Internet of Things (IoT) in Healthcare

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Research Group

Politeknik Elektronika Negeri Surabaya (PENS)

Webinar Pascasarjana PENS, 28 Agustus 2020

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Welcome to AlkautsarPENS – M. Udin Harun Al Rasyid,Ph.D:

AlKautsar means many goodness and eternal in world and afterlife, one of them is AlKautsar River in Paradise, the ultimate aim or destination of life. PENS is my institution – Electronics Engineering Polytechnic Institute of Surabaya (EEPIS, English Version)
Dosen Teknik Informatika Politeknik Elektronika Negeri Surabaya (PENS)

Management:

- Head of the Informatics Engineering Study Program - Kepala Program Studi D4 Teknik Informatika (Pebruari 2020 - Now)
- Members of the academic senate PENS - Anggota Senat PENS (July 2017 - Now)
- Head of Distance Learning Department - Kepala Pendidikan Jarak Jauh (PJJ) (September 2017 - Pebruari 2020)
- Coordinator of Distance Learning Program - Kordinator Pendidikan Jarak Jauh (PJJ) (Mei 2013 - September 2017)
- Head of Computer Vision Laboratory (Nopember 2012 - Juli 2013)

Research Area:

- Wireless Sensor Network (WSN)
- Wireless Body Area Network (WBAN)
- Internet of Thins (IoT)
- Web Technology

Research Group/Center – Professional Membership:

- EEPIS Wireless Sensor Network (EWSN) Research Group - Lead
- Ubiquitous Services Research Center - Member
- IEEE (93503614)
- IAENG (116141)

https://www.scopus.com/authid/detail.uri?authorId=55569020700

Scopus Preview

Author search Sources

Author details

Al Rasyid, M. Udin Harun

View potential author matches

http://orcid.org/0000-0002-4473-2364

Affiliation(s):
Politeknik Elektronika Negeri Surabaya, Surabaya, Indonesia

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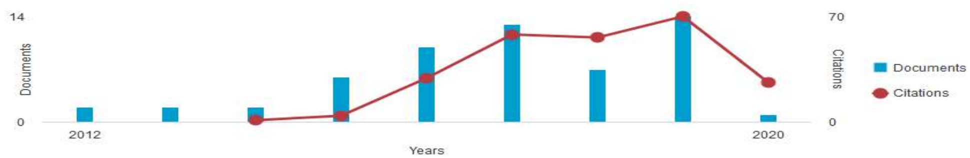
Subject area: Computer Science, Engineering, Energy, Mathematics, Physics and Astronomy, Decision Sciences, Materials Science, Social Sciences, Agricultural and Biological Sciences, Chemistry, Environmental Science

Documents by author	Total citations	h-index:
57	245 by 185 documents	9

Document and citation trends:



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Wireless Sensor Network Wireless Body Area Network Computer Network Application Internet of Things Web Technology

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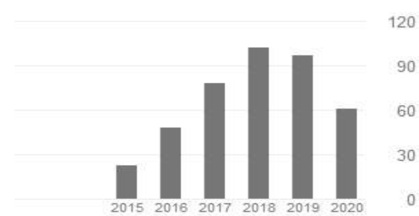
TITLE	CITED BY	YEAR
Analysis of superframe adjustment and beacon transmission for IEEE 802.15. 4 cluster tree networks BH Lee, MUH Al Rasyid, HK Wu EURASIP Journal on Wireless Communications and Networking 2012 (1), 219	25	2012
Wireless body area network for monitoring body temperature, heart beat and oxygen in blood MUH Al Rasyid, BH Lee, A Sudarsono 2015 International Seminar on Intelligent Technology and Its Applications ...	20	2015
Pollution monitoring system using gas sensor based on wireless sensor network MUH Al Rasyid, IU Nadhori, A Sudarsono, YT Alnovinda International Journal of Engineering and Technology Innovation 6 (1), 79	17	2016
Analysis of superframe duration adjustment scheme for IEEE 802.15. 4 networks BH Lee, E Yundra, HK Wu, MUH Al Rasyid EURASIP Journal on Wireless Communications and Networking 2015 (1), 1-17	16	2015

Cited by

	All	Since 2015
Citations	417	415
h-index	12	12
i10-index	21	21

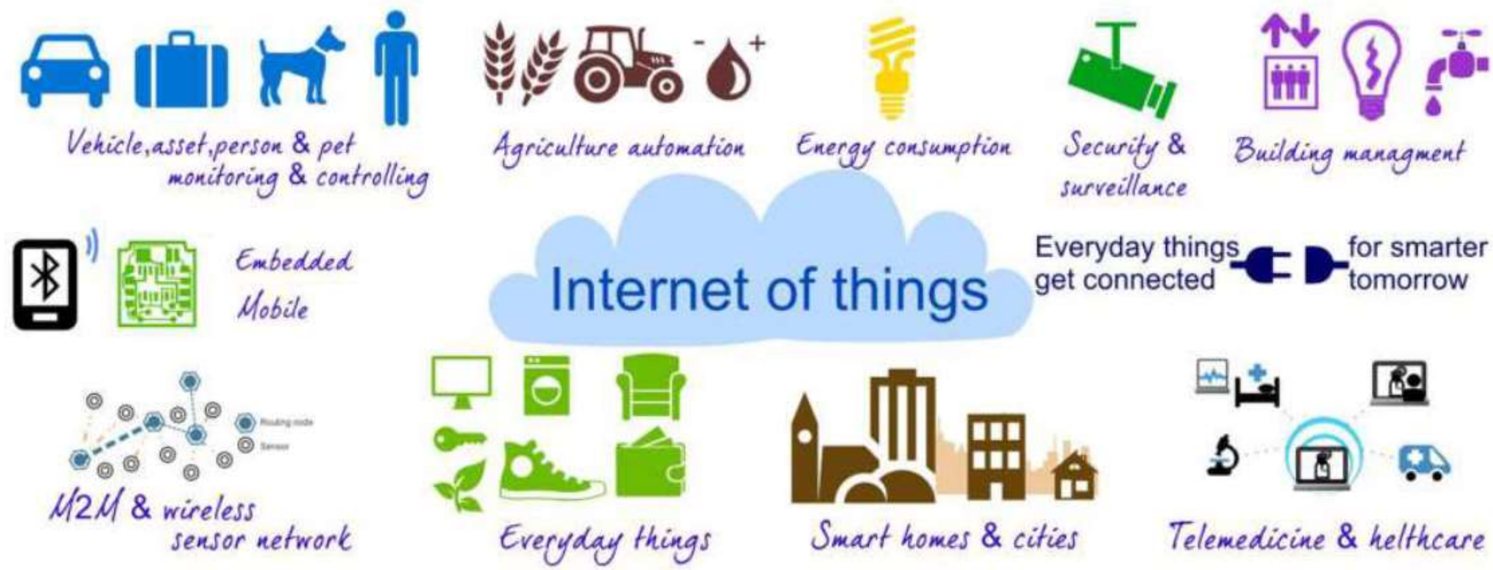


Co-authors VIEW ALL

Content

- IoT in Healthcare
- Research results IoT in Healthcare from RG EWSN
- Research topic for student of Pascasarjana PENS

IoT in Healthcare



https://ocw.cs.pub.ro/courses/iot/courses/01

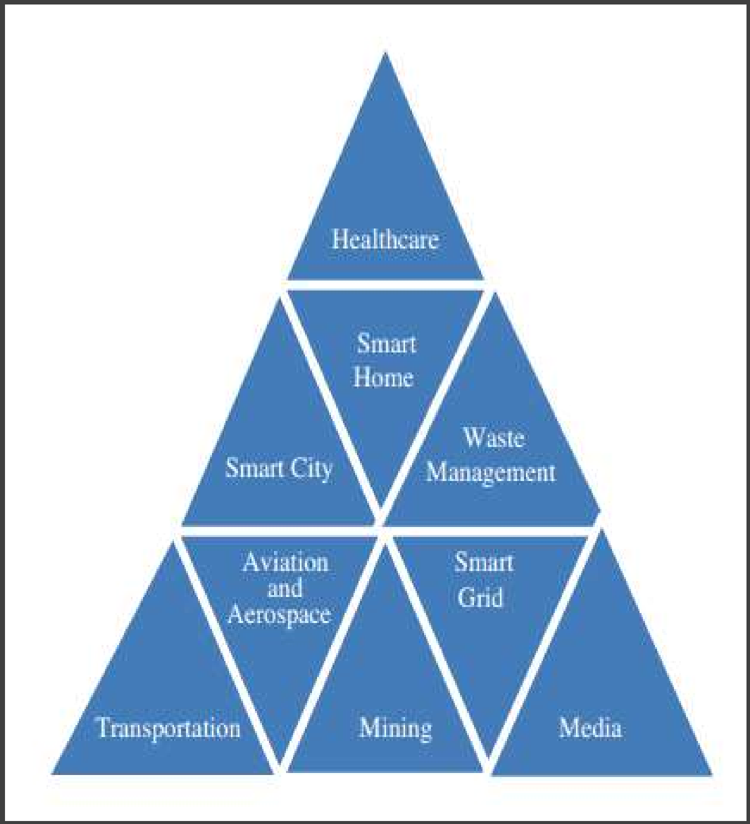
Introduction

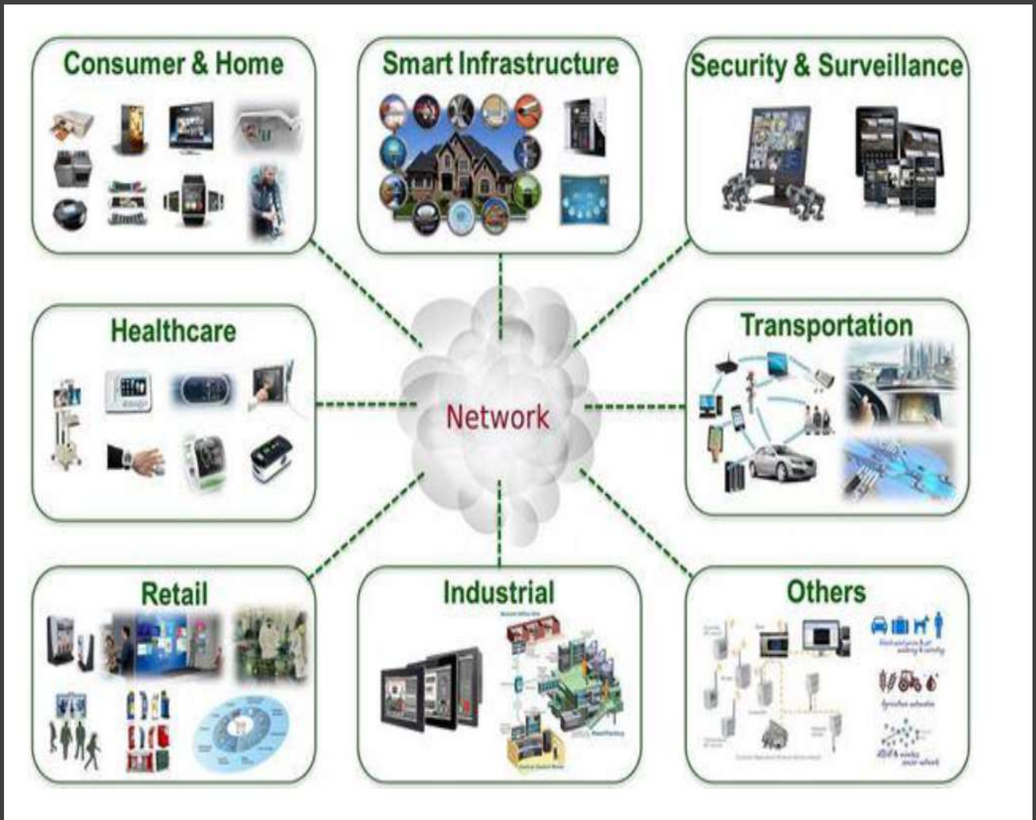
- IoT is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers (UIDs) and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.

What is the IoT

- The interconnection via the Internet of computing devices embedded in everyday objects, enabling them to send and receive data.
- IoT = Sensor + Network + Data + Services

https://ocw.cs.pub.ro/courses/iot/courses/01

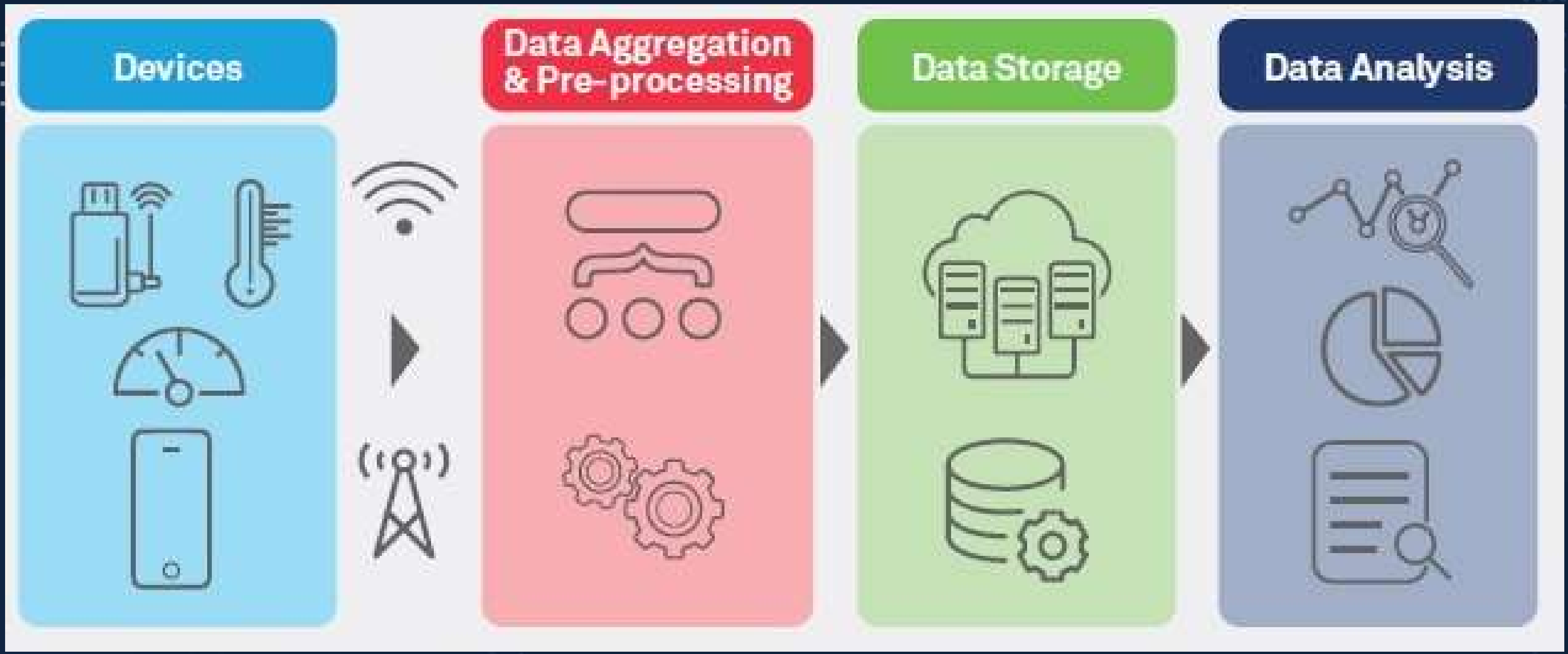




- Domain supported by IoT

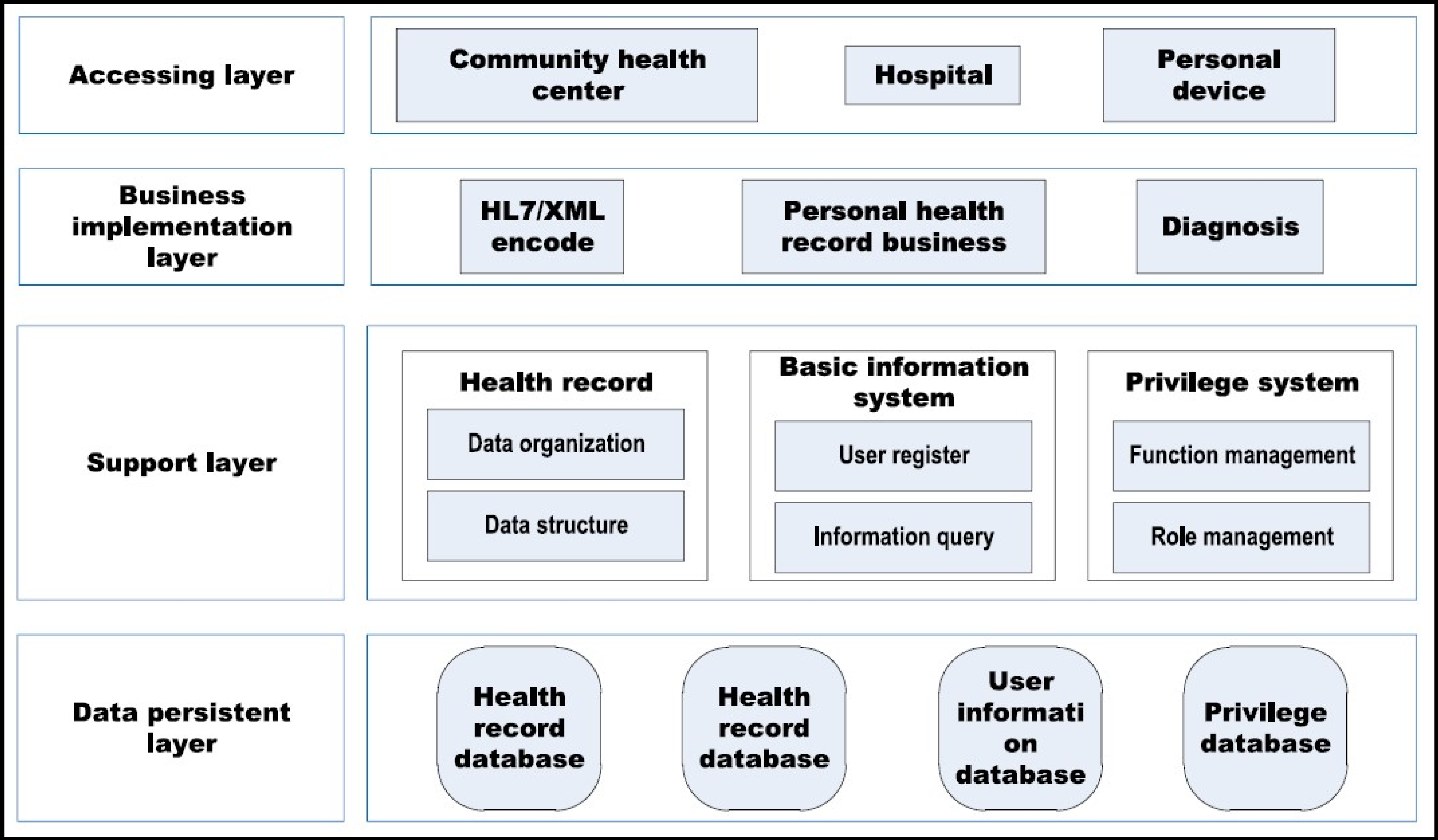
- Semua aktifitas manusia terhubung dengan internet

- Remote monitoring in the healthcare sector
- Interactions with doctors have become easier and more efficient.
- Reducing the length of hospital stay.



four-step basic architecture IoT

- **Step 1:** deployment of interconnected devices that includes sensors, actuators, monitors, detectors, camera systems etc. These devices collect the data.
- **Step 2:** aggregated and converted sensors data to the digital form for further data processing.
- **Step 3**: pre-processed data, standardized and moved to the data center or Cloud.
- **Step 4**: analyzed Final data, Advanced Analytics applied to this data, get business insights for effective decision-making.



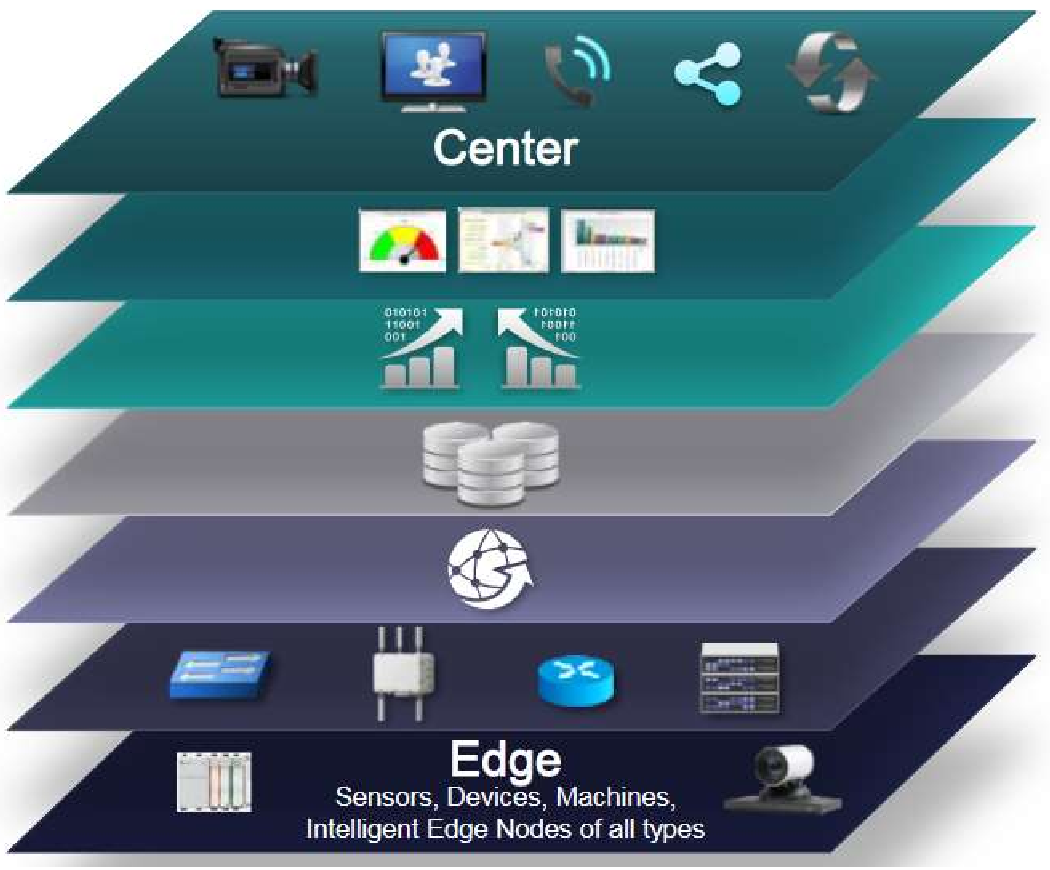
A functional framework of a health information service model

The Internet of Things for Health Care: A Comprehensive Survey, IEEE Access, 2015

