

The Measurement of Impact Forces Relating to Medial Tibial Stress Syndrome (MTSS) in Sport

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1- Abstract

The adaptation of a design idea to develop a device capable of detecting and storing the number of impacts experienced by an athlete during exercise, and enabling the transfer of the raw data to an external device for further analysis and use in the prevention of Medial Tibial Stress Syndrome (MTSS).

Medial Tibial Stress Syndrome, more commonly known as shin splints, is a common condition which can be experienced by anyone who engages in an exercise involving repetitive actions i.e., running. The effect of chronic cases of MTSS on elite athletes can result in extended periods in recovery leading to a prolonged absence from training and competition.

This report evaluates the process of developing an initial idea into a proven prototype, which would have the potential to be passed forward for further development into a device suitable for production.

2 - Aim

To research the methods of measuring the forces contributing to MTSS and design and construct a device capable of measuring and storing this data for use in the development of strategies for the prevention and treatment of MTSS

3 - Objectives

- Research and investigate current impact measurement techniques and technology
- Design and simulate the circuit using Proteus simulation software and C language coding
- Build a prototype for bench testing
- Test and evaluate the system - modify where necessary
- Prove concept

4 - Research

Research was carried out into the following:

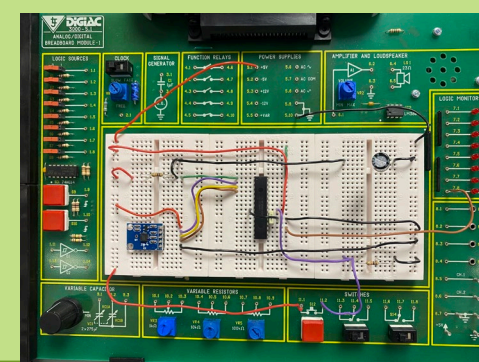
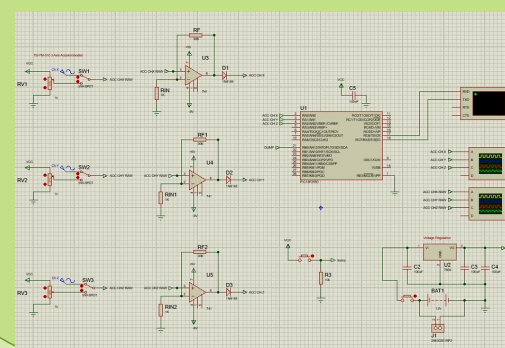
- Existing impact studies – World Rugby Head Impact Study
- Existing technology – Prevent Biometrics Impact Measuring Mouthguard (IMM)
- System Design – Control by Programmable Interface Controller (PIC)
- Sensor technology – Three axis accelerometer
- Power supplies – Battery and/or power regulation



5- Design

The design phase was carried out in stages:

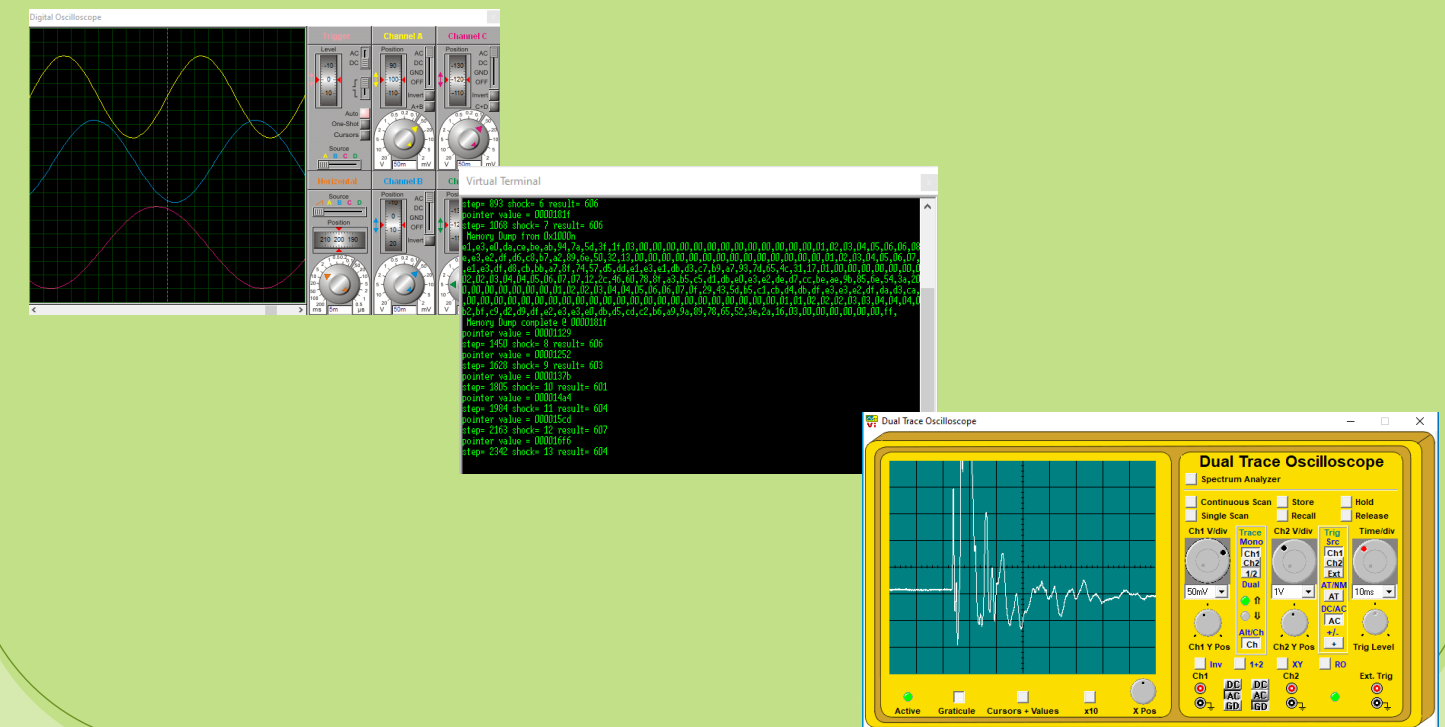
- Device – Tri-axial accelerometer with three analogue outputs X, Y and Z applied to the inputs of a PIC 18F2550. Simulated data output via RS232 to virtual terminal.
- Program coding written in C Programming Language using CCS Compiler
- Circuit construction and simulation using Proteus Professional simulation software.
- Construction of test bed prototype for testing and evaluation



6-Testing

The circuit was constructed using Proteus simulation software and the program code loaded into the simulation via CCS Compiler. The simulation was run and signals sampled using virtual oscilloscopes. The initial results were successful in that the observed signals were correct, with data processing witnessed via the output to a virtual terminal.

Test bed evaluation proved concept in that the accelerometer output signal waveforms were observed. Data collection and storage was proved as the dump function was observed via oscilloscope.



7- Conclusion

The project was a success as all objectives were met to achieve the aim.. The impacts were measured, registered as a "Step" or a "Shock" impact, and the data displayed and stored as such. The data was able to be retrieved and output via an RS232 port. Both the Proteus Simulation and Test Bed testing showed appropriate signal outputs. The final designs successfully proved concept.

8- Link to test video

<https://youtu.be/BZ0JX8meEpw>