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A Low Cost Health Monitoring System by Maintaining Covid 19 Protocol

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***Abstract*—Social isolation and home quarantining have been standard procedures around the world, since the outbreak of the novel coronavirus (COVID-19) sickness pandemic. Due to the spread of the COVID-19 disease, patients' remote monitoring becomes even more important in this situation. There are two reasons for this: (i) They must be kept alive and their symptoms under control; (ii) they must not leave the quarantined region throughout the quarantine time. This work presents a low-cost method for sensing patients' the physiological characteristics and displaying them on an Android-based mobile application. The Arduino UNO, a DHT11 Humidity Temperature Sensor sensor device, and HC-05 Bluetooth module were carried out to make up the system. A sensor was included in the system to capture the physiological health parameters of patients automatically. As a result, the patients can be remotely observed using the suggested method from a safe distance, avoiding direct contact and adhering to social distancing procedures. It was developed using free available online platform for developing mobile application is MIT inventor-2. Thus, even at the most difficult stage of the COVID-19 epidemic, increased health and a comfortable lifestyle can be accomplished.**

***Index Terms*—Covid 19 Pandemic, Arduino UNO, DHT11 Humidity Temperature Sensor, HC-05 Bluetooth,MIT inventor-2,Mobile App.**

I. INTRODUCTION

When the COVID-19 sickness was rapidly spreading over the world, hospitals' biggest challenge was protecting their medical workers from the deadly infection. As a result, it is the hospitals' primary responsibility to protect their medical staff from infection. If medical personnel do not approach Covid patients in this condition, it is extremely difficult for doctors or other medical personnel to monitor the patients' vital signs. If the symptoms worsen, appropriate drugs must be administered as soon as possible. There will be no more delays in notifications. Implementation of a low-cost Bluetooth-based system implies that the real-time physiological parameter status on a smartphone via a mobile application. MIT App Inventor was used to create this mobile app. The physical interaction between the patient and the medical staff would be minimized with this Bluetooth patient monitoring device. When it comes to mobile applications, if they are built by professionals for health monitoring, they are highly expensive. In this work, I suggested a system that runs on mobile applications created using MIT App Inventor, a free online platform for developing mobile applications. It consists of a wearable sensor, an Arduino, a Bluetooth module, and a smartphone. Body temperature and humidity would be monitored through wearable sensors. The data sensed by the sensors is processed by Arduino, and the Bluetooth module transmits the data wirelessly to the mobile phone. The wearable sensor senses the physiological data of patients, which are shown in real time by the mobile application. This helps to prevent community spread and shields medical personnel from direct patient touch. When vital readings exceed or fall outside of the usual range, alerts such as changing the colour of the data display on the mobile application triggered by the patients would be sent out. The medical team can then take the necessary steps, such as phoning doctors or booking an intensive care unit. By using MIT app inventor, these features and functionalities are built and developed in mobile applications. This system also includes a visual depiction that helps developers better understand the interactions that occur within the Bluetooth module and its design. Different types of entities, including lot sensors and software's, can be modeled. This characteristic is ideal for the wireless concept and the requirements of the next low-cost health monitoring system.As a result,a health monitoring system can help patients reduce physical contact, wait time, and total health costs while also decreasing medical staff strain, burden, and stress. Advancements in information and communication technology, as well as mobile applications that

enable connectivity everywhere and at any time, have made a outstanding contribution to the development of the modern healthcare system, which is used in telemedicine and other portable medical application [1]. The goal of this research is to produce cross-platform Smart wear using a wireless controller and sensor technology. The disadvantage of this paradigm is that future biotech device attempts will need to be developed in a cost-effective manner [2]. This type uses a temperature sensor to measure the human body's heat. The disadvantage of this system was that it did not evaluate critical parameters This paper describes the design and implementation of an IoT-based health monitoring gadget using the temperature and pulse rate sensors [3]. The disadvantage of this arrangement is that the Raspberry Pi is more expensive. The proposed system is appropriate for hospital use. Doctors and nurses may monitor the ECG, temperature, BP, oxygen level in the blood, and heartbeat of any patient at any time and from any location using a computer or smartphone. The disadvantage of this model is that the free version of its mobile app has some limitations [4].

