

INDUSTRY 4.0: NOVEL APPROACH TO DWINDLE THE POPULATION BESTREW OF COVID-19 THROUGH IOT POINT-OF-MCARE SHAD APP

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The Internet of Things has revolutionized healthcare and empowered people in healthier and safer lives. COVID19 pandemic situation has revealed the facts about cleanliness and also the importance of maintaining a healthy lifestyle. Information and Communication Technologies (ICT) have integrated with the healthcare domain for efficient administration and reduction of spread among the public. Connected healthcare component is the main application of Internet of Healthcare Things (IoHT). It provides us with a comfortable environment for the well-being of elderly people. Hospitalized patients can be monitored with the help of wearable devices along with the IoT-enabled monitoring. In this proposed work, Smart Human Activity Detection (SHAD) Application has been proposed for collection of data as well as monitoring of data which will help to save the people's lifestyle during the quarantine and tracking of health conditions as well. SHAD helps in tracking of health data of COVID-19 patients while quarantined and also for the healthy individuals during exercise, meditation and sleeping. In addition, calories consumed through foods day-to-day are calculated and displayed in the user account. Data analyzed for a particular patient are tracked for a particular period of time and also alerts them for emergency situations for the additional care.

Therefore, COVID-19 patients' health conditions are monitored well, and also the best among the public are greatly dwindled.

1. Introduction

In the 21st century, the Internet of Things (IoT) has become a gifted area in almost all the sectors. During pandemic situations, people are in need of various wearable devices which help in reducing the infection among the public [15]. Emergency situations through the changes in body parameters are easily spread through the health network. These processes are defined under "Point-of-care mHealth" that gives us clinical information which supports healthcare practitioners in safeguarding the lives of people [6-9]. This system must provide instant information about current health conditions in order to proceed with the correct decision. Hence, it must be made available anywhere and anytime with the help of laptop and mobile devices. At present, modern medicines have proven the efficiency in medical services at global scale. Point-of-care highlights the paradigm shift in the healthcare domain, as it is not serviced independently. It is utilized in day-to-day activities with minimal number of healthcare practitioners. Most important characteristic of the system is that it must be more precise and reliable. Patients with chronic diseases must be handled with effective care. Major problems arise when the patient data is unavailable for taking appropriate decisions. Such problems can be resolved with the effectiveness home care service. Another important concern on Point-of-care technology is reliability and authentication level. To overcome these security level problems, various kinds of platforms are being developed. This favors team-building collaborations among practitioners, cooperation and local administrative organizations. However, there exists tension while making technological changes in organization. The main aim of this paper is to design a mobile health care which monitors temperature, pulse and their mutual effect on health conditions.

2. Related Work

According to Krishna et al [10], there is a great significance in improvements along with the medical information through mobiles. Remote health monitoring (RHM) provides great potential in managing heart patients. RHM has analyzed and helped the heart patient receive 42% reduction in hospitalizations and readmission each year [11]. Chaudhry et al. [12] has created a high impact in correlation of body weight and heart failure hospitalization, however, it concludes that RHM does not provide much benefits. With the advent of increased research in RHM systems, it remains a question whether RHM can help in preventing chronic disease in a cost-effective manner. RHM benefits can be analyzed only when we are clear about the individuals who can get successful results. Recent studies have provided the results that 60% of studies on chronic diseases have found that cardiovascular diseases and diabetes mellitus have achieved a special place called "niche market" for mobile applications [13]. In spite of all the advantages, research work carried out to predict the outcome based on the results and information from the medical records. Wanda-cardiovascular disease RHM system is defined as an advanced feature of the previous RHM system which targets the people with cardiovascular disease risk with the help of wireless coaching [14]. It is a technique in which messages received from the applications will trigger the actions such as, when calories are high, exercise must be increased. Android-based application initially collects data from the user and displays feedback from clinician. Bluetooth, Cellular technology and Wi-Fi along with the application are programmed with sensors to connect with various stand-alone monitoring systems [15]. Servers which are connected with these applications are provided with the graphical user interfaces to alert the patients about their body conditions. The

databases are integrated with a mobile communication platform (mHealth) and authorization is required while retrieval of clinical information from application [16]. Many research have shown that it is very difficult to detect the abnormalities in the count of heart beat in patients [17, 18]. Generally, the average count of a normal human (25 years old) is about 140 to 170 beats/minute, whereas in 60 yearsold it is about 115 to 140 beats/minute. Patients, who are not satisfied with the doctor’s treatment based on heartbeat, need devices which track internal changes in the body. Hossain a has explained that sensors play a vital role in the next-generation health industry. With the high count of senior citizens, there arises an exceeding need for real-time monitoring and analyzing of patient’s health care data for avoiding deaths. Wearables have a great impact for gathering clinical trial data and research studies. Also, wearables are used as clinical tools for fitness and wellness of people. Personalized health care works faster and preventive care along with low costs and improved patient centered practice with high sustainability. Suhas et al. [18] has discussed that physiological parameters along with pulse rate and temperature are obtained and processed with ARMLPC2138 processor and displayed through GUI. Abnormal condition of the patient is automatically sent to the doctor's mobile.

