Medical Device

(Electromyogram)

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***Abstract*—Electromyography is a technique used to detect, monitor electrical signals of muscle activities and diagnose nerve disorders. There are various methods of monitoring muscle activities. This paper intends to model the device, with a focus on the hardware components, the function of the device, its users as well as its future direction.**

I. Introduction

Electromyography also known as EMG is a procedure carried out to diagnose the health of muscles and the nerve cells that control them.

A. Purpose

EMG measures muscle response or electrical activity in response to a nerve's stimulation of the muscle. The test is used to help monitor nerve activity or detect neuromuscular abnormalities.

B. Scope

When a patient complains or shows signs of muscle numbness, pain, tingling or weakness in limbs, the EMG is used to measures the electrical activity of the muscles and translates these signals into graphs and sound, aiding the doctor to make diagnosis. EMG tests can be carried out with:

1) Surface electrodes: They are used for nerve conduction velocity test, to detect true nerve disorders or conditions whereby muscles are affected by nerve injury.

2) Needle Electrodes: The electrical activity is detected by a needle which serves as an electrode. A needle is inserted through the skin into the muscle.

C. Definition

- Amplifier:
- Diode:
- sEMG:

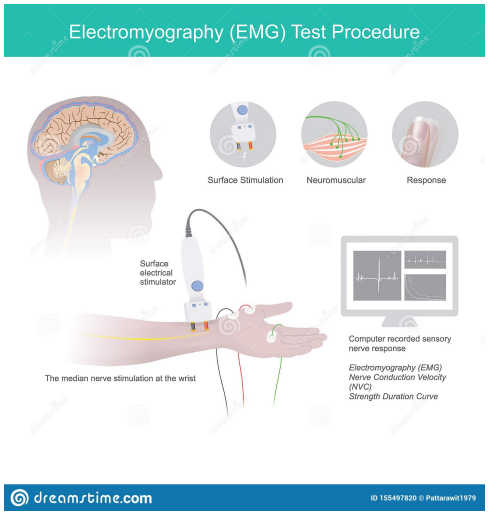

Fig. 1. Surface Electrode

Fig. 2. Needle Electrode

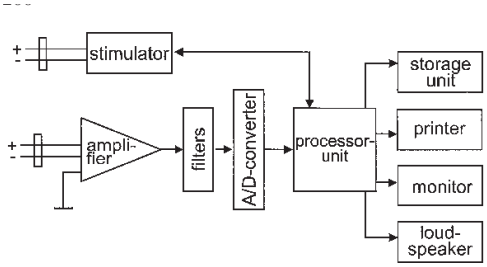

Fig. 3. Block Diagram EMG

Fig. 4. Fine Wire Electrode

D. Reference

E. Overview

This document contains a detailed explanation of the purpose of the EMG, pictorial illustrations of the device, how it functions with the aid of system modelling diagrams showing the hardware, critical-based parts of the system and user interface. Also, a discussion about the concept is revisited, the problem it solves, and improvements made on the system and finally, a summary with focus on the end results and future directions of the system is given.

II. Overall Description

An EMG test has a duration of 30 minutes to 60 minutes depending on how many nerves are being tested. During the test, EMG electrical signal output can be affected by the amount of muscle contraction which is generated by the individual during test duration. Also, electric noise signals which can be generated from power supply and environmental factors can also have an effect.

A. Product perspective

EMG is used to visualize the electrical signals of the muscle activity when the muscle cells are activated. It is made up of electrodes, attached to cable wires that connects the electrodes to a signal amplifier, a speaker which outputs the sound produced from the electric signals, a computer screen to monitors and save the signals. Below is a block diagrammatic representation of the major EMG components, interconnections, and external interfaces.

B. User Interface

Muscle activity of the specified part of the body is displayed visually on a computer screen and is also be detected audibly with a speaker. The presence, size, and shape of the wave form produced on the oscilloscope provide information about the ability of the muscle to respond to nervous stimulation. An illustration of the user Interface is displayed below:

C. Hardware Interfaces

An EMG comprises of the following hardware components:

- Fine wire electrodes: Detects electric activity generated by muscle contraction. It is made of ...
- Simulator: EMG Sensor: Measures the electrical signal generated.*Myoware 2.0*
- Amplifier:Electrical noise can be generated from power supply and environmental factors. This can be eliminated by using differential recording.*insert the name of amplifier *operational amplifier
- Filter:
- EMG detector
- A/D converter: samples electric signal and converts digital signal into an analog signal for data acquisition* recheck this function (high performance 32-bit ADC/ sigma-delta ADCs)
- Processor Unit:LPC1768 because of its high level of integration and low power consumption
- Monitor:A Linux centos 07 operating system displays the digitized result.
- Loudspeaker:The Electrical pulses of the muscle are monitored through a speaker.
- Storage Unit:A cloud storage space is made available (5Terra bytes) and an internal memory space of 10 Gigabytes*look into this