IoT World Forum Reference Model

Levels

7. **Collaboration & Processes** (Involving People & Business Processes)
6. **Application** (Reporting, Analytics, Control)
5. **Data Abstraction** (Aggregation & Access)
4. **Data Accumulation** (Storage)
3. **Edge Computing** (Data Element Analysis & Transformation)
2. **Connectivity** (Communication & Processing Units)
1. **Physical Devices & Controllers** (The "Things" in IoT)



http://cdn.iotwf.com/resources/72/IoT_Reference_Model_04_June_2014.pdf

Basic Premise

Devices

send and receive data interacting with the

Network

where the data is transmitted, normalized, and filtered using

Edge Computing

before landing in

Data storage / Databases

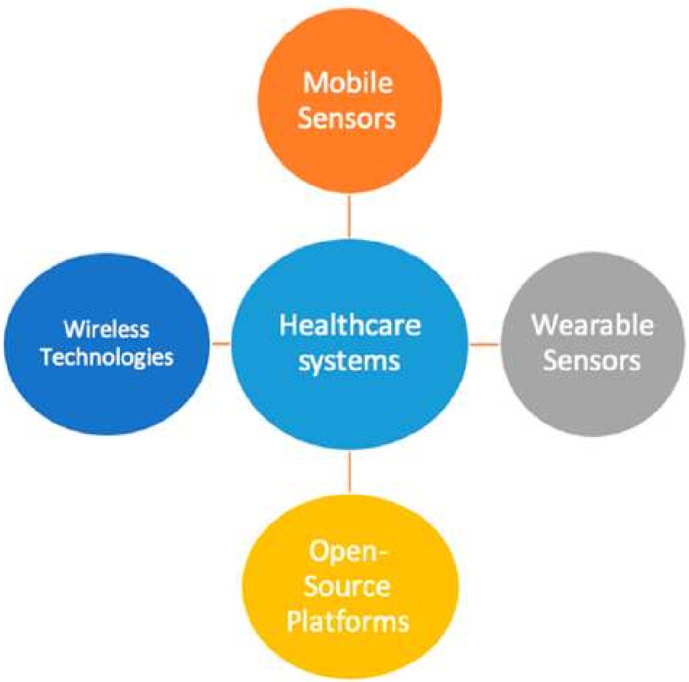
accessible by

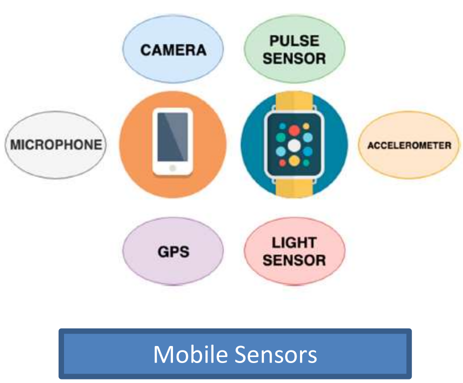
Applications

which process it and provide it to people who will

Act and Collaborate

http://cdn.iotwf.com/resources/72/IoT_Reference_Model_04_June_2014.pdf





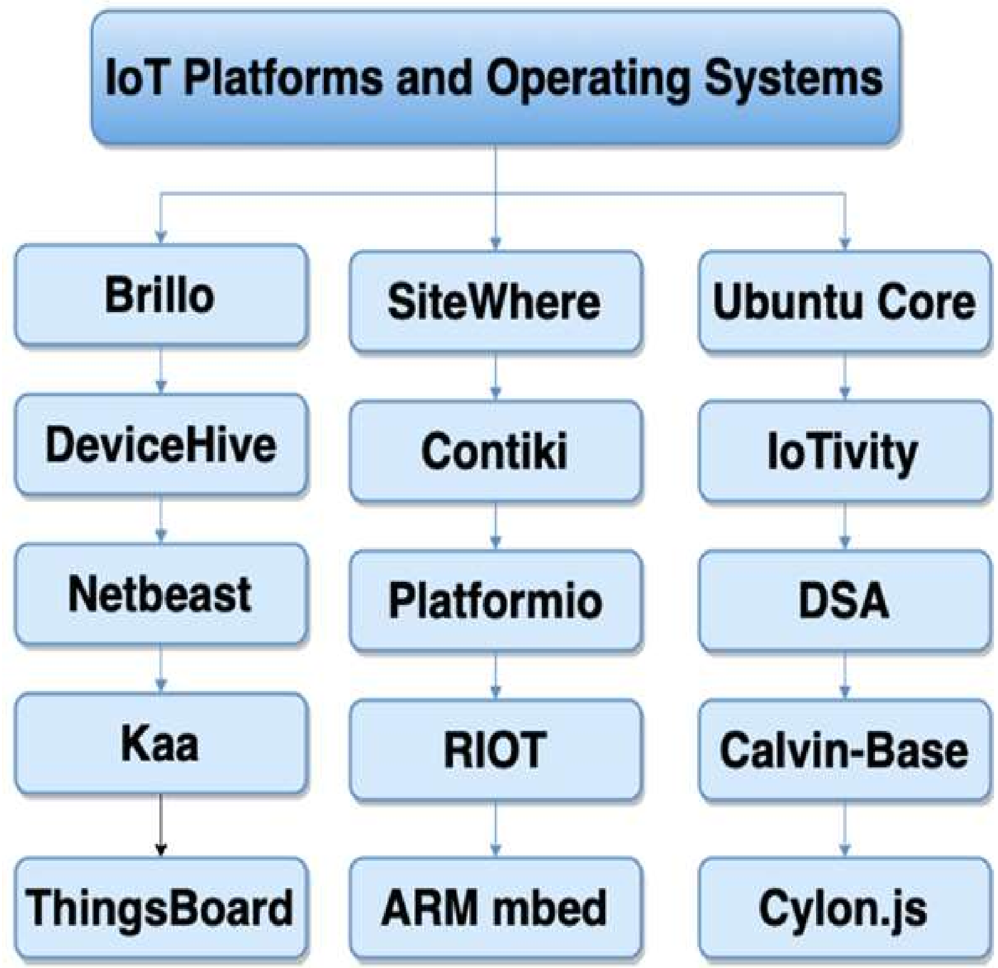
Important Areas of research for healthcare systems

- **Mobile and wearable sensors** for data collection used for human physiological status monitoring.
- **Wireless communication technologies** for data transmission.
- **Open-source platforms** for support data storage, visualization, analytics, numerous features for device management, and security.

Internet of Things Architectures, Technologies, Applications, Challenges, and Future Directions for Enhanced Living Environments and Healthcare Systems: A Review, 2019.

IoT platforms and operating systems

- Numerous open-source platforms and operating systems that aim to provide support for di
different systems, data confidentially, safety, fusion, and dissemination.



Internet of Things Architectures, Technologies, Applications, Challenges, and Future Directions for Enhanced Living Environments and Healthcare Systems: A Review, 2019.

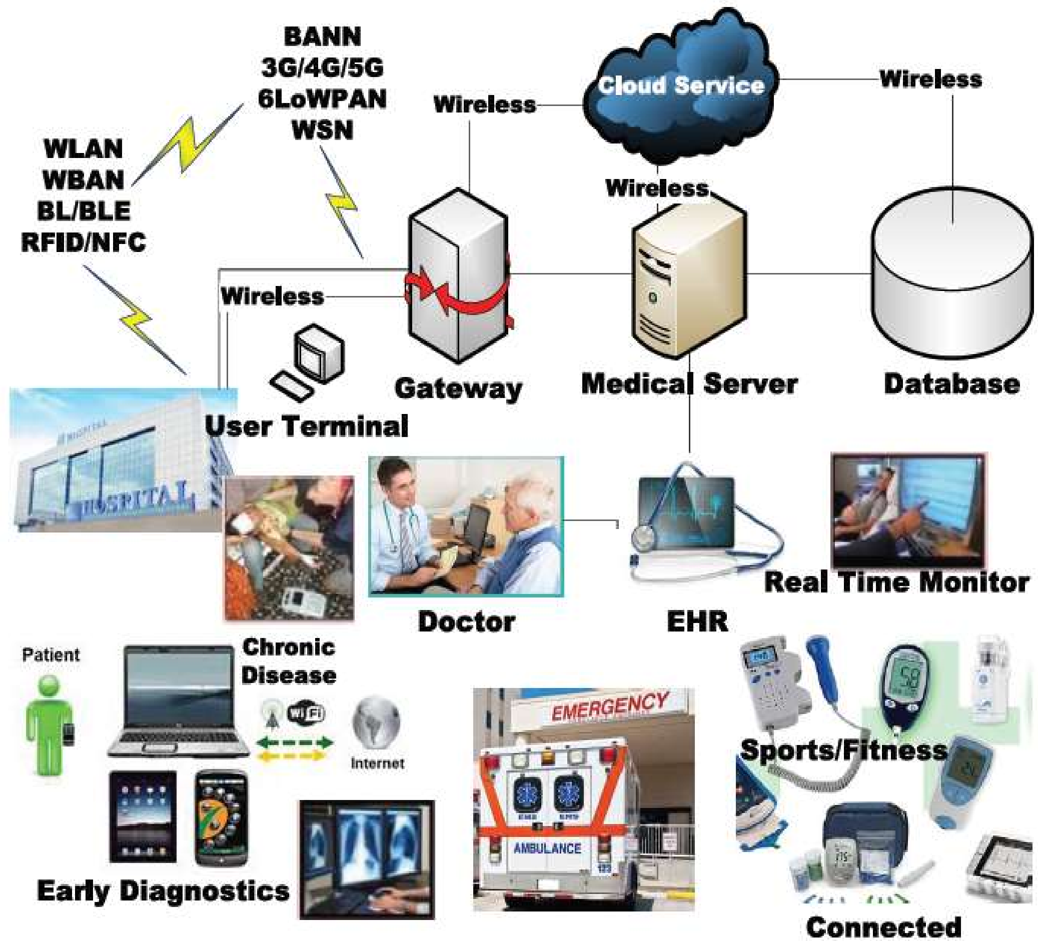
IoT Platform	Device Management	Security	Open-Source	Data Collection	Integration	Analytics	Visualization	Storage
SiteWhere	√	SSL, Spring Security	√	MQTT, JSON, AMQP, WebSockets	REST API	√	×	√
DeviceHive	√	JSON Web Tokens	√	REST API, MQTT	REST API, MQTT	√	√	√
Platformio	√	SSL	√	REST API, MQTT	Continuous Integration Software	×	×	×
RIOT	×	×	√	COAP, MQTT	REST API	×	×	×
ARM mbed	√	SSL/TLS, X.509 Certificate	√	REST API, MQTT	REST API	×	×	×
Ubuntu Core	√	RSA, SSH	√	MQTT, AMQP	REST API	×	×	√
IoTivity	√	DTLS/TLS	√	Message Queue	REST API	√	×	×
DSA	×	Basic Authentication	√	HTTP	REST API	√	×	√
Calvin-Base	√	×	√	REST API, HTTP	Calvin Script	√	×	×
Cylon.js	√	×	√	REST API, MQTT	REST API	×	×	×
Brillo	√	×	√	REST API	REST API	√	√	√
Contiki	√	×	√	REST API	REST API	√	×	×
Netbeast	√	TLS/SSL	√	HTTP, MQTT	REST API	√	√	√
Kaa	√	TLS/DTLS	√	MQTT, CoAP	REST API	√	√	√
ThingsBoard	√	TLS	√	MQTT, CoAP, HTTP	REST API	√	√	√

IoT platforms and operating systems comparison

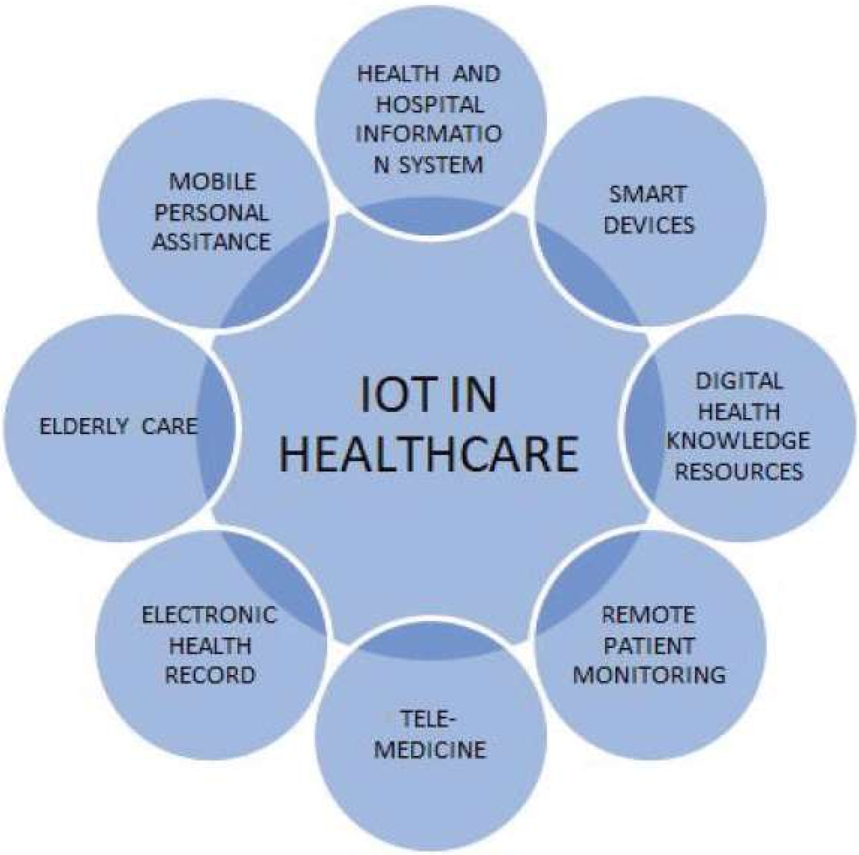
Internet of Things Architectures, Technologies, Applications, Challenges, and Future Directions for Enhanced Living Environments and Healthcare Systems: A Review, 2019.

Healthcare trends

- seamless and secure connectivity across individual patients, clinics, and healthcare organizations
- chronic diseases
- early diagnosis
- real-time monitoring
- medical emergencies



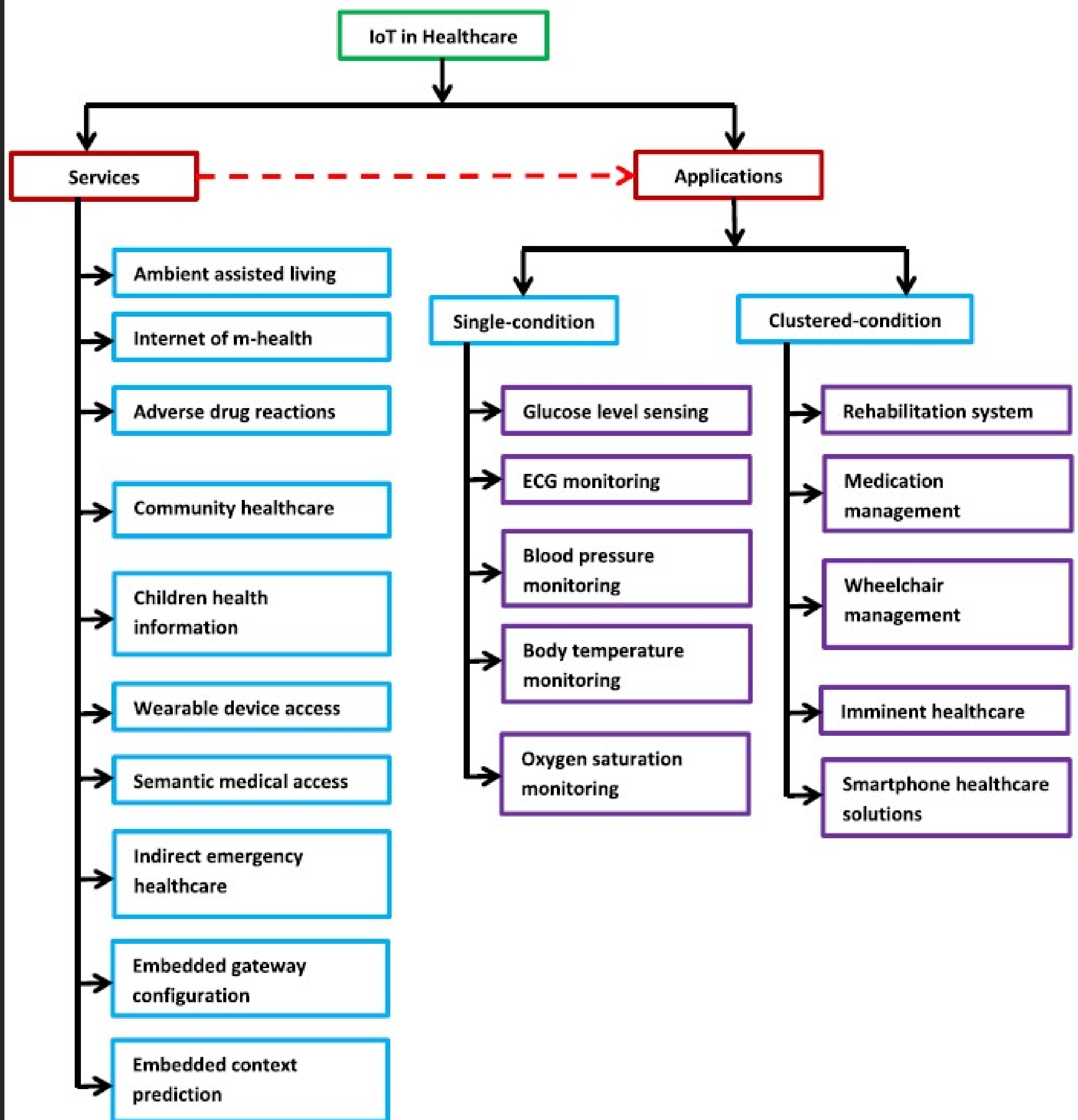
The Internet of Things for Health Care: A Comprehensive Survey, IEEE Access, 2015



IoT in healthcare

An IoT Equipped Hospital Model: A New Approach for E-governance Healthcare Framework, International Journal of Medical Research & Health Sciences, 2019.

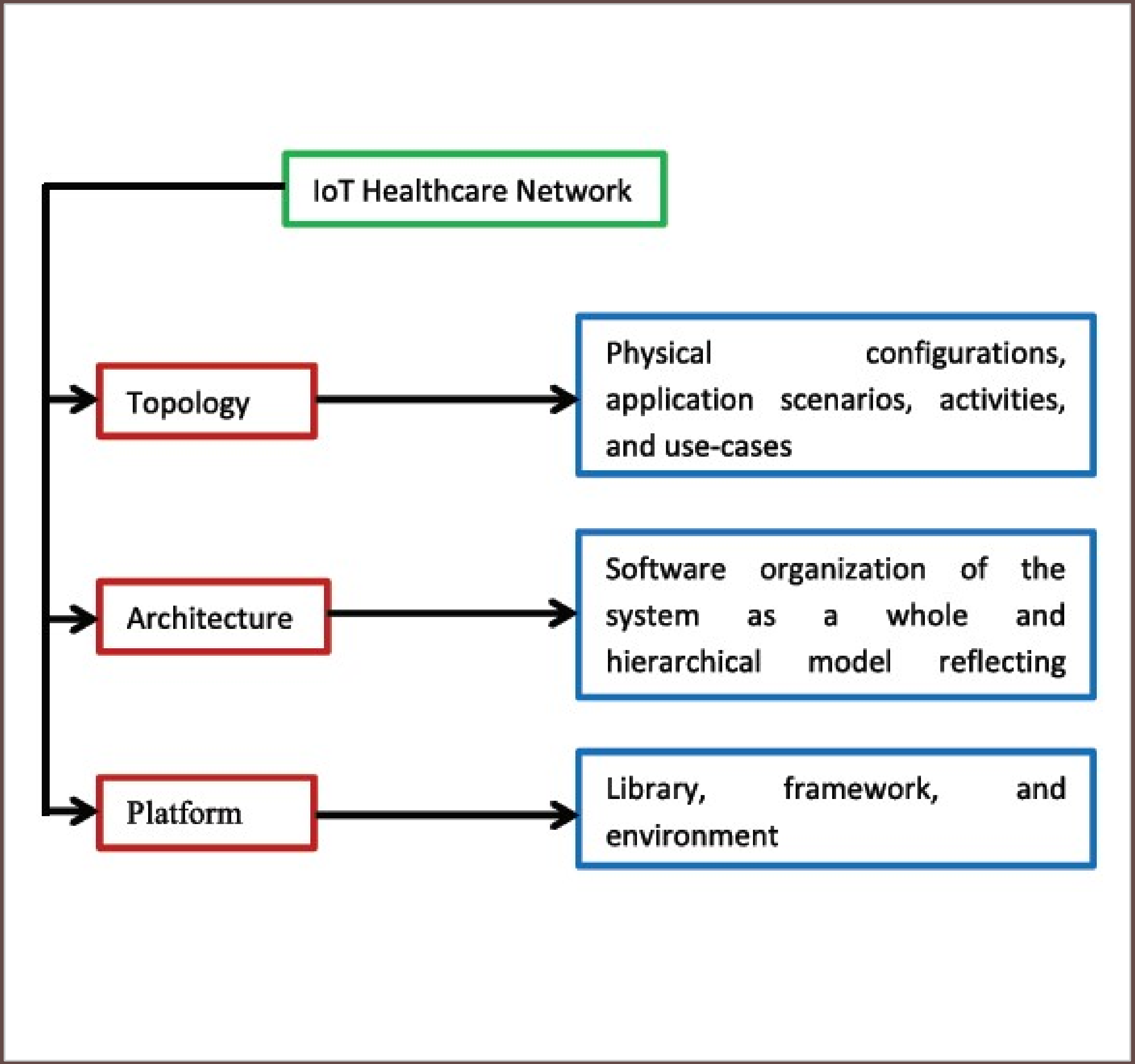
IoT healthcare services and applications



The Internet of Things for Health Care: A Comprehensive Survey, IEEE Access, 2015

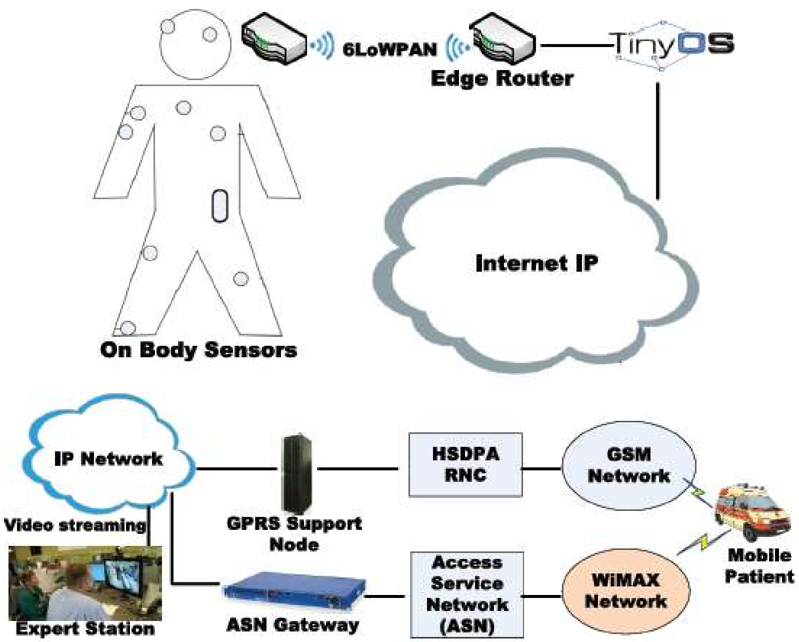
Healthcare systems' open issues

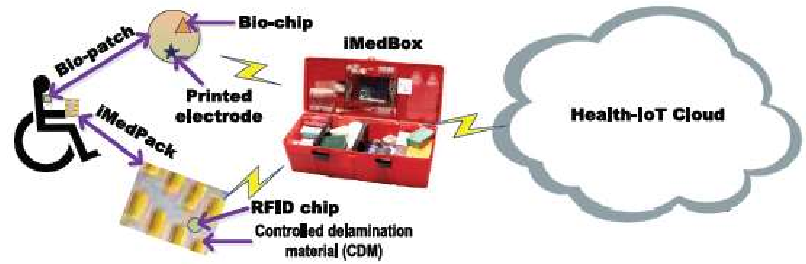
Internet of Things Architectures, Technologies, Applications, Challenges, and Future Directions for Enhanced Living Environments and Healthcare Systems: A Review, 2019.



