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An IOT-Based Automated Patients Health Monitoring System and Surveillance in Post-Pandemic Life

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Abstract- Healthcare is given the extreme importance now a- days by each country with the advent of the novel corona virus. So in this aspect, an IoT based health monitoring system is the best solution for such an epidemic. Internet of Things (IoT) is the new revolution of internet which is the growing research area especially in the health care. With the increase in use of wearable sensors and the smart phones, these remote health care monitoring has evolved in such a pace. IoT monitoring of health helps in preventing the spread of disease as well as to get a proper diagnosis of the state of health, even if the doctor is at far distance. In this paper, a portable physiological checking framework is displayed, which can constantly screen the patient's heartbeat, temperature and other basic parameters of the room. We proposed a nonstop checking and control instrument to screen the patient condition and store the patient information's in server utilizing Wi-Fi Module based remote correspondence. A remote health monitoring system using IoT is proposed where the authorized personal can access these data stored using any IoT platform and based on these values received, the diseases are diagnosed by the doctors from a distance.

Keywords:- Internet of Things, Health, Sensors.

I. INTRODUCTION

Health is always a major concern in every growth the human race is advancing in terms of technology. Like the recent corona virus attack that has ruined the economy of China to an extent is an example how health care has become of major importance. In such areas where the epidemic is spread, it is always a better idea to monitor these patients using remote health monitoring technology. So Internet of Things (IoT) based health monitoring system is the current solution for it [1].

Remote Patient Monitoring arrangement empowers observation of patients outside of customary clinical settings (e.g. at home), which expands access to human services offices at bring down expenses [2]. The core objective of this project is the design and implementation of a smart patient health tracking system that uses Sensors to track patient health and uses internet to inform their loved ones in case of any issues. The objective of developing monitoring systems is to reduce health care costs by reducing SMS based patient flourishing viewing and IOT based patient checking framework. In IOT based framework, subtle parts of the patient flourishing can be seen by different clients [4].

The explanation behind this is the information should be checked by passing by a site or URL. While, in GSM based patient viewing, the flourishing parameters are sent utilizing GSM by strategies for SMS. In most of the rural areas, the medical facility would not be in a hand reach distance for the natives [5]. So normally the people physician office visits, hospitalizations, and diagnostic testing procedure [3]. Each of our bodies utilizes temperature and also pulse acknowledging to peruse understanding wellbeing. The sensors are linked to a microcontroller

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to track the status which is thus interfaced to a LCD screen and additionally remote association with have the capacity to exchange alarms.

If framework finds any sudden changes in understanding heart beat or body temperature, the framework consequently alarms the client about the patients status over IOT and furthermore indicates subtle elements of pulse and temperature of patient live in the web.

In this manner IOT set up tolerant wellbeing following framework viably utilizes web to screen quiet wellbeing measurements and spare persists time. There is a significant capability between neglect any kind of minor health issues which is shown in early stages by variation of vital elements like body temperature, heartbeat rate etc.

Once the health issue has been increased to a critical stage and the life of the person is endangered, then they take medical assistance, which can cause an unnecessary waste of their earnings. This also comes into account especially when certain epidemic is spread in an area where the reach of doctors is impossible. So to avoid the spread of disease, if a smart sensor is given to patients, who can be monitored from a distance would be a practical solution to save many lives [6].

In this paper section II describes about the proposed system, section III describes about the experimental setup including the circuit and section IV about the algorithm used in the implementation. The paper discusses the experimental results in section V.

II. PROPOSED METHODOLOGY

The proposed system defeats by persistent observing of patients, helpful for different patients, database report upkeep and sign to concerned restorative authorities. In this strategy we utilized the arrangement of methods accessible for the ICU patient's wellbeing observing framework with wired correspondence innovation.

In the novel framework the patient wellbeing is ceaselessly observed and the obtained information is transmitted to an utilizing Wi-Fi remote systems. In future we can extend this framework by utilizing RFID innovation through this innovation we can screen the numerous quantities of patients.The patients in the ICU room can be consistently observed by detecting the parameters like temperature, heart beat rate, gas level with wired. The sign detected from the patients is millivolt however the sensors volt will be 5v sensors will have the speakers the detected sign is enhanced and it won't make hurt human wellbeing at that point the sign are send to the Arduino.

Using WI-FI module the outcomes will be ceaselessly transmit to web of thing and the information will be put away straightforwardly to the database and if any irregularity the sign will be send to restorative authorities. Wellbeing checking is a casual, non-statutory strategy for reviewing your workforce for indications of sick wellbeing, including lower back agony.

This sort of word related wellbeing the board framework can empower you, as a business, to know about medical issues and mediate to anticipate issues being caused or aggravated by work exercises. Temperature sensor is utilized to gauge temperature with an electrical yield corresponding to the temperature (in oC).

