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RESEARCH ARTICLE

AN IOT BASED INTELLIGENT MEDICINE BOX

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ABSTRACT:

A modern health care and in addition to this intelligent home monitoring, controlling embedded system capable of taking care of the patients from all aspects, covering personalized medication, vital signs monitoring. The project gives an experimental idea of patient's health condition and monitor environmental conditions and controlling. The platform involves an open-platform-based intelligent medicine box with enhanced connectivity and interchange ability for the integration of devices and services, Intelligent pharmaceutical packing with communication capability enabled by Zigbee and actuation capability enabled by functional materials and, flexible and wearable bio-medical sensor device enabled. The proposed platform devices with in-home healthcare services for improved user experience and service efficiency. The feasibility of the implemented Health platform has been proven in field trials and if any vital signs recognized then gives alert to predefine care takers through SMS alert and monitor the conditions continuously with an IP address of WIFI.

Keywords: *health monitoring, MEMS, WI-FI, ARM controller.*

1. INTRODUCTION

Now a day's healthcare is a burden factor for systems are struggling with aging population, prevalence of chronic diseases, and the accompanying rising costs. In response to these challenges, researchers have been actively seeking for innovative solutions and new technologies [8] that could improve the quality of patient care meanwhile reduce the cost of care through early detection/intervention and more effective disease/patient management. It is envisaged that the future healthcare system should be preventive, predictive, personalized, pervasive, participatory, patient-centered, and precise, i.e., p-health system. Health informatics, which is an emerging interdisciplinary area to advance p-health, mainly deals with the acquisition, transmission, processing, storage, retrieval, and use of different types of health and biomedical information. The two main acquisition technologies of health information are sensing and imaging. This paper focuses only on sensing technologies and reviews the latest developments in sensing and wearable devices for continuous health monitoring [2] and accessing the information

This invention relates generally to methods and systems for monitoring a person. The present invention relates to interoperability of medical devices.

Medical devices are essential to the practice of modern medicine. Physiologic measurements like blood pressure and temperature, x-ray and ultrasound imaging, administration of intravenous medications, and support of critical life functions are all routine procedures that use medical devices. However, at present, each device is designed to stand alone as an island. To address this issue, the Institute of Electrical and Electronics Engineers Inc. (IEEE) is developing two new point-of-care medical device standards. IEEE P1073.2.2.0 Health Informatics Point-of-Care Medical Devices Communication Application Profile Association Control Function will provide for the establishment, release and disconnection of an association between a medical device agent and a system acting as a manager. In medical device communications [14], manager systems indicate a set of desired capabilities when requesting an association. Agent systems respond by stating the capabilities they support across the connection. IEEE P1073.2.2.0 is referenced by other application-profile mode standards within the ISO/IEEE 11073 family. The second standards project, IEEE P1073.2.2.1 Health Informatics Point of Care Medical Device Communication Application Profile Polling Mode will define a method for retrieving application data with medical devices that communicate through polling protocols. IEEE P1073.2.2.1 will enable "plug-and-play" interoperability [14] for simple medical devices that use for management systems to query devices for all information to be communicated.

There is a clear trend that the devices are getting smaller, lighter, and less obtrusive and more comfortable to wear. Although physiological measurement devices have been widely used in clinical settings for many years, some unique features of unobtrusive and wearable devices due to the recent advances in sensing, networking and data fusion have transformed the way that they were used in. First, with their wireless connectivity [10] together with the widely available infrastructure, the devices can provide real-time information and facilitate timely remote intervention to acute events such as stroke, epilepsy and heart attack, particularly in rural or otherwise underserved areas where expert treatment may be unavailable. The objectives of this paper are to provide an overview of unobtrusive sensing and wearable systems with particular focus on emerging technologies [8], and also to identify the major challenges related to this area of research.

