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WEARABLE SAFETY WRISTBAND DEVICE FOR ELDERLY HEALTH MONITORING

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ABSTRACT

The number of elderly citizen is on the rise around the globe. As a result, the number of those living alone is also likely to increase. When an elderly person living alone has a heart attack or falls at home, nobody is around to alert family members or the doctor. It can take hours or days for the incident to be discovered, and the person may be dead by then. With this worrying scenario and the growing ageing population in mind, we have come up with a system that allows alert signals to be sent either automatically or at the push of a button. This wearable wristband health monitoring system comprises of a smart wristband device that can monitor the health of an elderly person and can find whether the person wearing it is in a medical emergency and can automatically alert the family members and doctors if necessary. The device can communicate with a smart phone and is equipped with exclusive and innovative features that are tailored for elderly care.

Key words: MEMS Accelerometer, NFC medication, ARM processor.

INTRODUCTION

In India the size of the elderly population, i.e. persons above the age of 60 years is fast growing although it constituted only 7.4% of total population at the turn of the new millennium. Rising health care costs and an increasing elderly population are placing a strain on current health care services. Elderly patients, particularly those with chronic conditions, require continuous long-term monitoring to detect changes in their condition as early as possible[1]. Most research activities have been focused on achieving common platform for medical records, monitoring health status of the patients in a real-time manner, improving the concept of online diagnosis, enhancing security and integrity of the patients, developing

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or enhancing telemedicine solutions, which deals with remote delivery of health care services applying telecommunications, etc.[2,3]

