Internet Of Things Based Wearable Sensors For Women Safety

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Abstract-- The internet has grown which let human being to access and utilize the services on a universal scale using traditional hosts, mobile devices such as smart phones across the globe. By linking the objects and devices, the Internet of Things (IoT) will fully utilize the network potential and facilitate the application of innovative services to a large set of scenarios, such as home and building automation, smart cities, healthcare, etc,. This will integrate new paradigms of Human-to-Machine (H2M) and Machine-to Machine (M2M) interaction. Nowadays, wearable devices are considered as the Hallmark of Internet of Things that can be worn on the human body. Wearable devices can be classified into two categories, namely passive and active wearable devices. This paper begins with the introduction of Wearable Internet of things, its attributes, and footprint of wearable technology in the women safety.

Keywords: *Internet Of Things, Wearable Sensors , Healthcare Industry, Human-to-Machine (H2M.*

I. INTRODUCTION

Over the past few decades, the Internet has drastically grown which allows the world to consume incomparable services with the help of hosts through smart phones over World Wide Web. Internet of Things embeds the World Wide Web in everyday's objects and enables them to send and receive data through sensors and smart devices. Internet of things enabled device is a computing device that connects the things to a network through wireless or wired fashion. The term "things" in the Internet of things may be a machine or wearable devices with an IP address which automatically collect and send data over a network without any assistance. Business Insider has announced that, by 2020, the businesses around the globe may invest nearly $70 billion to develop Internet of Things. From this it is understood that the Internet of Things will trigger the next industrial revolution and the demand for its solutions is set to increase. Internet of Things embraced real solutions to applications like aviation, insurance, manufacturing, traffic congestion, industrial sector, emergency services, security, smart cities, healthcare, logistics, retail sector and waste management as shown in Figure 1.1.

Figure 1.1 Internet of Things Solution in various fields

II. IMPACT OF INTERNET OF THINGS BASED WEARABLE'S IN HEALTHCARE

The effectiveness of Internet of things has opened up a world of possibilities in health care by providing smart, cost effective and accurate personalised healthcare service [1]. The necessity for preventive medicine and self-health monitoring is increasing rapidly due to the projected drastic increase in the number of elderly people until 2020. Wearable devices are currently at the core of just about every conversation related to the Internet of Things. Wearable devices are small wearable's that can be embedding on, in, and under accessories, body or clothes of the beneficiaries. The study for the development of wearable devices through sensory and computational devices is called wearable computing. Wearable devices which operates autonomously and acts as central connectors for connecting (other) devices is considered as primary wearable devices (e.g. wrist worn fitness tracker, smartphone) and those devices which captures specific actions and report to the primary wearable devices are considered as the secondary wearable devices (e.g. heart rate monitor worn around the chest)[1]. The innovation of electronic miniature components, the capability to collect and store data, to perform complex permutations in real world environment lead the wearable devices quickly to the most sensitive healthcare domain. The wearable devices are an IOT based things that is worn on body of the user as an accessories or it can be embedded in the cloth. These devices are connected to internet using Wi-fi or Bluetooth to exchange data. The operations performed by wearable devices are sensing, analysing, storing, transmitting and utilizing the data depending upon the application.

Architecture of Internet of things enabled wearable health care is illustrated in the figure 2. The foremost layer in the architecture is the sensing layer which observers the users mental, physical and emotional condition with the help of

sensors. Data processing layer retrieves the knowledge and pattern from the sensors. Security measures are applied to protect the data confidentiality. The Application layer provides judgment and suggestions based on the knowledge obtained from other 3 layers.

1. Sensing layer: The sensing layer is often called as "device layer", which accommodates physical objects and sensor devices like RFID, barcode, infrared, wireless sensors depends on the application. These devices spot the objects and collects valuable information in the form of orientation, vibration, location, chemical changes, acceleration, humidity and temperature. The collected information is securely transmitted to the network layer.
2. Communication layer: The communication layer or transmission layer transmits and processes the sensor data collected from the sensor devices. The medium of transmission can be wireless or wired based upon the technologies used like infrared, Bluetooth, ZigBee, Wi-Fi, 4G etc[1].
3. Data Processing Layer: Data processing is otherwise called the "middleware layer" which analyse and process the information collected from the communication layer. The responsibilities of this layer include service management and establishing the connection with database. The technological backgrounds for process the huge volume of data are database, big data and cloud computing.
4. Application Layer: The users can interact with the application layer which provides application oriented services to the users.

