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WEARABLE'S FOR INTERNET OF THINGS FOR HEALTH

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ABSTRACT: The Internet of Things (IoT) is an emerging paradigm for the range of new capabilities brought about by pervasive connectivity. The concept involves situations where network connectivity and computing capability expand to objects, sensors, and everyday items that exchange data with little to no human involvement. The premise of the IoT is to build, operate, and manage the physical world by meansof pervasive smart networking, data collection, predictive analytics, deep optimization, machine-to-machine methods, and other solutions. Its potential benefits can impact how individuals live and work. In the near future, corporate and government organizations, such as the U.S. Department of Defense, may be challenged by the inevitable addition of IoT devices to their networks and connected systems.This notion will serve as a source of innovative decision making.

Keywords: Raspberry-Pi Microcontroller, Temperature Sensor, Heart Beat Sensor, BP Sensor, AD8232 (ECG Sensor), MEMS Sensor & IBM Cloud.

1. Introduction:

Wearable technology has made significant progress in recent years, with millions of devices being sold to consumers and steady advances being made in technological capabilities. Although the form and function of contemporary wearables have changed from Shannon and Thorpe's 1961 experiment, many of the same conflicting design issues have to be taken into consideration when developing modern technologies that are intended to be worn. Al- though wearables have benefited from advances in mobile technologies, functionality remains limited compared to smartphones. Additional- ly, smartphones do not need to be comfortable to wear while in motion, are less restricted by weight and size requirements, and have more well-defined aesthetic requirements. However, wearables present a tremendous opportunity for capturing a continuous stream of data about our physiology and kinesiology, which can em-power consumer's withself-knowledge.

Human health and fitness are areas in which wearables can offer insights that smartphones cannot. This is evident from the immense popu- larity of fitness trackers (e.g., the Fitbit Blaze, Jawbone UP, and Nike+ FuelBand) and smartwatches(e.g.,theApple Watch and Samsung Gear) being used byconsumersto self-monitor physical activity. Additionally, wearable's are being used for self-monitoring and preventing health conditions such as hyper tension and stress. Donald Jones with the Scripps Translational Science Institute says, "My favorite wearable's to-day are those that measure blood pressure and that canbe used to impute stress. I think these are some of the most interesting areas of feedback that we have today. Hypertension is a cause of many illnesses, and stress is obviously a big contributor". Research continues to explore how wearable's can help patients and physicians before, during, and after medical procedures, such as surgery. For example, telemedicine can be performed by on-site paramedics wearing Google Glass, a head-mounted display with a camera and mi- crophone, and communicating with off-site medical doctors to provide expert care during disaster relief efforts. Ad- ditionally, wearables can pro- vide a more expedient means of monitoring a patient's vital signs during surgical procedures by reducing the size of equipment and the number of wires leading to external de- vices. Such applications could improve the quality of medical.

2. Literature Survey

Title: Health-e Everything: WearablesandtheInternetofThingsforHealth

Author: D. Metcalf, R. Khron, and P. Salber, Eds

Abstract

In our recent book *Health-e Everything: Wearables and the Internet of Things for Health*, we capture in an interactive e-book format some global thought-leader perspectives as well as early examples of case studies and novel innovations that are driving this emerging technology domain. Here, we provide a brief snapshot of key findings related to these novel technologies and use cases, which are driving both health care practitioners and health consumers (patients). As technologists, having a firm understanding of customer-driven innovation and the actual user benefits of inter connective devices for health will help us engineer better solutions that are more targeted to the triple aim of better, faster, and cheaper health solutions.

Title: Observing recovery from knee-replacement surgery by using wearable sensors

Author: L. Atallah, G. G. Jones, R. Ali, J. J. Leong, B. Lo, and G. Z. Yang,

Abstract:

A progressive improvement in gait following knee arthroplasty surgery can be observed during walking and transitional activities such as sitting/standing. Accurate assessment of such changes traditionally requires the use of a gait lab, which is often impractical, expensive, and labour intensive. Quantifying gait impairment following knee arthroplasty by employing wearable sensors allows for continuous monitoring of recovery. This study employed a recognized protocol of activities both pre-operatively, and at regular intervals up to twenty-four weeks post-total knee arthroplasty. The results suggest that a wearable miniaturised ear-worn sensor is potentially useful in monitoring post-operative recovery, and in identifying patients who fail to improve as expected, thus facilitating early clinical review and intervention.

