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REMOTE HEALTH MONITORING SYSTEM USING WEARABLE SENSORS AND IOT

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Abstract— **People need health care services to be done and maintained regularly. Although Health monitoring devices are affordable, monitoring them complicates the equipment along with its usage. Multiple modalities such as the heart rate, body temperature, CO2 content, Fall Detection can be sensed with the help of sensors and those data can also be stored for future monitoring and analysis processes. Though the possibility is there in every aspect to monitor there are complications that exist to be resolved. The primary goal was to develop a reliable health monitoring system using wearable sensors and IoT so that the healthcare professionals can monitor their patients, who are either hospitalized or at home using an IoT-based integrated healthcare system with the view of ensuring patients are cared for better. Though the possibility is there in every aspect to monitor; there are complications that exist to be resolved. The patient's temperature, heartbeat rate is monitored, and stored by the system and sent to the doctor's mobile containing the application, and CO2 Content, Fall Detection of the person can be monitored by the hospital fraternity and storing it in the database, initiating the person nearby to utilizing the first aid kid, send an emergency alert tracking the location through GPS. Thus, IoT based patient monitoring system effectively monitors a patient's health status and save life on time by taking the necessary steps possible to serve the person even at the extent of tracing the person and also diagnosing with appropriate procedures.**

Keywords—remote health monitoring, Arduino, IOT, wearable sensors, medical diagnosis

I. INTRODUCTION

Research reveals cardiovascular diseases as one of the major concerns which lead to the cause of deaths all over the globe. To impart a system which not only monitors the elder people but also provides care in critical situations and to own the aged people like their dear ones. Continuous supervision for patients in remote places where the infrastructure of medical care is not satisfactory and lack of desired feedback from them in times of need. Providing assurance of support for the disabled persons in times where they are unable to handle the emergency situation which needs medical assistance.

The proposed system provides support for the soldiers when encountered an unforeseen situation like trapped in snow, a war field, lynching, etc. and actively reacts to provide necessary action when there is enough scope for Global System for Mobile Communication. To alert the police and other monitoring teams when the woman is harassed or she thinks of trouble by sending the location using GPS module when she alerts the system by pressing the push button interfaced. In this way, the person who is wearing this device can have the ability to interact with the people monitoring the person's health condition. In most cases cardiovascular attacks are curable if admitted at the right time for medical supervision, so building a system to serve the purpose is our main objective.

II. LITERATURE REVIEW

A. Novel Wearable Sensor Device Methodology for STEMI Detection. – FRANSISCO FERNANDEZ.

Background Novel STEMI detection tools using wearable Single Lead EKG methodologies demonstrate vast potential in many clinical scenarios. Recent research suggests that smartwatches and other wearable devices can be repositioned to acquire "new" chest leads that have similar, but not equal, waveforms when compared to traditional precordial leads. Throughout our previous research, only Lead I data had been used to train our Machine Learning (ML) models due to a lack of datasets from these new leads.

ISSN : 0975-4520

III. EMBEDDED SYSTEM IMPLEMENTATION

Embedded systems are designed to do some specific tasks, rather than be a general-purpose computer for multiple tasks. Some also have real-time performance constraints that must be met, for reasons such as safety and usability, others may have low or no performance requirements allowing the system hardware to be simplified to reduce costs. Embedded systems are not always standalone devices

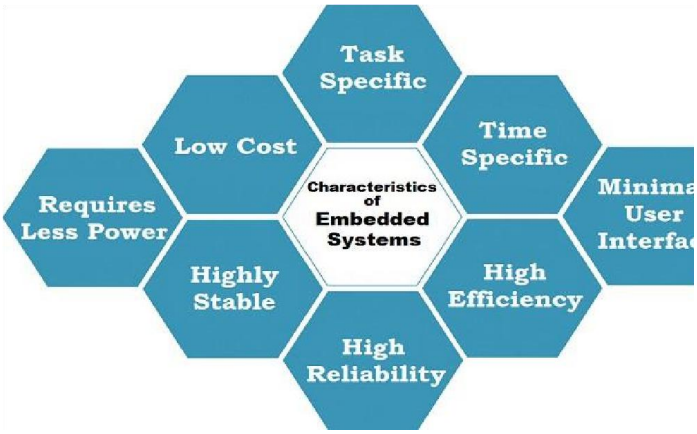

Fig Embedded System Characteristics

Many embedded systems consist of small, computerized parts within a larger device that serves a more general purpose. The program instructions written for embedded systems are referred to as firmware and are stored in read-only memory or Flash memory chips. They run with limited computer hardware resources: little memory, small or non-existent keyboard or screen.

