Video Extensometer

B.Sc. (Honours) in Applied Physics and Instrumentation

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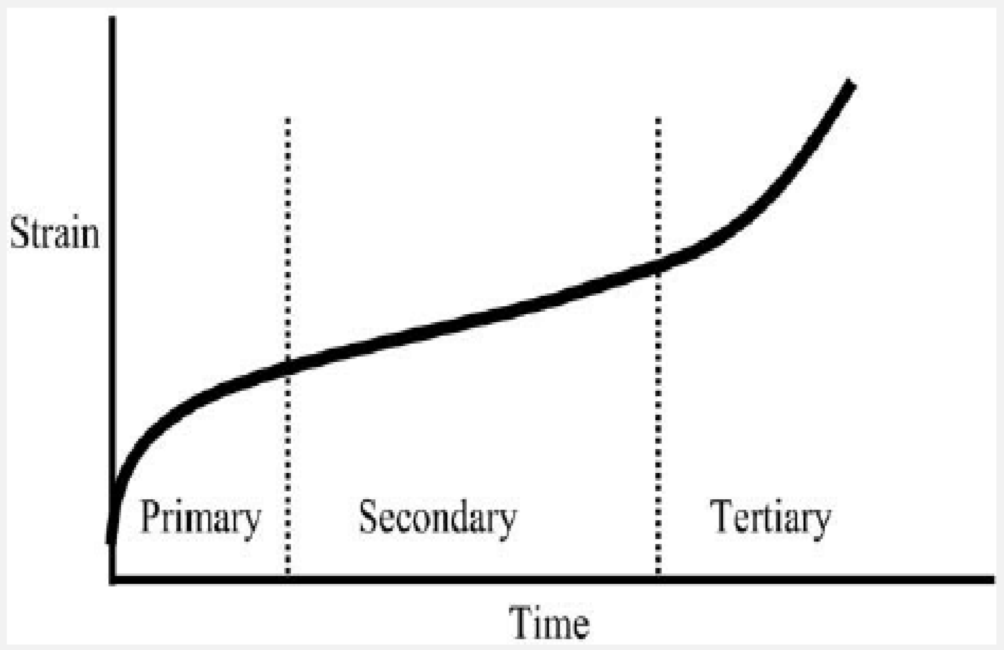
Background to Project

Video Extensometer

A video extensometer is used to measure the change in length of an object. Fiducial marks must be added to the surface of the material and the program must be able to detect these marks. These marks must be tracked throughout the recording of the material being stretched.

Ideal Creep Graph



Creep

Creep is defined as a time dependant strain. When a material is placed under constant load the material will begin to weaken and in the case of an elastic band will stretch or bend if the material is a metal. This phenomenon eventually leads to failure or breaking of the material. One of the aims of the project is to see this behaviour in an elastomer. [1]

Project Plan

Aims

The overall aim of this final year project is to create a low cost yet easy to use video extensometer. The video extensometer program will then be demonstrated by testing elastomers producing a strain vs time graph from the data collected.

Materials

Elastomers will be used as the test material, primarily elastic bands, this will work well to show how the video extensometer works as elastomer material is quite stretchy and easily accessible while completing the project from home.

Mark Recognition

There are a few possible ways to identify a mark on the test material, the option I will primarily be looking at are detection by shape and detection by colour. Computer vision tools will be used to help detect the mark as they have functions built in to recognise marks for example OpenCV has a circle detection feature. [2]

