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Smart Health Care Solutions Using IOT

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Abstract:

The health care represents one the top challenges that every country is facing today. Although health care of industry invest heavily in IT, yet the promised improvement in patient safety and productivity has not been realized up to the standards even today organizations still rely on paper medical records & hand return notes to inform hand make decisions. The IOT can bring multiple benefits to healthcare through the use of sensors, intelligent equipment's, etc. The Internet of Things (IoT) is a new concept that allows users to connect various sensors and smart devices to collect real-time data from the environment. However, it has been observed that a comprehensive platform is still missing in the e-Health and m-Health architectures to use smartphone sensors to sense and transmit important data related to a patient's health. In this project our contribution is twofold. Firstly, we critically evaluate the existing literature, which discusses the effective ways to deploy IoT in the field of medical and smart health care. Secondly, we propose a new semantic model for patients' e-Health. The proposed model named as 'k-Healthcare' makes use of 4 layers the sensor layer, the network layer, the Internet layer and the services layer. All layers cooperate with each other effectively and efficiently to provide a platform for accessing patients' health data using smart phones.

I. INTRODUCTION:

The Internet of Things (IoT) is a concept reflecting connected set of anyone, anything, anytime, anyplace, Any service and any network. The IoT is a megatrend in next-generation technologies that can impact the whole business spectrum and can be thought of as the interconnection of uniquely identifiable smart objects and devices within today's internet infrastructure with extended benefits. Benefits typically include the advanced connectivity of these devices, systems, and services that goes beyond machine-to-machine (M2M) scenarios. Therefore, introducing automation is conceivable in nearly every field. The IoT provides appropriate solutions for a wide range of applications such as smart cities, traffic congestion, waste management, structural health, security, emergency services, logistics, retails, industrial control, and health care. The interested reader is referred to for a deeper understanding of the IoT.

Medical care and health care represent one of the most attractive application areas for the IoT. The IoT has the potential to give rise to many medical applications such as remote health monitoring, fitness programs, chronic diseases, and elderly care. Compliance with treatment and medication at home and by healthcare providers is another important potential application. Therefore, various medical devices, sensors, and diagnostic and imaging devices can be viewed as smart devices or objects constituting a core part of the IoT. IoT-based healthcare services are expected to reduce costs, increase the quality of life, and enrich the user's experience. From the perspective of healthcare providers, the IoT has the potential to reduce device downtime through remote provision.

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In addition, the IoT can correctly identify optimum times for replenishing supplies for various devicesfor their smooth and continuous operation. Further, the IoT provides for the efficient scheduling of limited resources by ensuring their best use and service of more patients. Fig. 1 illustrates recent healthcare trends. Ease of cost-effective interactions through seamless and secure connectivity across individual patients, clinics, and healthcare organizations is an important trend. Up-to-date healthcare networks driven by wireless technologies are expected to support chronic diseases, early diagnosis, real-time monitoring, and medical emergencies. Gateways, medical servers, and health databases play vital roles in creating health records and delivering on-demand health services to authorized stakeholders.

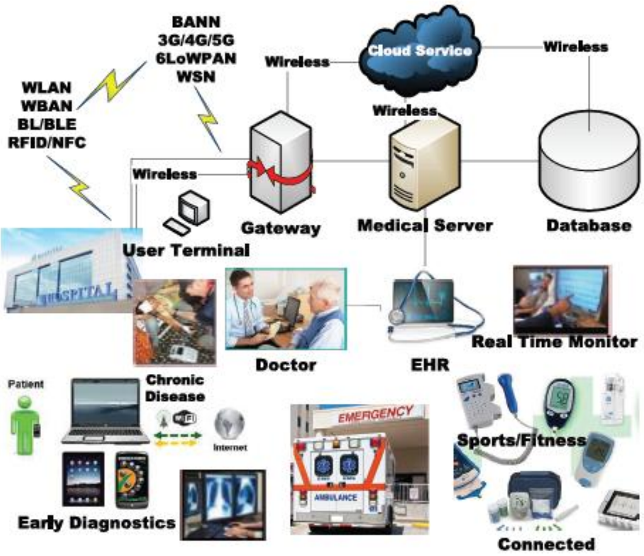

Fig 1: Healthcare trends

II. IoT HEALTHCARE NETWORKS:

The IoT healthcare network or the IoT network for health care(hereafter ``the IoThNet") is one of the vital elements of the IoT in health care. It supports access to the IoT backbone, facilitates the transmission and reception of medical data, and enables the use of healthcare-tailored communications. As shown in Fig. 2, this section discusses the IoThNet topology, architecture, and platform.

