Original Article: Brief Report

Brain-Computer Interfacing: A method to detect pain signals in the brain of a patient under operation.

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Introduction

This is a study of the brain waves of our subject who is going through medical operations mainly concentrating on the pain signals which might be produced.

Electric signals are captured using different surface electrodes and these signals will be studied further.

Subjects going through medical procedures will be given two kinds of chemicals. The numbing agent and the paralyzing agent.

Sometimes the paralyzing agent does its part but the numbing agent fails to do its part thereby causing a lot of pain the subject and the subject wont be able to convey this message to the doctors.

So by studying the brain waves of the patient we would be able to understand the condition of the subject if he or she is in the right condition for the medical procedure .

Project Objective

Our brain communicates with the entire body through electrical impulses. Our brain produces electrical waves belonging to different frequencies depending on the surrounding conditions. This study focuses on ways to isolate particular signals.

To study the signals produced in the brain of patients before the commencement of medical procedures and declare whether the patient is in the right condition for the medical procedure by displaying the appropriate message on the LCD.

Our aim is to capture a signal of particular frequency if present in the brain waves and display its presence on LCD using a microcontroller.

Flowchart

1.The noise removal system removes the signals which are not necessary for our study.

2.The feature extraction system amplifies our signal and triggers the next block is present.

3.The feature translation system converts the triggered output into a form that can be understood by processing unit.

4.And finally performing the Logical Operation or Decision making .

