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IoT based on Health Caring Systems Survey

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Abstract: Nowadays, using E-Health technologies has enabled health services to reach patients worldwide efficiently anytime anywhere. Internet of things (IoT) revolution has brought booming in the healthcare sector. E-Health caring has created a dazzling and cheap checking organism for obtaining greater comfortable living to the people tormented by a variety of diseases through utilizing diverse techniques like wireless exchanges, wearable, and convenient remote health monitoring tools. This paper provides a recent review of the e-health care platform tabulated according to the IoT layers along with the advantages and disadvantages to guide researchers on the most important future work in each layer.

Keywords: E-Health, IoT, Sensors, Mobile, Raspberry Pi.

I.INTRODUCTION

The current world population is 7.8 billion as of February 2020, and the birth rate is 18.2 per 1,000 people[1], according to the World Health Organization(WHO) reports. This prompted complex medical problems, remembering the expansion of incessant illnesses, development in emergency clinic spending, and clinical administration services expenditures. Advances in wireless networks, IPv6, supports about 340 undecillion addresses, which is enough to give universally unique IP addresses to each IoT device[2]. This technological progress, in addition to the population increase, led to the necessity of considering alternatives to traditional health systems. Therefore, there is a crucial need to develop effective healthcare solutions which helps to reduce the pressure on hospitals and providing health care for all while improving the quality of care as well as reducing its costs.

IoT has the potentials for creating remote health caring tools. Recently, its applications in E-health filed have been of great interest to researchers and technologists as these applications might achieve the following advantages:

(i)Wide healthcare access to remote places as a result of the proliferation of mobile phones and the emergence of many health applications.

(ii) Multipoint real-time video trading can be used for conducting training sessions, live demonstrations of surgeries, cooperation in finding solutions of incurable diseases, as it is happening now in the light of the spread of Crohn's virus collaborations, and so forth.

(iii) A large number of people can use a simple internet connection to monitor many sensors that transmit or follow a specific physical or chemical phenomenon.

(iv)Using E-health technologies is very important to overcome the problem of the patient-doctor ratio, especially in our country where the expanded workshop held in 10-11/ 6/2019 recorded a decrease in the number of doctors and nursing staff compared to international standards[3].

(v) The presence of Electronic Health Records (EHR) for patients resulting from periodic monitoring helps to anticipate future problems and thus, addresses problems before they occur.

(vi) Providing health services for the elderly is the most challenging task in our world today. The WHO estimates that the proportion of people over 60 will double to 22% in 2050 compared to 11% in 2000. Thus more than two billion people will need additional medical support as they will be most in need of private health care. Using e-health, the elderly can be serviced by industrial telemedicine and home care.

For all of the above points, the electronic healthcare system plays an important role in medical supervision and treatment. Its services are about to make a complete change in this area, as it includes various automation devices, smart sensors, and data exchange systems to direct control or monitoring functions on large systems.

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E-health based on IoT is one of the most concerns of researchers. Different approaches have been presented to control IoT devices[4][5] with applications[6], data transmission process[7], IoT security issues[2][8] and other concerns the role of many technologies including, mobile, satellite, Internet and cloud topologies which are providing low cost with timely health caring[8].

This paper is divided into 4 sections including introduction. In Section 2 a brief description of the IoT E-health systems is given; Sections 3, Health Care Systems. The paper finally concludes with Section 4.

II. IoT for E-health Care System

IoT strategies are often performed to achieve care for remote residents, chronic diseases, the disabled, and the elderly as these systems offer remote checking and support early detection. At the same time, they provide continuous care without compromising patient comfort (outside of hospitals) as well as emergency treatment.

IoT applications can be taken by merging several technologies like sensors, data processing, networks(wireless communications) and cloud saving, as shown in figure 1, which consists of five layers: sensor, transmission, processing, storage, learning, and mining.