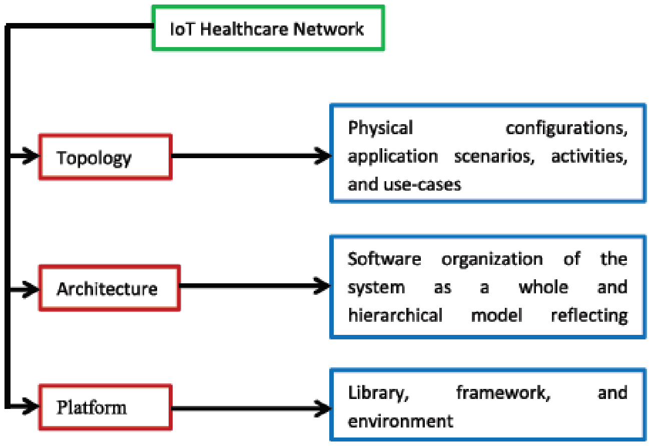

Fig 2.IoT healthcare network (IoThNet) issues

THE IoThNet TOPOLOGY:

The IoThNet topology refers to the arrangement of different elements of an IoT healthcare network and indicates representative scenarios of seamless healthcare environments. Fig. 3 describes how a heterogeneous computing grid collects enormous amounts of vital signs and sensor data such as blood pressure (BP), body temperature, electrocardiograms (ECG), and oxygen saturation and forms atypical IoThNet topology. It transforms the heterogeneous computing and storage capability of static and mobile electronic devices such as laptops, smart phones, and medical terminals into hybrid computing grids. Fig. 4 visualizes a scenario in which a patient's health role and vitals are captured using portable medical devices and sensors attached to his or her body.

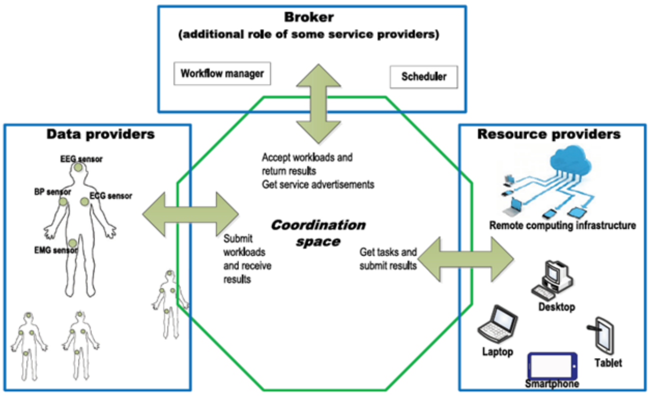

Fig 3. A conceptual diagram of IoT-based ubiquitous healthcare solutions

Captured data are then analyzed and stored, and stored data from various sensors and machines become useful for aggregation. Based on analyses and aggregation, caregivers can monitor patients from any location and respond accordingly. In addition, the topology includes a required network structure for supporting the streaming of medical videos. For example, the topology in Fig. 4 supports the streaming of ultrasound videos through an interconnected network with worldwide interoperability for microwave access (Wi MAX), an internet protocol (IP) network, and a global system for a mobile (GSM) network as well as usual gateways and access service networks.

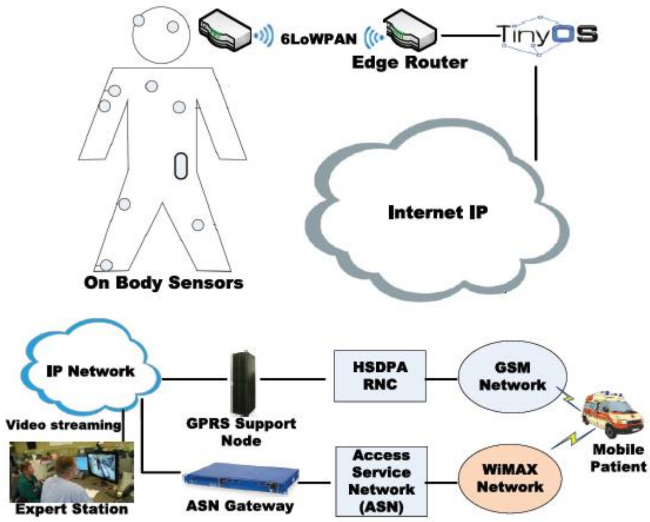

Fig 4: Remote monitoring in wearable's and personalized health care

Fig. 5 presents an IoThNet topology showing the role of a gateway. Here intelligent pharmaceutical packaging (iMedPack) is nothing but an IoT device that manages the problem of medicine misuse, thereby ensuring pharmaceutical compliance. The intelligent medicine box (iMedBox) is considered a healthcare gateway with an array of various required sensors and interfaces of multiple wireless standards. Various wearable sensors and IoT devices are wirelessly connected to healthcare gateways connecting the patient's environment to the health-IoT cloud, a heterogeneous network (HetNet) that enables clinical diagnosis and other analyses.