Existing System

A person performs daily activities at regular interval of time. This implies that the person is mentally and physically fit and leading a regular life. This tells us that the overall well-being of the person is at a certain standard. If there is decline or change in the regular activity, then the wellness of the person is not in the normal state. Elderly people desire to lead an independent lifestyle, but at old age, people become prone to different accidents [10], so living alone has high risks and is recurrent.

A growing amount of research is reported in recent times on development of a system to monitor the activities of an elderly person living alone so that help can be provided before any unforeseen situation happened.

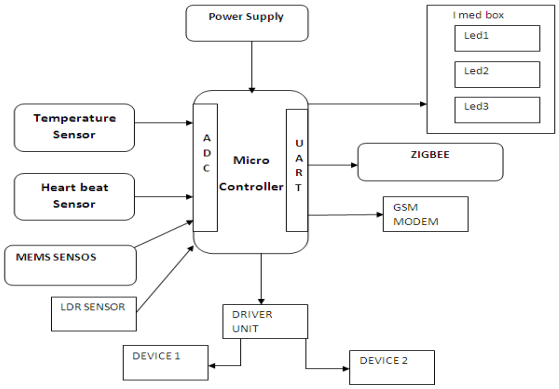
Proposed System

An intelligent home monitoring system based on ZigBee [13] wireless sensors network has been designed and developed to monitor and evaluate the well-being of the elderly living alone in a home environment. Wellness of elderly can be evaluated for forecasting unsafe situations during monitoring of regular activities. The developed system is intelligent, robust and does not use any camera or vision sensors as it intrudes privacy. Based on a survey among elderly we find that it has a huge acceptability to be used at home due to non use of the camera or vision based sensors. The intelligent software, along with the electronic system, can monitor the usage of different household appliances [12] and recognize the activities to determine the well-being of the elderly.

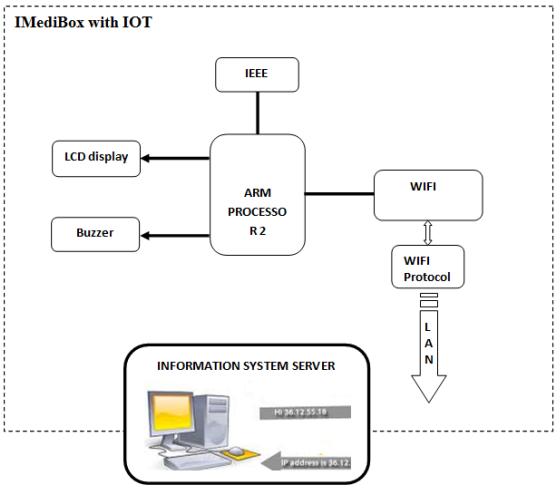
2. ARCHITECTURE AND WORKING THEORY:

The overall structure of the system consists of two important modules: i) Wireless Sensor Network (WSN) with Zigbee modules and ii) Intelligent home monitoring software system to collect sensor data and perform data analysis. Exploration of the sensor data involves measuring the wellness and detecting behavioral changes of an elderly. Above figure depicts the block diagram of the wellness measurement system. Block diagram of Computer Based Wellness Measurement system A. Design of the Sensing Units: The WSN setup [5] used for monitoring smart home consists of fabricated electrical sensing units. These are installed at an elderly home to monitor their daily activity behavior in terms of object usages and execute effectively process. The electrical sensing units

connected to various household appliances in this proposed system we implement a health monitoring platform such as temperature heart beat fall occurrence and in addition to this gives an alert message to caring persons or hospitals by using GSM technology. In addition to this an automatic environment controlling like temperature dependent fan controlling and intercity based room light controlling and the additional features to this system



MONITORING SECTION:



Medical data using a first medical data collection appliance coupled to a network [7], the first appliance transmitting data conforming to an interoperable format, wherein the medical data is transmitted using a first wireless protocol

3. HARDWARE MODULES USED:

ARM7 FAMILY:

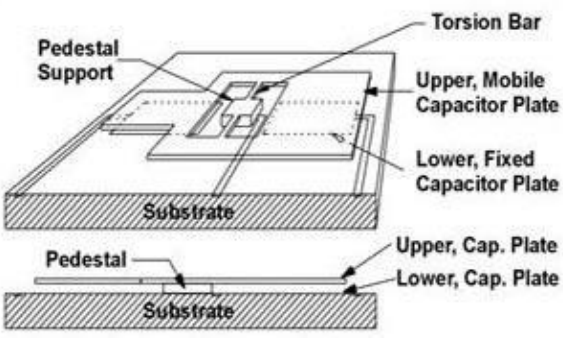
The ARM7 family includes the ARM7TDMI, ARM7TDMI-S, ARM720T, and ARM7EJ-S processors. The ARM7TDMI core is the industry's most widely used 32-bit embedded RISC microprocessor solution. Optimized for cost and power-sensitive applications, the ARM7TDMI solution provides the low power consumption, small size, and high performance needed in portable, embedded applications. The ARM7TDMI-S core is the synthesizable version of the ARM7TDMI core, available in both VERILOG and VHDL, ready for compilation into processes supported by in-house or commercially available synthesis libraries.

LPC2148 MICROCONTROLLER:

LPC2148 microcontroller board based on a 16-bit/32-bit ARM7TDMI-S CPU with real-time emulation and embedded trace support, that combine microcontrollers with embedded high-speed flash memory ranging from 32kB to 512kB. A 128-bit wide memory interface and unique accelerator architecture [3] enable 32-bit code execution at the maximum clock rate. For critical code size applications, the alternative 16-bit Thumb mode reduces code by more than 30% with minimal performance penalty. The meaning of LPC is Low Power Low Cost microcontroller. This is 32 bit microcontroller manufactured by Philips semiconductors (NXP).

MEMS Technology

Micro-Electro-Mechanical Systems (MEMS) is the integration of mechanical elements, sensors, actuators, and electronics on a common silicon substrate through micro fabrication technology. MEMS is an enabling technology allowing the development of smart products, augmenting the computational ability of microelectronics with the perception and control capabilities of micro sensors



The increasing demand for MEMS (micro-electromechanical systems) technology is coming from diverse industries such as automotive, space and consumer electronics. MEMS[9] promises to revolutionize nearly every product category by bringing together silicon-based microelectronics with micromachining technology, making possible the

realization of complete systems-on-a-chip, first developed for the integrated circuit industry, for this emerging market.

Features of MEMS

- 3-axis single-chip accelerometer
- Built-in IC integrating temperature Sensor and self-diagnosis function
- High sensitivity: up to 1,000mV/G
- External connection for low pass filters
- Automatic correction of mounting angle
- Small size: 5.0 x 5.0 x 2.3mm
- Lead-free.

HEART BEAT SENSOR:

The Heart Beat Sensor provides a simple way to study the heart's function. This sensor monitors the flow of blood through ear lobe. As the heart forces blood through the blood vessels in the ear lobe, the amount of blood in the ear changes with time. The sensor shines a light lobe (small incandescent lamp) through the ear and measures the light that is transmitted. The clip [7] can also be used on a fingertip or on the web of skin between the thumb and index finger. The signal is amplified, inverted and filtered, in the box. By graphing this signal, the heart rate can be determined, and some details of the pumping action of the heart can be seen on the graph. Blood flowing through the earlobe rises at the start of the heartbeat. This is caused by the contraction of the ventricles forcing blood into the arteries and by shutting of the heart value at the end of active phase.

