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The Integration of Portable Sensors with a Mobile Application for Self-Observation

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Abstract:- IoT in mobile healthcare significantly benefits patients by reducing treatment costs, saving time, and reducing the time and effort required for minor complications. Smart healthcare systems have significantly reduced the death rate worldwide by providing real-time monitoring of critical conditions, enabling immediate assistance from doctors. The proposed work introduces an IoT mobile application for healthcare monitoring, utilizing wearables and biosensor patches to regularly monitor both inpatients and outpatients. The system will facilitate the connection, monitoring, and decision-making for a precise evaluation of health changes.

Keywords:- *Monitoring, Wearable, Biosensor Patch, Application, Health, Mobile.*

I. INTRODUCTION

The physical and psychologically active embodiment is said to be healthy person. By monitoring in real-time the person can maintain their health, and stay away for sickness. In recent years, the rapid growth in the smart wearable outcome which alters lots of applications. Each and every product becomes smarter when connected with internet such as smart watch, smart eye glasses, smart foot and hand wear devices and some of the smart jewelleries are developed will be connected with different applications. when the wearables and biosensor patches are connected with the smart phones which can gradually monitor the data of the subject such as heartbeat count, pressure changes, temperature of the body, breath level. Bluetooth is a low-energy wireless telecommunication. It is used for the communication with the nearby people, which improves the corporeal experiences. It is intended for one-to-one and one-to-multi point communication.

The personalised healthcare is categorized into four layers include,

- *Observe Layer-*

The observe layer is used for gathering the fitness of the subject both physically and psychologically. In this layer, EKG is used to check the proper functioning of the heart, whether it is normal and strength.

- **BP electric eye**-The sensor used to measure the blood pressure.
- **Smart Watch**-It will be helpful for maintaining the fitness of the subject.

- *Internet Layer-*

Wi-Fi-the router that allows the mobiles, desktop or other devices to merge with the internet. It is a wireless network used to communicate with one or many in a certain location. The transmission of data will be secured identical data units.

- *Process of Data Variables-*

In this process, retrieval of valuable data of the photoelectric cell that obtained from the observe layer.

- *Application-*

In this proposed system, the application generated will be helpful to view more than one wearable data in a single application, so that it not only saving the time of the subject but also helpful for self-monitoring themselves.

Based on the observe layer, internet layer and process of data variables, the generated application will be supplied for disease prediction, self-health management, active assist for the patients, abnormalities detection.

The variables that can be gathered using wearables and biosensor patches are heartrate count, temperature of the body, breath level, glucose level of the subject and pressure. If the heartbeat count is high it will lead to many other diseases, like atherosclerosis, cardiomyopathy, tumours, etc. when the blood force is extremely high, through the walls of arteries then the condition is referred to as high blood pressure. If the pressure of the blood is above 140/90 then the situation is said to be hypertension. If the heartrate count is fewer it causes lots of diseases which includes hypothyroidism, Bradycardia, etc.

Blood glucose level will be increased with the release of hormones of the psychological tensity. Blood glucose level will be affected due to the hormonal differences during menses for women. Blood glucose level will increase after a meal and rise after one hour. Based upon the consumption of food, the blood glucose level will be keeps on changing.

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Fig 1 Monitoring Glucose level using Smart Watch

Temperature of the body will be low in the day time and higher in the evening time for the healthy person based upon the activities taken by a subject. If the body temperature is low then the condition is said to be hypothermia, if the temperature is high then it is referred to be hyperpyrexia.

Fig 2 Monitoring the Temperature, Breath level, Heartbeat Count, bp Count

The breath rate will be calculated by the total number of breaths takes place for a minute and it will be doubled. The breath level below 12 and above 25 breath at resting state is said to be unusual.

II. INTERNET OF THINGS IN SMART PHONE AND WEARABLES

➢ *YAMAY Fitness Tracker:*

Yamay fitness tracker can be worn as a watch, will be used to monitor the pressure of the blood, it helps us to store the blood pressure record in memory for real-time monitoring and also for future use. Yamay fitness tracker will also help us to maintain the fitness by calculating the total number of moves that the subject taken place, if the subject is cycling it will be collecting the kilometres travelled by the subject, and total amount of fat burned. The wearable when connected with the mobile will transfer the records to the related mobile application, and if there are any changes in the variables will be shared with the health advisors to track and give feedback.