The gateway itself can investigate, store, and display all collected data.

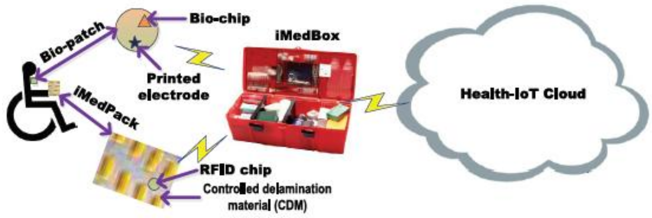

Fig 5. An IoThNet topology with an intelligent healthcare gateway

III. IoT HEALTHCARE SERVICES AND APPLICATIONS:

IoT-based healthcare systems can be applied to a diverse array of fields, including care for pediatric and elderly patients, the supervision of chronic diseases, and the management of private health and fitness, among others. For a better understanding of this extensive topic, this paper broadly categorizes the discussion in two aspects: services and applications. Applications are further divided into two groups: single- and clustered-condition applications. A single-condition application refers to a specific disease or infirmity, whereas a clustered-condition application deals with a number of diseases or conditions together as a whole.

Fig. 6 illustrates this categorization. Note that this classification structure is framed based on today's available healthcare solutions using the IoT. This list is inherently dynamic in nature and can be easily enhanced by adding additional services with distinct features and numerous applications covering both single- and clustered-condition solutions. This section introduces each of the services and applications shown in the figure.

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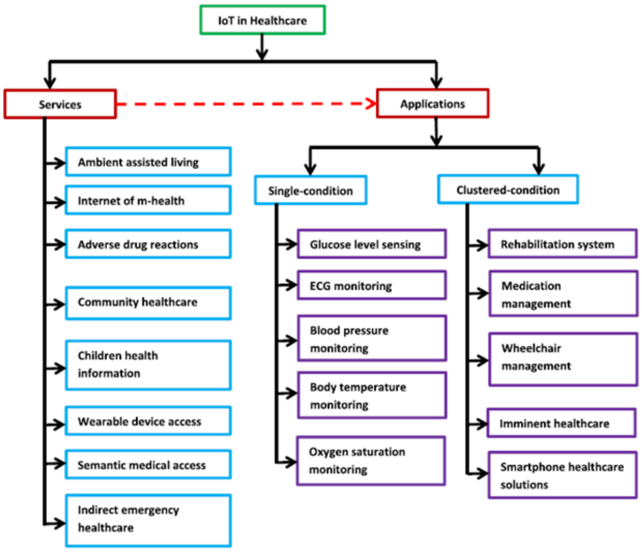


Fig 6:IoT healthcare services and applications

IoT HEALTHCARE APPLICATIONS:

In addition to IoT services, IoT applications deserve closer attention. It can be noted that services are used to develop applications, whereas applications are directly used by users and patients. Therefore, services are developer-centric, whereas applications, user-centric. In addition to applications covered in this section, various gadgets, wearable's, and other healthcare devices currently available in the market are discussed. These products can be viewed as IoT innovations that can lead to various healthcare solutions. The next subsections address various IoT-based healthcare applications, including both single- and clustered-condition applications.

IV. WORKING PRINCIPLE AND RESULT:

In this project, we are giving the complete description on the proposed system architecture. Here we are using Raspberry Pi board as our platform. It has an ARM-11 SOC with integrated peripherals like USB, Ethernet and serial etc. On this board we are installing Linux operating system with necessary drivers for all peripheral devices and user level software stack which includes a light weight GUI based on XServer, V4L2 API for interacting with video devices like cameras, TCP/IP stack to communicate with network devices and some standard system libraries for system level general IO operations. The Raspberry Pi board equipped with the above software stack is connected to the outside network and a camera is connected to the Raspberry Pi through USB bus.

The architecture of the web server has the following layers.

• In the lower level the web server has the physical hosting interfaces used for storing and maintaining the data related to the server.

• Above the Physical hosting interface the server has HTTP server software and other web server components for bypass the direct interaction with the physical interaction with the lower levels.

• The final layer has the tools and services for interacting with the video streams which includes the Image codec and storing interfaces, connection managers and session control interfaces etc.

After connecting all the devices power up the device, when the device starts booting from flash, it first loads the linux to the device and initializes all the drivers and the core kernel. After initialization of the kernel it first checks weather all the devices are working properly or not. After that it loads the file system and starts the startup scripts for running necessary processes and daemons. Finally it starts the main application. When our application starts running it first check all the devices and resources which it needs are available or not. After that it checks the connection with the devices and gives control to the user.

