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Research Paper on Smart Health Diagnosis System

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Abstract: *In the recent times, health diagnosis system is one of the inventive idea that has been introduced in many of the developing countries. The framework is used to help the people to get proper health care services from the hospital to the home atmosphere. With that, patients get health care more rapidly, particularly in case of emergency situations. Such system is also very useful in pandemic situations like recent COVID19, or Spanish flu, etc. The system we develop will record various human body parameters such as body temperature, heart rate and oxygen level.*

Keywords: Health monitoring, sensor, USB, Face Detection.

I. INTRODUCTION

This Smart Health Diagnosis System is an intelligent electronic based system embedded with various sensors, electronics, and intelligent software. The aim of this system is to achieve easy to use and smart health diagnosis in order to collect data from patients without any need of human interaction (doctors, nurses). Such system is also very useful in pandemic situations like recent COVID19, or Spanish flu, etc.

The major advantage of this system is it records various human body parameters such as body temperature, heartrate, and oxygen level in blood. In order to monitor such parameters, it uses various analog & digital sensors such as NTC thermistor for temperature monitoring, MAX30100 pulse- oximeter for heartrate & SpO2 monitoring. Apart from sensory system it also consists of voice feedback and speech recognition system which helps patient for easy interaction. This voice feedback & speech recognition sub-system collects various general data from patient such as name, age, and gender.

For speech recognition, voice feedback, and face detection an intelligent python-based software is implemented which also consist of GUI (Graphical User Interface). This software interfaces with hardware over USB-To-TTL bridge with laptop/desktop. For image capturing it uses hardware inbuilt-camera of laptop/desktop. For facial detection an Artificial Intelligent (Deep Neural Network) [AIML] based approach is used which is achieved by using media-pipe API/Library. This complete software handles 70% of the overall intelligence of smart health diagnosis.

The remaining 30% is implemented as a firmware in 8-bit base-line AVR microcontroller (ATmega8A). This firmware allows microcontroller to interact with various interfaces such as sensors, basic GPIO devices, UART, etc. This uC firmware is responsible for collecting data from various sensors, transmitting sensory data over UART, controlling basic output devices such as buzzer & Signal LED based on time-event triggers, and compares data received over UART in order to re-trigger buzzer event (for alert indication).

The overall collected information of patient (image, face image, info, body params.) is summarized as a report (text file) and saved in folder/directory with patient's name & timestamp.

II. WORKING

The Smart Health Diagnosis System is electronic based system which consists of various active and passive electronic components mounted on Printed Circuit Board (PCB). This system is also referred as embedded system as it is embedded with electronics and software/firmware. Most of the basic (task-specific) embedded system are built around which contains few electronic components, various input devices/sensors, various output devices, and interfaces for other embedded systems

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In this system also we've used AVR microcontroller which is a backbone of foundation. The microcontroller acts as a heart of the system which controls flow of signals all over the electronic system were the firmware acts as a brain which tells controller how to control flow of signals. Apart from microcontroller as shown in block diagram and circuit diagram this system also consists of various electronic devices/components such as sensors, buzzer, LEDs, resistors, capacitors, etc.

For indication purpose a buzzer and LED is used. The buzzer beeps on detecting heartbeat and beeps if patient's diagnosis is complete. The green- colored signal LED blinks after every few seconds to indicate that system is working fine. For power indication one more red colored LED is used which indicates if system is plugged to USB of laptop/desktop or not. For measuring various parameters such as body temperature, heartrate, oxygen level, and distance/proximity few sensors are used. For distance/proximity measurement an HCSR04 ultrasonic sensor is used which is a digital sensor. This distance is then used in order to detect if person is still seating on chair or not. For body temperature monitoring an NTC thermistor is used which is interfaced with microcontroller. For heartrate & oxygen level monitoring an MAX30100 pulse-oximeter sensor is used which is interfaced with microcontroller. Once the data is pre-processed then microcontroller uses some FSM to detect peaks of pulses and duration between them in order to calculate heartrate in BPM . For interfacing with software, an FTDI chip-based USB-To-TTL bridge/module is used which allows microcontroller and intelligent software in laptop/desktop to communicate with each other for data sharing.

