Application of Graphical User Interface of Matlab for Opencast Mining Machinery Noise Prediction

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Abstract
This paper highlights the application of graphical user interface of Matlab for opencast mining machinery noise prediction. A number of models were developed were expensively used for the assessment of sound pressure levels and their attenuations around mining working environments. The impact of noise in mining conditions depends upon the sound power level of noise generators, prevailing geo-mining conditions and meteorological parameters of the mining complex. To predict the appropriate noise level in mines, there are many statistical models were available ex. CONCAWE, ISO-9612, VDI-2710 etc. However, due to complexity in model evaluation, very few are applied in mining industry. To solve this problem, here a Matlab GUI application is represented and implication to CONCAWE noise prediction model. This GUI based CONCAWE model gives more visualization support to engineers to predict mining machinery noise in more precisely.

1. INTRODUCTION

Noise is generated from all most all the opencast mining operations from different fixed, mobile and impulsive sources; thereby becoming an integral part of the mining environment. With increased mechanization, the problem of noise has got accentuated in opencast mines. Prolonged exposure of miners to the high levels of noise can cause noise induced hearing loss besides several non-auditory health effects [1, 2]. The impact of noise in opencast mines depends upon the sound power level of the noise sources, prevailing geo-mining conditions and the meteorological parameters of the mines. The noise levels need to be studied as an integrated effect of the above parameters. In mining, the equipment and environment conditions continuously change as the mining activity progresses. Depending on their placement, the overall mining noise emanating from the mining equipment varies in quality and level. Thus for environmental noise prediction models, the noise level at any receiver point needs to be the resultant sound pressure level of all the observation locations.

In this research work, Matlab GUI applied to predict mining machineries noise with CONCAWE noise prediction model. The impact of noise in mining conditions depends upon the sound power level of noise generators, prevailing geo-mining conditions and meteorological parameters of the mining complex. To predict the appropriate noise level in mines, there are many statistical models were available ex. CONCAWE, ISO-9612, VDI-2710 etc. However, due to complexity in model evaluation, very few are applied in mining industry. To solve this problem, here a Matlab GUI application is represented and implication to CONCAWE noise prediction model.

2 CONCAWE Noise Prediction Model

Manning [9, 10] and his associates developed CONCAWE noise prediction model and its industrial application. The sound pressure level received at a point remote from the noise source is a function of the acoustic power of the source and the various mechanism of attenuation. It is possible to separate the dominant factors affecting the attenuation of sound and examine the contribution of each individually.

Thus, in a simplified form the sound pressure level at a remote point can be related to the source sound power level by the expression:

$$L_p = L_w + D - \sum K(dB) \quad (1)$$

where L_P is the sound-pressure level (dB re 20 μPa), L_W is the sound-power level (dB re 10^{-12}W), D is the directivity index of the source in dB and $\sum$K is the sum of the losses defined above. The algorithm ignores sound diffraction sideways around the edges of the barrier but one could of course calculate this contribution and include it as a separate source.

3. Development of Matlab- GUI based Noise Prediction Model

The GUI is created by using GUIDE (Graphic User Interface Developing Environment) in MATLAB. The GUI will let the user select the output that they wanted to predict and the sub-GUI will predict the desired values once the input parameters are keyed-in into the respective data boxes accordingly. Here a Matlab GUI is developed to predict opencast mining machineries. The GUI is based or designed according to CONCAWE noise prediction model. After connection of the process model to the PC, we started to develop graphic user interface (GUI) and control programs. GUI is very important for users as it is much simpler to enter parameters through GUI than to write commands in the MATLAB command window [11]. The methodology flowchart is represented in figure 1.

4. Result and Discussion

In this research article, Matlab graphical user interface (GUI) was used to development of noise prediction model for predicting opencast mining machineries noise. This model was based with CONCAWE noise prediction model. The purpose of the developed GUI is to ease the programming part during modeling. Therefore, the GUI is represented with basic graphics such as push buttons. Users are only required to handle graphic objects while the program automates the work as desired. The following GUI is the completed version which is created via MATLAB's GUIDE. After successfully designed Matlab-GUI, automatically the source-code of the respected GUI is created and it can be implemented in hardware in future. Here, the Matlab-GUI is capable of predicting accurate sound pressure level (SPL) of mining machineries with calculating all attenuations. The GUI is represented in Figure 2.

