

IoT Analytics

Assignment 4:

A Social Distancing indicator and alarming along with
Patient Monitoring using temperature Sensor

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AIM

To create a smart health monitoring system with multiple functionalities. The system includes multiple tasks, one at a time using the pushbuttons. It facilitates the following activities:

- Measure temperature and pulse rate using different sensors.
- It can also be used as a social distancing reminder outdoors.
- We also made a device that can be used as a medicine reminder using IR remote.

Literature Survey

Study [1] presents an IoT system with algorithms that enable environmental and structural monitoring along with emergency management. using ML models which are trained using predefined datasets, the model suggests safe paths for a person to move onto. environmental an structural sensors, cameras, NFC technology is used to give input to the model on which social distancing recommendations and warnings are given. the deployment is using small microcontrollers which are energy and space efficient.

One of the primary thing which goes down when disaster strikes is communication lines. Crucial patient data relayed through verbal communication channels often are misinterpreted, wrongly recorded or not recorded at all. This lead to hospitals or other resources not ready to recieve or treat patients. The paper proposes a system [4] which integrates 4 sensors like ECG, BP, Temperature and Pulse Oximeter sensors into one module. Another system [5] uses uses Arduino nano to collect data and see if the patients are recieving indoor mobility assistance or not. Similarly, in paper [2], a system uses NodeMCU as the processor to transmit data by sensors and dispay it on ThingSpeak. The data collected is sent over the internet to the cloud using a wifi module from where it can be stored, analysed and acted upon.

Literature Survey (Contd.)

The healthcare segment has many fields which can deploy IoT for better patient monitoring and servicing. But the efficiency of IoT devices to monitor patients spread out in large geographical areas is highly questionable and unreliable. The paper [3] demonstrates IoT sensors like temperature, respiration, accelerometer, and heartbeat sensors which are connected to a Raspberry Pi Board, which in turn acts as a small intermediate clinic from where data is relayed to healthcare professionals worldwide so that they can take further actions on the patient.

People in contemporary culture ignore numerous daily necessities as a result of their busy lives. Dementia affects the elderly and those with chronic illnesses who must take their medications on time without skipping any. The creation of a low-cost medical sensing, communication, and analytics tool that tracks patients' physical status and medicine intake or the need for changed or updated medicines in real time through the internet is conceivable [6]. Another proposed system, the IoT-based pill reminder, and monitoring system could significantly enhance medication adherence for patients. The system's key component is the smart pillbox that has embedded sensors to detect when pills are being taken. The IR sensor technology used in the pillbox provides a non-intrusive and accurate way of detecting medication intake [7]. However, the authors note that the notification system could be improved by incorporating a voice-alert notification. Web-based monitoring is required for the Internet of Things (IoT) network to enable active and real-time appointments of patients, hospitals, carergivers, and doctors.