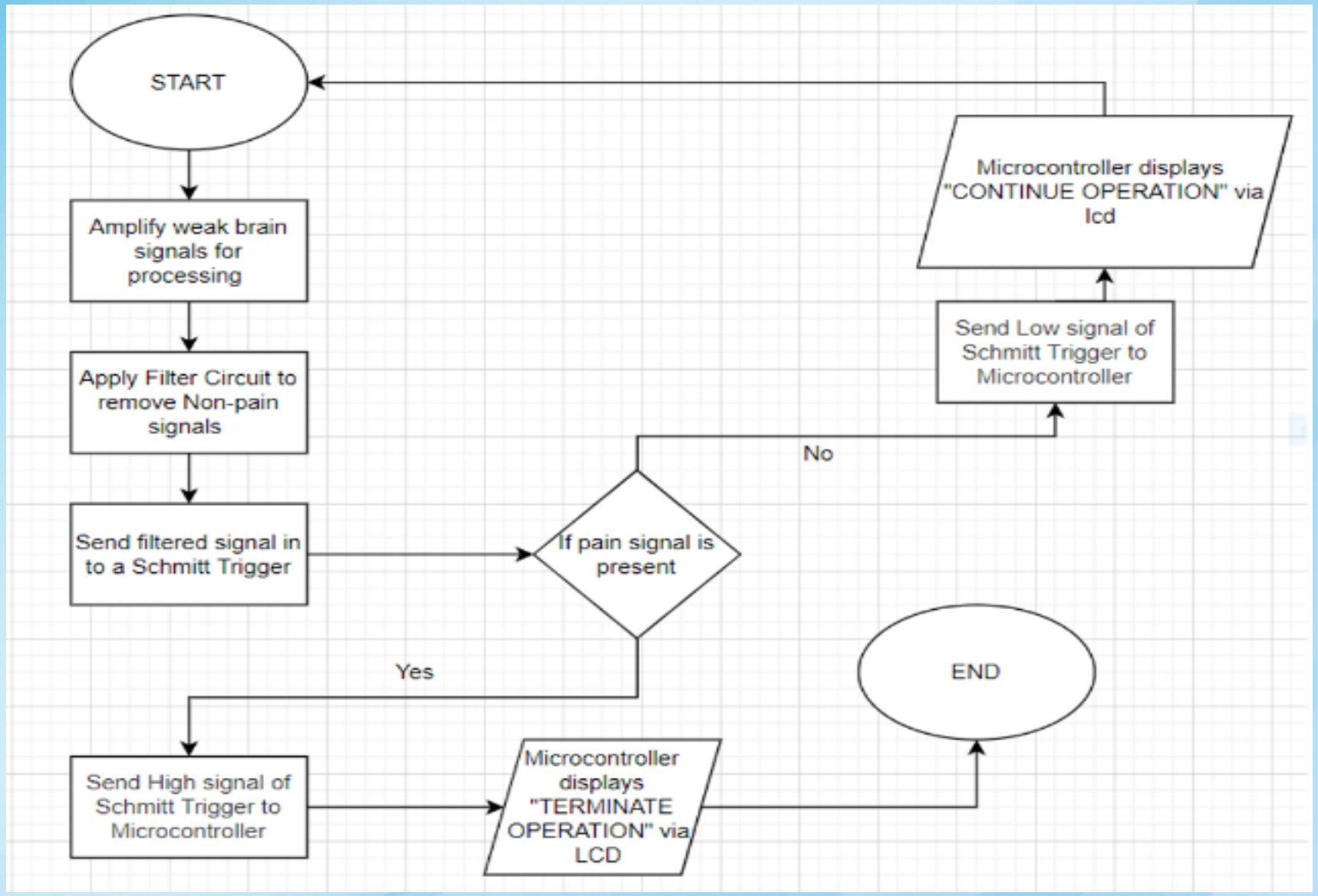


Figure 2. Flow Chart

CIRCUIT DESIGN

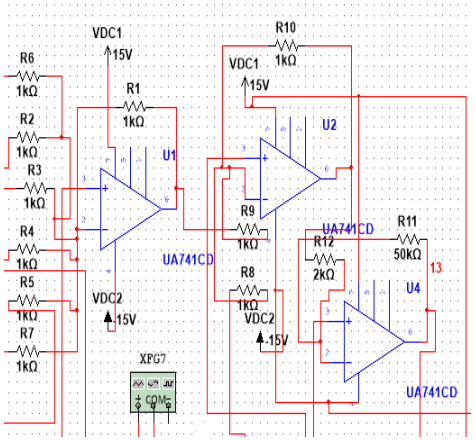


Figure 3
Amplification Circuit

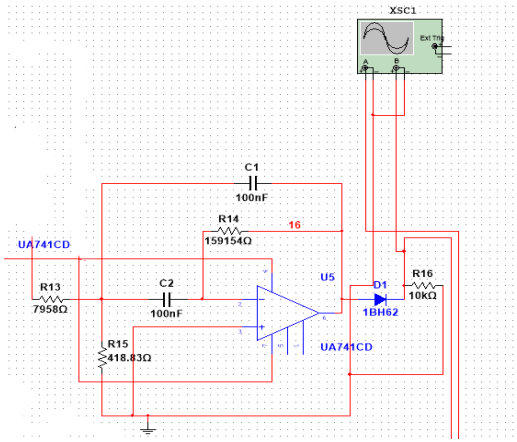


Figure 4
Filtering Circuit

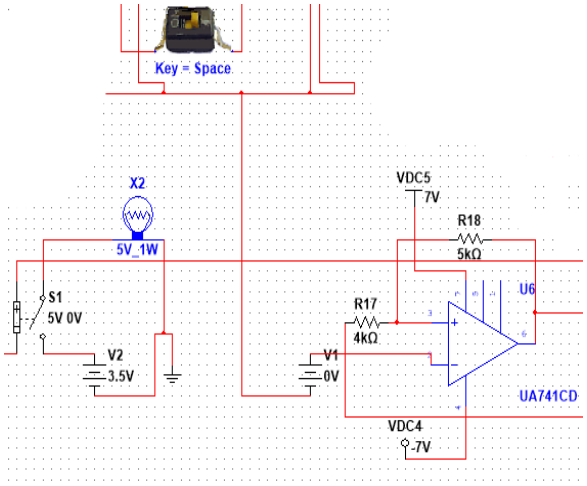


Figure 5
Schmitt trigger circuit

Simulators and Applications Used

1.**Multisim**

Used to simulate the entire signal processing circuit.(Figure 6)

2**. Proteus**

Used to simulate the microcontroller and LCD circuit .(Figure 7)

3**. Keil**

Platform to code and build HEX files which can be used to burn into the microcontroller.