A. EMBEDDED HARDWARE

As with any electronic system, an embedded system requires a hardware platform on which it operates. Embedded system hardware is built with a microprocessor or microcontroller. The embedded system hardware has elements like input-output (I/O) interfaces, user interface, memory, and display. Usually, an embedded system consists of Power Supply, Processor, Memory, Timers, Serial Communication Ports, Parallel Communication Ports, Output Circuits, Interrupt Controller, System Application Specific Circuits.

B. EMBEDDED SYSTEM SOFTWARE

The embedded system software is written to perform a specific function. It is typically written in a high-level format and then compiled down to provide code that can be lodged within a non-volatile memory within the hardware. An embedded system software is designed to keep in view of three limits:

- Availability of system memory
- Availability of processor's speed
- When the system runs continuously, there is a need to limit power dissipation for events like stop, run and wake up.

IV. EXISTING SYSTEM

In today's scenario, the system used for patient monitoring is the fixed monitoring system which is available only when the patient is admitted in the hospital. The available systems are bulk in size and can be served in hospitals especially in ICU. In the social insurance framework for patients who stay at the home during post-operational days checking is done only with the overseer/ medical caretaker. Ceaseless observing may not be accomplished by this system, on the grounds that anything can change in wellbeing parameter inside of part of seconds and amid that time if guardian or caretaker is not in the premises causes more noticeable harm.

DRAWBACKS OF EXISTING SYSTEM

i. In the existing system patient can be monitored only if that person is admitted to the hospital.

ii. Regular monitoring of the patient is not possible once that person is discharged from hospitals.

iii. These health monitoring systems cannot be used at an individual level.

iv. Existing systems are huge in size and their maintenance and cost pose a challenge.

v. They are not successfully implemented when a patient is moving.

vi. In Person Assistance is mandatory to monitor the person continuously or even in times of emergency, negligence in monitoring may lead to devasting situations.

vii. Most of the Existing systems uses wired communication which is too tedious for long-distance communications

V. PROPOSED SYSTEM

To overcome the drawback of the existing system this system which was implemented using SMS as the mode of communication in emergency situations, and also for continuous monitoring purpose all the data is stored in the cloud. In this proposed system Arduino Controller is used for controlling the whole process of the system. The GSM is used to send SMS regarding GPS locations and if any sensor exceeds the sensor SMS will be sent. LCD is for displaying and also here a few sensors are used which are a temperature sensor, Heartbeat Sensor, MQ2, MEMS sensors are used. These Four sensors are used to monitor the health of the patient and if it crosses the threshold value then a message will be sent, and also updated in the cloud server.

ISSN : 0975-4520

ADVANTAGES OF THE PROPOSED SYSTEM

i. User-friendly operation process and lightweight on-body monitoring sensors.
ii. Easy information sharing between patients and doctors.
iii. Emergency situations can be handled very well.
iv. The main concern of traditional health monitoring systems is that patients are constrained within the rooms and monitoring devices are fitted to the bed and this drawback has overcome in this system
v. In traditional health monitoring systems GPS Feature is not enabled, by adding this feature to our proposed system increases the accessibility of searching the person in emergency situations.

VI. TOOLS REQUIRED

HARDWARE REQUIREMENTS

i. Arduino UNO (MEGA 2560).
ii. Power Source Circuitry.
iii. Sensors.
    a. Heart Beat Sensor.
    b. Temperature Sensor.
    c. MQ2 Sensor.
    d. MEMS Sensor for Fall Detection.
iv. LCD Display.
v. GSM Module.
vi. GPS Module.
vii. Emergency Switch (Push Button).

SOFTWARE REQUIREMENTS.

i. Arduino IDE.
ii. ThingSpeak API.

