SMART WEARABLES BASED HEALTH MONITORING AND PERSONAL HEALTH ASSISTANT

[1]Shshir Chandra Nigam, [2]Swapnil Soni, [3]Abhishek Kumar Anand, [4]Senthil M
[1]Student, [2]Student, [3]Student, [4]Assistant Professor
[1]Department of Computer Science and Engineering,
[1]SRM Institute of Science and Technology, Chennai, India

Abstract : The Healthcare has always been a very challenging area, especially when it comes to immediate solutions. Humans have been striving enough since ages to provide immediate assistance in case of emergency or where a criticality is observed. But we still face a lot of cases where lives could be saved through instant assistance but was unavailable due to some circumstances. With the recent advancements in the technology, Internet of Things (IOT) is fastly becoming a disruptive technology in almost every important field, IOT based solutions are no longer challenging vision. Wearable Smart and connected devices are playing a vital role and are a great success with larger possibilities in future. With our idea, one gets an instant personal assistance in a situation of emergency (like cardiac arrest), also immediate or regular alert when a criticality is observed. Data Mining combined with Machine Learning can help analyze the data and match it with the patient data, to generate the results on the type of disease and the possible solutions. Categorizing algorithm will help significantly to get to the proper data in required time.

IndexTerms **- Internet of things, Health Bands, network communications, personalized healthcare, smart wearables, health assistant.**

I. INTRODUCTION

Healthcare finds its place in the eight recognized millennium development goals (MDGs), hence stating the importance of Healthcare. However, WHOs survey in 2013 highlighted a "decline in global heath workforce in coming decades"[1]. The main causes of this decline are cancer, heart diseases, kidney failures etc. However, the causes of deaths due to heart related disease made up for 29.3% which is highest among all[3]. A case of man survived 17 blocks in heart through a record number of 12 grafts was successfully conducted under Dr Ramakanta Panda[3], shows us how far have we reached in the field of medical science. However, as it is sated that Prevention is always better than cure.

The IoT remains a relatively new field of research, and its potential use for healthcare is an area still in its infancy. Here, the Internet of Things is explored and its suitability for healthcare is highlighted. Several pioneering works towards developing healthcare IoT systems are discussed. Building on the recurring themes from these works, a generic and standardized model for future end-to-end IoT healthcare systems is proposed, with the aim of guiding the future development of such systems[7].

Using smart wearables for personalized heath assistant can be a new hope towards reducing the fatality rate by monitoring and tracking health conditions[2]. Today's smartwatches and phones are equipped with a range of sensors including optical (to measure heart rate, blood glucose and pressure. Personalized healthcare could not only enable remote monitoring and tracking, it can even endeavor in diagnostics, early detection and pre-emption of diseases. With the implementation of individual to individual communication, the overall architecture and supported technologies for the connected health and safety applications is evolving [4].

With the revolutions in our technology, keeping a track of our health has now become very easy. Today keeping a track of health is possible very easily even using Smart Watches, Fitness Bands and Smartphones etc. There are a lot of fitness tracking devices available in market in every price range which give a good and accurate idea of the condition of the body. Smartwatches by Apple, Samsung have Heart Sensors which can detect the condition of your heart. Now the 2018 Apple watch has much more improved Heart Sensor and is even capable of conducting an ECG test for a better interpretation of your Heart Condition. While many Smartphone companies in their flagship smartphones come with Heart Sensors for keeping a track of Health of your Heart. While the Fitness bands also in a very affordable price tag also come with the features of keeping a track of your Heart's health. Brands like Xiaomi, Lenovo keep coming up with their fitness tracking bands each year in a budget range thus making it easier for a majority of people to make use out of them.

However still there is much large path to go. Even with these implementations there can be various problems like lack of immediate attention. Also, data privacy and security, cost effectiveness in the widespread use of wearable is an important and concerning issue. These problems can be solved to a much larger extent by using a "Personal Health Assistant" which works in

synchronization with the Smart wearables.

II. OBJECTIVE

The main objective is to make the usage of everyday Smart devices like Smartwatch or smart band to empower healthcare systems in cases of medical emergency. Providing instant personal health assistance to the person with instant valuable guidance required as an emergency aid will be a boon. The vision is to initiate a step ahead towards saving valuable lives that're lost due to incapability or limitations of the present emergency solutions.