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II. PROPOSED WORK

The System block diagram consist of DHT-11 temperature and humidity sensors to monitor the patients' body temperature and humidity levels. The output readings of the sensors are utilized to examine the patient's health. These sensors are linked to the Ardunio UNO Micro-controller, which allows the patient to be monitored on a frequent basis. The HC 05 Bluetooth module is used to transfer physiological parameters from the system to the mobile phone in wireless mode. If there are any anomalies in any of the health parameters, the doctor's mobile application developed by MIT App inventor sends out an alarm message via a change in color display. DHT-11 Humidity and Temperature sensor, HC 05 Bluetooth module, and smart phone are the major components in this system Fig. 1(A) and components connection is explained in Fig1(B).

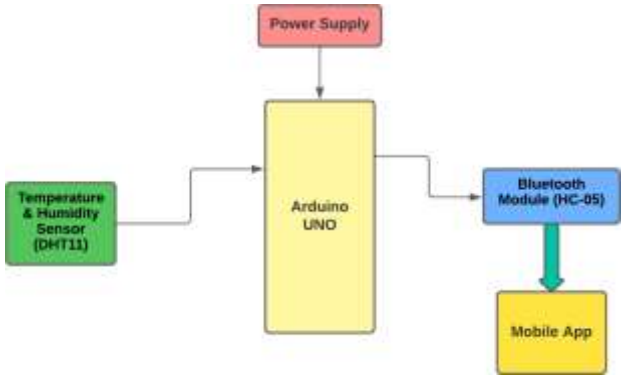

Fig. 1. Block diagram of system

A. Arduino Micro-controller

This is the system's workhorse processor, and it was utilised to link the entire system together. The Arduino board has a number of digital and analogue input/output (I/o) pins that can be connected to expansion boards, breadboards, and other circuits[5]. The connection between Arduino and all sensors must be established by plugging all sensors into Arduino. The sensors collect information from the patient, such as temperature and humidity. Arduino uses code to collect data from sensors and stores it in variables. In Arduino, a specific code must be written. This code use a looping technique to obtain data from sensors in real time. Sensors feed the physiologic parameter data of patients to the Arduino every time the algorithm is looped, allowing the Arduino to acquire a live real-time picture of the patient's health. The data was received by Arduino, and it needed to be sent to the mobile app through Bluetooth module. As a result, the current state of patients' health may be tracked [6]. C, Java, and C++ are the three programming languages available. In this study, however, C was chosen for the Arduino IDE instructions since the Arduino IDE has made it straightforward to write code and upload/burn the programme to an Arduino compatible board. The IDE version used in this paper is version 1.8.13. The code was written based on the logic software's output results. The USB cable should be used to transport data from the PC to the hardware, which will necessitate changing the port settings on the Arduino.[7]

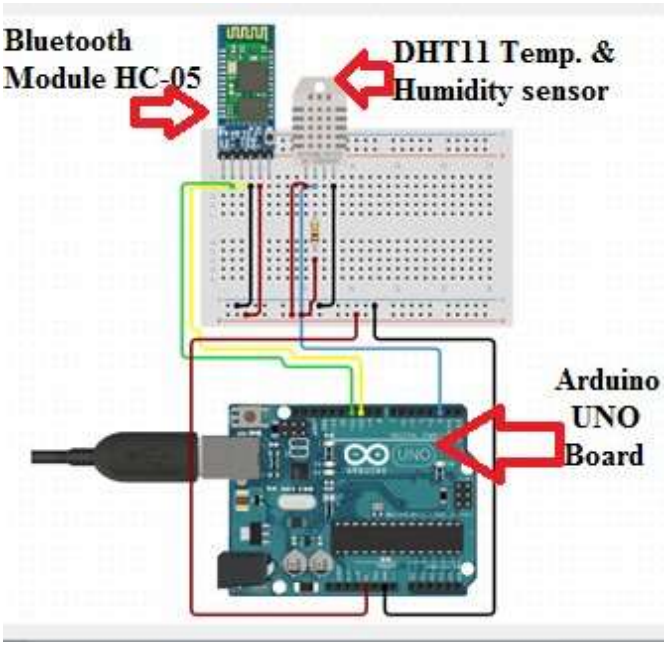

Fig. 2. Circuit Diagram of Proposed system

B. Temperature and Humidity Sensor

The DHT11 is a widely used temperature and humidity sensor with a dedicated Negative Temperature Coefficient (NTC)

for temperature measurement and an 8-bit microprocessor for serial data output of temperature and humidity values.