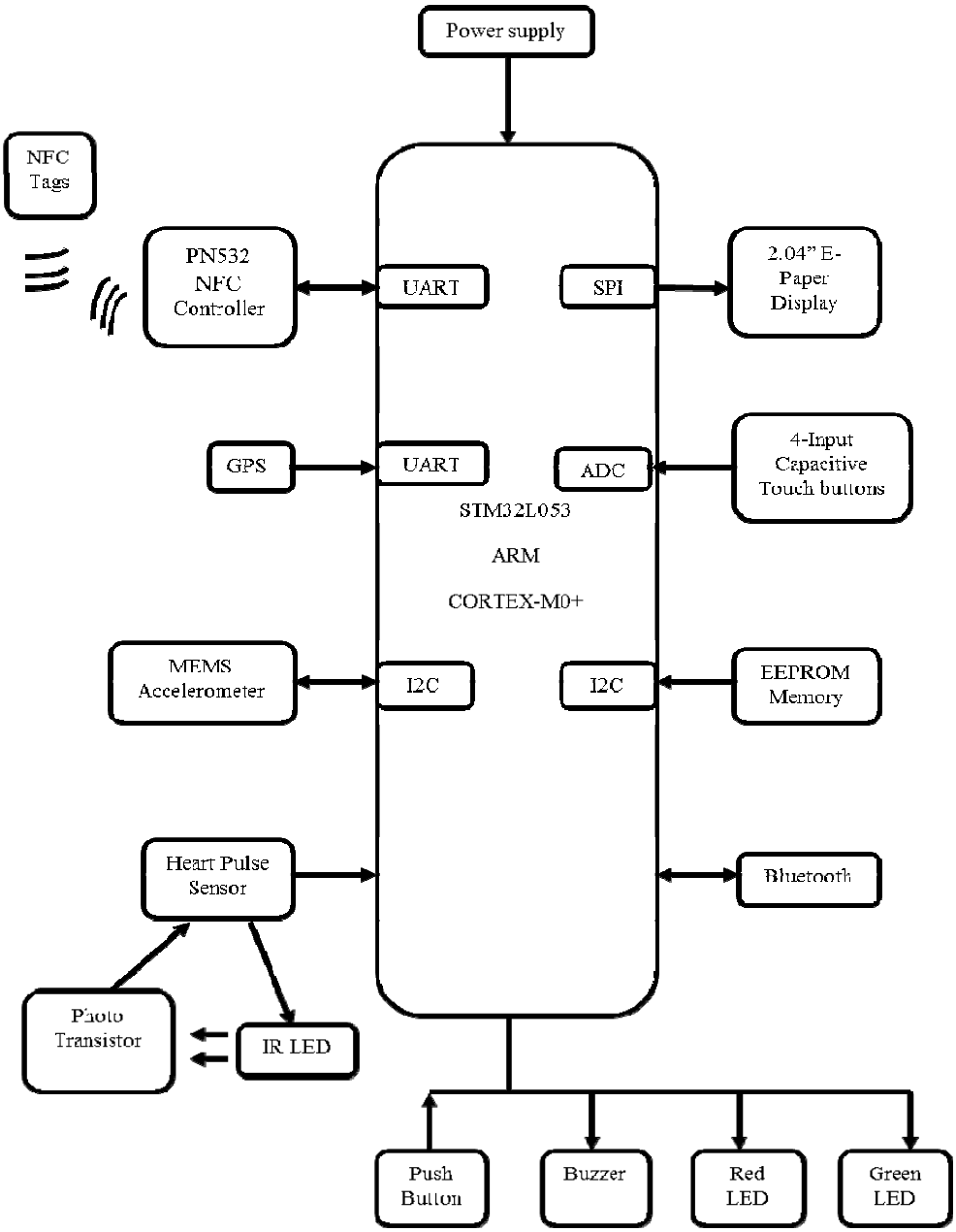

Fig. 1: Block diagram of wearable wrist band device

Proposed system architecture

Health monitoring and emergency response

Falling and Heart attack are the most common causes of hospital admissions for trauma and the leading cause of death among those who age 65 or older[3]. The device has a heart rate sensor and a body motion sensor that are used to constantly monitor these conditions[8]. The device waits for predetermined time period and if the person is inactive then, an alert SMS will be sent to those on the device contact list. A smart phone app must be installed before using this device. The emergency contact numbers can be entered manually on this app, which will be stored on the device on a permanent memory[5-7].

E-Paper display

An E-Paper Display is used as the main GUI for the device. This type of display doesn't need a backlight and doesn't need to be refreshed like a conventional smart phone screen and thus needs no power to retain the image displayed on it. This results in an always-on and extremely low power consumption display that enables the device to run for much longer duration increasing the battery recharge interval.

Smart NFC medication

This feature guides the elderly people to take the medicines at appropriate time since it runs a real time clock It issues an audible alarm whenever the time is up for a medicine intake. If the patient cannot remember which medicine to take and at what quantity, simply bring the medicine tag near the device and it will blink Green light if that medicine should be taken or Red light if that is not allocated for that time.

GPS Location tracking

A location query SMS can be sent to the device which will reply with the current GPS location. The device has an accurate GPS sensor, and helps others to know the current location of the elderly**.**

Smartphone connectivity

The device is linked with a smart phone using blue tooth wireless connection. The device can notify the user with time, data and SMS messages. A smart phone app can send alert SMS to those contacts in case of an emergency. The contact numbers can be edited and stored in the permanent memory of the device.

Device missing alert

The device can find the distance from the smart phone by measuring the signal strength of blue tooth radio and when it is more than 5m from the smart phone, will give a beep alarm and blink the RED LED. This is useful when the user forgets to take the smart phone.

Cap-Touch buttons

The device uses a 4-input Cap-Touch buttons as the main user input method. It offers more reliability and longer life when compared to traditional mechanical solutions. Here the PCB itself acts as the touchpad.

Distress alarm button

A push button on the device allows the user to send a distress alarm SMS to all those emergency contacts stored in memory.

Audible beep signal

The device is also able to trigger a buzzer beep signal from that could be audible to those passers-by and very close neighbors. This way it can render help more quickly.

Hardware specifications

Power supply

A power supply provides a constant output regardless of voltage variations. "Fixed" three-terminal linear regulators are commonly available to generate fixed voltages of plus 3 V, and plus or minus 5 V, 9 V, 12 V, or 15 V when the load is less than about 7 amperes.

ARM cortex mo

The ARM Cortex™-M3 processor is the industry-leading 32-bit processor for highly deterministic real-time applications including microcontrollers, automotive body systems, industrial control systems and wireless networking and sensors.

Serial peripheral interface

Serial Peripheral Interface is a simple interface, which enables to communicate microcontroller and peripheral chips or intercommunicate between two or more microcontrollers. SPI Bus uses synchronous protocol, where transmitting and receiving is guided by clock signal generated by master microcontroller.

I^2 C Protocol

I²C is a multi-master serial computer bus invented by Philips that is used to attach low-speed peripherals to a motherboard, embedded system, or cell phone.

MEMS Accelerometer

An accelerometer is a device for measuring acceleration and gravity induced reaction forces. The LIS302DL is an ultra compact low-power three axes linear accelerometer. It includes a sensing element and an IC interface able to provide the measured acceleration to the external world through I2C/SPI serial interface[4].

RESULTS AND DISCUSSION

This wearable wristband device is tested for several scenarios. The heart rate is monitored through a heart rate sensor and it was displayed in E-Paper. Whenever the patient is in distress it is indicated by the beep signal. Using the Smart NFC medication the drug for 3 dosages is programmed and the user is alerted to take the medicines at right time. The location of the elderly patient was identified using GPS and smart phone connectivity. The device missing alert feature is also tested.

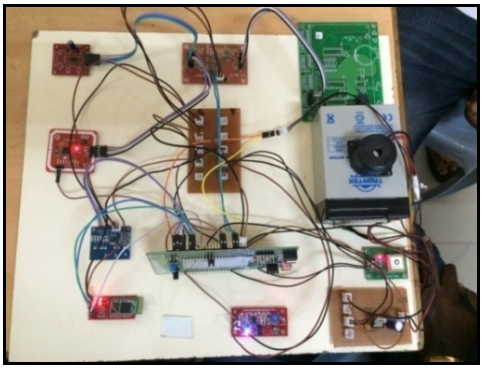

Fig. 2: Hardware circuit of wearable wrist band health monitoring device

CONCLUSION

Our elderly wearable wristband device is very much useful in the health monitoring of Elderly people in the absence of human support at all times. It is very much user friendly and cost effective system. It provides assistance to the elderly in monitoring the blood pressure and if it shoots up then it would be informed to the remote assistance through Android Application.

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