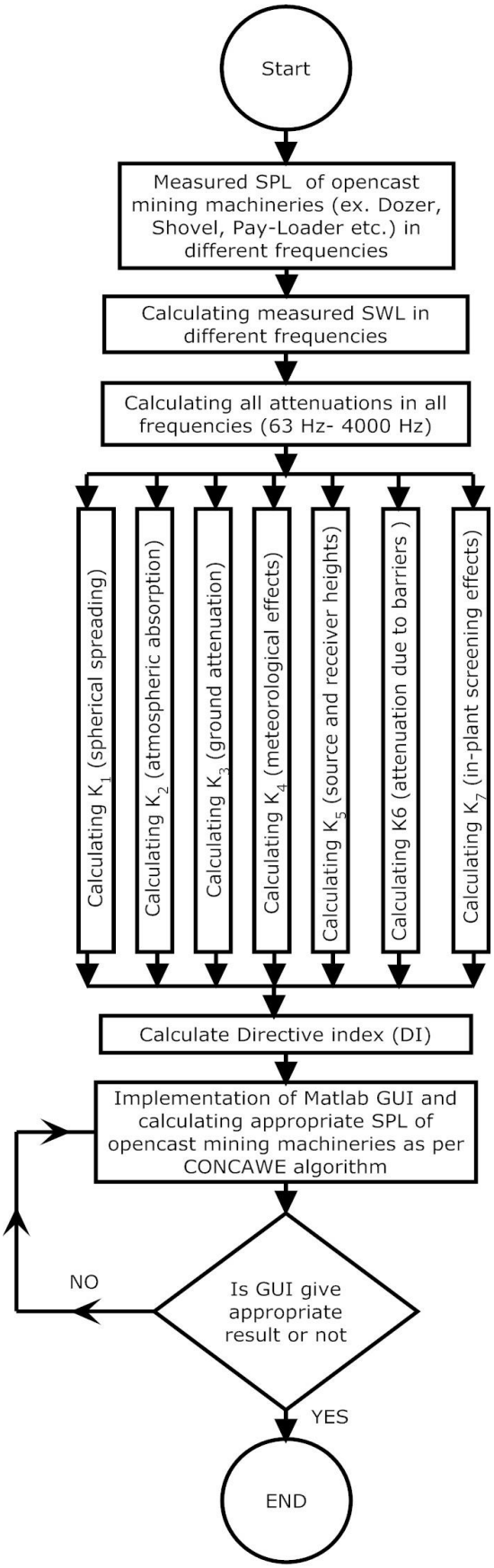

Fig.1. Methodology Flow chart

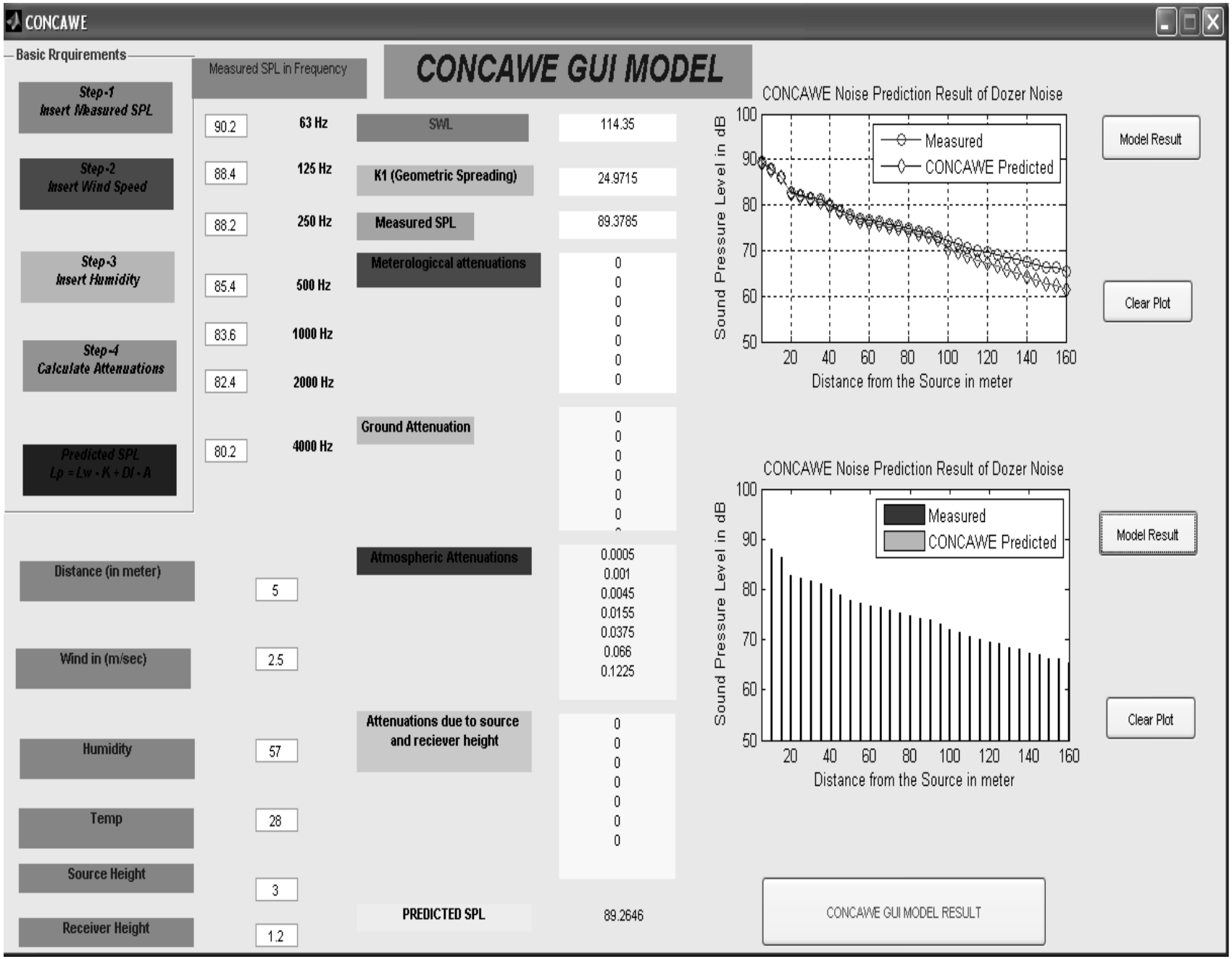

Fig.2. Matlab GUI based CONCAWE Noise Prediction Model

5. Conclusion

In this paper a successful attempt has been made to develop Matlab GUI based noise prediction model which was based with CONCAWE noise prediction model. This GUI model can predict any machineries noise with any type of attenuations and any type of meteorological conditions. In future, it can be implemented in hardware application and at this stage, this GUI can help to engineers to predict appropriate noise level of any machineries.

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