III. PROBLEM STATEMENT

Providing instant personal health assistance that can assist the person with instant valuable guidance required as an emergency aid can be boon compared to the present scenario. As it is practically rare for a person with or without a medical background to act instantly in case of emergency and assist. One cannot get to track his health status regularly and that too manually. Manual health checks require physical presence, hence missing on alerts for criticality.

In a present condition, a large amount of data needs to be analyzed, to match and categorically identify certain problems, and hence providing the possible solutions however using Personal Assistant this issue can be resolved. Instant medical assistance can possibly save a large no. of lives as it may help the individual be pre-aware of his health conditions and act accordingly & eventually guiding him in case of a distress.

IV. PROPOSED SYSTEM

The idea of Personal Health Assistant makes use of the present technologies in an efficient and more effective ways. The idea is to make use of these technologies in a way that can not only help a person to keep a track of his health but also provide solution in the time of need.

The data obtained can be transmitted to the smart wearables, thus it will become a way easier to analyze the data. The smart wearables connected with the smartphones can keep a track of these data and also notify the person about it. If there is an alarming situation then the wearable device connected with the smartphone, will be capable of performing the following tasks:

A. Analyzing the data obtained and determining the actual condition of the person and acting in accordance to it.
B. First task first is to assist the person in taking immediate First Aid measures, which is performed by voice assistance technology.
C. The Smartphone getting the signal from the wearable, will automatically book for an Ambulance without any delay by making use of the proper location from built-in GPS.
D. Smart wearable will be able to send alert signal to the specified people as a message and notification, though an automated call can be the best alternative.
E. Also, the important use will be to automatically find the nearest Hospital for heart problems, which will involve huge number of datasets.
F. Register the patient in the hospital database (which can be done through the partnership program) or send raw data for the hospital management to pre-register, as these paper formalities take a lot of valuable time.

V. APPLICATIONS

The following list outlines the different types of applications being focused on categorically. They are categorized based on their focused aspect of implementation.

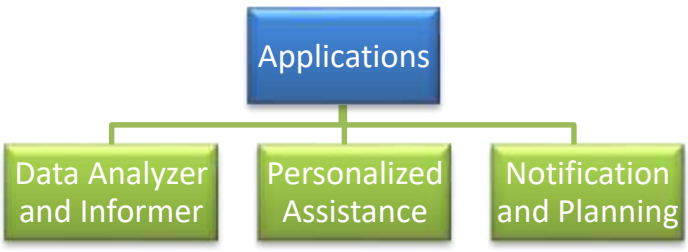

Figure 5.1: Categorization of Applications

- **Data analyzer and informer**
  The perfect collection of datasets is required for data analysis. This system equipped with various sensors detects the vital signs like (blood pressure, pulse rate, respiration), that indicate the status of the body's vital functions. These measurements are taken to help assess the general physical health of a person, which give clues to possible diseases, and show progress toward recovery. The data detected over a period of time is stored and then analyzed over various aspects

like consistency, variation levels, rate of variation, frequency of variation, etc. The insights generated from these analyzed data is then concluded and displayed as an informative points. These generated informative points help the user to get the track of the changes or variations occurring in his body and hence signals for any abnormal activity. These regular or real time information also helps one be prepared for any upcoming mishappenings, so that one can be mentally prepared and can easily tackle it down. These data will grow exponentially in coming time due to the huge increase of wearable devices being used. However, this data grows rapidly in terms of volume. Hence again Analysis will become more complex for the huge amount of personal data.[5].

- **Personal Health Assistant**
  At the time of any mishappening or criticality, the signaling system is not enough being of a smart device, it must also have a way to help the user get over it. The person himself or the one present with him at the time of distress or criticality, however smart, active or professional he/she is, generally gets easily panicked and finds it difficult to take immediate actions or decisions and hence losing the priceless time. More number of cases are being witnessed nowadays where the valuable lives can be saved using instant actions or solutions, but was unavailable or unable to perform. The system proposes the way to incorporate a personal health assistant that guides through the immediate steps needed for the course of action hence providing instant and personal assistance making it easier towards the scenario of an emergency aid. The step by step guide towards emergency aid helps one to fight back or tackle down many emergency situations that need immediate or instant actions like different kinds of heart diseases.