Smart Healthcare System

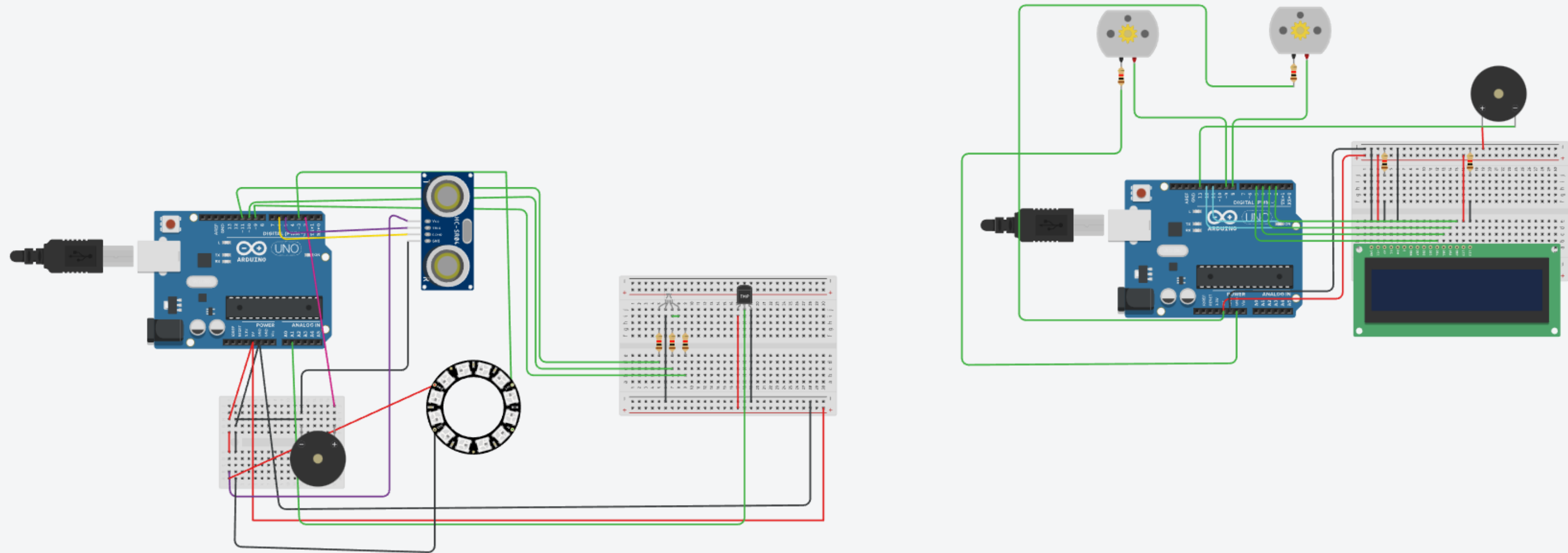
