IoT Based Automatic Bed for Differently-abled

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***Abstract*:** The Internet of Things (IoT) is the next wave of innovation that promises to improve and optimize our daily life based on intelligent sensors and smart objects working together. Through Internet Protocol (IP) connectivity, devices can now be connected to the Internet, thus allowing them to be read, controlled, and managed at any time and at any place. In this paper we aim to design a smart bed that could be used as an aid for bed ridden people. The bed is made up of a number of modular sections (hexagonal stools) that can be moved around to create different positions according to command given by user via internet. The individual stools that make up the bed are motorized allowing them to be raised and lowered using pneumatic actuator. Also each module can tilt its position in different degrees using ball bearings. Each element of the module can be controlled through any device which is connected to internet as. Proposed project uses Internet of things technology, so that each modular section of the bed can be controlled from any part of the world. Each of the modules is considered as devices and has its own MAC address. The communication between user and bed via internet is defined using a specific protocol, this ensures security and reliability.

Keywords: IoT, smartbed, Raspberrypi, machine-to-machine communication, cloud to machine communication.

I INTRODUCTION

The notion of internet of things (iot) has been recognized by industrial leaders and media as the next wave of innovation, and pervading into our daily life [1], [2]. Sensors around us are increasingly becoming more pervasive and attempt to fulfill end users' needs, thus providing ease of usability in our everyday activities. Devices deployed in households, industrial automation, and smart city infrastructures are now interconnected with the internet.

The smart bed is several modules which can be controlled collectively or individually.bed ridden people usually require assistance to do even the smallest of things. this smart bed allows them to do minimalistic operations like raising the upper body or lower body, rotating the bed etc. it also provides a provision for communication between the patient and his help/doctor/relative through an app. the product consist of a smart bed and an app. the bed is made up of stool like modules that can be moved around to create different positions according to commands given from the user via internet through the app. the app has predefined commands for elevation, tilt, rotate, depress of the modules .the smart bed structure can be controlled by the app.

II RELATED WORKS

A. Smart bed by Compliant Concept

A smart bed that automatically repositions a patient throughout both day and night.The bed essentially imitates the movements of a healthy person during sleep so bedridden patients are less likely to develop "decubitus ulcers," otherwise known as bedsores. It also logs the patient's movements to provide an ongoing account of how much the patient moves—be it independently or with the help of the bed.[20]

Features

- Automatic reposition of patients
- helps in preventing bed sores
- tracks patients movements and sends it to the doctor

Disadvantages

- Highly expensive($43000 approx)
- Fairly less advantages to offer to a partially bedridden person.

B. PRASHAMANA, The Smart Bed

Conventional hospital beds with remote monitoring capabilities are complex and cost is very much putting them beyond the reach of most of hospital and patient. Modifying these costly beds and invasive monitoring devices could provide a much better experience for patients and ease the burden on hospital staff responsible for managing these complicated beds and multitude of devices. The hospital beds used for their treatment are not so user friendly compare to the type of monitoring and facility necessary for their healthcare of patient. A busy surrounding and daily check-up routines in the hospital affects patient privacy. It affects

mentally to a patient when they see adjacent patient's condition and the environment.It is very much essential provide better environment to patient, monitor patient sleep analyse sleeping patterns.

Features

- It has everything that is needed for a patients well being and at a very reduced cost

Disadvantage

- It is designed keeping in the patients who are paralyzed/comatose. The bed will be a liability for partially bedridden patients.

II IoTPROTOCOLS

To provide communication between devices and services several protocols are used in IoT.some of these are MQTT,COAP,SOAP,REST etc.there are three types of commnicatications-device to device(D2D),device to server(D2S),and server to server(S2S).devices must communicate with each other (D2D). Device data then must be collected and sent to the server infrastructure (D2S). That server infrastructure has to share device data (S2S), possibly providing it back to devices, to analysis programs, or to people.the protocols used to provide secure interaction can be described as:

MQTT: a protocol for collecting device data and communicating it to servers

XMPP: a protocol best for connecting devices to people, a special case of the d2s pattern, since people are connected to the servers

DDS: a fast bus for integrating intelligent machines (D2D)

