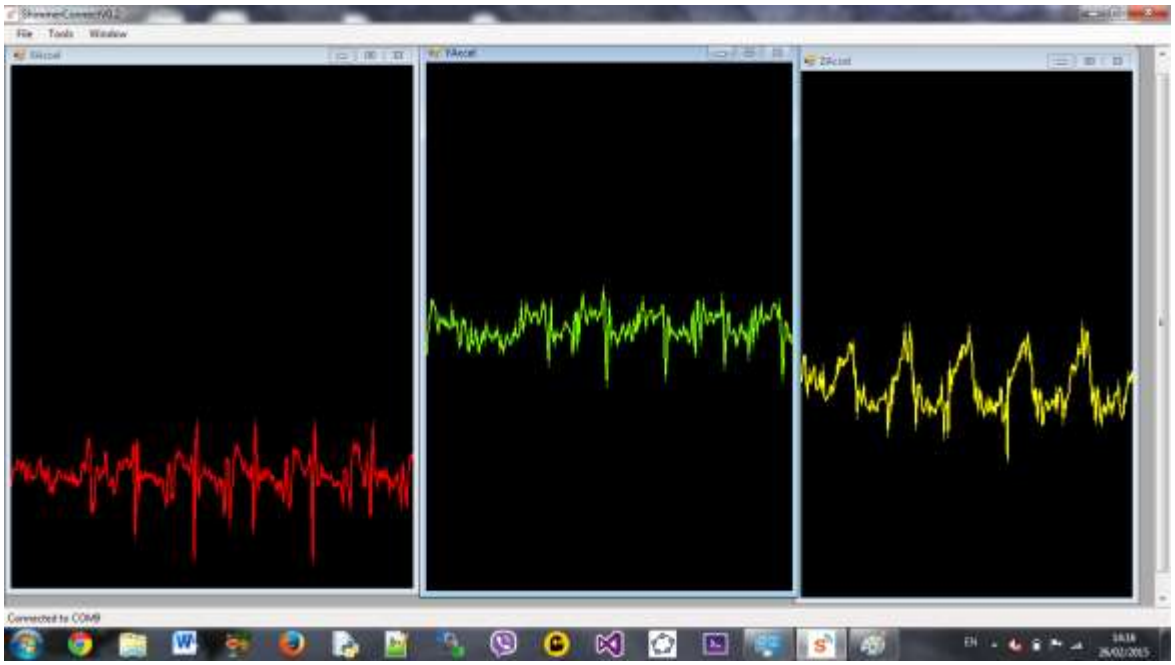
Question 1(a):

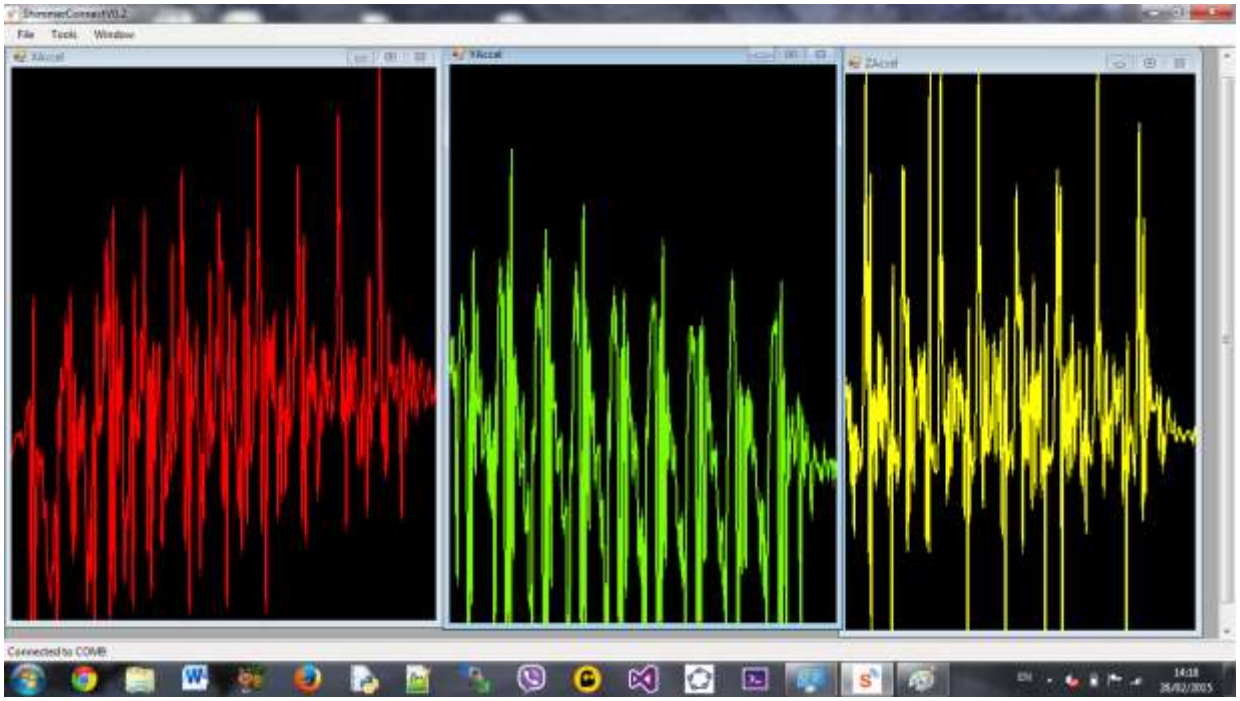
In order to determine the maximum effective range of the Shimmer module we gave the module to one person and the others remained with the laptop. The person with the Shimmer module would shake the module while taking a few steps and allow it to flat-line after they stopped while the others indicated whether the maximum range had been reached or to keep moving. We discovered around the 60-70 metre mark that the person's body blocked the Shimmer module so we got them to walk with Shimmer module not blocked by their body. After the change of the Shimmer module's position we discovered its effective range to be around 90 metres. We measured the distance using elongated steps of roughly one metre in length and subtracted a few metres at the end to account for shorter steps taken throughout the measuring process.

