Original Research Paper

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Comparative study of oscillation of Ketar's pendulum using smartphone sensor and video analysis tool

Physics

KEYWORDS :

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ABSTRACT

This paper includes the study of oscillation using smartphone accelerometer sensor. The data recorded by free android application, accelerometer sensor gives directly acceleration in the form of graphical analysis. The result obtained by smartphone accelerometer sensor is compared with video analysis and modelling tool. This work introduce how two dimensional oscillation can studied using two different approaches

Introduction:

Many experiment using smartphone sensor, for use in teaching of Physics has been reported. Smartphone camera, ambient light sensor, magnetic sensor, proximity and gyroscope sensor have been used to study Physics experiment. For instance by using simple smartphone camera, physics experiment can be recorded. The recorded video allows us to measure position, velocity and acceleration of an object.

Today's simple smartphone incorporate acceleration sensor has been used to study of oscillation at schools, colleges and universities. In this work, we use smartphone accelerometer sensor to study the oscillation of Ketar's pendulum. In most study, smartphone accelerometer is used, whereas in this paper we have incorporated the video analysis open source software to compare the result obtained by smartphone accelerometer.

In our experiment set-up we use smartphone Samsung Galaxy Note 3 neo (SM-N750) with android version 5.1.1. The accelerometer sensor is based on three mutually perpendicular silicon circuits, each one oscillating in one direction, like a ball hanging on a string whose moment is restricted in one direction. For the control of accelerometer sensor the free android application SPARKvue version 2.5.0.14 is used.

Experimental Set-up:

In the first experiment set-up, to measure directly the acceleration of Ketar's pendulum, the smartphone is placed between two bob of Ketar's pendulum (FIGURE.1) and the acceleration of Keter's pendulum is measured continuously measured until it comes at rest.

FIGURE.1 Smatphone suspended between two bob of Ketar's Pendulum to measure acceleration

FIGURE.2 Experiment set-up of recording of oscillation of Ketar's pendulum using smartphon camera

In second experiment set-up, smartphone is placed on stand for capturing video recording and the video recording of oscillation of Ketar's pendulum is captured (FIGURE.2) using smartphone camera for video analysis. The video analysis of recoded video of oscillation of Ketar's pendulum is done using Open Source Physics Tracker version 4.95.

Conclusion:

The directly measured acceleration versus time graph for the first experiment set-up is obtained using smartphone accelerometer sensor. Acceleration of one dimensional oscillation shows (FIGURE.3) that initially oscillation continues of equal amplitude and with the increase in time oscillation becomes slow results in damping.

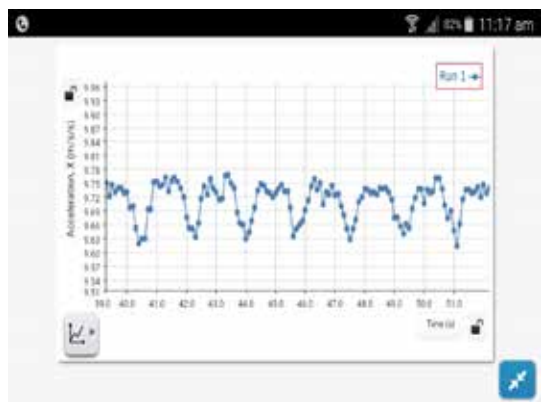

FIGURE.3 Screenshot of graphical analysis directly measured using accelerometer in first experiment set-up using SPARKvue free android application

FIGURE.4 Screenshot of video analysis of Ketor's pendulum oscillation using Tracker Open Source Physics.

The graphical analysis obtained in second experiment set-up also give acceleration verses time graph for one dimensional oscillation using Open Source Physics Tracker software. This graph (FIGURE.4) is obtained using special feature 'Autotracker' of Tracker 4.95 which shows that initially when oscillation started, equal amplitude of oscillations seen as it was in case of oscillation measured using accelerometer sensor. With the increase of time, oscillation vanishes shown as damping in graph.

References:

(1) Monsoriu J A, Giménez M H, Riera J and Vidaurre A 2005 Measuring coupled oscillations using an automated video analysis technique based on image recognition Eur. J. Phys. 26 1149–55

(2) Vogt P and Kuhn J 2012 Analyzing simple pendulum phenomena with a smart-phone acceleration sensor Phys. Teach.50 439–40

(3) The study of two-dimensional oscillations using a smartphone acceleration sensor: example of Lissajous curves Luis Tuset-Sanchis1, Juan C Castro-Palacio2, José A Gómez-Tejedor3, Francisco J Manjón4 and Juan A Monsoriu5