Health Prediction using Wearable Device A Review

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Abstract:
A new wave of portable bio sensors allows frequent measurement of health-related physiology. We investigated the use of these devices to monitor human physiological changes during various activities and their role in managing health and diagnosing and analyzing disease. By recording over 250,000 daily measurements for up to 43 individuals, we found personalized circadian differences in physiological parameters, replicating previous physiological findings. Interestingly, we found striking changes in particular environments, such as airline flights (decreased peripheral capillary oxygen saturation [SpO₂] and increased radiation exposure). These events are associated with physiological macro-phenotypes such as fatigue, providing a strong association between reduced pressure/oxygen and fatigue on high-altitude flights. Importantly, we combined biosensor information with frequent medical measurements and made two important observations: First, wearable devices were useful in identification of early signs of Lyme disease and inflammatory responses; we used this information to develop a personalized, activity-based normalization framework to identify abnormal physiological signals from longitudinal data for facile disease detection. Second, wearables distinguish physiological differences between insulin-sensitive and -resistant individuals. Overall, these results indicate that portable biosensors provide useful information for monitoring personal activities and physiology and are likely to play an important role in managing health and enabling affordable health care access to groups traditionally limited by socioeconomic class or remote geography.

I. INTRODUCTION:
Health is the only asset that every one of us here can try and maintain on the richer scale. There is no poverty or upper hand when it comes to the topic of health. If you are gifted with the best of your physique, you are on the upper hand in this wealth aspect and if you are suffering from diseases and lack of health in spite your financial aspects are high; you are still in poverty in accumulating this asset. To keep up the essence of the most essential asset of life, you will need to have certain checkpoints in life that assures your well being—the major checkpoint being your blessing for a good health. Researchers have developed an integrated, wearable system that monitors a user’s environment, heart rate and other physical attributes with a goal of predicting and preventing various health attacks. The researchers plan to begin testing the system on a larger subject population this summer. “Our goal is to design a wearable system that could track the wellness of the subjects and in particular provide the infrastructure to predict asthma attacks, heart attacks, pulse rate issues, sugar level etc, so that the user could take steps to prevent them by changing their activities”, “Preventing an attack could be as simple as going indoors or taking a break from an exercise routine,” says James Dieffenderfer, lead author of the paper and Ph.D. student in the joint biomedical engineering program at NC State and the University of North Carolina at Chapel Hill. Physiological parameters such as heart rate (HR), blood pressure, and body temperature can provide critical information about the physical health status of a person. Elevation of any of these parameters can be of concern; elevated HR and blood pressure are associated with cardiovascular disease, and elevated body temperature occurs during pathogen infection and inflammation. Peripheral capillary oxygen saturation (SpO₂) is a measure of oxygen saturation of hemoglobin in the blood, and patients with chronic pulmonary disease often have lower resting SpO₂ and are required to use supplementary oxygen to attain a more optimal SpO₂ [5]. Skin temperature is associated with alertness levels and quality of sleep. Emerging wearable biosensors (hereafter called wearables”) are a low-cost technology that both continuously or frequently measures physiological parameters and provides a promising approach to routinely monitor personalized physiological measurements and potentially identify alterations in health conditions. Wearable’s are capable of passive and routine recording and immediate delivery of multiple types of measurements in real time to the wearer or physician with minimal attention or training required. In addition to physiological measurements such as HR and skin temperature, wearable technology has the potential to precisely capture the wearer’s daily physical activities, such as walking, biking, running, and other activities, often in conjunction with a GPS, which provides direct information about the location of the activity. The popularity of wearable devices has substantially increased in recent years. As of July 2015, there are more than 500 different health care-related wearables present on the market and over 34.3 million devices sold. This is triple the number sold in 2013]. The paper, “Low Power Wearable Systems for Continuous Monitoring of Environment and Health for Chronic Respiratory Disease,” is published in the IEEE Journal of Biomedical and Health Informatics. The paper was co-authored by Henry Goodell and Brinnae Bent of the joint biomedical engineering program; Steven Mills, Michael McKnight, Shanshan Yao, Feiyan Lin Eric.

