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Research paper

Iot Based Health Monitoring System for Persons with Intellectual Disabilities

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Abstract

IoT (Internet of Things) is utilized as a part of a great deal of uses. A portion of the uses of Internet of Things are savvy stopping, shrewd home, brilliant city, keen condition, mechanical spots, horticulture fields and wellbeing observing procedure. One such application is in medicinal services to screen the patient wellbeing status by means of Internet of Things makes therapeutic gear more effective by permitting ongoing checking of patient wellbeing, in which sensor get information of patient's and decreases the human blunder. The Internet of Things in the therapeutic field draws out the answer for compelling continuous checking of rationally impaired individual at diminished cost and furthermore lessens the exchange off between tolerant result and infection administration. So far we have seen the wellbeing observing framework which gathers data of fundamental parameters, for example, heart beat, temperature, circulatory strain and development parameters. In this paper we examine about checking patient's mind flags and recognizing the status of the patient progressively. To gather the information of cerebrum signals, we are utilizing Neurosky Mindwave Mobile Headset which deals with the EEG innovation. It demonstrates the yield result in waveform design. In this paper the fundamental point is to give legitimate and productive therapeutic administrations to patients by gathering information data of cerebrum and other body parameters through sensors which would incorporate patient's heart rate, body temperature and EEG (Electro Encephalograph). In the event that the gathered information is underneath than the normal esteem it sends a crisis alarm to patient's specialist with his present status and full restorative data. Besides, the framework spares the patient's customized estimations to a cloud-based information store progressively.

Keywords: *IOT, EEG ,CloudStorage, Raspbean, VNC server.*

1. Introduction

Observing the rationally debilitated people turns into a troublesome errand in the cutting edge life and Keep following of their wellbeing status when you are out is a troublesome assignment. Particularly rationally impaired patients ought to be occasionally checked and their friends and family should be educated about their wellbeing status every now and then while at work. So we propose an imaginative framework that robotized this undertaking effortlessly. Our framework advances a brilliant patient wellbeing following framework that utilizations Sensors to track quiet wellbeing and utilizations web to illuminate their friends and family if there should be an occurrence of any issues. In this framework we are utilizing EEG sensor to track the mind influxes of the patient. Our framework utilizes temperature and in addition pulse detecting to monitor tolerant wellbeing. These sensors are associated with a Microcontroller (Arduino Uno) to track the status which is thusly interfaced to a Wi-Fi association keeping in mind the end goal to transmit cautions. On the off chance that framework identifies any unexpected changes in quiet pulse, cerebrum signals, body temperature, the framework consequently alarms the client about the patient's status over IOT and furthermore demonstrates subtle elements of pulse, mind signals, temperature of patient live finished the web. Along these lines IOT based patient wellbeing following framework viably utilizes web to screen tolerant wellbeing details and spare lives on time.

By this model, it empowers clients to enhance wellbeing related issue and observed the rationally debilitated people by gathering, recording, examining and putting away vast information streams continuously effectively. The possibility of this undertaking came so to lessen the successive visit of patient to specialist each time he have to check his circulatory strain, heart beat rate, temperature and so forth. With the assistance of this proposition the season of the two patients and specialists are spared and specialists can likewise help in crisis situation however much as could reasonably be expected.

Under-five wellness care is important because this long time group suffers high rates of mortality and morbidity, often from preventable diseases. The effects of tyke hood malnutrition and disease are evident in later life history . Nipper mortality, which is a key indicator of child health and welfare , remains a challenge for most African countries. One of the 8 Millennium Development Goal

(MDGs) was to reduce the figure for under-five mortality by two-third gear by 201quint . For instance, Nyasaland is among the countries that achieved this goal. According to the joint UN child mortality approximation write up (2015), under-five mortality has declined between 2000 and 2015 from 174 to 64 deaths per 1,000 live nativity [5]. The major ingredient contributing to Malawi's success story is the country's expanding network of residential district health workers [6].To continue the improvement in shaver deathrate , increasingly sophisticated natural process is needed. The United Nations sustainable development destination (SDG) number 3 is to reduce under-five mortality to 25 deaths per 1,000 live births by 2030. The role of diagnostic equipment and electronic wellness care Robert William Service (e-health) in accurate and meter ly management of kid health conditions cannot be over-emphasized. Handiness of clinical data in real number - clip is crucial for grounds -based planning of resource and interventions, as well as early detection of health alarum such as disease irruption and drug-resistance. It can thus be strongly suggested that further tread in reduction of kid mortality can be realised if these HSAs are equipped with a portable, compact, low-cost screening system covering mental test recommended for under-five clinics and with capability for real time transmission of personalised clinical data to a cloud-based storage for further processing.