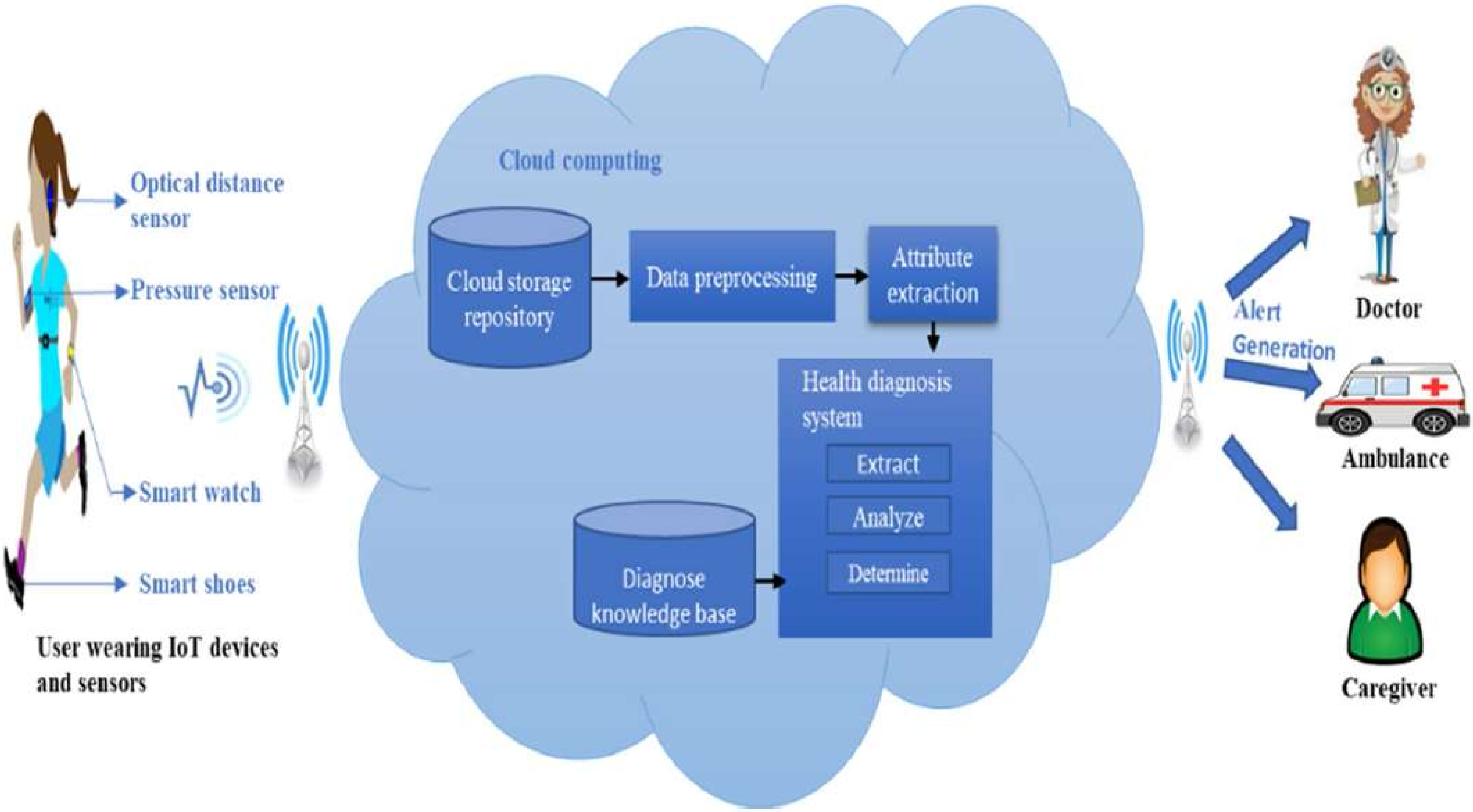
IoT healthcare network (IoThNet) issues

The Internet of Things for Health Care: A Comprehensive Survey, IEEE Access, 2015





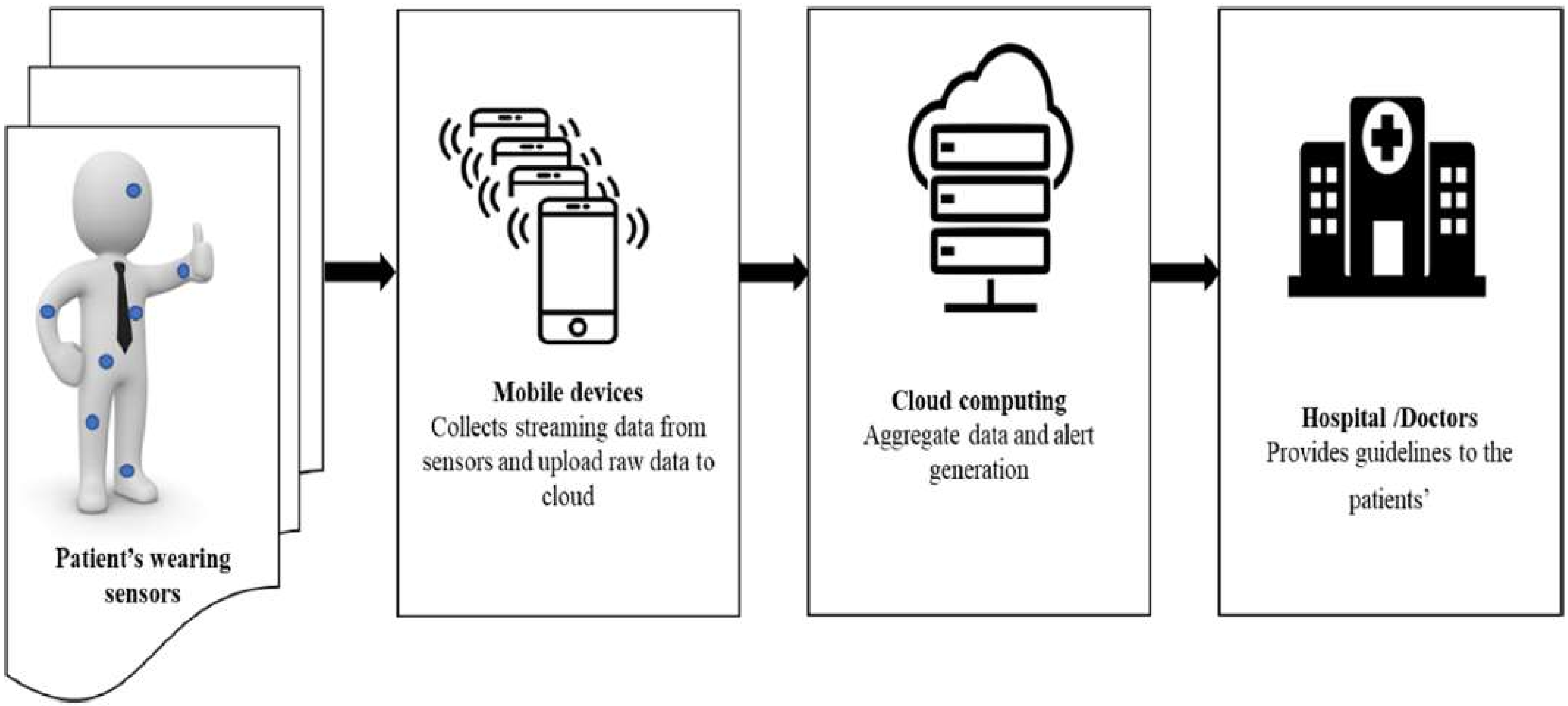
- Remote monitoring in wearables and personalized health care.
- An IoThNet topology with an intelligent healthcare gateway.



Cloud computing architecture related to healthcare

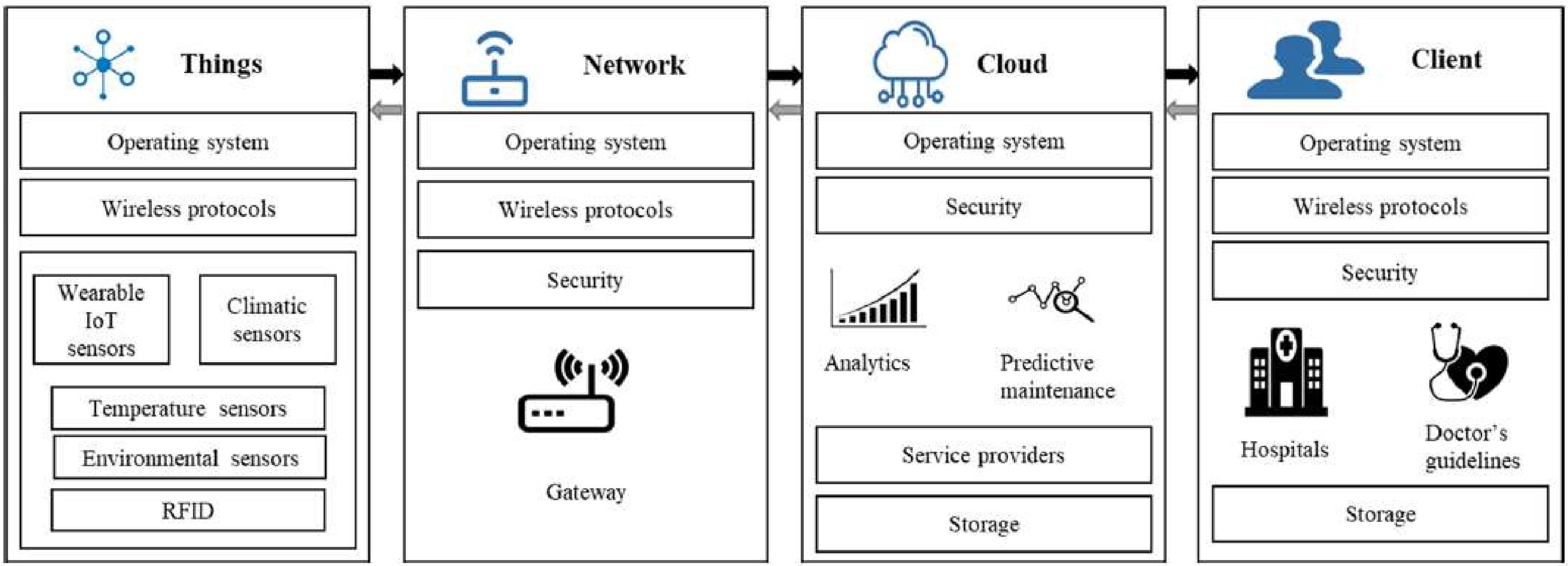
A study on medical Internet of Things and Big Data in personalized healthcare system, Health Information Science and Systems, 2018.

Mobile healthcare architecture



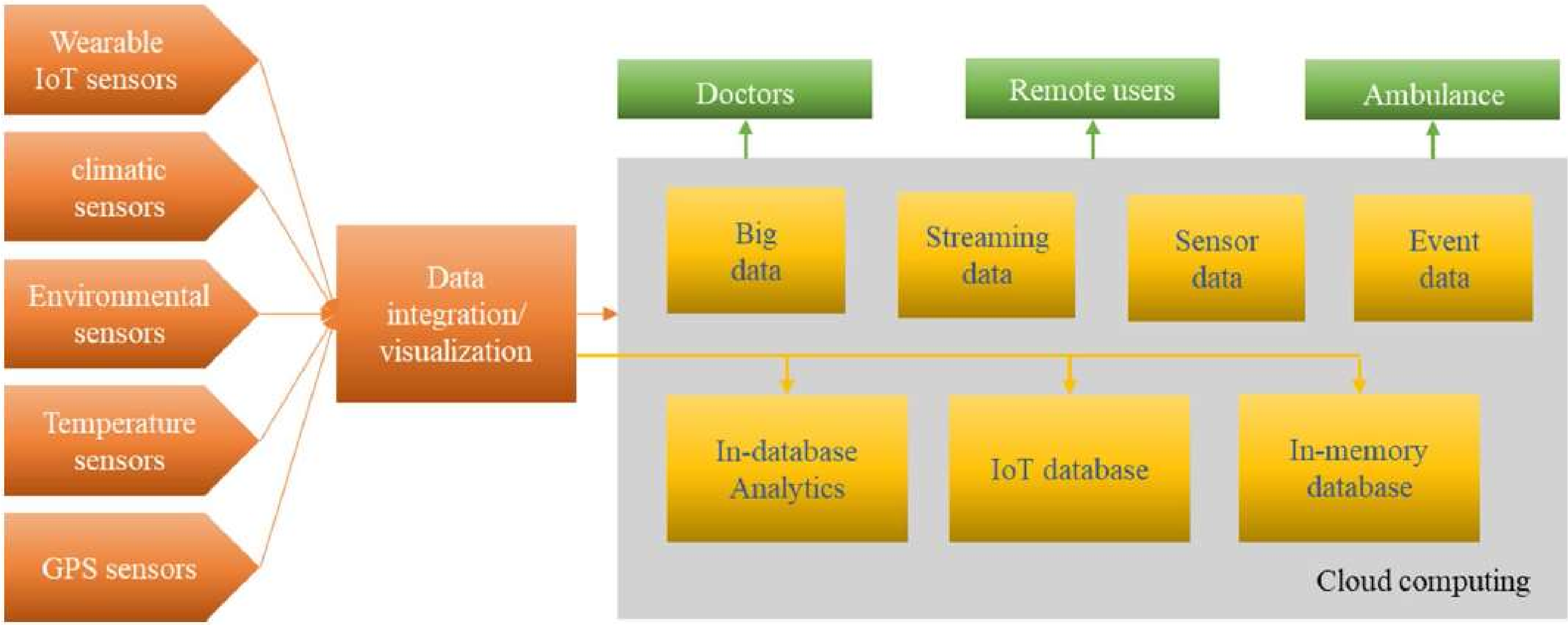
A study on medical Internet of Things and Big Data in personalized healthcare system, Health Information Science and Systems, 2018.

IoT-based healthcare monitoring architecture



A study on medical Internet of Things and Big Data in personalized healthcare system, Health Information Science and Systems, 2018.

Big Data architecture related to healthcare

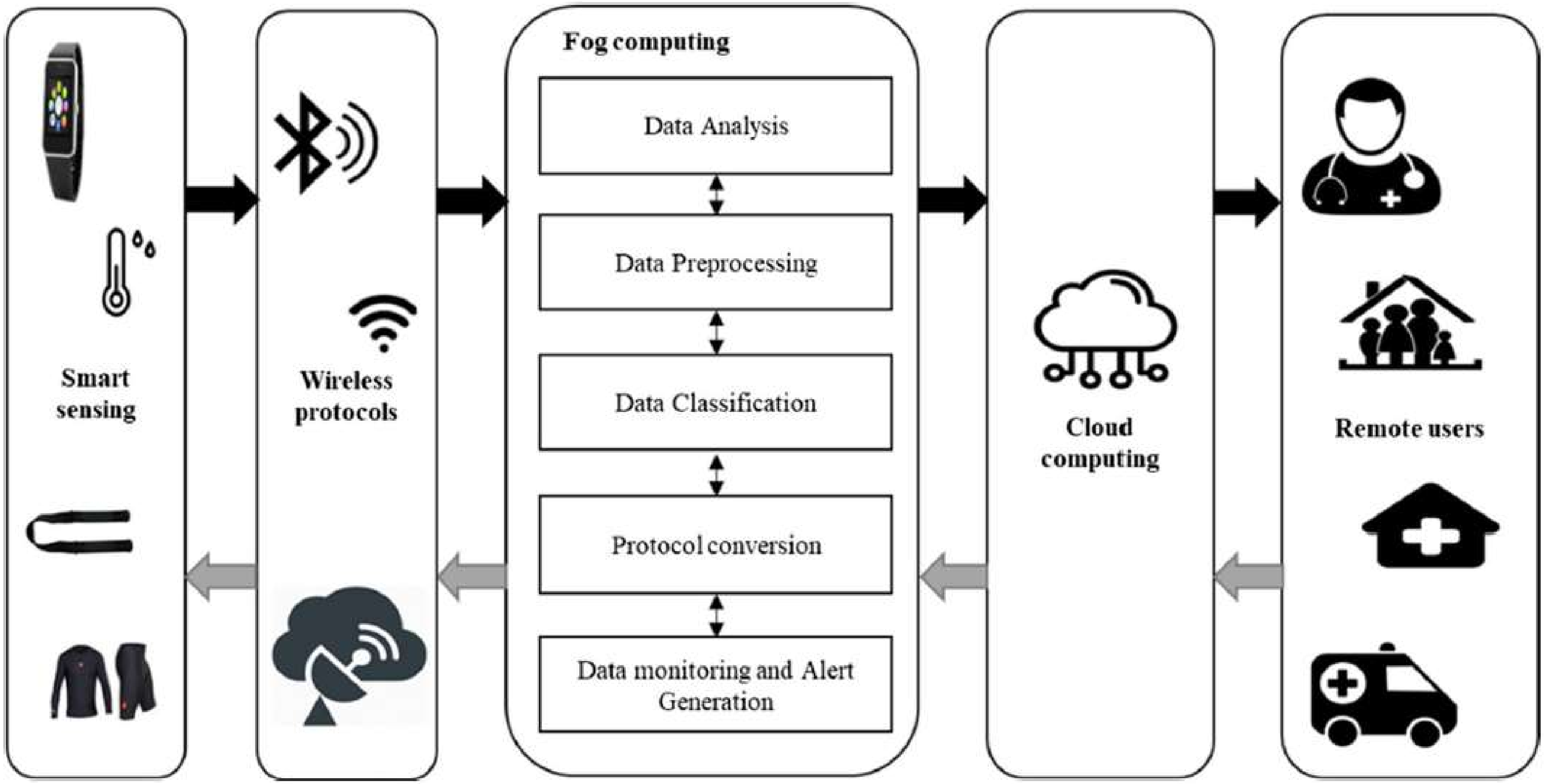


A study on medical Internet of Things and Big Data in personalized healthcare system, Health Information Science and Systems, 2018.

Architectural elements of healthcare IoT systems

Editorial, Internet-of-Things and big data for smarter healthcare: From device to architecture, applications and analytics, Future Generation Computer Systems, 2018.

Fog computing-based healthcare monitoring architecture



A study on medical Internet of Things and Big Data in personalized healthcare system, Health Information Science and Systems, 2018.

Table 1: Wireless technologies for IoT systems.

Standards	Operating Frequency	Data Rate	Range	Power Consumption	Battery Time
IEEE 802.15.4	868/915 MHz, 2.4 Gz	250 kbps	10 to 300 m	Very Low	Months-year
Wi-Fi	2.4 to 5.8 GHz	11–105 Mbps	10 to 100 m	High	Hours
Bluetooth	2.4 GHz	723 Kbps	10 m	Very Low-Low	Days-Weeks

Table 2: Web technologies for IoT systems.

Protocol	Transport Mechanism	Messaging Method	Resource Consumption	Successful Applications
HTTP RESTful	TCP	Request/Response	10 Ks Flash or RAM	Smart home and grid
CoAP	UDP	Request/Response	10 Ks Flash or RAM	Used in Field Area Networks (FAN)
MQTT	TCP	Request/Response Public/Subscriber	10 Ks Flash or RAM	Remote monitoring and controlling of devices
XMPP	TCP	Request/Response Public/Subscriber	10 Ks Flash or RAM	Remote management of major appliances (white goods)

Wireless & Web technologies for IoT systems

Framework for E-Health Systems in IoT-Based Environments, Wireless Communications and Mobile Computing, 2018

Achieving Interoperability of High-Quality Data Acquired by IoT Medical Devices

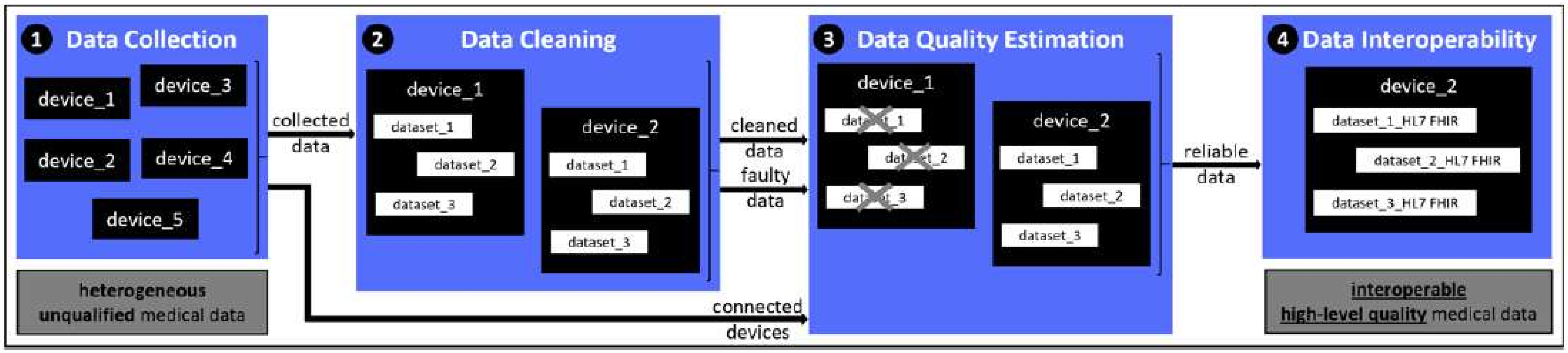


Figure 1. Architecture of the proposed mechanism.

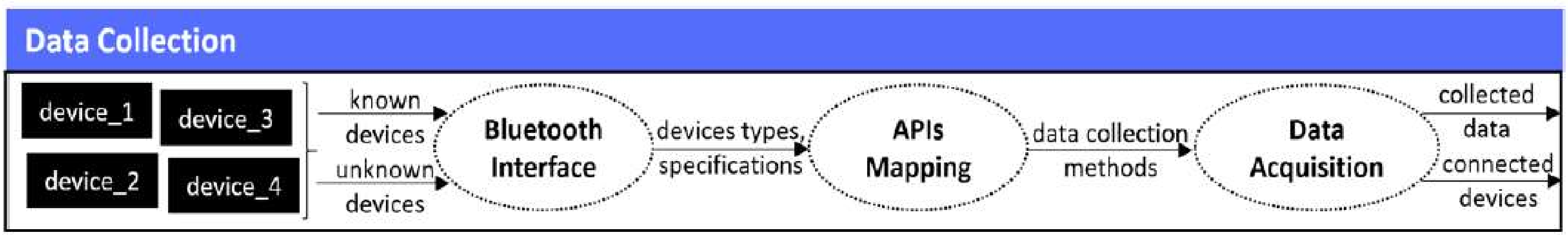


Figure 2. Data collection stage.

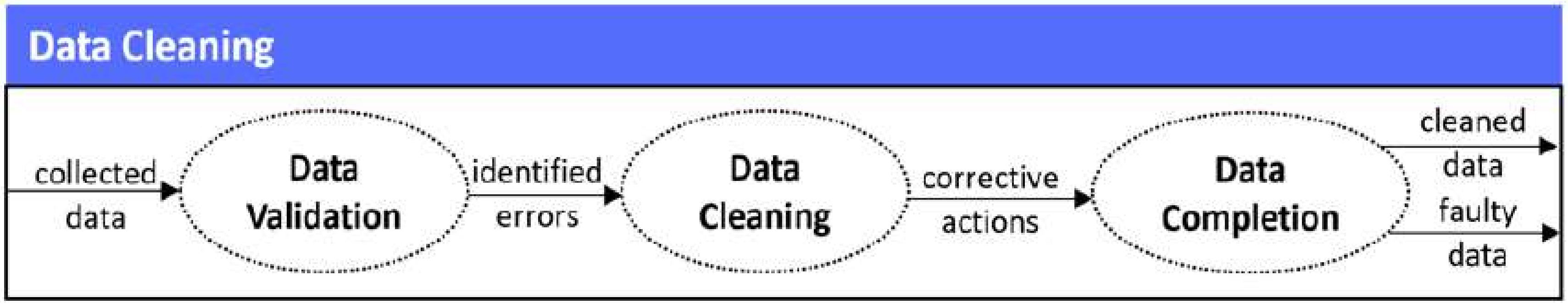


Figure 3. Data cleaning stage.

