Design and Development of Health Band for Monitoring of Novel COVID-19 under Medical Observation.

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ABSTRACT

The proposed health band developed for monitoring of the patients send to quarantine, or under medical treatment. The novel COVID-19 is created time of pandemic of as, large crowd of people send for either isolation or quarantine centre, Their health monitoring is a challenge for today's medical team as well as patients under observation. This health band is developed, to provide quality monitoring without spreading the virus among the patients and medical staff.

KEYWORDS- *Health Monitoring; patient monitoring; medical instrument.*

I. INTRODUCTION

The current state of corona virus as positive patients is more than 6,50,000 and expanding as a rate of 1.5 times, in India and more than thousands of people are sent to quarantine. It is difficult to monitor all the patients. Due to limited number of laboratory instruments at the isolation center, giving every patient a separate instrument, it is not feasible and reuse of instrument it is not an option, because if any patient is infected then reusing these instruments will infect the medical staff as well as the patients.

1. Proposed Design Solution

There is development for a health band to overcome the above discussed problem. The proposed health band is designed by using electronic system the selected majority of components are a microcontroller, temperature sensor, blood oxygen sensor, heart beat rate sensor, display, Wi-Fi module, and a battery. All these components are integrated together and the Electronic system is made which is named as health band.

Fig1. *Health band showing real time body temperature of the patient.*

The developed health band can be given to the patient at the time when he gets admitted into isolation or a Quarantine Centre. All the sensors used in the band will sense the three body parameters (temperature, heart beat and blood oxygen level) from time to time (with an interval of 5 minutes or can be modified) and the data will be monitored. This monitored value that is uploaded to the server with the help of the Wi-Fi module and microcontroller.

Fig (2) *Health band showing real time Heartbeat of the patient.*

After all the information about the patient is collected, it can be upload and recorded in the server, this way the data of every patient are maintained. We can provide a separate band to every patient so that mass information can be collected over the server for every patient.

Fig (3). *Health band showing reminder to wash hands.*

The data of every patient can be monitored and extended to isolation central control room, Based on the data the district health monitoring center, as well as the Ministry of Health can support to hospital, patients as urgent need. The data can be seen live.

1.1   Design Methodology

1.1.1 The proposed design is under following steps:

Microcontroller unit
It is an integrated chip which contains one or more CPUs (processor cores) along with memory and programmable input/output peripherals. [1]
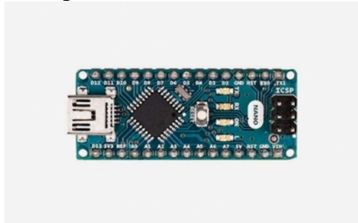For our development Arduino board is used.

Fig (4) *Arduino Nano*

Temperature sensor
It is a device, usually an RTD (resistance temperature detector) or a thermocouple, that collects the data about temperature from a particular source and converts the data into understandable form for a device or an observer. [2]
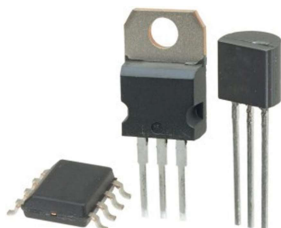

Fig (5) *Temperature Sensor*

Blood oxygen and pulse sensor

A pulse oximeter is a medical device that indirectly monitors the oxygen saturation of a patient's blood (as opposed to measuring oxygen saturation directly through a blood sample) and changes in blood volume in the skin, producing a photoplethysmogram that may be further processed into other measurements. [3]

Fig (6) *Pulse oximeter sensor.*

OLED Display
It is a flat light emitting technology, made by placing a series of organic thin films between two conductors. When electrical current is applied, a bright light is emitted. [4]
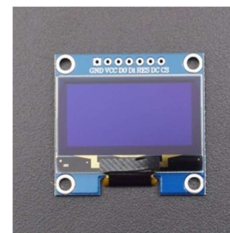

Fig (7) *OLED Display*

Wi-Fi module
The ESP8266 Wi-Fi Module is a self-contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your Wi-Fi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. [5]

Fig (8) *ESP8266 Wi-Fi module*

II. TEST RESULT
This research covers three cases. The normal Parameter (issued by Government) are
Bode temperature from 97°F (36.1°C) to 99°F (37.2°C).
BMP: 90 %<.

