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Physiological and Environmental Parameter Healthcare Monitoring System using Internet of Things

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Abstract-This is to analyze the physiological and environmental monitoring of human health care. We develop flexible IoT gateway that can adopt different commercial product for measuring. In such a way different users/patients owing products can use this solution. Platform is not restricted to only specific vendors. In personalized healthcare monitoring, wearable are playing in important role in terms of data measurement collection. Hence we develop an innovative wrist-worn prototype for ambient monitoring and flexible IoT gateway .The prototype measures the most critical parameter from an ambient domain. Therefore depending on the target investigation, status of the patients, requirements and demands, medics can determine the setup parameter for measurements. Thus the application of this platform is not limited to specific groups but widely may be applied whether in daily routine or medical research investigation.

Keywords:- IoT healthcare, ambient parameters, flexible IoT gateway, physiological parameters, wearable devices.

I. INTRODUCTION

The main focus of this heath care is to gradually shifting from traditions methodology to health protection by prevention and prediction.

The Internet of Things has become one of the major communications Para diagram that is spreading over a different range of application and provide the possibility of centralized data accessibility and fusion. The promising experience with electronics health and mobile health the medical IoT is in the centre of interest in the new era of healthcare.

Proposing an efficient solution within IoT by deploying WBAN in healthcare for environmental and physiological monitoring requires addressing numerous issues properly. The interconnection between the physiological and environmental indicators is the aspect in healthcare which requires data investigation and only can be demonstrated by means of data analysis through the suitable algorithm decisions from continuous monitoring of an individual. The impact could be varied for various parameters and requires a careful investigation and determining the internal/external players.In this atmosphere environmental measuring platform each device transmit a packet including the collected data as well as the location and operation status of the measuring device through the LTE network.

This version of common sense measures multiple ambient air pollutants,including CO,NO and O3 gas sensors as well as the sensors measuring light, temperature, relative humidity and body orientation. Data transmission from the prototype to the smart phone is realized through an integrated Bluetooth module from Spark Fun. The received data are visualized on a Smartphone and are sent to a host server by a GPRS ratio. These data are visualized and analyzed on the Web-Server as well a smart solution for a smart city is a combination of one or more

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intelligent components that helps in improving the living standards of its citizens. Components of a smart solution may include sensing elements such as sensors and actuators, computational elements such as processors, workstations, and servers etc., connected to each other to perform ubiquitous computing.

Smart transportation, smart buildings, smart energy, smart governance, and smart healthcare are notable components of smart city solutions. With an aim towards improving the healthy living of citizens, smart healthcare plays a significant role in a smart city. The costs involved in treating chronic diseases have been constantly increasing. By 2025, this cost is expected to increase to a total of 60% of total healthcare costs.

In addition to this, the healthcare inequalities amongst individuals require any healthcare solution to enhance remote assistance. This has been the driving force for traditional healthcare applications shaping into smart healthcare solutions shows the difference between traditional healthcare and smart healthcare.

II. RELATED WORKS

Proposing an efficient solution within IoT by developing WBAN in healthcare for the environmental and physiological monitoring requires addressing numerous issues proposely. The medical devices used in the smart healthcare design can be classified based on whether the device is placed on the human body or is a stationary medical device used in creating a smart environment. Body sensors are mainly designed for physiological monitoring.

Wearables such as smart watches, activity trackers, smart clothing, and wearable cameras are designed with a focus on obtaining one or more physical parameters from the human body. These wearable's are designed either for a single condition such as activity monitoring, drug delivery system, or a cluster of multiple conditions such as fitness monitoring, assisted living etc. Ingestible sensors involve devices which can be swallowed in order to monitor the human body from the inside.

On the commercial perspective, smart healthcare can be classified based on the end-user market and system management.

III. CONCEPT AND STRUCTURE

In the existing system large scale and gender perspective the effective parameter from behavioral ambient and physiological domains are the most influencing fields of interest in healthcare monitoring. In this platform via IoT gateway as an intermediate have between the wearable and IoT server bidirectional communication between the end user and matrix is established in real-time. In addition the physician as a real time observer of patients is given the possibility to set up the required parameter for measuring the IoT gateway and sensors.

Thus the gateway becomes the data concentrator for the individual investigation and adapts the data collection process regarding the acquired data the transferred data volume and the power consumption by the remote configuration of the sensor nodes. The medical devices used in the smart healthcare design can be classified based on whether the device is placed on the human body or is a stationary medical device used in creating a smart environment. Body sensors are mainly designed for physiological monitoring.