3. Working Principle:

Initially we will connect the DHT11 sensor, Heart Beat Sensor, Blood Pressure Sensor, ECG Sensor & MEMS sensor to the raspberry pi.

- DHT11 Sensor will work for the atmospheric temperature we are collecting the temperature from the DHT11 Sensor by using I2C if any changes in the room temperature then it will effects on the resistance of DHT11 Sensor according to that we will get the value in binary which we need to change to the decimal then we will get exact temperature in 0C.
- Heart Beat Sensor is worked based on the IR principle we will keep our fore finger into the sensor then it will counts the heartbeat during on time and we need to wait for 60secs nothing but 1 min in order to collect the heart beat of a human being.

- Blood pressure sensor is working on the pressure we are applying we will connect the BP sensor to our hand and start pumping the pressure then it will give the readings according to our pressure.
- ECG sensor is going to connect to our hand and start collecting the max beat of the heart and according to that we will plot the value.
- MEMS sensor is working based on the change of angle in the motion we will check the max angle change when it is connected to the hand.

After collection of all the parameters from the sensors we will update the same values in the server which doctor can only access according to the parameters the doctor will come to know the patient condition according to that values itself he will pass the prescription to the patient as msg/display.

Block Diagram

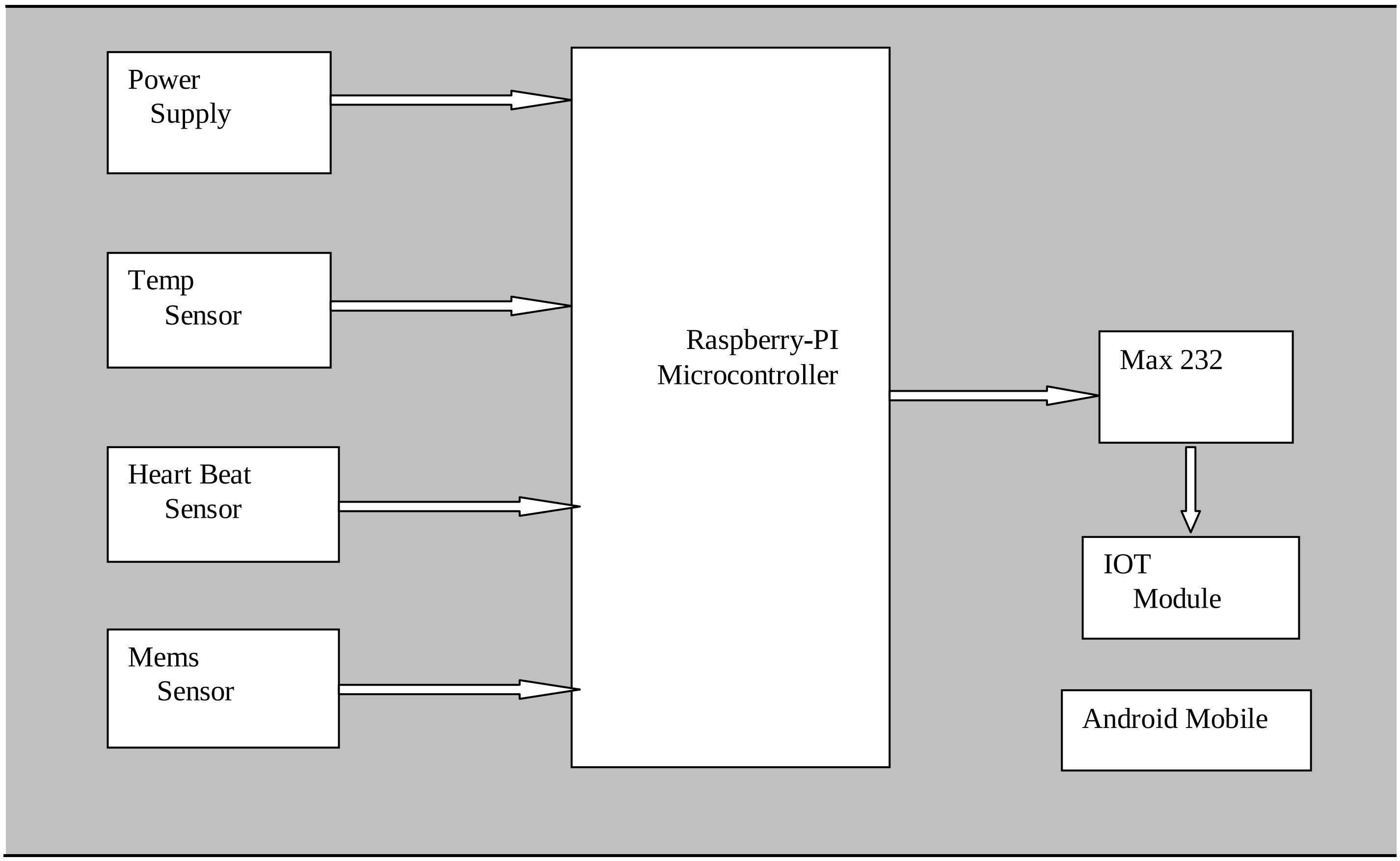

Figure: Architecture Diagram

Circuit Design:

- **Regulated Power Supply:** Usually, we start with an unregulated power supply ranging from 9volt to 12volt DC. To make a 5volt power supply, KA8705 voltage regulator IC has been used. The KA8705 is simple to use. Simply connect the positive lead form unregulated DC power supply (anything from 9VDC to 24VDC) to the input pin,connect the negative lead to the common pin and Mathematical Methods and Optimization Techniques in Engineering ISBN: 978-960-474-339-1 93then turn on the power, a 5 volt supply from the output pin will be gotten**.**

- **Raspberry Microcontroller**: A microcontroller is a computer control system on a single chip. It has many electronic circuits built into it, which can decode written instructions and convert them to electrical signals. The microcontroller will then step through these instructions and execute them one by one. As an example of this a microcontroller we can use it to controller the lighting of a street by using the exact procedures.