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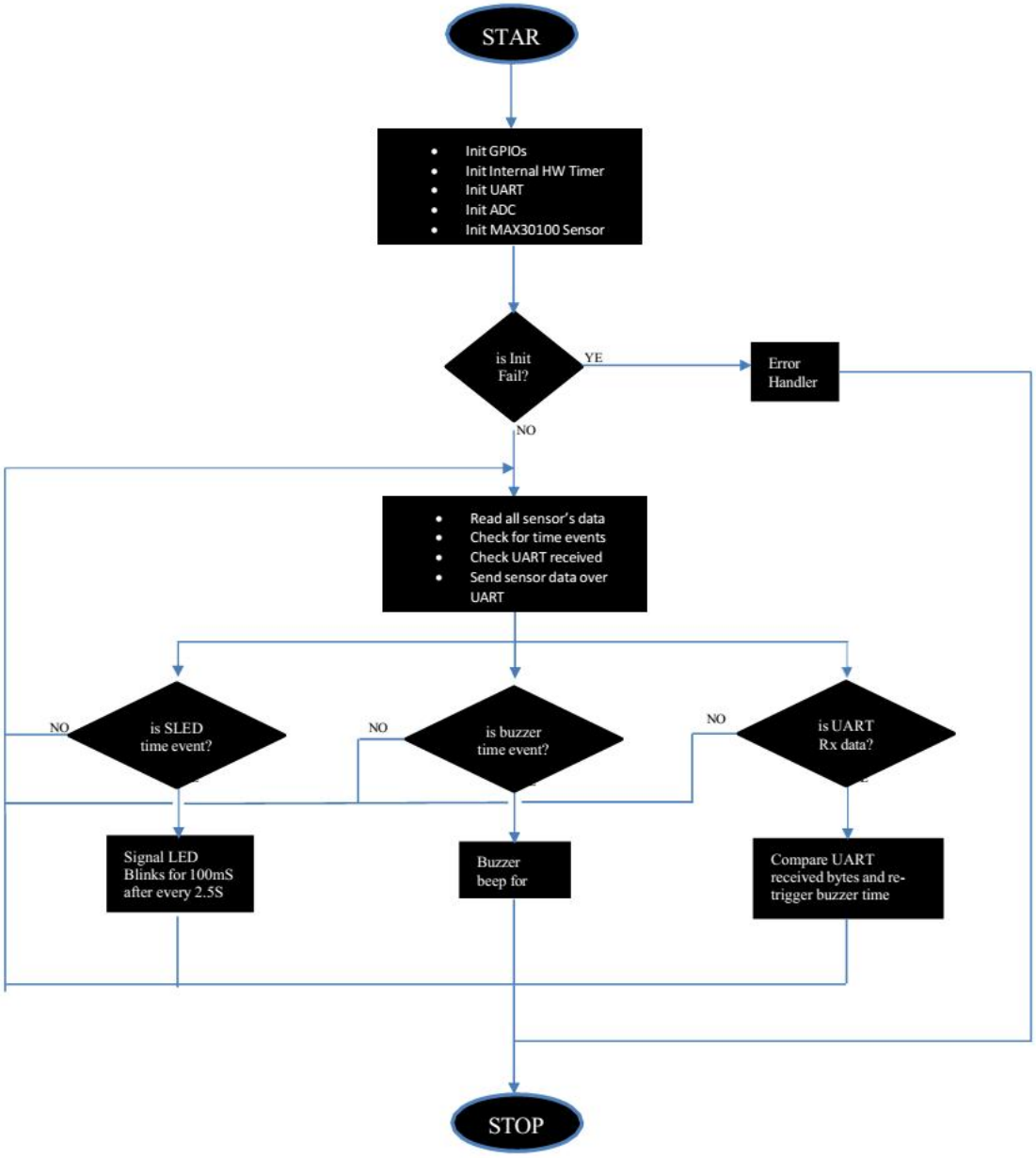
III. SYSTEM FLOW CHART



IV. HARDWARE USED

ATMega8 Microcontroller

The Atmel®AVR® ATmega8 is a low-power CMOS 8-bit microcontroller based on the AVR RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega8 achieves throughputs approaching 1MIPS per MHz, allowing the system designer to optimize power consumption versus processing speed.