- **Notification and Planning**
  The smart and advance technology, however progress it has made but requires human intervention. The personal assistant is a great breakthrough, but the human intervention is still required for many actions which includes physical activity such as providing medication or treatment. In the cases of distress or criticality observed by the smart devices using various sensors, the device in addition to the above two also notifies all the preset contacts and sends alerts with location to them in case of emergency. This notification system alerts the contacted ones about the mishappening or criticality. In addition to notifying the contacts the smart device will be able to auto book for the ambulance and also book for a special appointment with the doctor of choice, if needed. These automatic planning activity like (ambulance and appointment book) will help save a lot of valuable time, required in case of an emergency.

VI. IMPLEMENTATION OVERVIEW

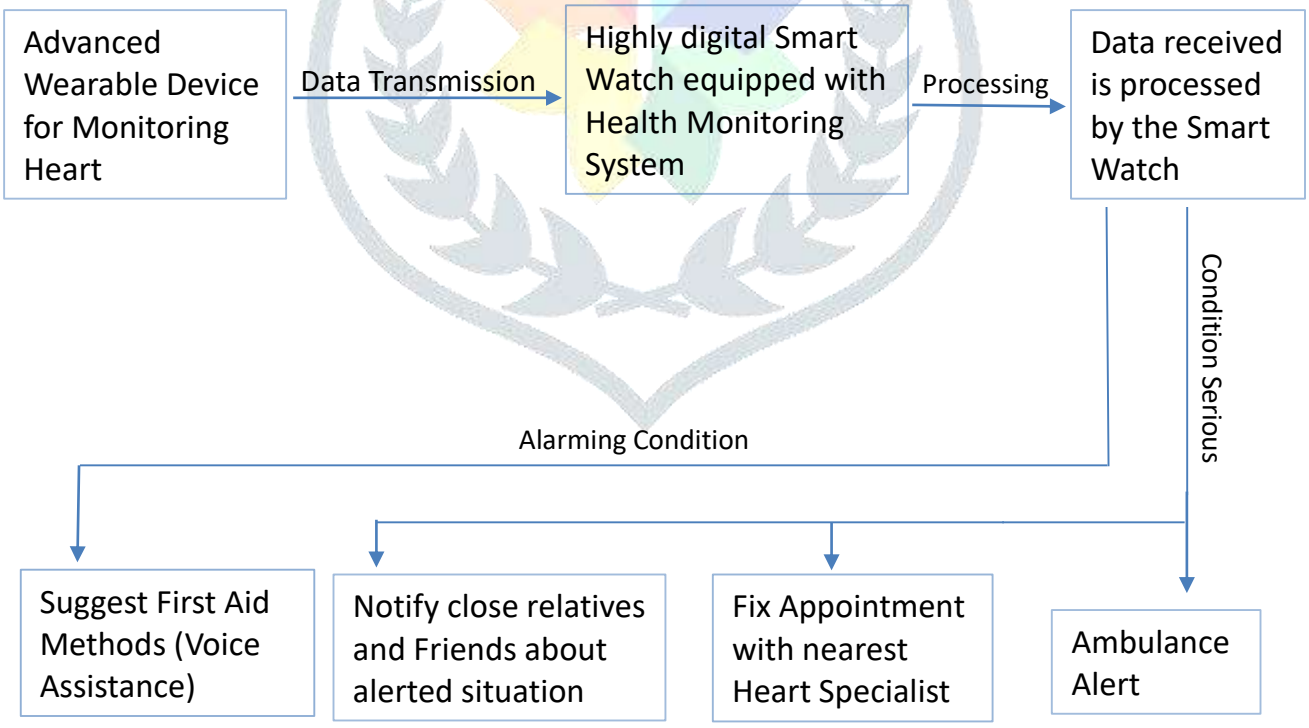

Figure 6.1: Flow of Implementation

The implementation part comprises of Advanced Health Tracking Devices like Pro Form Smart Beat, Chaotic Moon Tattoo etc. Smartwatches, high-end Smartphones and accessible communication between them along with a smart application is helpful in processing data in both Smartwatch and Smartphone.

The main objective of the project i.e. "Personal Health Assistance" can be achieved by making use of these devices that works together in sync with each other. The Advanced Health Tracking wearable will play the most important role in this Assistant application. The user must connect the wearable with both the Smartwatch and Smartphone. Then the user must wear the wearable at a correct position. After this the band will now start to collect the data.