VII. SYSTEM DESIGN

The proposed system for remote health monitoring using the wearable sensor circuitry is shown below

A. BLOCK DIAGRAM OF THE PROPOSED SYSTEM

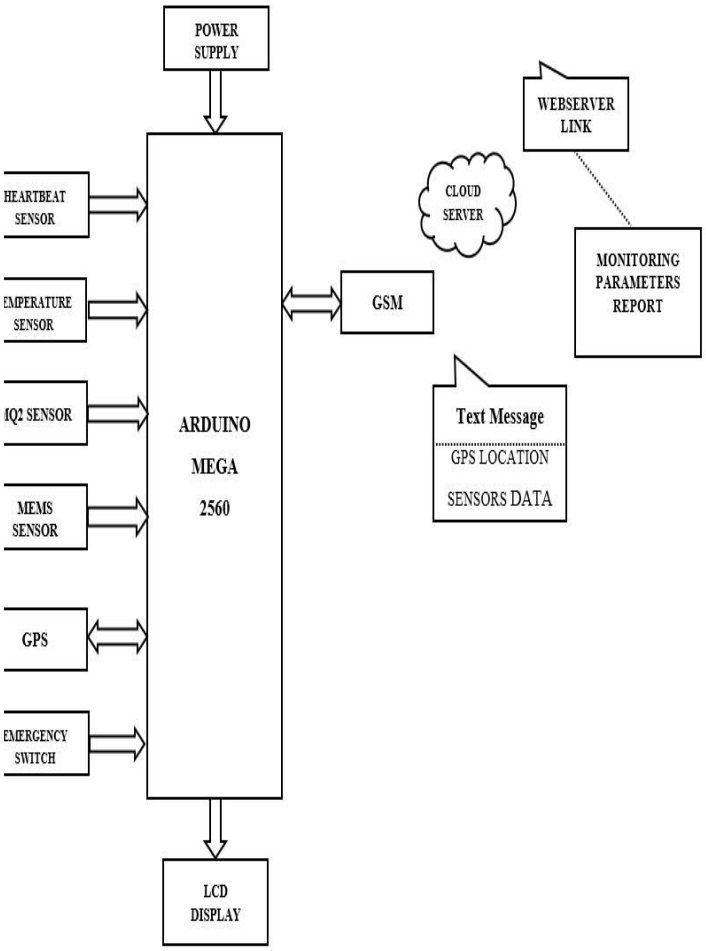

Fig Block Diagram of the Proposed System

ISSN : 0975-4520