1.1 Problem Formulation

We have seen the health monitoring system, monitoring the patients by checking the vital parameters such as pulse rate, blood pressure, body temperature, growth parameters etc.
But in this paper we are introducing EEG to detect abnormalities related to brain via wearable sensors. In this project we are using Neurosky Mind wave sensor in order to read the brain wave signals which runs on EEG technology. These sensor display the output in wave pattern. If the values are critical then it will alert the particular doctor of the patient.

2. Block Diagram & Hardware description

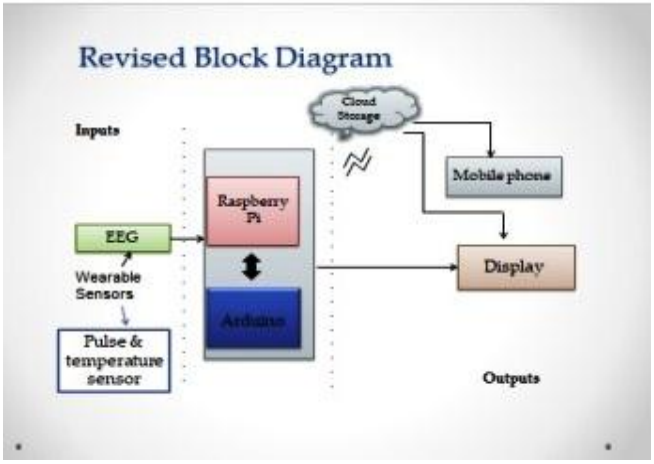

Fig .1: Proposed block diagram

2.1. Components used

Arduino Uno
Temperature sensor LM35
Pulse sensor
EEG sensor
Bluetooth module HC 05
Raspberry pi 3

2.2. Specifications and description about components

2.2.1. Introduction to arduino

The key features are: Arduino is amodel stage(open-source) in view of a simple to utilize equipment and programming. It comprises of a circuit board, which can be programmed and programming environment called Arduino IDE, which is utilized to compose and transfer the PC code to the physical board.

Fig .2: HC 05 connection with Arduino Uno

2.2. Working principle

The sensor comprises of a red LED and light detector. The LED light should pass spread in finger and recognized by locator. Presently, when the heart draws a beat of blood through the veins, the finger turns out to be marginally more murky with less light detection. Heart heartbeat the locator flag fluctuates. This variety is changed over to electrical signal. This signal collected and amplified which yields +5V logic level.

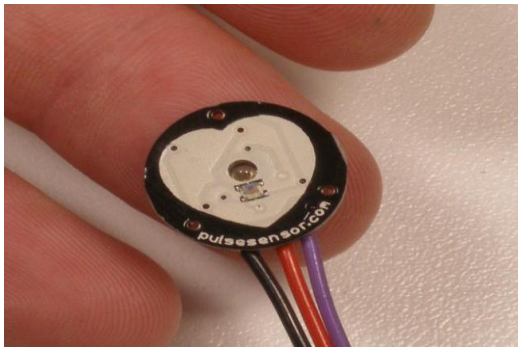

Fig.3: Working of pulse sensor

2.2.1. EEG Sensor – Mindwave mobile headset

The MindWave Mobile Brainwave Starter Kit is the principal proficient EEG headset for home and versatile utilize. With Neurosky ease MindWave Mobile headset and neuro feedback software sensor measures the mind's electrical action and exchanges the information