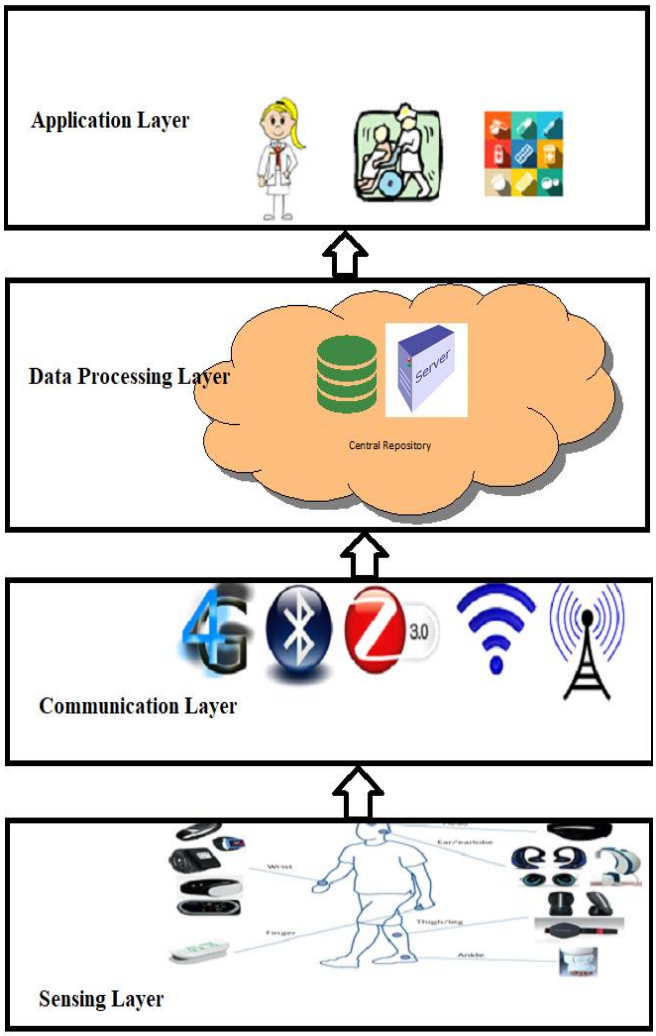

Figure 2 Architecture of IOT enabled health care

Figure 3 shows representation of operations associated with gathering and processing data with the aid of wearable. Consider a scenario that if the wearable devices detected any poisonous gases, the sensed data is processed in the wearable and it issues a warning. Meanwhile it may be transmitted to a remote location for testing to find accurate results to save life [2].