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On the commercial perspective, smart healthcare can be classified based on the end-user market and system management. In the proposed system the user and authorized personnel might be able to access data depending on the task definition for each individual.

IoT can connect number of sensors vehicle house and appliances together to the internet which allows a user to share data information and resources. We combine synchronize and process the physiological and ambient parameter for the medical investigation on the interactions. The flexible IoT gateway that has developed can adopt different commercial products

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for measuring the physiological parameter. It's available that current sensor nodes timestamp is requested to recognize possible time differences with the IoT gateway. This time offset is stored to enable the synchronization of all received measurement data together.

The measurement data of the directly accessible sensor nodes are collected continuously which also includes appending the timestamp. To monitor the healthcare the body parameters like ECG and Temperature sensors are used to calibrate the values. The Humidity and gas sensors are used to measure the ambient parameters. All the sensors are integrated with the Arduino UNO to calculate the measured range of the sensors.

Since we proposed a wearable module so that we are using Bluetooth communication protocol to reduce the power/battery consumption.

The HC-05 Bluetooth module will send the sensor data to our smartphones about the healthcare parameters and ambient parameters. Microcontroller is minute device which proceeds as a mini computer and used similar to System on a Chip. It contains many CPU, Input/output devices and Memory. It is mainly applicable for embedded systems. It helps to do specific purpose application which controls automatically.

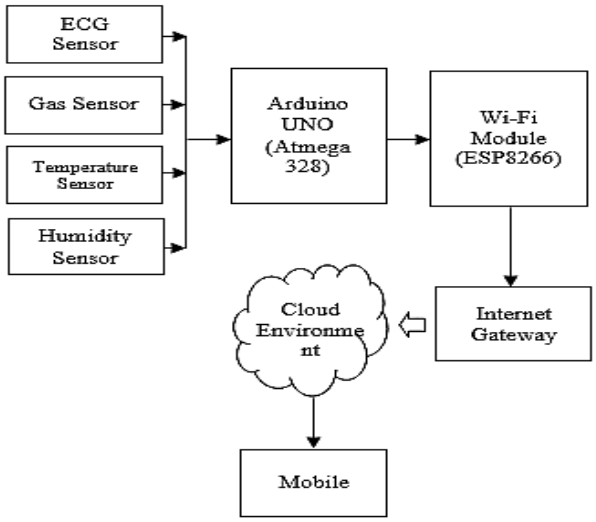

Figure 1: Blocked Diagram for Health Parameter Monitoring.

It works on lesser frequency of 4 kilohertz. In high device, the software is necessary. In our proposed system, microcontroller acquires the input from the ECG sensor, Temperature sensor, Humidity sensor and Gas sensor.The presented healthcare IoT approach in this article focuses on a flexible mobile data collection system for preventive and occupationally monitoring of daily routine.

Ubiq sense has been developed for comprehensive parameter monitoring in the environmental applications. Toxic/hazardous gases, noise, UV, air temperature, humidity and pressure are included in the field of personalized ambient monitoring. The wearable in this approach must be convenient size and lightweight.The configurability of platform is supported via IoT gateway.

From one side via the flexible, adoptable and configurable IoT gateway,the differ sensor nodes, products and prototype are adapted into the platform and from the other side this IoT gateway gives the medics,the flexibility of task definition and data set up via the sensor activation to support the end to end communication. The integration of such data includes Intra-inter-individual parameter and sensors aspects, which often require long-term investigation data, high level data fusion and analytics or the consideration of other study results.

1. Temperature and Humidity Sensor:

The Humidity and Temperature are the key ambient parameters which are directly cause the patient health conditions. Decrease in the temperature or increase in humidity directly impacts the patients and vice-versa. The Humidity and Temperature sensors are used to sense the change in atmospheric conditions. The DHT11 sensor is used to measure temperature and humidity value.

2. Gas Sensor:

Exposing of people suffering from heart diseases and cardiovascular to chemical air pollutants (Ex. CO, NO2, and smoke) can cause a serious degree of risk in breathing rate and heart failure depending on the period of exposure, concentration and the volume of the pollutants, and the health status of the patients. The atmospheric air quality is being measured to classify the air pollution. We used MQ135 gas sensor to detect the air pollution.

3. ECG Sensor:

The ECG sensing network is the foundation of the entire system, which is responsible for collecting physiological data from the body surface.

