International Journal of Engineering Sciences & Emerging Technologies, Dec. 2024
ISSN: 22316604 Volume 11, Issue 4, pp: 738-745 ©IJESET

E-CLINIC: IOT BASED VIRTUAL OPD PLATFORM FOR REMOTE CONSULTATION

Shailesh Khaparkar and Agya Mishra
Department of Electronics and Telecommunication,
Jabalpur Engineering college, Jabalpur M.P (India)

[a)] Corresponding author: shaileshkhaparkar@gmail.com
[b)]agyamishra@gmail.com

ABSTRACT

This research introduces an innovative concept for a smart telemedicine system allowing patients to consult with the doctors from a remote place. The initiative offers an Internet of Things (IoT)-based real time online OPD and consultation system. Online OPD system provide the facility of screening of patient by monitoring vital signs such as heart rate, oxygen saturation, ECG, skin temperature, eyes, tongue as well as audio and video system for online consultation. Doctors can recommend/prescribed medicine, pathological test and consultation through cloud based data sheet .Vital sign details are recorded in e- datasheet for future purposes. Developed Online OPD system are tested and verified in presence of senior doctor on 15 patients. The results are as expected as per clinical needs.

Keywords— *Online OPD, e-Datasheet, telemedicine, Online prescription.*

I. INTRODUCTION

Maintaining our health ought to be our first priority since, as they say, "health is wealth."Our irresponsibility makes us suffer more. These days, a multitude of issues have disturbed our daily routine and way of life, including the pressures of our employment, unhealthy diets, and environmental conditions. As a result, it is detrimental to our health. A strong healthcare system is required to maintain better health even though health concerns are increasing. Timely action and safety precautions are essential for improved care. We have to wait in the OPD for several hours after making the appointment before we can see the doctors. These days, going to the hospital is highly contagious due to the possibility of catching the corona virus. Seniors now face increased risk when visiting hospitals due to the COVID-19 epidemic. Getting a therapy plan from the design concept for an online healthcare tracking platform for smart healthcare is shown in Figure 1. People are watched for health indicators, and the system includes several sensors accessible for screening health signs at the input side. A advanced, data-driven system examines sensor data to identify anomalies and facilitates video consultations with healthcare providers. An overview of the main contribution of this research is given below.

- Make data-driven analysis and study possible by utilizing essential medical Data accuracy in health apps is important for overall performance and may even have an effect on people's quality of life.
- Easy-to-use hardware and software that enables real-time online video calling; Proactive and preventive treatment against cardiovascular diseases.

II. KEY FEATURES

A. Video Consultation

Video consultation between doctor and patient is carried out through video calling; it is a web base /application-based healthcare system. In today's era people are extremely busy and the cost of healthcare is not affordable to everyone in our society as majority of our population is middle class . Healthcare facility is costly in India, to improve healthcare facility and to reduce the cost of the healthcare; technology is mitigating the healthcare issues at certain level. Remote Patient Monitoring and online consultation is possible through IoT Based technology. Video consultation is one of the demanding needs of healthcare, to fix a schedule appointment. Schedule appointments in advance and share the meeting details securely with the patient. Real time online consultation between doctor and the patient to diagnose and medicate according to the patients need.

B. Prescription Online

An online prescription system for prescriptions should be available at all hospitals and other social insurance-related facilities. Administrative systems that minimize human error are effective. and treats clients and patients with greater care. The Most Important Clinics adhere to one of the foundational models of patient-physician collaboration: a list of the prescriptions and the recommended dosage plan that should be followed, a group of medications provided by the doctor to the patient, and a guide between the patient and their Nonetheless, the patient waited in the pharmacy line tousling the nearby or on the solution, pay for the prescription drugs nonetheless, the patient proceeded to wait in another queue to receive the prescriptions after having paid for them.

C. E-Data sheet

It is cloud base sheet used to maintain the record of patient in terms of vital signs and prescription offered by clinician during Remote patient monitoring data sheet is updated in real times with timestamps, and it used to visualize it with live data and graphs. Using live visualizations, authorities may properly track and analyze personal health data in order to make better decisions. It simplifies the logging, sharing, and analysis of real-time IoT data! Via a single platform. Data sheet is a key feature of this work because a single sheet is available for doctor and patient to track the health in real time as well as to prescribed medicines and pathological test.

III. THEORY OF MODEL

Continuous or repeated observations or measurements of the patient's physiological parameters are necessary for the purpose of efficient forecasting, including when to give therapeutic treatments and how well those interventions function.

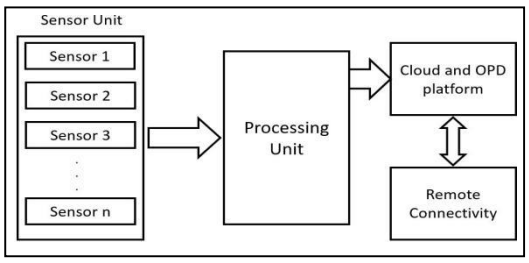


Figure 1. Smart Tele-Healthcare Model

parameters and how life support systems work.In addition to offering the physiological input data requi red to control essential health parameters, the portable healthcare model alerts doctors to possibly dang erous circumstances.It is essential to develop a costeffective, userfriendly, and easily accessible realtim e health monitoring system.The proposed system measures the patient's vital signs by connecting a nu mber of Internet of Things (IOT)-based sensors to a Wi-

fi developer boardThe web application and data sheet receives the measured analog data from the senso rs, which allows doctors to communicate with patients in real time and provide the correct diagnosis an d treatment plan.Multiple sensors are utilized in a sensor unit, which is used to measure the various physiological features that make up an individual. A physiological parameter can be converted into corresponding electrical signals using these sensors. The processing unit conducts further processing on these electrical signals. A micro-controller, frequently referred to as a microprocessor-based system, is a computing unit. After signal processing, the signal is fed into a communication device. The link between the analyzer and this communication device is its responsibility.

IV. PROPOSED TELE-HEALTHCARE MODEL

Three sensors are integrated with the proposed system, sensor 1, sensor 2 and sensor 3 for patient screening during online OPD. System is scalable and can interface more than three sensors as shown in figure 1.Sensors data can get acquainted for next processing through data acquisition module. Digitized sensor data is feed to microcontroller-based computation system. Sensor data is communicated to doctor using cloud Server.

These low power applications, low noise sensors have been used or determining an individual's body skin temperature, pulse and Spo2.The Arduino module serves to capture data, which are then sent to a cloudbased server where signals are saved and compared to the informa tion gathered at an established threshold level.An alert message will be given to the patient, hospital, and relatives of patients if any discrepancies become apparent.Additionally, the designed technology establishes an online video consultation link with the physician [1].Fig. 1 shows the suggested IoTba sed system architecture.

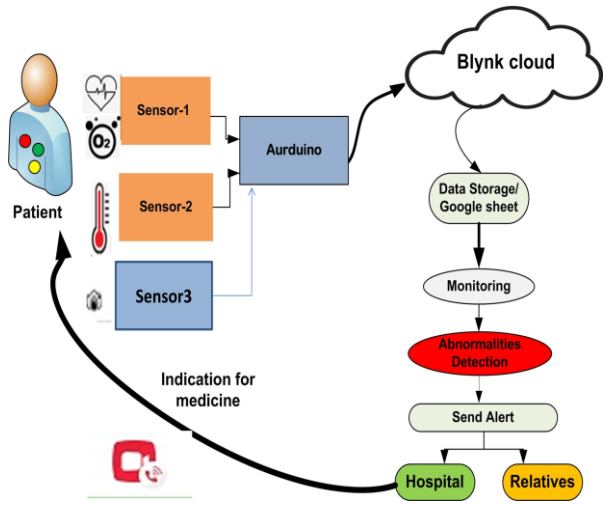


FIGURE 2. Proposed Tele healthcare models

I. Hardware set-up

The sensor reading is read by the Arduino hardware board at the start of the code's execution. After that, cloud Sheets and the cloud get the sensor data. A Arduino board is simultaneously reading information from sensors. The programming language Python takes an indirect route by sending the data to the Cloud server. Before transferring the data to cloud Sheets via the Google Drive API, it is first read from the serial port using Python. Fig. 2 depicts the suggested system's hardware arrangement.