Temperature Sensor module depends on the semiconductor LM35 temperature sensor. The LM35 Linear Temperature Sensor module can be utilized to identify surrounding air temperature. This sensor is created by National Semiconductor Corporation and offers a practical range between - 40 degree Celsius to 150 degree Celsius.

A heart beat rate screen is an individual observing gadget that enables one to quantify one's pulse continuously or record the pulse for later examination. It is to a great extent utilized by entertainers of different sorts of physical exercise. The ordinary testing grown-up human pulse ranges from 60–100 bpm.

III. PROPOSED METHODOLOGY FLOW CHART

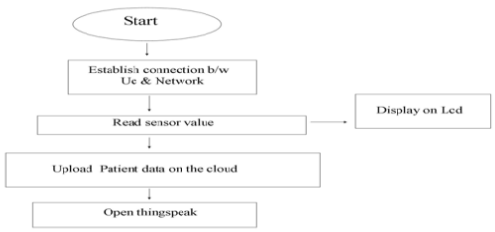

Fig 1. Flow chart of Proposed Methodology.

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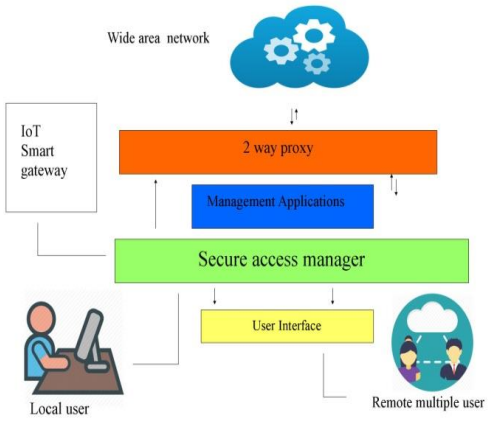

Fig 2. Proposed system.

IV. IMPLEMENTATION METHODOLOGY

- Hardware Description
- Arduino uno
- Temperature Sensor (LM35)
- Pulse sensor
- LCD

V. SENSORS

The temperature sensor connected to the analog pin of the arduino controller is converted into digital value with the help of ADC [10].

Using this digital data, the controller converts it into the actual temperature value in degree Celsius using the equation:

temperature (°C) = [raw ADC value*5/4095-(400/1000)]*(19.5/1000)

The heartbeat sensor is based on the principle of photo phlethysmography. It measures the change in volume of blood through any organ of the body which causes a change in the light intensity through that organ (a vascular region) [7].

The digital pulses are given to a microcontroller for calculating the heat beat rate, given by the formula:

BPM (Beats per minute) = 60*f, where f is the pulse frequency

A humidity sensor (or hygrometer) senses, measures and reports both moisture and air temperature. Humidity sensors work by detecting changes that alter electrical currents or temperature in the air.

The relative humidity is calculated as given below:

Voltage = (ADC Value/1023.0)*5.0;

Percent relative humidity = (Voltage-0.958)/0.0307;

VI. EXPERIMENTAL RESULTS

The body temperature sensor, pulse rate sensor, room temperature and humidity sensor values are calibrated using the microcontroller.

The complete prototype of the health monitoring system with the sensors are shown in Fig. 5 and Fig.6, where it shows the output values of the sensors calculated and displayed in a LCD display, so that these values are visible even to the patient.

1. Sensor Values displayed on LCD:

Fig 3. System Prototype.

2. Sensor Values Displayed on IOT Application Platform:

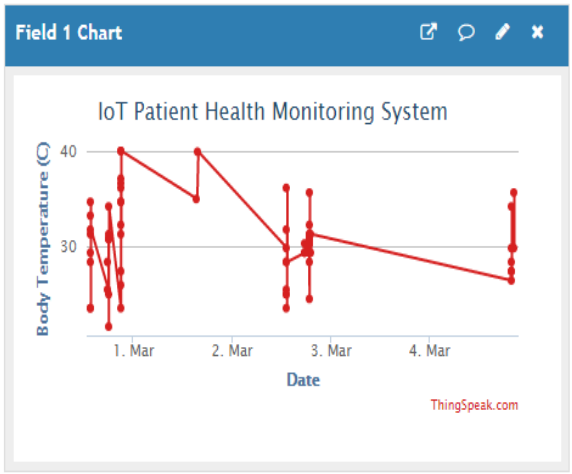

Fig 4. Patient Body Temperature.

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Table 1. Database Structure.

Sensor data	Datatype
Patient ID	Int
Body Temperature	Float
Pulse rate	Float

Table 2. Pulse Rate.