C. Bluetooth Module (HC-05)

The HC-05 Bluetooth Module is a simple Bluetooth SPP (Serial Port Protocol) module that allows for the construction of a transparent wireless serial connection. It communicates via serial transmission, making it simple to connect to a controller or PC. It receives the command and sends it to the Arduino micro-controller for execution. Through a serial port, the micro-controller receives the command. As a result, the Arduino micro-controller compares the command from the Android phone to the Arduino Uno code. The relevant output pin turns high if it matches the command. The micro-controller sends a signal to the mobile app, which displays the related readings on the phone. The HC-05 requires a supply voltage of 3.6VDC to 6VDC to operate, but the RXD pin's logic level is 3.3 V and is not 5 V tolerant. [7] The Bluetooth module is connected to the Arduino-Uno board. Steps 1–3 were used to connect the Arduino-Uno and the Bluetooth module so that the mobile application could communicate with the Arduino-Uno. Step 1. The VCC pins of the Bluetooth module and the micro-controller were joined. Step 2. The GND pins of the Bluetooth module and the micro-controller were joined. Step 3. Similarly, the Bluetooth module's transmitter (Tx pin) is connected to Pin 10 of the micro-controller, and the Bluetooth module's receiver (Rx pin) is connected to Pin 11 of the micro-controller.

D. Mobile Application on Smart Phone

Object-oriented programming languages like Java or Swift are commonly used to create the app. However, designing an Android application from the ground up may not be appropriate or efficient in all circumstances, particularly for prototyping, when designers are expected to concentrate on the mobile application's concept and design [8]. Furthermore, particularly for those clients have without significant programming expertise [9]. As a result, it is sometimes better to utilize a visual editor for developing a smart application so that designers may more easily develop their sketch and apply the planned concept. MIT App Inventor 2 is one of the most widely used applications for this purpose [10]. The MIT App Inventor 2 is a drag-and-drop visual environment that allows users to design and develop fully functional Android applications using a graphical interface [11, 12]. The Component Designer and Blocks Editor are two elements of the MIT App Inventor 2. The components designer is shown in Fig. (2) [13], which allows the user to drag and drop items like text boxes and buttons to design an Android application's user interface. The Blocks Editor, on the other hand, allows the user to programs the components to behave in specific ways by organizing logic blocks [14], which look like puzzle pieces and have their own set of tabs and blanks. This allows users to construct customized or broad software while avoiding the majority of potential faults. Furthermore, because it is designed for educational purposes, MIT App Inventor 2's ease of use makes it ideal for prototyping before moving forward with the development of an Android app with more advanced features. The MIT App Inventor 2 is utilized in this system to construct an Android application that controls Bluetooth-based devices. Because Bluetooth is the most extensively utilized communication protocol in commercial cellphones today, it was chosen for wireless communication. As a result, the technology can be used without the need for an additional smartphone module [10]. .

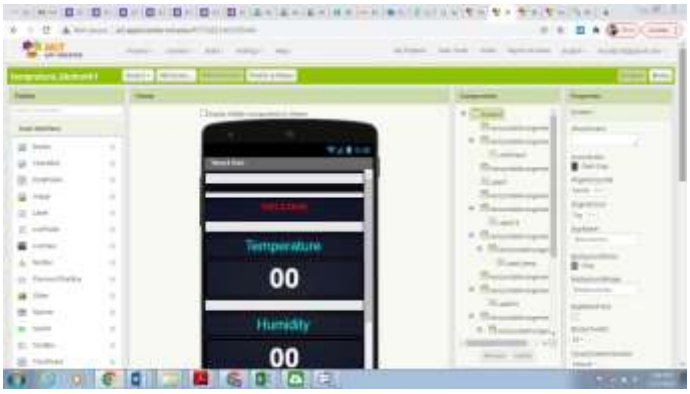

Fig. 3. The Components section of MIT App inventor (from MIT app inventor website)

