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A PATIENT- SPECIFIC SINGLE SENSOR IOT-BASED WEARABLE FALL PREDICTION AND DETECTION SYSTEM

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ABSTRACT:

The project aims in designing a system which helps in monitoring the heartbeat and fall detection of elderly people on IOT. One of the ideal ways of using technology is to employ it to sense serious health problems so that efficient medical services can be provided to the patient in correct time. This idea to provide efficient health service to patients has given birth to the project heart beat monitoring system along with fall detection send location using GSM. The modules in the project are: MEMS accelerometer which is capable of fall detection, heartbeat sensor which continuously gives the heartbeat, and PC to display the monitored parameters. Heart beat monitor and display system is a portable and a best replacement for the old model stethoscope which is less efficient. The heartbeat rate is calculated manually using stethoscope where the probability of error is high because the heart beat rate lies in the range of70 to 90 per minute, so this device can be considered as a very good alternative instead of a stethoscope. The functioning of this device is based on the truth that the blood circulates for every one heart beat which can be sensed by using a circuit formed by the combination of an LDRand LED. Depending upon the rate of circulation of blood per second the heartbeat rate per minute is calculated. This device consists of a micro controller which takes the input from the heart beat sensor and calculates the heart rate of the patient. Also, the Micro controller gets the information from MEMS accelerometer about the tilt angle. Them microcontroller takes the responsibility to display the same send location using GSM The sensible Health observance System monitors health standing and saves it on the online page based on IoT.

Keywords- *IOT, Arduino Mega, BP Sensor, LCD, GSM, Temperature sensor,MAX30105sensor,ESP8266,Buzzer,Power supply,MEMS.*

INTRODUCTION

The fundamental element of people's needs is health .Humans face a haul of surprising death and plenty of diseases because of varied diseases that are a result of lack of treatment to the patients at right time. The main objective of this project is to develop a reliable sensible patient health observance system victimization IoT so the attention professionals will monitor their patients. The sensors will be either worn or be embedded into the body of the patients, to unendingly monitor their health. the knowledge collected in such a fashion will behold on, analyzed, and well-mined to try and do the first prediction of diseases. A mobile device-based attention observance system is developed which may offer period on-line data regarding physiological conditions of a patient primarily consists of sensors, the information acquisition unit, Arduino, and programmed with code. The patient's temperature, heartbeat rate, pressure level, graph knowledge square measure monitored, displayed, and hold on by the system and sent to the doctor's and patient's mobile containing the appliance. The Internet of things (IoT) describes the network of physical objects "things" that are embedded with sensors, software, and other technologies for the purpose of connecting and exchanging data with other devices and systems over the Internet

EXISTING SYSTEM

A wide variety of passive monitoring systems are currently available to detect when an individual has fallen. These systems can be wearable or non wearable systems. Non-Wearable Based Systems (NWS) are environmentally mounted system such as infrared sensors, microphones and pressure sensors that detects when falls have occurred. However, they are costly and there is consequent lack of privacy for elderly people because these systems require the sensors to be strategically placed in the indoor environment in which the elderly lives. Their operation is limited where the sensors have been deployed. Smart phone based detectors are also available but they may face difficulties with real time operations, sensing architecture, stability of the accelerometers sampling frequency etc. Also smartphones cannot be overloaded with continuous sensing commitments that undermine the performance of phones. Environmentally mounted system that automatically detects when falls have occurred. All methods start with a feature extraction, for example, the ratio of people's height and weight, the edge points from the silhouette of a person, changes in illumination, the orientation of the main axis of the person, the width, height and depth of the human posture, the skin colour to detect people, etc. Then these features are compared and classified to distinguish normal activities from real falls using different techniques. Wearable devices can be miniature electronic sensor-based devices that are worn close to and/or on the surface of the skin, where they detect, analyze, and transmit information concerning to a fall event. Most of the wearable fall detectors are in the form of accelerometer devices. These devices are not much costly due to the availability of cheap embedded sensors included in smartphones. Most of these systems uses a GSM module to generate an SMS to the doctor but does not convey the actual readings of the patient during the critical condition. Since such a devices are in close contact with the user, it can easily collect data.

PROPOSEDSYSTEM

The cause of dementia in elderly is impaired vision and hearing, muscle and joint weakness, dizziness and neuropathy affecting the nasal nerves. This device provides an alert to the relatives or other about the fallout in elderly people. Here used the Arduino MEGA , is a microcontroller board, it contains everything needed to control the microcontroller.

The system is implemented using the combination of hardware components. The smart patient health monitoring system will have sensors to detect body temperature, pulse rate and MEMS data. The health monitoring sensors are used to collect health related data i.e. for data acquisition. Communication can be done by controller for sending data on internet wirelessly. Data processing has been done at server. All data collected and aggregated at server point. To get health related information in understandable format it can be shown on web page using Thing Speak IOT. All these data will be accessible in real time scenario for continuous monitoring. Health monitoring is the major problem in today's world. Due to lack of proper health monitoring, patient suffer from serious health issues.

COMPONENTS

ARDUINO MEGA:

The Arduino Mega 2560 is a microcontroller board based on the ATmega2560. It has 54 digital input/output pins (of which 15 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button.

Figure1:Arduino Mega

ESP8266 WIFI MODULE:

The ESP8266 is an micro controller which have the inbuilt Wifi module to connect the device to internet.Esp8266 have I analog pin and 11 data pins to connect many sensors in an single system.

Figure 2:ESP8266 Wi fi Module

LCD 16*2:

The term LCD stands for liquid crystaldisplay. It is one kind of electronic display module used in an extensive range of applications like various circuits & devices like mobile phones, calculators, computers, TV sets, etc. These displays are mainly preferred for multi-segment light-emittingdiodes and seven segments. The main benefits of using this module are in expensive; simply programmable, animations, and there are no limitations for displaying custom characters, special and even animations,etc.

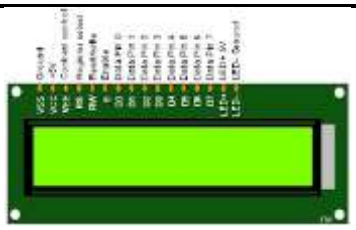

Figure 3:LCD 16*2

BUZZER:

A buzzer is a simple yet versatile device commonly used to generate audible alerts or signals in various electronic circuits, appliances, and systems.Typically composed of an electro mechanical component,it produces a buzzing or beeping sound when activated.

Figure 4: Buzzer

GSM MODULE:

GSM Global System For Mobile Communications. It is a set of mobile communications standards and protocols governing second-generation or 2G networks, first developed and deployed in Europe. GSM is a digital cellular communication standard that is universally.

Figure 5: GSM Module

BP Sensor:

The pressure sensor is used to measure the air pressure inside the inflatable cuff. The output is in analogue electrical signal representing the exerted pressure. This has been done by the piezoresistive transducer of the sensor. The piezoresistive transducer is actually in a diaphragm form, which it will stretch due to difference pressure and produced certain electrical signal. The stretched piezoresistive transducer wills affect the resistance value hence the output voltage will also differ from applied voltage. This process occurred according to bridge circuit principle As explained before, the output of the pressure sensor is amplified and filtered by amplifier and low pass filter. This is because the output of the pressure sensor is small for blood pressure level (up to 300 mmHg or about 50 kPa) as the Freescale pressure sensor able to measure pressure in the range between 0 kPa and 700 kPa. From the amplified and filtered output signal, the microcontroller wills analyses and determines the systolic and diastolic pressures

Figure 6: BP Sensor

Temperature Sensor:

Temperature sensor that comes with a dedicated NTC to measure temperature and an 8-bit microcontroller to output the values of temperature and humidity as serial data. The series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The Temperature sensorthus has an advantage over linear temperature sensors calibrated in Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling. The Temperaturesensordoes not require any external calibration or trimming to provide typical accuracies of ±1⁄4°C at room temperature and ±3⁄4°C over a full −55 to +150°C temperature rangeAs it draws only 60 µA from its supply, it has very low self-heating, less than 0.1°C in still air. The DHT11 is rated to operate over a −55° to +150°C temperature range, while the DHT11C is rated for a −40° to +110°C range (−10°with improved accuracy).

.Figure 7: Temperature Sensor

MAX30105 Sensor:

The MAX30105 is a highly integrated optical sensor module developed by Maxim Integrated. It's specifically designed for applications such as pulse oximetry and heart-rate monitoring. The sensor combines two LEDs, a photodetector, optimized optics, and low-noise analog signal processing to detect pulse oximetry and heart-rate signals.

Figure 8: MAX30105 Sensor

MEMS:

Innovations in precise gadgets that organise mechanical parts, sensors , actuators and hardware in a standard silicone substrate, by miniature manufacturing advancement, are SMS electronic mechanical systems or MEMS Technology**.**

Smaller scale**:** smaller systems, produced micro

Electro**:** Signal / control electrical

Mechanical**:** Mechanical utility

Structures, devices and systems Implementations

MEMS is also known as European Microsystems **(**MST**)** and Japan Micro Machines **(**JMM**).** MEMS are also known as MEMS**.** MOEMS-Micro-Opto-Systems of optical systems is classified as MOEMS**).**

MEMS usesstrong 'micromachining,' in which silicon wafer components may particularly be generated or new auxiliary layers are introduced, regardless of how the IC device is made**.** Electrical circuit development then generates a frame that moves these mechanical squares on a related substratum. MEMS consists of mechanical microstructures, micro sensors, and micro actuators, all of them coordinated in a similar silicone chip in the largest frame**.** This occurs in the diagram schematically**.**

