DESIGN AND DEVELOP LOW-COST DEVICE FOR MONITORING OCCUPATIONAL NOISE EXPOSURE TOWARD WORKERS IN FACTORY

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ABSTRACT: *Occupational noise exposure towards worker is a major problem related to health and safety. It can be annoying and affects the worker's concentration and health during the working hours. Environmental stress such as occupational noise exposure from factories and industrial sites are well known with a harsh environment. This occupational noise pollution such as heavy machinery noise, high number of large vehicles in and out of the sites which causing undesirable situation as a good working environment. However, the undesired noise exposure also will lead to causes hazard and unhealthy environment at the workplace. Hence, this study done as a solution for this problem where at least decreased the level of problems effect towards workers and increase the company performance. The purpose of this study is to design and develop low-cost device on monitoring occupational noise exposure named (LCDONE). This LCDONE consist of programming for Arduino Wi-Fi UNO based ESPDuino-32 with integrated with IoT analytics platform service ThingSpeak to gathered real time data monitoring. The data collection will be shown in decibel (dB) throughout the ThingSpeak Viewer and has been validated with the established sound level meter RS PRO RS-95 with the average percentage of error for LCDONE from this study is 2.52%. The selected factory for this study and testing LCDONE was in Palm Oil Mill located in Kota Samarahan, Sarawak, Malaysia.*

Keywords: Occupational Noise, Noise Exposure, Low-cost device, Workers, Factory, ESP32, ThingSpeak

1. INTRODUCTION

Noise is one of a physical hazard that contributes to health issues in the occupational world. One of the major problems is a permanent hearing loss in such heavy industries and manufacturing. Canadian Centre for Occupational Health & Safety show that annoyance, stress, and interference with speech communication are the main concerns in noisy offices, schools, and computer rooms [1]. Therefore, to avoid the negative effect of high level of noise exposure, the amount should be reduced to an acceptable range. One of the best method of noise reduction is to use engineering modifications to the noise source itself, or to the workplace environment [1]. One of the simple engineering control or technology to prevent noise exposure are such as ear plugs and muff, as the technology cannot completely control the problem. Usage of personal protective equipment is one of the methods to reduce perceived noise by the workers.

Some study shows that chronic noise in the workplace caused an increase in blood pressure and heart rate [2]. Heart disease is the leading cause of death for both men and women, according to the Center for Disease Control and Prevention. By ensure the workplace noise level to a minimum it can help increase the health of your workers. Noise-induced hearing loss (NIHL) is the occupational disease most frequently that has been reported to the Norwegian Labor Inspection Authority and the Petroleum Safety Authority [3]. In a working population of 2.7 million, that has been reported that every year the two authorities receive close to 2000 and 600 new reports of NIHL, respectively, accounting for 60 % of all reported work-related diseases [4]. An Excessive noise is a global occupational health hazard with considerable social and physiological impacts, including noise-induced hearing loss (NIHL) [5].Occupational noise has major exposure in such industries. In heavy industries, research reported noise exposure among workers at steel factories in Indonesia [6-7]; also there are reported on workers' exposure in Africa [8]; Noise exposure was reported in the textile workers' exposure in India [9] and in China [10]. Others reported noise exposure among the construction workers in Washington State, USA [11].

In Malaysia, Factories and Machinery (Noise Exposure) Regulation 1989 was promoted conservation program to protect the workers from excessive exposure to noise [12]. By following the regulations from Factories and Machinery (Noise Exposure) Regulation 1989, the permissible exposure limit, the employee or workers shall not be exposed to noise level exceeding equivalent continuous A-weighted sound pressure level of 90 dB(A) or exceeding the limits specified in the First Schedule or exceeding daily dose of unity and must not exposed to noise level exceeding 115 dB(A) at any time [12]. The 85 dB(A) is adopted as a criterion for action (action level). When the action level is reached or exceeded, it necessitates implementation of activities to reduce the risk of noise-induced hearing loss [13]. To date, there has been limited study on noise exposure among workers in Malaysia factory. As the general study indicates some of factory workers tend to not wear hearing protection while performing the work even though being in very close to noisy equipment. The purpose of this study is to design and develop low-cost device that can monitor the noise exposure level among workers and been tested in selected factory at Kota Samarahan, Sarawak, Malaysia.