VIVA-TECH IJRI ANNUAL RESEARCH JOURNAL
VIVA-TECH INTERNATIONAL JOURNAL FOR RESEARCH AND INNOVATION
ANNUAL RESEARCH JOURNAL
ISSN(ONLINE): 2581-7280

Wearable Device in Medical IoT

Rahul Ankush Dalvi[1], Kaushik Yatin More[2]
[1](MCA, VIVA Institute of Technology/ University of Mumbai, India)
[2](MCA, VIVA Institute of Technology/ University of Mumbai, India)

Abstract : *Health is one of the most important aspects of life. Still, people still could not get proper health services. It's caused by limitation to the used technology in hospitals and limitations to get to the hospital. Internet-of-Things (IoT) as one of the utmost trending motifs presently, formerly giving so many results in many ways, for example, in healthcare. Wearable devices are currently at the heart of just about every discussion related to the Internet of Things. The requirement for self-health monitoring and preventive medicine is increasing due to the projected dramatic increase in the number of elderly people until 2020.Developed technologies are truly able to reduce the overall costs for prevention and monitoring. This is possible by constantly monitoring health indicators in various areas and in particular, wearable devices are considered to carry this task out. These wearable devices and mobile apps now have been integrated with telemedicine and telehealth efficiently, to structure the medical Internet of Things. This paper reviews wearable health care devices both in scientific papers and commercial efforts.*

Keywords - *Delivering of health care, Information Storage and Retrieval, Internet, Mobile Application, Smartphones, Telemedicine*

I. INTRODUCTION

The Internet of Things (IoT) is a new conception, furnishing the possibility of healthcare monitoring using wearable devices. The IoT is defined as the network of physical objects which are supported by bedded technology for data communication and detectors to interact with both internal and external objects countries and the terrain.

In the last decade, wearable bias has attracted important attention from the academic community and assiduity and have lately come veritably popular. The most applicable description of wearable electronics is the following "bias that can be worn or slept with mortal skin to continuously and nearly cover an existent's conditioning, without interposing or limiting the stoner's movements".

Moment, the range of wearable systems, including micro-sensors seamlessly integrated into fabrics, consumer electronics bedded in fashionable clothes, motorized watches, belt- worn particular computers (PCs) with a head mounted display, spectacles, which are worn on colorful corridor of the body are designed for broadband operation. The field of wearable health monitoring systems is moving toward minimizing the size of wearable bias, measuring further vital signs, and transferring secure and dependable data through smartphone technology. Although there has been an interest in observing comprehensive memoir/non-bio medical data for the full monitoring of environmental, fitness, and medical data lately, but one egregious operation of wearable systems is the monitoring of physiological parameters in the mobile terrain. The maturity of commercially available wearable bias are one- lead operations to cover vital signs. Still, utmost of similar recreational bias is not suitable for the medical monitoring of high threat cases. Those bias that have been qualified for medical use are generally simple.

The ideal of this paper is to review wearable health care bias both in scientific papers and marketable sweats. Our end is to address the most important wearable bias, which measure effective parameters in health status directly. Compendiums can gain comprehensive and useful information on the most dependable presently available bias and specialized generalities in this area. Conclusion are eventually epitomized with suggestions for unborn workshop.

II. WEARABLE DEVICES ON HEALTH MONITORING

In today's world, where time is precious, people, the working class especially, spend most of the day shuttling between various tasks and tend to ignore their health and fitness. Even a simple appointment with a doctor in a clinic can require several tests set for diagnosis, prescription, and finally treatment, which can take a lot of time. Therefore, many patients only go to a clinic when they are suffering from a serious illness. Hence, many people are seeking for an alternative, such as a device that can be worn on the body, which would not only continuously monitor the user's health in real time but also provide timely insights on various health parameters to the user as well as his or her physician.