Testing

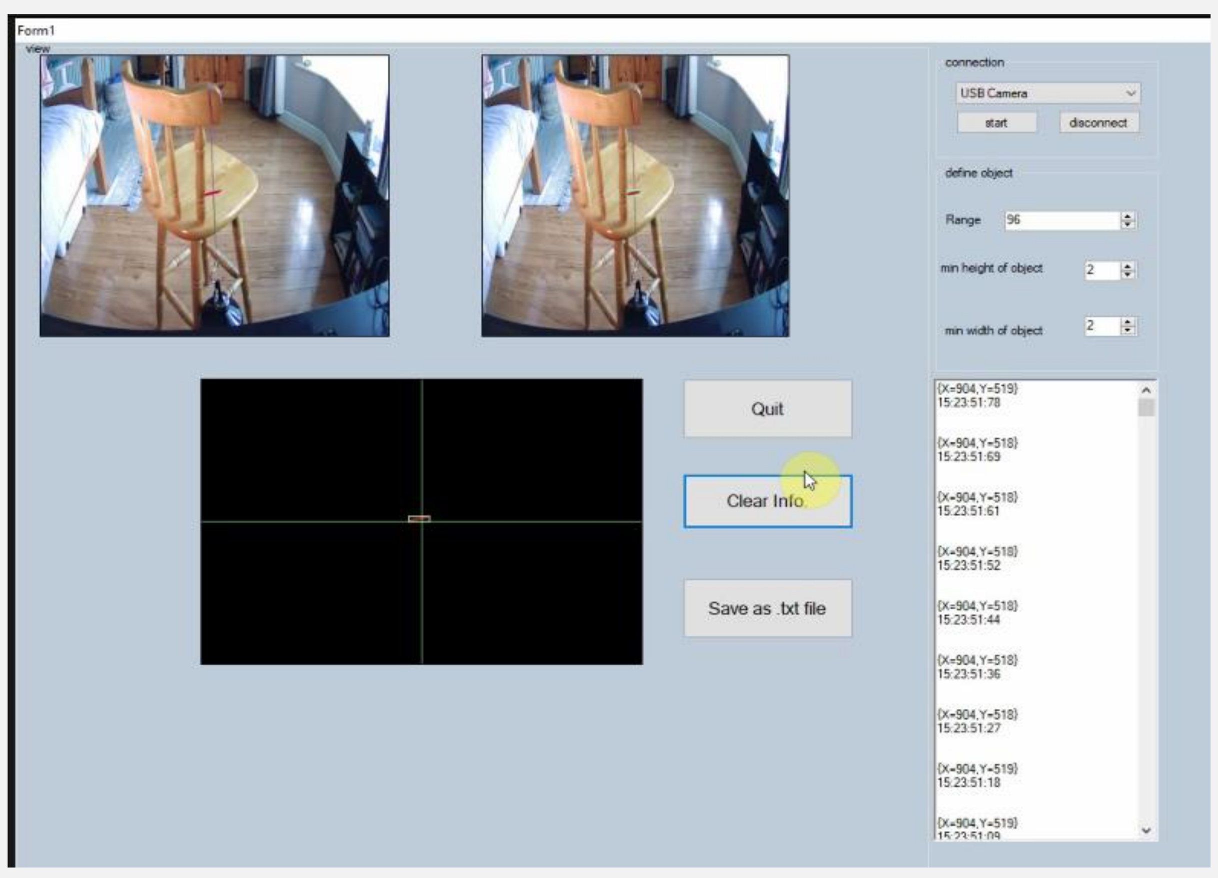
In order to test the video extensometer I will be placing a load off of the elastic band and the video extensometer should be able to recognise the mark on the band and track this mark while storing the co-ordinates of the mark on the screen. Ultimately this experiment will give a strain vs. time graph – this is also known as a creep graph