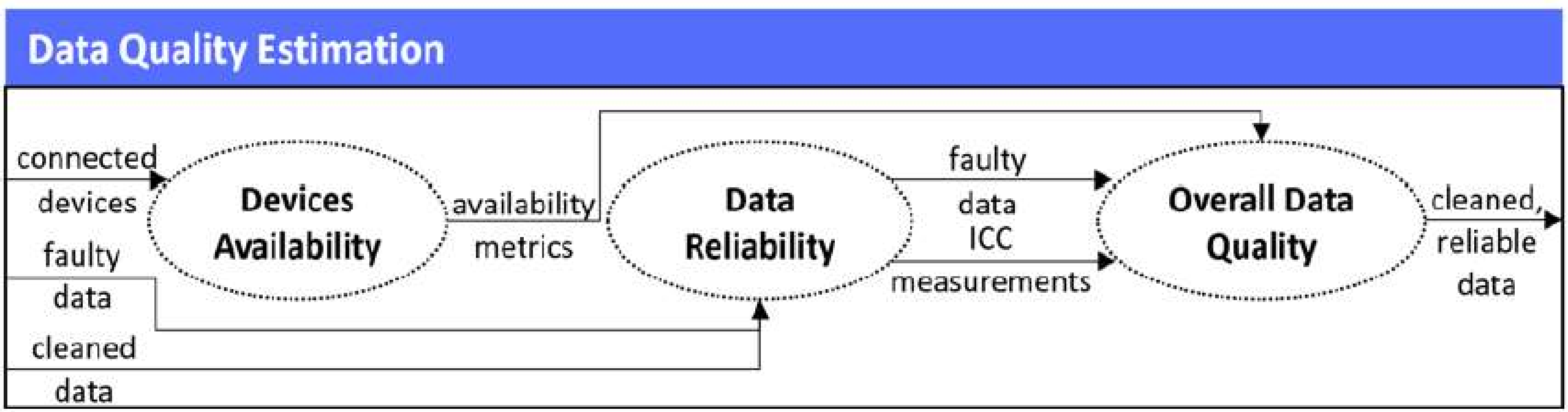


Figure 4. Data quality estimation stage.

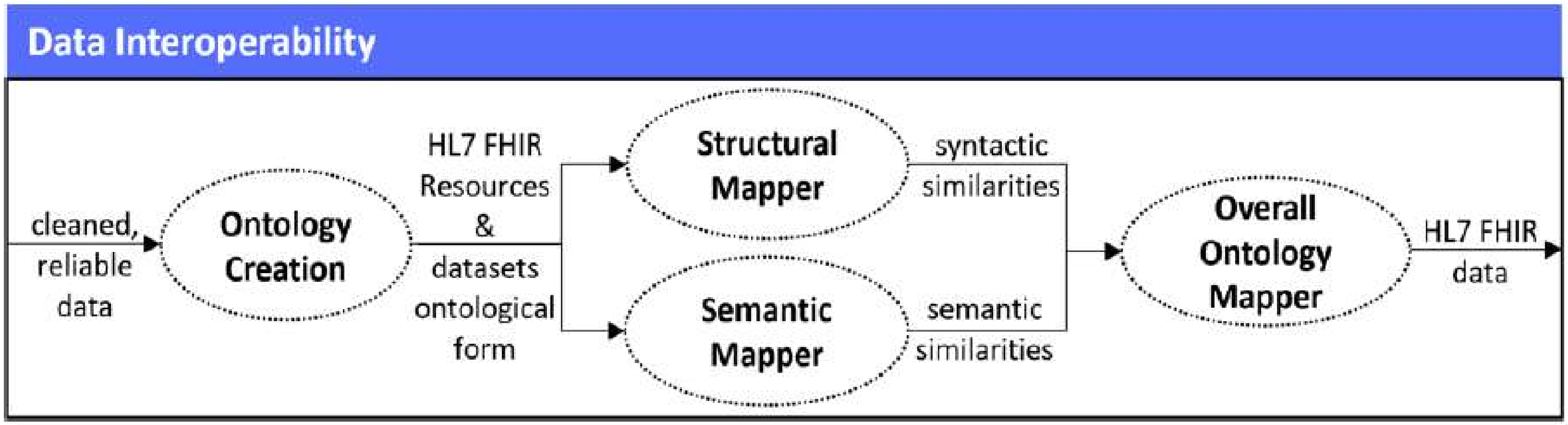
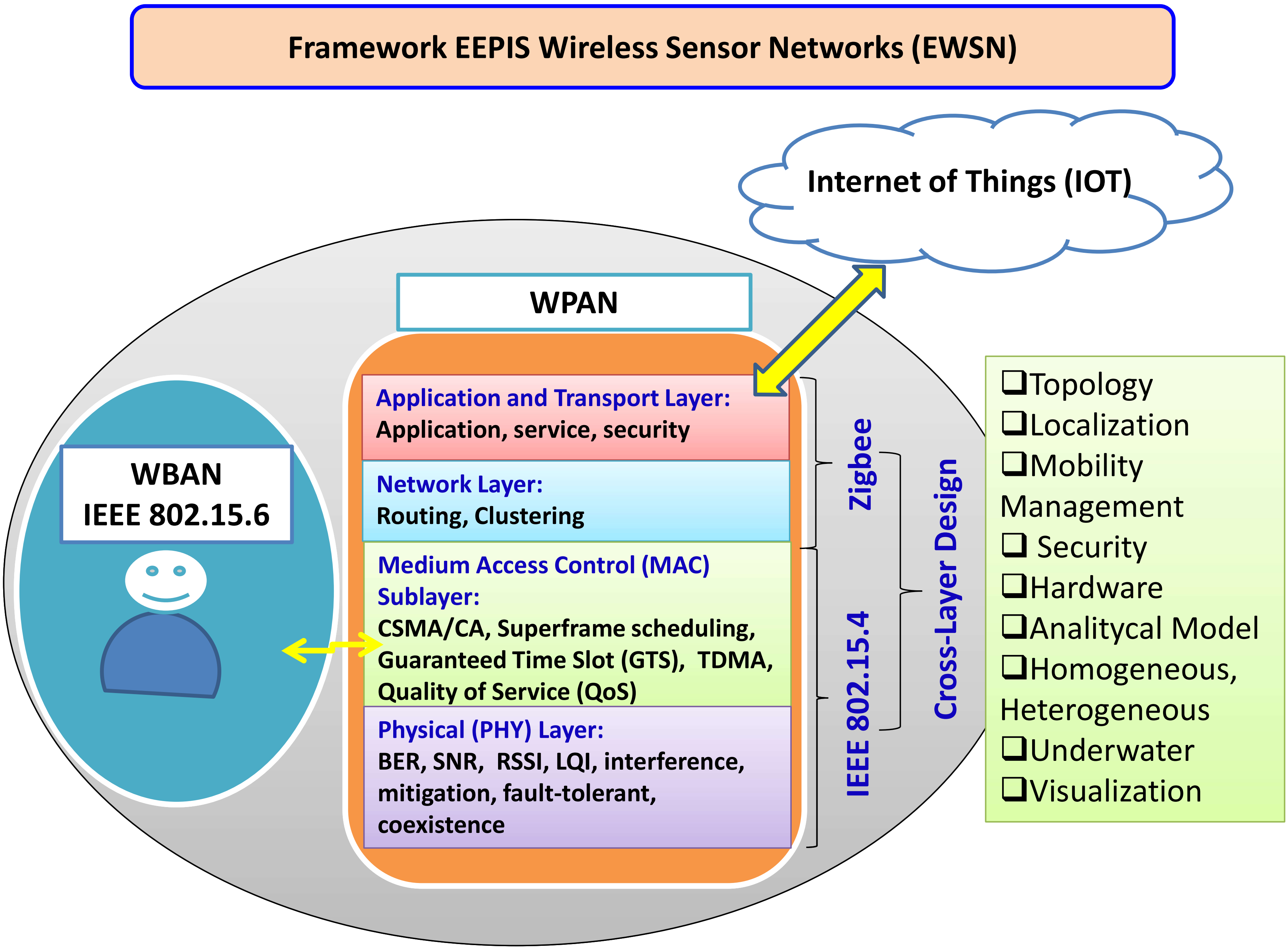


Figure 5. Data interoperability stage.

Research results IoT in Healthcare from RG EWSN



Framework EEPIS Wireless Sensor Networks (EWSN)
Internet of Things (IOT)
WPAN
WBAN
IEEE 802.15.6
Application and Transport Layer:
Application, service, security
Network Layer:
Routing, Clustering
Medium Access Control (MAC) Sublayer:
CSMA/CA, Superframe scheduling, Guaranteed Time Slot (GTS), TDMA, Quality of Service (QoS)
Physical (PHY) Layer:
BER, SNR, RSSI, LQI, interference, mitigation, fault-tolerant, coexistence
Zigbee
IEEE 802.15.4
Cross-Layer Design
❑Topology
❑Localization
❑Mobility Management
❑ Security
❑Hardware
❑Analitycal Model
❑Homogeneous, Heterogeneous
❑Underwater
❑Visualization

Research
http://udinharun.lecturer.pens.ac.id/#research

RESEARCH

Scientific Research and Project.

No	Year	Title	Funding
1	2019	Smart Farming: Implementasi environment Monitoring Analitics Real-time restorasi gambut pada konsesi perkebunan RIAU menggunakan Wireless Sensor Network dan teknologi IoT untuk mengidentifikasi potensi kebakaran lahan dan hutan	Penelitian Kerjasama Perguruan Tinggi (PKPT) - Dengan Polbeng, KemenristekDikti. SK: T/140/E3/RA.00/2019
2	2018-2020	Partition LEACH Algorithm for Environmental Monitoring based on Wireless Sensor Network. *(Chief)*.	International Research Collaboration and Scientific Publication - Penelitian Kerjasama Luar Negeri (PKLN), KemenristekDikti (76,5). SK: 0045/E3/LL/2018; Penelitian Dasar Kemenristekdikti. SK: T/140/E3/RA.00/2019;B/87/E3 /RA.00/2020
3	2018-2020	Implementasi Teknologi Portable Ubiquitous Health (U-Health) Dengan Layanan Cloud Untuk Mendukung Smart Health Buatan Indonesia. *(Chief)*.	Penelitian Terapan Unggulan Perguruan Tinggi (PTUPT), KemenristekDikti (120). SK: 0045/E3/LL/2018; T/140/E3 /RA.00/2019; B/87/E3/RA.00/2020
4	2018-2019	Implementasi Vehicle as a Mobile Sensor Network terintegrasi dengan Smart Environment Monitoring and Analytics in Real-time (SEMAR) system sebagai Pemantau Permukaan Jalan dan Lingkungan untuk mendukung Smart City. (*Member*).	Penelitian Terapan Unggulan Perguruan Tinggi (PTUPT), KemenristekDikti. SK: 0045/E3/LL/2018; T/140/E3 /RA.00/2019
5	2018-2019	Smart Fishpond Monitoring and Control System in Real Time Based on IoT With MQTT Protocol Data Transmission. *(Member)*.	Penelitian Kerjasama Perguruan Tinggi (PKPT) - Dg Poliwangi, KemenristekDikti. SK: 0045/E3/LL/2018; T/140/E3/RA.00/2019

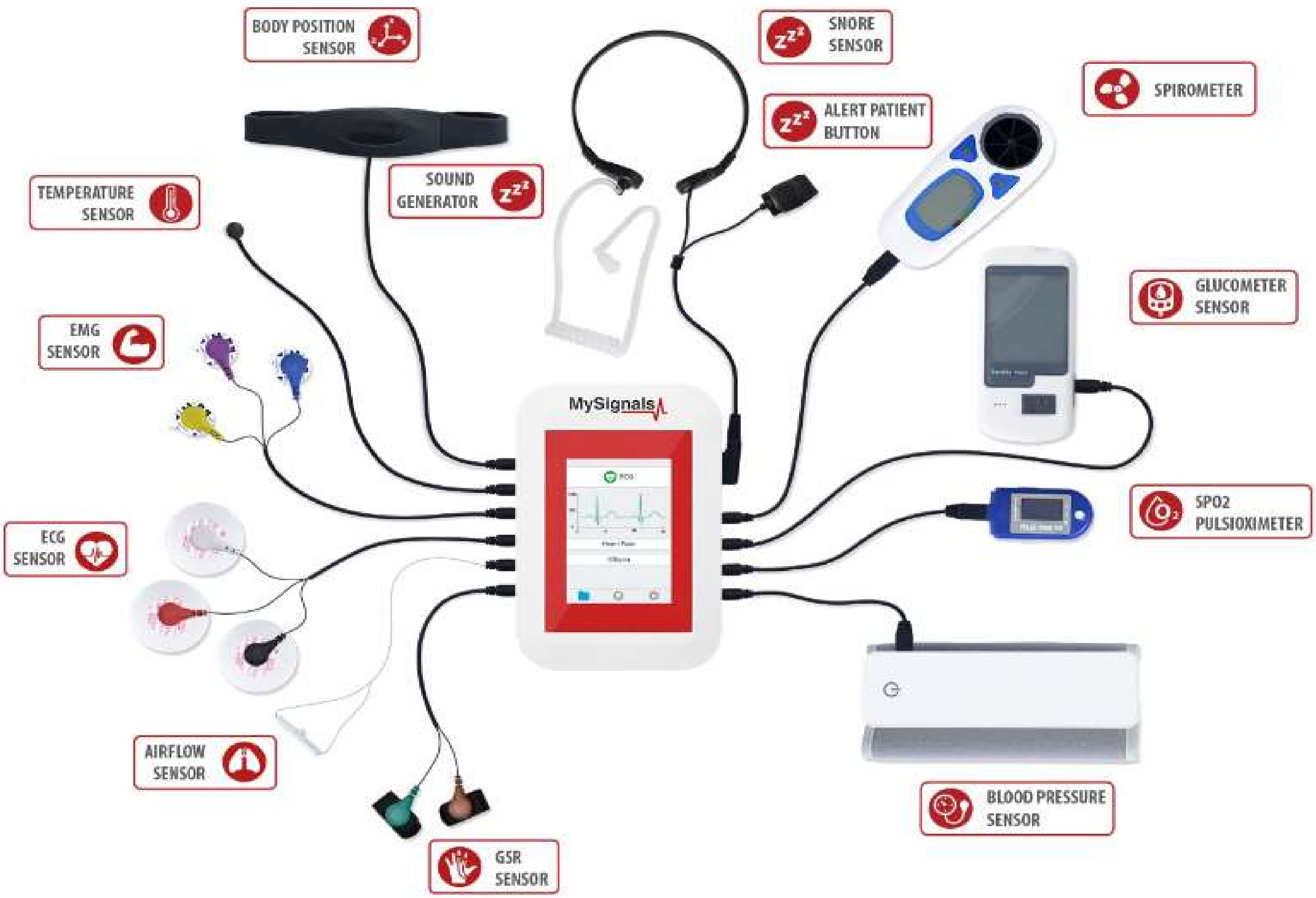
Foto – Foto Lab

E-Health Sensors in Lab EWSN

(libelium product)

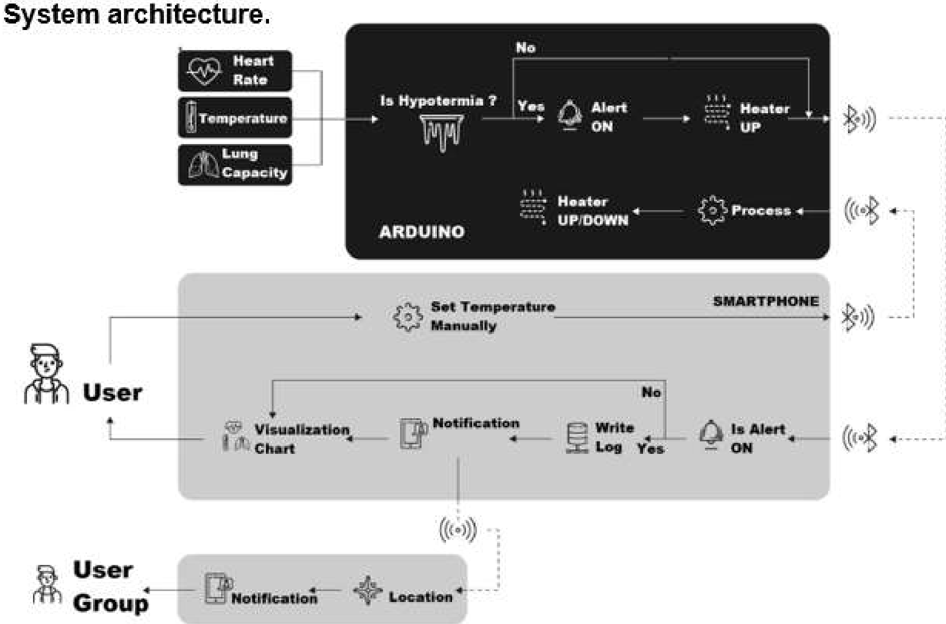
E-Health Sensors in Lab EWSN

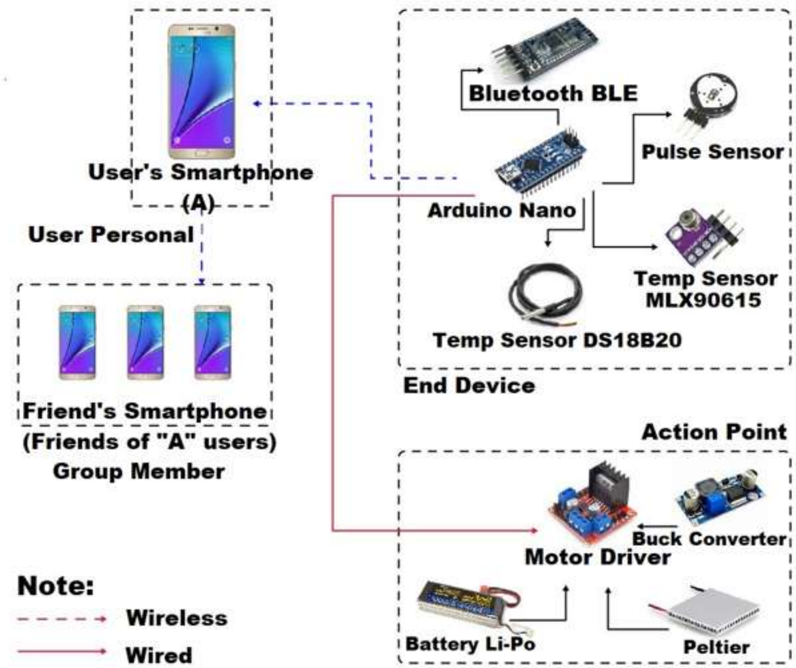
(libelium product)

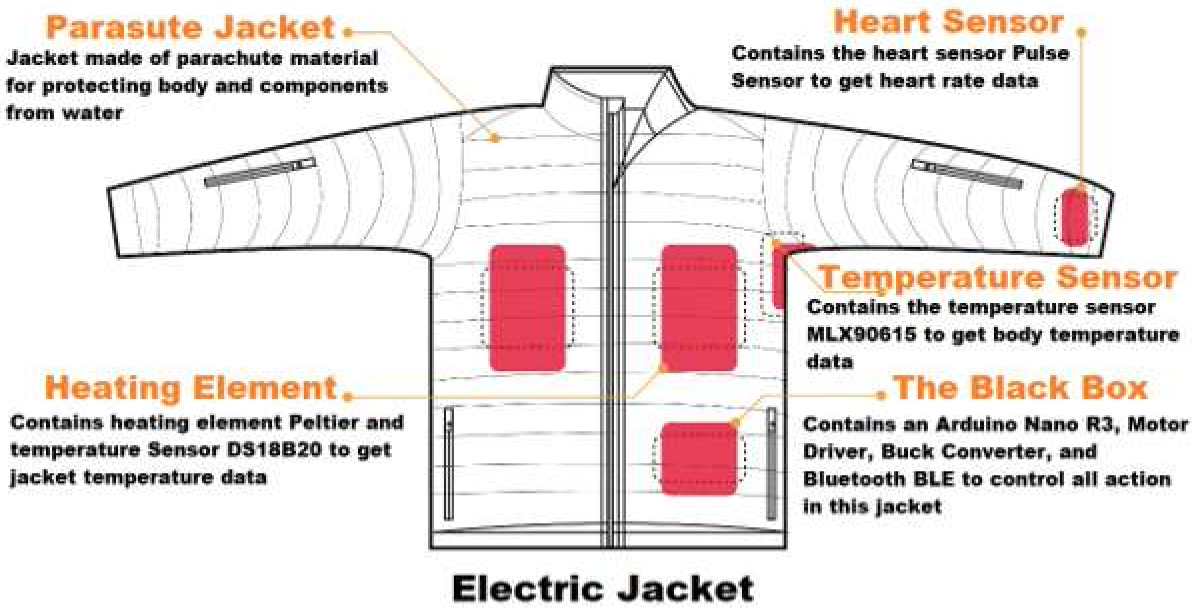


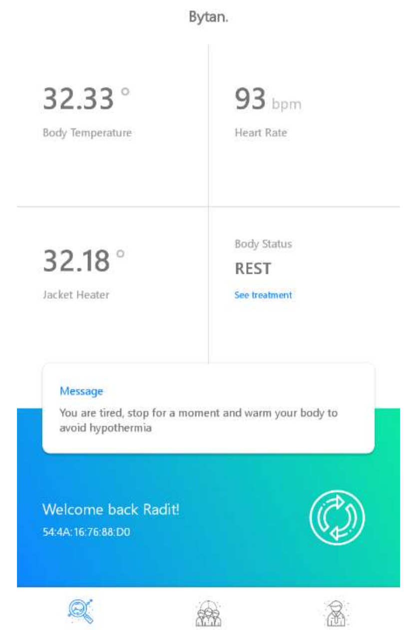
Design and Implementation of Hypothermia Symptoms Early Detection with Smart Jacket based on Wireless Body Area Network
(IEEE Access, Agustus 2020)

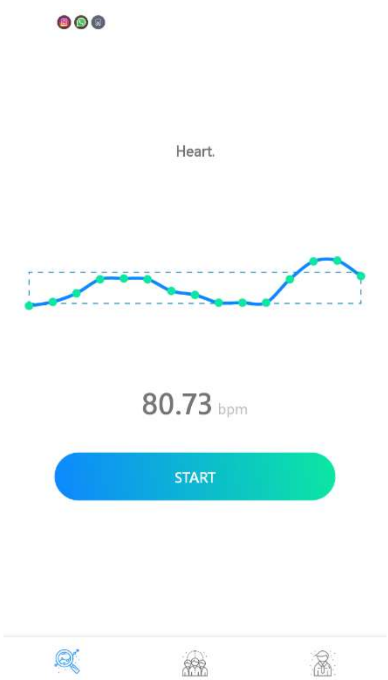
System architecture.