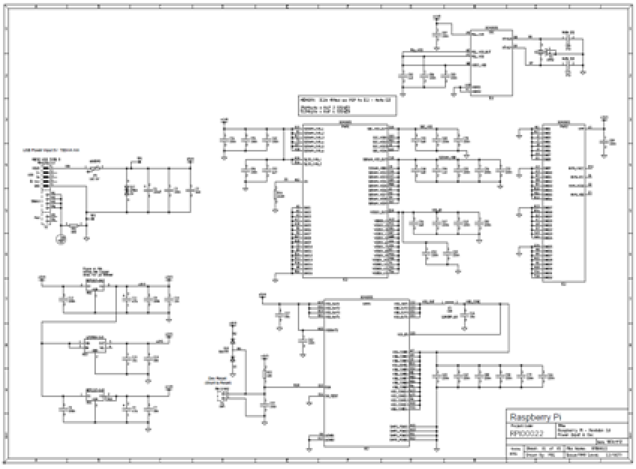
Circuit Diagram and its overall operation:

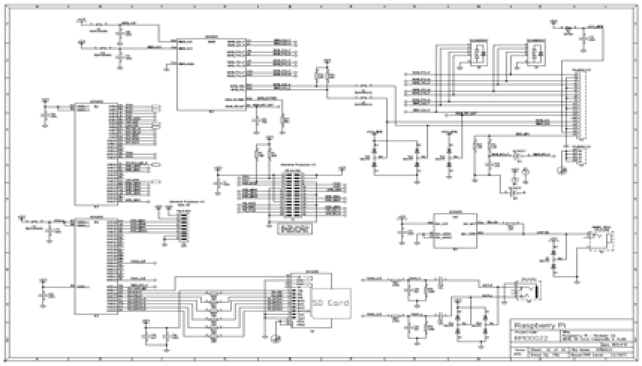
The Interface for the user has the following things.

•A label for displaying the image which is coming from the image.

•Text-boxes for showing the sensor values.

The board continuously reads data from the camera and at the same time it reads the data from the sensors. The scheduler is monitoring the process dedicated for camera reading and sensor reading. The camera read image and sensor values with scheduler information will send to the web server. There the user in front of the web server will monitor the priorities and the sensor and camera data. Whenever the user wants to change the priorities of the processes then using the web interface he can change the priorities. Whenever change is occurred then the web server sends the modified signals to board. Whenever the board got the modification, it will send the scheduler to change the priorities





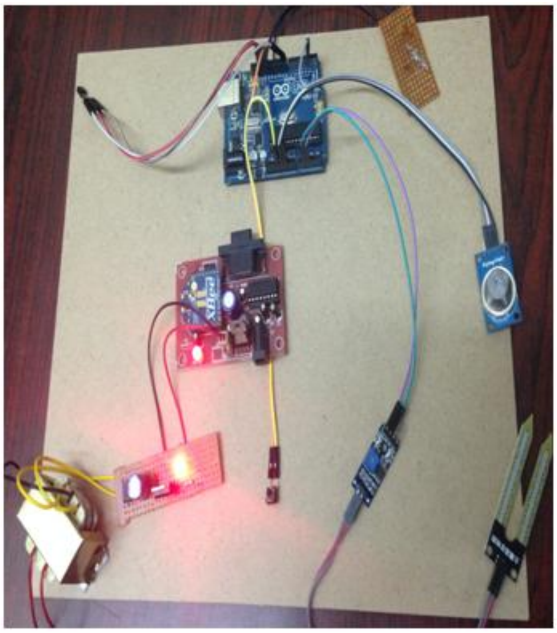


Fig 7: INPUT CIRCUIT

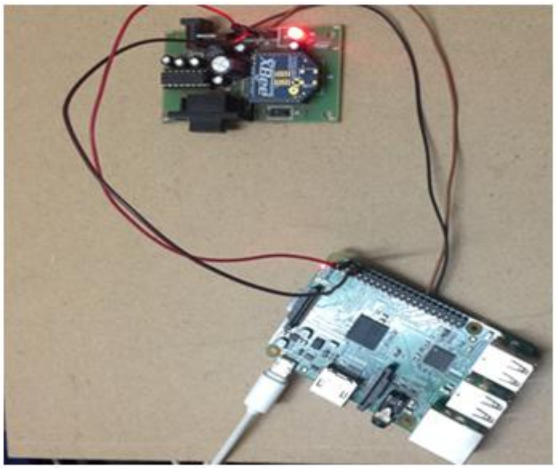


Fig 8: OUT PUT CIRCUIT

V. CONCLUSION:

The project "SMART HEALTH CARE SOLUTIONS USING IOT" has been successfully designed and tested. It has been developed by integrating features of all the hardware components and software used and tested. Presence of every module has been reasoned out and placed carefully thus contributing to the best working of the unit. Secondly, using highly advanced ARM 11 Processor board and with the help of growing technology the project has been successfully implemented.

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