Microcontrollers are now changing electronic designs. Instead of hard wiring a number of logic gates together to perform some function we now use instructions to wire the gates electronically. The list of these instructions given to the microcontroller is called a program. There are different types of microcontroller, this project focus only on the Raspberry-PI Microcontroller where it's pins.

- **Heart beat sensor:**

Heart beat sensor is designed to give digital output of heat beat when a finger is placed on it. When the heart beat detector is working, the beat LED flashes in unison with each heart beat. This digital output can be connected to microcontroller directly to measure the Beats per Minute (BPM) rate. It works on the principle of light modulation by blood flow through finger at each pulse.

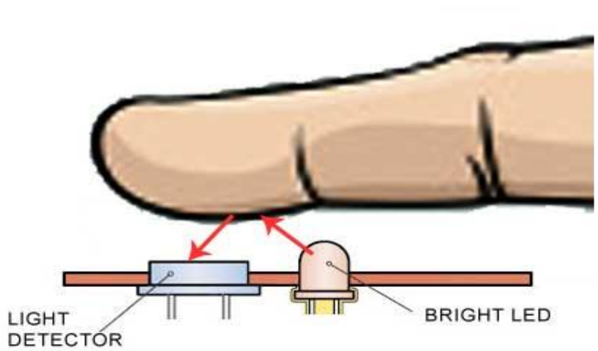

Figure: Heart Beat Sensor

Figure: Heart Beat Sensor

- **MEMS Sensor:**

Microelectromechanical Systems (Mems) (Also Written As Micro-Electro- Is The Technology Of Very Small Devices; It Merges At The Nano-Scale Into Nano Electromechanical Systems (Nems) And Nanotechnology. Mems Are Also Referred To As Micro Machines (In Japan), Or Micro Systems Technology – Mst (In Europe).

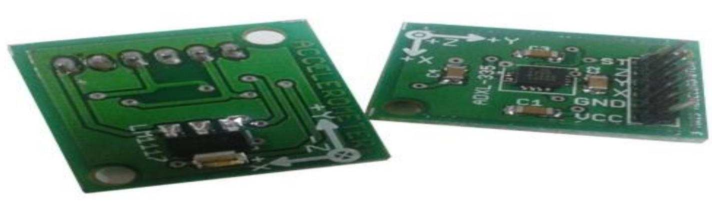

Figure: MEMS Sensor

ECG Sensor

"ECG" redirects here. For other uses, see ECG (disambiguation). Not to be confused with echocardiogram, electromyogram, electroencephalogram, or EEG.

Image showing a patient connected to the 10 electrodes necessary for a 12-lead ECG Electrocardiography (ECG, or EKG [from the German Electrocardiogram]) is a transthoracic interpretation of the electrical activity of the heart over time captured and externally recorded by skin electrodes.[1]

Figure: ECG Sensor

It is a noninvasive recording produced by an electrocardiographic device. The etymology of the word is derived from the Greek electro, because it is related to electrical activity, cardio, Greek for heart, and graph, a Greek root meaning "to write". In English speaking countries, medical professionals often write EKG (the abbreviation for the German word electrocardiogram) in order to avoid confusion with EEG.

