Wearable Device to Track Covid 19 Symptoms

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Abstract:- **Covid 19 forms a chain when contact with an infected person in the early months. It's very difficult for us to detect whether the person is having Covid or not. In this article, we are proposing a wearable device that can track Covid 19 symptoms. The proposed framework consists of 4 sensors for heart rate, body temperature, cough rate, and for measuring minimum distance. In the early months of the Covid-19 pandemic with no designated cure or vaccine, the only way to break the infection chain is self-isolation and maintaining the physical distancing. Here a combined application of the Internet of things with the Medical sector to make sure safety of every individual in this pandemic period. Internet-based solutions, brought by the Internet of Things (IoT) and cloud computation and storage technologies, have been driving revolutionary approaches in the sensitive domain of healthcare such as Real-time diagnosis of medical issues, Telemedicine, Remote monitoring of patients, Computer-assisted smart transportation in case of emergencies, are anticipated as Systems-of-Systems (SoS) that can execute several applications of different criticality, thus necessitating mission-critical and non-critical peripheral components. The Wearable IOT node works in association with the user's smartphone to collect proximity data using Bluetooth and to communicate with the server through the cellular data network.**

Key terms:- Sensors, Microcontroller, Gsm Module, IoT, Arduino Nano Board.

I. INTRODUCTION

This project is an IOT based project where the Internet of Things (IoT) development brings new opportunities in many applications, including smart cities and smart healthcare. The paper proposes COVID 19 detection and monitoring system that would collect real-time symptom data from wearable sensor technologies. Since COVID is increasing day by day, the death rate also increasing. COVID 19 also causes respiratory problems, high fever, cough, throat pain, etc. Recent studies have demonstrated the evolution of disease to hide its symptoms. As it is highly transmittable this disease might spread at an exponential rate costing the lives of thousands of people[1]. This chain of transmission has to be detected with utmost priority through early detection and isolation of infected people. One way to control the spread of viruses, until the vaccine is found effective. By implementing better systems for surveillance, healthcare, and transportation, contagious diseases will have less chance of spreading[3]. An IoT framework is presented to monitor participants' health conditions and notify them to maintain physical distancing. Applying ML algorithms on body parameters makes it possible to monitor participants' health conditions and to notify individuals in real-time. In addition, locally processing the data makes it possible to use the IoT node in environments without internet connectivity or fog-based networks. The system can assist participants in monitoring their daily activities and minimize the risk of exposure to the Coronavirus.

II. RELATED WORKS

Internet of Things (IoT) is an innovative technology used to provide information and monitoring systems during the COVID-19 epidemic. This technological platform can be used to tackle challenges during lockdown-like situations. IoT would help to provide an automated and transparent treatment process to tackle the COVID-19 pandemic situation. Internet of Things (IoT) enabled healthcare system is useful for proper monitoring of COVID-19 patients, by employing an interconnected network. This technology helps to increase patient satisfaction and reduces the readmission rate in the hospital. In a smart healthcare setting, the IoT can help to provide a remote diagnosis before hospitals for more efficient treatment [4].

For diabetic patients, it is vital to monitor their blood glucose continuously [5]; blood glucose data can be sent from wearable sensors to doctors or smartphones for continuous monitoring of patient's state of health. Castillejo et al. [6] develop an IoT e-health system based on Wireless Sensor Networks (WSN) for firefighters. Smartphones do play a large role in the IoT, however, because many IoT devices can be controlled through an app on a smartphone.

You can use your smartphone to communicate with your smart thermostat, for example, to deliver the perfect temperature for you by the time you get home from work. Another study helps us to track and identify the infected person using mobile phone tracking mechanism. IoT devices contain sensors and mini-computer processors that act on the data collected by the sensors via machine learning. Essentially, IoT devices are mini-computers, connected to the internet, and are vulnerable to malware and hacking Machine learning is when computers learn similarly to humans — by collecting data from their surroundings — and it is what makes IoT devices smart. Collected data can help the machine to learn your preferences and adjust itself accordingly. Machine learning is a type of artificial intelligence that helps computers learn without having to be programmed by someone. Access to High-quality Data:

Everyone, especially marketers and entrepreneurs, loves data and with the invention of IoT devices, companies now have greater access to data related to their customers and products than ever before. Technically, the more information you have, the easier it is for you to take the right decision. Better Tracking and Management Whatever the industry is, IoT makes tracking and management a breeze for organizations. From keeping track of inventory item by item to monitoring road traffic and weather conditions to notifying the concerned authorities about any suspicious behavior, IoT revolutionizes the way how we currently track and manage our business assets. IoT is not just about smart homes anymore, but it is now also about smart offices, smart warehouses, and smart anything else. Efficient Resource Utilization: Be it home, office, hotel, or car, IoT facilitates efficient utilization of assets for improved productivity. Leveraging the power of machine-to-machine interaction, an IoT system collects real-time data with the help of sensors and actuators so you can further use it to improve process efficiency and minimize human intervention, as a basic example, if any of your Home Appliances notifies you about the task completion, you need not worry about the inefficient consumption of the electricity.

Automation and Control: Automation is the need of the hour and IoT is renowned for the same. Since most of the IoT devices are connected through a wireless infrastructure, they can operate on their own with little or no manual intervention. For instance, home appliances such as air conditioners, washing machines, ovens, and refrigerators can be automatically get operated and you can even monitor and control them remotely. Comfort and Convenience: We live in a fast-paced world where busy people don't even care about small things like switching on/off lights and reading energy meters, and this is where the Internet of Things comes in.

IoT-Assisted ECG Monitoring Framework With Secure Data Transmission for Health Care Applications which is Capable of sensing, processing, and communicating, allowing sensors, embedding devices and other ' things ' to be created and the Health buffs who actively track their physical progress can have a reliable tracker for heart activity. Human Activity Recognition Based on Improved Bayesian Convolution Network to Analyze Health Care Data Using Wearable IoT Device. The data collection using decision-making tools uses wearable sensors for monitoring using cloud-assisted internet of things (IoT).

III. PROPOSED METHODOLOGY

In this article, the proposed COVID-SAFE framework offers: 1) a low-cost and lightweight IoT node[Fig .1] to monitor continually a person's body temperature, heart rate, and periodically monitor cough rate; 2) a smartphone app to display the parameters and individual risk factors; 3) a physical distance tracking mechanism to alert the user in case of violation of safe physical distance, and 4) a fog server that collects data from the IoT nodes and through internet it sends the necessary information towards the smartphone. The system mainly consists of namely 3 Modules. These modules combine to form our system.

A. MODULES

i. *User Module*

User Module Temperature sensor called Lm35 is an integrated circuit sensor the can be used to measure temperature with an electrical output proportional to the temperature more accurately than using a thermistor Heartbeat sensor. To use the sensor simply power it Vcc and ground pins. The sensor can simply power it using Vcc and ground pins. The sensor can operate at both 5 and 3.3v systems once powered connect the signal pin to the ADC pin of the microcontroller to monitor the change in output voltage.

ii. GSM Module

Global system for mobile communication. GSM module can send all the data towards the cloud server we can access the internet to the microcontroller using the GSM module.

iii. Server Module

Through the internet, the server module can send all the data to an android app called MITapp inventor.

B. SYSTEM ARCHITECTURE

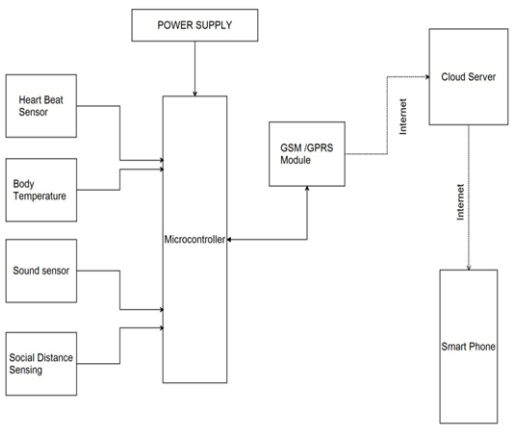

Fig 1. System Architecture

The framework for our proposed system includes a wearable IoT device, smartphone app, and fog (or cloud) server. Here we are using four sensors that are connected to a microcontroller called ATMEGA 328. The sensors used are the heart rate sensor, body temperature sensor, sound sensor, and the sensor for minimum distance maintaining. These parameters are all being controlled by a microcontroller that can coordinate all these values like a microprocessor. Using GSM Module/GPRS Module we can send all these data towards the cloud server or fog server. The data are visible on our smartphones. We can power the microcontroller using an adaptor or USB. The system architecture illustrates the high-level architecture of the COVID-SAFE framework.