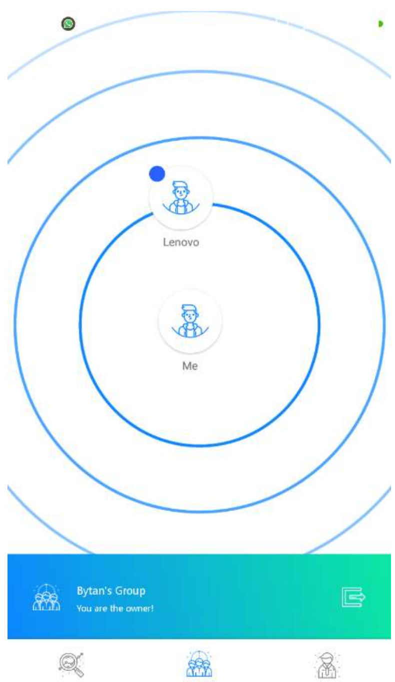


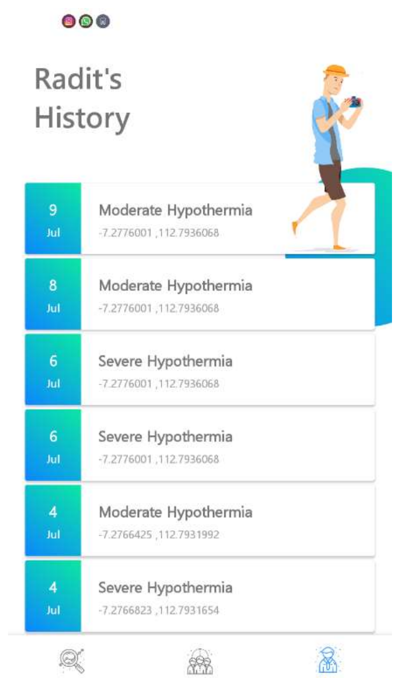


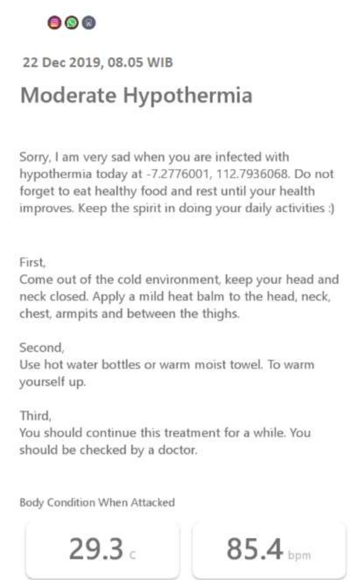

Parasute Jacket
Jacket made of parachute material for protecting body and components from water
Heart Sensor
Contains the heart sensor Pulse Sensor to get heart rate data
Temperature Sensor
Contains the temperature sensor MLX90615 to get body temperature data
Heating Element
Contains heating element Peltier and temperature Sensor DS18B20 to get jacket temperature data
The Black Box
Contains an Arduino Nano R3, Motor Driver, Buck Converter, and Bluetooth BLE to control all action in this jacket
Electric Jacket


Bytan.
32.33 °
Body Temperature
93 bpm
Heart Rate
32.18 °
Jacket Heater
Body Status
REST
See treatment
Message
You are tired, stop for a moment and warm your body to avoid hypothermia
Welcome back Radit!
54:4A:16:76:88:D0


Heart.
80.73 bpm
START

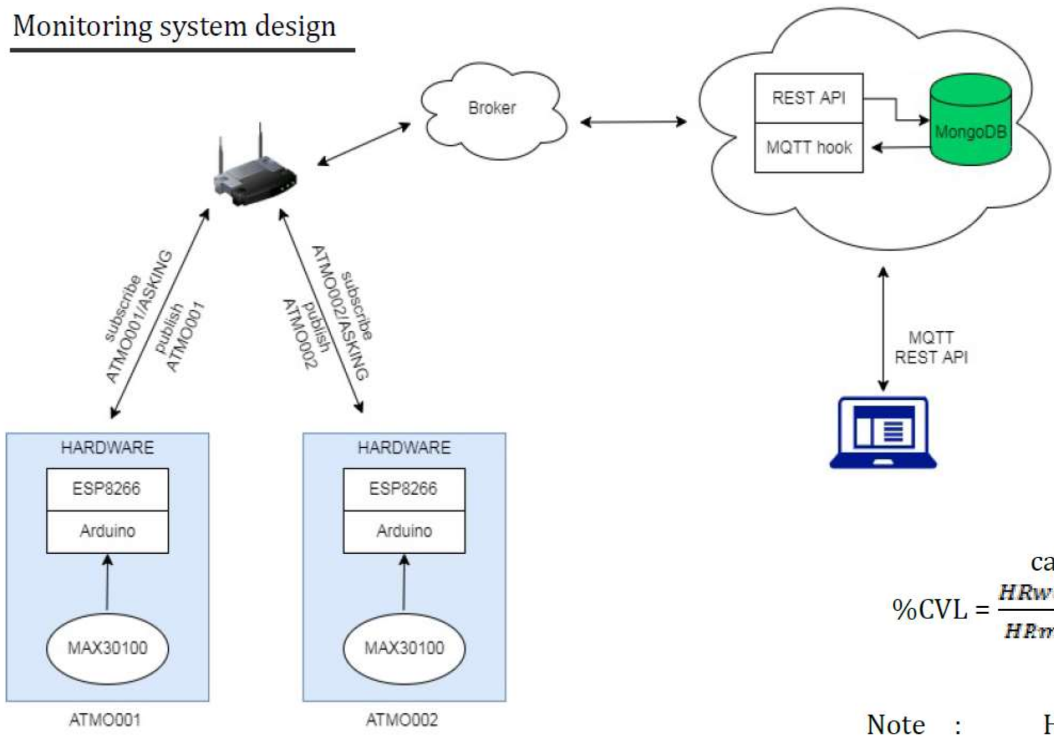

Lenovo
Me
Bytan's Group
You are the owner!


Radit's History
9 Jul
Moderate Hypothermia
-7.2776001 ,112.7936068
8 Jul
Moderate Hypothermia
-7.2776001 ,112.7936068
6 Jul
Severe Hypothermia
-7.2776001 ,112.7936068
6 Jul
Severe Hypothermia
-7.2776001 ,112.7936068
4 Jul
Moderate Hypothermia
-7.2766425 ,112.7931992
4 Jul
Severe Hypothermia
-7.2766823 ,112.7931654


22 Dec 2019, 08.05 WIB
Moderate Hypothermia
Sorry, I am very sad when you are infected with hypothermia today at -7.2776001, 112.7936068. Do not forget to eat healthy food and rest until your health improves. Keep the spirit in doing your daily activities :)
First,
Come out of the cold environment, keep your head and neck closed. Apply a mild heat balm to the head, neck, chest, armpits and between the thighs.
Second,
Use hot water bottles or warm moist towel. To warm yourself up.
Third,
You should continue this treatment for a while. You should be checked by a doctor.
Body Condition When Attacked
29.3 c
85.4 bpm

Implementation of oximetry sensors for Cardiovascular Load Monitoring when Physical Exercise (EMITTER International Journal of Engineering Technology, July 2020)

Monitoring system design



Classification of working heart rate

Heart Rate Work(bpm)	
Sitting/Very Light	60-70
Light	70-100
Moderate	100-125
Heavy	125-150
Very Heavy	150-175
Extremely Heavy	>175

Oxygen Saturation Range

SpO2 Range(%)	
Low	70-90
Medium	91-94
High	95-100

cardiovascular load (cardiovascular =%CVL)

$$\%CVL = \frac{HRwork - HRrest}{HRmax - HRrest} X\ 100$$

Note : HRwork : Work Heart Rate
HRrest : Resting Heart Rate
HRmax : Maximum Heart Rate

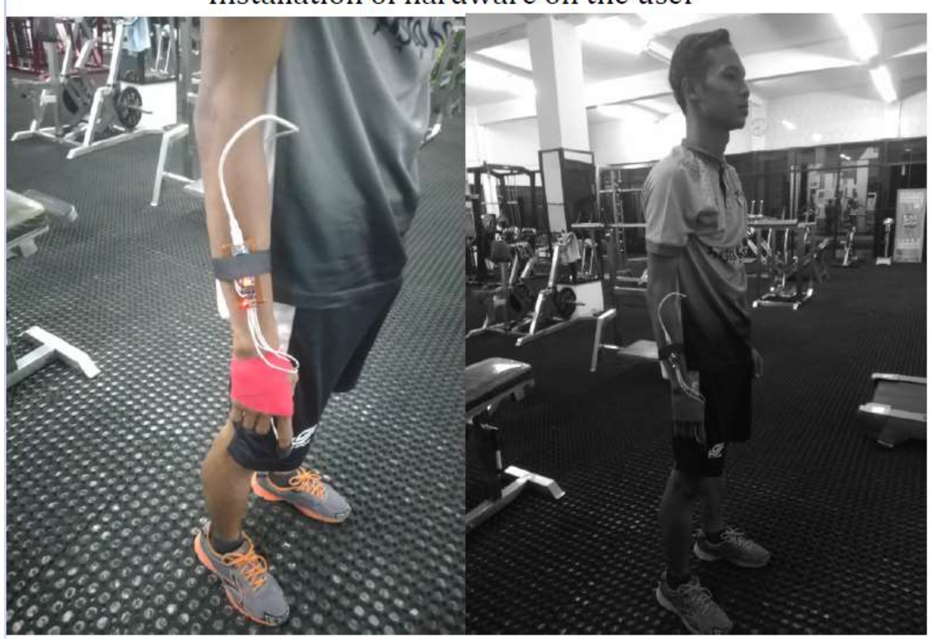
% CVL classification

% CVL	Classification
<30%	No Fatigue
30% s/d 60%	need for improvement (Fatigue Level 1)
60% s/d 80%	work in no time (Fatigue Level 2)
80% s/d 100%	urgent action is required (Fatigue Level 3)
>100%	no activity allowed

Realtime monitoring interface

Realtime Monitoring During Exercise

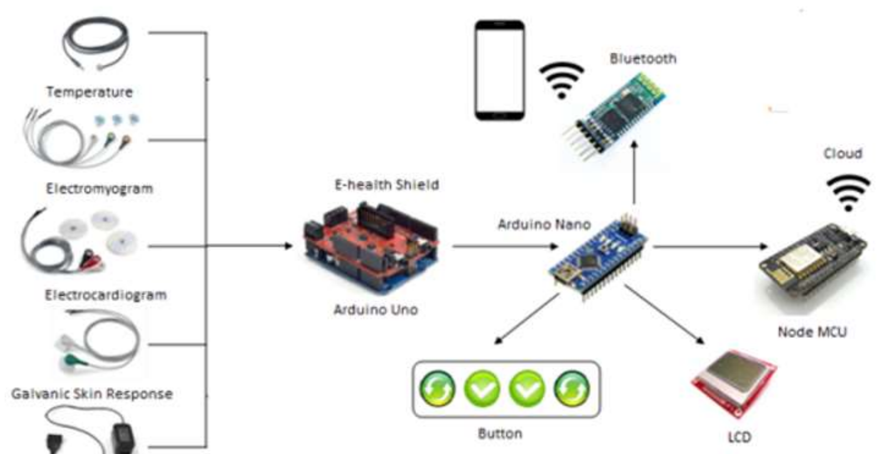
Installation of hardware on the user



Physical Condition of Volunteers

User	User 1	User 2	User 3	User 4	User 5	User 6
Age(years)	29	19	28	19	32	27
BMI(Height/ Weight)	175/58	173/59	174/88	170/53	160/62	160/50
HR Rest(bpm)	66	96	74	64	81	76
HR Maks(bpm)	191	201	192	201	187	193
Note	Warming Up	Without Warming Up	Without Warming Up	Warming Up	Without Warming Up	Without Warming Up

Design and Integration of Portable Health Sensors
(International Conference on Advanced Engineering and Technology (ICATECH), September 2020)
(not yet published)

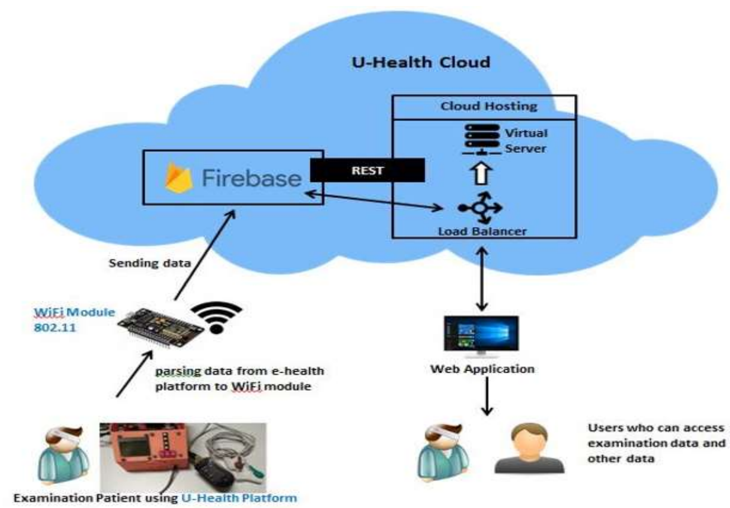


Design system of portable health platform.

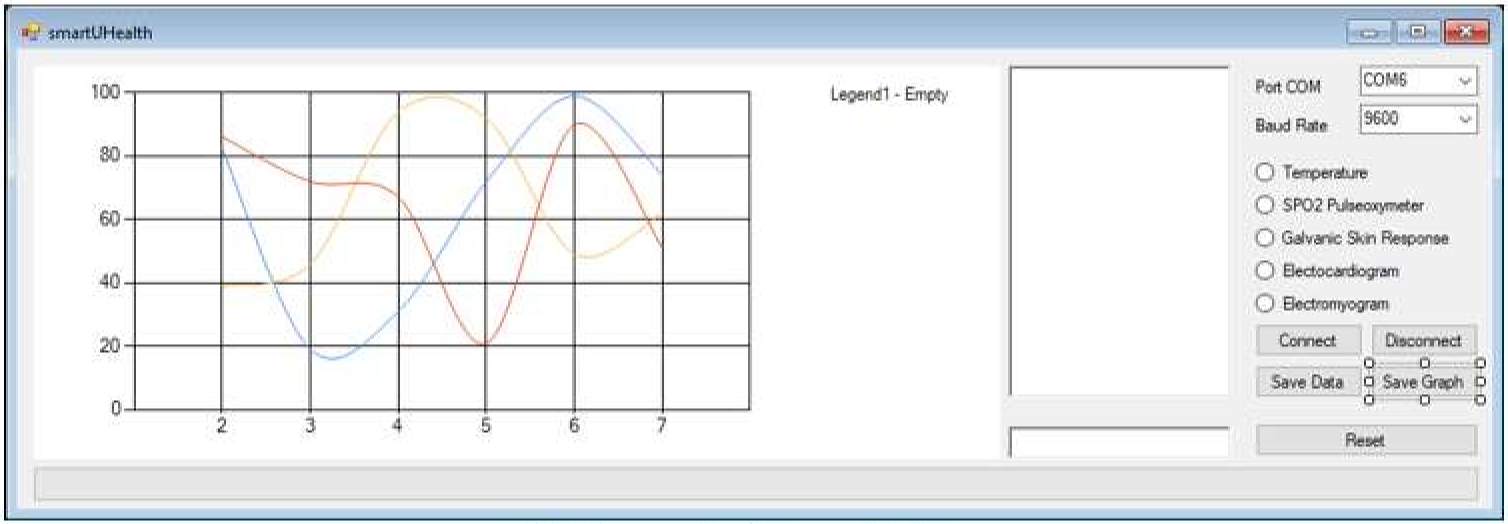
Prototype of smart E-Health device.

Sensing and processing device.

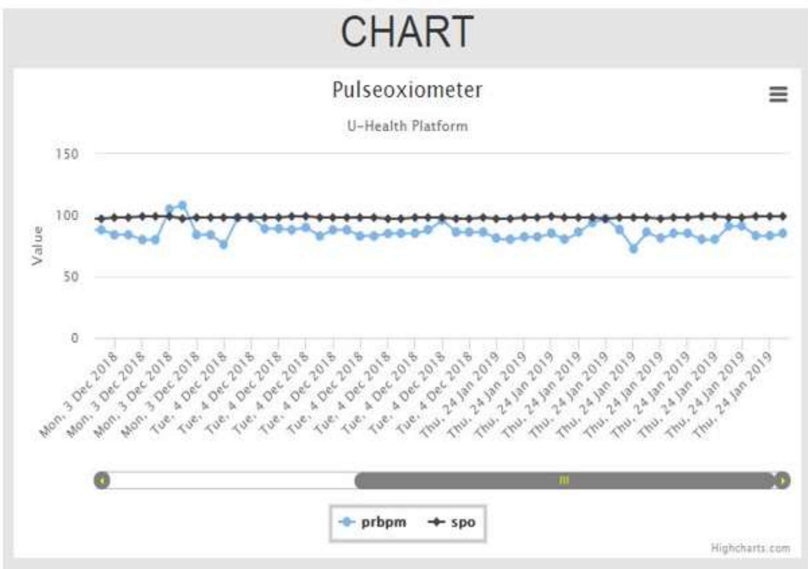
the E-Health platform, Arduino Uno, NodeMCU, Arduino Nano, and Bluetooth have been combined into one



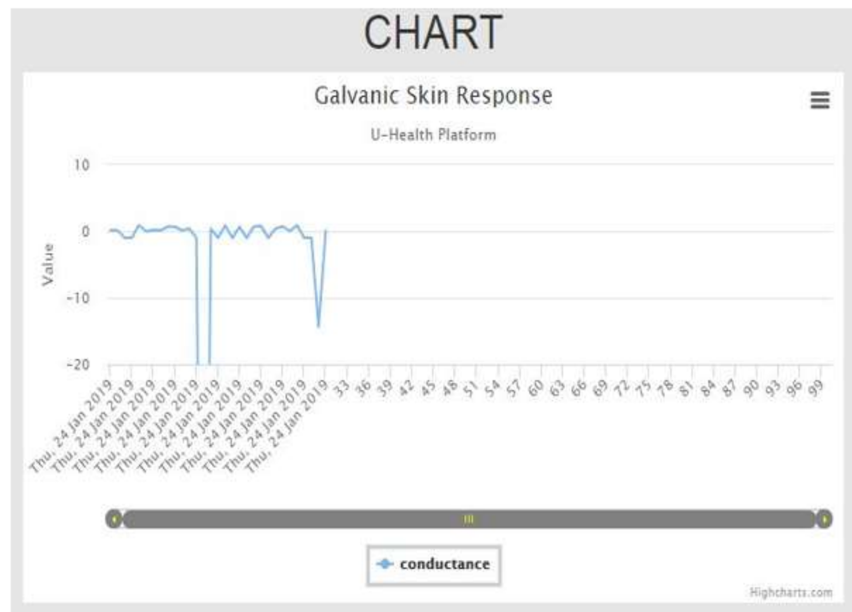
U-Health cloud system.



Dekstop application monitoring



Pulse oximeter sensor graphics in the web.



GSR sensor graph in the web.

Health Monitoring and Early Diseases Detection on Dairy Cow Based on Internet of Things and Intelligent System
(International Electronics Symposium (IES) 2019)