Question 1(b)

Slow Walk: The slow walk produced a recurring pattern with low spikes and a small level off between steps as was expected of a slow walk. We achieved the slow walk by walking at a reduced pace in a straight line as any turning caused unexpected spikes in different axes.

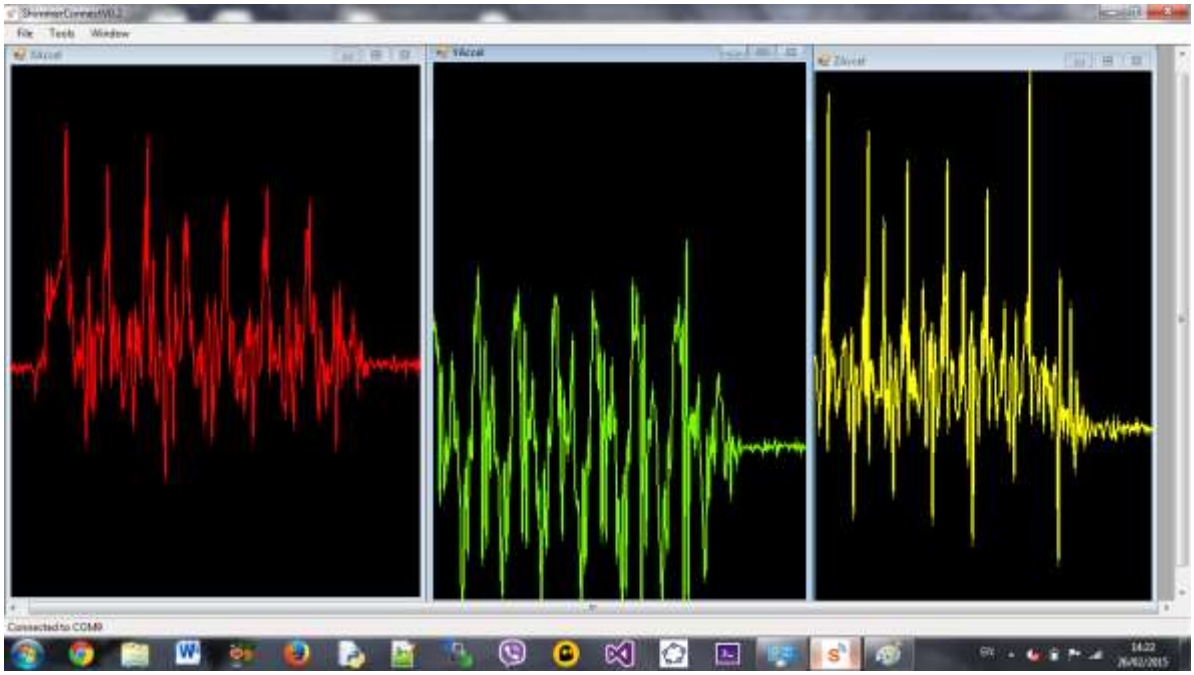


Fast Walk: The fast walk produced much sharper spikes in comparison to the slow walk. Although the spikes are much closer together there is still a very brief level off between steps so the recurring pattern is still present it is just much harder to distinguish between the large spikes. Turning did not have as large an effect on the fast walk it just skewed the pattern slightly.