2.1. Motion Trackers

The dimension of human movement (motion tracker) has several useful operations in sports, medical, and other branches of studies. Similar operations include fall threat assessment, quantifying sports exercise, studying people habits, and covering the senior. Wearable trackers are getting decreasingly popular for two main reasons. They can motivate the stoner during the diurnal drill to perform further exercise, while furnishing exertion dimension information through a smartphone without homemade computation. Also, they enable the wearer to come apprehensive of the diurnal distance walked, which is veritably useful to insure that the stoner maintains sufficient exertion in the diurnal routine to maintain a healthy life. In particular, to directly observe stir of the mortal body, 3- axis accelerometers, magnetometers, and gyroscopes detectors gain data, each for a specific purpose. These detectors can be used for mortal exertion recognition in the ubiquitous computing sphere as well. Gyroscopes and magnetometers are supplementary detectors that can be independently be combined with accelerometers to compensate the lack of delicacy in attained data for stir shadowing. In utmost cases, the combination of these three detectors lead to 9DoF.

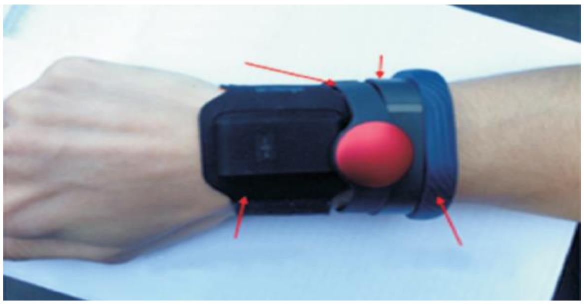


Fig2.1 Motion Tracker

2.1.1 Motion measurement in body tracking

A new design was presented by Bertolotti etal. (26) to ap- bias for objective measures of box or branch movements for the assessment of mortal body balance and control capacities. This system is grounded on a 72 MHz, 32- bit CPU (STM32F303VC; STMicroelectronics, Geneva, Switzerland) bedding a high performance ARM CortexM4, 32- bit RISC core, with the eventuality of supporting several detectors externally with high performance in both SPI and I2C mode. In this exploration, the detector factors (STMicroelectronics detectors) have a direct range and a perceptivity that allow mount-er dimension of body movements. Online processing, in the sense of data accession from different detectors, altering, and data generation are performed at a high frequency of over to 72 MHz Body movements are measured using 9DoF detectors three inertial detectors, an accelerometer, a magnetometer, and a gyroscope. The full-scale values of the detectors can be modified by means of specific commands transferred by the microcontroller