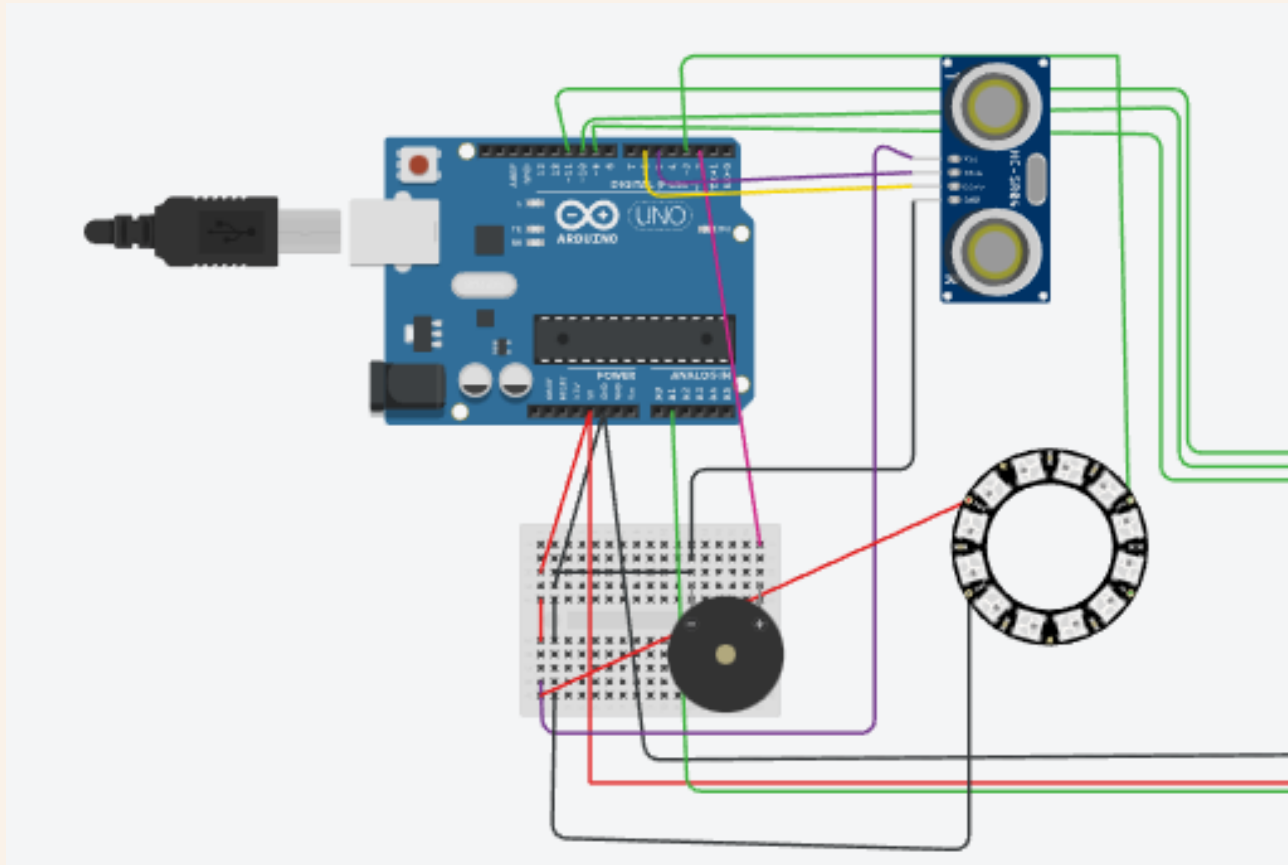