3. Networks and Components

In Figure 1, information related to health is collected through wearable sensors and its then transferred through gateways. It can be then implemented as required to the user. Internet of Health Care Network (IoThNet) is composed of network topology, architecture and platforms as shown in Figure 2. Network topology denotes the integration of nodes and types of arrangement on different elements of the IoT health care network. It can represent scenarios of entire environments in which health care elements are eligible to work. Through the topology elements, heterogeneous computing works by collecting an enormous amount of sensor data such as body temperature, heart rate and blood pressure. IoThNet architecture denotes the specification outline for the elements, functions and its working principles and their techniques. IoThNet platform denotes both network and computing platform.

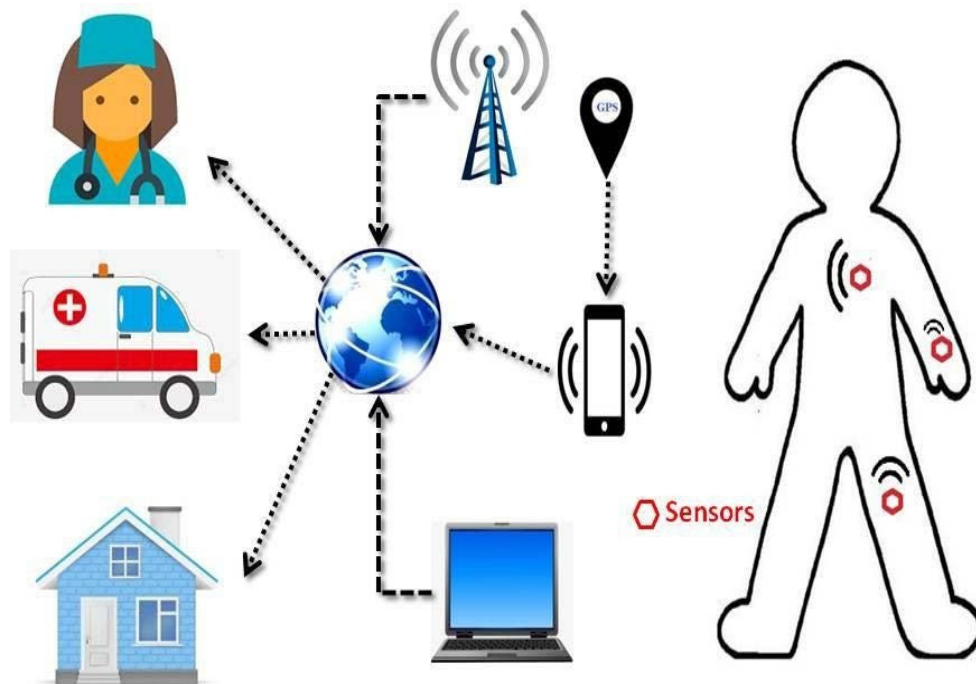


Figure1 Internet of HealthCare

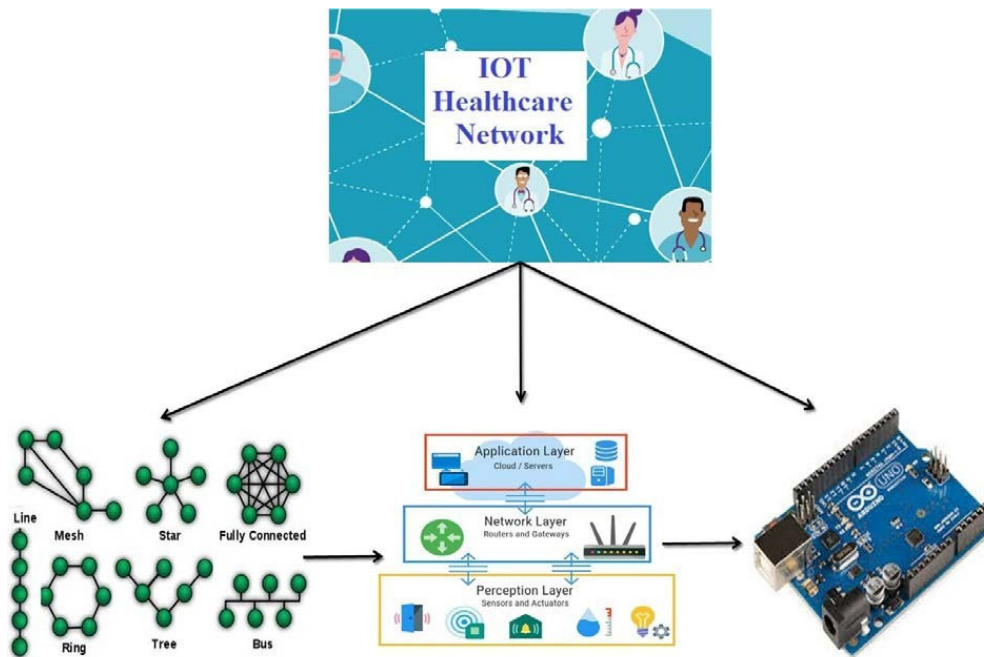


Figure2 IoTHealthcare Network (IoThNet)