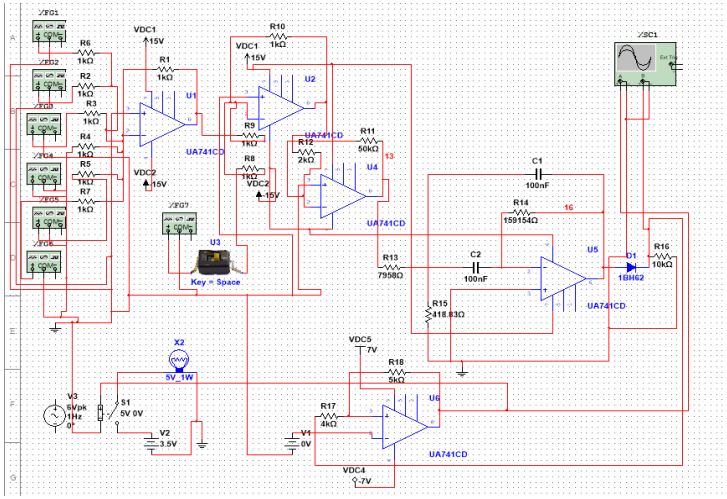


Figure 6
Signal Processing Circuit

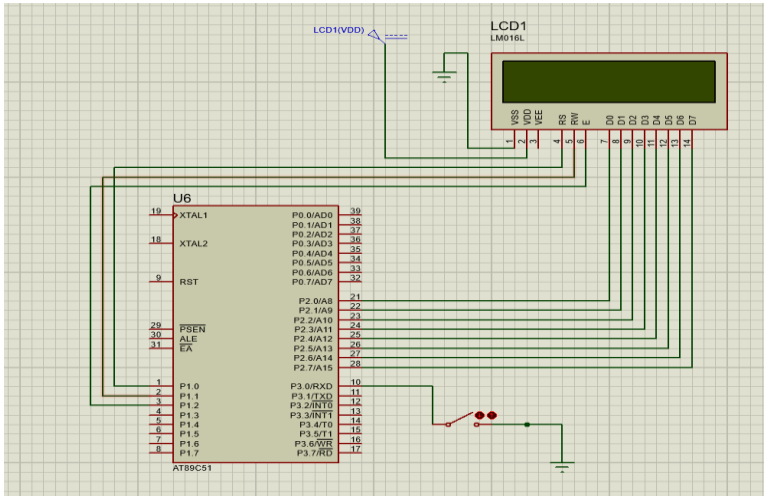


Figure 7
Microcontroller and LCD circuit

Connecting Simulation to Real World

1. Different Brain waves are mimicked using different function generators(XFG1-XFG6)(Figure 8).

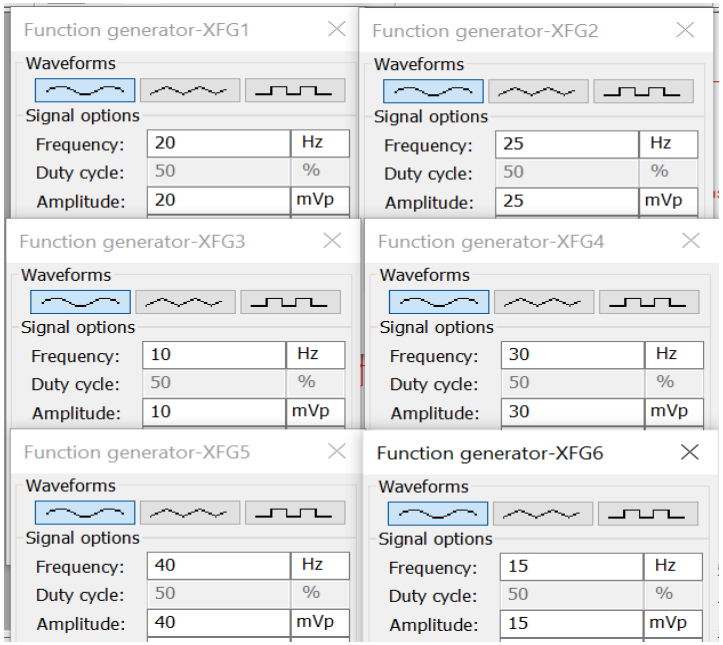


Figure 8. Function generators

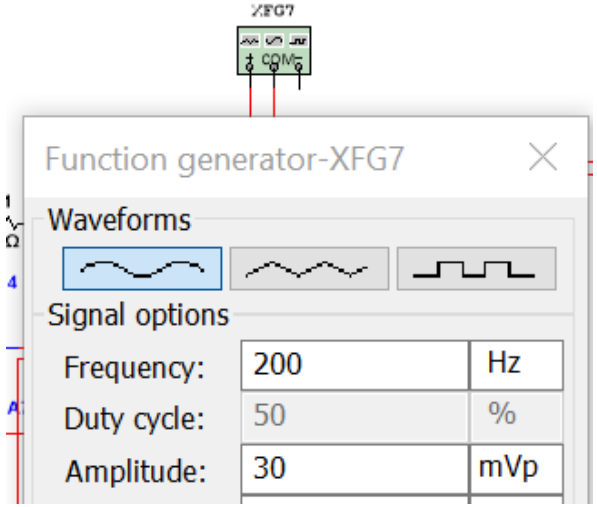
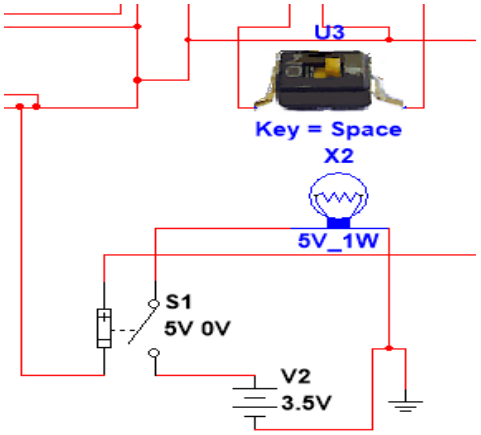
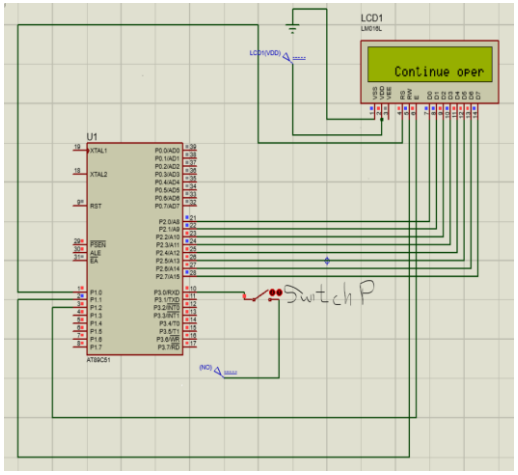


Figure 9. Pain Signal introduction

