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PARALYSIS PATIENT HEALTH CARE SYSTEM USING IOT

Sameer Bante[*1], Vivek Pardhi[*2], Chaitali Warbhe[*3], Jyoti Mesram[*4], Snehal Bagde[*5]

[*1,2,3,4]Students Of Information Technology, Tulsiramji Gaikwad Patil College Of Engineering And Technology, Nagpur, Maharashtra, India.

[*5]Prof., Department of Information Technology, Tulsiramji Gaikwad-Patil College Of Engineering & Technology, Nagpur, Maharashtra, India.

ABSTRACT

The goal of this project is to create a system that uses an accelerometer to detect and measure wrist motions in order to let carers keep an eye on patients who are paralysed. The wrist motions of the patient's hands are essential in this suggested system since paralysis is a disorder that affects many people. It is possible to measure the tilt angle and utilise it to send various messages by inserting a device on the dorsal region of the hand. A Wi-Fi module and a Blynk application will be utilised to send notifications to the carer in the event of an emergency. This will allow for efficient communication and guarantee that the patient's demands are met as soon as possible in any situation.

Keywords: Wrist movements, tilt angles, Wi-Fi, Emergency Notification, Sensors.

I. INTRODUCTION

Loss of voluntary muscular function, often known as paralysis, can be brought on by a number of illnesses that affect the muscles or nerves, metabolic disturbances, or traumas. Depending on the location and size of the afflicted area, several types and degrees of paralysis, such as partial or whole, temporary or permanent, flaccid or spastic paralysis, may develop. Patients may find it difficult to communicate their demands to carers as a result of this condition's communication problems. The suggested solution to these issues is a device installed on the dorsal region of the hand that uses a three-axis accelerometer to detect and analyse tilt angles. Every tilt angle has been set to warn the carer with a buzzer sound and show certain messages on an LED screen.

II. SYSTEM DESIGN

Proposed Methodology –

The "The Paralysis Patient Health Care System Using IOT" is a tool made to continuously assist people with paralysis of one or more limbs, including people who have trouble speaking. The tool can help people with paraplegia (paralysis of the legs), monoplegia (paralysis of one limb or arm), and other disorders comparable to these, both in routine circumstances and in emergency scenarios.

The gadget known as "Paralysis Patient Health Care System Using IOT" can be fastened to any portion of the patient's body that is mobile, however in this instance, it is fastened to the patient's wrist. An analogue accelerometer, a microcontroller with a WiFi module (NodeMCU), an LED display, an analogue multiplexer, and a buzzer are all components of the gadget on the patient's side. The NodeMCU only has one analogue input (A0), thus the accelerometer is connected to it using an analogue multiplexer. This gadget uses a triple-axis accelerometer, which detects changes in the X, Y, and Z axes in response to movement. Due to its extreme sensitivity, even minor motions might result in changes. As a result, both the messages that will be shown and the directions in which the wrists will move are predetermined.

A block schematic of the "Paralysis Patient Health Care System Using IOT" device's operation is shown in Figure 1. The analogue multiplexer receives the inputs from the accelerometer first, and it then transfers the X, Y, and Z coordinates in turn to the microcontroller. The associated message is shown on the LED screen and a buzzer sound is produced if the coordinates are within the pre-specified range. For instance, the LED screen will show the phrases "Need Water," "Need Food," and "Washroom," respectively, when the patient turns their wrist to the right, left, or front. Any nearby carers will be alerted by the buzzer sound, and they can then read the message that is displayed on the screen and take the appropriate action to help the patient.