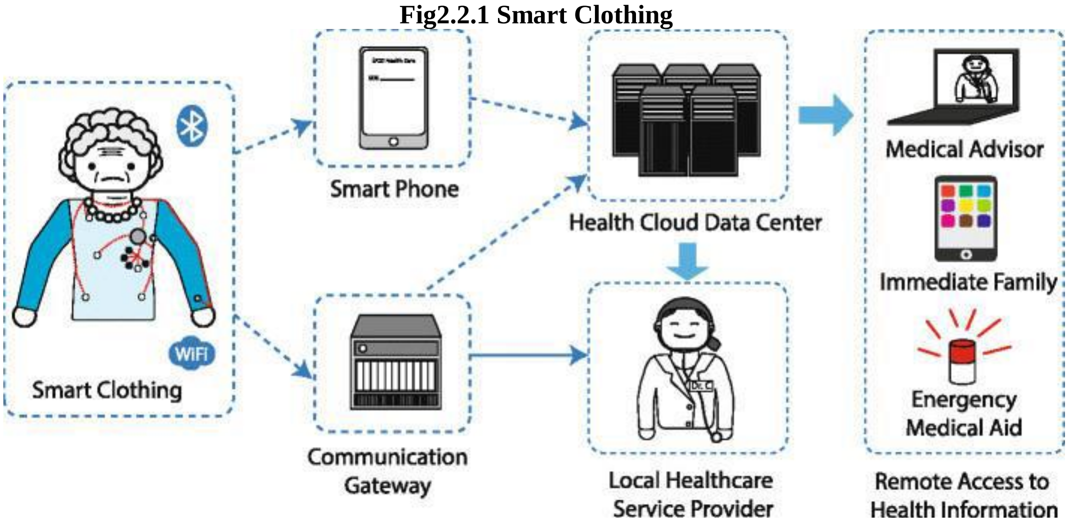
2.2. Vital Signs Measurement

Numerous wearable devices have been enforced to measure critical rudiments in healthcare monitoring. The maturity of these devices are in one lead similar as electrocardiogram (ECG) and electroencephalogram (EEG) dimension, skin temperature, etc. There have been recent sweats in wearable bias to give multi-task vital signs dimension. Then, we present the most creative and recent papers in this area. Numerous bias, structures, designs, and results for remote wearable ECG monitoring, which plays a vital part in health monitoring have been proposed in the literature and assiduity. Generally, these results are hard to apply and aren't effective enough in power consumption or performance. Some of them are remarkable but don't have the possibility of incorporating with other out signals from different system.

2.2.1 Body-worn smart clothing

To gain health care status's signals from colorful physiological pointers due to forming a source data center for comprehensive health monitoring, a 'smart apparel' design was presented in. To make smart apparel systems intelligent, a structure incorporating smartphones, mobile operations, pall computing, and big data logical is needed to communicate in the structured design. Although several exploration approaches in the field of health monitoring have been proposed and enforced, the being results in different aspects have failed for long term health monitoring. Traditional health monitoring, which frequently collects one or a veritably limited number of physiological signals, isn't veritably useful for habitual conditions in a full- range health monitoring system. Detector deployment on the body is the main difference between old wearable bias and smart apparel. In smart apparel, all detectors which are used to measure the vital signs are integrated into cloth apparel. Detector placement is a critical point that has to be performed duly. To give effectiveness and a well- formed design, the quality of the used detectors, proper positioning, layout of flexible electricity string, weak signal accession outfit, low- power wireless dispatches, and stoner comfort are pivotal factors. The fabric of the smart apparel to be worn, has to be comfortable. In this design, it has been tried to measure only vital and necessary parameters. Now the used sensors and also the location they are placed on the body are described below.

Fig2.2.1 Smart Clothing



III. METHODOLOGY

3.1 Wire-based wearable devices: limited physiological and environmental parameters measurement

In this, a new approach to medical monitoring was introduced by Sanfilippo and Pettersen. The methodology is line- grounded and numerous vital signs are measured. This wearable intertwined health-monitoring system is grounded on the e-Health Sensor Platform (48) V2.0, which is the first biometric guard for Arduino and Raspberry Pi Still this device isn't certified for medical health monitoring. The system allows experimenters to measure and probe health through body monitoring by using 10 detectors to observe vital signs and perform stir shadowing. EEG, ECG, and body temperature dimension are carried out by these detectors, which are connected to the platform. A drive button is considered for exigency cases. Collected data are used in two scripts. In the first, the stoner is covered in real time, and in the alternate, sensitive data are transmitted to be anatomized for medical opinion.