Fig: Circuit diagram of Smart Healthcare System

Resource Requirements

Name	Quantity	Component
U1, U4	2	Arduino Uno R3
RING1	1	NeoPixel Ring 12
PIEZO1, PIEZO2	2	Piezo
U2	1	Temperature Sensor [TMP36]
D1	1	LED RGB
R1, R2, R3, R4, R5, R6, R7	7	1 kΩ Resistor
DIST1	1	Ultrasonic Distance Sensor
U3	1	LCD 16 x 2
M1, M2	2	DC Motor

Social Distancing Alarming System



For Social Distancing and Alarming System, Arduino UNO, Ultrasonic sensor, NeoPixel 12 RGB LEDs Ring, and Buzzer are connected to implement the system. Tinkercad text programming platform is used to implement it.

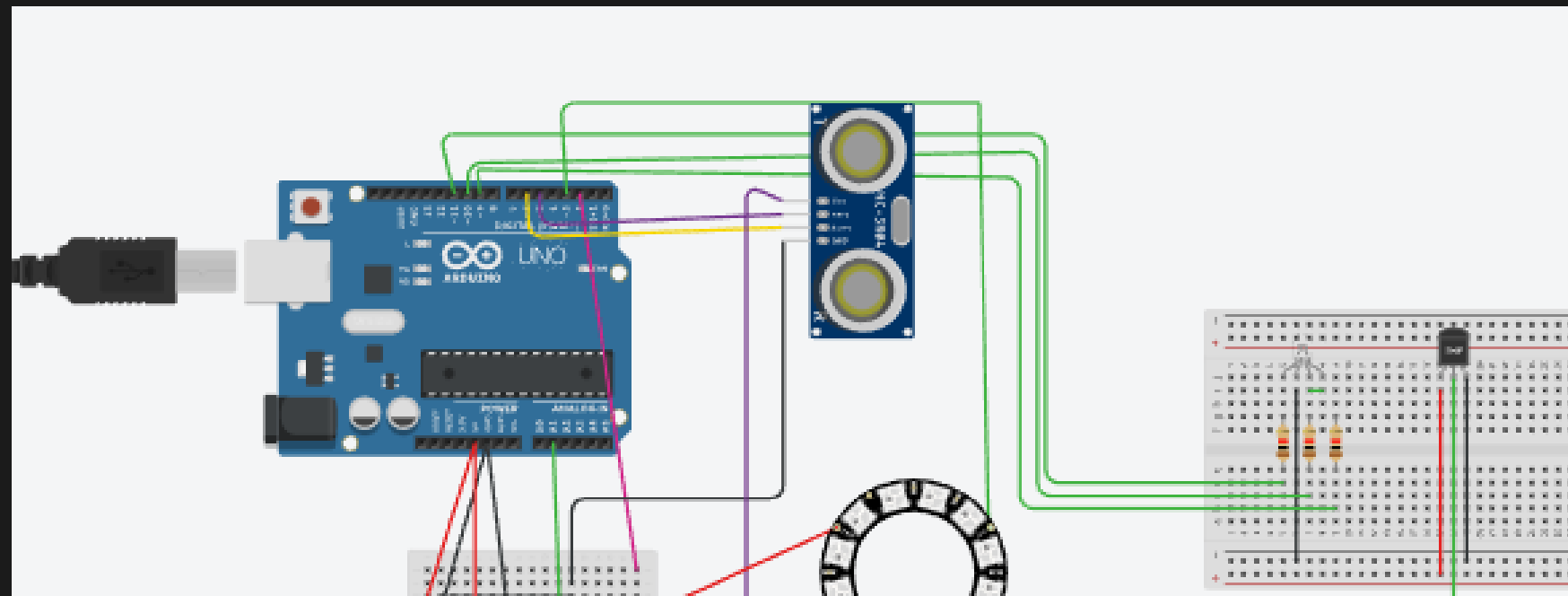
For the programming part we used text programming method. As soon as the arduino is powered up, the system starts measuring the distance in the range from 300 to 100 cm. The ultrasonic sensor echo pin is connected to digital pin 6 and trigger pin is connected to digital pin 5 of Arduino Uno board. As we move from safe to critical distance, at 100 cm all the LEDS will start glowing and the buzzer will give alert of violation of social distancing.

