Arduino Uno, Arduino Mega, Arduino Leonardo, Arduino small and lots of additional. Every of them contain a microcontroller on the board that's truly programmed and accepts the knowledge within the kind of code. The most code, conjointly called a sketch, created on the IDE platform can ultimately generate a Hex File that is then transferred and uploaded within the controller on the board. The IDE setting in the main contains 2 basic parts: Editor and Compiler wherever former is employed for writing the specified code and later is employed for aggregation and uploading the code into the given Arduino Module. This setting supports each C and C++ language.



Adafruit

Adafruit could be a library that supports the MQTT (Message Queue measuring Transport) [2],

[5]. It acts as AN MQTT broker. MQTT is predicated on protocol service that gives the causation and receiving of the feed knowledge [6]. The advantage of MQTT is that it provides a quicker rate of transmission of {the knowledge the info the information} and needs less data computer memory unit for the property. It needs eighty bytes for establishing the affiliation between the device to the server and twenty bytes from server to device. Arduino IDE software system is employed to compile the code [36].

Working

First, it checks the temperature of the body employing a device. Next, if it detects that temperature is on top of usual then it passes the primary symptom to positive, indicating the symptom on OLED show as s1+. Then, mistreatment the Max30100 device it monitors the heartbeat and O proportion.

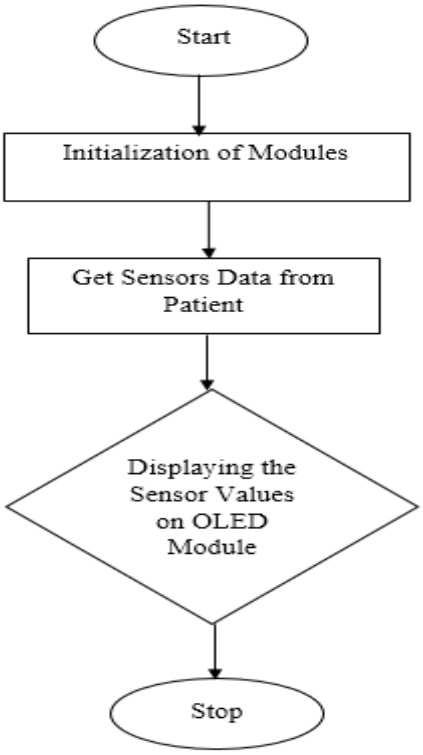


Fig 8: Flowchart

If the device calculates that the O proportion within the blood is below the conventional O level then the device passes the second symptom additionally, indicating the symptom on OLED show as s2+. If each the symptoms area unit positive, the person may need contracted the virus and might be taken to a hospital for confirmation and treatment [6]. We area unit mistreatment some sensors like temperature and measuring system to understand the temperature values and therefore the O and pulse of the person. The measuring system is connected to NodeMCU to urge values and therefore the knowledge returning from the device is given to the Arduino. The temperature device is connected to arduino and therefore the knowledge is given to the Arduino unceasingly. All the device values area unit showed on the oled that could be a display module.

Results:

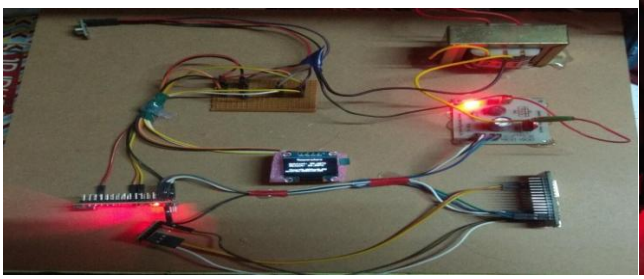


Fig 9. Circuit diagram

Fig 10. Output

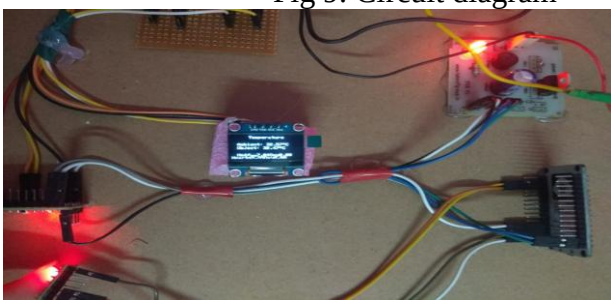


Fig 11. Output of oximeter sensor

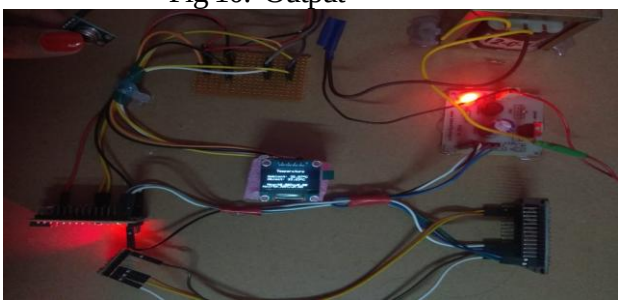


Fig 12. Output of temperature sensor

Advantages and Applications:

1. **Advantages:**
   - Observance the patient /person unceasingly.
   - They'll simply communicate with America.
2. **Applications:**
   - Used in hospitals.
   - Patient's reception.
     Use this device at malls or any public areas.

Conclusion:

The device designed won't solely scale back testing prices however conjointly scale can back the exposure to care professionals. It's quite possible. Which might be employed in public places to sight the vulnerability of the illness .The symptoms is also assumed which can facilitate in any diagnosing. The body parameters of someone would be thought-about which might facilitate in clinical survey of the individual for treatment. Our device provides several blessings like the device will sight the abnormality through the body parameters and might maintain social distancing. We are able to management our device wireless.

Level 1. A comprehensive ubiquitous healthcare solution on an android mobile device
Nowadays it has become important to focus on healthcare awareness and also the growth of wireless mobile technologies. For this reason ubiquitous health care solutions has become important as it provides services at anytime and anywhere. To complete our needs android smart phone device has put fourth mobile monitoring terminal to observe and analyze ecs electrocardiography] waveforms from wearable ECG devices in real time under the coverage of wireless sensor network. Due to use of wireless sensor network in a healthcare we are able to reduce complications of wire networks and we can move a healthcare from one location to another desired location. Mobile phones are used as barcode decoder for medicinal care as an extension to monitoring schemes. In order to provide better and more comprehensive healthcare services. We can use barcode decoder to verify and assist out patient in the medication administration process.
Level 2. Android based body area network for the evaluation of medical parameters
There are various vital parameters in this system. They are ECG, heart rate, heart rate variability, pulse oximetry, plethysmography and fall detection. The tele-medical system is the system which

focuses on the system which focuses on the measurement and evaluation of these vital parameters. In a android smart phones there are two different designers of a (wireless) body networks the real time system features several capabilities. Data acquisition in the (w) ban plus the use of the Smartphone sensors, data transmission and emergency communication with first responders and clinical server. It is very important to smart and energy efficient sensors. This can be compensated. In the first zigbee based approach, sensor nodes acquire physiological parameter perform signal processing and data analysis and transmit measurement value to the coordinator node. Sensors are connected via cable to an embedded system. In the second deign. In the both types of system, Bluetooth is used for transferring the data to an android based Smartphone.

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