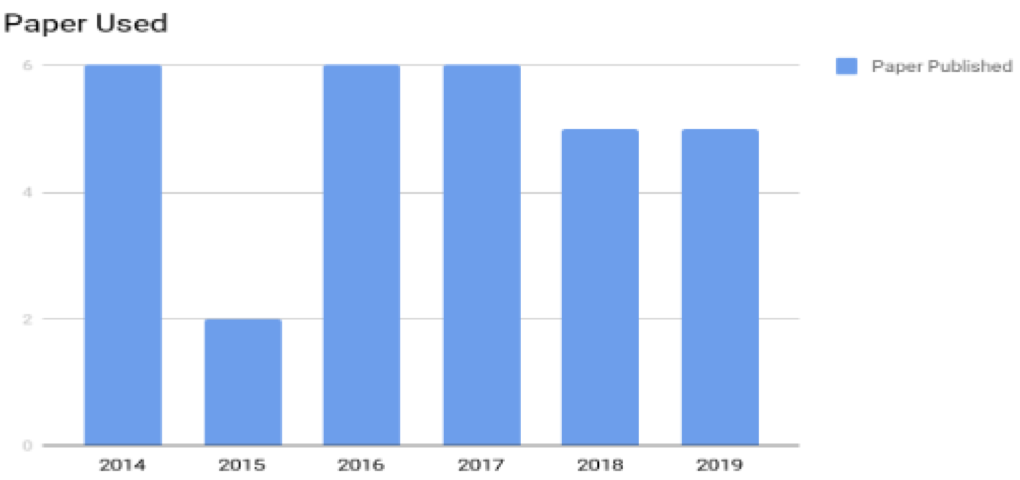
In this paper, a wearable health detector monitoring system grounded on a multi-sensor emulsion approach is outlined. The enforced device consists of a casket-worn device that embeds a regulator board, an ECG detector, a temperature detector, an accelerometer, a vibration motor, a color- changing light- emitting diode (LED), and a drive- button. The bedded vibration motor makes it possible to actuate distinctive haptic feedback patterns according to the wearer’s health state. Haptic feedback, informs the wearer about his or her health status in three different countries. When it does not joggle, it indicates a normal state; through low- frequency and high-frequency vibration, abnormal data observation and implicit threat are indicated, independently. To address sequestration enterprises, data is translated before transmission. Data collected for endless storehouse are transferred to pall storehouse, while data to be imaged in real- time, are transferred directly to a laptop or smart phone. The structural frame is grounded on a multi-sensor emulsion approach. In particular, a customer garcon pattern is espoused. A casket-worn device, comprising an Arduino Uno board Grounded on the ATmega328micro-controller, an Arduino Wi-Fi Shield-Health Sensor Shield, a wobbling motor, and push button, operates as a customer and ever communicates with a garcon. The garcon is enforced in three Situations of sense and communication. The device structure is enforced in three layers (Figure 3.1). The bottom and introductory sub caste is Arduino ATmega328. To enable communication capabilities to this proposed wearable device, an Arduino

Wi-Fi Shield (50) is piled on top of the espoused regulator board, which forms the alternate sub caste. In detail, the Arduino Wi-Fi Shield allows the customer to communicate with the garcon by using the802.11 wireless specification (Wi-Fi) (48). The communication between the Arduino Wi-Fi Shield and the Arduino Uno board uses long wire wrap heads that extend through the guard. The third and top sub caste is enforced when the wearer's biometric data are gathered, and an-Health Sensor Shield (51) is piled on top of the espoused communication module.

3.2 Review

In this section, the literature review method is discussed. The review is started by deciding the keyword that will be used when searching for the references. The literature related to one of these topics: IoT, wearable device, healthcare, sensor, and disease. All the decided keywords are "wearable device in healthcare", "wearable device for Parkinson", "wearable device for blood pressure", and "wearable device for breathing". All of the literature used in this review was searched from online search engines such as Google, Google Scholar, and IEEE Xplore. We prioritize literature from reliable publishers to be used in this review, such as IEEE, Elsevier, and Springer. The problem is that many journals were published more than five years ago. It means the journal is not suitable as references for this review. After filtering the references based on the relevance and published year (last five years), we find results: literature published in 2014 (6 paper), published in 2015 (2 paper), published in 2016 (6 paper), published in 2017 (6 paper), published in 2018 (5 paper), published in 2019 (5 paper).

Fig3.1 Number of related paper published this year



3.3. General Architecture

In this, not all papers use the same type of armature but utmost use armature like thisFig. 2 shows the complete general armature of wearable-IoT for healthcare. The armature consists of the wearable detector, mobile device, mobile network, and the medical pall platform. The data attained from the detector is transmitted to a mobile device via Bluetooth or Wi-Fi. Mobile device acts as an edge device thatpre-processes the detector's data before transmitted to the medical pall platform via a mobile network. In the medical pall platform, data analytics and data storehouse are conducted. The sapience from data analytics will be transferred to the mobile operation to give druggies sapience into their health.