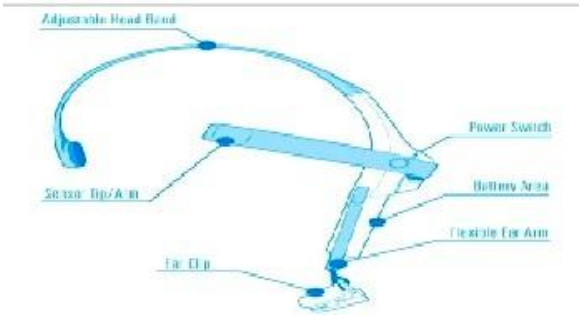

Fig.4: Mindwave sensor

Table 1: Brainwaves Frequencies Characterstics

Brainwaves : Brainwave Type	Frequency range	Mental states and conditions
Delta	0.1Hz to 3Hz	Deep, dreamless sleep, non-REM sleep, unconscious
4Hz to 7Hz		Intuitive, creative, recall, fantasy, imaginary, dream
Alpha	8Hz to 12Hz	Relaxed (but not drowsy) tranquil, conscious
Low Beta	12Hz to 15Hz	Formerly SMR, relaxed yet focused, integrated
Midrange Beta	16Hz to 20Hz	aware of self & surroundings
High Beta	21Hz to 30Hz	Alertness, agitation

2.3. Block diagram of the proposed project

Inputs to the Arduino are Pulse, Temperature Sensor and EEG Sensor. These inputs are connected to the Arduino. And from Arduino, the values are send to the cloud storage via Raspberry pi. Raspberry pi is connected to Arduino serially. Once the data is send to the cloud, the patient can retrieve the data from anywhere and check his details. To retrieve the data the patient can login to patient mobile app and see his details. If the patient get the abnormal readings, then an alert is send to the doctor mobile app. After receiving the alert, the doctor sends a suggestion to the patient mobile and also approaches him to cure.

3. Plan and results

Monitoring the wellbeing status of the patient at home is a troublesome undertaking. Particularly rationally incapacitated patients ought to be occasionally checked and their friends and family should be educated about their wellbeing status every once in a while there are grinding away. So we propose a creative framework that mechanized this errand easily. Our framework advances a shrewd patient wellbeing following framework that utilizations Sensors to track understanding wellbeing and utilizations web to illuminate their friends and family if there should be an occurrence of any crisis. In this framework we are utilizing EEG sensor to track the mind floods of the patient. Our framework utilizes temperature and pulse detecting to monitor understanding wellbeing. The sensors are associated with a microcontroller to track the status which is thusly interfaced to a Wi-Fi association keeping in mind the end goal to transmit cautions. In the event that framework recognizes any sudden changes in understanding pulse, cerebrum signals, body temperature, the framework consequently cautions the client about the patient‟s status over IOT and furthermore demonstrates subtle elements of pulse, mind signals, temperature of patient live finished the web. In this manner IOT based patient wellbeing following framework viably utilizes web to screen understanding wellbeing details and spare lives on time.

The proposed display empowers clients to enhance wellbeing related dangers and lessen social insurance costs by gathering, recording, breaking down and sharing expansive information streams continuously and proficiently. The possibility of this task came so to decrease the cerebral pain of patient to visit to specialist each time he have to check his pulse, heart beat rate, temperature and so forth. With the assistance of this proposition the season of the two patients and specialists are spared and specialists can likewise help in crisis situation however much as could be expected.

3.1. Results collected from sensors to arduino

We are utilizing arduino for mix of sensors i.e., Temperature sensor LM35, Pulse sensor, and EEG sensor. Raspberry Pi is incredible instrument for installed designs yet it needs ADC. One more downside is all its IO‟s are 3.3V level. On the opposite side Arduino is great at detecting the physical world utilizing sensors. To get advantages of both the frameworks one may need to interface them. EEG sensor is associated with arduino utilizing Bluetooth module HC-05. Here HC-05 go about as ace and EEG sensor as slave. Its fills in as TTL Master/Slave Transceiver module with serial UART convention for correspondence. Outlined by Full speed Bluetooth task with full piconet bolster. It enables us to accomplish the business' largest amounts of affectability, precision, with least power utilization.