The ECG works mostly by detecting and amplifying the tiny electrical changes on the skin that are caused when the heart muscle "depolarizes" during each heart beat. At rest, each heart muscle cell has a charge across its outer wall, or cell membrane. Reducing this charge towards zero is called de-polarisation, which activates the mechanisms in the cell that cause it to contract. During each heartbeat a healthy heart will have an orderly progression of a wave of depolarization that is triggered by the cells in the senatorial node, spreads out through the atrium, passes through "intrinsic conduction pathways" and then spreads all over the ventricles. This is detected as tiny rises and falls in the voltage between two electrodes placed either side of the heart which is displayed as a wavy line either on a screen or on paper. This display indicates the overall rhythm of the heart and weaknesses in different parts of the heart muscle.

Usually more than 2 electrodes are used and they can be combined into a number of pairs. (For example: Left arm (LA), right arm (RA) and left leg (LL) electrodes form the pairs: LA+RA, LA+LL, RA+LL) The output from each pair is known as a lead. Each lead is said to look at the heart from a different angle. Different types of ECGs can be referred to by the number of leads that are recorded, for example 3-lead, 5-lead or 12-lead ECGs (sometimes simply "a 12-lead"). A 12-lead ECG is one in which 12 different electrical signals are recorded at approximately the same time and will often be used as a one-off recording of an ECG, typically printed out as a paper copy. 3- and 5-lead ECGs tend to be monitored continuously and viewed only on the screen of an appropriate monitoring device, for example during an operation or whilst being transported in an ambulance. There may, or may not be any permanent record of a 3- or 5-lead ECG depending on the equipment used.

4. RESULT ANALYSIS:

In this project we are introducing a new method for patient health monitoring. In this we are using a Raspberry-pi Microcontroller for connecting the sensors like Temperature Sensor, Heart Beat Sensor, BP Sensor, ECG Sensor IOT module Temperature Sensor will calculate the room temperature which is very important for asthma patients whenever the temperature increases more than the room temperature then it will provide a buzzer sound in order to intimate that temperature is increases/decreases. Similarly we are also using Heart Beat Sensor in order to collect the heart rate and also the MEMS sensor in order to check the paralyzed condition or not. After collecting all the information from the patient the microcontroller will send the complete data to the doctor system based on that he will check and finalized the medicine for that particular patient.

Pattern	Bytes	Bitrate UL/DL
Pattern 1	206 / 140	1.648 / 1.12
Pattern 2	1036 / 66	8.288 / 0.528
Pattern 3	204 / 102	1.632 / 0.816
Pattern 4	420 / 564	3.36 / 4.512
Pattern 5	506 / 140	4.048 / 1.12
Pattern 6	66 / 66	0.528 0

Table: Pattern Analysis

5. CONCLUSION AND FUTURE WORK

The IoT is a potential emerging solution that consists of interconnected devices. These networked devices offer better, faster, and cheaper customer-driven innovations in health care consumption as well as provision. Networked wearable devices and apps play an integral role, serving as the foundation to the ever-evolving practice of the IoT in health care.Daniel Kraft of the Aspen Institute believes that apps and their IoT connections may begin supporting clinicians' workflow. He says, "As the incentives are aligning and value-based care comes together, the future will be the IoT that blends with wearable devices, apps, and smart analytics on top of data. This is so the clinician and care team can get the right insights from the data at the right time and not be overwhelmed. Smart preventative decisions can be made for a more proactive individualized care and therapy" [1]. With the wearables market still in its early phases of expansion and the IoT continuously changing, communications and electronic engineers will be at the forefront of building next-generation solutions.There may be a substantial increase in things like embeddables— small and easily powered microchip implants that can be placed anywhere within a person's body. In terms of the health care sector, they may be able to measure vital signs without invasive surgery. Embeddables, such as electronic tattoos, for example, may be equipped with sensors that can transmit through wireless technology. Also, three-dimensional printed medical devices are very promising additions to the IoT, in that every object implanted in the human body may be scannable or trackable through networks.Similar to what we see in science fiction movies, wearable devices that have electrostatic properties connected to various wireless systems could create new user experiences with the added capacity of artificial intelligence, making our future devices truly smart. With all of these looming innovations, the future seems to be very bright and electric.

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