System standards: Below is a list of the parameters of its sensors, which have an important influence on its performance:

1) Pulse Oxymeter: 70% - 100% SpO2 range

2) of Temperature Sensor: Range of temperatures: -55°C to +125°C Accuracy of temperature: ±0.5°C between -10°C and +85°C

3) ECG Sensor: Three lead handy ECG Sensor to record the heart activity suitable for remote monitoring and it operates from −40°C -to- +85°C

4) Interfaces and Peripherals: 802.11b/g/n HT40 Mini USB port on Wi-Fi transceiver for charging 800 mAh batteries with LED status.

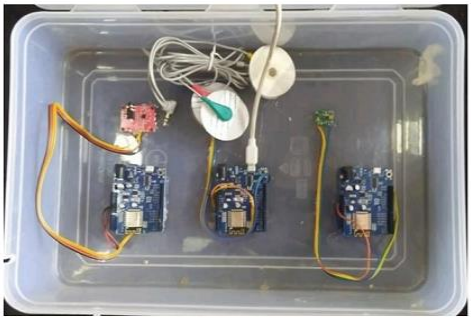
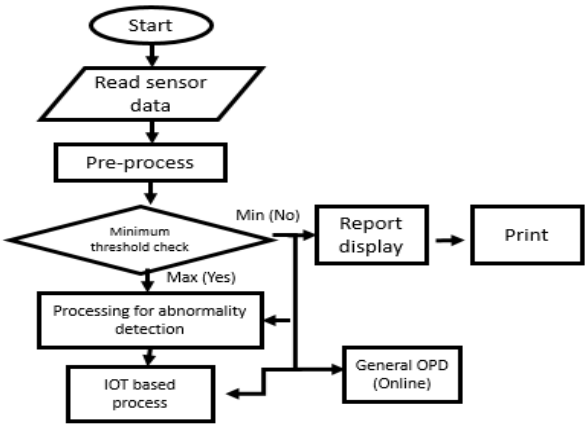


FIGURE 3. Hardware setup

II. Flowchart

The suggested model starts by analyzing sensor input. Following the sensor reading, data is preprocessed for the minimal threshold check. A minimum threshold check is used to look for abnormalities in the patient's physiological parameters. After the abnormality check, the report is displayed and uploaded to the cloud platform, and the patient and the healthcare professional establish a link via a camera-module-using communication device. With the help of the camera module and sensor unit, the medical professional receives all the required readings and visual feeds of the patient's eyes and tongue, enabling him to continue assessing the patient's health and help provide the exact remedy.



V. EXPERIMENTAL RESULTS

This result section shows the development of IoT Based online consultation/OPD and the results obtained by created system. Online OPD System are divided in two parts like Hardware module (Sensors and Arduino) and Cloud base platform.. This the values of the several health measures that are collected from sensors are assessed by the system. Depending on the internet speed of the service provider, the data retrieved from the cloud server is updated in real-time. The dashboard in Figure 6 shows the random temperature, heart rate, Spo2 level, ECG, and the pictures of the tongue and eyes that were taken. The operator's cell phone will have access to the same dashboard. Real-time updates

are made to the data sent from the sensor to the cloud, incorporating date and time stamping. Figure 6 simultaneously displays the data that was obtained from the cloud sheet.

Which also shows how the Google Meet platform can be used to set up an online video consultation. By monitoring the physiological features, the suggested system tested in real time. Health anomalies are diagnosed using the heart rate and SpO2 level. Ten participants submitted the data, and they were from 15 to 70 years.

FIGURE 4 . Measurement of Spo2 and BPM Using Sensor

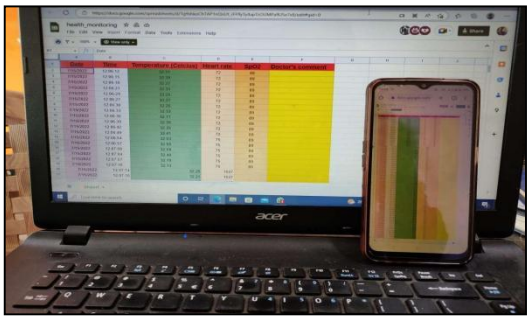


FIGURE 5. Digitized Input sensor data

A. Case study 1:

The testing of the developed hardware is done on 10 subject's .Experimentation done at morning time after breakfast. Experiment on subject is recorded in presence of senior doctor. The result of the real-time hardware testing is depicted in Figure 6, Pre processing unit capture sensors data, the same sensors digitized data is updated on local site as well as remote site through e- data sheet .Camera sensor is used here for real time image capturing and video conferencing consultation. Following Characteristics of subjects are taken during recording of data.