E. Design and Implementation of Mobile Application

MIT app inventor2 created this mobile application; The Designer and the Blocks Editor are the two parts of App Inventor. In the Designer section of a web browser window, you've been configuring your app's screen and components. To begin programming the app's behavior, navigate to the Blocks Editor. To access the Blocks Editor, click the Blocks button in the upper right corner of the MIT App inventor interface screen Fig. (3)[13].

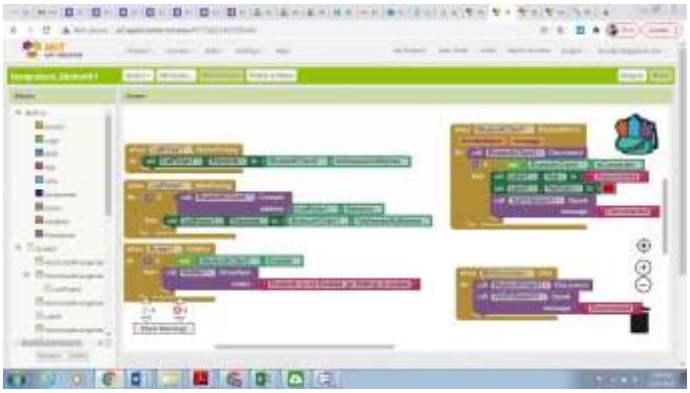

Fig. 4. Blocks Editor Section of MIT app inventor (from MIT app inventor website)

F. Colour changing indicators

This system's humidity and temperature monitoring feature is based on the flowchart shown in Fig. (4). Current reading came from the patient body is displayed on the mobile

application through the coding with the MIT app inventor as shown in Fig. (5 A 5 B)[15]. As depicted in fig when the parameters crosses the set limit it change the color of the display parameters as shown in Figs. (5 A 5 B), (6) and (7) respectively [15].