3.1 Sensors Used:

IoT has many applications in the health care sector along with the mobile phones and RFID-sensor functionalities for the monitoring of patients. Sensors, Zig-bee, RFID, NFC(Near Field Communication),and Wi-Fi allow us to monitor the improved measurements of important functions (blood pressure,temperature,cholesterol levels, heartrate).Wearables help in saving the patient who is suffering from diabetes, coronary heart disease,and chronic obstructive pulmonary disease and also during emergency situations.

3.2 Specifications

- Dual-CoreProcessor
- Wi-Fi(802.11B/G/N2.4GHz)
- Pulse Sensor
- Temperature Sensor
- Piezoelectric Sensor

Pulse sensor is used for measurement of optical power variation when light is passed through the heart and blood cells. As the scattering of light varies from time to time, it sense the heart beat changes. Heart rate is then monitored via pulse sensor which gives information about the health of the patient's heart. It helps the patients within monitoring of their heart's health. If any malfunctioning of the heart is observed, the data is then directly sent to the doctors whose details are already stored in the database server according to the patient's treatment.

Temperature sensor is used for measuring the patient's body temperature continuously. As the COVID patients need regular checkups on temperature, it is very necessary to monitor their body heat with respect to the medications provided. The proposed SHAD application provides the wearable temperature sensor which can help the doctors to monitor the temperature without any contact with the infected persons. Piezo-electric sensors are used for monitoring the oscillation between the pulse and temperature within the body. These sensors make their fluctuation over the data to the piezo-electric sensors, and it will send the oscillation to the doctor's mobile phones as per the threshold value provided.

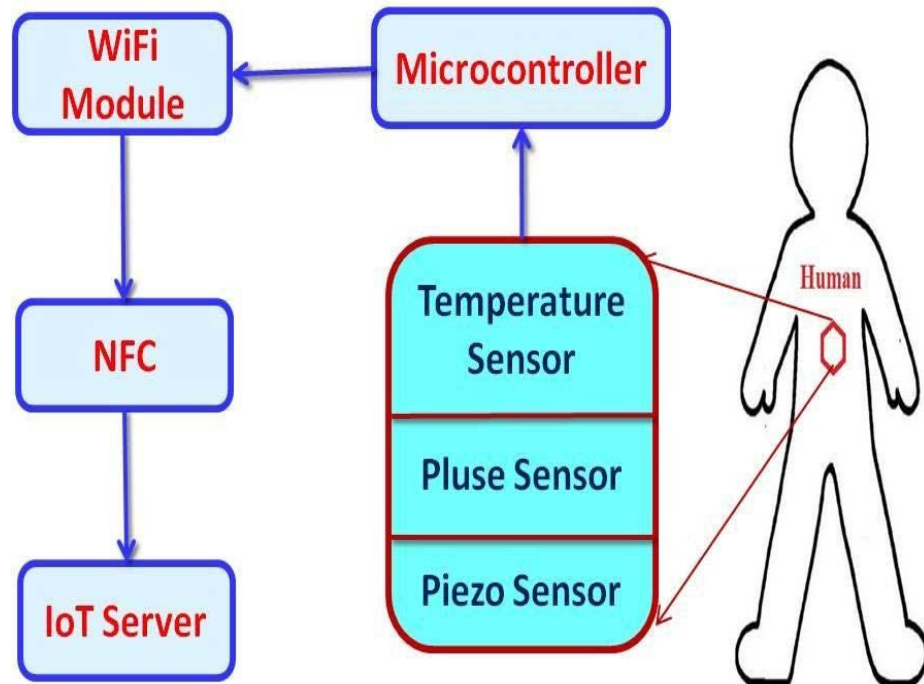


Figure 3. Integration of the healthcare monitoring system

4. Results and discussion

➤ Data Measurement

SHAD application is used for measuring the user's pulse, temperature during day-to-day activities such as exercise, meditation and sleeping. Calories consumed from food intake and burnt by exercise are detected and displayed in the user dashboard. These sensors have visible light, LED display along with the photo sensors which all work together for signal detection. These data restored in the IoT server.