B. ARCHITECTURE OF THE PROPOSED SYSTEM

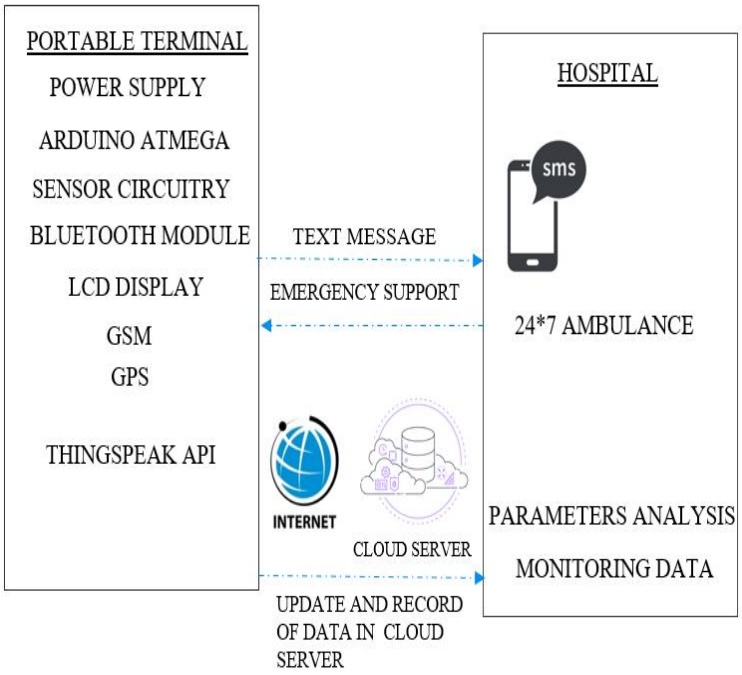

Fig Proposed System Architecture

C. FLOWCHART OF THE PROPOSED SYSTEM

ISSN : 0975-4520

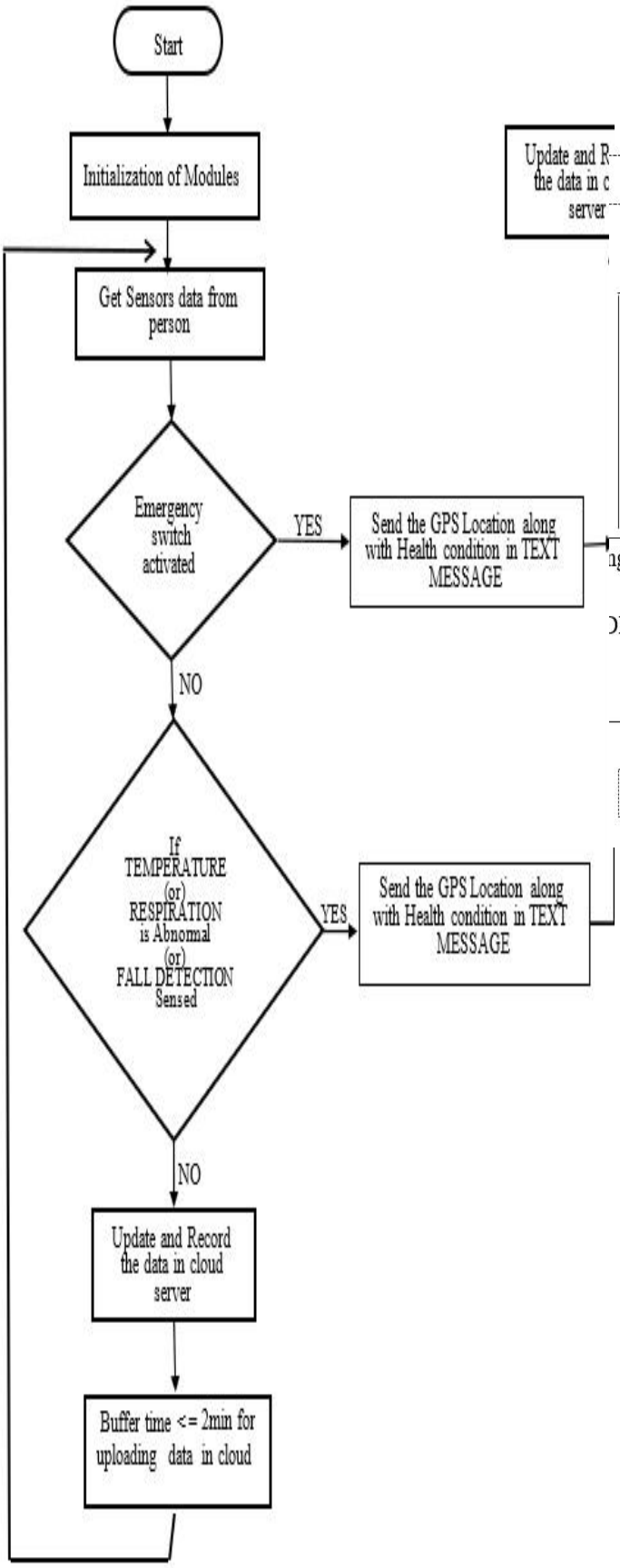

Fig Flowchart of the Proposed System.