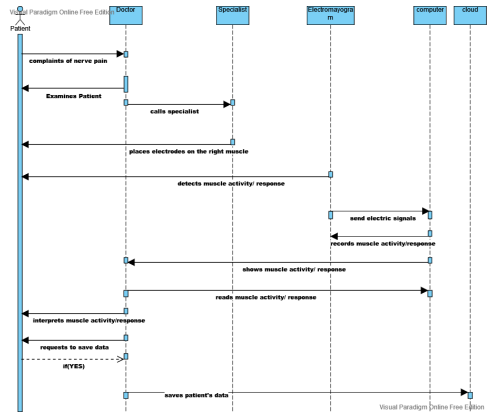

Fig. 5. Sequence Diagram

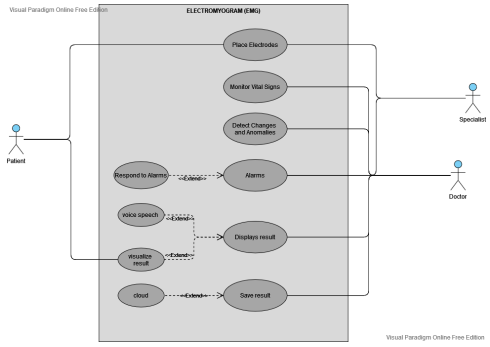

Fig. 6. Use Case

D. Product function

An EMG records and measures electrical signals caused by muscle activity. An EMG test takes about 30 minutes to 60 minutes to be completed. Depending on the nerves being test. Below is an illustration of how the and EMG test is conducted and its major functions.

E. User Characteristics

The EMG can be used by a doctors who has specialized in nerve and muscle disorder or a hospital technician on a patient. For a doctor to carry out an EMG test, the patient may have shown symptoms of nerve pain, tingling, weakness or loss of muscle strength.

F. Assumptions and dependencies

Before an EMG test is initiated, The needle electrode has is assumed to be new and not expired. Also, it is assumed that the patients muscles is at rest and the electrical activity is commenced as a result of contraction of the muscle.The larger

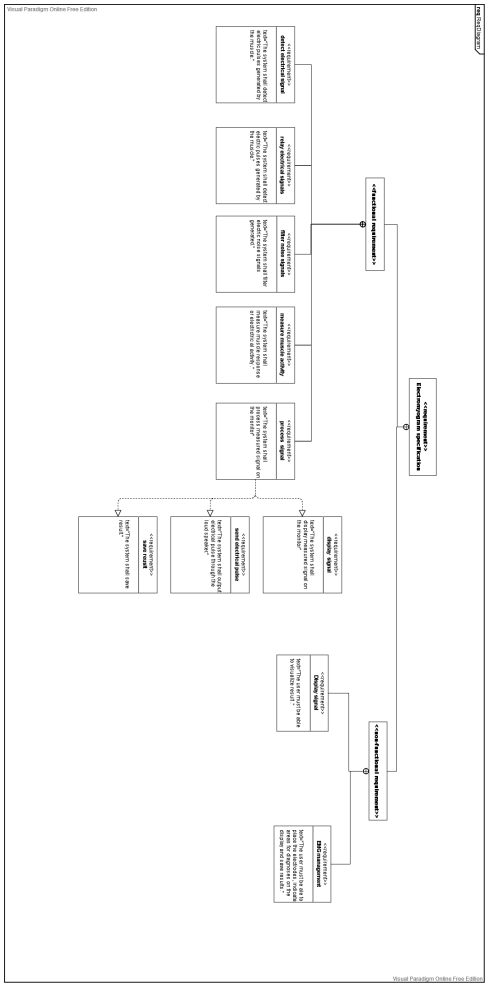

Fig. 7. Requirement Diagram

the amount of weight held during muscle contraction, the larger the amplitude of electrical signal.Various factors can have effect on the EMG results. These may include:

- Electrical noise signals generated.
- Electrode structure and placement
- Location of electrode with respect to the motor points in the muscle.
- Other factors could be biological or physiological.

III. Specific Requirement

The primary aim of the EMG is to detect, measure and visualize electrical signals generated by muscle activity during test. Below is a diagrammatic representation of its functional and non-functional requirements.

A. System Attributes

1) Reliability:

2) Availability:
3) Portability:
4) Security: **to cloud

IV. Conclusion

**Short Overview of the project and the main conclusions

A. Future Direction

Advanced EMG for signal detection would be possible in the near future due to VLSI technology that would enable detection of fine movements rather than taking signals from the entire muscle. More advanced algorithms with high data quality and accuracy would help solve the problem of pattern recognition.Future steps in the direction of reducing electric signal noise is being looked into.