SpO_2:60-90 BPM (for adult). [5-7]. The result are compared based on these data. Following are test cases as discussed below:
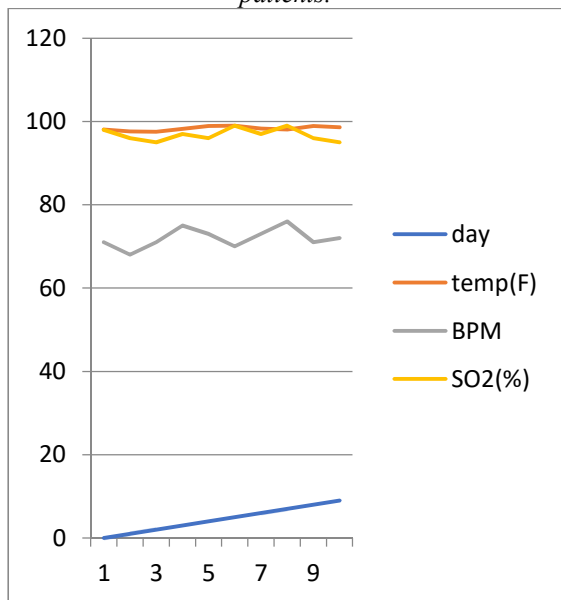
2.1 Constant health case
Table 1 shows the test result of patient with constant health condition. Fig (9) shows the graph of the test result.

Table 1 *Improve condition patient (day average values)*

Day	Temp(F)	BPM	SpO$_2$(%)
0	98.1	71	98
1	97.6	68	96
2	97.5	71	95
3	98.2	75	97
4	98.9	73	96
5	99	70	99
6	98.3	73	97
7	98.1	76	99
8	98.9	71	96
9	98.6	72	95

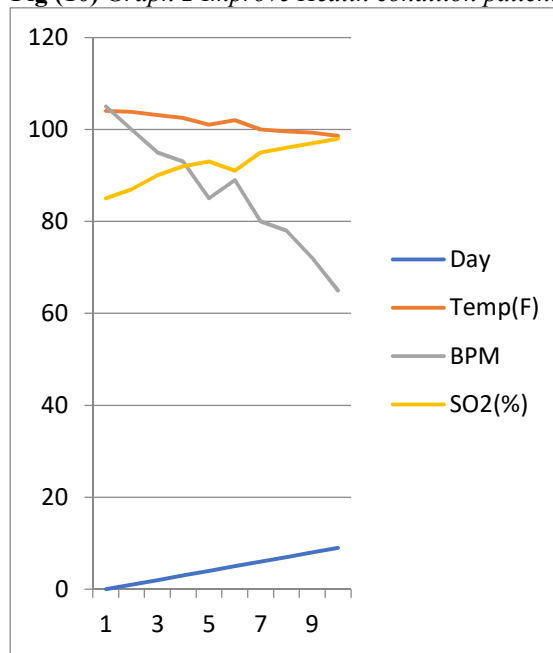**Fig (9)** *Graph 1 Constant Health condition patients.*

2.2 Improve Health Case
Table 2 shows the test result of patient with improving health condition. Fig (10) shows the graph of the test result.

Table 2 *Improve condition patient (day average values)*

Day	Temp(F)	BPM	SpO$_2$(%)
0	104	105	85
1	103.8	100	87
2	103.1	95	90
3	102.5	93	92
4	101	85	93
5	102	89	91
6	100	80	95
7	99.6	78	96
8	99.3	72	97
9	98.6	65	98

Fig (10) *Graph 2 Improve Health condition patient.*


2.3 Deteriorate Case
Table 3 shows the test result of patient with deteriorating health condition. Fig (11) shows the graph of the test result.