D. MODES OF CONNECTIVITY OF THE PROPOSED SYSTEM

i. Connectivity with the Hospital

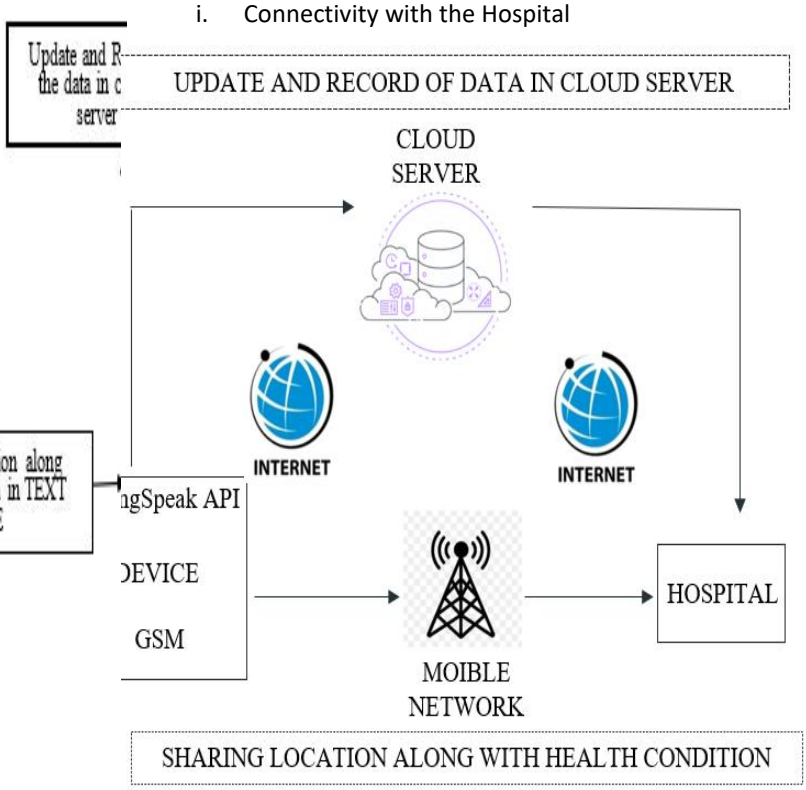

Fig Connectivity with the Hospital.

E. WORKING OF THE PROPOSED SYSTEM

Power Supply of 230Volts, 50Hz AC Supply is converted to Regulated DC supply by the power source circuitry, with that power all the modules including the Arduino Mega are initiated, as the sensors were in the process of continuous monitoring, they serve the purpose of acquiring the health condition of the person who is wearing the device continuously. If any one of the health parameters keep fluctuating abnormally the condition of the person can be analyzed remotely somewhere away from person and can take the necessary action from that place itself and can also trace the person as the GPS Location of person can be notified in this system.

i. Sending the Text Message along with the Health Condition and GPS Location.

After analyzing the sensors data from the person by the processor in the Arduino, if any one of the parameters is not the range of normal condition of the person i.e., exceeding the threshold values of the person wearing the device that is predefined in the instruction given to the

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processor, an SMS alert containing the GPS location along with the health condition will be sent to the hospital people and in turn, an emergency service like ambulance will be initiated from hospital people to serve the person who is wearing the device that has an active GSM Module, GPS Module.

ii. Update and Record the Data in Cloud Server.

The process of continuously monitoring the health condition of the person in a most analytical way can be done by updating the sensors data and recording the data in a cloud server whenever an active internet connection is established for the device through the GSM module. The data can be plotted continuously in a graph for better understanding the health condition of the person for the medical staff and also the dear one's of the person so that the necessary action can be done to serve the purpose of the needy.

iii. Visualization of Data in LCD Display.

The data can be visualized on LCD display. The presentation of the numerical values of the sensors data can be visualized on the LCD Display. For testing and maintenance purposes the data can be visualized in the LCD display.