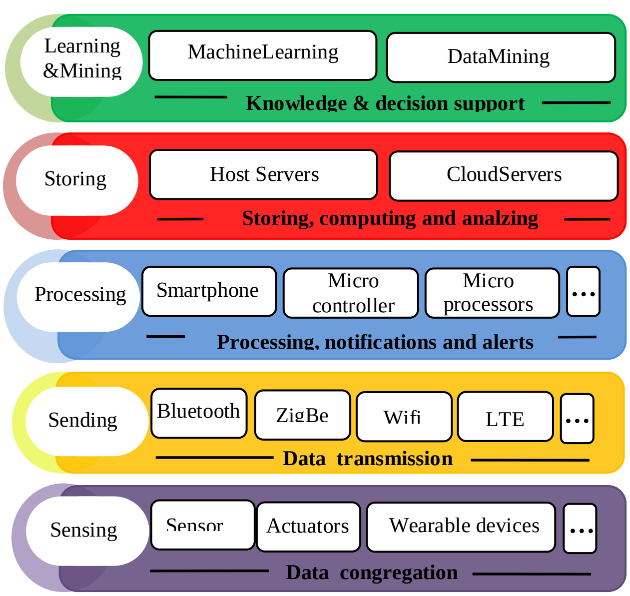

Figure 1: IoT Layers Ref[6]

A. Sensing Layer

This observation layer contains sensors, wearable devices, and electronic objects which are used to record patients' health parameters. Depending on the sensor kind, the collected data can be humidity, temperature, motion, orientation, location, vibration, acceleration, etc. The collected measurements data are then transmitted to the processing layer which may consist of:

- *Wearable devices*

Recently, big companies are racing to make many wearable devices, these include bracelets, wristwatches, pendants, glasses, earrings, smart tops, fitness trackers, patches, and other global health gains accessories. It comprises three parts: sensors, computing, and displays. Nowadays, wearable tools can provide biological signs like steps walked, heartbeat rate, blood pressure, calorie burnedxrc, time spent exercising, etc[4]. They generally include the following sensors.

1. **Pulse Oximetry**: It is used to measure the oxygen saturation level in the human body and tracks the difference in the blood level of the skin concerted to the cardiac cycle. It can be connected to a finger or an earlobe.
2. **Electrocardiography(ECG)**: A signal that tracks the heart running persistently and affords the oscillation pulse with time.
3. **Electrocardiogram(EMG)**: To watch muscle performance by observing electrical signals.
4. **Electroencephalography(EEG):** Electroencephalography is the depiction of events in the human brain.
5. **Blood Pressure:** is the blood force pushing against blood vessels' walls.
6. **Heartbeat, Temperature,… etc.**

- *Implantable devices*

Such as implanting subcutaneous devices to measure some parameters or to replace missing parts. Nowadays, we can see artificial limbs, orthopedics, cardiovascular brace, artificial pacemaker, dental implants and filling dental filling, cochlear implants, etc. Some implantable devices are listed below:

1.Glucose Monitoring: Implanting a device to monitor the level of glucose in the body every 30 seconds or less with the ability to control it by giving the actual need of insulin.

2.Neural Stimulators: These stimuli are used to deliver electrical impulses to the spinal cord or brain to treat chronic pain.

B. Sending Layer

This layer provides a procedure for connecting, sharing data, as it enables records from existing infrastructure to be accessed. Then it connects IoT sensors into local networks and finally, it connects these local networks to the internet. Local transfer between the sensing layer and the processing layer is normally done by ZigBee, Wifi, or Bluetooth(Bluetooth is a low-power consumption, tiny cost device for short distances data transmitting). The operation frequency is about 2.4GHz. ZigBee also consumes little power, but compared to Bluetooth, it isn't rife.

C. Processing Layer

This layer contains the processing unit and software applications required for the computational part. Maybe a microcontroller, microprocessors, smartphones, printed as system on chip (SOC) combinations, and field-programmable gate matrix(FPGA). Hardware platforms like Phidgets, IntelGalileo, Arduino and RaspberryPi+, Gadgeteer, BeagleBone, Cubie-board as well as Operating systems like Android, Lunix, TinyOS, LiteOS, Contiki, and IOS[6].

D. Storing Layer

IoT healthcare systems connect large electronic devices that measure a huge amount of patients' information that needs efficient storage ways[8]. The collected sensing information is stored for further analysis. Many cloud platforms are available for data storage from IoT such as AWS Amazon, Google Cloud, OpenIoT, and ThingWorx, GENI[9].

E. Mining and Learning Layer

This layer involves tools that support machine learning and data mining processes which are used by servers or processing stages to extract knowledge from the monitoring information to support the decision. Data mining involves the discovery of novel and fascinating patterns doubtlessly beneficial from giant data sets and forming algorithms to extract hidden information. Its functions include classification, grouping, association analysis, time series investigation, and external analysis[6]. Machine learning strategies are very helpful in health care studies. They provide the management of huge databases, discovering information, and development throughout the examinations.