Wearable ECG sensors are usually adopted in this system, which have little impact on the user's daily life. Through this means, ECG data can be recorded over long hours or even days. By measuring the ECG we can analyze the patient conditions. All the sensor data are put together and the ambient and physiological parameters are identified for patients health monitoring.

4. Arduino UNO Microcontroller Board:
The Arduino microcontroller board contains an Atmega328 microcontroller. It consists of 14 digital pins and 6 analog pins for input/output operations. The sensor module is connected directly with Arduino UNO. It measures the sensor readings and categorizes the ambient parameters (Temperature, Gas and Humidity) and physiological parameter (ECG). These measured values further uploaded in the cloud.

5. ESP8266 Wi-Fi module:
To upload the sensor data in a cloud environment we required and wired/wireless communication module. This module allows microcontrollers to connect to a Wi-Fi network and make simple TCP/IP connections with simple commends. It receives the sensor value through Arduino UNO and helps to upload to the cloud.

6. Internet Gateway:
It gives connectivity support to the internet and acts as an intercommunication module to connect Wi-Fi and Cloud environment.

7. Cloud Environment:
All the collected sensor data will be gathered in Cloud Environment. In this work, we are using Thing Speak Open source cloud for collecting and analyzing the sensor information. The ECG, Temperature, Humidity and Gas sensor values are received and viewed through graphically. Every sensor value will be uploaded with every 15 secs. Further this data is viewed through the mobile app.

IV. PHYSIOLOGICAL PARAMETER MONITORING

For the acquisition of the physiological parameters commercially available solutions are used. The web interface allows access to the user sensor system and it also allows a retrospective data request. However the compactness if the sensors combined with a wide range of provided data are very comfortable for investigation in the field especially for the patients or subjects. This includes the selection of parameters to be transferred and the defined limit values which results in indication messages by transgression.

The selection of sensor solutions represents a competitive as well as a complementary sensor system configuration which allows increasing the fault tolerance and the range of information.

V. ENVIRONMENTAL PARAMETER MONITORING

It is measured as indoor and outdoor air quality which in each different parameter is considered for measurement. In chemical pollutants toxic and hazardous gases and the physical parameter, UV index and noise but air pressure, humidity and temperature are of concern. Mode of wear ability, multi parameter monitoring, prolonged monitoring, modular hardware, efficient data transmission, device flexibility and convenience are the most remarkable highlights in wearable sensor and technologies to be considered.

VI. DATA TRANSMISSION TO IOT GATEWAY

The collected data are transmitted to the IoT cloud through the gateway. The strategy of data transmission avoids consuming power unnecessarily. The ambient physical parameter, including air pressure, temperature and humidity are transmitted in one packet as well, Noise, gas, UV are all transmitted in a separated packet with sequence number and packet ID, respectively.

VII. INFORMATION MANAGEMENT AND COMMUNICATION

Every IoT gateway provides an individual, which consists of all the required sensor configurations and options access and call back URLs, tokens, IDs, parameter, priorities and access limits. After receiving the investigation relevant information the IoT gateway tries to establish a connection to the required and declared data sources.

- Short range communication – for the sensor gateway communication Bluetooth/BLE used.

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- Mobile Internet communication – for the communication between the gateway and the involved cloud solutions WLAN, G3 and higher is used.

Usually the configuration options are offered by the sensor nodes, which support comprehensive scopes of the parameter. The data collected from the different sources are prepared by the IoT gateway regarding the reformatting, possible pre-processing and the data synchronization. Our solution supports the data compression as well.

VIII. RESULTS AND DISCUSSIONS

We aim at prolonged and pervasive parameters monitoring with convenient modes of wearability in personalized health care. The flexible IoT gateway has been implemented for the mutual contributions to user and medics.This methodology can be applied in working environments especially in areas where people are exposed to hazardous conditions that might endanger their lives. However we aim at supporting the technical applicability, approach and methodologies evaluation, specifications, proof of concept and implementation of the solution rather than clinical investigation.

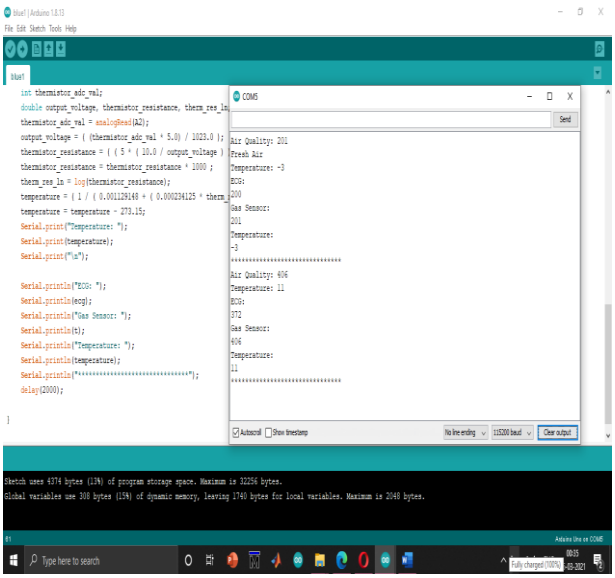

Fig 2. Arduino output.