➢ *Biosensor Patch:*

Biosensor is a wearable medical patch that can be attached near the chest of the subject cannot be worn like a smartwatch, so that the heartbeat rate, breath level and temperature will be gathered. Since the subjects were monitored in the real time, it will reduce the cardiac and respiratory problems.

➢ *Glucose Monitoring Wearable:*

Wearable technology will play a major role that reduces the readmissions because of unmanaged fitness health. The glucose monitoring wearable will be helpful for the patients who were suffering with diabetes.

Wearables will be not only helpful for the subjects to use, but also for the health advisors to analyse the data of the subject. The subject is going to be monitored by using the mobile applications, which makes a health physician and the subject to bring together which helps the healthcare advisors to give health advice through the application of the smart phone by using the collected data.

III. METHODOLOGIES

Applications of mobile when connected with wearables allows the effective communication between the doctors, subject and the family members. Applications can be accessible in all the time, so the health of the subject will be managed. Lots of healthcare applications are available for maintenance of the health data, communications with healthcare providers and consultation with specialist, if there are any changes in the health, monitoring the subject, objective decision making for health of the subject.

Smart wearables related applications are already trading and obtainable in the display. The present work concentrates on assisting the subjects who experience struggling in continue independent surviving, for an example, subjects with certain chronic illness includes diabetes, heart problems, etc.

➢ *Smart Phone to Self-Healthcare:*

In our day-to-day life, mobile become our centre of conveying. Mobile phones with in-built photoelectric cell provides multiple functionalities and development, which is expected to revolt a number of social and commercial sectors. Smart phones have been given with a wide range of photoelectric cell units, such as digital compass, GPS, etc.

➢ *Smart Wearable:*

Smart wearables are less-weighted and it will not disturb the regular work of the subject. So, it can be worn for regular use, and it will be helpful for keeps on monitoring the data of the subject.

Some of the Smart wearables are,

Smart eye glass wearable- Smart glass is a device which brings the desktop page closer to the human eye used to represent the data, which was gathered from the stored particulars.

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Smart contact lens- The subject with minimum vision will be beneficial by the smart lens which has an in-built visual display.

Each smart wearable will be designed with certain applications, so that the data can be viewed and accessed through that application and transfer the data to the healthcare advisors, if need of any health-related advices.

