ANALYSIS ON NOISE LEVEL MONITORING FOR INDUSTRIAL APPLICATION BASED ON OSHA REQUIREMENT

SHUMITRA A/P RADAKRISHNAN

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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SHUMITRA A/P RADAKRISHNAN

This report is submitted in partial fulfilment of the requirements for the degree of Bachelor of Electronic Engineering with Honours

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MAZRAN BIN ESRO
Pensyarah Kanan
akulti Kejuruteraan Elektronik Dan Kejuruteraan Kompu
Universiti Teknikal Malaysia Melaka (UTeM)
Hang Tuah Jaya, 76100 Durian Tungga
Melaka.

Tarikh : 01 JANUARI 2019

Tarikh : 01 JANUARI 2019

DECLARATION

I declare that this report entitled "Analysis on Noise Level Monitoring for Industrial Application Based on OSHA Requirement" is the result of my own work except for quotes as cited in the references.

Signature : ....

Author : SHUMTRA RADAKRISHNAN

Date : 18/12/18

APPROVAL

I hereby declare that I have read this thesis and in my opinion this thesis is sufficient in terms of scope and quality for the award of Bachelor of Electronic Engineering with Honours.

Signature   :

MAZRAN BIN ESRO
Pensyarah Kanan
Fakulti Kejuruteraan Elektronik Dan Kejuruteraan Kompute
Universiti Teknikal Malaysia Melaka (UTeM)
Hang Tuah Jaya, 76100 Durian Tunggal
Melaka.

Supervisor Name :

Date   : 18/12/18

DEDICATION

Especially for my parents, Mr Radakrishnan & Mrs Thangeshwari Radakrishnan, my brother,

Mr Nanthiswara Radakrishnan and my sister, Dr Divia Jothy Radakrishnan. Special thanks to

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ABSTRACT

Occupational Safety and Health Administration (OSHA), requires periodical noise monitoring inspection in industries to certify their workplace is within the safe hearing range. This is governed under the standard in ISO14001 & OSHAS18001. The conventional method which is widely in practice require two types of noise level inspection which are the personal monitoring and area monitoring. Currently the inspection is done manually by the appointed certified consultant. Such inspection is very costly for the industries especially for large scale production floor. The result from the test could be disputable as the factory setup could be modified during inspection. Therefore this project will use sound sensor measuring in decibel (dB) and the data will be relayed through an IoT platform for real time monitoring by the safety inspector.

ABSTRAK

Pentadbiran Keselamatan dan Kesihatan Pekerjaan (OSHA), memerlukan pemeriksaan pemantauan kadar bunyi dalam industri untuk mengesahkan tempat kerja mereka berada dalam zon pendengaran yang selamat. Pemautauan ini dipantau di bawah piawaian dalam ISO14001 & OSHAS18001. Terdapat dua kaedah konvensional yang diamalkan secara meluas untuk melaksanakan pemeriksaan tahap bunyi iaitu pemantauan peribadi dan pemantauan kawasan. Pada masa ini, pemeriksaan dilakukan secara manual oleh perunding diiktiraf yang dilantik oleh organisasi masing-masing. Pemeriksaan sedemikian sangat mahal bagi industri terutamanya untuk peringkat pengeluaran berskala besar. Oleh itu, hasil ujian pemeriksaan boleh dipertikaikan kerana persediaan kilang dapat diubah suai semasa pemeriksaan dijalankan. Oleh itu, projek ini akan menggunakan sensor bunyi yang akan mengukur bunyi dalam unit decibel (dB) dan data akan disampaikan melalui platform IoT untuk pemantauan masa yang nyata oleh inspektor keselamatan.

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LIST OF SYMBOLS AND ABBREVIATIONS

NIHL : Noise Induced Hearing Loss

PSM I : Projek Sarjana Muda I

PSM II : Projek SarjanaMuda II

UTeM : Universiti Teknikal Malaysia Melaka

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

This document is to analysis on noise level monitoring for industrial application based on OSHA requirement. There are parts of circuit design, experiment implementation, hardware developing and software implementation in order to analyze the noise level monitoring. This chapter includes the project introduction, project objectives, problem statement, scope of project as well as the concern of developing the project.

1.1   Problem Statement

Poor occupational health : In many countries, noise induced hearing loss is the most prevalent irreversible industrial disease, it recommends hearing protections in the workplace if there is exposure to noise greater than 85 dB because the of the potential

lead to temporary or permanent hearing loss according to World Health Organization report on prevent the noise-induced report.

Low efficiency: Working under noisy surroundings can be extremely affect person ability to perform well. Noisy may weaken concentration, decrease motivation, increase rates of errors and can thus lead to preventable accidents in the workplace. In addition, communication may be affected and lead to misinterpretation of instructions, further reducing an employee effectiveness and accuracy [1].

Manual measurement: The manual measurement of noise level monitoring is prone to manipulation made by industry management as they will know the schedule of inspection from OSHA and DOSH. Therefore, the accuracy of the information during the scheduled inspection is questionable.

1.2   Objective

The aim of this project is to justify by simulation circuit and hardware implementation for the analysis on noise level monitoring. In order to achieve that, the objectives have been set as follow:

1) To upgrade the manual inspection process of noise level monitoring to IoT based system in industries.

2) To produce a system that can analyze the level of hazardous noise pollution in comply with OSHA & DOSH requirement.

1.3 Scope of Work

The scope of project is the criteria that a project needs to accomplish. This purpose of the project to analyse the noise level monitoring based on OSHA requirement. Therefore, the scope of work is to design an applicable hardware for implementation of the study on noise level monitoring based on OSHA requirement.