III. HEALTH CARE SYSTEMS REVIEW

The Internet of Things (IoT) is a connected set of anything, anyone, anyplace, anytime, any network, and any service. Nowadays, medical and health care represents one of the most striking application fields for the IoT, especially during the corona pandemic time. The IoT has opened up a world of opportunities in medicine: once connected to the internet, ordinary medical sensors can amass invaluable bonus data, give extra acumen into symptoms with trends, enable remote health care, chronic diseases, fitness programs, elderly care and generally give peoples supplementary control over their lives and cure. Various medical sensors, imaging devices, and diagnostic what appeared as smart objects instituting a core portion of the IoT[10]. Services of the IoT health care system are projected to scale back costs, amplify the standard of life, and enrich the user's skill. Continuous infections, early diagnosis, real-time surveillance, and medical emergencies are expected to improve up-to-date healthcare wireless networks. Research in the IoT health care systems includes network architectures, platforms, new sensors services, and security according to the mentioned IoT layers. It is important to compare the previous works according to the layers of the Internet of things. Therefore, this paper suggested classifying previous works according to the IoT classes to clarify the most important features of each research in all layers as demonstrated in table1.Table2 lists the advantages and disadvantages of the reference systems. The comparison of IoT layer variables, according to the reviewing results, was depicted in Figure 2. The distributions of the reference health care services are plotted in Figure 3. And the constructive points of each layer are write in table 3.

Table 4 presents a summary of the research plans of healthcare projects associated under discussion. It is still too early to carry out the IoT health system, as many challenges still stand. The application requires accurate sensors for a large number of users using cloud computing with high security as well as ensuring that the systems are accessible to all.

Recently, many new health-caring devices, like smartwatches, have acted in numerous worldwide electronic product-client exhibitions. Wearable devices construct stays to be hot, and the market demand keeps increasing[36]. According to the data from the International Data Corporation(IDC), global wearable scheme freights, mainly smart watches, smart glasses, smart bracelets, etc., sales reached up to 335.3 million units in 2019[36].

One of today's challenges is the fact that these wearable sensors will inevitably be in contact with the skin which may cause many problems, like disquiet, due to the incidence of sensory stresses and steam on clammy skin. So one of the main healthcaring trends is the developing flexible device materials to make them smaller, lighter, lower cost and have a more comfortable patch design[37].

Secondly, there is a rising interest in architectures and approaches that exploit Fog and Edge computing as a solution to compensate for the cloud weaknesses[38][39]. Another major challenge that must be overcome, is particularly related to security and privacy [40].