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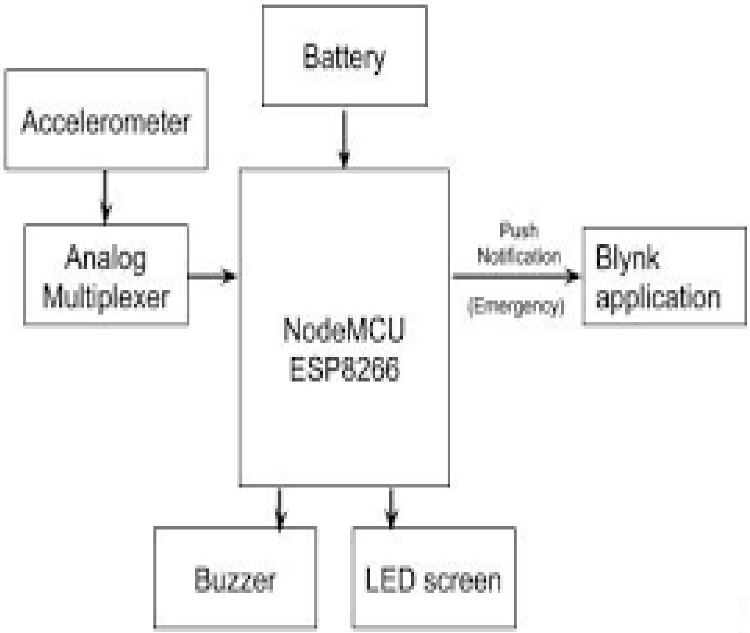
Block diagram of the proposed model.



A separate buzzer sound and the word "Emergency" are flashed on the LED screen when the patient moves their wrist backward in an emergency. A push notice is simultaneously delivered to the caregiver's phone's Blynk app. When a patient is in need, this function makes sure that even if the carer is not nearby, they will still receive a notice on their phone and may act quickly to help.

III. SYSTEM IMPLEMENTATION

A. Hardware Implementation –

1. Node MCU ESP8266

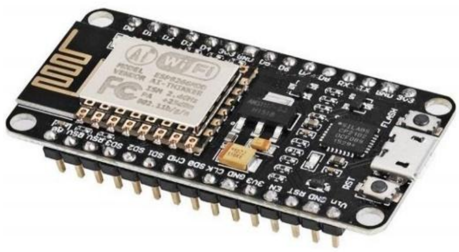


Figure 2: Node MCU ESP8266.

A development board and open-source firmware called NodeMCU ESP8266 is made primarily for Internet of Things (IoT) applications utilising the Lua programming language. It is based on the ESP-12 module and is powered by Espressif Systems' ESP8266 Wi-Fi SoC. Tensilica Xtensa 32-bit LX106 RISC CPU, which supports RTOS and runs at a configurable clock frequency of 80MHz to 160MHz, is a component of the NodeMCU ESP-12E module. NodeMCU also contains 4MB of Flash memory and 128KB of RAM, which gives it plenty of room to store data and programmes. NodeMCU is a great option for IoT applications thanks to its strong processing capabilities, integrated Wi-Fi and Bluetooth features, and capacity for deep sleep mode.
As an IoT-based microcontroller for processing data from an accelerometer, our project makes use of the Node MCU. Through an analogue MUX, the accelerometer is connected to the Node MCU. The Node MCU then takes decisions depending on the data it has received, such as whether to show a message on the LED screen or utilise the WiFi module and the Blynk app to send an emergency message to the user's caregiver's phone

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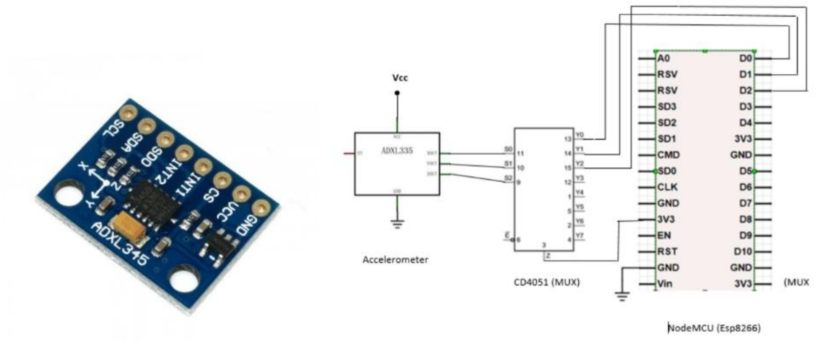
2. Interfacing Accelerometer to Node MCU

The suggested system makes use of the ADXL335 accelerometer to measure the tilt angle of the patient's hand, as shown in Figure 3(a). The voltage outputs produced by this compact, thin, low-power, full 3-axis accelerometer are signal-conditioned. It can measure both the static acceleration of gravity in tilt-sensing applications as well as the dynamic acceleration brought on by motion, shock, or vibration with a minimum full-scale range of 3 g.