This study is conducted to examine the noise level measurement and control measures focusing in classroom scale - of production floor in industry. The software has to be developed in order to program the Arduino module and also the WiFi module for the project. The coding has to be clear from any errors and should be troubleshot if any problem exists. The project will be used IoT platforms which is the ThingsPeak. This system does not measure the outdoor noise and it is fully focused for closed area. If the production area is larger than the classroom scale, the inspection has to be done when the system can be developed using network sensors or using multiple inspection stations. However, the network sensor system is not covered in my project. The project prototype will be the initial attempt before the final product is produced and tested.

1.4   Importance of the project development

The unwanted sound that displeases to the living beings is known as noise. Noise pollution always connected to health problems such as high blood pressure and hearing loss problems. In industries, the noise pollution might be greater than other job environment as sometimes, the old equipment can produce sound while it is operating compared to new equipment. Therefore, the staffs that work nearby that particular equipment may have hearing problems. Sometimes, it is not only because of noise pollution in industries may lead to hearing impaired but also, the habit of listening to loud music using earpieces may also be the contribution point to this problem. Therefore, we need to have a proper sound management and analysis system in order to know the cause of hearing impairment among the working staff in industries.

The noise level monitoring is essential in industrial sector as it is a mandatory element in one industry in terms of safety and health of workers. Therefore, this project is basically very useful for the industrial environment as this project will monitor the sound pollution that occurs at industrial areas. Management in industries could be legally taken action if industries are destroying the environment with sound pollution as this automated system can be observed from time to time from anywhere through the IoT facility. Thus, the noise pollution can be reduced and green working environment be realized as the effect of long period of the implementation of the system. An advantage is added in this system as the system is comply to the OSHA requirement.

CHAPTER 2

BACKGROUND STUDY

Design and research is an on-going process that involves creative problem solving activities. Among the factors that bring about the success of a project depends on the creativity and the use of appropriate technology to meet market needs and requirements of users. All restarting from an explosion of ideas produced and ends with the production of the project. In the manufacture of a product, to obtain the best results research on the project should be made in advance. This study starts from the design process until the operation. Detailed planning is also important to ensure that the project be completed as planned.

2.1 Occupational Safety Health Perspective in Malaysia

The Department of Occupational Safety and Health is the only government agency responsible for administrating, managing and enforcing legislation pertaining to OSH in the country, with the vision of making all occupations safe and healthy whilst enhancing the quality of working life (OSHA, 1994), [2]. The data accumulated from DOSH report on industrial accidents statistics by sector from 2005 to 2010 shows, the most numbers accidents have occurred in manufacturing sector. In addition, there is another study showed that in last five years, there were about 83.7% of occupational noise induced hearing loss cases, 4.4% of occupational musculoskeletal diseases and 2.3% occupational lung disease cases as per reviewed by the DOSH since 2012 to 2016 [3]. From the DOSH report, the industrial accident statistics are tabulated in Table 2.1. The data describes the number of industrial accidents occurred by sector from the year 2005 to 2010.

Table 2.1: Industrial accidents statistics by sector 2005-2010

Sector /Year	Year 2005			Year 2006			Year 2007			Year 2008			Year 2009			Year 2010		
	D	PD	NPD	D	PD	NPD	D	PD	NPD	D	PD	NPD	D	PD	NPD	D	PD	NPD
Manufacturing	65	93	2058	66	116	2752	63	133	2094	76	134	1564	63	90	1419	56	162	1493
Mining and Quarrying	3	4	107	2	1	22	9	1	5	6	0	4	3	1	2	1	1	2
Construction	87	36	246	81	25	365	95	10	76	72	2	55	71	6	38	66	4	50
Agriculture and Forestry	18	23	614	32	19	1014	30	14	712	42	7	365	44	8	440	30	18	469
Utility	2	20	177	5	6	66	10	4	51	19	12	82	23	3	116	11	3	34
Transport & Communication	14	0	145	10	1	47	2	0	7	8	1	18	18	0	21	14	1	6
Wholesale and retail	2	3	53	0	1	13	3	1	11	0	0	2	0	0	0	0	0	0
Hotel and restaurant	3	1	27	0	0	7	0	2	11	1	1	13	0	0	18	0	0	25
Financial & Real Estate	0	0	10	4	2	18	4	0	25	4	1	2	1	0	0	1	1	30
Public Services	2	2	22	9	3	44	3	3	16	2	1	3	1	0	0	3	2	40
Total	196	182	3459	209	174	219	219	168	3008	230	159	2108	224	108	2054	185	192	2159

Table 2.2: Industrial accidents reported by sectors in Malaysia from 2012-2016

Sector	2012	2013	2014	2015	2016
Manufacturing	1,722	1,655	1667	2040	2333
Mining and quarrying	42	35	62	39	25
Construction	177	164	172	237	233
Agriculture, forestry, logging and fishery	446	535	492	480	471
Utility	94	108	70	96	75
Transport, storage and communication	95	93	102	131	130
Wholesale and retail trade	73	78	83	108	109
Hotel and restaurant	15	20	57	63	90
Financial, Insurance, Real estate and business services	62	71	74	119	126
Public services and statutory bodies	54	67	26	32	110
Grand Total	2780	2826	2805	3344	3702

Table 2.3: Statistic of occupational poisoning and diseases from 2012-2015

Years	Number of occupational diseases cases
2011	1198
2012	1792
2013	2588
2014	2648
2015	5960