Flood Detection Note 1

Let us assume that the force exerted by the person on the mobile phone acts only in the vertical direction (initially for simplicity of argument).

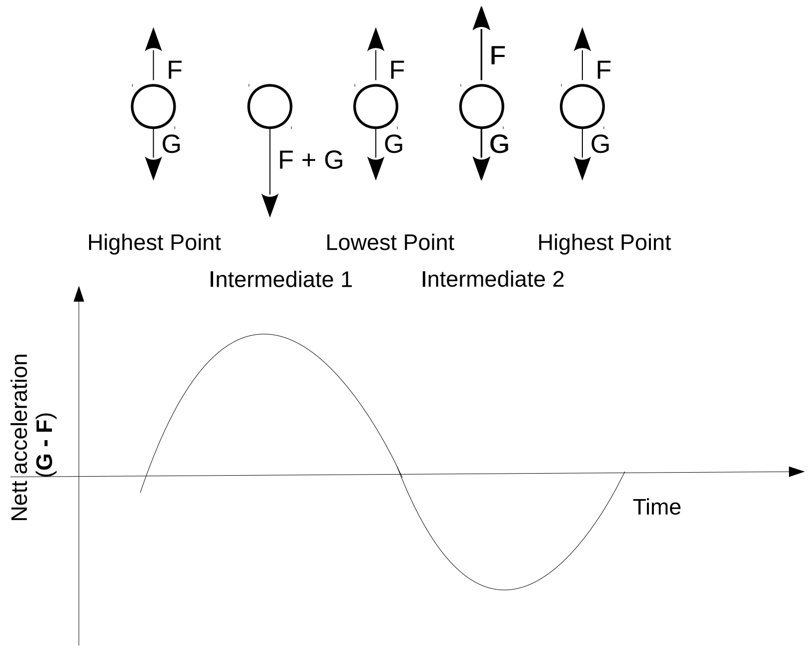

Figure 1: Nett acceleration vs time

Refer Fig. 1. It shows how nett acceleration varies with time. Whether the mobile phone is in the hand of a person or in his pocket, it tends to exhibit to and fro motion. At the highest point, the force upwards **F** balances the force due to gravity **G**. The same is the case at the lowest point. This is because the phone is temporarily stationary at these two positions which means that the forces balance out. At the intermediate positions, in one case **F** is in the direction of **G**, and in the other (intermediate) position it opposes gravity. A graph depicting the nett acceleration is also shown below. This pattern is bound to repeat.

The nett acceleration at intermediate positions for different levels of flooding may be used to identify or learn the level of flooding. Another interesting aspect is how long it takes for a person to complete one cycle (i.e. from highest position to highest position) as this indicates the speed of his walking and this can also be used to classify flooding vs non-flooding.

In reality **F** is not vertical, eventhough **G** is, but we are mainly interested in its component along the direction of gravity; so we are mainly interested in the vertical component of **G – F**. If **a** represents the nett acceleration recorded by the accelerometer, and **v** represents the gravity recorded by the accelerometer (both with respect to axes of mobile), then the vertical component **G – F** can be obtained as

$$\frac{\mathbf{a} \cdot \mathbf{v}}{\mathbf{v}}$$

Note: Bold face represents vectors