VIII. EXPERIMENTAL RESULTS

i. Actual Version of the System

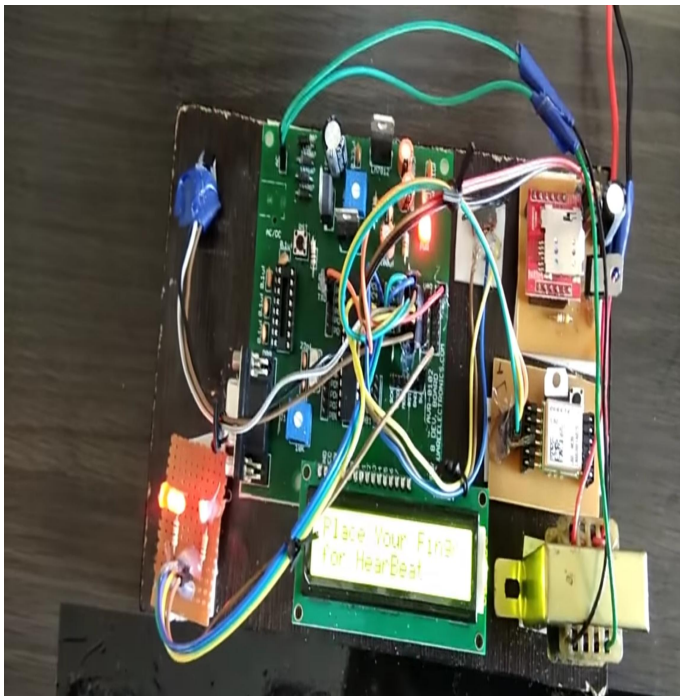

Fig Actual Version of the System Demonstration.

ii. Nano Version of the System

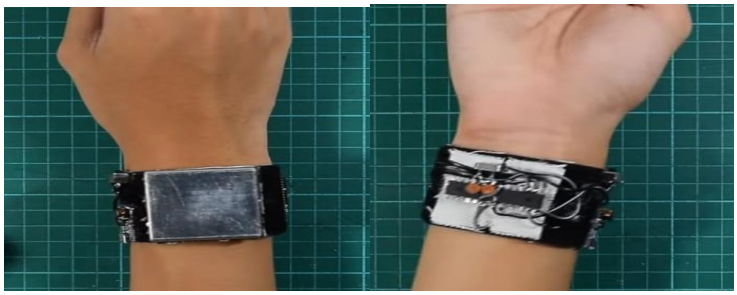

Fig Nano Version of the System fitted in a Watch like Band

iii. LCD Display Results

Fig LCD Display Results

iv. Emergency Text Message with GPS Location Along with Health Condition.

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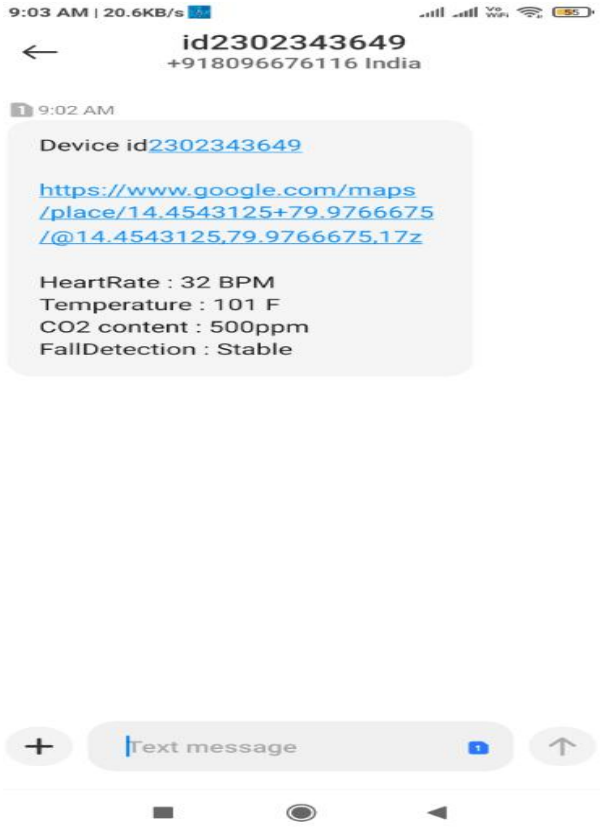

Fig Emergency Text Message with GPS Location Along with Health Condition

v. Visualization of Data in ThingSpeak API

Fig Visualization of Data in ThingSpeak API

IX. CONCLUSION AND FUTURE SCOPE

We have proposed a new Remote Mobile Health-Monitoring system that can provide continuous health-monitoring of patients. Based on the web services in the cloud, we designed a multilayer architecture.

With the advancements in the communication networks, the ongoing research of using satellites instead of regular mobile towers increases the feasibility of reaching communication even in remote areas.

The system was capable of only real-time monitoring of the patient's status, not professional analysis and instruction. Therefore, data analysis with expert experience needs to be further studied to provide more useful information.

The idea of continuously wearing a monitoring device requires more comfort so as to choose a material that provides optimum comfort while wearing

X. REFERENCES

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