➤ Data Extraction

Extraction of data involves the following steps namely:

Step 1: Launch the SHAD application in smart phone connected wearable devices.

Step2: Navigate to Smart Human Activity Detection tab, where the activities are shown as in Figure 4.

Step 3: At the bottom, we have all the results stored in the server. Once the activities are monitored for a particular period of time, the data are sent to the respective clinician. Also, when abnormal conditions occur, the data are passed to the clinical knowledge.

Step 4: After a certain amount of period, health data collected by SHAD Application are then exported to the patients and clinician mobile. The Dashboard of SHAD is shown in Figure 4.

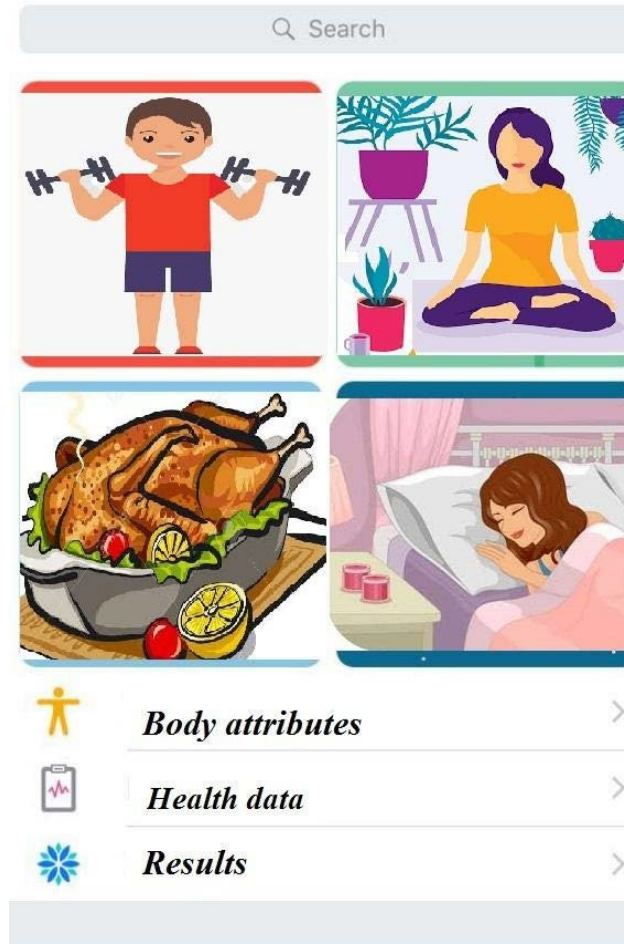


Figure 4 Smart Human Activity Detection Application

➤ Data Generation

After exportation of data, the oscillation of values in the data collected are represented as shown in Figure 5. It is noted that heart rate increases during workout (gym, sport activities) and it is down, while there is no workout activity. SHAD application involves activities such as walking, jogging, sleeping and yoga.

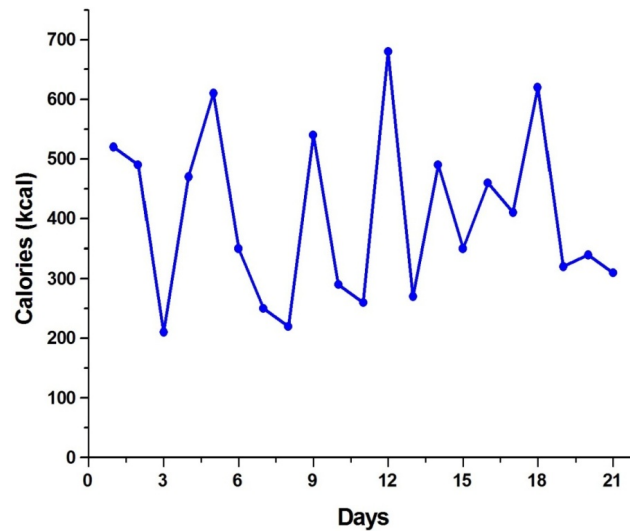


Figure 5 Calories consumed per day

5. Conclusion

As the IoT is very important for monitoring the patient's health in the pandemic situation, SHAD application helps in mobile health and in monitoring the elderly people at home. Connected health care devices help in providing improved care and better treatment in saving people's lives as it is ubiquitous in connection. IoT has made a new and novel trend among the new generations. It is providing a platform for the people who suffer from environmental stress and professional health issues. In addition, it helps the people who are very curious in maintaining a healthy body with the help of exercises and activities. Measurable advantages which can be benefited through the connected medical devices are reduced clinic visits, reduced days of care in hospital and patient's stay in hospital. Major problem faced during COVID-19 is the reduced shortage of beds. In order to care for the patients who can be made home quarantined can be allowed to use SHAD application which will have great impact in medication.

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