



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 12, Issue 13, April 2023

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Real Time Operating System for Wearable Devices and Implant Techniques

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ABSTRACT: Mobile health technologies offer great promise for reducing healthcare costs and improving patient care. Wearable and implantable technologies are contributing to a transformation in the mobile health era in terms of improving healthcare and health outcomes and providing real-time guidance on improved health management and tracking. We review the biomedical applications of wearable and implantable medical devices and sensors, ranging from monitoring to prevention of diseases, as well as the materials used in the fabrication of these devices and the standards for wireless medical devices and mobile applications. We conclude by discussing some of the technical challenges in wearable devices and implantable technology and possible solutions for overcoming these difficulties.

I. INTRODUCTION

Wearable devices are products controlled by electronic components and software that can be incorporated into clothing or worn on the body like accessories. Nowadays, a variety of wearable devices, such as smart glasses and smartwatches, and so many devices have been invented. Implant techniques is a major tool for regeneration of organs or tissues. It is a medical device manufactured to replace a missing biological structure, support a damaged biological structure, or enhance an existing biological structure using prosthesis. Medical implants are man-made devices, in contrast to a transplant, which is a transplanted biomedical tissue.

WEARABLE DEVICES

“Wearable” means whatever a subject can wear, as sweaters, hats, pants, glasses, bras, socks, watches, patches or devices fixed on the belt, without disturbing the daily activities or restricting mobility. The concept of wear ability is of particular importance in fields like monitoring for healthcare, well being and fitness/sports. Today, there are numerous trendy wearable devices (“Wearables”) but not all of them are capable of measuring or telling us something reliable about our health status. For this we use wearable biomedical sensors to monitor the both physiological parameters and to be worn. Some factors should be considered such as based on conventional electronics, either rigid or bendable, powered by conventional batteries. This includes mobile phone peripherals. It also includes the textiles which are fabricated into electronic devices. In this case, they should be washable, stretchable and foldable and sometimes printable or transparent. Calibration has to be performed and maintained, minimizing the effects of factors like temperature, humidity and motion. Despite these critical features, there is a huge development of wearable devices.

II. BODY AREA NETWORKS

BAN s or body sensor networks (BSN s) are systems composed of a network of wearable devices that can be:

- Implanted in the body
- Placed on the body in fixed positions
- Carried by the person in clothes pockets, by hands or in a bag.

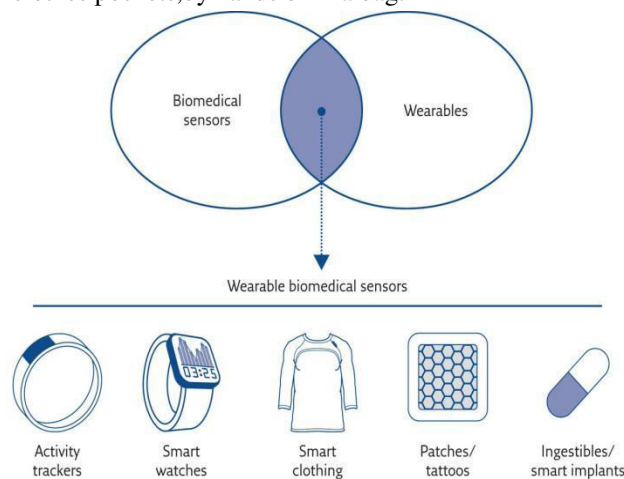


Figure 1 : Wearable Biomedical Sensors in wearable devices

III. ARCHITECTURE OF PATIENT MONITORING SYSTEM USING WEARABLE SENSORS

In a typical architecture of a patient monitoring system using wearable sensors. It can monitor the vital signs of patients using wearable devices at anywhere using gateway devices. The information from the patients can be either stored locally on a monitoring wearable device for later transmission or directly transmitted to a medical Centre where patient's data can be accessed online using the internet independently of the patient's location.

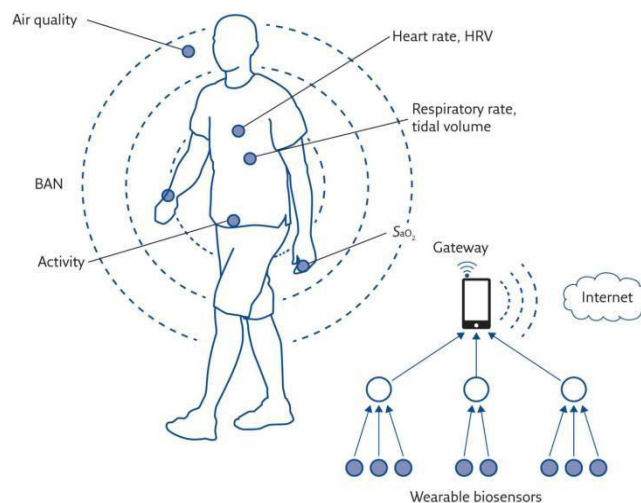


Figure 2: Architecture of a patient monitoring system using Wearable sensors

IV. WEARABLE DEVICES FOR RESPIRATORY ASSESSMENT

Nowadays several wearable devices providing useful information for either assessing and monitoring respiratory function of a patients or providing environmental information that can be of interest for the respiratory system have been introduced.