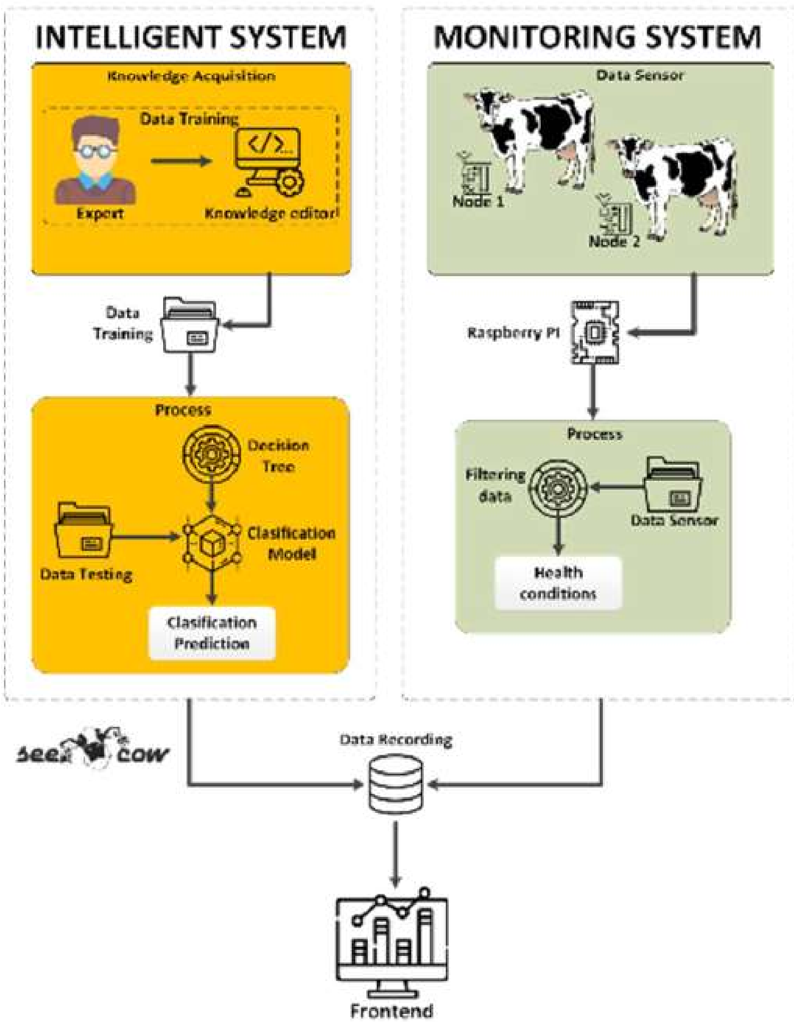


Fig. 1. System design

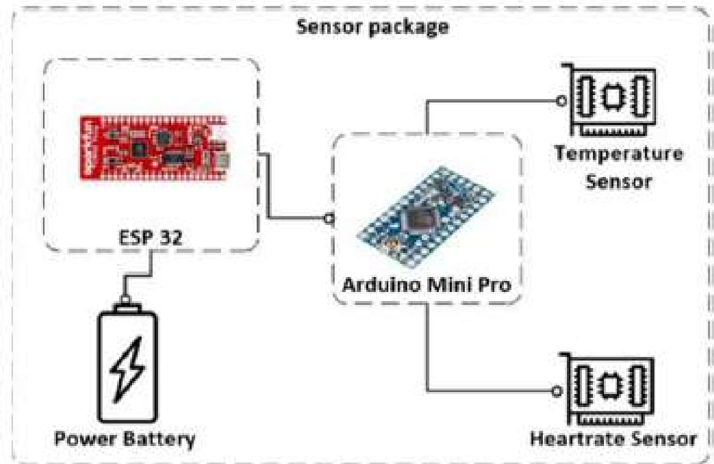


Fig. 2. Design of electronics components

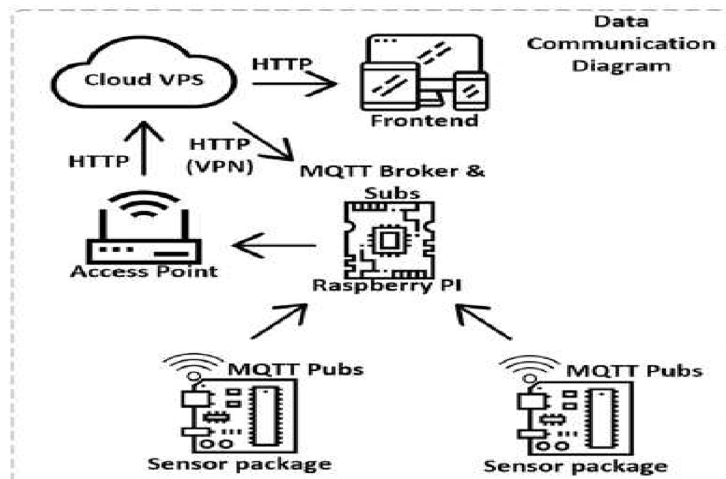


Fig. 3. Data communication diagram

Fig. 10. Installation of node on dairy cow

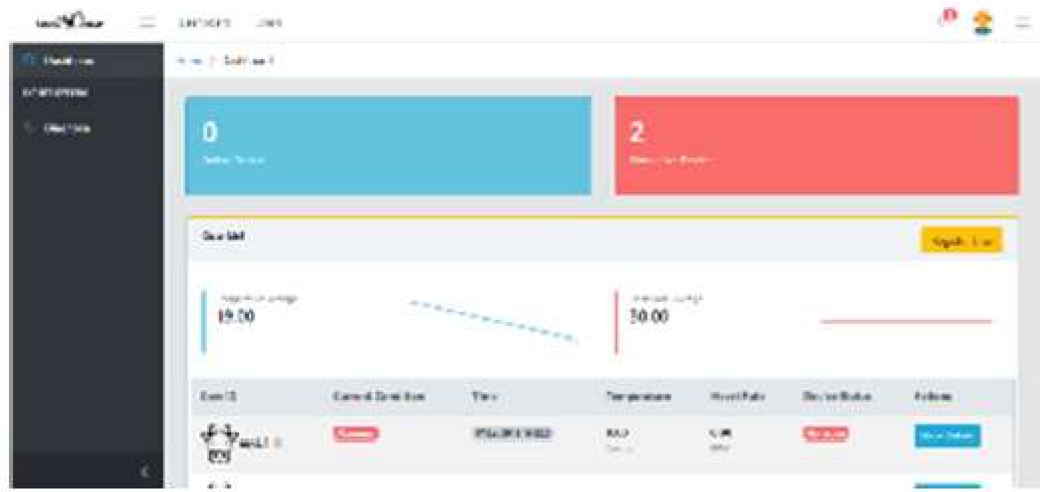


Fig. 7. User interface web based

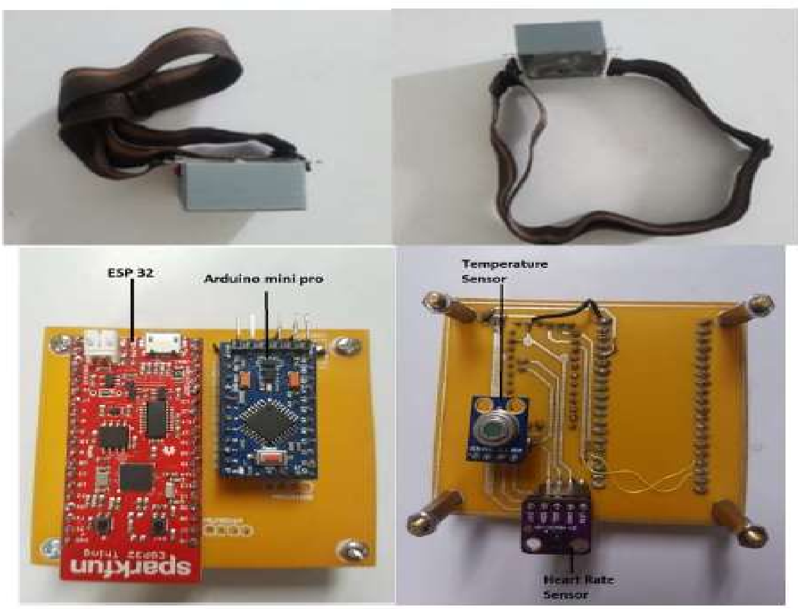
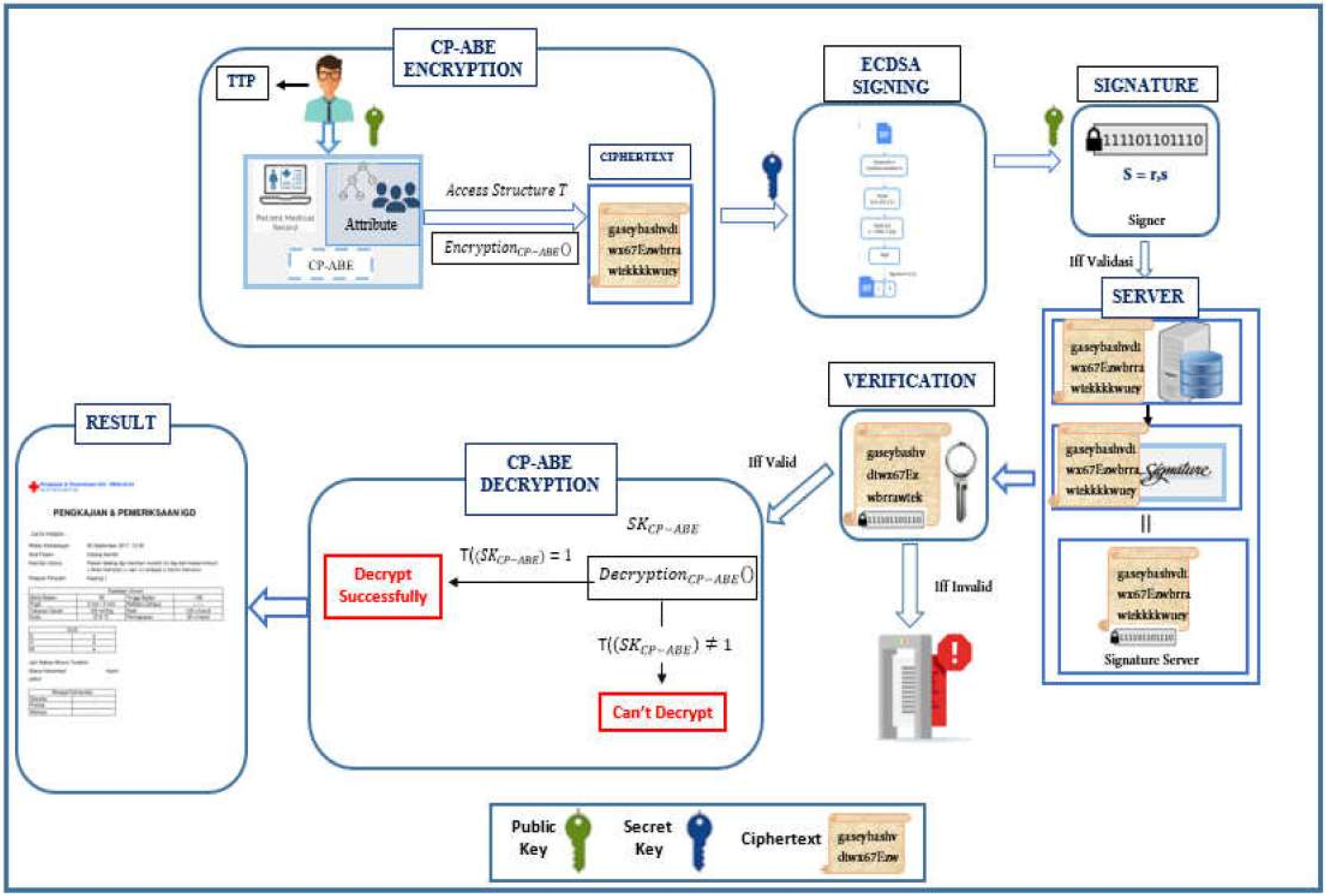


Fig. 8. Design of node

Fig. 9. Web visualization

Medical Health Record Protection Using Ciphertext-Policy Attribute-Based Encryption and Elliptic Curve Digital Signature Algorithm
(EMITTER International Journal of Engineering Technology, July 2019)



Mobile Monitoring of Toddler's Body Temperature For Early Effort of Febrile Seizure Prevention (International Seminar on Application for Technology of Information and Communication (iSemantic) 2019)

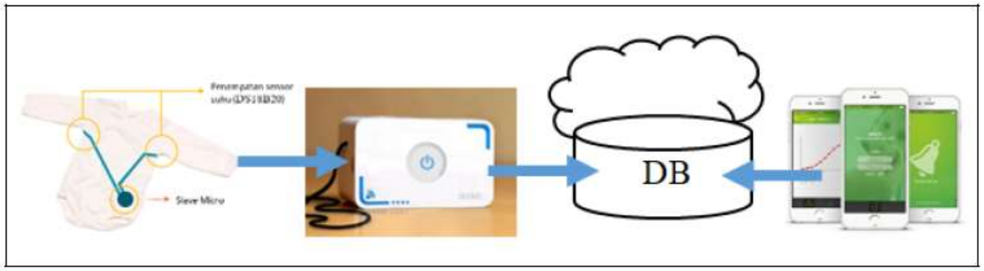


Fig.1. General system design.

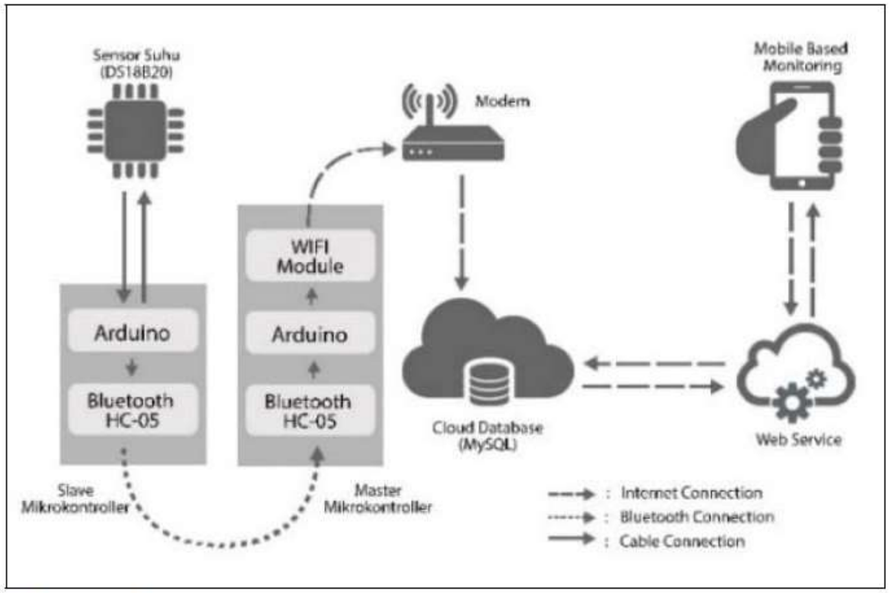


Fig. 2. System design process.

Fig. 6. Mechanical Slave Hardware

Fig. 7. Mechanical Hardware Hardware

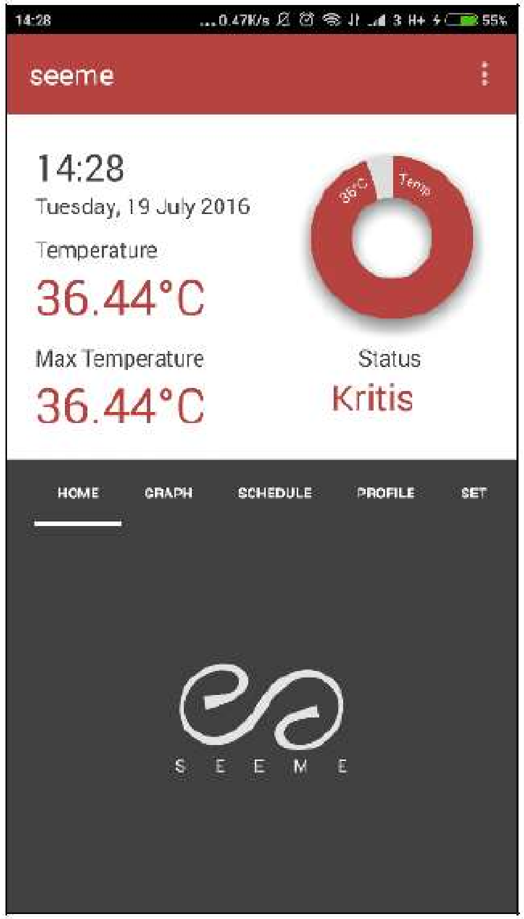


Figure 8. Home menu.

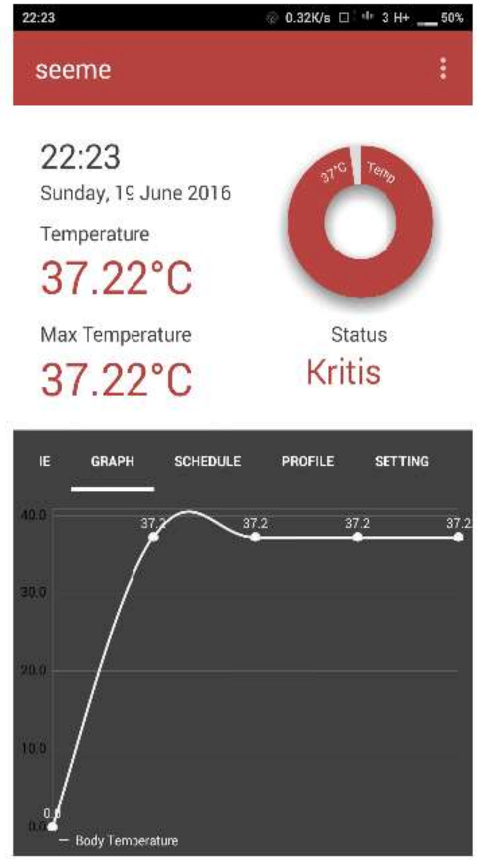


Fig. 9. Realtime Graph.

AT-Mo: Wireless Data Collection System For Physiology Monitoring of Athlete
(International Electronics Symposium (IES) 2019)

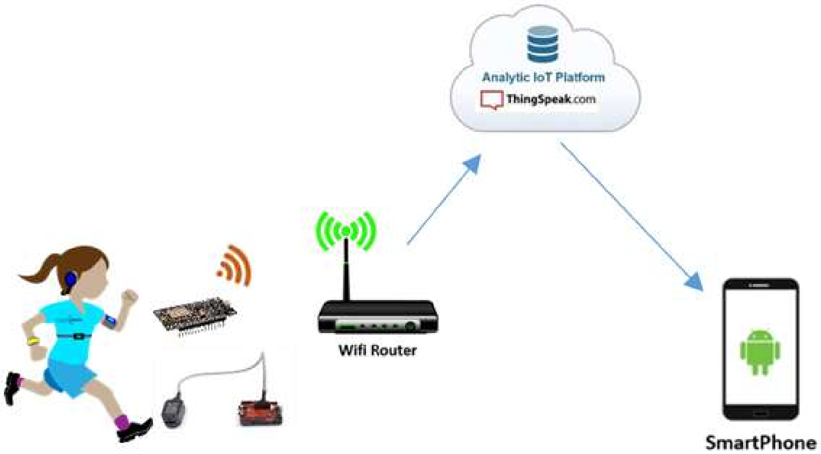


Fig. 2. System Design

Fig 4. E-Health Sensor Platform

Fig 3. Pulse Oximetry Sensor

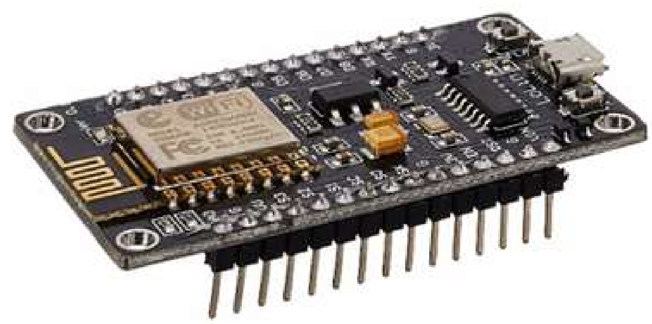


Fig 6. Nodemcu

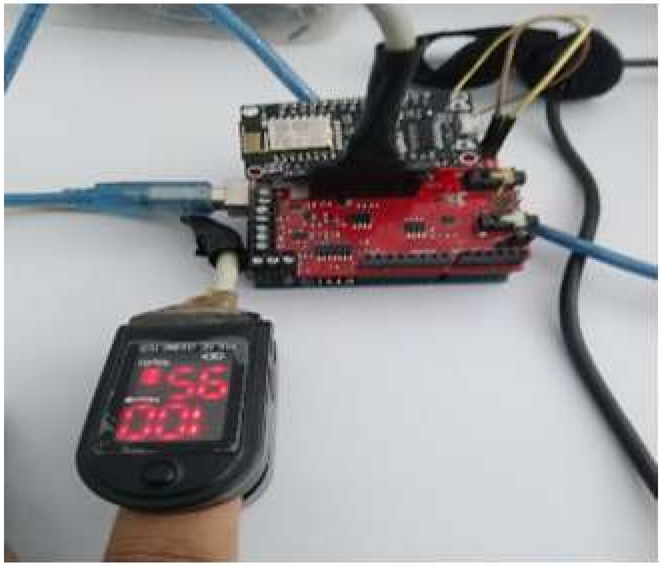


Fig. 7. Implementasi Pulse Oximetry

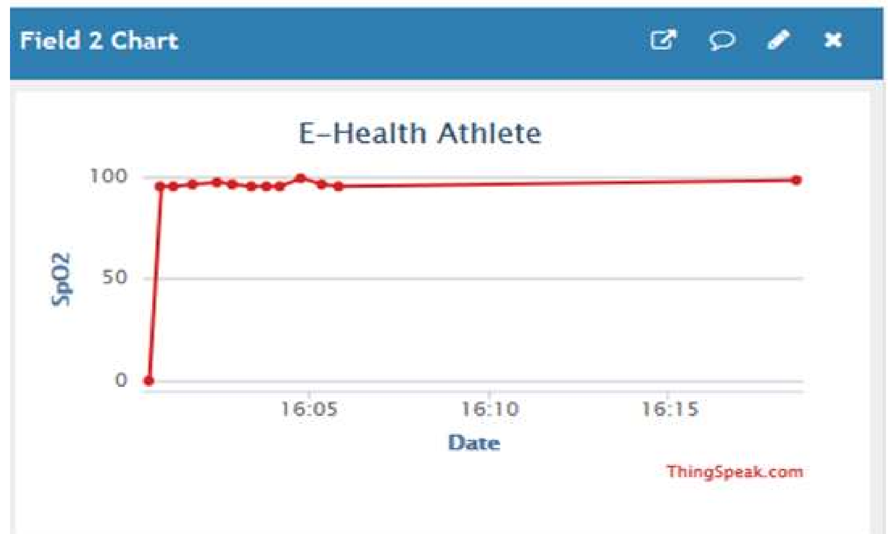


Fig. 10. Visualization of Data Thingspeak

Design and Development of Portable Spirometer
(IEEE International Conference on Consumer Electronics – Taiwan (ICCE-TW), May 2018, Taiwan)

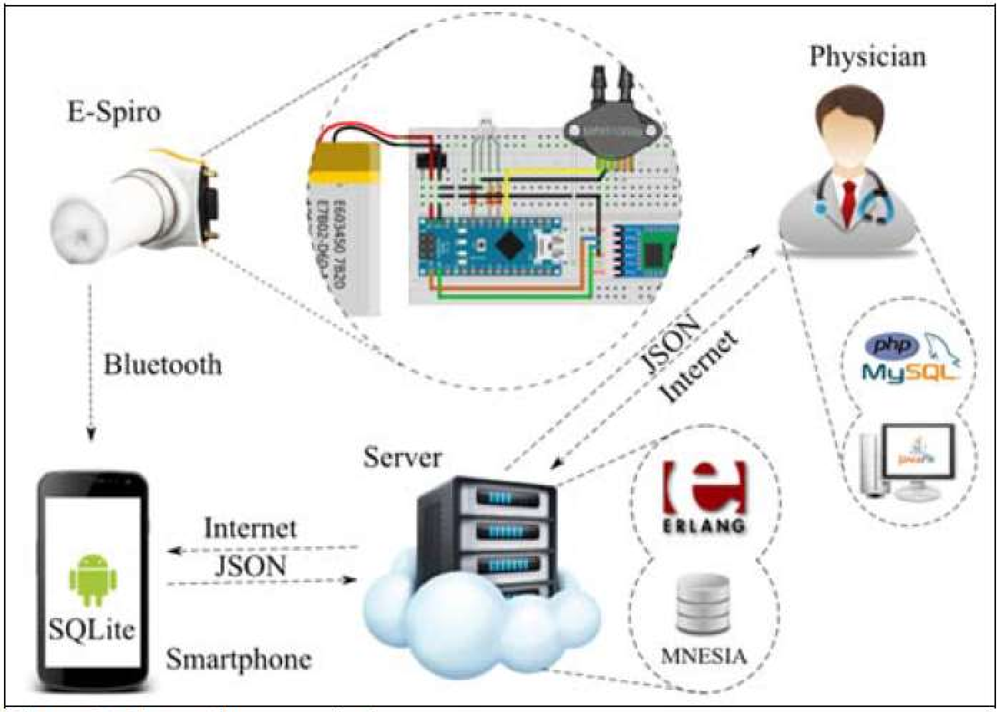


Figure 1. General system design

Clinical diagnosis of Chronic Obstructive Pulmonary Disease (COPD).

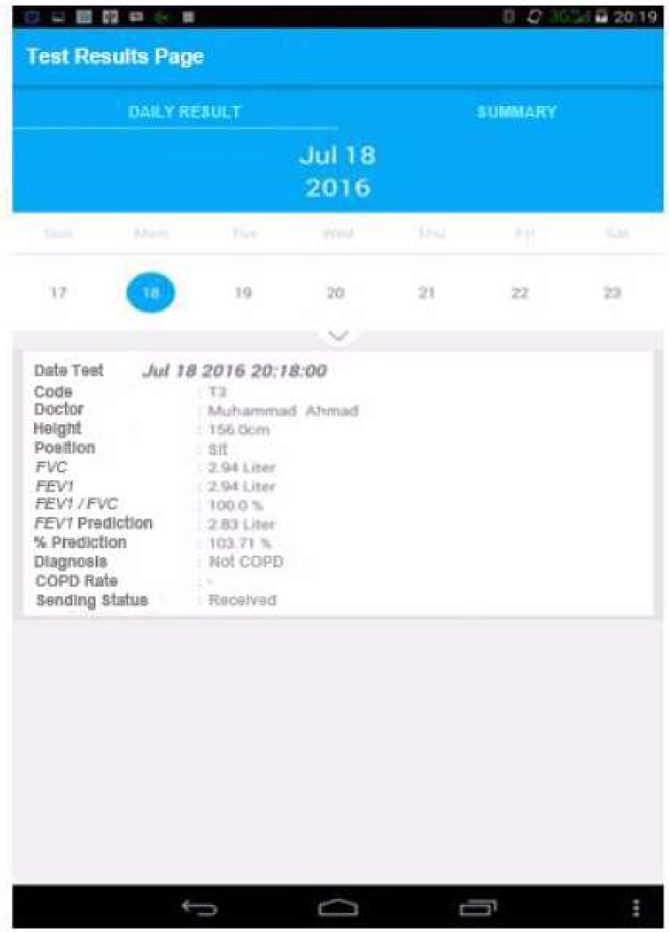


Figure 2. Mobile monitoring result

Building Platform Application Big Sensor Data for e-Health Wireless Body Area Network (International Electronics Symposium (IES), September 2016)

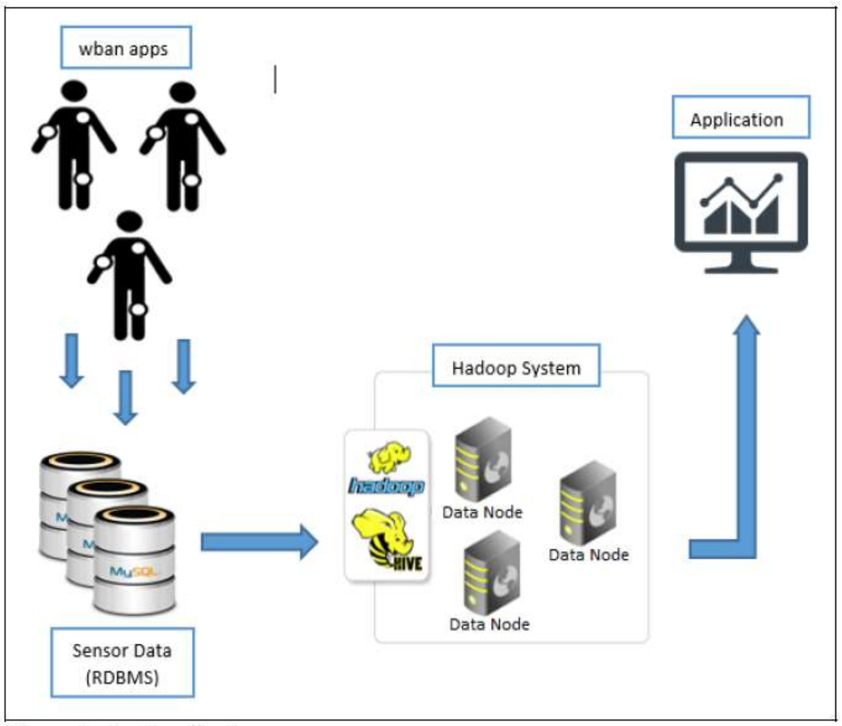


Figure 1. System Design

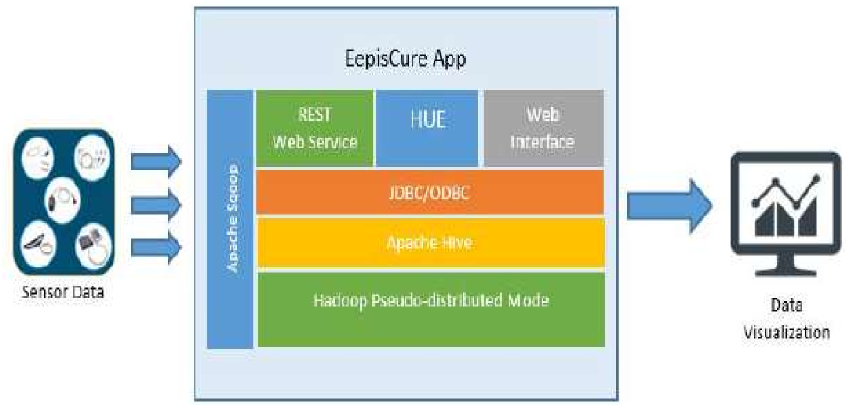


Figure 2. Overall architecture of EepisCure.