II. LITERATURE SURVEY:
The HET system incorporates a host of novel sensing devices, which are incorporated into a wristband and a patch that adheres to the chest. The patch includes sensors that track a patient’s
movement, heart rate, respiratory rate, the amount of oxygen in the blood, skin impedance and wheezing in the lungs. The wristband focuses largely on environmental factors, monitoring volatile organic compounds and ozone in the air, as well as ambient humidity and temperature. The wristband also includes additional sensors to monitor motion, heart rate and the amount of oxygen in the blood. The paper, “Low Power Wearable Systems for Continuous Monitoring of Environment and Health for Chronic Respiratory Disease,” is published in the IEEE Journal of Biomedical and Health Informatics. Diabetes-Related Stats-Back in 2015, Google received a patent for contact lenses that sense a wearer's glucose levels, with the idea those diabetes patients can monitor this vital stat via a sensor in front of their eyes. Glucose-sensing lenses aren’t the only wearable approach to diabetes management already in the works, though. A startup called SirenCare aims to prevent diabetic foot ulcers with a pair of temperature-monitoring socks.

Sweat
Many exercisers see sweat as an indicator of a productive workout, but perspiration can reveal more than just your level of exertion. Researchers are developing a tiny, patch-like wearable biosensor that analyzes sweat to return a variety of useful information — from electrolyte levels to response to military training to screening for diseases such as cystic fibrosis. While this device isn’t ready for market, it provides a glimpse at the kind of functionality we could someday see in the most popular wearables.

Sun Exposure and Sunburn Risk
Most of us know that the sun’s rays are harmful, but few of us are actually applying enough protection when we venture outside. That’s where UV-sensing devices come in — these gadgets measure UVA and UVB exposure and can even provide personalized notifications to alert you when you need to apply or reapply sunscreen. Examples include the June “beauty coach” and the Violet, the latter of which aims to help you strike a balance between optimal vitamin D levels and protection from the sun.

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III. WORKING:

- We have an idea regarding the topic and a startup called “HEALTH PENDANT”, a device which will be in the form of pendant worn on the neck and will work as a health detector.
- It will be near to the heart and will work on the pulse rate and the heart beat of that person.
- It will work on the principle of “TO & FRO motion”. When our heartbeat increases it will give signal that some problem is going to arise. This device comprises of two components, one of those will be the portable machine and the other one will be the pendant worn on the neck.
- The portable device will have all the readings related to functioning of our body, especially the reflexes of the brain.
- All the readings like RBCs, WBCs, pulse ratings, heartbeat, blood pressure, etc. will be reflected in this device.
- When some disorder takes place inside the body, the pendant will alarm us by giving a red signal.
- The pendant will be connected to the portable device.
- When the pendant alarms, the person will understand that some internal disorder is taking place.
- Then the person will go through the reading of the device and will get the most probable idea of the disordering inside the body.

IV. APPLICATION:

- Everyone is patient at some time or another and we all want good medical care. We assume that doctors are all medical experts and that there is a good research behind all their decisions but that can’t always be case.
- In this case, this device will be useful to find the internal issues to a certain extent.
- It will be useful to detect the disease at an initial state, if it will be minor one, can be resolved at an individual’s level itself.
- This device can be used in regular life as a daily routine checkup.
- Sometimes it is observed when the doctor predicts a wrong disease and a wrong treatment is given but this device will sort out this problem to much extent.
- A large number of people will be benefited as a routine checkup can be done on a daily basis.

V. DISADVANTAGES:

- High complexity will be involved in constructing the device.
- It will be costly for common people.
- It will not be easy to wear the pendant all the time.
- Technical errors can occur.
- It will not work for the external disorder of the body, e.g fracture, sprain etc.
VI. FUTURE SCOPE:

In future it will be able to detect major diseases like cancer, tumors, which can be cured only if detected at an early stage.

VII. REFERENCES:

