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Automatic Fall Detection and HeartbeatMonitoring for Elderly

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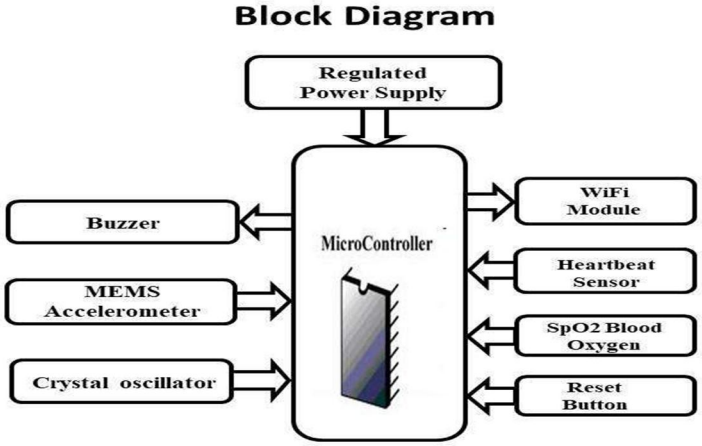
Abstract: ***Falls and fall-related injuries are major incidents, especially for elderly people, which often mark the onset of major deterioration of health. More than one-third of home-dwelling people aged 65 or aboveand two-thirds of those in residential care fall once or more each year. Reliable fall detection, as well as prevention, is an important research topic for monitoring elderly living alone in residential or hospital units. The aim of this study is to review the existing fall detection systems and some of the key research challenges faced by the research community in this field. We categorize the existing platforms into two groups: wearable and ambient devices; the classification methods are divided into rule-based and machine learning techniques. The relative merit and potential drawbacks are discussed, and we also outline some of the outstanding research challenges that emerging new platforms need to address.***

I. INTRODUCTION

The purpose of this project is to develop IoT enabled Smart Health Monitoring System for elderly persons. In this project we are sensing health parameters like Heartrate, fall detection and SpO2 (Blood Oxygen) level. The Health parameters are displayed on web browser on WiFi enabled devices like smart phone or Labtop. Technology is being used every where in our daily life to fulfill our requirements. We are employing different sensorsfor different applications some times we may even use same sensors differently for different applications. What ever it may be the final output is life has increased its speed with the technology boosters. We can not only increase the speed of life but also increase security with good ideas to make use of this technology. 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 with interfacing to IoT. Heart beat monitor and display Graf system is a portable and a best replacement for the old model stethoscope which is less efficient. The heart beat rate is calculated manually using stethoscope where the probability of error is high because the heart beat rate is in between 70 to 90 per minute whose occurrence is less than 1 sec, 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 canbe sensed by using a circuit formed by the combination of an and LED. Depending upon the rate of circulation of blood per second the heart beat 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. The micro controller also takes the responsibility to convey the same information to the remote mobile using IoT.

Block Diagram



1) Micro controller (Arduino)
2) Reset button
3) Crystal oscillator
4) Regulated power supply (RPS)
5) LED Indicator
6) Heartbeat sensor
7) SpO2 sensor
8) MEMS accelerometer sensor
9) Wi-Fi Modem

II. RELATED WORK

1) *Microcontrollers:* Circumstances that we find ourselves in today in the field of microcontrollers had their beginnings in the development of technology of integrated circuits. This development has made it possible to store hundreds of thousands of transistors into one chip. That was a prerequisite for production of microprocessors, and the first computers were made by adding external peripherals such as memory, input-output lines, timers and other. Further increasing of the volume of the package resulted in creation of integrated circuits. These integrated circuits contained both processor and peripherals. That is how the first chip containing a microcomputer, or what would later be known as a microcontroller came about. Microprocessors and microcontrollers are widely used in embedded systems products. Microcontroller is a programmable device. A microcontroller has a CPU in addition to a fixed amount of RAM, ROM, I/O ports and a timer embedded all on a single chip. The fixed amount of on-chip ROM, RAM and number of I/O ports in microcontrollers makes them ideal for many applications in which cost and space are critical.
2) *Reset Button:* Reset input pin. LOW signal on this pin with a minimum width of 1.5 microseconds will bring the microcontroller into reset condition, although the clock is not running. Signal with a width of less than 1.5 microseconds does not guarantee a Reset condition.
3) *Crystal Oscillator:* XTAL1 and XTAL2 are input and output, respectively, of an inverting amplifier which can be configured for use as an On-chip Oscillator, Either a quartz.Crystal or a ceramic resonator may be used. The CKOPT Fuse selects between two different Oscillator amplifier modes. When CKOPT is programmed, the Oscillator output will oscillate a full rail-to-rail swing on the output. This mode is suitable when operating in a very noisy environment or when the output from XTAL2 drives a second clock buffer. This mode has a wide frequency range. When CKOPT is unprogrammed, the Oscillator has a smaller output swing. This reduces power consumption considerably.
4) *LED:* A light-emitting diode (LED) is a semiconductor light source. LED's are used as indicator lamps in many devices, and are increasingly used for lighting. Introduced as a practical electronic component in 1962, early LED's emitted low-intensity red light, but modern versions are available across the visible, ultraviolet and infrared wavelengths, with very high brightness.
5) *Heartbeat & SPO2 Sensor:* This is the MAX300100 breakout board that reads heart rate or pulse oximetry. The chip has an integrated optical sensor that derives its reading from emitting two wavelength of light from the two LED's then measures the absorbance of pulsing blood through a photodetector. The signal is processed by a low noise analog signal processing unit and communicated to the Microcontroller through the i2C Interface. The MAX30100 operates from 1.8v and 3.3v voltage input and can be powered down through software with negligible standby current, permitting the power supply to remain connected at all times. The device is suitable for wearable devices like smart watch, medical monitoring equipment's, fitness assistant and smart suits. Required Components Arduino Microcontroller, ESP8266 (Arduino IDE Integrated), Teensy MCU (TeensyDuino Integrated),Buzzer / Alarm (Optional)LCD / OLED i2C Display (Optional)Solder Less BreadboardJumper Wire.
6) *MEMS Accelerometer:* The MMA7260Q is a 3-axis accelerometer .An accelerometer measures acceleration (change in speed) of anything that it's mounted on. Single axis accelerometers measure acceleration in only one direction. Dual-axis accelerometers are the most common measure acceleration in two directions, perpendicular to each other. Three-axis accelerometers measure acceleration in three directions. Accelerometers are very handy for measuring the orientation of an object relative to the earth, because gravity causes all objects to accelerate towards the earth. A two-axis accelerometer can be used to measure how level an object is. With a three-axis accelerometer, you can measure an object's acceleration in every direction.

7) *WI-FI Modem:* ESP8266 offers a complete and self-contained Wi-Fi networking solution, allowing it to either host the application or to offload all Wi-Fi networking functions from another application processor. When ESP8266 hosts the application, and when it is the only application processor in the device, it is able to boot up directly from an external flash. It has integrated cache to improve the performance of the system in such applications, and to minimize the memory requirements. Alternately, serving as a Wi-Fi adapter, wireless internet access can be added to any microcontroller-based design with simple connectivity through UART interface or the CPU AHB bridge interface.

III. CONCLUSION

The project "Automatic fall detection and Heartbeat monitoring for elderly" was designed such that the heartbeat measured is displayedon general purpose computer. The heartbeat sensor, which detects beat of the heart, is interfaced to micro controller along with PC which is used to display the measured heartbeat. It also detects the fall or bending of the person and sends information to WiFi connected devices.

Integrating features of all the hardware components used have been developed in it. Presence of every module has been reasoned out and placed carefully, thus contributing to the best working of the unit. Secondly, using highly advanced IC's with the help of growing technology, the project has been successfully implemented. Thus the project has been successfully designed and tested. The monitoring app can be developed for smart phones so that the data can be stored for historic viewing purpose. Audible alerts can be generated by apps for alerting the user.

Our project "Automatic fall detection and Heartbeat monitoring for elderly" is mainly intended to design a system, which gives very accurate result than the existing devices in the present day world. This system has a heart beat sensor and Wi-Fi interfaced tothe micro controller. The micro controller is programmed in such a way that it takes input from the heart beat sensor when a finger is inserted into it and displays the value on the Smart Phone continuously.

This project can be extended by using RS485 which also uses wired mechanism, but distance can be increased. Also, wireless technology like Zig bee can be used which eliminates the wired mechanism. Also, GSM module can be used to send the monitored heart beat values.

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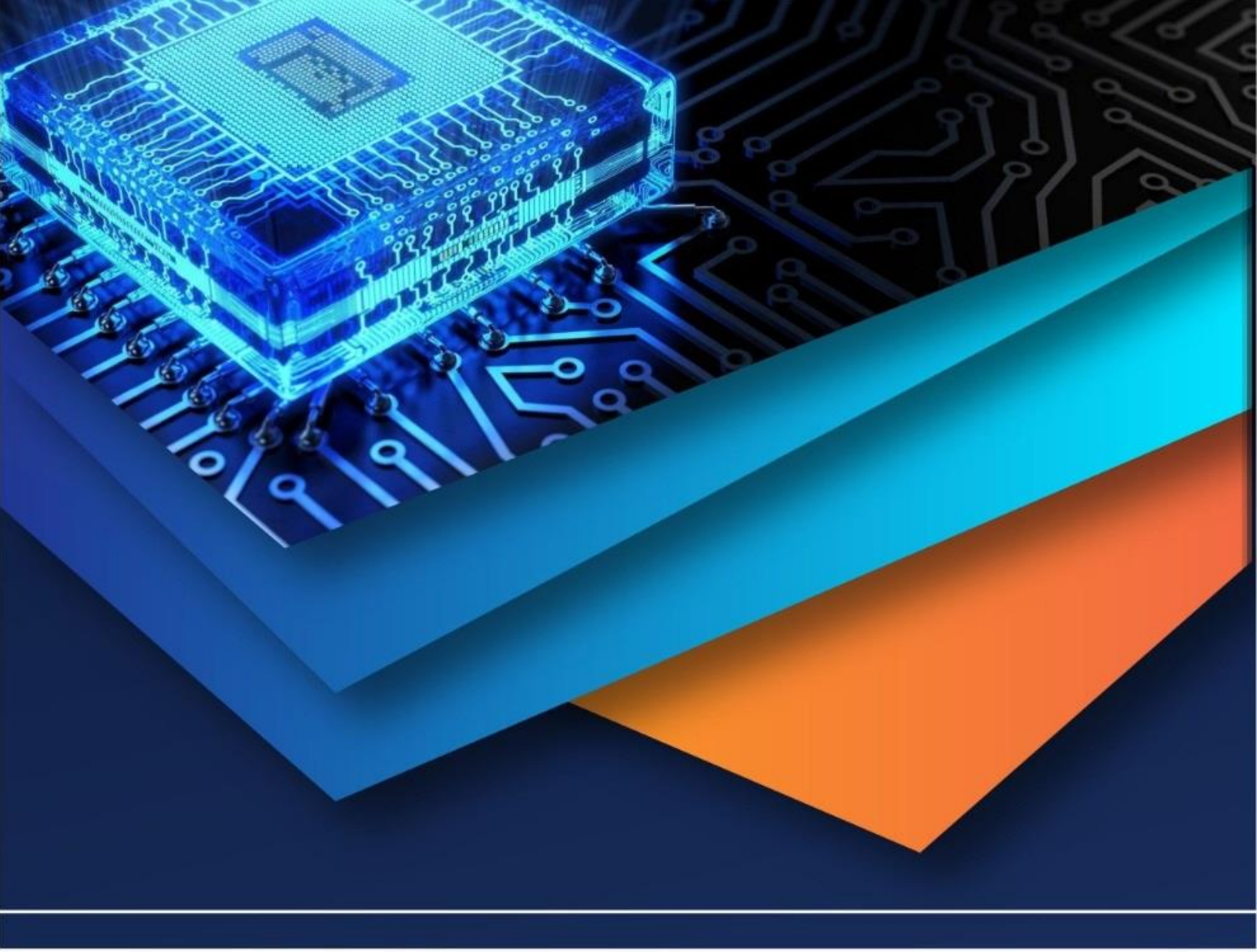

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