Temperature sensor:

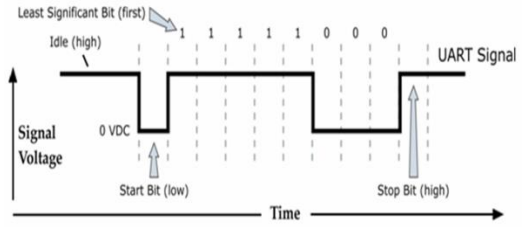
TheLM35 pin diagram is shown in the fig2. The temperature sensor in the circuit will read the temperature from the surroundings and shown the temperature in Celsius (degrees). The LM35 is a low voltage IC which uses approximately +5VDC of power [2]. This is ideal because the arduino's power pin gives out 5V of power. The IC has just 3 pins, 2 for the power supply and one for the analog output. The output pin provides an analog voltage output that is linearly proportional to the Celsius temperature. Pin 2 gives an output of 1millivolt per 0.1°C (10mV per degree).

ZIGBEE:

The ZigBee protocol support the unique needs of low-cost, low-power wireless sensor networks. The modules require minimal power and provide reliable delivery of data between remote devices. The modules operate within the ISM 2.4 GHz frequency band The XBee/XBee-PRO ZB firmware release can be installed on XBee modules. This firmware is compatible with the ZigBee 2007specification, while the ZNet 2.5 firmware is based on Ember's proprietary "designed for ZigBee" mesh stack (EmberZNet 2.5). ZB and ZNet 2.5 firmware are similar in nature, but not over-the-air compatible.

Serial Data enters the module UART through the DIN (pin 3) as an asynchronous serial signal. The signal should idle high when no data is being transmitted. Each data byte consists of a start bit (low), 8 data bits (least significant bit first) and a stop bit (high). The following figure illustrates the serial bit pattern of data passing through the module.

The module UART performs tasks, such as timing and parity checking, that are needed for data communications.



Serial Data Format

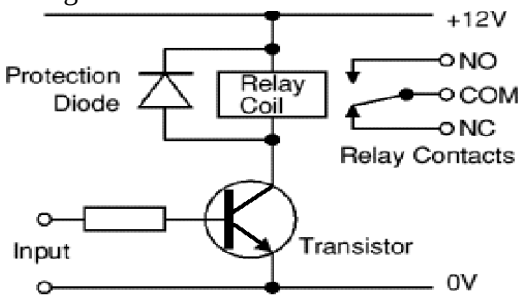
Serial communications depend on the two UARTs to be configured with compatible settings (baud rate, parity, start bits, stop bits, data bits).

Relay circuit

The coil of a relay passes a relatively large current, typically 30mA for a 12V relay, but it can be as much as 100mA for relays designed to operate from lower voltages. Hence a CB amplifier is used to achieve the current rating of the relay.

Transistors and ICs must be protected from the brief high voltage produced when a relay coil is switched off. The diagram shows how a signal diode (e.g. 1N4148) is connected 'backwards' across the relay coil to provide this protection. Current flowing through a relay coil creates a magnetic field which collapses suddenly when the current is switched off. The sudden collapse of the magnetic field induces a brief high

voltage across the relay coil which is very likely to damage transistors and ICs.



GSM MODEM:

A GSM modem is a wireless modem that works with a GSM wireless network. A wireless modem behaves like a dial-up modem. The main difference between them is that a dial-up modem sends and receives data through a fixed telephone line while a wireless modem sends and receives data through radio waves.