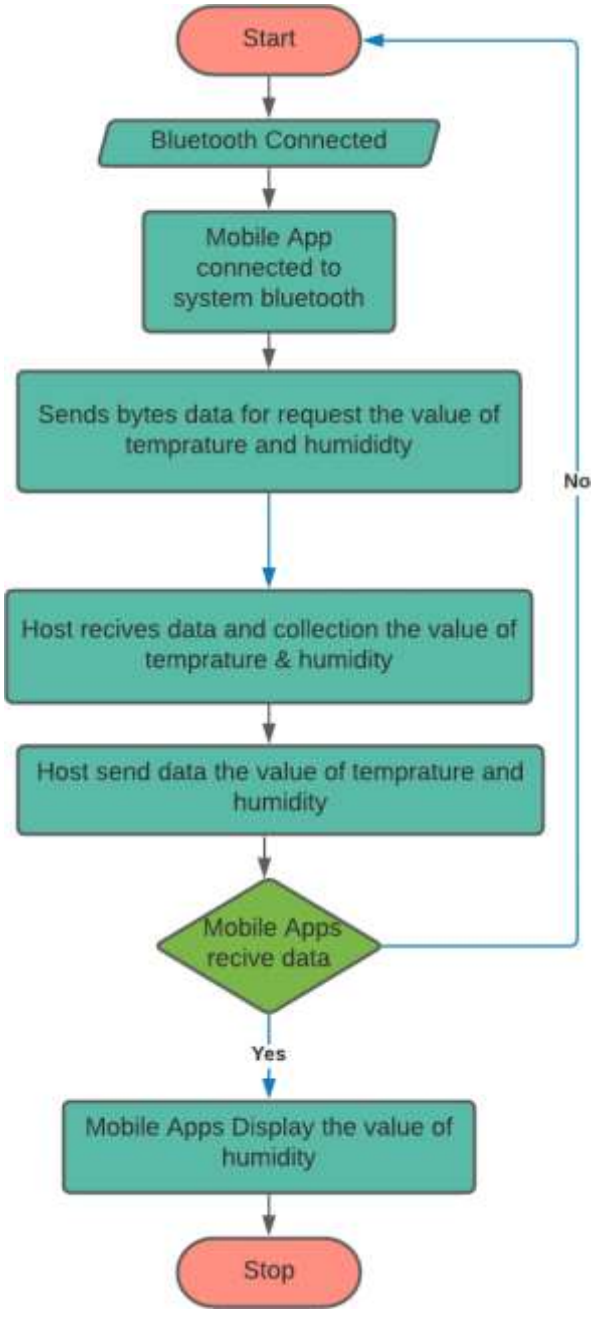

Fig. 5. Workflow of temperature and humidity sensor

G. Bluetooth connectivity

The mobile application communicates with the host via Bluetooth protocol; as a result, the user is aware of the Bluetooth host's address as well as the status of connectivity (Fig.8). The part dedicated to this operation is built around four components to ensure that the Bluetooth function runs smoothly (Fig.9) (1) To detect all Bluetooth devices accessible for connecting, press the Bluetooth Symbol (BS) button. (ii) Display the name of the list of Bluetooth devices available for pairing, (iii) Connectivity status when it is connected to the host i.e. "connected" text message display, (iv) Disconnect button.

The Bluetooth pairing process is as carried out (a) Press the Bluetooth button to search the device from remote location until the message is "disconnected" in red color, (b) List of remote devices near by the mobile application, (c) Select the device from the list that you wanted to be form pair after pairing the text message "connected" appears in green color on mobile application, (d) The Bluetooth device is disconnected with the disconnect button which red in color. When Disconnect button pressed then the Bluetooth link disconnected from the pair devices and sound of disconnect come from the mobile application using text to speech components. The status change to disconnect from connected [10].

III. Results and Discussions

A. Mobile Application Test

After finishing the designed application part, the file that will be installed on a mobile phone, namely an Android APK file, can be developed by selecting the 'Build' option in the MIT app inventor 2 free online platform . The APK file can be downloaded by the two methods either it is downloaded by generating QR code or simple code in online application and scan the QR code or input the simple code using the MIT APP inventor 2 Companion app that is already installed on mobile phone. This mobile app is used for testing the mobile app on your mobile phone without installation. Other method is that save the APK file directly on the computer and install it the user mobile phone. MIT app inventor's build tab can be used to make the app's APK file available. It is approximately 4MB in size. The build tab provides two options for obtaining an APK file for mobile installation: the first is to download it directly from download link, and the second is to scan a QR code using a bar-code scanner (Fig. 10)[13].

Click on the button to download the app, right –click on it top copy a download link or scan the code with a bar-code scanner to install. After the installation of Apk file, the designed app is testing on the several mobiles phone with different configurations. The first phase of checking the app is that smart phone should connect with the Arduino host with Bluetooth. This checking is to identify that the app is running properly on all mobile phone with minimum specification require for smart phone. Therefore, in order to ensure that the product reaches as many people as possible. These applications tested on colleague mobile phone in our department, with this Bluetooth connectivity problem is also sort out. Form the above result it is concluded that this app is run on any mobile with minimum specification.