The next step involves the usage of data which is generated by the wearable. This data is then transmitted to the Smartwatch and Smartphone which consist of a dedicated application to analyze this data. The app will now determine the condition of the person using the data statics obtained and keep a track of it each and every time. In a case when the data obtained shows some unfavorable results, the app will now generate an alert signal which will notify the user about his/her deteriorating health condition and he may take any kind of necessary action to avoid any sort of mishappening. However, the app will act as a personal assistant and will even be capable of suggesting a proper First-Aid, in situation of any mishappenings.

The next main function of this application will be to send an alert signal, to all the people who have been registered by the user through his app, about the alarming condition of the persons health so they may reach out to him as soon as possible so as to take him to hospital or take any necessary action accordingly hence avoiding any kind of mishappening due to late arrival at the Hospital or lack of attention on time.

The other part of the implementation includes the usage of the app's Hospital locating feature. The app, depending on the location of the person, can find the best Hospital nearby related to the persons problem. The app can also complete the paper formality to a big extent so as to avoid the wastage of valuable time. This would also include a feature of booking for an ambulance, so the person can be taken to the hospital as soon as possible and hence reducing the wait time to all possible extents.

The System makes use of a collaboration of the fields of Communication, IoT, Data Analytics, sensors, hi-tech health tracking Bands, Smartwatches and Smartphones etc. to create an Assistant Service which can help in improving the health status of the people and reduce the risks that may have caused big problems for the person**.**

VII. FUTURE EXPECTATIONS

The future implementation of the Project can make use of Artificial Intelligence or Machine Learning to provide Health assistance with context of the data obtained through the Advanced wearables. The AI based assistant will be capable of providing preventive suggestions or measures that can be acquired depending on the seriousness data received or insights generated. Heath Assistant can be made more precise that can keep the person more alerted towards variation in his vital signs or any declination observed in his health, thus making the person more prepared.

Data mining can further improve the possibilities and prospects by continuously collecting and analyzing the new cases and health issues and cross verifying it by applying it on the beholder in order to be cautioned about the new threats developing every day.

VIII. CONCLUSION

The healthcare sector is adopting the IoT very rapidly. Exponential growth of the wearable devices, powerful communication technologies used in association with one another can shape the future of Healthcare in the world. Combining the different applications of the IoT in future healthcare associating with the recent network communication technologies is very important for exploring the future research challenges and directions. Furthermore, in order to deal with the huge amount of data by selecting the most suitable methods for data analytics is also an indispensable requirement for future healthcare applications. This survey paper presents advances in IoT-based future healthcare for various use case scenarios, explores the recent and emerging communication technologies and standards in IoT. Finally, it can be concluded that for most of the application scenarios such as infectious disease etc. current communication technologies are able to meet the requirement in terms of reliability, connectivity, data rate and latency. However, a more efficient network of technologies will be needed to provide better results with the help of emerging healthcare applications[6]. This will raise new research questions such as how will these technologies coexist or how will these communication technologies impact the transmission characteristics in such heterogenous scenarios? Furthermore, for cases like cardiovascular diseases, which requires near real-time processing of data unfortunately the current technologies lack to satisfy such requirements. There is a need for new more advanced system that can monitor the Health and can be a savior by providing the assistance.

REFERENCES

[1] http://www.un.org/en/sections/issues-depth/health/index.html
[2] "Surveying Wearable Human Assistive Technology for Life and Safety Critical Applications: Standards, Challenges and Opportunities," Sensors, vol. 14, no. 5, pp. 9153–9209, 2014.
[3] https://en.wikipedia.org/wiki/Ramakanta_Panda
[4] "Wearable Body-to-Body networks for critical and rescue operations; The CROW2 project," in 2014 IEEE 25th Annual International Symposium on Personal, Indoor, and Mobile Radio Communication (PIMRC), Sept 2014, pp. 2145–2149.

[5] "A wearable device-based personalized big data analysis model," in International Conference on Ubiquitous Computing and Ambient Intelligence. Springer, 2014, pp. 236–24
[6] "A Survey on the Roles of Communication Technologies in IoT-based Personalized Healthcare Applications"
[7] "Internet of Things for Smart Healthcare: Technologies, Challenges, and Opportunities"