In this application, the tilt-sensing of the patient's hand uses the ADXL335 to detect the static acceleration of gravity. It is interfaced with the NodeMCU, as seen in Figure 3(b). An analogue multiplexer is needed to connect the ADXL335 to the NodeMCU, though, as it is an analogue accelerometer and there is only one analogue pin on the NodeMCU. The Arduino IDE code is used to choose each pin sequentially and send it to the NodeMCU analogue pin from the three inputs of the analogue MUX that are coupled to the 3-axis output of the accelerometer.



(b)

B. Software Implementation –

1. Microcontroller Programming

The Node MCU ESP8266 is programmed by the system using the Arduino IDE, and it is connected to the ADXL 335 accelerometer. The analogue MUX transmits the data to the Node MCU through the accelerometer, which detects the static acceleration of gravity brought on by the patient's hand tilt angle. The software on the Node MCU compares this information with a specified range of values for each tilt direction, which is calculated by examining and compiling the range of values for each tilt direction of the accelerometer. The Node MCU programme chooses whether to show a message on the device or use the Blynk app to send an emergency message to the patient's carer based on this comparison. Additionally, the programme is made to sound a buzzer with a particular tone after each message is displayed to alert a nearby person or carer. The emergency signal is given a particular tone in order to set it apart from other messages.

2. Algorithm for Node MCU ESP8266

Require: Inputs from Accelerometer.

Ensure: Connected to Wi-Fi.

Notions:

X: measure the static acceleration of gravity of x-axis.

Y: measure the static acceleration of gravity of y- axis.

Z: measure the static acceleration of gravity of z- axis. BZ: pin connected to buzzer. BV: Blynk virtual pin

1. START
2. Read (X, Y, Z);
3. n = 0;
4. LED display "**********";
5. **if** (var 510<=x<=550) && (var 530<=y<=570) && (var 585<=z<=620)
6. LED display "Room T";
7. LED display "Contact Number: 123";
8. BZ = 1;