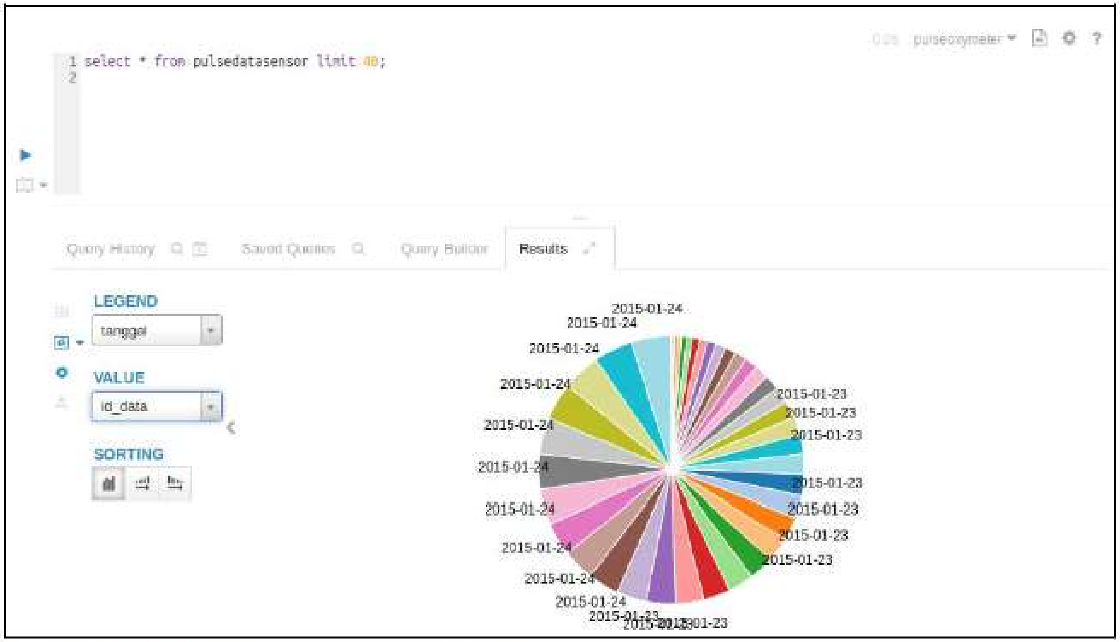


Figure 6. Pulse Data Sensor in Pie Chart

Table 1. Hive and MySQL Table Comparison

LOAD DATA		
Data Size	Hive	MySQL
100 Mb	9 sec	47 sec
400 Mb	74 sec	249 sec
800 Mb	257 sec	1042 sec
1.2Gb	182 sec	1881 sec
COUNT DATA		
Data Size	Hive	MySQL
100 Mb	7 sec	1 sec
400 Mb	17 sec	6 sec
800 Mb	22 sec	13 sec
1.2Gb	27 sec	21 sec

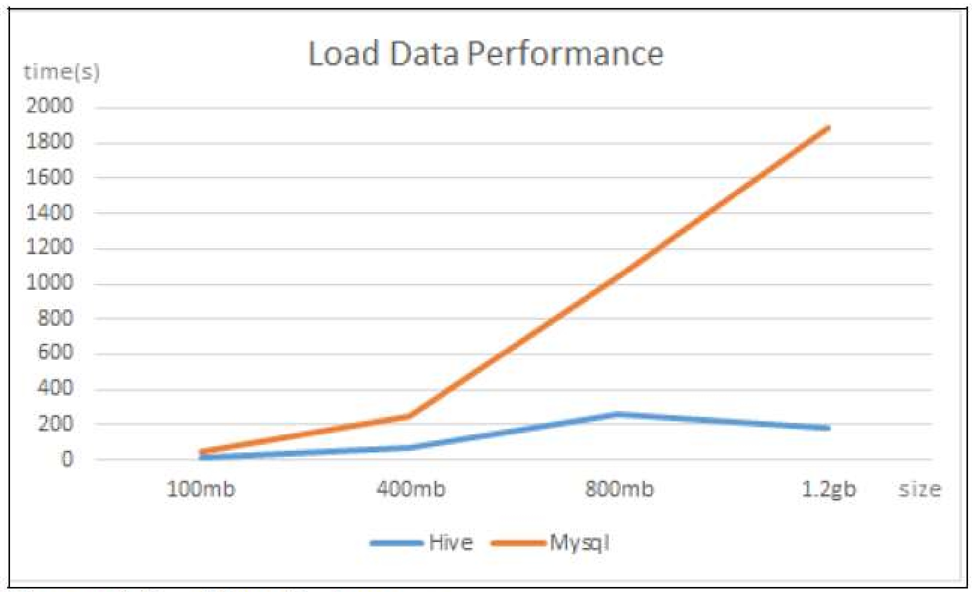


Figure 10. Load Data Performance

Portable Electrocardiogram sensor monitoring system Based On Body Area Network

(2016 International Conference on Consumer Electronics-Taiwan)

- GOAL:

– heartbeat using electrocardiogram (ECG) sensor, Raspberry Pi, mini singleboard computer.

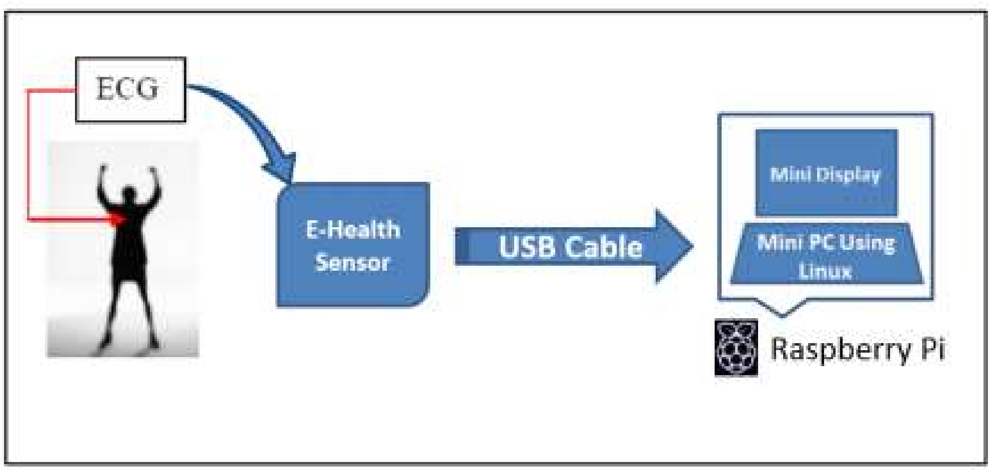


Fig 1. System Architecture of Portable ECG

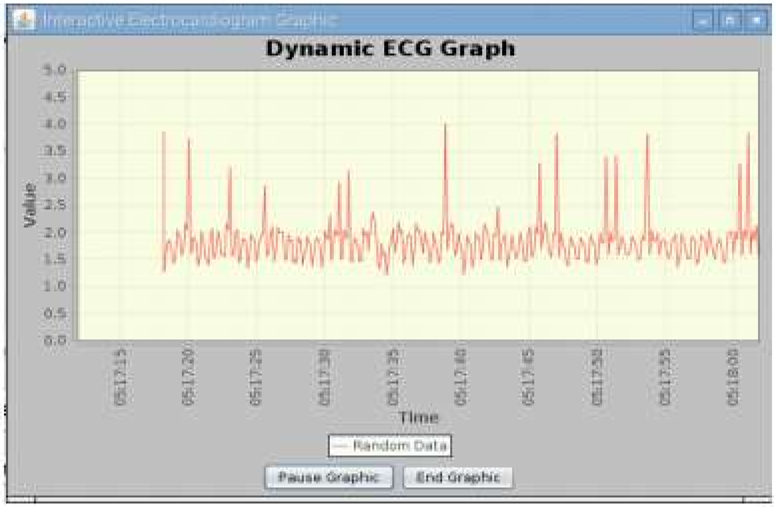


Fig 3. Real-time ECG graphic.

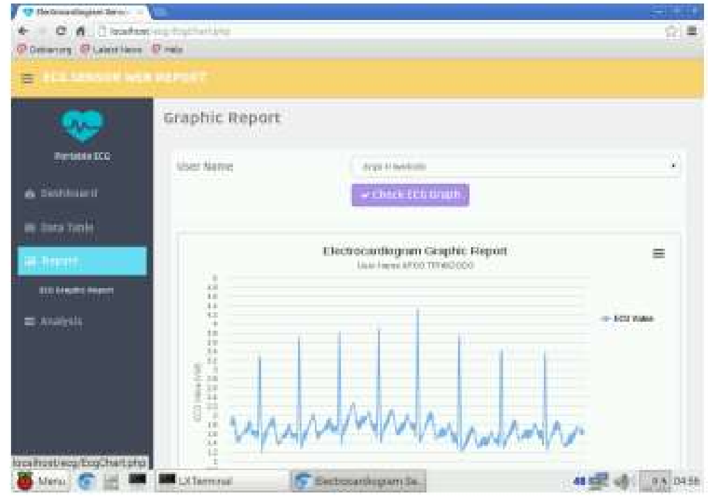


Fig 4. ECG graphic web report.

Fig 2. The assembled system using acrylic box.

Implementation of Blood Glucose Levels Monitoring System Based on Wireless Body Area Network

(2016 International Conference on Consumer Electronics-Taiwan)

- glucometer sensor monitoring, arduino uno board, and zigbee module.

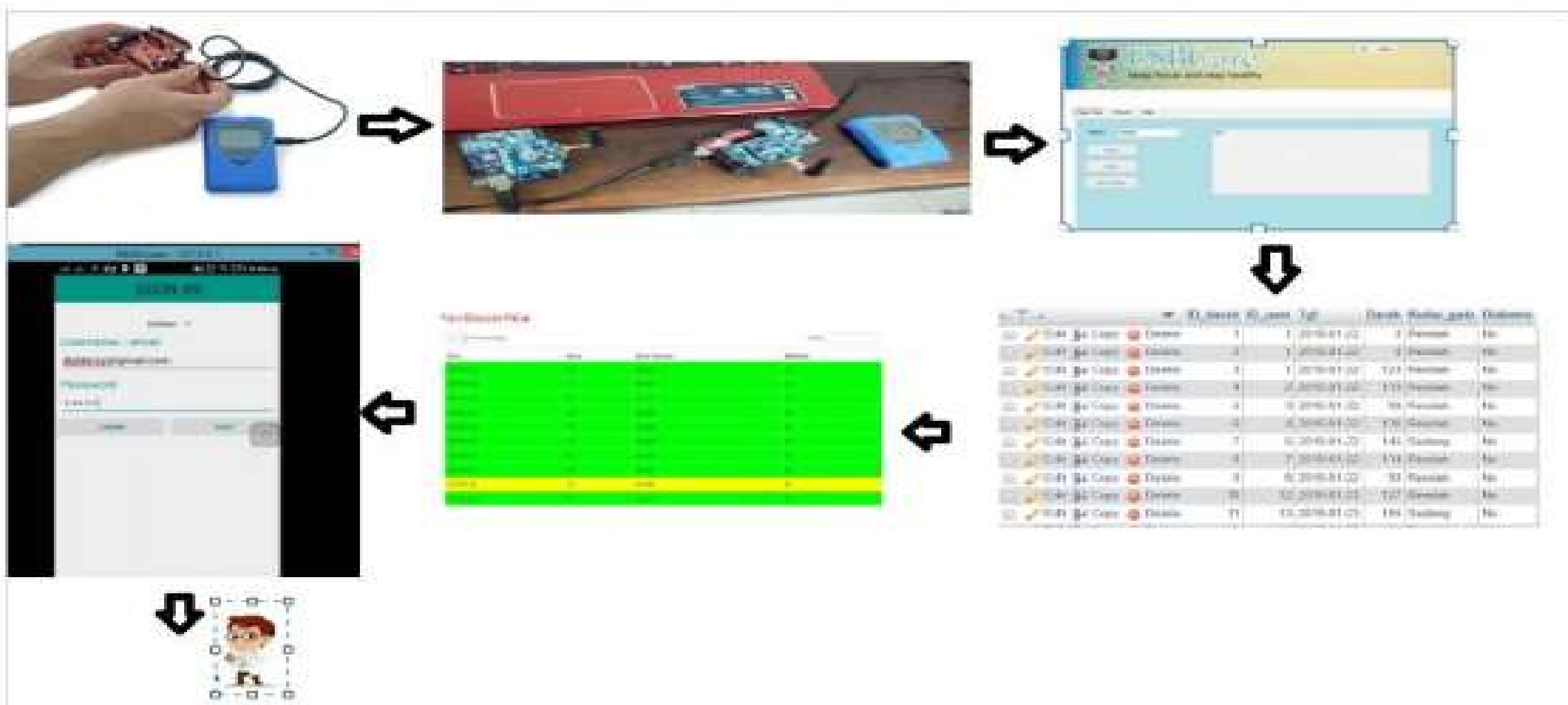
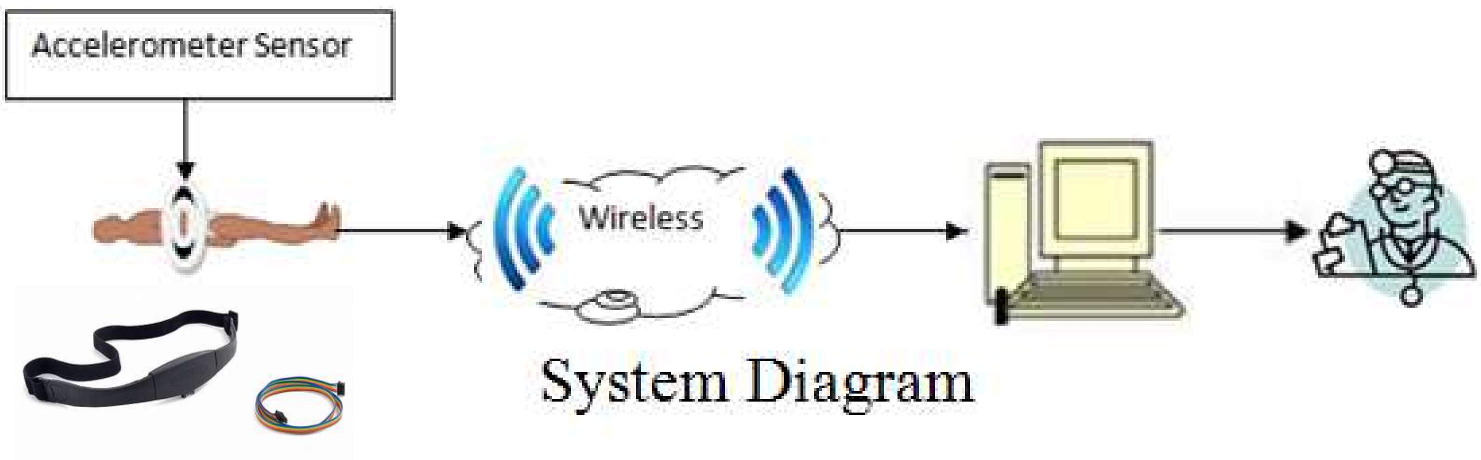


Fig. 1. System Design

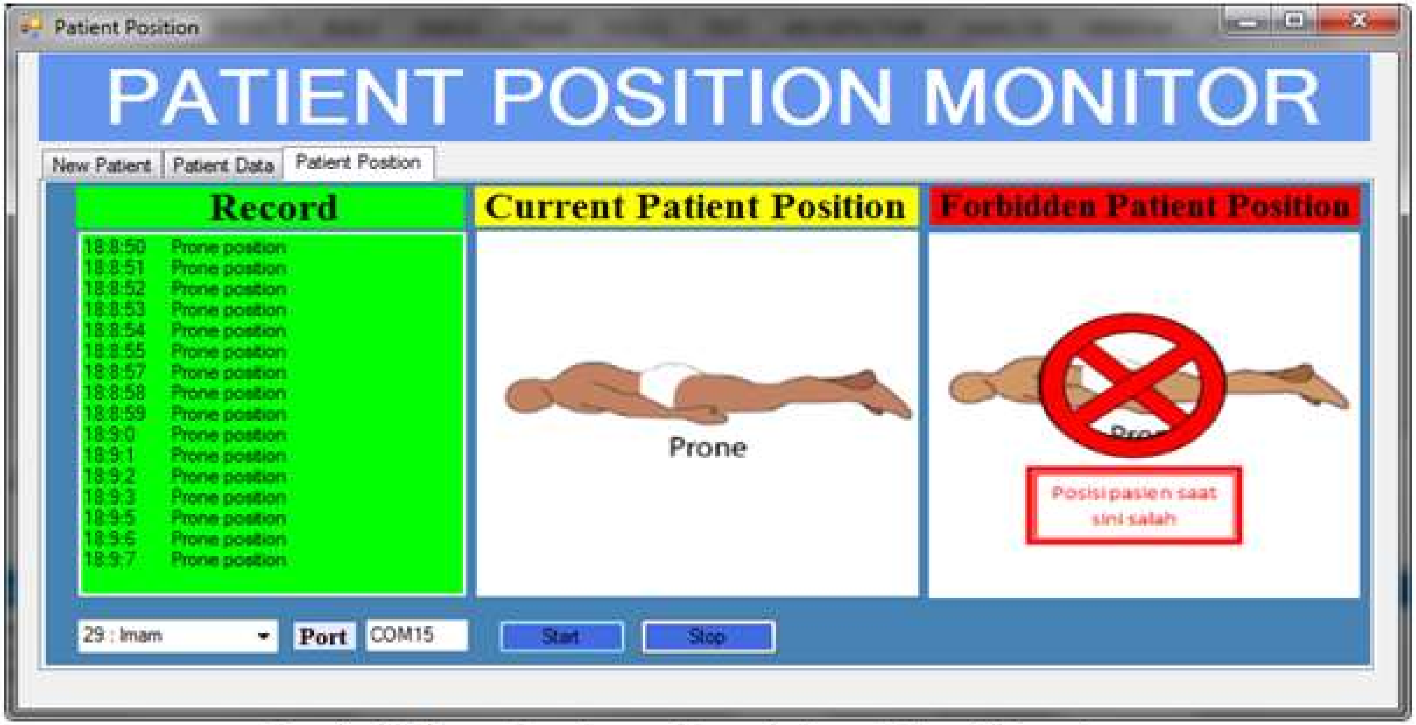
Monitoring System of Patient Position Based On Wireless Body Area Sensor Network

(2016 International Conference on Consumer Electronics-Taiwan)



System Diagram

Input New Patient

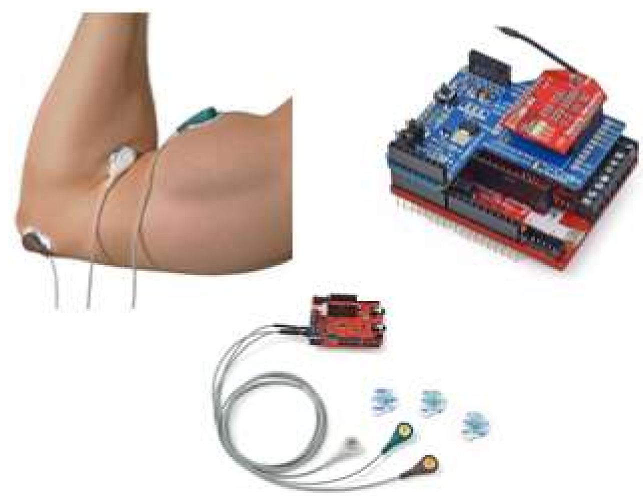


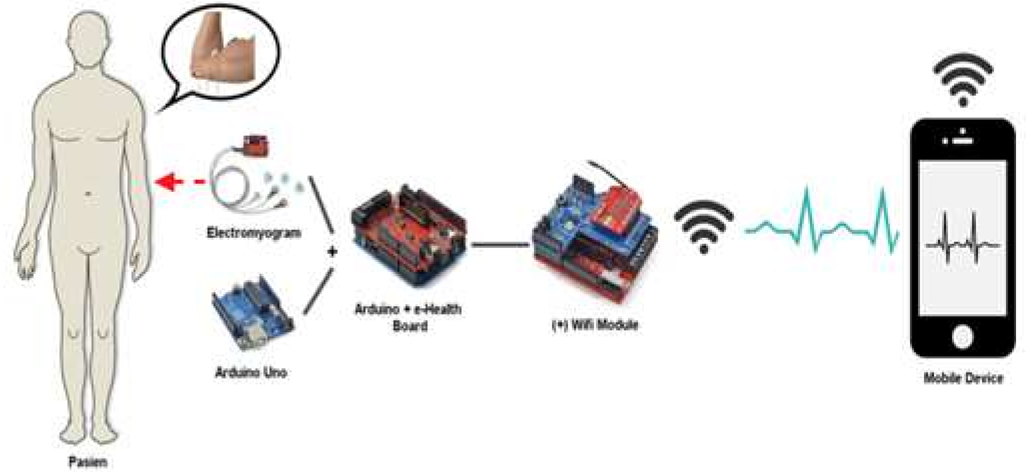
Forbidden Patient Position Notification

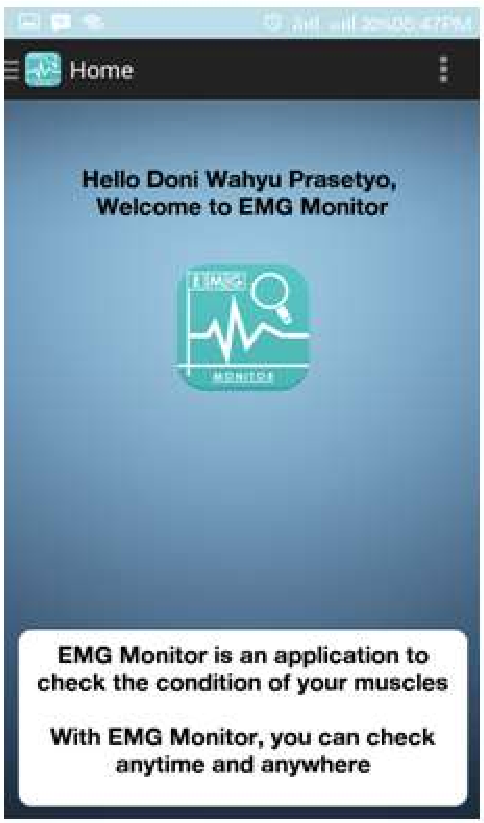
Mobile Monitoring of Muscular Strain Sensor Based on Wireless Body Area Network

(2015 International Electronics Symposium (IES))

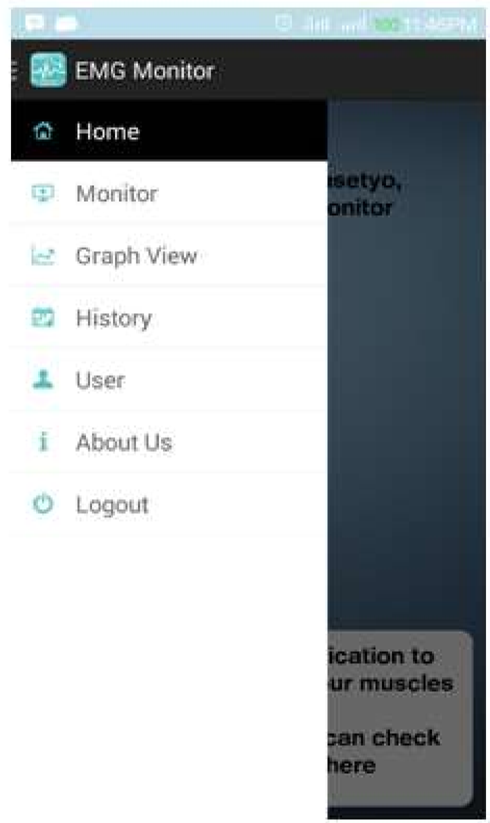
- GOAL:
  - Muscle strain sensor Electromyogram (EMG) monitoring
  - Help doctor or health workers in monitoring patients, athletes and sportsmen in using the Electromyogram EMG to be easilyaccessible and can be carried anywhere.