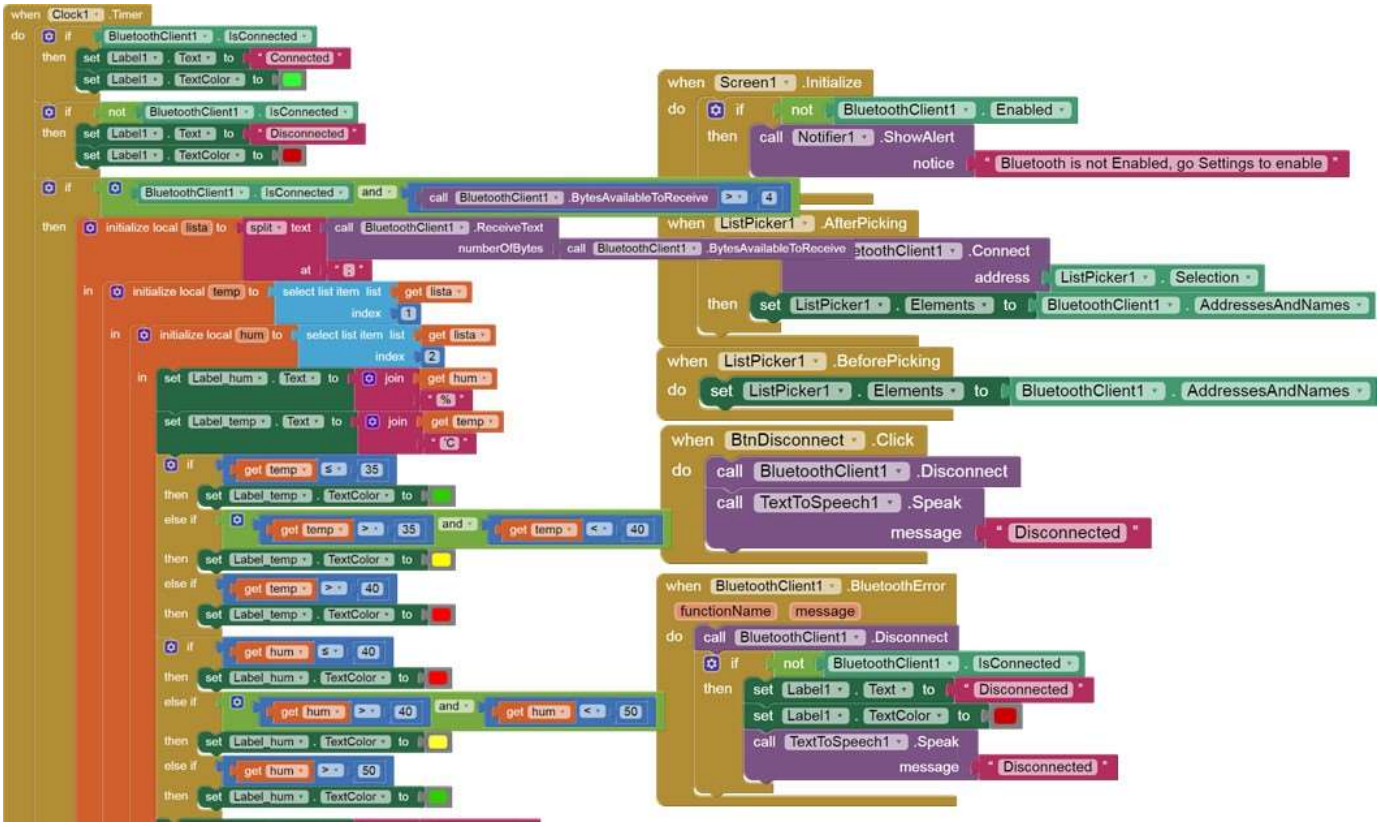

Fig. 6. Blocks for the system logic (Reference: https//github.com/embedded lab786 Temperature and Humidity Monitoring System)

Fig. 7. Blocks for the logic of change in color of the temperature and humidity text (Reference https://github.com/embeddedlab786 Temperature and Humidity Monitoring System)

Fig. 8. Change of color of temperature and humidity parameters on mobile application

B. Operational test

After the faithful link formation between the mobile phone and practical setup host system shown in Fig.11, the next step is to check the mobile app is functioning properly on received response from the host. The system on consist of temperature and humidity sensor attached on the body of patient to send physiological parameters live readings on to the smart phone using Bluetooth technology. The mobile application is give properly response to live reading came from the system, and the change in color of display reading for the minimum and maximum value is also functioning properly as shown in Fig. 12. The health worker's has their mobile phone in hand, they can follow COVID 19's social distancing policy from the patients, so they may see the trigger alert and take preventative action to save the patient's life. .

