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EMG MONITORING USING INTERNET OF THINGS

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Abstract: The Electromyogram (EMG) technique is commonly used to assess muscle health and identify nerve and muscle tissue issues. In this paper, a project is presented that employs a specialized EMG sensor as a tool for recording, analyzing, and presenting muscle activity in real-time. This monitoring can help for analyzing different neuromuscular diseases.The project uses an IoT approach to acquire and transmit EMG signals wirelessly to a live EMG reading is recorded using the Wi-Fi-enabled NodeMCU and Arduino and then sent to a remote server in our case ThingSpeak server with the help of IoT concepts which helps in the telemetry of the obtained remote ThingSpeak server, as well as displaying the live recordings on a PC through the Arduino serial plotter. This technology could assist in monitoring a patient's progress remotely, without the need for physiotherapists to be physically present. Therefore, this project aims to develop an IoT-Based EMG monitoring device for the analysis of EMG signals.

Keywords: Internet Of Things(IOT), Electromyography(EMG), Neuromuscular diseases etc.

I. INTRODUCTION

A diagnostic test called electromyography (EMG) assesses the health of the muscles and the nerves that regulate them. Motor neurons are the name for these nerve cells. They send electrical signals to the muscles, which cause them to contract and relax. A record known as an electromyogram is created during an EMG using a device called an electromyograph. These signals are converted by an EMG into graphs or numerical values, which aid with diagnosis. The test is used to identify aberrant neuromuscular function. One or more tiny needles are injected into the muscle during the test through the skin. Surface electrodes are also employed occasionally. The amplitude of a surface electromyograph (sEMG), which is commonly used to estimate the strength of the neural signal received by muscles, is dependent on the degree of muscle activation.

The results of an EMG can be used to diagnose conditions affecting the muscles, the nerves, or the relationship between the muscles and the nerves. [1]. The live EMG reading is recorded using the Wi-Fi-enabled NodeMCU and Arduino and then sent to a remote server. [2].With the trend going on in ubiquitous computing, everything is going to be connected to the Internet and its data will be used for various progressive purposes.[3] The electrode was applied to EMG smart clothing for fitness, and the EMG signal detection performance was analyzed.[4] parameters of the front-end amplifier (input impedance, noise, CMRR, bandwidth, etc.. and techniques for interference and artifact reduction. The individual's EMG wave is collected, amplified, filtered, and digitally transformed from analogue before being used for EMG wave analysis. Amplification, filtering, and an analog-to-digital converter are therefore required. EMG signal analysis is mostly used for clinical diagnostics and biomedical applications, which is why there is interest in this field. One of the key application areas is the field of management and rehabilitation of motor disability. Action Potential shapes and firing rates in EMG signals serve as a crucial source of data for the diagnosis of neuromuscular illnesses. The nature and features of the signal may be fully understood, and hardware implementations can be built for a variety of EMG signal-related applications, once suitable techniques and methodologies for EMG signal analysis are easily accessible EMG is a technique used to determine muscle activation and has gained popularity in recent years for its potential to assist individuals with disabilities in interfacing with the external world. The myoelectric signals generated by the human body can control powered external devices, known as myoelectric control (MEC). EMG signals are complex and non-stationary and can be affected by various physiological and anatomical properties of the body, as well as the instrumentation used to detect them. EMG signals are typically described in terms of parameters such as amplitude, frequency, and phase, and can provide insight into muscle properties, coordination, and neuromuscular disorders. In a previous study, time-domain features were extracted from EMG signals, and three statistical features were considered for signal classification, with the ideal feature determined by the percentage error. The results suggest that these features can be useful for signal classification.

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OFFICIAL NODEMCU	NODEMCU CARRIER BOARD
Microcontroller	ESP-8266 32-bit
NodeMCU Model	Amica
NodeMCU Size	49mm x 26mm
Carrier Board Size	n/a
Pin Spacing	0.9" (22.86mm)
Clock Speed	80 MHz
USB to Serial	CP2102
USB Connector	Micro USB
Operating Voltage	3.3V
Input Voltage	4.5V-10V
Flash Memory/SRAM	4 MB / 64 KB
Digital I/O Pins	11
Analog In Pins	1
ADC Range	0-3.3V
UART/SPI/I2C	1 / 1 / 1
WiFi Built-In	802.11 b/g/n
Temperature Range	-40C - 125C

Table 1. [9] Node MCU Specifications

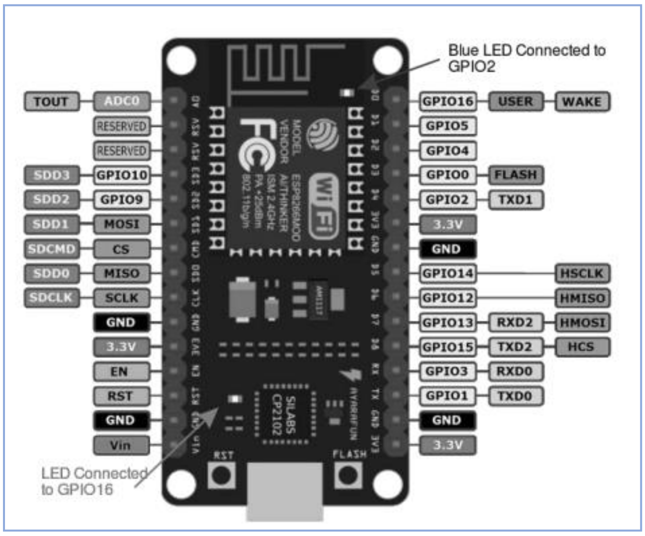

Fig. 1 Node MCU Esp8266

II. IMPLEMENTATION OF EMG SENSOR

A cheap open source IoT platform is Node MCU. It originally included hardware based on the ESP-12 module and firmware that runs on Espressif Systems' ESP8266 Wi-Fi SoC.From Fig.1 is a pin diagram for NodeMCU Esp8266 system. Support for the 32-bit ESP32 Microcontroller was later added. There are open source prototyping board designs for the NodeMCU open-source firmware. NodeMCU is a combination of the node and MCU (micro-controller unit). [9] NodeMCU technically refers to the firmware rather than the accompanying development kits. The designs for the prototyping boards and firmware are also open source. 1. High Resilience Due to its broad operational temperature range, ESP8266EX can reliably operate in industrial settings. The chip delivers dependability, compactness, and resilience