Pulse rate	State
60 BPM - 100 BPM	Normal
>100 BPM	High
<60 BPM	Low

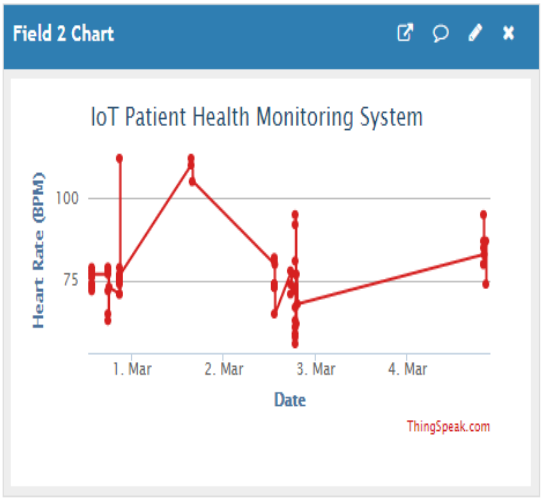

Fig 5. Patient Heart Rate.

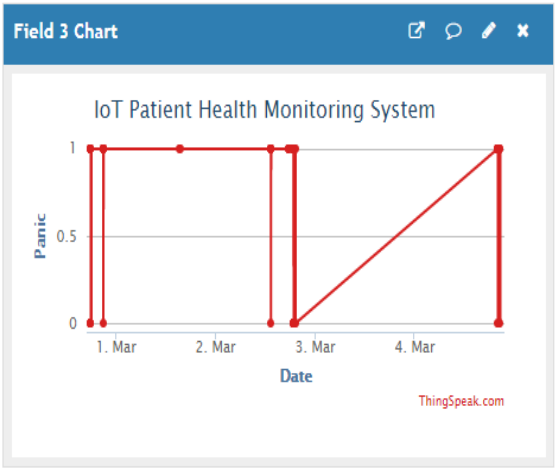

Fig 6. Patients Panic Situations.

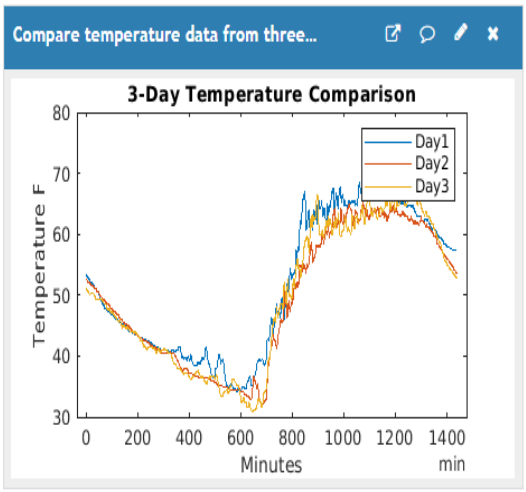

Fig 7. Matlab Analysis in Thingspeak.

When the pulse rate value was taken as 82.8 BPM (Normal) and the body temperature as 37°C (Normal), then the output value of health state is 91.4, which comes in the membership function-Healthy. So for all combinations of the input sensors, the output health state can be simulated and diagnosed using the Matlab simulation.

Table 3. Export Data in CSV Format

64	2021-03-02 13:24:56 UTC	63	30.79	81	1
65	2021-03-02 13:25:28 UTC	64	32.26	92	1
66	2021-03-02 13:25:44 UTC	65			0
67	2021-03-02 13:26:29 UTC	66			0
68	2021-03-02 13:27:34 UTC	67	29.33	62	1
69	2021-03-02 13:28:00 UTC	68			0
70	2021-03-02 13:30:54 UTC	69			0
71	2021-03-02 13:40:40 UTC	70	29.33	77	1
72	2021-03-02 13:40:55 UTC	71			0
73	2021-03-02 13:47:32 UTC	72	31.28	68	1
74	2021-03-02 13:48:09 UTC	73			0
75	2021-03-04 14:28:23 UTC	74	26.39	83	1
76	2021-03-04 14:28:41 UTC	75	28.35	95	1
77	2021-03-04 14:28:59 UTC	76	29.81	87	1
78	2021-03-04 14:29:17 UTC	77	27.37	80	1
79	2021-03-04 14:29:35 UTC	78	27.37	80	1
80	2021-03-04 14:30:16 UTC	79	34.21	85	1
81	2021-03-04 14:30:41 UTC	80			0
82	2021-03-04 15:05:53 UTC	81	29.81	87	1
83	2021-03-04 15:06:13 UTC	82	35.68	74	1
84	2021-03-04 15:06:53 UTC	83			0

VII. CONCLUSION

The Internet of Things is considered now as one of the feasible solutions for any remote value tracking especially in the field of health monitoring. It facilitates that the individual prosperity parameter data is secured inside the cloud, stays in the hospital are reduced for conventional routine examinations

and most important that the health can be monitored and disease diagnosed by any doctor at any distance.

In this paper, an IoT based health monitoring system was developed. The system monitored body temperature, pulse rate and room humidity and temperature using sensors, which are also displayed on a LCD. These sensor values are then sent to a medical server using wireless communication. These data are then received in an authorized personals smart phone with IoT platform. With the values received the doctor then diagnose the disease and the state of health of the patient.

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