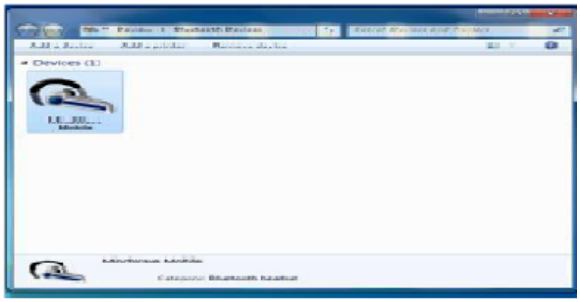

Fig.5: Bluetooth device Mindwave gadget

Right click → Properties → Bluetooth Then know your Unique Identifier Number (Note it)

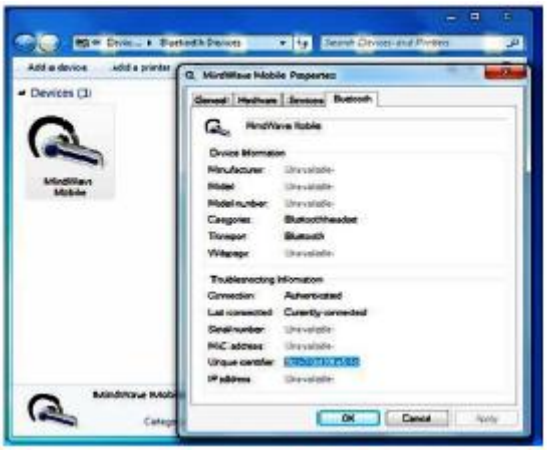

Fig .6 : IP address of the Bluetooth device

Example: This module Unique no =9cb7,0d,89e51c
AT Commands for HC-05 Module Initialize for Mindwave Kit
First Enter into command mode, after then enter the following commands for HC-05 Module to communicate our Mindwave Kit.

AT+NAME=”PANTECH”
AT+UART=”57600,0,0”
AT+ROLE=”1”
AT+PSWD=”1234”
AT+CMODE=”0”
AT+BIND=”XXXX,YY,ZZZZZZ” (Mindwave Unique Number)

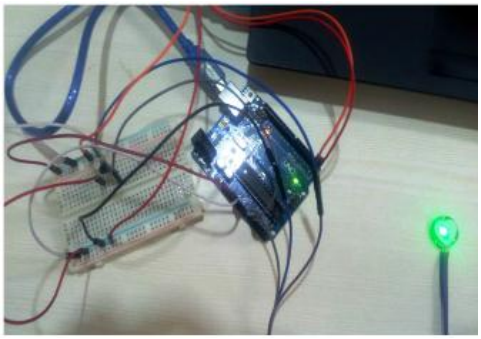

Fig.7: Interfacing peripherals to arduino

Step 2: Values from arduino to raspberry pi:-
Setting up Your Raspberry Pi to Laptop:
After binding, make the connection, we will get the values from sensors to the arduino. These values are sent to the cloud using raspberry pi 3 board. Arduino is connected to raspberry pi via serial communication.
To associate raspberry pi to PC show, you can just utilize an Ethernet link. The work area GUI (Graphical User Interface) of the raspberry pi can be seen through the PC show utilizing a 100Mbps Ethernet association between the two. There are numerous product accessible that could set up association between the raspberry pi and your workstation. We would utilize the VNC server programming to interface the pi to your PC. Introducing the VNC server on your pi enables you to see the raspberry pi‟s work area remotely, utilizing the mouse and console as though you were sitting directly before your pi. It additionally implies that you can put your pi anyplace else in your home, yet at the same time control it. Likewise, web can be shared from laptop‟s WiFi over Ethernet. This additionally gives you a chance to get to web on the pi and associate raspberry pi to workstation show.
Before moving to interface raspberry pi to workstation show, you require a SD card having the OS preinstalled. Configuration the SD card before embeddings into the raspberry pi utilizing SD card formatter. Presently introduce the Noobs programming onto the SD card.
In the wake of setting up your SD Card, embed it into the raspberry pi. Next, for fueling the pi associate your small scale USB link to it. Likewise associate your raspberry pi to the workstation by means of an Ethernet link. Also, interface the console and mouse to it. Presently, interface the HDMI show (the HDMI is required for running the pi out of the blue). Presently control on your Pi. Also, take after the subsequent stages to associate raspberry pi to PC show. Share your workstation web with the raspberry pi through Ethernet link. In Windows: For sharing web to numerous clients over Ethernet, go to Network and Sharing Center. At that point tap on the WiFi arrange:
Tap on Properties at that point go to Sharing and tap on "Enable other system clients to associate". Ensure that systems administration association is changed to "Neighborhood":
Note: Doing this will give a dynamic IP to the Ethernet port of your PC and different Devices associated with your PC. Presently, to check the IP alloted to your PC, Click on the new neighborhood interface made
Check the answer from gadget: "arp – a"
Setting Up the VNC Server to Connect Raspberry Pi to Laptop Display
Interface Raspberry with ethernet link to your PC and power it. At that point open VNC Viewer, say the IP address of your pi. Also, we can utilize the show of workstation as the raspberry pi‟s screen.