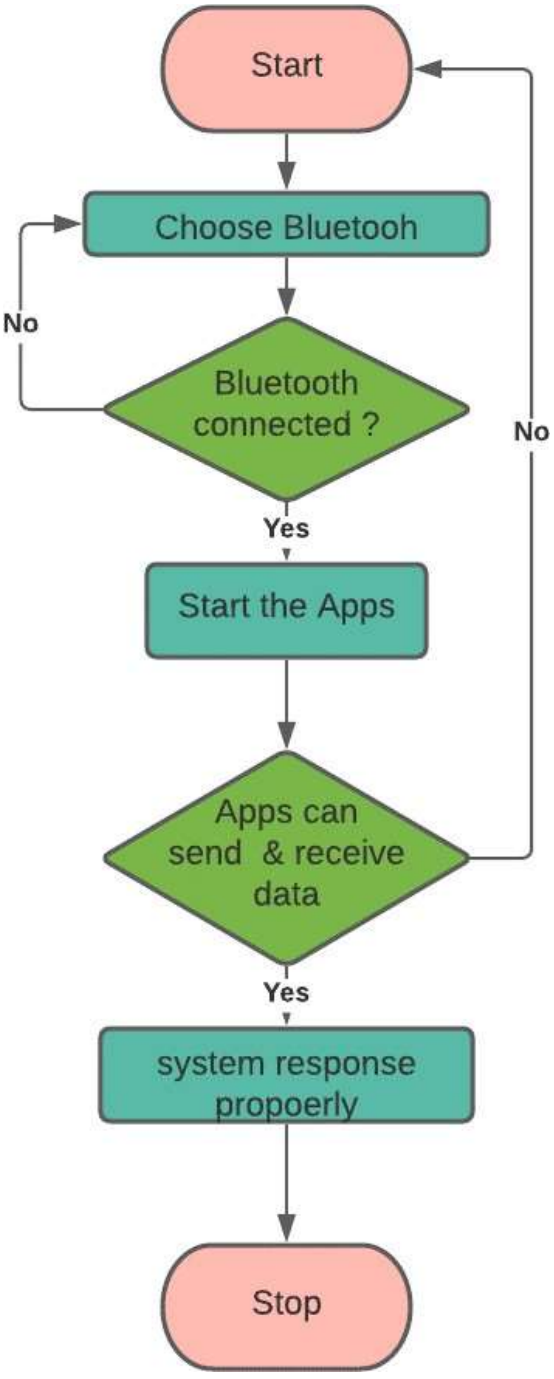

Fig. 9. Flow chart of working of the system

Fig. 10. Bluetooth link formation tab on mobile application: (a) Bluetooth Connect button (b) Text message showing Bluetooth not connected (c) Text message showing Bluetooth form pair with other devices (d) Bluetooth disconnect Button

Fig. 11. Build Tab options of MIT app inventor

IV. CONCLUSION

This paper presented the low cost solution is provided for maintain Social distance protocol in Covid 19 situation. The entire world is phasing the COVID 19 pandemic situation, as the health workers are still not sufficient to look after the COVID 19 patients. So the situation is more dangers when the patient does not get proper treatment on time. In this scenario the health worker is protection is vital, if they infected at