i. Wearable IOT Device

The deployment of sensor devices has tremendously increased. Similarly, IoT applications have witnessed many innovations in addressing the COVID-19 crisis. State-of-the-art focuses on IoT factors and symptom features deploying wearable sensors for predicting the COVID-19 cases. The working model incorporates wearable devices, clinical therapy, monitoring the symptom, testing suspected cases. This IoT node works in association with the user's smartphone to collect proximity data using Bluetooth and to communicate with the server through the cellular data network. .It consists of a heart rate sensors body temperature sensor, a sound sensor, and a GSM module for data communication. We can access the internet to the microcontroller through GSM Module. The system then is synchronized with the software to monitor the user's behavior during daily activities. To measure the power consumption of the system, the wearable IoT device is connected to an adaptor or USB and elements of IoT.

ii. *Smartphone App*

The smartphone app shows the status of the patient. Firstly we have to enter personal details. By accumulating this information, the system can provide an individual risk factor for the user. Each parameter is shown in different fields. Here we are concerned about four parameters such as heart rate, body temperature, cough rate, and measuring social distance. These parameters are shown as the first field, second field, third field, and fourth field. The COVID-SAFE smartphone app, which is built to interact easily with users. This application collects all the data of related to patients. The app asks for symptoms following the body parameters, and provides the risk evaluation, and sends some useful tips.

iii. Arduino Nano Board

The Arduino Nano is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started.

iv. USB Plug & External Power Supply Plug

Every Arduino board needs a way to be connected to a power source. The Arduino Uno can be powered from a USB cable coming from your computer or a wall power supply that is terminated in a barrel jack. The power source is selected automatically. The USB connection is also how you will load code onto your Arduino board.

v. Voltage Regulator

The voltage regulator is not something you can (or should) interact with on the Arduino. But it is potentially useful to know that it is there and what it's for. The voltage regulator does exactly what it says – it controls the amount of voltage that is let into the Arduino board. Think of it as a kind of gatekeeper; it will turn away an extra voltage that might harm the circuit. Of course, it has its limits, so don't hook up your Arduino to anything greater than 20 volts.

vi. Power Pins

Voltage In Pin – The input voltage to the Arduino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin. 5V Pin – This pin outputs a regulated 5V from the regulator on the board. The board can be supplied with power either from the DC power jack (7 – 12V), the USB connector (5V), or the VIN pin of the board (7-12V). Supplying voltage via the 5V or 3.3V pins bypasses the regulator, and can damage your board. It's not recommended. 3.3V Pin – A 3.3 volt supply generated by the onboard regulator. The maximum current draw is 50 mA. Ground Pins – There are several GND pins on the Arduino, any of which can be used to ground your circuit. IOREF Pin – This pin on the Arduino board provides the voltage reference with which the microcontroller operates. A properly configured shield can read the IOREF pin voltage and select the appropriate power source or enable voltage translators on the outputs for working with the 5V or 3.3V.

vii. Input & Output Pins

Each of the 14 digital pins on the Uno can be used as an input or output. They operate at 5 volts. These pins can be used for both digital input (like telling if a button is pushed) and digital output (like powering an LED). Each pin can provide or receive a maximum of 40 mA and has an internal pull-up resistor (disconnected by default) of 20-5k Ohms. In addition, some pins have specialized functions: Serial Out (TX) & Serial In (RX) – Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the ATmega8U2 USB-to-TTL Serial chip. External Interrupts – Pins 2 and 3 can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value. PWM – You may have noticed the tilde (~) next to some of the digital pins (3, 5, 6, 9, 10, and 11).