TABLE 1: THE SURVEY OF E-HEALTHCARE SYSTEMS ACCORDING TO THE IOT LAYERS

Ref	Sensing	Processing	Software	Sending	Storing	Security	Results
11 2014	ECG EEG	laptop		WBANs	UEC Cloud	Dieharder Cryptographic keys	cloud-based secure mobile healthcare system focuses on inter-sensor communication security with patients' data security and privacy.
12 2014	ECG (ADAS1000)	Raspberry Pi	C and Python			-	An ECG and respiration home measurement device based on Raspberry PI and ADAS1000 has been developed and evaluated
13 2015	ECG , Heartbeat	Raspberry Pi	Python	GSM module	website database	authorized personnel	continuously monitor ECG, stored in a database and displayed it in a website that can be accessed only by authorized personnel
14 2015	RFID tag , ECG Blood pressure	PC-based				RFID	E-Health solutions to effectively manage and monitor university students' health
15 2016	Temperature , ECG ATMEGA328	PC-based	MATLAB Python	Zigbee		SSL encryption	The ECG signal and heart beat can be monitored through laptop or personal computer wirelessly
16 2016 write	Temperature(TTC05) Heart rate,Oxygen Saturation(SPO2) Blood pressure(US9111)	Raspberry Pi	JAVA	WIFI GSM			Integrating IoT features into medical devices as IoMT, created a new networking paradigm – IoNT, which shows the biggest advances in the biomedical domain
17 MSc 2017	ECG, Accelerometer GPS, Arduino(ADC)	Arduino	offline analysis MATLAB	LE-Bluetooth	Smart phone's database	-	A wearable ECG sensor is used to monitor the pulse patterns and smartphone built-in sensors-accelerometer and GPS
18 2017	Heart Rate , GPS Touch Pressure	smartphone application	JAVA/J2EE	Bluetooth	MySQL database	User registration	Handicapped pulse rate will be sent as text message to the nearest people and alarm generation just by pressing the smartphone screen for few seconds.
19 2017	ECG	Raspberry pi 2					Detrended fluctuation analysis(DFA) to disparity between smoker and nonsmoker heart electric signal
20 2017	Temperature(LM 35) ECG(AD8232),Heart Rate MEMS(MMA7361)	Raspberry Pi	LabVIEW	GSM		-	System design to measuring and tracking temperature, ECG and heart beat in hospitals
21 2017	Temperature, ECG blood pressure	Raspberry Pi		Bluetooth	Docker container & Local database	User registration	Mobile apps healthcare system using a raspberry pi and docker container
22 2017	ECG(AD8232) ADC(MCP3008)	Raspberry Pi	C and Python	WiFi		User account	Mobile apps for detecting different types of arrhythmia
23 2017	ECG(AD8232) biopotential AFE chip	ARM Cortex M0	Python	BLE (RFD77101)	-	User account	a wearable ECG monitoring system integrated on a T-shirt by a compact flexible PCB
24 2018	Temperature-thermistors(NTC)ECG(AD8232), arduino(ADC)	PC-based		WIFI Module	Database	User account	Mobile App.daily monitor patient's health statusand sent to the doctor's mobile containing the application
25 2018	Temperature, blood pressure EMG, galvanic skin	PC-based	MATLAB Python	WiFi	SQLite[2] database	Yes	Mobile health sensing data using YANG-based semantic model and to generate the OCF IoTivity[3] request
26 2018	Temperature(PTC) ECG, Airflow, GSR, EMG blood pressure&position	Raspberry Pi	JAVA	WiFi	Thing Speak Cloud	Yes	Cost-Effective Mobile Health System Based ona Multi-Sensor System-on-Chip Platform and DataFusion in Cloud for Sport Activity Monitoring

27 2018	Temperature(LM35) ECG, PIC(ADC) SIM 800, Oxygen in blood(SPO2) ,ESP8266	Arduino	offline analysis MATLAB	WIFI			Mobile Apps Serve as the communication backbone for telemedicine implementation in rural India
28 2019	Temperature(LM35) blood pressure ECG electrodes DAQ	smartphone application	JAVA/J2EE Labview		database	-	Measure and screen basic physiological data of a patient and distributed it on the web.
29 2019	Temperature(LM35) Heartbeat ADC8080	Raspberry pi 2		cable	Webserver	-	Patient's vital signs sent remotely and displayed via system website
30 2019	Temperature(MLX90614) Heartbeat(A0813) ECG(AD8232) Arduino(Mega328: ADC) Pi camera	Raspberry pi 2 B	IDE	WIFI	Webserver	User account	IoT intelligent Health monitoring system
31 2019	ECG(AD8232) GPS(NEO6)	Arduino UNO	C	ESP 8266 WIFI		-	Mobile Apps: ECG Smart Jersey for automated detection of heart defects among athletes using Next Generation Computing
32 2019	Temperature (DS18B20) Heartbeat ADC(MCP3008)	Raspberry pi	python		webserver	-	Web patient's monitoring system in front of a computer screen and sent an email to the doctor for abnormal cases
33 2020	Glucowise NodeMCU	Raspberry Pi		WIFI	webserver		System Prevent Diabetes Complications by inform caregivers remotely knowledge of any situation that occurs using an SMS message with an Internet connection

wireless body area networks: (WBANs)
UBUNTU Enterprise Cloud: (UEC)
Bluetooth low energy:(BLE)
biopotential acquisition analog front-end: (AFE)
Printed Circuit Board:(PCB)
[1]YANG: is a data modeling language used to model configuration and state data manipulated by the Network Configuration Protocol
Internet Engineering Task Force:(IETF)
Open Connectivity Foundation: (OCF)
Integrated Development Environment:(IDE)
[2]SQLite is a C-language library that actualizes a little, quick, independent, high-reliability, full-highlighted, it is the most used database engine in all mobile phones and most PCs and it is packed inside innumerable different applications that individuals utilize each day.
[3]IoTivity Compositional objective is to make another standard by which billions of wired and remote gadgets will interface with one another and to the web.

TABLE 2: THE COMPARISON OF REFERENCES IN TABLE 1.