- Arterial Oxygen Saturation
- Minute Ventilation, Respiratory rate and Breathing pattern
- Physical activity ,Thoracic activity, pulse oximetry
- Air Quality.

A.OXYGEN SATURATION

Pulse Oximetry is a test used to measure the oxygen level of the blood. It is a noninvasive method for monitoring a person’s oxygen saturation.It can be measured using two wavelengths ,typically 660 n m (red) and 940 n m (infrared),and measuring light absorption, which depends on the level of oxygenated and de oxygenated blood (reduced hemoglobin).Two types used. Transmission and reflection oximetry.In Wearable pulse oximeters, motion artefacts and low perfusion are critical however, recent technology are significantly distinguish artefacts from true signals by analysing signal waveform.

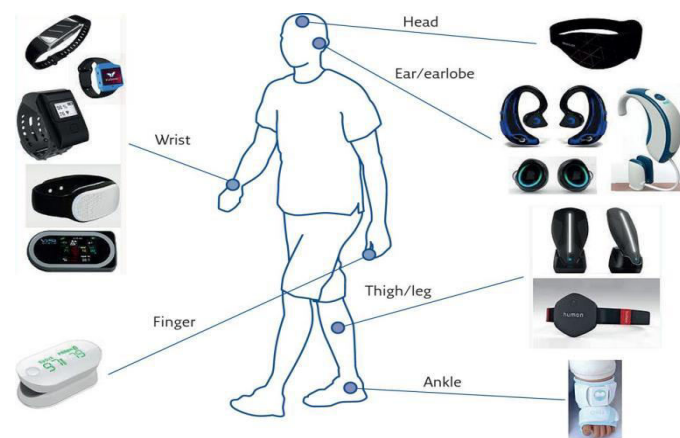


Figure 3: Location on the body of several commercially available wearable devices able to perform pulse oximetry.

Devices can be worn on the wrist like a watch (combined with blood pressure,respiration rate and body temperature).It can also be worn on the head,like the Neuroon device,which is also able to measure electro-oculography, electro-encephalography, motion and temperature, and is therefore particularly used for sleep analysis. A new, interesting trend is to use earphones combining audio features with pulse oximetry.

B.PULMONARY VENTILATION

Although pulse oximetry is fundamental for monitoring the adequacy of ventilation, measuring arterial haemoglobin saturation alone is not enough and it still needs more.

Pulmonary ventilation is the product of respiratory rate and tidal volume (the volume of air that is inhaled and exhaled with each breath).It monitors the inspiratory time,expiratory time ,duty cycle.These parameters are fundamental to assess ventilatory function in a patient.vital signs used to monitor the progression of illness and abnormal respiratory rate. It shows adverse clinical events,such as cardiac arrest or admission to the intensive care unit.As many heart and lung diseases ,such as pneumonia can be monitored.Wearable devices for monitoring ‘babies

'Breath have great impedance.Example of Sensorised garment for neonates, it prevents sudden infant death syndrome and the factors that can cause accidental suffocation. It can monitored the movements of baby on the parent's smartphone or tablet using an app.Another one is using Elastic bands to measure the changes in chest wall circumference either directly or indirectly, the variations of the thoracic and abdominal circumference occurring during breathing are measured through elastic bands that changes their electrical resistance with stretching.Using the fabricated a compression shirt or bra by transfer process or embedded in the textile. Air go it is a device that measures circumference changes with a silver coated adjustable strap worn over the lower floating ribs.Bluetooth device allow data to be collected and either to saved or sent to a remote dice.Real time monitoring of respiratory rate,together with heart rate and motion,can also obtained by a piezoelectric sensor device that can be slipped underneath the patient's mattress.This can also be applied to sleep monitoring at home.Physical activity can also be measured in wearable devices,such as metabolic rate,body temperature,bio mechanical effects.



Figure 4: Location on the body of several commercially available wearable devices able to estimate ventilation from chest and movement of thoracic region.

V. IMPLANT TECHNIQUES

1. INTRODUCTION

An implant is a Medical device manufactured to replace a missing biological structure, support a damaged biological structure,or fixing the prosthesis. These are man made devices. Many implants are prosthetics, intended to replace missing body parts. Other implants deliver medication, monitor body functions, made from skin, bone or other body tissues. Others are made from metal,plastic,ceramic or other materials. Examples: Artificial Heart , Artificial heart Valves, Cardiac Pacemaker and Coronary stent ,leg prosthesis etc...