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thanks to its fully integrated on-chip functionalities and low external discrete component count. 2. Compactness: A 32-bit Tensilica CPU, common digital peripheral interfaces, antenna switches, an RF balun, a power amplifier, a low noise receive amplifier, filters, and power management modules are all built within the ESP8266EX. Our ESP8266EX contains every one of them in a single, compact package. 3. Energy-Efficient Architecture The ESP8266EX, which was designed for mobile devices, wearable electronics, and Internet of Things applications, uses a mix of 23 patented technologies to achieve low power consumption. Three operating modes—active mode, sleep mode, and deep sleep mode—are part of the power-saving architecture. This enables designs powered by batteries to operate longer. 4. A Tensilica 32-bit processor The Tensilica L106 32-bit RISC processor, which has exceptionally low power consumption and tops out at 160 MHz, is integrated inside the ESP8266EX microcontroller. Around 80% of the processing power is made accessible for user application programming and development via the Real-Time Operating System (RTOS) and Wi-Fi stack.

III. EXPERIMENTATION

Once the electrodes have been placed on the muscles, the data are first collected using the surface electrodes and EMG sensor. The signal is next transmitted to NodeMCU, an Arduino family member that helps with monitoring and analysis. [10]The Arduino IDE is used to construct the graphs that show the EMG data, which are collected using a computer and shown. For telemetry reasons, the signal is further processed and stored in the cloud. 35 This is a description of the project setup that was used to measure and track EMG online readings. Get the Arduino IDE from Arduino.cc in at least version 1.6.4. You might also try downloading the ready-to-use package from the ESP8266-Arduino project if the proxy is giving you problems. Install the ESP8266 Board Package in the Extra Board Manager URLs box of the Arduino v1.6.4+ settings. Next, employing the Board manager, install the ESP8266 package. Go to "Tools" -> "Board:" -> "Board Manager" to view this panel. Scroll down to "esp8266 by ESP8266 Community" and click the "Install" button to install the ESP8266 library package. Website for the ESP8266 software download When the installation is complete, close and reopen the Arduino IDE to enable the ESP8266 library. After restarting the Arduino IDE, select 'NodeMCU1.0' from the 'Tools' 'Board:' selection option. to determine which Com Port is designated for "USB-Serial CH340." Fig.2. refers the software implementation of EMG live acquisition using the Arduino IDE platform.

Table Captions

Tables must be numbered using uppercase Roman numerals. Table captions must be centred and in 10 pt. Captions with table numbers must be placed before their associated tables, as shown in Table 1.

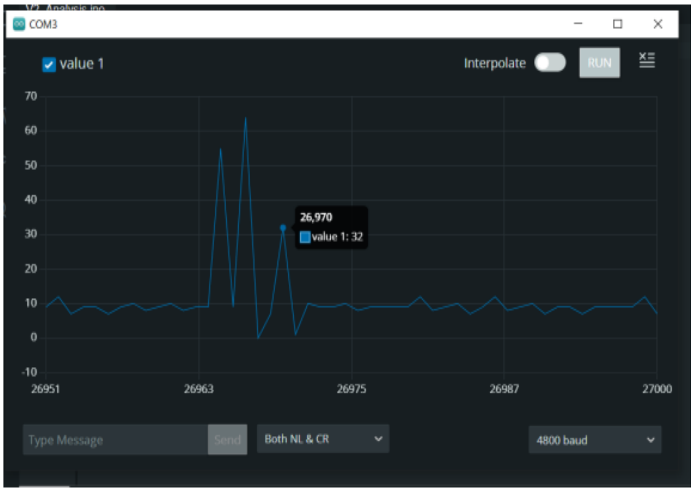

Fig.2.Software Implementation

A. References

The heading of the References section must not be numbered. All reference items must be in 8 pt font. Please use Regular and Italic styles to distinguish different fields as shown in the References section. Number the reference items consecutively in square brackets (e.g. [1]). When referring to a reference item, please simply use the reference number, as in [2].

Examples of reference items of different categories shown in the References section include:

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- example of a book in [1]
- example of a book in a series in [2]
- example of a journal article in [3]
- example of a conference paper in [4]
- example of a patent in [5]
- example of a website in [6]
- example of a web page in [7]
- example of a databook as a manual in [8]
- example of a datasheet in [9]
- example of a master's thesis in [10]

IV. CONCLUSION

The EMG sensor and Wi-Fi enabled NodeMCU allow us to obtain real-time readings of the EMG by implementing the suggested project. The IoT idea can be used to send data to the ThingSpeak server. This information can be published either privately or publicly, depending on the requirements. We offered a monitoring service for an EMG monitoring device at a reasonable price. This paper describes how to establish real-time IoT-based monitoring of EMG sensor data using an EMG sensor and a NodeMCU. The project implements a very cost-effective biomedical system using the Arduino IDE and required hardware.

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[9] https://en.wikipedia.org/wiki/NodeMCU

[10]-https://www.arduino.cc/en/software