Ref	Advantages	Disadvantages
11 2014	1. Good security of inter-sensor communication and patient data privacy. 2. It uses multiple biometrics items to produce a collective key for inter-sensor communication.	1. Used two sensors (ECG and EEG) only. 2. Not include any monitoring result 3. Used a hospital community cloud
12 2014	1. ECG homecare with an aging population 2. Isolated (patient/operator) from the high-voltage parts of the system, and minimized leakage currents. 3. Declare the component cost of their Prototype.	4. Measuring the ECG signal only. 5. Not communicate the result to the doctor or cloud. 6. Used ECG only, Not accumulate to another device to specify the true health case for automatic treatment.
13 2015	1. monitor distinctive ECG machines naturally, refreshing the database of the site consistently and cautioning the specialists by a message.	1. Measuring the ECG signal only. 2. Need to delete the message in the SIM card to make space.
14 2015	1. Monitor health services for students in their schools or institutions. 2. Used RFID tag to access his/ her medical records	1. Not give any information about sensors or monitoring parameters. 2. Not write any measure of their system
15 2016	1. Design an ECG embedded device. 2. Used continuous wavelet transform(CWT) to detect heart rate for denoising ECG signal 3. Using GUI interactive application from Matlab.	1. Need Laptop with Matlab package and someone who knows the GUI operating 2. Not include any measuring results.
16 2016 write	1. Discuss Do it yourself health care system. 2. Discuss many related thinks, Environmental factors, building the prototype, many applications, etc. 3. Outlook for the future of the Internet of Things healthcare systems in terms of spending and security risks.	1. Not include any measuring results.
17 MSc 2017	1. Collected real-time data of ECG and accelerometer 2. Used Fourier transform transformation and filtering to extract features. 3. Sent data to a smartphone via a lower energy Bluetooth for real-time plotting	1. Treat problems of heart diseases only 2. MATLAB used for offline analysis for training,
18 2017	1. Describes pulse rate monitoring and the change in the location of handicapped people.	1. Only measures the heart rate and detects patient location. 2. Describe mobile application only, not give any hardware or measuring result.
19 2017	1. Developed an ECG device for detruding fluctuation analysis (DFA) to assess the human heart electric signal. 2. Reducing the cost of the proposed ECG device to $ 400 to compare and offer a comparison with prices for earlier work. 3. Gives experiment curve for comparing smoker and non-smoker based on DFA.	1. Only measuring ECG signals and used for consumers in the home environment.
20 2017	1. Using Labview to monitor temperature, heart rate, and ECG signal in a hospital.	1. The collection system need PC or laptop and Labview .program 2. Not give any measuring results. 3. Used an LM35 temperature sensor.
21 2017	1. Describe IoT adoption in healthcare(data security, Memory Limitations, and the challenge of data mining. 2. Conveying patients' information to the central cloud. using a docker container with the local data set. 3. Using socket programming creates a two-way connection. between two nodes.	1. Focuses on collecting sensors with the medical cloud. 2. Used 6LowPAN for Low-power Wireless Personal Area Networks above IPv6, which is used for the smallest devices with limited processing ability to transmit wirelessly. 3. Not give any measuring result
22 2017	1. Detecting various types of arrhythmia. 2. Plot the ECG signal, heartbeat/min and 'Send RR, PR, QT, and QRS intervals., 3. Test MIT-BIH standard arrhythmia database	1. Focus on ECG Signal only.