We aim at prolonged and pervasive parameters monitoring with convenient modes of wearability, in personalized healthcare. We focus on the prediction and prevention for earlier disorder functionality detection of the subject. In implementing the solution, users, physicians, clinical requirements, and applications have been taken into account. Hence, the flexible IoT gateway has been implemented for the mutual contributions to user and medics. On one side, medics can define the tasks and parameters to measure, communicate to the user, monitor the data in real time, and configure the wearables according to the necessary investigations and clinical concerns.

On the other side, the users are not only restricted to specific vendors. Wearers can use alternatives that are easily adapted into the systems. Indeed, the user does not need to fit within the solution, but the IoT gateway has the compatibility to fit with the user, instead.

This methodology, in particular, can be applied in working environments, especially in areas where people are exposed to hazardous conditions that might endanger their lives.

This includes mine workers, technicians/chemists, and also workers/technicians in the heavy operational industry and construction.

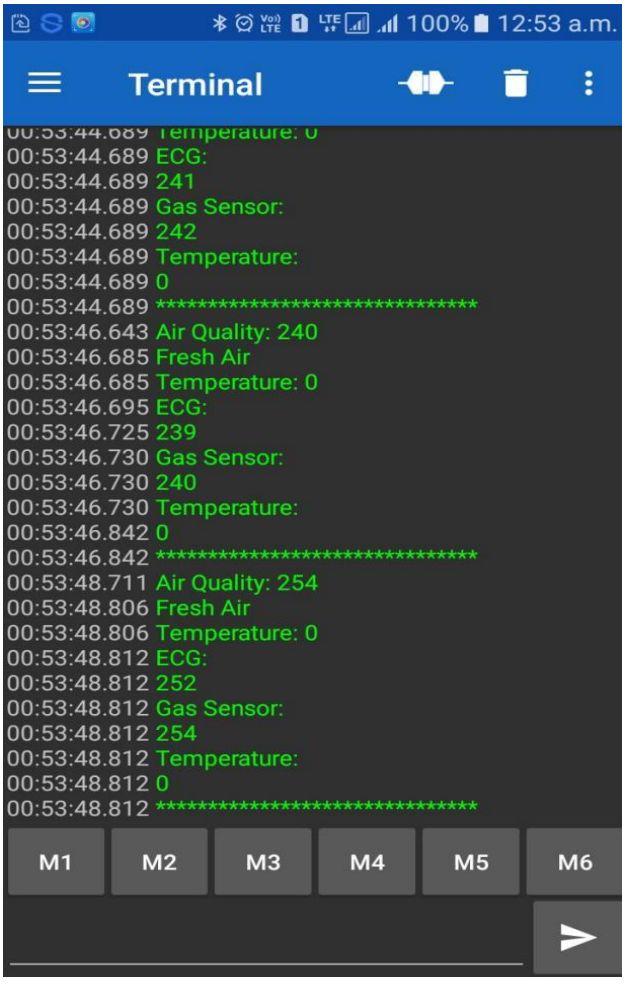

Fig 3. Output through smartphone.

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This project helps in identifying the obstacles along with distance, so that the visually impaired can analyse the distance and can perform his action. The audio commands helps them in recognizing an object and in recognizing the person standing in front of them. And with the help of the translation tools he can convert the text to the desired language and then again by using the Google speech recognition tool he/she can convert that changed text into voice.

IX. CONCLUSION AND FUTURE WORK

An IoT gateway as an intermediate hub between the physical layer and the server has been developed for data collection and synchronization to facilitate an efficient and to end communication between the user and the medic in real time. From one side the smart phone as the IoT gateway supports the physician to define tasks, configure the wearable, select the required parameter for measurements and specify the activation/deactivation sensor period and form the other side the user is not restricted to some specific vendors.

In future work, we aim at the application extension and further clinical investigation and work can also be focused on validation approach, technical specifications and usability rather than clinical inspection

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