Social Distancing Alarming System

How does it
work?

- The distance measured from ultrasonic sensor is mapped to number of LEDs glowing from 0 to 11th which are a set of RGB LEDs.
- The LEDs starts glowing with decrease in the distance of a person who is carrying the system and the other person who is not.
- If distance reaches to 100 cm or less, the buzzer activates and indicates social distancing violation along with all 12 RGB neopixel rings glowing.

Patient Monitoring with Temperature Sensor



For temperature sensing we have used, Arduino UNO, small breadboard, temperature sensor for input. For output we used RGB LED, 3 resistors to limit supply to the LED.

For the programming part we used text programming method. The values from the temperature sensor is connected to the analog pin A1 of Arduino. The unit we have chosen for detecting is degree celcius. . The temperature sensor comes in a variety of versions. The output voltage of this type, the TMP36, is conveniently proportional to temperature in degrees Celsius. r. As the temperature rises the LED will give different colors indicating if the patient is having a fever or not.

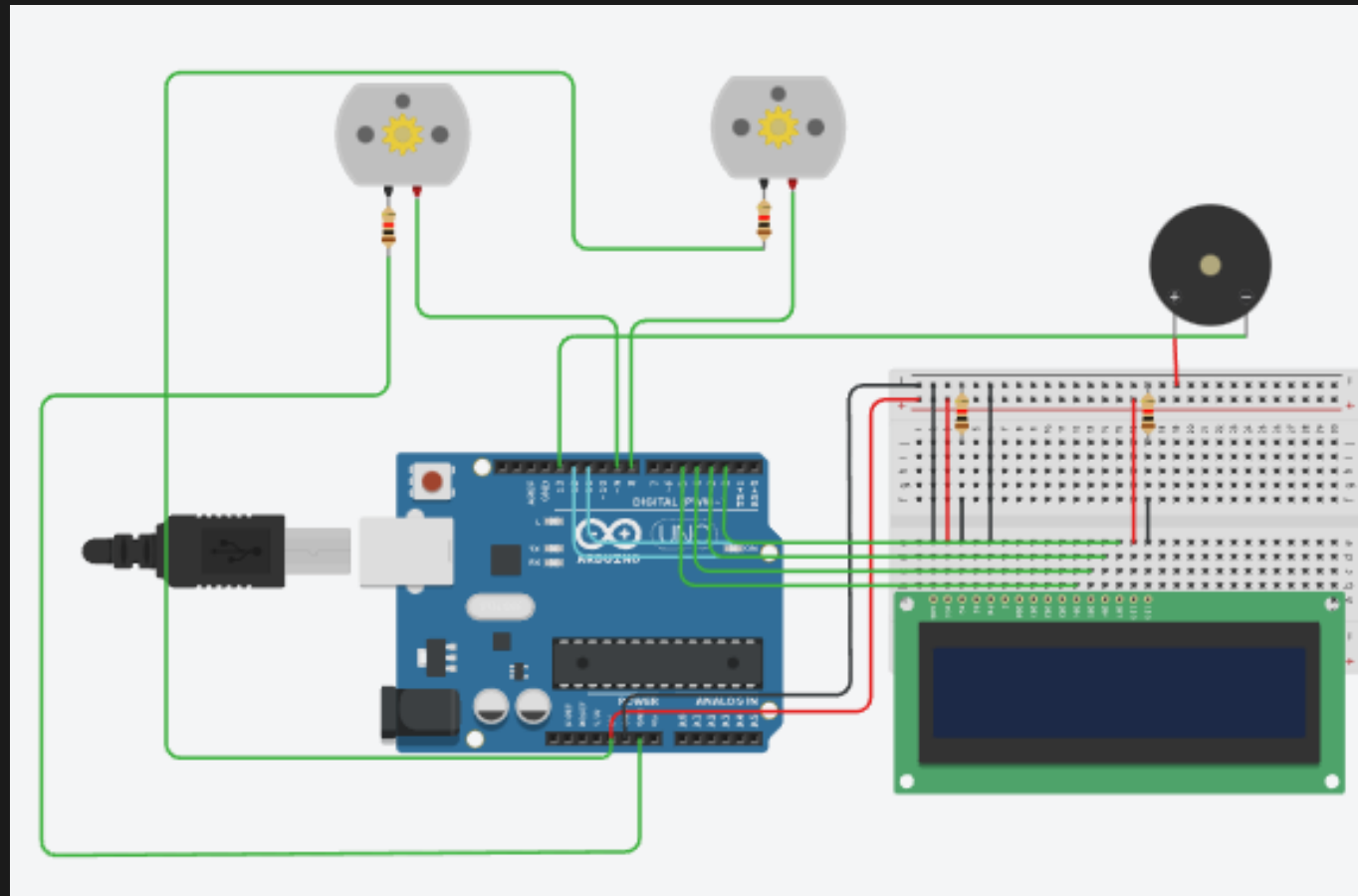
Patient Monitoring with Temperature Sensor

How does it work?

- We used controls to set different conditions. We choose three conditions in our case.
- We used the RGB pins to show the output by connecting them to pin no 11,10 and 9 of Arduino board.
- Then we used conditions like :
 1. If temperature < 36 deg C, no fever, and we set it in blue color
 2. If temperature > 36 deg C, mild fever, and we set it to little greenish color
 3. If temperature > 39 deg C, high fever, and we set it to red color

Medicine Reminder

For Medicine Reminder system, we have used Arduino Uno, 2 DC Motors, resistors, piezo buzzer, LCD 16X2 and a breadboard.



For the programming part we used text programming method. We have connected the buzzer to pin 13 and LCD points to digital pin 12,11,5,4,3 and 2 of Arduino board.

Serial.begin(9600) code helps Arduino to send commands through USB connection.

Medicine Reminder

How does it
works?

- We will start the stimulation with the serial.begin command
- Digital pin 8 and 9 are the output pins of the LCD. And digital pin 7 is the input pin.
- After starting the stimulation we have used LCD.print command to display the name and quantity of medicines to be taken by patient 3 times a day.
- We have used a delay of 1000 in between various medicine reminders because of time constraints.
- The buzzer beeps as soon as the screen displays the name and quantity of medicines to alert the patient to take the pills without miss.