Fig.9: Authentication of VNC viewer

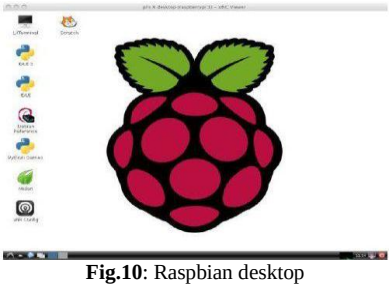

Fig.10: Raspbian desktop

After entering the login details you will get the following screen as shown in the following above figure 3.6
Now attach the arduino board in raspberry pi by pressing the ls/dev/tty in command terminal of raspberry pi. We will get a list of devices available. Paste this /dev/ttyACM0 in the code. The values from the arduino go to raspberry pi. These values are send to the cloud via calling url in the code:
base_url=
"http://healthmonitoringsystem.thesmartbridge.com/API/update?key=31508143088"
line =""
To see the uploaded data go to the webpage “healthmonitoringsystem/thesmartbridge.com” and login into it, you will see the particular details as shown in the below figures.

3.2. Results is uploaded into cloud

Fig.11: Home page of webpage

Here we are using cloud of smart bridge to store the data. The data which is collected from the sensors is send to the cloud of domain smart bridge and sub domain health monitoring system through API.

The patient can view his health details after logging-in. In this project we are using pulse sensor to know the patient heartbeat, LM35 to know his body temperature and EEG sensors to know his brain signals.so after login he will get a display of readings in tabular form as shown in the figure. The tabular consists of columns of temperature values taken from LM35, heart beat taken from pulse sensor, meditation and attention values taken from EEG sensor and noise quality of EEG sensor.

The EEG Sensor (values of Attention, Meditation), For calculation Range of 1-100 was taken

- Range from 40 to 60 is considered "neutral".
- Range from 60 - 80 is considered "slightly high", and interpreted as higher levels than normal.
- Range from 80 - 100 are considered "high", that mean it is strong indication levels Severe levels.
- Range between 20 to 40 indicates "Low levels" levels of the eSense,
- Range between 1 to 20 indicates "very low levels " levels of the eSense.

These low levels symptoms of distraction, agitation, or abnormality, according to the opposite of each eSense.

Fig .12: Patient details

Fig.13: Values in waveform

Fig 14: Normal person details

3.2.1. Meditation details

Meditation is related to control and focus the brain towards one particular point by balancing other activities of the brain signals. It has long been an observed that closing one's eyes turns off the mental activities which process images from the eyes. So closing the eyes is often a positive method for increasing the Meditation level. Meditation levels balances the activity of brain signals.