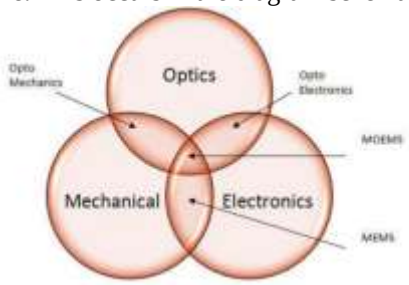

Figure 9: MEMS

POWER SUPPLY:

Provides power to the entire system, likely a battery in a real application.An internal power supply form is an AC, AC/DC or AC/DC combination adapter and is mostly found in an AC-like shell. It will delivers the DC voltage at the output side to operate any electronic device. It will be in the range of 6V to 12V.

Fig 10: Power supply

BLOCKDIAGRAM

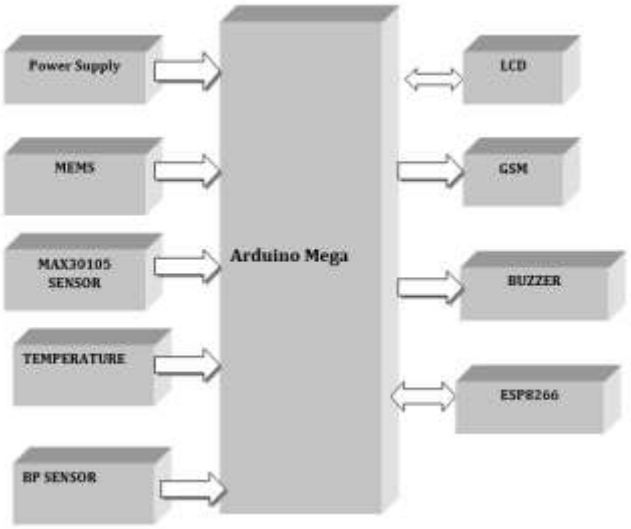

Figure 11: Block Diagram

WORKING PRINCIPLE

The working principles of a patient monitoring system involve the Data.This data is transmitted wirelessly to a centralized platform for analysis. Advanced algorithms andanalytics are applied to detect patterns, trends, and abnormalities.The patient monitoring device can be used to monitor the healthconditions ofinfants as well asadults.

EXPERIMENTAL RESULTS

To show the results of our patient- specific single sensor iot-based wearable fall prediction and detection system

Figure 12:*Patient health monitoring output*

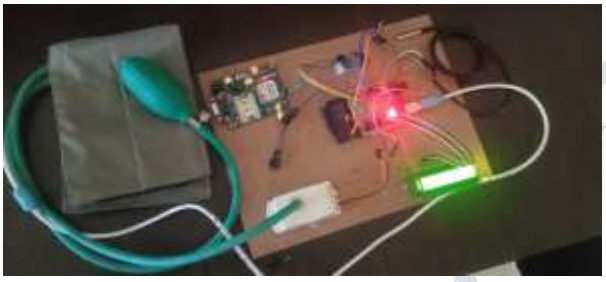

Figure 13:*Hardware Setup*

ADVANTAGES

Early Prediction and Prevention: By analyzing data from the sensor in real-time, the system can identify patterns or changes in gait, balance, or movement that may precede a fall.

Integration with Other Health Systems: IoT-based systems can often be integrated with other health and home automation systems, providing a holistic approach to patient care and safety.

Cost-Effective: By preventing falls, such systems can significantly reduce healthcare costs associated with fall-related injuries, which are often serious and require hospitalization.

APPLICATIONS

- Assisted Living and Nursing Homes
- Sports and Physical Training
- Emergency Response and Remote Monitoring

CONCLUSION

Since fall detection is a major challenge in the health care domain, especially in case of elder people, we have built an IoT based wearable fall detection system using an accelerometer sensor. The system monitor the movement of the human body and the detection method uses a threshold value to detect a fall from the activities of daily living like sitting, walking, lying down etc. When the acceleration exceeds the critical threshold, the fall is detected and an alarm is generated along with a message to the patient's contact person's mobile and the hospital side. The use of vibrator ensures less chances of false alarm. The system consumes less power and is efficient. Is also keep track of some of the biological parameters such as MEMS, temperature etc. The system does not interfere in the daily activities or privacy of the person unlike other vision based or pressure sensor based systems. This product can be worn on the person's thigh or can be kept in the pocket. This system works well for indoor as well as outdoor fall detection since both the hardware and software designs are suitable for this purpose.

FUTURESCOPE

Incorporating GPS capabilities into a patient-specific, single-sensor, IoT-based wearable fall prediction and detection system opens up a multitude of future possibilities and enhancements. The integration of GPS technology not only enhances the existing functionalities of fall detection and prediction but also introduces new applications and improvements in care, safety, and data analysis.

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