TABLE 1 Features of the subjects:

Characteristics	**Statistics**
No. of persons	10
No. of measurement per subjects	5
Age (Year)	(18-70)
No. of Male	7
No. of Female	03
Height (cm)	(165-170)
Weight(kg)	(45-70)
BMI (kg/m2)	(20-24)

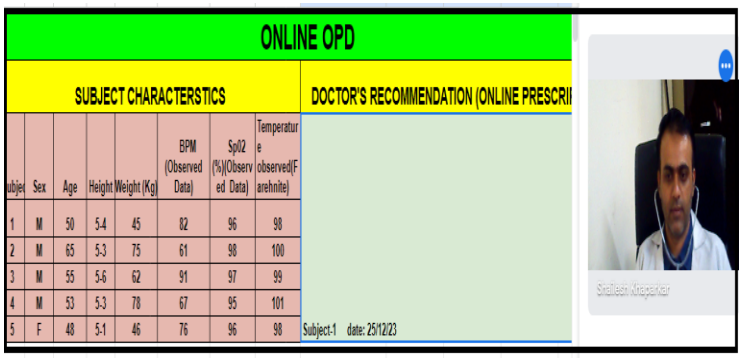


FIGURE 6. Real time vital sign monitoring in data sheet by doctor

Figure 5 shows the e-data sheet on doctor's site to monitor the different vital signs of the subject. After watching these parameters doctors can recommend the proper treatment plan through online prescription that is one part of e-data sheet. E-data sheet is editable sheet can be edit multiple times by doctor to prescribed medicine or some pathological test.

B. Case Study 2:

For online OPD System it is important to monitor eye and tongue status by doctor as like physical OPD. In this case study some Eye and Tongue images has been captured by camera sensor by 2 Mega Pixel as shown in figure 7. Camera sensor are used here for real time image capturing, Camera alignment angle is adjustable to capture proper images of eye and tongues, Captured images are displayed on cloud based data sheet as shown in figure 7. These images is visual at the remote site (doctors web console).Figure 7 shows the result of captured images. These images are helpful to doctor for diagnosis purpose.

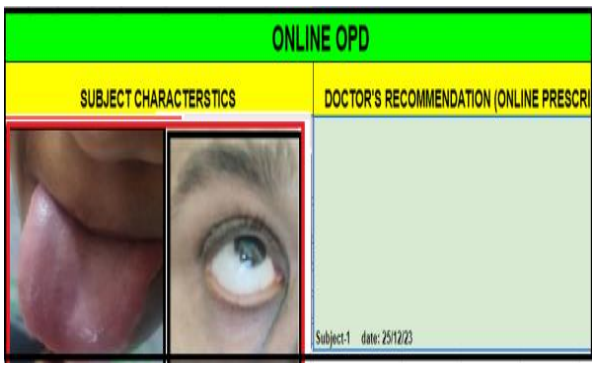


FIGURE 7. Real time capture image of tongue and Eye

Three lead ECG sensor is also used in this study to record the ECG Signal of the subject, Developed system is compatible to transmit recorded ECG on web console as shown in the figure 8,it also shows the placement of ECG Leads at proper place to record the signal with minimum artifacts. Left side of the figure shows the ECG Signal trace on the web console, Doctor can monitor this ECG Signal at remote site to check the health status of heart.