23 **2017**	1. Integrated ECG sensors on a T-shirt 2. Their system has a low power consumption (5.2 mW) and can be work more than 110h continuously.	1. Plot ECG Waveform only.
24 **2018**	1. Used cheap microcontroller UNO with a simple sensor.	1. Need a Pc or laptop and Testing only two people.
25 **2018**	1. Used Semantic Model based on the IETF YANG 2. Collect many sensors(body temperature, blood pressure, electromyography, and galvanic skin).	1. The measured results of the Round-Trip Times(RTT) values are quite high because of the inherent problem.
26 **2018**	1. Focused on measuring athletes' physiological parameters. 2. Comparison amongst eight sports monitoring systems.	1. Tested for a small group of tri-athletes 2. The possibility of data loss sometimes occurs in some of the most important sensor samples (ECG).
27 **2018**	1. Used ECG, SpO2, temperature, and blood pressure sensors. Their system has a friendly web-based.	1. Hardware functionality only not offer any testing. 2. Not include any specifics of their sensor. 3. Not record any measurement of any sensor. 4. Used an LM35 temperature sensor.
28 **2019**	1. Used blood pressure sensor, 2. Used blood glucose sensor.	1. Graphical User Interface (GUI) information out, needed PC with Labview program. 2. Used an LM35 temperature sensor.
29 **2019**	1. Minimum complexity and portable health caring	1. .Not include any measuring result. 2. PC- prototype. 3. Used an LM35 temperature sensor.
30 **2019**	1. Used two health stage one for sensors. 2. Connect a 5-megapixel camera with raspberry pi for video purposes. 3. Using chat.	1. Used two microcontrollers (Uno and Raspberry pi). 2. Send sensor data from Uno to Raspberry, not to the web. 3. Data Updates every 2- minutes 4. Used an LM35 temperature sensor. 5. Recorded seven readings only for one patient.
31 **2019**	1. Offer a Prototype of ECG Smart Jersey. 2. Machine Learning and Android App.	1. Testing heart condition only. 2. Paper show ECG result for three users.
32 **2019**	1. Inform the doctor if any abnormality occurs from time to time.	1. Measuring temperature and heartbeat only.
33 **2020**	1. Measure the blood glucose level. 2. Used historical readings to evaluate the averages for the next periods. 3. Used cheap microcontroller NodeMCU WiFi. 4. Give graphic results of time to send a notification comparing with two other papers.	1. Measure blood glucose only. 2. Offer results for one patient only.
34 **2020**	1. Developed a solution for sharing patient's data directly with their doctors based on Ethereum blockchain. 2. Study 3-cases: cardiac monitoring, EEG following epileptic seizures, and sleep apnoea testing. 3. Plot performance of the Ethereum network. 4. Discuss multiple attack scenarios.	1. Not include any real health testing of the system(ECG, EEG). 2. Paper focused on decentralizing data transfer without other aspects of IoT.