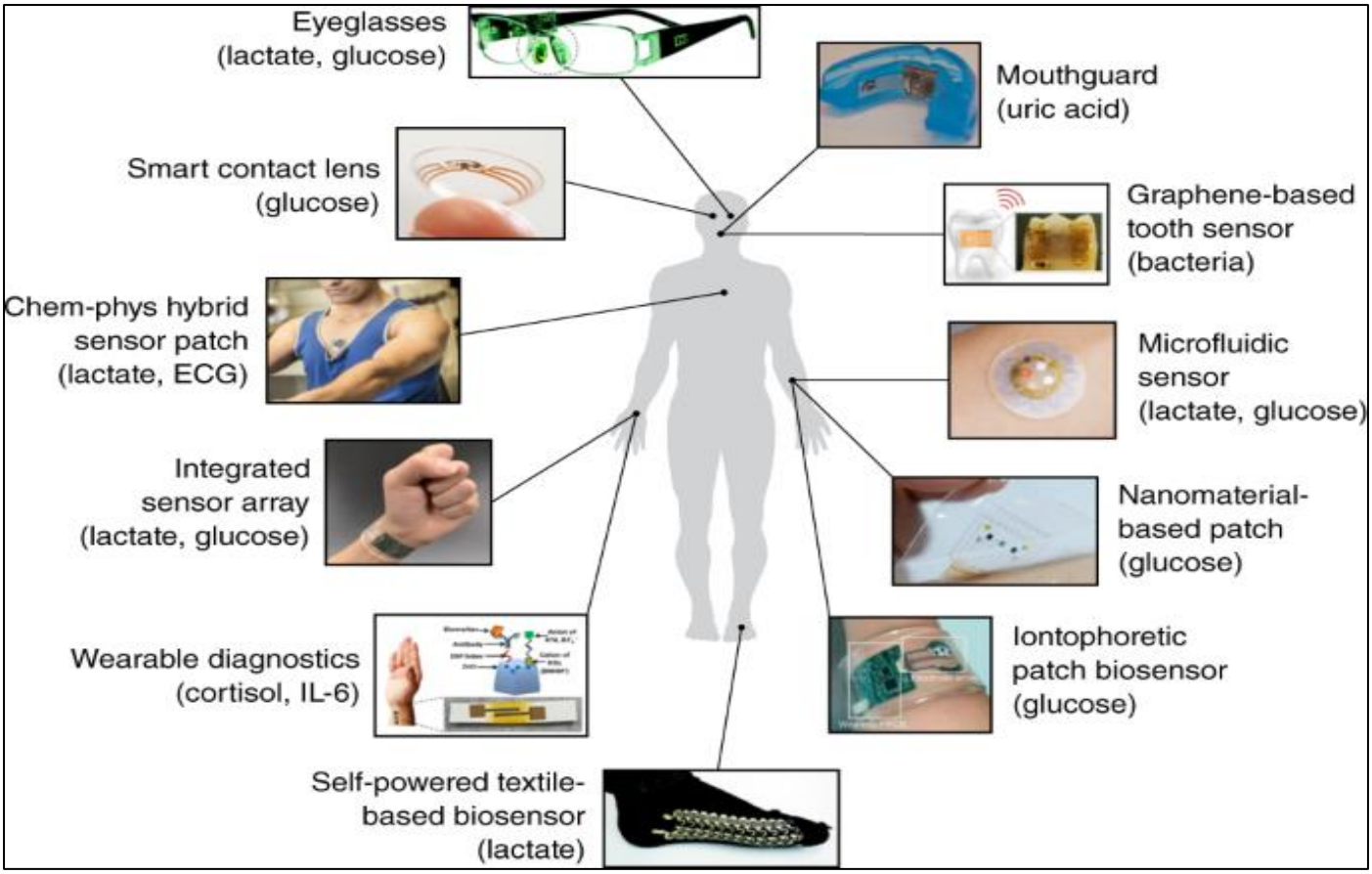

Fig 3 Types of Wearables Available for Health Monitoring

➢ *Smartphone with Wearable Sensors:*

Photoelectric cell and its network are the basic technologies, which are positioned to receive the number of fitness related sign, such as heartbeat and EKG. The solution for the photoelectric cell monitoring is using a mobile phone as a network router, that collects the electric eye waves, and it will be transferred to the healthcare centre or the server which collects the data. The number of interrelated wearable sensing appliances to gather a series of medical variables includes pressure, temperature of the body, glucose level, breath level and heartbeat count. These photoelectric cell nodes are interlinked through the communication protocols such as Bluetooth and wi-fi. Photoelectric cell nodes are mostly with less memory and computing volume; therefore, photoelectric cell data are transferred to other processing server, where smartphone are uniformly accepted.

IV. SYSTEM ARCHITECTURE

We can view the data through the smart watch itself, but when connected to the smart phone application it will help the subject to view in broad screen and data can be stored and accessed at any time. The subject should connect the smart wearable with a smartphone by turning on the Bluetooth in the smartwatch.

If a subject is using more than one smart wearable, the subject has to make a separate time for visualizing the health data. In the proposed system, the application generated for merging the two different wearables into a single application, so that the subject needs less time for self-monitoring and maintain the data in particular application.

Device1(fitness tracker) which will monitor the blood pressure by the direct contact with the skin which will be worn as a smart watch in wrist. The data of the device1 will be collected by the wireless connectivity Bluetooth 5.0 BLE.

Device2(biosensor patch) which will be used for measuring the temperature of the body, heart beat count, respiratory count. The data will be transferred to IGS (Initial Graphics Exchange Specification).

Device3(Glucose monitoring device) which will be used for calculating the glucose level of the diabetes patients. The data will be transferred to the mobile application. The combination of all three devices will be managed by database system. Each movement of the subject will be managed by mobile event system. If the subject need to monitor by themselves all the data can be viewed through the mobile application.

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The mobile application will share and store the data in cloud. So that it can be viewed by doctor, if the patients want to know their data, they can self-monitor themselves. Cloud acts as a multi-patient bridge.