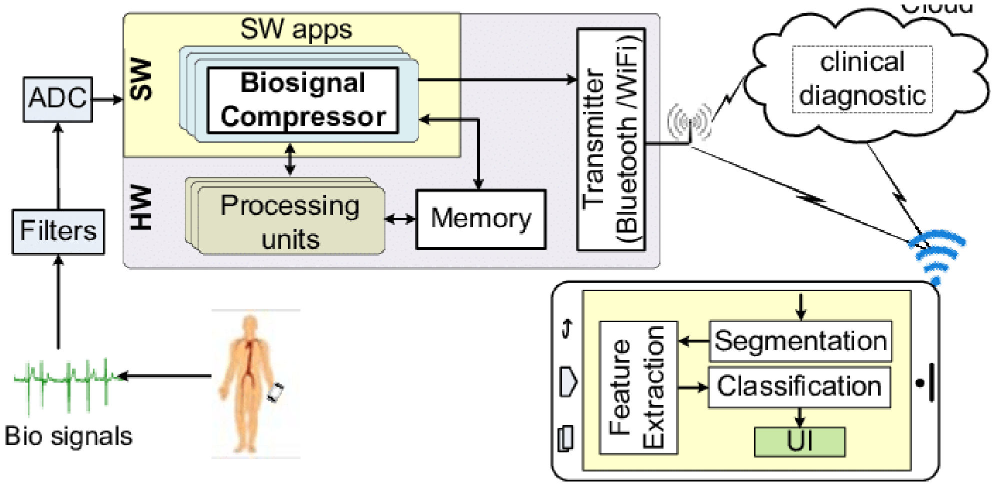


Fig 3.2 Architecture of Wearable devices

IV. CONCLUSION

Wearable devices are getting popular in colorful fields from sport and fitness to health monitoring. In particular, due to the adding senior population throughout the world, wearable devices are getting important for long term health monitoring. The main end of this work was to give a comprehensive overview of this area of exploration and to report the full range of tools in area of wearable health monitoring bias. In this review paper, we've reported both exploration workshop and marketable bias to study and probe the presently available technology. In preparing this paper, we studied the literature from colorful points of view. Grounded on discussion with expert scientists in environmental engineering and drug, we believe that, stir trackers, gas sensors, and vital signs are the most important rudiments in health monitoring; thus, to achieve the full range of health monitoring, all these parameters were studied. In each field, a variety of methodologies are employed, but not all are effective and effective. The most important criteria in this study was the possibility of using the device in the real world, performance, effectiveness, and power consumption. In addition, we considered the price of each device. Among all enforced workshop so far, no effective result has been proposed for comprehensive monitoring in gas discovery, stir shadowing, and vital sign monitoring to integrate all these into a single device. It might be possible to realize this in unborn work by creating a system with following

characteristics

-#MULTIPLE detectors on ONE detector knot,

. -#MULTIPLE bumps on ONE existent,

. -#MULTIPLE individualities on ONE pall system.

Monitoring of an individual with number of parameters in his working/ living terrain is possible. Also, computational models and software development for data encryption and data contraction have to be delved for further effectiveness. In the first script over, which seems to be the stylish approach, there are serious restrictions in available detectors. To realize this wearable possibility, applicable factors must be located duly and must serve well. In the alternate script, tasks can be devoted to each knot. For case, stir shadowing detectors can be enforced on one detector knot, and vital sign monitoring can be enforced on another. The third script is incorporating of the first and alternate methodology, which could widen the range of druggies and the range of practical operation.

Acknowledgements

We thank the Head of Department and all the members of the Master of Computer Application department of the VIVA Institute of Technology for the encouragement that helped us to complete this review paper

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