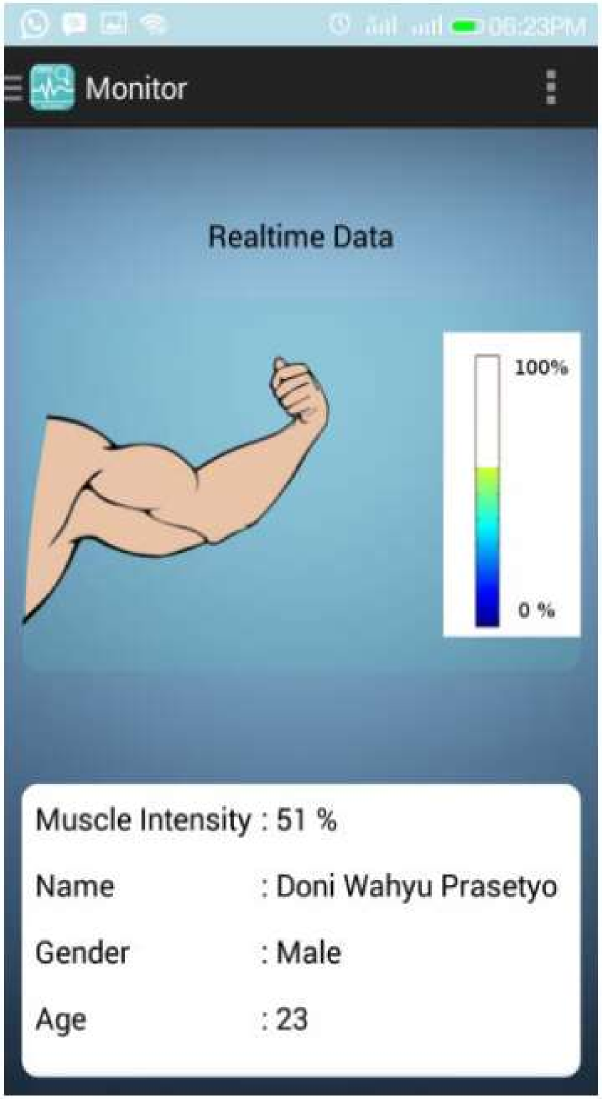




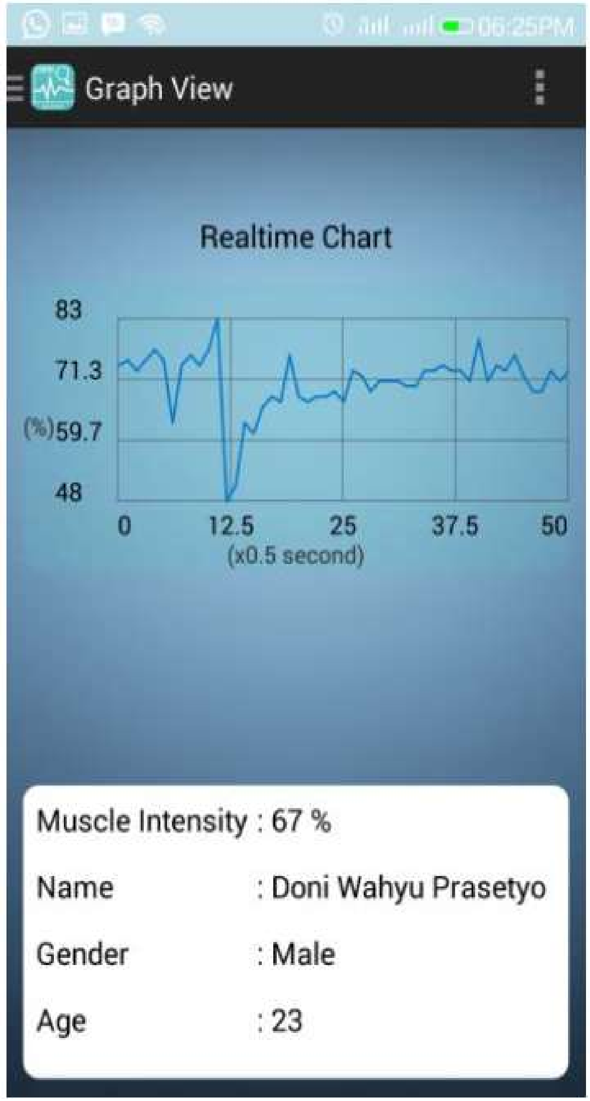
Home Menu



Main Menu



Monitor Menu

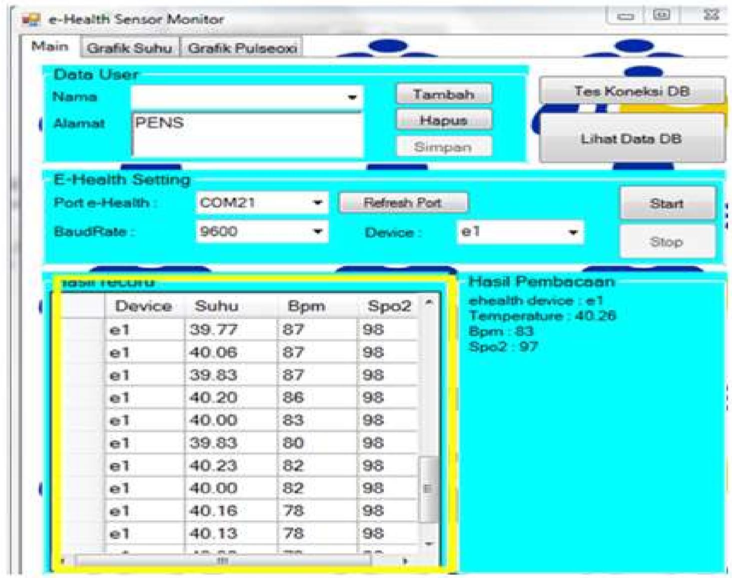


Graph View Menu

History Menu

Wireless Body Area Network for Monitoring Body Temperature, Heart Beat and Oxygen in Blood (2015 International Seminar on Intelligent Technology and Its Applications (ISITIA))

Server Monitoring, Body Control Unit, Body Sensor Unit

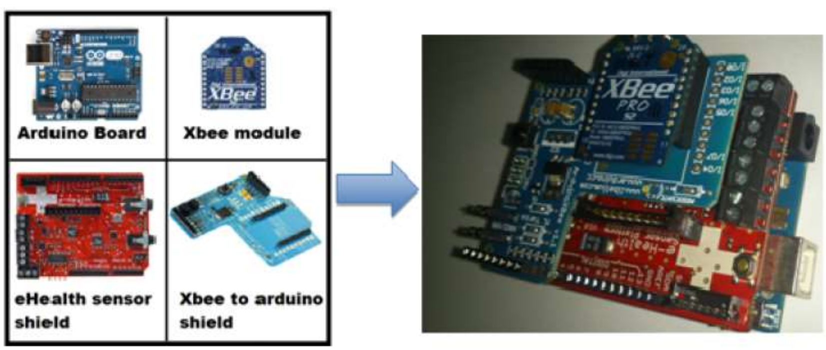


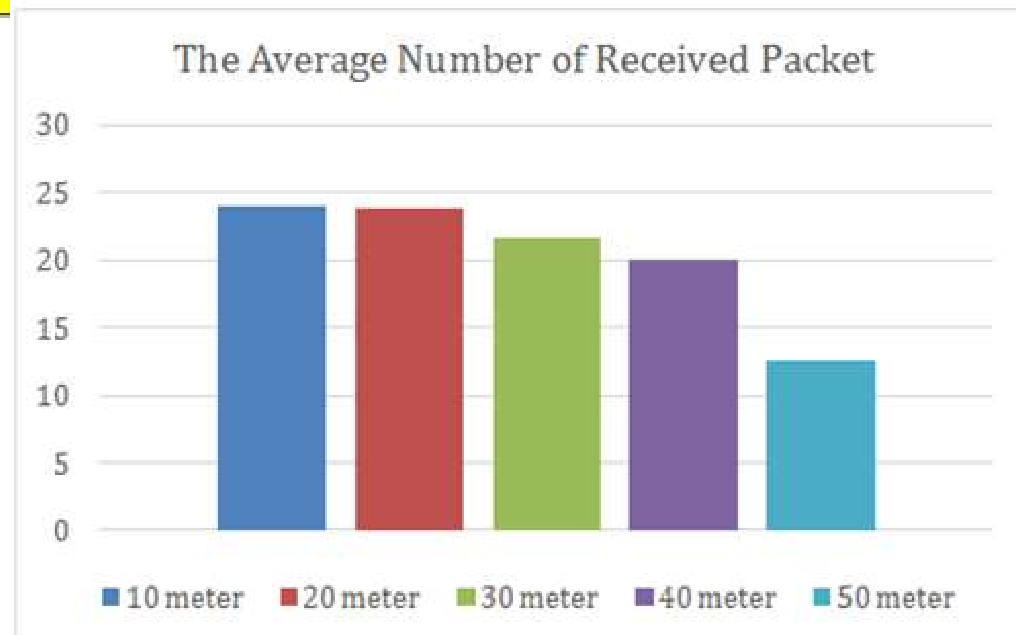
Data Received By Server Monitoring

System Architecture of WBAN

Result Table

	10 meter	20 meter	30 meter	40 meter	50 meter
1st trial	24 packet data	24 packet data	24 packet data	16 packet data	14 packet data
2nd trial	24 packet data	23 packet data	18 packet data	24 packet data	9 packet data
3th trial	24 packet data	24 packet data	22 packet data	24 packet data	11 packet data
4th trial	24 packet data	24 packet data	20 packet data	18 packet data	14 packet data
5th trial	24 packet data	23 packet data	24 packet data	20 packet data	13 packet data
Average	24 packet data	24 packet data	22 packet data	20 packet data	12 packet data





Distance vs. the Average Number of Received Packet

Implementation of Energy Efficiency Based on Time Scheduling to Improve Network Lifetime in Wireless Body Area Network (WBAN)
(EMITTER International Journal of Engineering Technology 2015)

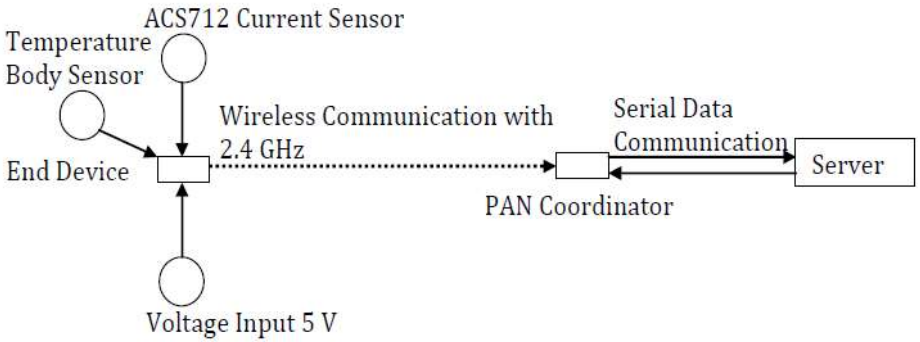


Figure 1. System diagram

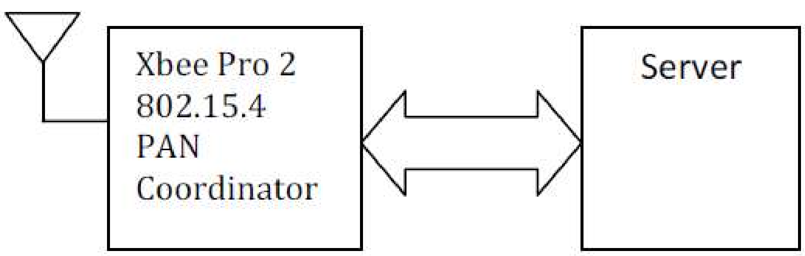


Figure 2. PAN Coordinator system with Xbee 802.15.4 series pro 2

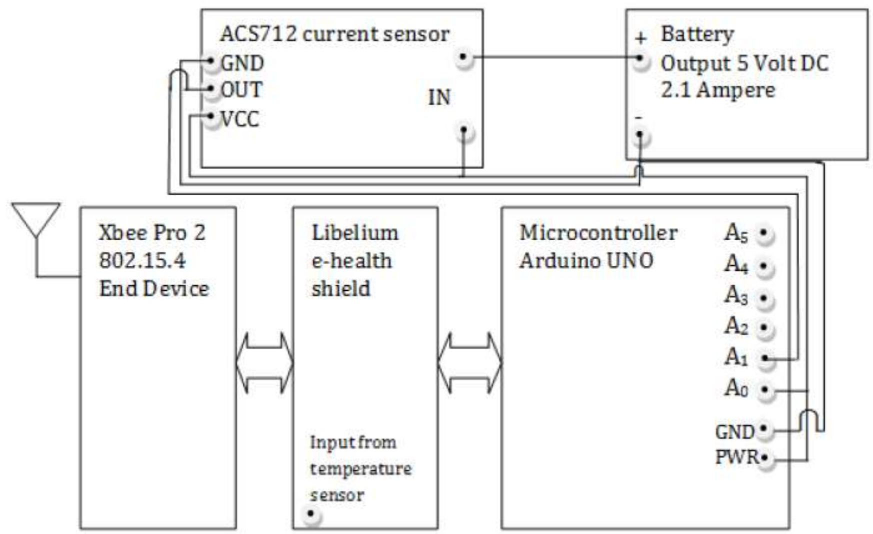


Figure 4. End Device System with Xbee 802.15.4 Pro series 2.

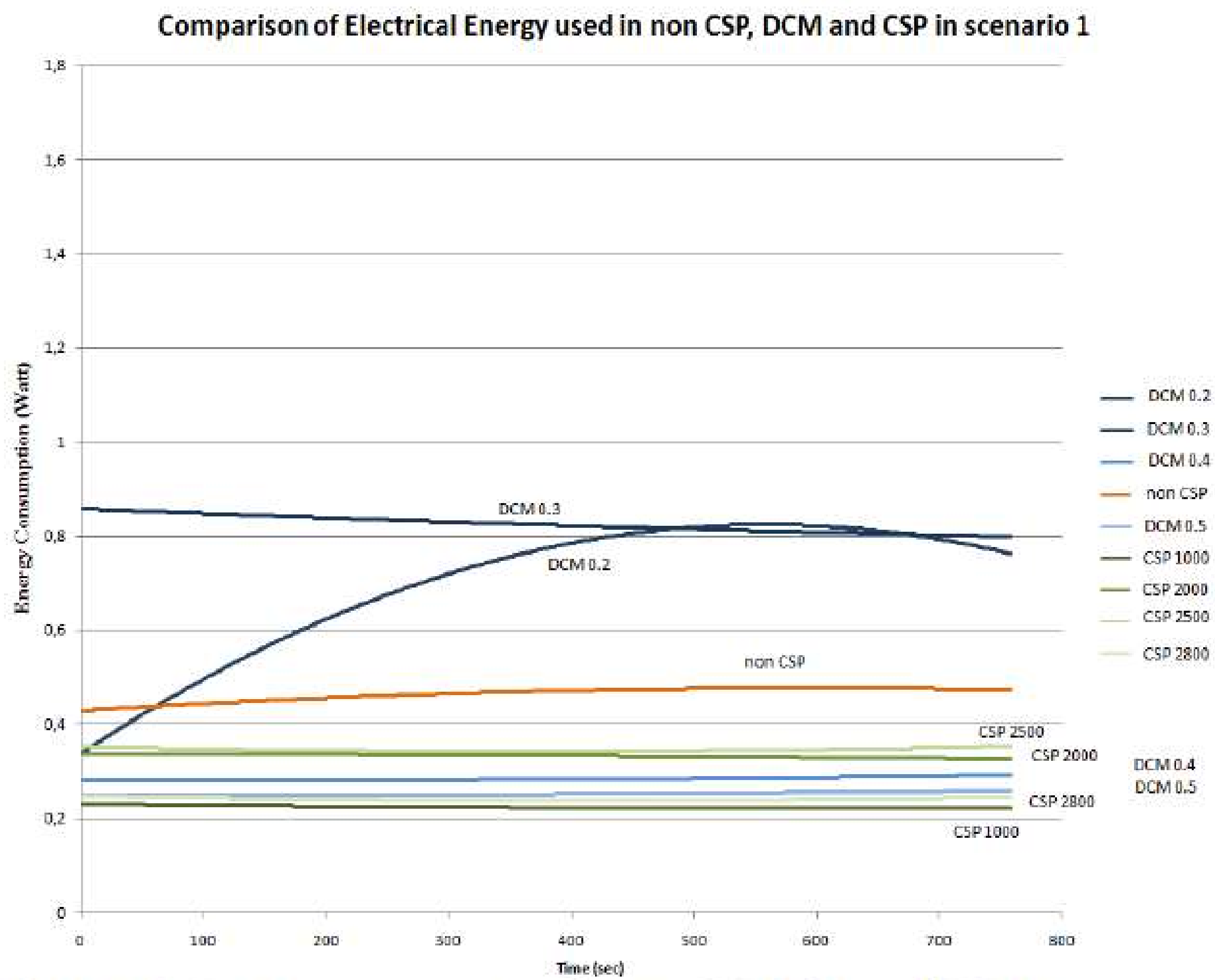


Figure 11. Energy consumption for non CSP,DCM, and CSP in scenario 1

Implementation of Body Temperature and Pulseoximeter Sensors for Wireless Body Area Network (Sensors and Materials, International Journal on Sensor Technology, 2015)

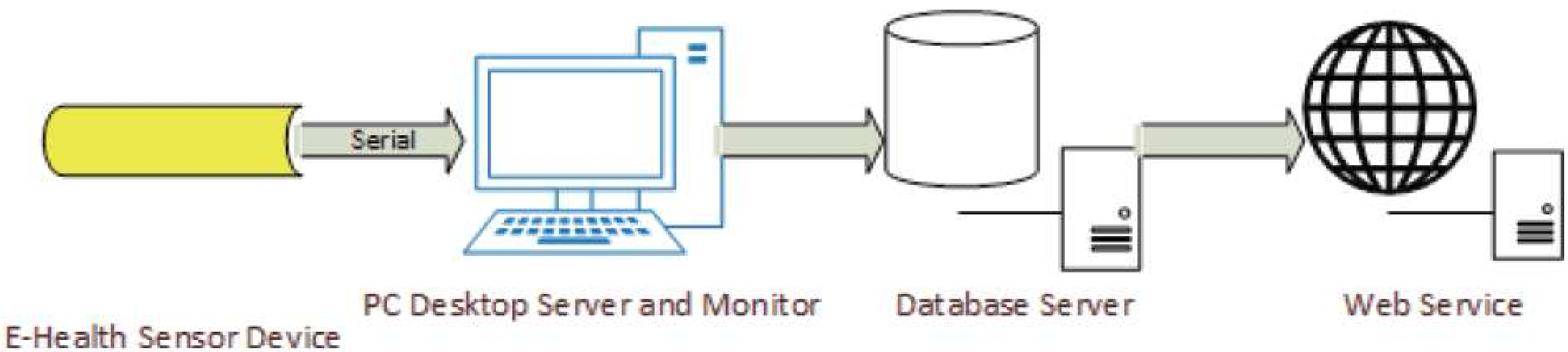
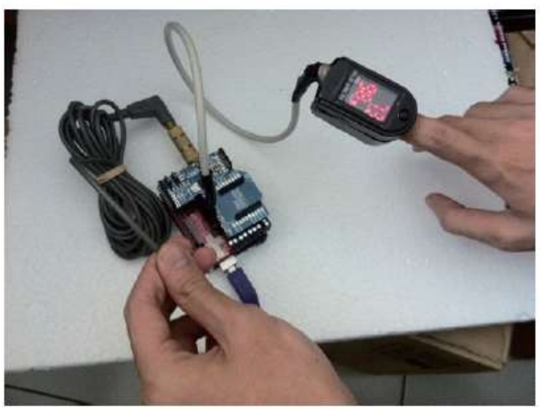


Fig. 1. (Color online) System design architecture.



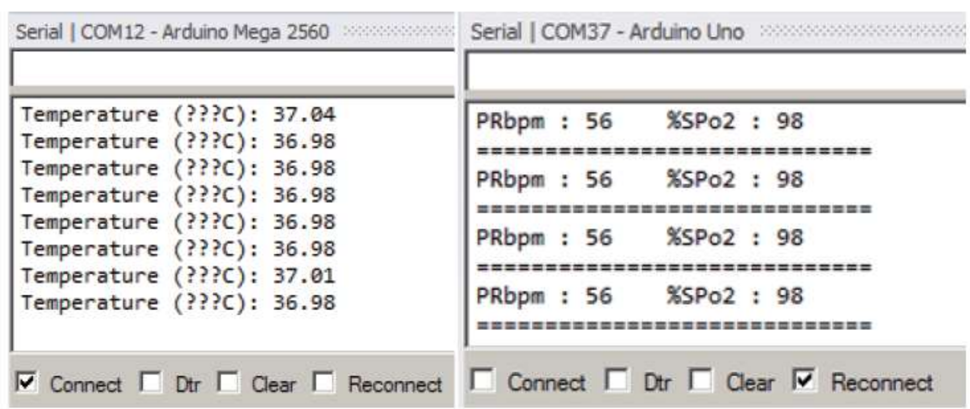


Fig. 2 (left). (Color online) E-health sensor device.
Fig. 3 (right). Body temperature sensor output.

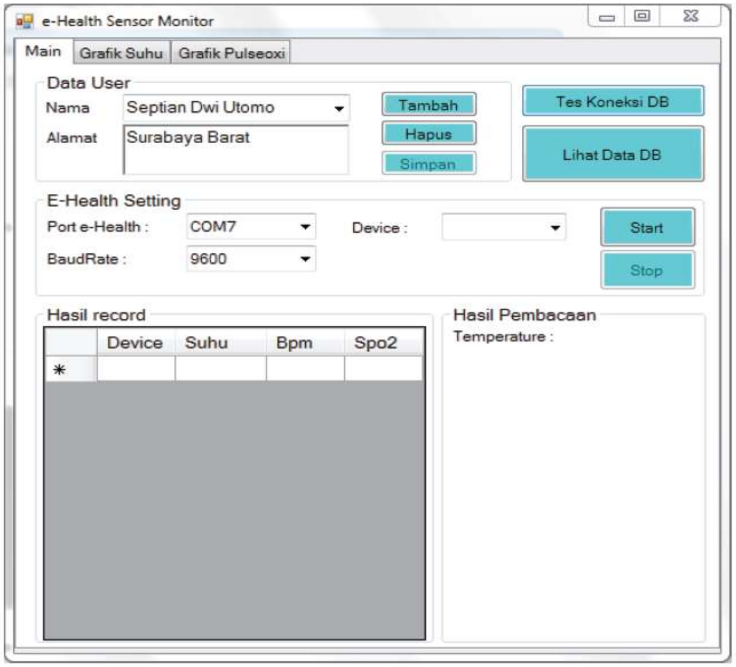
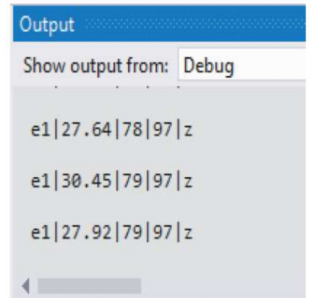


Fig. 4. (Color online) Main application.



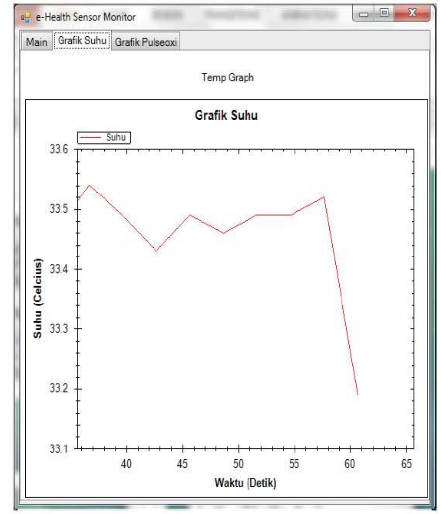


Fig. 5 (left). (Color online) Console version output.
Fig. 6 (right). (Color online) Graph output.