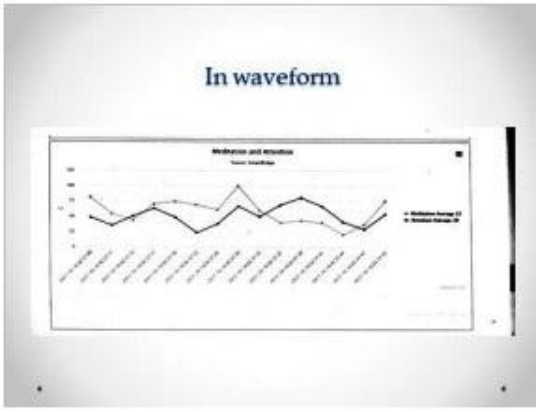

Fig.15: Patient meditation details

3.2.2. Attention details of patient

Meditation level indicates user's level of brain signal "focus" or "attention", such as that which occurs during deep concentration and directed stable and balanced brain activity. Its value ranges from 0 to 100. Identifies the Range of levels to Predict the patient condition such as Anxiety, Deep Sleep and Active state.

Fig 16: Patient attention details

3.2.3. Average of both meditation and attention

As we are using only one sensor, the data is fluctuating little bit. So to overcome that we are taking average of 15 values of meditation and attention. If these average values are less than normal values then a alert is going to the doctor mobile.

Fig.17: Average of Meditation and Attention

3.3. To retrieve the stored data via mobile apps

We are using two mobile apps – one for the patient to check his health details, and other one for the doctor to check his patient‟s health assigned to him. We have created these apps using android studio 3.0.0 version. After installing the .apk file of patient app it will display as shown in the figure

Fig.18: Patient login

After logging-in he can see his personal details and doctor‟s name. He can see his health details in terms of graph by clicking on data visualisation.

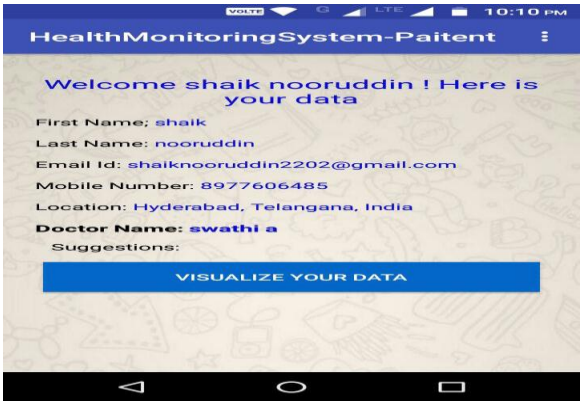

Fig.19 : After patient logging in

After clicking on the visualise your data one can check his details in terms of graph form. The graphical representation of patient values is seen in figure

Fig.20: Graph of patient values

Similarly to patient login, doctor can also login in the same way. After installing .apk file the figure will be displayed to him. If the values are slightly reduced then the normal values, than the doctor can alert him by sending a suggestion through app itself.

Fig 21: doctor logging in

Fig 22: After doctor logging in

4. Conclusion

The project has been tested perfectly and successful results are achieved. These results are successfully uploaded to the cloud using raspberry pi. Protocols like SPI have been understood and verified its functionality with practical implementation.

The main aim of the project is to monitor the mentally handicapped patients periodically and their loved ones need to be informed about their health status from time to time while there are at work. It's also reduces the patient work load by checking his details staying at home rather going to a hospital. If system detects any abrupt changes in patient heartbeat, brain signals, body temperature, the system automatically alerts the doctor and respective relatives about the patient's status over IOT and also stores the patient details in the cloud for future use. The project is able to provide the solutions for the problems faced in real time and perfect achievement is succeeded.

The project justifies the terms "Embedded System" and "Internet of Things" as it is integrated the hardware and software serving for dedicated application via internet as a medium for data transmission and storing the information.

4.1 Future Scope

After verifying the results, it is proved that designed project can be used for real-time environment without any error absolutely. The usage of internet of things technology helped the project to access the web portal globally. Such that by seeing the results respective

step is taken to prevent before the health condition of patient is going even worse.

In this project, we are using mindwave mobile headset which works on EEG technology. This sensor consists of one main sensor and one reference electrode. This project can be implemented in future by making more sophisticated by expanding the sensors used to read the brain waves.

The main working of mindwave mobile headset goes in TGAM (ThinkGear ASIC module) chip. In this project, we are using TGAM1 chip in the sensor. To enhance and implement more accurate values in future we can use TGAM2 chip in the sensor.

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