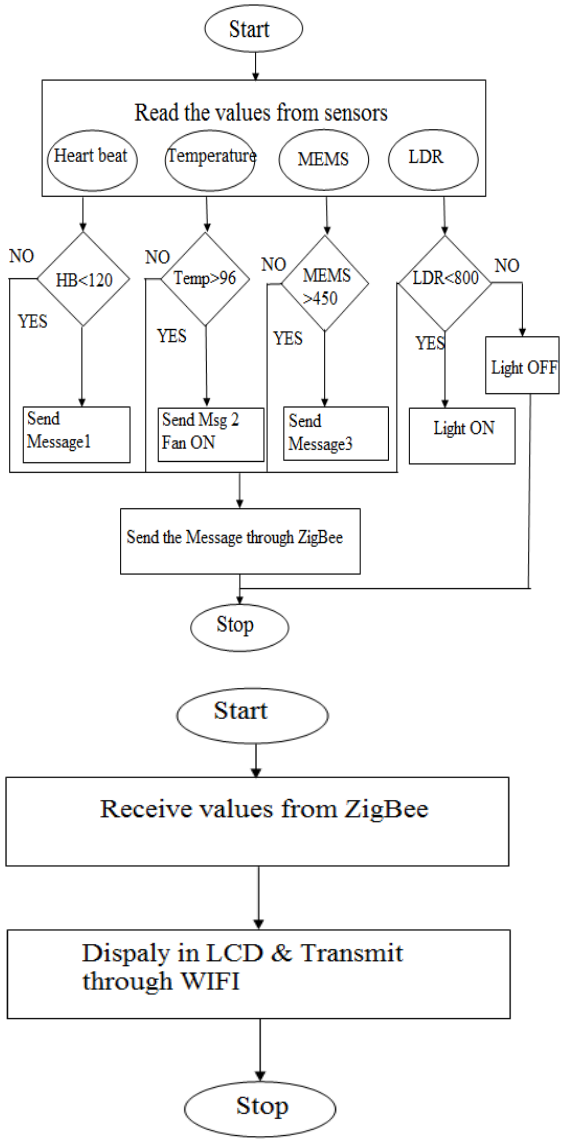
A GSM modem can be an external device or a PC Card / PCMCIA Card [13]. Typically, an external GSM modem is connected to a computer through a serial cable or a USB cable. A GSM modem in the form of a PC Card / PCMCIA Card is designed for use with a laptop computer. It should be inserted into one of the PC Card / PCMCIA Card slots of a laptop computer. Like a GSM mobile phone, a GSM modem requires a SIM card from a wireless carrier in order to operate.GSM SMS messaging can handle large number of transaction in a very short time. You can receive large number SMS messages on your server like e-mails without internet connectivity. E-mails normally get delayed a lot but SMS messages are almost instantaneous for instant transactions. Consider situation like shop owners doing credit card transaction with GSM technology instead of conventional landlines. Time you find local transaction servers busy as these servers use multiple telephone lines to take care of multiple transactions, whereas one GSM connection is enough to handle hundreds of transaction.

Mobility, Quick installation:

WIFI

HLK-RM04 is a new low-cost embedded UART-ETH-WIFI[9] module (serial port - Ethernet - Wireless network) developed by Shenzhen Hi-Link Electronic Technology co., Ltd This product is an embedded module based on the universal serial interface network standard, built-in TCP / IP protocol stack, enabling the user serial port, Ethernet, wireless network (WIFI) interface between the conversions. Through the HLK-RM04 module, the traditional serial devices do not need to change any configuration; data can be transmitted through the Internet network. Provide a quick solution for the user's serial devices to transfer data via Ethernet.

4. Flow Chart:



5. CONCLUSION AND RESULT:

We presented an interactive embedded measurement of daily activities through usage of household appliances sensor data. Predicting the behavior of an elderly person was based on past sensor activity durations. Combination of sensing system with time series data processing and enabled us to measure how well an elderly person is able to perform their daily activities in real-time. So far, the forecasting

process was able to rightly measure the wellness indices related to use of non-electrical appliances. Hence, some of the basic elderly daily activities such as sleeping, toileting, dining and relaxing are rightly assessed care takers and hospitals by the wellness measurement system. The most of the electrical appliances usage durations are predefined; validation for activities such as preparing food is limited. However, additional data processing method such as sensor sequence activity pattern analysis was able to rightly measure the occurrences of activities such as preparing breakfast, lunch, dinner and snacks. The next step will be to devise a robust forecasting method including outliers in the wellness of old and ill people measurement and alerting system.

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BIOGRAPHIES

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