These pins act as normal digital pins, but can also be used for something called Pulse-Width Modulation (PWM). Think of these pins as being able to simulate analog output (like fading an LED in and out). SPI – Pins 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). SPI stands for

Serial Peripheral Interface. These pins support SPI communication using the SPI library. Analog Input Pins – Labeled A0 through A5, each of which provides 10 bits of resolution (i.e. 1024 different values). These pins can read the signal from an analog sensor (like a temperature sensor) and convert it into a digital value that we can read. By default, they measure from ground to 5 volts, though is it possible to change the upper end of their range using the AREF Pin (Stands for Analog Reference Most of the time you can leave this pin alone). Additionally, some pins have specialized functionality: TWI – Pins A4 or SDA pin and A5 or SCL pin. Support TWI communication using the Wire library. Reset Pin – Bring this line LOW to reset the microcontroller. Typically used to add a reset button to shields which block the one on the board.

viii. LED Indicators

Power LED Indicator – Just beneath and to the right of the word "UNO" on your circuit board, there's a tiny LED next to the word 'ON'. This LED should light up whenever you plug your Arduino into a power source. If this light doesn't turn on, there's a good chance something is wrong. Time to re-check your circuit! On-Board

LED – There is a built-in LED connected to digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off. This useful to quickly check if the board has no problem as some boards has a pre-loaded simple blinking LED program in them.

TX & RX LEDs – These LEDs will give us some nice visual indications whenever our Arduino is receiving or transmitting data (like when we're loading a new program onto the board).

ix. ATmega 328 Microcontroller

The black thing with all the metal legs is an IC or Integrated Circuit. Think of it as the brains of our Arduino. The main IC on the Arduino is slightly different from board type to board type but is usually from the ATmega line of IC's from the ATMEL company. This can be important, as you may need to know the IC type (along with your board type) before loading up a new program from the Arduino software. This information can usually be found in writing on the top side of the IC. If you want to know more about the difference between various IC's, reading the datasheets is often a good idea.

x. Reset Button & ICSP Header

ICSP stands for In-Circuit Serial Programming. There are two ICSP headers on the board one for ATmega16U2 and the other one is for ATmega328. These are used to update or load the firmware into the microcontroller. Pushing the reset button temporarily connects the reset pin to the ground and restart any code that is loaded on the Arduino. This can be very useful if your code doesn't repeat, but you want to test it multiple times.

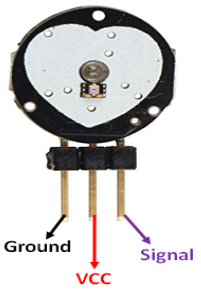

Fig 2. Hardware Overview

IV. FUTURE SCOPE

The future of health care is shaping up in front of our very eyes with advances in digital health technologies, like IoT, AI, Robotics, and nanotechnology. As this IoT-based device is capable of measuring human body parameters it can also be used for the continuous evaluation of patients who need regular medical checkups and for senior citizens. Doctors and nurses can use this handheld device to record patients' real-time data and constantly update their medical history. This makes more accurate and more efficient diagnoses and treatments.

V. .CONCLUSION

A wearable system/device capable to track key COVID-19 symptoms is presented. The COVID-19 is associated with typical symptoms. Their list is not short, but the most typical are fever, cough, shortness of breath or other breathing problems, chills, muscle pain, sore throat, loss of taste or smell. Serious symptoms, among others, include elevated heart rate (above 100 bpm) and lower oxygen saturation <92%. The ideal COVID-19 wearable device would be capable of measuring as many mentioned parameters as possible in everyday conditions and being easy to use by the seniors, young, without special training and knowledge. Off-the-shelf hardware and software components as simple sensors, general-purpose microcontroller, and gadgets like mobile devices and peripheries are used to detect and monitor body temperature, heart rate, continues cough, which are important to alert patients and remote medical staff about unusual symptoms correlated to COVID-19 or similar diseases. This product also helps to keep social distancing between peoples. The principle is not just simple and low cost, based on the components we use every day, but very immune to noise and artifacts.

VI. .ACKNOWLEDGEMENT

The authors wish to express gratitude towards the principal Dr. Manoj George, Dr. Sunitha E.V, H.O.D, Computer Science Department, and Ms. Gayathri Krishna, Assistant Professor, Computer Science Department, for the appropriate direction, significant help, and supportive remarks during the editing.

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