2. Pain Signal is mimicked by introduced signals from another Function generator (XFG7) in to the Normal signals (Figure 7) via switch U3(Figure 10).

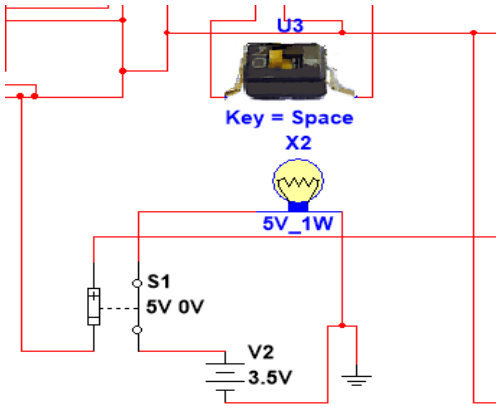
Results

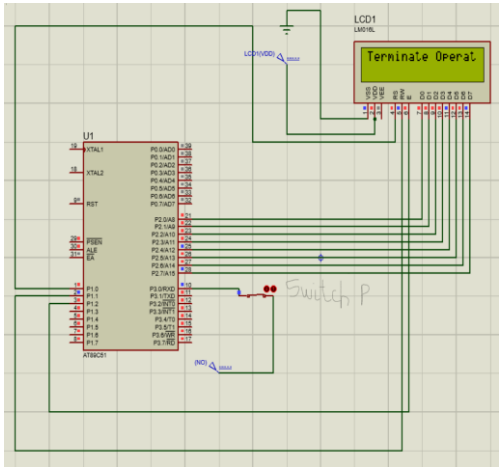




Pain Signal not introduced.
The bulb X2 remains OFF.
The LCD displays “continue operation”

Figure 10 and Figure 11 . Mimicking Absence of Pain Signals





Pain signal is introduced by triggering the switch U3.
The bulb X2 turns ON.
The LCD displays “terminate operation “

Figure 12 and Figure 13. Mimicking Presence of Pain Signals