Results

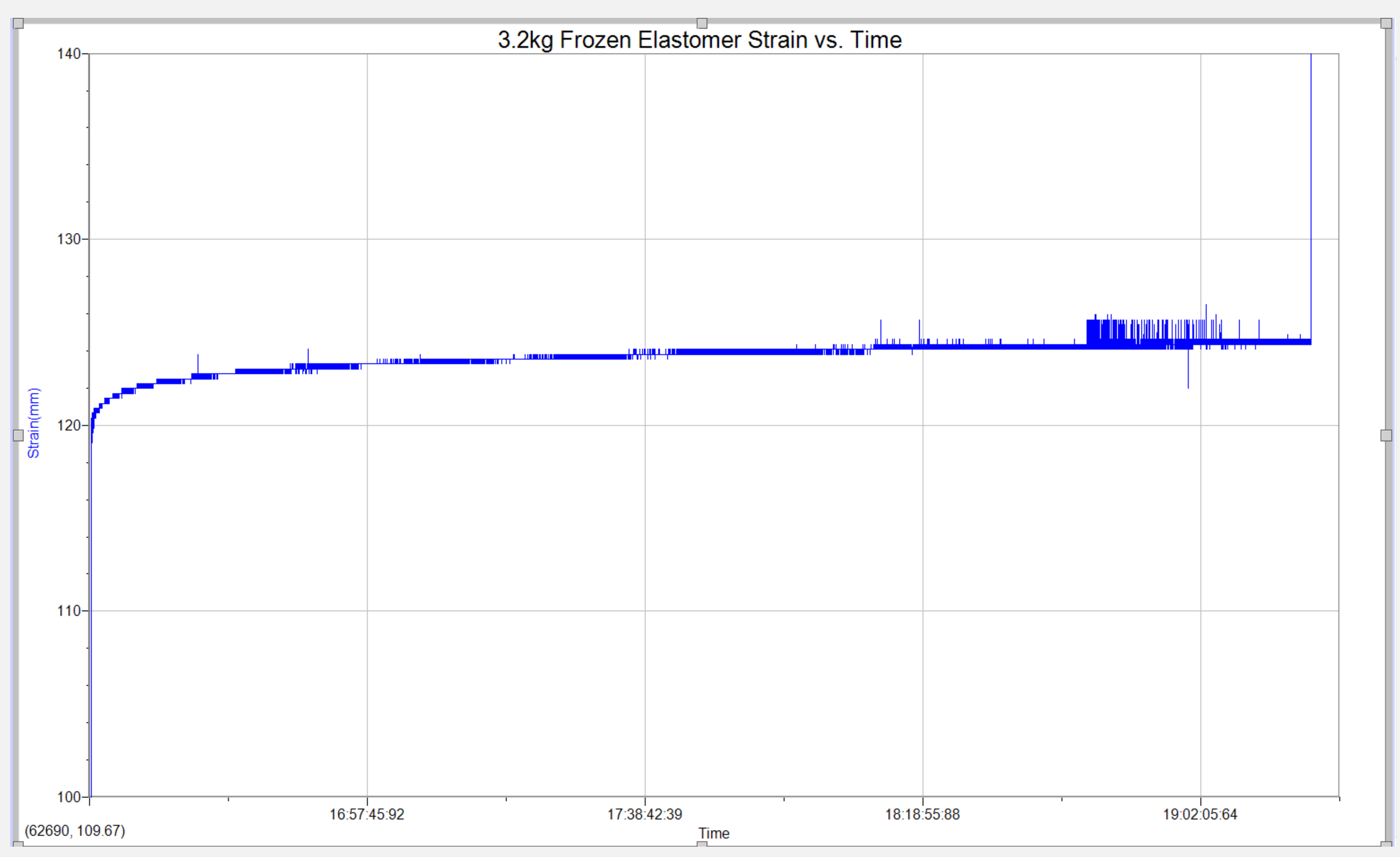
Recognition of the fiducial mark

AForge.NET was the computer vision tool that worked with the video extensometer, this assisted in recognizing the fiducial mark by colour, The video extensometer can successfully detect and track a red mark attached to the elastic band. The collected data can then be exported to a text file. [3]

User Interface:



Frozen Elastomer Creep Graph, follow three creep stages:



References

[1] Collins, D. (2019) Mechanical properties of materials: Stress and strain, https://www.linearmotiontips.com/mechanical-properties-of-materials-stress-and-strain/

[2] OpenCV, Image Processing (imgproc module), https://docs.opencv.org/master/d7/da8/tutorial_table_of_content_imgproc.html

[3] AForge.NET.NET, Color channels manipulations, http://www.AForge.NETnet.com/framework/features/color_channels_manipulation.html