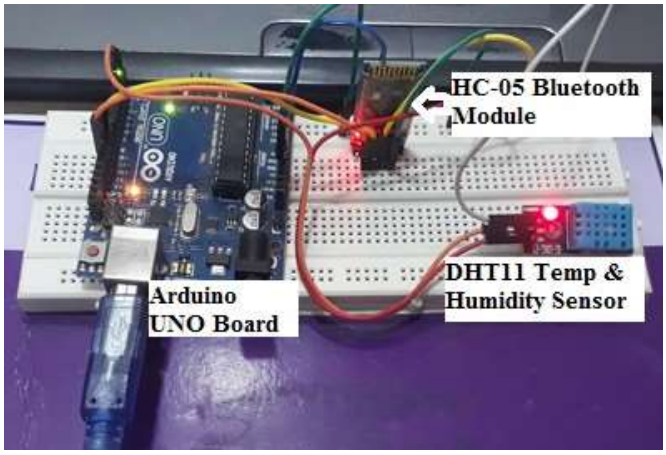

Fig. 12. Practical Setup

Fig. 13. Change in colour

the time of giving treatment to the patient, then the situation make worst. So isolation of health worker from the infected patient can be the solution by maintain the social distancing at the time of monitoring the patient. But the problem is that without monitoring patients' physiological parameters, health worker cannot begin the treatment. This system is low-cost since professional software development is expensive, and the Arduino micro-controller is employed in this proposed systemrather than the Raspberry Pi. In comparison to Arduino, the Raspberry Pi employed in the existing system is more expensive. This proposed low cost system helps to monitor and measure the temperature and humidity of the patients with Bluetooth technology, send these live readings directly on to the mobile phone of health worker. This system just not provide live readings but it also provide alerts when the readings crosses certain preset limits either it low or high. This is indicated by change in color of live reading on application of mobile phone, which is developed using free online platform provided by MIT app inventor. It will also aid in the maintenance of social distance. In rural area hospitals and in less facility, it really helps to protect the health workers and block the spreading of COVID 19 in rural hospitals.

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REFERENCES

[1] O. Taiwo, A.E. Ezugwu, Smart healthcare support for remote patient monitoring during covid-19 quarantine, Informatics in Medicine Unlocked, 20 (2020) 100428. https://doi.org/10.1016/j.imu.2020.100428
[2] T.R. Aditya, G. Jagadamba, U. Karthik Bhat, P. Manjunath, S. Sanath Pai, Real time patient activity monitoring and alert system, Proceedings of the International Conference on Electronics and Sustainable Communication Systems (ICESC), 2020.
[3] A. Divya Priya, S. Sundar, Health monitoring system using IoT, International Conference on Vision Towards Emerging Trends in Communication and Networking (ViTECoN), 2019.
[4] Sangeethalakshmi K. , Preethi Angel S., Preethi U., Pavithra S., Shanmuga Priya V. Patient health monitoring system using IoT, Materials Today: Proceedings, https://doi.org/10.1016/j.matpr.2021.06.188 2214-7853/ 2021 .
[5] Kelebogile Confidence Mejea,Lindiwe Bokopanea, Kanzumba Kusakanaa,Mukwanga Siti,Real-time power dispatch in a standalone hybrid multisource distributed energy system using an Arduino board, Energy Reports 7(2021) 479–486
[6] Dewa A. D. Audreya,Stanleya, Kevin S. Tabarakaa, Adriel Lazaroa, Widodo Budihartoa , Monitoring Mung Bean's Growth using Arduino, Procedia Computer Science 179 (2021) 352–360
[7] Abiodun E. Amoran,Ayodele S. Oluwole, Home automated system using Bluetooth and an android application , Scientific African 11 (2021).
[8] Kang, H., Cho, J., Kim, H., Application study on Android application prototyping method using App inventor. Indian Journal of Science and Technology, 8 (19) (2015)1–5.
[9] K. Radoslaw, L. Turczynski, L., K. Zyla, Comparison of App Inventor 2 and Java in creating personal applications for Android on example of a notepad. Advances in Science and Technology Research Journal, 10 (31) (2016) 247–254.
[10] Efficient Android Software Development Using MIT App Inventor 2 for Bluetooth-Based Smart Home Trio Adionol • Sinantya Feranti Anindya2 • Syifaul Fuada2 • Khilda Afifah3 • Irfan Gani Purwanda4.
[11] S. C. Pokress, J. J. D. Veiga, MIT App Inventor: Enabling personal mobile computing (2013). arXiv preprint arXiv :1310.2830.
[12] Colter, J. A. (2016). Evaluating and improving the usability of MIT App Inventor. Doctoral dissertation, Massachusetts Institute of Technology, Massachusetts.
[13] https://appinventor.mit.edu/
[14] Kang, H., Cho, J, Case study on efficient Android programming education using multi Android development tools. Indian Journal of Science and Technology, 8 (19) (2015) 1–5
[15] https://github.com/embeddedlab786/Temperature and Humidity Monitoring System