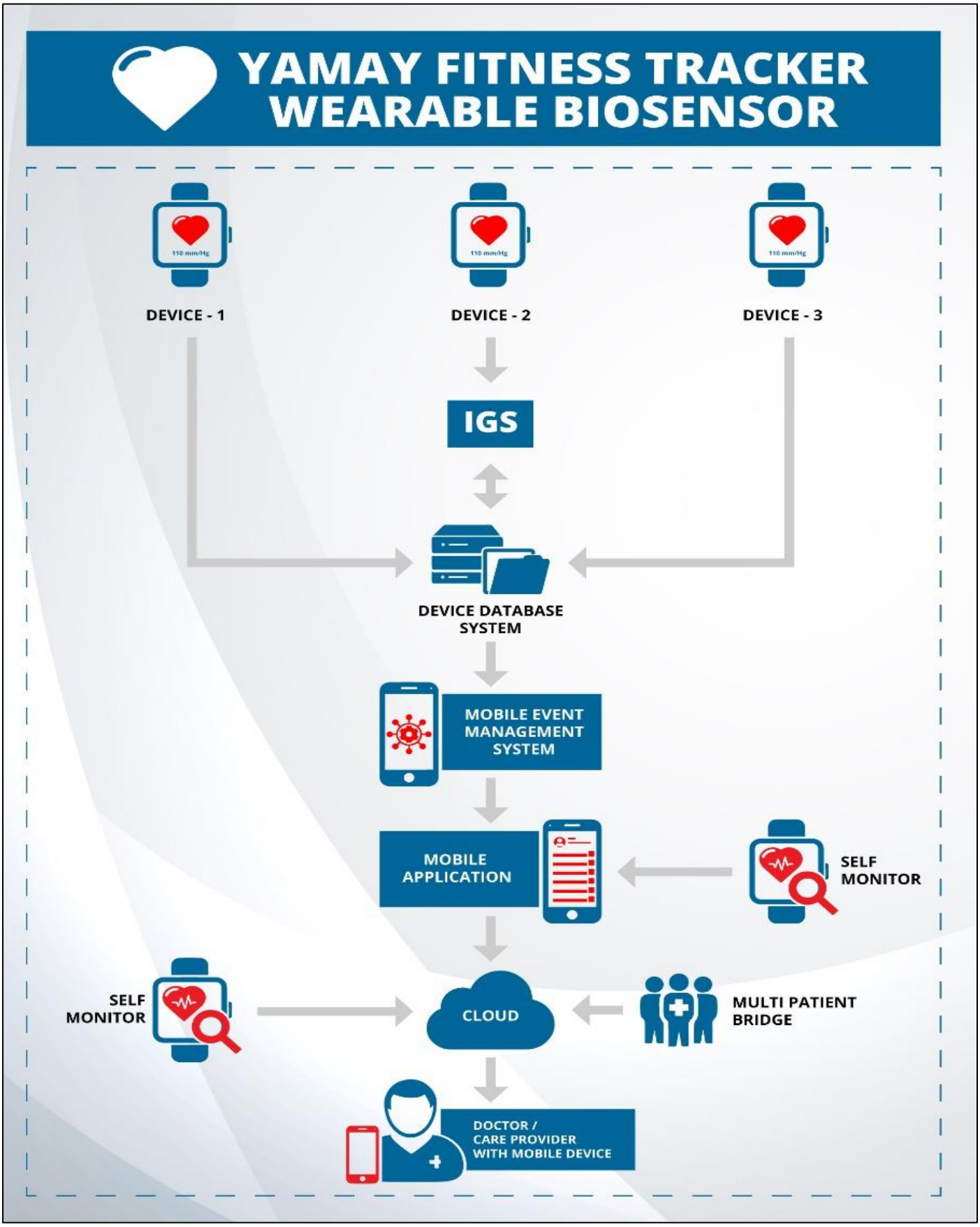

Fig 4 System Architecture of Connecting Three Various Devices into a Single Application

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Fig 5 Application for Self-Monitoring

If the subject is using more than one healthcare wearable, it will be difficult for them to view the records in different applications. In this fig5, all three devices were connected into a single application and records can be viewed in a particular application.so that it will be helpful for self-monitoring.

V. CONCLUSION AND FUTURE ENHANCEMENT

In this proposed work, corporal and cerebral health will be monitored using an application. The structure be made up of wearable sensor, a smart phone and tenacious depository unit for storing the data of the subject. The wearable appliance stores the vital indication and carry out them to the smart phone which was specially designed for android application. The application acts as a doorway that assist the corporal data accumulated and stored, as well as the wearable data will be sync to the remote depository for additional processing. The proposed system allows the self-monitoring by visualizing the vital action collected with the help of wearable photoelectric cell.

In the future work, aim is to give an intimation to the subject as well as the healthcare providers, if there are any changes in the data collected in an application. If the variables such as temperature of the body, changes in the heartbeat count, changes in glucose level, etc exceeds or fewer, the subject will receive the intimation that the health condition of the subject is abnormal.

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