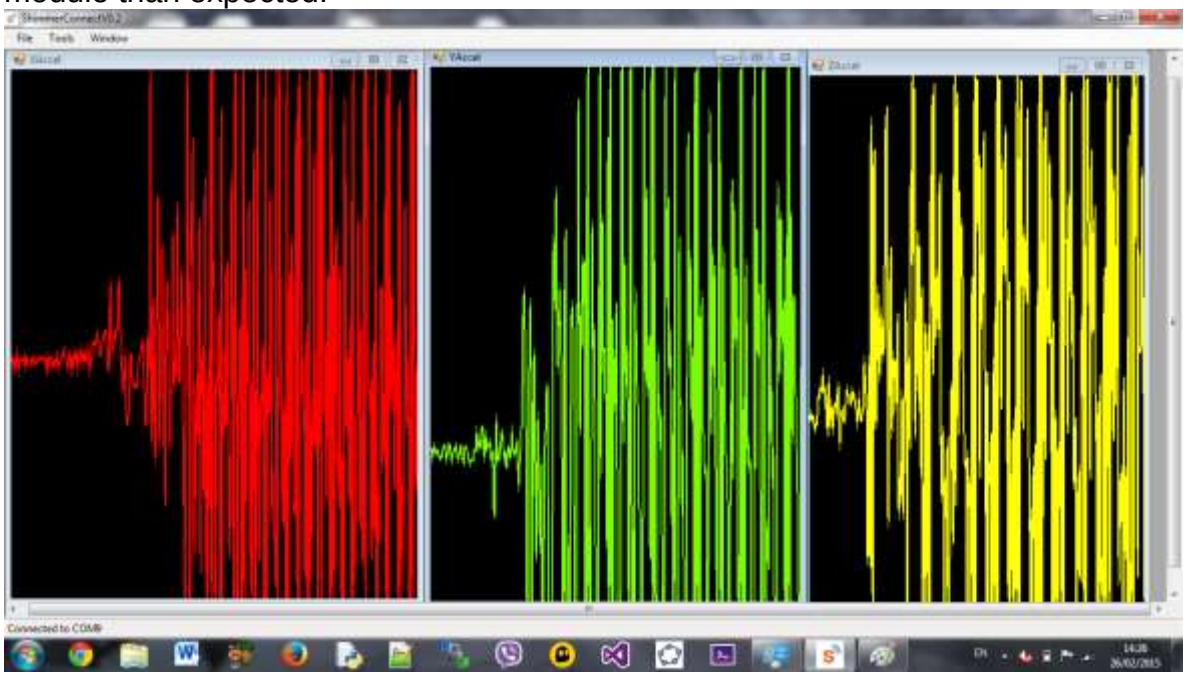


Jumping: The jumps created large very large spikes on both the positive and negative planes of each axis. We left a small gap between each jump to allow for a brief level off to distinguish between each jump. The jumps were consistent in the results they produced on the graphs each showing the peak of acceleration followed by the low as the jumper landed back down.

Stairs: The stairs created a recurring pattern similar to that of the ones seen in the slow and fast walks but there were definite differences between them as the stairs shows the brief pause as you climb up the next step followed by sharp spike as you climb, the pattern was not as consistent as the two types of walking.



Run: As a side experiment we tested the Shimmer module with a run to compare the size of the spikes created the results were sharp spikes with an indistinguishable break between each stride. The graph showed much sharper acceleration for the module than expected.



Shimmer Position: We decided that the waste would be the best location for the shimmer module for detecting an actual fall as the legs created spikes too large to distinguish between a fall and a fast walk. The shoulders showed promise for the fall but the swinging of the arms created spikes that made it difficult to accurately distinguish between all types of movement.

Question 1(C)

There are certainly quite distinct visual differences between the 4 stated movement types, slow and fast walking, jumping and climbing stairs, making differentiating between them using only the sensor possible, if not necessarily straightforward. For our tests, we had the sensor placed in the pocket of our tester's trousers.

Take, for instance, the fast and slow walking cases. The drastic difference between them in terms of frequency and amplitude makes it very easy to determine if the person is walking quickly or slowly.

Jumping is simple to determine, as there is not necessarily a recurring pattern. Even if someone is jumping continuously, the pattern would not be as regular as either form of walking, meaning that jumping can almost always be diagnosed.

In a way, the pattern for climbing stairs is quite similar to that of walking, in so far as that the pattern is regular, as opposed to sporadic like jumping. However, what we found with climbing stairs is that the graph had higher spikes on every second cycle, indicating when the person had climbed a step using the leg on the side that the sensor was on.

Given these differences in behaviour, it can be seen that a single Shimmer sensor can be used to determine the current type of movement.