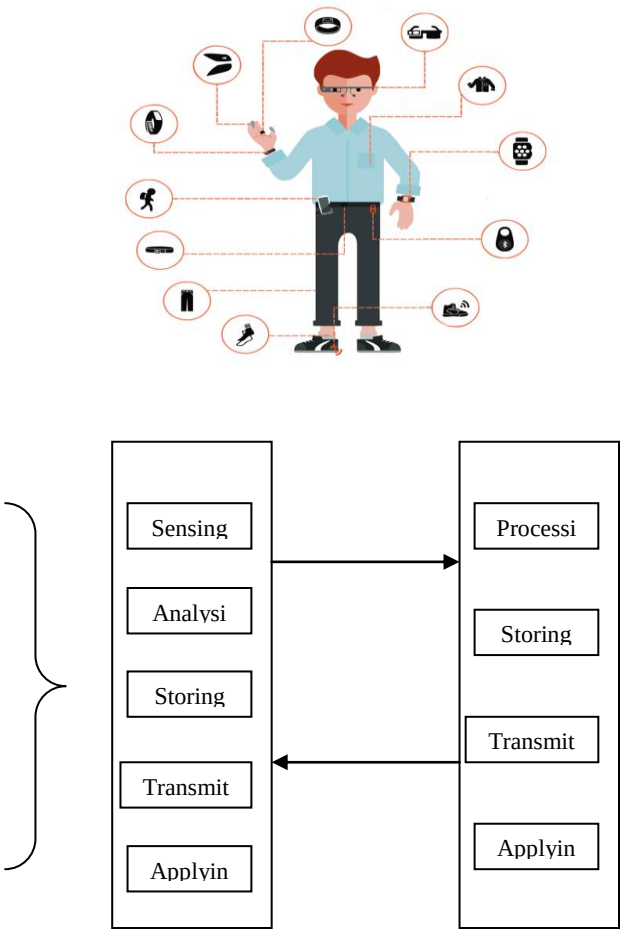

Figure 3 Situational awareness using wearable's devices

III. TAXONOMY OF WEARABLES

Wearables are classified into active and passive based on the role of power supply required to operate the devices. Oximetry sensors fall under active wearables which require power to operate whereas temperature probe is a passive wearable that does not rely on power. Based on the mode of signal transmission the wearables can be seen as wired in which the signals are transmitted over a physical data bus or wireless that transmits the signals wirelessly to the monitoring unit. Based on the sensors it is classified as invasive and non invasive wearables. Invasive wearables can be further categorized as minimally invasive such as a pacemaker which needs a medical procedure to be place inside the body. Non-invasive wearables seldom require physical contact such as gas sensor to sense poisonous gases in the environment. Figure 4 shows the diagrammatic representation of taxonomy of wearables.

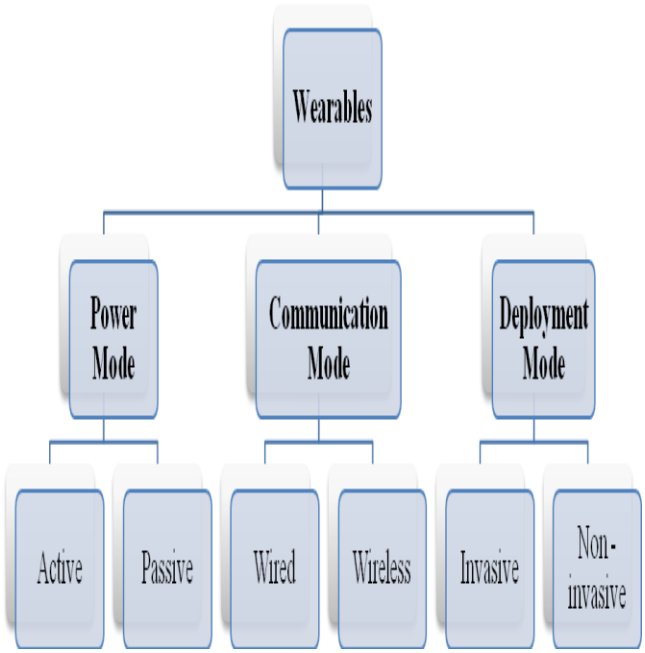

Figure 4 Taxonomy of wearables

IV. WEARABLE DEVICES FOR WOMEN SAFETY

In the current scenario, there is a huge increase in the safety and security of women harassment issues. The thought of every citizen is that the girl should move freely without any fear about their security even in the odd hours. The wearable devices assist in automatic sense of the current situation and the victim can be saved from the critical scenario. Security system is required to provide the security for women while facing social related issues. The recent advancement in wearable techniques helps in detecting the location of a person that enables for immediate action accordingly based on GSM, body temperature sensor, pulse rate sensor, and alarm. There are many kinds of sensors available which precisely senses the real situation of the women in critical situations. Nowadays, smart devices for women is easy to handle and more comfortable when compared to existing solutions such as bulky belt, separate garment etc. The data such as body temperature, pulse rate will be communicated directly with the help of wearable devices and the movement is continuously tracked by the application that is installed in the smart device. In case of any critical situation, the particular app alerts the device to perform the below mentioned functionalities:

- The family members are informed immediately along with the coordinates.
- Information is transmitted to nearby police station for immediate action.
- Sends information to persons in the near locality to receive the public attention.