Table 3 *Deteriorate condition patient (day average value)*

Day	Temp(F)	BPM	SpO2(%)
0	98.9	70	98
1	99	72	99
2	99.5	78	97
3	100	85	95
4	101	91	93

5	102	95	91
6	102.3	98	92
7	102.8	100	90
8	103	102	89
9	103.4	104	87

Fig (11) *Graph3 Deteriorate condition patient*
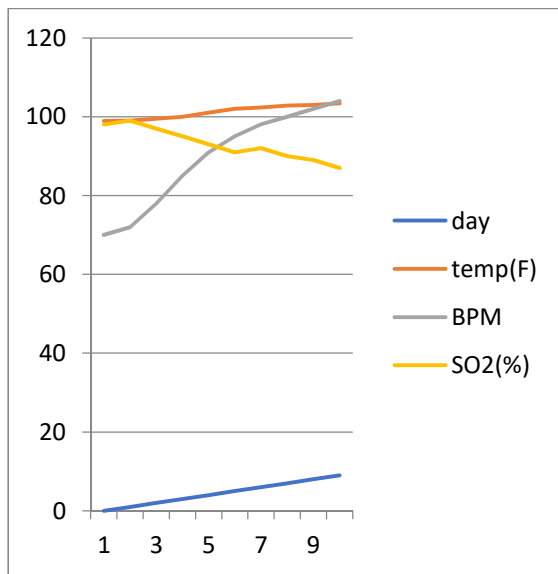
Based on result It is very clear from observation Table1 , that the health of patient sent to Quarantine, having constant in range parameter(Temp, beat/min and SpO_2),so this case has low infected risk. From observation Table 2, we can analyze the Health of patient is improving with time (Temp is decreasing, BMP is decreasing and SO_2 level is increasing); so patient is in recovering state.

From observation Table 3, we can analyze the Health of patient is deteriorate with time (Temp is increasing, BMP is increasing and SO_2 level is decreasing); Thus this case has high infected risk.

Thus any medical observation, we need five major parameters to be recorded by medical experts. Those are:
1. Body temperature
2. Heartbeat
3. Blood oxygen level
4. ECG
5. Respiratory analysis

Using our device, we can analyze three parameters (body temperature, heartbeat and blood oxygen level) at present and in future we can also add the other two parameters (ECG and respiratory analysis) to make a perfect device for any medical observation.

Here idea is to the database of patients can be shared with government application like "**Aarogya Setu**" for enhancement the utility of this application.

Advantage
2.2.1. Social distancing can be achieved.
2.2.2. Spreading of virus can be stopped.
2.2.3. Since the device is as small as a band and whole communication is wireless, it makes it easier for the patient to wear.
2.2.4. 24x7 observation is available.
2.2.5. The record is uploaded over the cloud, so a large number of audiences can be monitored.
2.2.6. The uploaded data can be taken is reference for research work.
2.2.7. A large number of crowds can be quality monitored.
2.2.8. Due to the limited number of ICU bed, we can analyze the data properly and prioritize the patient with high risk which can be found by our health band.

2.3   USP of the band

2.3.1. The health band uploads the data on the server from time to time as well it shows the live status on the display.
2.3.2. In this size, shape and concept wise no other device is present in the Indian Medical market

III. CONCLUSION
This health band seems to be a powerful weapon against the fight of Covid-19.

We can only win against this virus when we do more number of testing's and this health band helps in high number of quality observation over the crowd of patients. Among them this can play a major role in identifying the infected one. In proposed health card social distancing can be achieved. Spreading of virus can be stopped.

The device is as small as a band and whole communication is wireless, it makes it easier for the patient to wear. Observation is available

continuously. The record is uploaded over the cloud, so a large number of audiences can be monitored. The uploaded data can be taken is reference for research work. A large number of crowds can be quality monitored. Due to the limited number of ICU bed, we can analyse the data properly and prioritize the patient with high risk which can be found by our health band.

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