AMQP: a queuing system designed to connect servers to each other (S2S)each of these protocols is widely adopted. There are at least 10 implementations of each. All four claim to be real-time publish-subscribe iot protocols that can connect thousands of devices. And it's true, depending on how you define "real time," "things," and "devices."Nonetheless, they are very different .today's internet supports hundreds of protocols. The iot will support hundreds more. It's important to understand the class of use that each of these important protocols addresses[18]

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A.MQTT

MQTT, the Message Queue Telemetry Transport, targets device data collection. As its name states, its main purpose is telemetry, or remote monitoring. Its goal is to collect data from many devices and transport that data to the IT infrastructure. It targets large networks of small devices that need to be monitored or controlled from the cloud.

B. CoAP

Constrained Application Protocol (CoAP) is a software protocol intended to be used in very simple electronics devices, allowing them to communicate interactively over the Internet. It is particularly targeted for small, low-power sensors, switches, valves and similar components that need to be controlled or supervised remotely, through standard Internet networks. CoAP is an application layer protocol that is intended for use in resource-constrained internet devices, such as WSN nodes. CoAP is designed to easily translate to HTTP for simplified integration with the web, while also meeting specialized requirements such as multicast support, very low overhead, and simplicity Multicast, low overhead, and simplicity are extremely important for Internet of Things (IoT) andMachine-to-Machine (M2M) devices, which tend to be deeply embedded and have much less memory and power supply than traditional internet devices have. Therefore, efficiency is very important. CoAP can run on most devices that support UDP or a UDP analogue[19].

III IMPLEMENTATION

There are three modules in this system ,the main modules are:Communication,Hardware,Software

A. COMMUNICATION

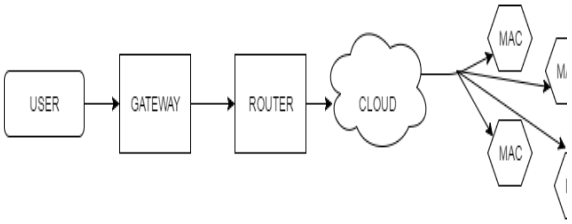

Fig.1 Communication

B. Hardware

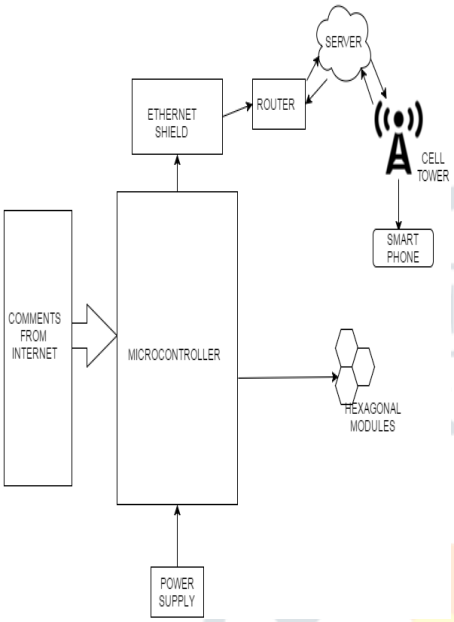

Fig.2 Hardware

ACOMMUNICATION

In this propsed system there is 3 types of communication

1. Device-to-Device Communications

The device-to-device communication model represents two or more devices that directly connect and communicate between one another, rather than through an intermediary application server. These devices communicate over many types of networks, including IP networks or the Internet. Often, however these devices use protocols like Bluetooth,wifi to establish direct device-to-device communications.

2. Device-to-Cloud Communications

In a device-to-cloud communication model, the IoT device connects directly to an Internet cloud service like an application service provider to exchange data and control message traffic. This approach frequently takes advantage of existing communications mechanisms like traditional wired Ethernet or Wi-Fi connections to establish a connection between the device and the IP network, which ultimately connects to the cloud service

3. Device-to-Gateway Model

In the device-to-gateway model, or more typically, the device-to-application-layer gateway (ALG) model, the IoT device connects through an ALG service as a conduit to reach a cloud service. In simpler terms, this means that there is application software operating on a local gateway device, which acts as an intermediary between the device and the cloud service and provides security and other functionality such as data or protocol translation

B HARDWARE

In this weuse,Raspberry pi 3,a computer that is on the cusp of challenging the modern PC. The bump to the processing power of the latest machine has, according to its co-creator, elevated its performance to a point where it can comfortably be used as a desktop computer

Servomotors both rotary actuator and linear actuator that allows for precise control of angular or linear position, velocity and acceleration. It consists of a suitable motor coupled to a sensor for position feedback.Used here to elevate,compress,and rotate the modules of the bed.