2. COMMON IMPLANT TECHNIQUES

- Artificial Lens for the Eye (cataract surgery)
- Ear Tubes (for recurrent ear infections)
- Artificial knee/knee Joint Replacement
- Coronary Artery Stents (opens blocked heart arteries)
- Dental Implants
- Bone Fracture (Trauma) Repair:Screws,Pins,Plates
- IUD (Contraception)
- Spinal Surgery:Screws,rods,plates
- Breast Implants

- Artificial Hip/Hip Replacement

VI. DENTAL IMPLANTS

A **Dental implant** (also known as an endogenous implant or fixture): Is a surgical component that interfaces with the bone of the jaw or skull to support a dental prosthesis such as crown, rigid, denture, facial prosthesis or to act as an orthodontic anchor.

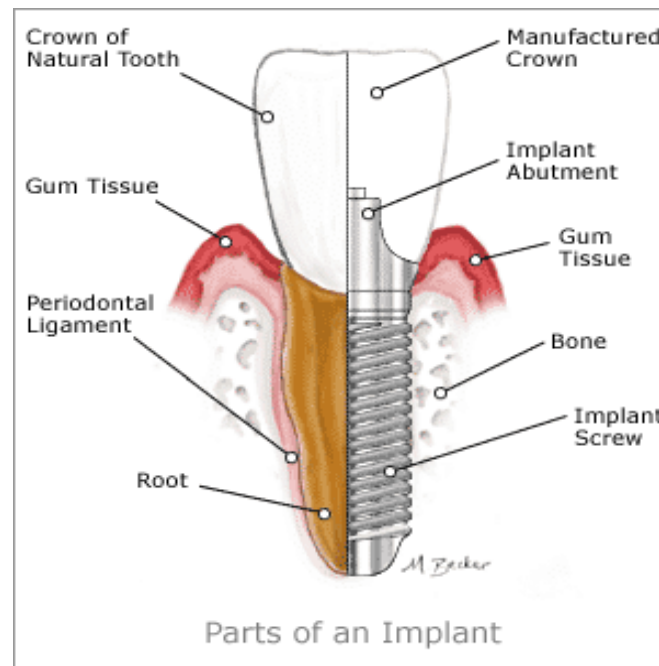


Figure 5: Parts of Dental Implants

VII. TYPES OF DENTAL IMPLANTS

There are three common types of dental implants, they are

- ENDOSTEAL
- SUBPERIOSTEAL AND
- ZYGOMATIC

A. ENDOSTEAL IMPLANT

In this type the tooth roots are replaced by screws, cylinders or blades that are usually made of titanium or ceramic material. The implant is surgically drilled into the jawbone that helps to hold the artificial teeth in that place.

Endosteal Implant



Figure 6: Endosteal Implant

B.SUBPERIOSTEAL IMPLANTS

These Implants use a metal frame designed to fit over the jawbone and beneath the gums. This metal frame has a series of posts that are then used to support the placement of a dental prosthetic like a crown, bridge, or denture.

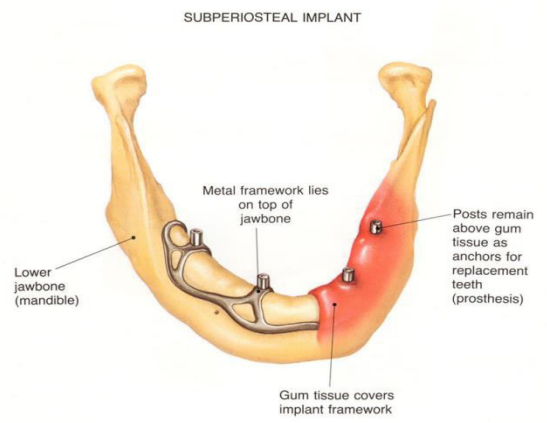


Figure 7: Sub periosteal Implant

ZYGOMATIC IMPLANTS

Zygomatic implants are different from conventional dental implants in that they anchor in to the zygomatic bone rather than the maxilla. They may be used when maxillary bone quality or quantity is inadequate for the placement of regular dental implants.

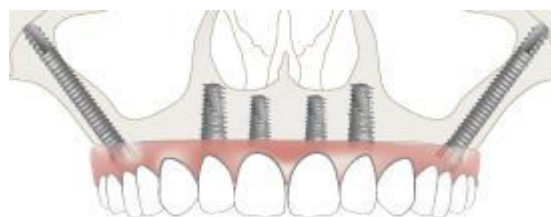


Figure 8: Zygomatic Implant



VII. FUTURE WORK

1. WEARABLE DEVICES

- Some wearable devices are expensive we have to produce low cost devices with same features for Users.
- It can cause serious health issues ,itching of tissues, headaches and dizziness to nervous system damage. This is due to emission of radio frequencies from the devices .
- Avoid Radio frequency devices in wearable technology to produce less radiation .
- Short Battery Life leads to damaging the device, In future chargeable battery should be preferable.
- Check the compatibility to wear the device whether it is comfort or not to the Users.

2. IMPLANT TECHNIQUES

IN DENTAL

- Stem -Cell Research and Nanotechnology
- 3D Printing
- X-Guide Technology
- Painless Insertion of Implants in Teeth
- Designing Low cost Implants

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