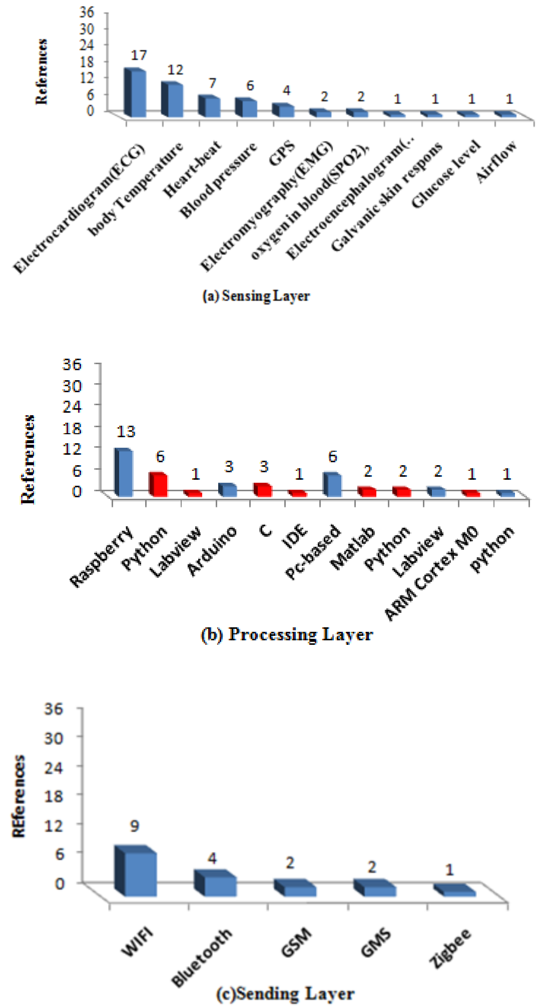

Figure 2: Reviewing Layers variables in the References

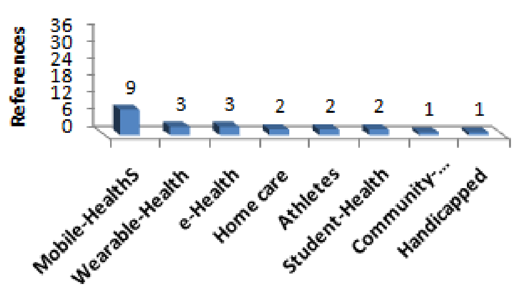

Figure 3: Services of the health care systems in the paper researches

TABLE 3: CONSTRUCTIVE STUDY OF IOT LAYERS

Layer	Discussion
Sensing	1-Most papers used an ECG sensor, while, there are other primary sensors for health caring like temperature, heart rate, blood pressure, etc. 2- Four papers measured temperature using an LM35 sensor, which is not a human body sensor (Full range from-55 to 150). 3-Most researchs do not distinguish between normal health monitoring sensor and critical case. 4-Most papers used a few sensors and they weren't collected for better health caring. 5-Most papers did not give any measuring results in the observation period, compared to the actual measurements and the opinions of the specialists. 6-There is no sensors integration model of usual cases and another one for critical cases.
Processing	1-Most papers used Raspberry Pi microcontroller(a mini-computer),. although the simpler one such as arduino is adequate better in terms of size, cost and programming.
Sending.	1-Most suggested works used Wifi for its speed and flexibility while Zigbee has more benefits like, low (power-cost), reliability, and scalability. 2-BLEselected as a low-power solution to control and check health parameters[35].
Storing	1-Few papers talked about cloud, which is very important for:(Streamline Collaborative Patient Caring, Efficient Storage of Electronic Medical Records-EMR, Decreases Storage Costs, Offers Security, Flexibility, and Enhance Medical Research for monitor big data etc.
Security	1- Healthcare data holds huge values, making it a highly desirable target for attackers. Poor cyber security cause risks to both patient safety and the infrastructure that keeps hospitals working. It's an ongoing challenge for healthcare security professionals. 2- Provides authentication, authorization, and access control within health visualized network and still need a lot of works to get it.

TABLE 4: SUMMARY OF REFERENCES PERFORMANCES

Criteria	References
Reliability	[11],[12],[14],[16],[17],[18],[19],[20],[21],[22],[23],[24],[26],[28],[29],[30],[31],[32],[33],[34],[36],[41].
Accuracy	[12],[13],[17],[19],[22],[23],[24],[25],[26],[28],[30],[31],[33],[34],[41].
Applicability	[11],[16],[17],[18],[19],[20],[21],[22],[23],[26],,[28],[29],[30],[31],[32],[33],[34],[35],[41].
Cost	[12],[17],[19],[23],[36],[37].

Lastly, the COVID-19 pandemic has fetched into sharp focus the need to harness and empower the digital infrastructure for remote clientobserving[41].

Mysterious data localized to areas such as zones or zip codes can offer public health officers and researchers a precious utensil to predict and mitigate the spread of the virus, particularly through the next wave. Identifiable information of cohorts (businesses, family, and facilities) allied with individual detection of COVID-19, can provide prized data such as acceleration of spread and sign onset.

Most recently, in Germany, the Robert Koch Institute sustained the adoption of a smartphone application(Corona-Datenspende) which traced temperature, pulse rate, and sleep from a minimum of 10,000 volunteers clothing, smartwatches, or fitness followers to differentiate how much of the populace is clinically symptomatic from an influenza-like sickness[41]. Nowadays, more than 160,000 people have been already registered. Results from this mobile application will be displayed on an online interactive, allowing both health experts and the universal public to better gauge the incidence and community dispersals of infections.

IV. CONCLUSIONS

This paper identifies the issue of traditional health care and the problems facing our society such as aging, increased chronic diseases, and high costs of hospitals and clinical services. To Reduce health care systems pressure inside the hospital and provide better quality with less costs as well as delivery to remote areas E-health become very nesessary. Remote E-health monitoring tools based on IoT strategies have marvelous potentials. Now, internet of medical things (IoMT) market is expected to swell up to a $158 billion valuation in 2022. This paper reviews recent IoT systems and tabulate their works in a new style depending on IoT layers, enabling researchers to compare previous works and vierfy need in each layer.

According to the paper contribution style, there is much work needed for each layer, in the sensing layer. Five researches used LM35 for body temperature?. Few papers added blood pressure, one of them measures sugar level, while these signs are more essential. Designing community health monitoring needs a large dataset. Only two papers used cloud. There is still a lot of work to be done to improve the electronic health caring system.

For future work, precise sensors for normal health caring are assemble with critical sensors like (ECG, EEG, and video camera) for special cases are suggest. The health platform using cloud with cybersecurity to collect world patients anywhere anytime. And monitor all health metrics through machine learning that can develop an algorithm to fastly notice the change in the health status.

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