Features

- High-performance, Low-power Atmel®AVR® 8-bit Microcontroller
- Advanced RISC Architecture
- High Endurance Non-volatile Memory segments
- Special Microcontroller Features

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Ultrasonic Module HC-SR04

Ultrasonic ranging module HC - SR04 provides 2cm - 400cm non- contact measurement function, the ranging accuracy can reach to 3mm. The modules includes ultrasonic transmitters, receiver and control circuit.

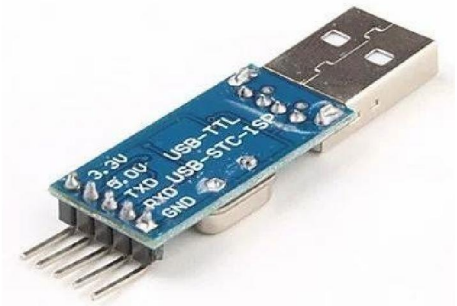
The basic principle of work: (1) Using IO trigger for at least 10us high level signal, (2) The Module automatically sends eight 40 kHz and detect whether there is a pulse signal back. (3) IF the signal back, through high level , time of high output IO duration is the time from sending ultrasonic to returning.

MAX30100 Pulse Oximeter (SpO2) Sensor

The MAX30100 is an integrated pulse oximetry and heartrate monitor sensor solution. It combines two LEDs, a photodetector, optimized optics, and low-noise analog signal processing to detect pulse oximetry and heart-rate signals. The MAX30100 operates from 1.8V and 3.3V power supplies and can be powered down through software with negligible standby current, permitting the power supply to remain connected at all times.

USB-To-TTL Converter Module

The USB to TTL serial adapter is based on the high quality and very popular FTDI FT232RL chipset and is an excellent way to connect TTL serial devices to a PC through a USB port. This USB to TTL serial adapter is ideal for many uses, including: Programming microprocessors such as ARM, AVR, etc Working with computing hardware such as routers and switches Serial communication with many devices such as GPS devices Serial terminals on devices like the Raspberry Pi.



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NTC Thermistor

This is a Negative Temperature Coefficient Resistor Whose resistance changes with ambient temperature changes. Thermistor comprises 2 or 4 kinds of metal oxides of iron, nickel,cobalt, manganese and copper, being shaped and Sintered at high temperature(1200℃ to 1500℃). Conversion power supply, switch power, UPS power, Kinds of electric heter, electronic energy-saving lamps, electronic ballast etc all kinds of power cicuit proterction of electronic equipments, filament proterction of CRT, bulb and other lighting lamps.

Electrolytic Capacitor

An electrolytic capacitor is a type of capacitor that uses an ionic conducting liquid as one of its plates with a larger capacitance per unit volume than other types. An electrolytic capacitor is a type of capacitor typically with a larger capacitance per unit volume than other types, making them valuable in relatively high- current and low-frequency electrical circuits. This is especially the case in power-supply filters, where they store charge needed to moderate output voltage and current fluctuations, in rectifier output, and especially in the absence of rechargeable batteries that can provide similar low-frequency current capacity

V. SOFTWARE USED

1. Arduino IDE:- It is used for programming for microcontroller and AVR ATMega 8. It is purpose for buzzing and LED light .
2. Proteus ISIS & ARES:- It is used for making Circuit Design and PCB designing.
3. Python:- It is used for speech to voice recognition and face detection of the system .

VI. APPLICATION

1. It is easy for patients and medical professionals to use the system.
2. Minimizes the human efforts and work.
3. Disable patient can use this device.
4. Patient health parameter data is stored over the laptop/desktop.

VII. CONCLUSION

Hence the system provides the opportunity for the doctors to monitor the health of the patients. The proposed system of patient health monitoring can be highly used in emergency situations as it can be daily monitored, recorded and stored as a database. The system collects information like temperature, blood pressure and pulse rate of the patient and updates the same to the doctor. This project is cost effective and provides timely response to improve the patients health..

VIII. ACKNOWLEDGMENT

First and foremost we would like to thank our guide, Department of Electronics and Telecommunication) Prof. Jayant Dorave for his constant support and guidance. Sir's active cooperation and involvement have helped us through various stages of project development. We would also like to express gratitude to sir for his thoughtful recommendation and suggestions.

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