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```
Delay();
BZ = 0;
end if
else if (var 520<=x<=560) && (var 630<=y<=670) && (var 510<=z<=545)
LED display "Need water";
BZ = 1;
Delay();
BZ = 0;
end if
else if (var 495<=x<=540) && (var 440<=y<=480) && (var 535<=z<=580)
LED display "Need food";
BZ = 1;
Delay();
BZ = 0;
end if
else if (var 425<=x<=460) && (var 540<=y<=575) && (var 525<=z<=560)
LED display "washroom";
BZ = 1;
Delay();
BZ = 0;
end if
else if (var 620<=x<=675) && (var 530<=y<=570) && (var 490<=z<=555)
LED display "Emergency";
tone( BZ, 523, 200);
Delay();
n = 1;
BV = n;
end if
END
```

3. Blynk Application

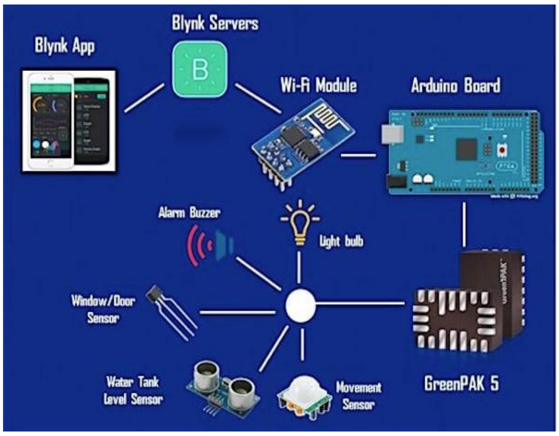

Figure: Blynk Application

IoT application Blynk is made for storing, visualising, and controlling devices from a distance. It also displays sensor data. Through the ESP8266's built-in Wi-Fi module, it communicates with the Node MCU over the internet. As seen in Figure 5, the Blynk application architecture facilitates effective communication with microcontrollers over Wi-Fi by allowing users to programme the application in the Arduino IDE using Blynk libraries. In this system, in the event of an emergency, a notification is sent to the carer using Blynk.

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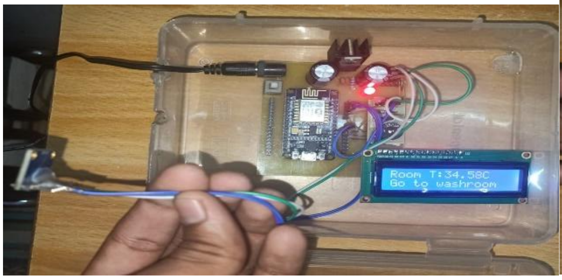
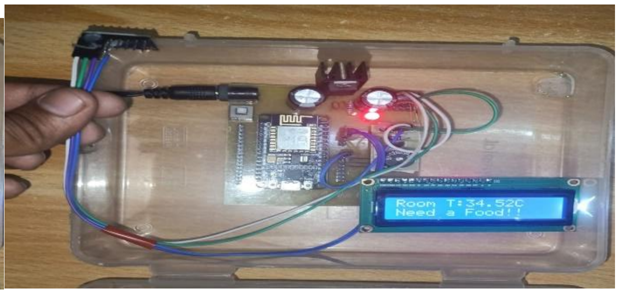
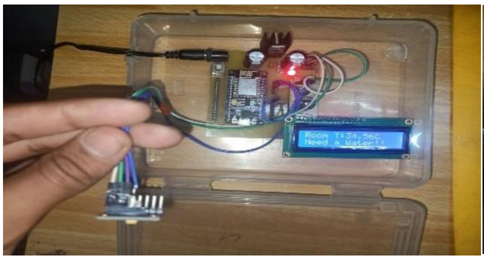
The Node MCU transmits an emergency signal to the caregiver's phone through the internet where the Blynk application is loaded in the event that the patient tilts the accelerometer backward.

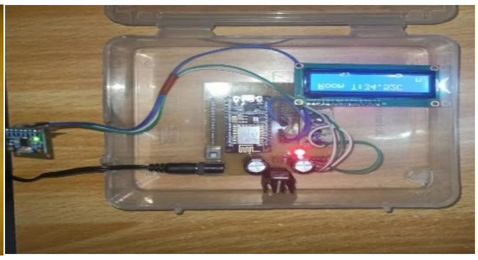
IV. RESULTS



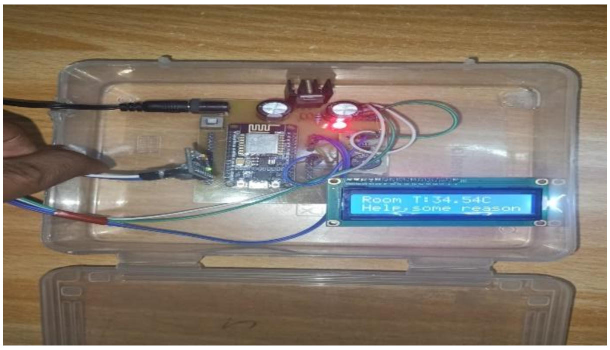


(A) (B)





(D) (E)



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An extensive range of values rather than just one was found by normalising the tilt angle in each direction using several trial samples. When displaying precise messages based on the tilt direction, this technique proved to be very efficient and practical. Depending on the situation, the range of tilt changed, but in every experiment that was run, the necessary messages were displayed with 100% accuracy. The four tilt directions were right, left, down and up, and each was linked to a message signalling the need for food, drink, a toilet or an emergency. The buzzer sounded at a preset frequency when the tilt happened, and the LED showed the matching message. The alert was also transmitted via the "Blynk" app to the caregiver's phone in case of an emergency tilt

(A) LED displaying “Room Temperature during static position.

(B) displaying “NEED A WATER” on backward tilt

(C) LED displaying “GO TO WASHROOM” on left tilt.

(D) LED displaying “NEED A FOOD” on forward tilt.

(E) LED displaying “HELP, SOME REASON” on right tilt.

V. CONCLUSION

The suggested approach provides a quick, safe, and effective way for paralysed patients to communicate their fundamental requirements to carers by merely tilting their hands. Messages are shown on the LED with pre-set settings for each tilt direction, and the buzzer informs the carer. Patients with various types of paralysis can make use of this straightforward, affordable equipment. A digital multiplexer upgrade might also minimise the hardware requirements for the device. The system has tremendous potential for monitoring more bodily functions in the future, making it a superb tool for efficient communication with the least amount of patient involvement.

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