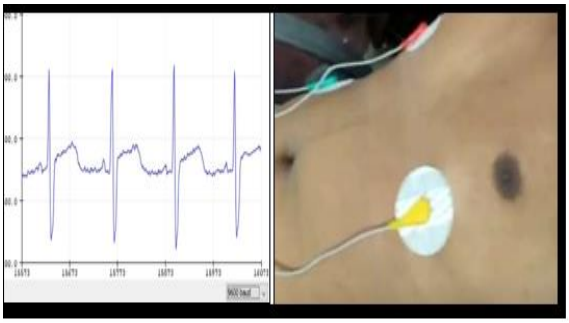


FIGURE8. Real time ECG capture Signal

c. Comparison Table:

The comparison between the suggested model and the prior models is displayed in Table II. The outcome demonstrates that the suggested model outperforms the developed models

TABLE II

Comparison table:

Ref work.	Sensor and Hardware used	Model output	Digital data record	Real time remote connectivity
[1]	MLX90614, Arduino micro-controller board	Real time temperature monitoring data can be transferred to authentic observer by utilizing internet of things (IoT)	No	Yes
[2]	LM35, DHT11, MQ9, MQ135 ESP32 micro-controller board	Medical personnel receives information about the patients' conditions through a portal.	Yes	No
[3]	LM35, AD8232,MAX30100,Nodemcu	Sensor data will be transmitted to NodeMCU, ESP8266, and then uploaded to the cloud via this device.	Yes	No
Proposed work	MAX30100, MLX90614, Weos D1, r1,Camera	Both Google Sheets and the cloud server receive the sensor's data.	**Yes**	**Yes**

VI. CONCLUSION

This study describes the successful realization of a prototype for real-time telemedicine that includes precise monitoring through IoT technology and video conferencing between a doctor and patient. The system has undergone extensive testing on multiple participants. An experiment is conducted on a diverse group of subjects to validate the system. It is determined to be adequate. Real-time contact between a physician and a patient is the primary goal of this research project. It won't be a problem to have health infrastructure focused on cities and no health insurance, especially in emerging nations' rural peripheries. The suggested telemedicine system successfully enables proper diagnosis and appropriate therapy.

REFERENCES

[1] S. Bhaskar et al., "Telemedicine across the globe-position paper from the COVID-19 pandemic health system resilience PROGRAM (REPROGRAM) international consortium (Part 1)," Front. Public Health, vol. 8, 2020, Art. no. 556720.

[2] WHO, "WHO coronavirus (COVID-19) dashboard." Accessed: Mar. 29, 2022. [Online]. Available: https://covid19.who.int/

[3] X. Ding et al., "Wearable sensing and telehealth technology with potential applications in the corona virus pandemic," IEEE Rev. Biomed. Eng., vol. 14, pp. 48–70, 2021.

[4] Q. Ma et al., "Global percentage of asymptomatic SARS-CoV-2 infections among the tested population and individuals with confirmed COVID-19 diagnosis: A systematic review and meta-analysis," JAMA Netw. Open, vol. 4, no. 12, 2021, Art. no. e2137257.

[5] Z.Wu and J.M.McGoogan, "Characteristics of and important lessons from the corona virus disease 2019 (COVID-19) outbreak in China: Summary of a report of 72 314 cases from the chinese center for disease control and prevention," J. Amer. Med. Assoc., vol. 323, no. 13, pp. 1239–1242, 2020.

[6] D. R. Seshadri et al., "Wearable sensors for COVID-19: A call to action to harness our digital infrastructure for remote patient monitoring and virtual assessments," Front. Digit. Health, vol. 2, no. 8, pp. 1–11, 2020.

[7] M. Michelen et al., "Characterising long COVID: A living systematic review," BMJ Glob. Health, vol. 6, no. 9, 2021, Art. no. e005427..

[8] Venkatesan, "NICE guideline on long COVID," Lancet Respir. Med., vol. 9, no. 2, 2021, Art. no. 129M. Young, The Technical Writer's Handbook. Mill Valley, CA: University Science, 1989.

[9] H. Crook, S. Raza, J. Nowell, M. Young, and P. Edison, "Long COVID— mechanisms, risk factors, and management," Brit. Med. Assoc., vol. 374, 2021, Art. no. n1648.

[10] Y. A. Qadri, A. Nauman, Y. B. Zikria, A. V.Vasilakos, and S. W. Kim, "The future of healthcare internet of things: a survey of emerging technologies," IEEE Communications Surveys & Tutorials, vol. 22, no. 2, pp. 1121–1167, 2020.

[11] M. H. Kashani, M. Madanipour, M. Nikravan, P. Asghari, and E. Mahdipour, "A systematic review of iot in healthcare: Applications, techniques, and trends," Journal of Network and Computer Applications, vol. 192, p. 103164, 2021.