1. Raspberry PI3

The Raspberry Pi is a series of small single-board computers developed in the United Kingdom by the Raspberry Pi Foundation to promote the teaching of basic computer science in schools and in developing countries. Raspberry Pi 3 have 1 GB of RAM. The Raspberry Pi may be operated with anygeneric USB computer keyboard and mouse. It may also be used with USB storage,USB to MIDI converters, and virtually any other device/component with USB capabilities.Other peripherals can be attached through the various pins and connectorson the surface of the Raspberry Pi.

2. Linear Servo Motor

The servo motors that supports linear motion is used here to lift and lower the modules.A linear motor is an electric motor that has had its stator and rotor "unrolled"so that

instead of producing a torque (rotation) it produces a linear force along its length.

3. Rotatory Servomotor

A servomotor is a closed-loop servomechanism that uses position feedback to control its motion and final position. The input to its control is a signal (either analogue or digital) representing the position commanded for the output shaft.

C SOFTWARE

In software part embedded software is used for programming the microcontroller. We are also implementing secure protocol for communication.For programming the microcontroller,python is used and to implement web part architecture PHP and MySQLite is used.Microsoft Azure cloud server is used to store the information.

1. Microsoft Azure Cloud Service

Microsoft Azure is a cloud computing service created by Microsoft for building, deploying, and managing applications and services through a global network of Microsoft-managed data centers. It provides software as a service, platform as a service and infrastructure as a service and supports many different programming languages, tools and frameworks, including both Microsoft-specific and third-party software and systems.

2. PHP

PHP is a server-side scripting language designed primarily for web development but also used as a general-purpose programming language. Originally created by RasmusLerdorf in 1994,the PHP reference implementation is now produced by The PHP Development Team. PHP originally stood for Personal Home Page, but it now stands for the recursive acronym PHP: Hypertext Preprocessor.

3. PYTHON

Python is a widely used high-level programming language for general-purpose programming, created by Guido van Rossum and first released in 1991.An interpreted language, Python has a design philosophy which emphasizes code readability (notably
using whitespace indentation to delimit code blocks rather than curly braces or keywords), and a syntax which allows programmers to express concepts in fewer lines of code than possible in languages such as C++ or Java.

4. ADOBE DREAMWEAVER CC

Adobe Dreamweaver is a proprietary web development tool developed by Adobe Systems. Dreamweaver was created by Macromedia in 1997, and was maintained by them until Macromedia was acquired by Adobe Systems in 2005.Adobe Dreamweaver is available for macOS and for Windows.Following Adobe's acquisition of the Macromedia product suite, releases of Dreamweaver subsequent to version 8.0 have been more compliant with W3C standards.

5. XAMP

XAMPP is a free and open source cross-platformweb server solution stack package developed by Apache Friends, consisting mainly of the Apache HTTPServer, MariaDB database,
and interpreters for scripts written in the PHP and Perl programming languages.

VII EXPERIMENTAL RESULTS

In order to evaluate our application, a series of tests were conducted and the results were analyzed. The application is tested with the collected sample test data and the accuracy for each class is calculated by number of images correctly retrieved divided by the total number of images.

VIII CONCLUSION

'IoTNextGen Bed', has been developed as an aid for the stool like sub structures and they can be controlled collectively or individually.Bed ridden people usually requires assistance to do even the smallest of things.This smart bed allows them to do minimalistic operations like raising the upper body or lower body,rotating the bed etc.it also provides a method for communication between the patient

and his help/doctor/relative through an app. The app has predefined commands for elevation, tilt, rotate,depress of the modules .The smart bed structure can be controlled by both the app and hand gestures. The product is made cost effectively and can be affordable to normal folks. Since we use IoT technology we can control the Structure from any part of the world.

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