In the densely populated cities, lot of crime against woman is occurring continuously which threatens the women

security. The solutions available are limited and the feasible technologies are in demand for these kinds of sensitive issues. The persons who can be contacted in case of any urgent situation are acting as a community database and the verified users can be enlisted for communication. The people nearer to the victim can be alerted using ZigBee, IEEE 802.15.4 standard and GPS tracking. Once the alert message is triggered, GSM transmits message to the individuals in the predefined community list. Meanwhile, the location details are sent to other devices in the proximity range. The broadcast receiver of the concerned victim's application checks the message that is transmitted and the application can obtain the contacts from the community database for the persons in the range.

Clothing and other accessories incorporates advanced technologies known as wearables have seen an exponential growth from the past decade. Wearables can be worn by a user to track information such as fitness, health status etc. A tiny motion sensor can be fixed in the wearable devices to take snapshots and that can be transmitted to the mobile devices. These devices are not only offering information about physiological monitoring but can also be preferred for personal safety. The wireless wearable technology is designed to record and monitor women safety information. The mobile technology enables to receive the alert message on time in case of emergency.

The incidents such as theft, harassment happen on victims who are isolated out from large crowded cities and have been rising very rapidly from the past decade. The system is not supporting the immediate response in the current alert mechanism incorporated in smart phone applications. The victim's family members may be residing somewhere, whilst the nearest patrol may be little far away, informing them will not support in such circumstances. Instead, if persons around the victim are intimated about the incident, the chances for rescuing the victim would be more.

SHE (Society Harnessing Equipment) is a garment that has an electric circuit generates 3800kV assist the victim to get away from the critical situation. ILA security is designed with three alarms that can disorient the attackers in such a way the victim is safeguarded from risky situation. AESHS (Advanced Electronics System for Human Safety) is an electronic device with GPS facility that assists in monitoring the location of the victim continuously. Smart Belt looks like a normal belt which consists of screaming alarm, pressure sensors and Arduino board. If the threshold of the pressure sensor is exceeded, automatically the device would be activated. The siren seeks for help once the screaming alarm is triggered out.

Pulse Rate Sensor: The sensor which gives the digital output of the heart beat and it is linked with the microcontroller to compute the beats per minute (bpm) rate.

Temperature Sensor: Body temperature plays a significant role in maintaining the health and hence it is compulsory to track it regularly. Several temperature sensors are available to measure the body temperature. For example, in LM35 integrated circuit sensor, it operates with +10.0mV/°C scale factor and 0.5°C accuracy.

Global positioning system (GPS): The longitude and latitude of a receiver is determined by computing the time variation from different satellites to attain the receiver. Approximately 12,500 miles away from the earth, 24 MEO (Medium-Earth Orbit) satellites revolve 24 hours around the earth and sends location every second in addition to the present time in atomic clocks. The blood flow is monitored if the human body is in touch with the wrist band for each pulse.

GSM is used to transmit data from the control unit to the base unit and GSM 300 is operated at 900 MHz frequency. The uplink band range is from 890MHz to 915MHz, whilst the down link range is from 935MHz to 960 MHz and it combines the advantages of TDMA and FDMA. At any instance, 992 channels would be available in GSM 300. [5] [6].

Dual Technology Motion Sensor: It is a sensor that tracks the moving objects and the motion detector automatically alerts the user's movement in a specific location. Converging multiple sensing technologies in one motion detector minimizes the false triggering, but it increases the vulnerability factor. [7].

BLE (Bluetooth Low energy) connects devices with less power consumption. A Beacon software study report says that, peripherals like proximity beacons can function with a 1,000mAh coin cell battery for one year. Bluetooth smart protocol only sends small packets as compared to the classic one which is suitable for high bandwidth data. [8]

V. CONCLUSION

This paper elaborated the recent advancement in wearable devices for real-life applications in view of women's safety. Smart sensors with advanced configurations, tolerance, stretchable and flexible wearable device interfacing pulse monitor sensors and skin conductance sensor senses the fear or anxiety from women body when they encounter critical situation. The crimes against women can be brought to an end with the help of real-time implementation of wearable devices.

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