Observation and Conclusion

- For Social Distancing Alarming system.

Distance	No of LEDs	Buzzer	Alert Reminder
>335 cm	NO LED	NO	Safe distance
Between 300 to 335 cm	1 Green LED	NO	Safe distance
Between 280 to 334 cm	2 Green LED	NO	Alert
Between 245 to 279 cm	4 Green LED	NO	Alert
Between 220 to 244 cm	2 Yellow LED and 4 Green LED	NO	Not safe
Between 185 to 219 cm	4 Yellow LED and 4 Green LED	NO	Not safe
Between 0 to 115 cm	4 Red LED, 4 Yellow LED and 4 Grren LED	YES	Critical

- For Temperature Sensing System.

Temperature	LED Color	Inference
<39 deg Celcius	Blue	No Fever/ Less Fever
>39 deg Celcius	Red	High Fever, need treatment

- For Medicine Reminder System.

Stimulation Interval	Reminders	Medicine	Quantity
Start Stimulation	Reminder 1	Crocin	2
Delay 1000	Reminder 2	Strepsil	3
Delay 1000	Reminder 3	Saridon	1

Application of Proposed Methods

- To detect people within close vicinity, a wristband with PIR sensors can be created. The suggested PIR sensor-fitted bracelet is simple to wear on the wrist. A buzzer, push button, speaker jack, Arduino (LilyPad), connecting cables, and two PIR sensors make up the bracelet. The person who is breaking the social distancing rule as well as the person who is wearing a wristband will be signalled by the buzzer.
- In the automotive industry, temperature sensors can detect changes in engine temperature, alerting drivers of potential problems and prevent accidents. Automotive, retail, industry, water, energy, agriculture, consumer electronics, among others. All these areas can benefit from temperature sensors.
- Medication reminder apps or medication adherence apps. They allow us to record the name of medicine, the dose to be taken and the time of day we need to take it.

Alternative Approaches

- The conventional sensor-based diagnosis in the medical field requires a large number of sensors and human efforts, making it difficult due to a shortage of medical professionals and system setup.
- To overcome this issue, an IoT-based health care application can be proposed consisting of a web and mobile application based on continuous wireless monitoring of patients' vital signs using sensors connected to a controller and transmitted to the cloud via Wi-Fi module.
- The system will help implement a low-cost system and transmit the patient's vital signs in emergency situations, reducing the burden on doctors and providing the exact health status of patients.
- One of the main benefits of this system is its ability to connect patients with specialists from all over the world. In case of emergency situations, the system sends a message to the doctor when sensor data exceeds threshold values, which minimizes the intervention time

Impact Analysis

According to Gartner Research, IoT spend by healthcare providers will grow from \$16 billion in 2018 to nearly \$52 billion in 2028 at a compound annual growth rate of 12%. Chronic condition management will have the largest revenue growth of \$28 billion, but the highest growth rate will be in hospital hygiene monitoring (38% CAGR). Internet of Medical Things is one of the key applications of IoT for healthcare, impacting the industry in a positive way and has the potential to solve medical issues such as:

- Simultaneous reporting and monitoring
- End-to-end connectivity and affordability
- Data analysis and data assortment
- Assisting the elderly
- Real-time tracking and alerts
- Check-up on the go
- Remote patient monitoring

Professional and Ethical Practices

- Huge amount of granular personal data being generated and sent over the open web to different servers
- Adequate care should be taken to ensure data is not stolen in attacks or is not misused by the companies or healthcentres storing them
- Since the data being shared has the potential of altering personal images and standing in society, it should be used in strict confidence, and non-disclosure clauses have to be made to prevent misuse
- Also, data stored should not be outsourced to pharma and other companies for unnecessary marketing and sales gimmicks without patient consent.
- limited sensor data or stale data can produce results that can cause bias in diagnosis. Data integrity and quality have to be insured at all costs.



Thank you!