UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF ALERT NOTIFICATION OF INDOOR AIR QUALITY LEVEL USING GSM SYSTEM

This report is submitted in accordance with the requirement of Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electronics Engineering Technology (Telecommunications) with Honours.

by

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I hereby, declared this report entitled "Development of Alert Notification of Indoor Air Quality Level Using GSM System" is the results of my own research except as cited in references.

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APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Electronics Engineering Technology (Telecommunications) with Honours. The member of the supervisory is as follow:

……

(Mr Mohd Khanapiah Bin Nor)

ABSTRAK

Persekitaran dalaman disifatkan oleh beberapa sumber pencemar. Oleh kerana orang biasanya menghabiskan lebih dari 90% masa mereka dalam persekitaran tertutup. Oleh itu, kualiti udara dalaman (IAQ) diiktiraf sebagai faktor penting untuk dikawal untuk kesihatan dan keselesaan penghuninya. Projek ini menerangkan sistem (IAQ), kos rendah pemberitahuan amaran sistem tahap kualiti udara dalaman, yang dibangunkan menggunakan Arduino, modul GSM, buzzer dan sensor. Dalam projek ini, sensor gas MQ7 digunakan untuk memantau kepekatan karbon monoksida, CO di udara dalaman masing-masing. Sistem ini adalah program untuk memberi pemberitahuan amaran apabila kualiti udara dalaman berada di luar paras tertentu, bererti apabila ada jumlah gas yang berbahaya yang terdapat di udara dalam ruangan seperti karbon monoksida, CO Ia akan menunjukkan kualiti udara dalaman dalam PPM pada LCD dan buzzer digunakan sebagai sistem peringatan dan akan menghantar mesej kepada pihak tertentu pada sistem GSM. Hasilnya mendedahkan bahawa sistem ini dapat memberikan penilaian kualiti udara dalaman yang berkesan untuk mencegah risiko pendedahan. Malah, kualiti udara dalaman mungkin sangat berbeza berbanding apa yang diharapkan untuk persekitaran hidup yang berkualiti.

ABSTRACT

Indoor environments are described by a few contamination sources. As people normally spend over 90% of their time chance in indoor environments. Thus, indoor air quality (IAQ) is perceived as an important factor to be controlled for the occupants' health and comfort. This project describes the system (IAQ), a low-cost of alert notification of indoor air quality level system, developed using Arduino, GSM modules, buzzer, LCD display and gas sensors. In this project, MQ7 gas sensor are used to monitor and detect the concentration of carbon monoxide in indoor air respectively. This system is program to give an alert notification when the indoor air quality goes down beyond a certain level, means when there is sufficient amount of harmful gases are present in the indoor air like carbon monoxide, CO. It will show the indoor air quality in PPM on the LCD display and buzzer is used as the alert system and will sending a message to a particular party on GSM system. The results reveal that the system can give an effective indoor air quality assessment to prevent exposure risk. In fact, the indoor air quality might be extremely different compared with what is expected for a quality living environment.

DEDICATION

Special thanks to my father and mother, Shahli Bin Mohamad and Jamelah Binti Mohamed and all of friend for their support and encouragement through my journey in UTeM. Special thanks too to my supervisor, Mr. Mohd Khanapiah Bin Nor for all the guidance and advices.

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IAQ	-	Indoor Air Quality
EPA	-	Environmental Protection Agency
CDC	-	Centers for Disease Control
HVAC	-	Heating, Ventilating and Air-conditioning
CO	-	Carbon Monoxide
CO2	-	Carbon Dioxide
COHb	-	Carboxyhemoglobin
GSM	-	Global System for Mobile Communications
SMS	-	Short Message Service
PPM	-	Part Per Million
LCD	-	Liquid Crystal Display
TVOC	-	Total Volatile Organic Compound
USEPA	-	United States Environmental Protection Agency
WHO	-	World Health Organization
CH2CI	-	Methylene Chloride
ASHRAE	-	The American Society of Heating Refrigeration and Air Conditioning Engineers
OSHA	-	Occupational Safety & Health Administration
DC	-	Direct Current

AC	-	Alternating Current
AVR	-	Advanced Virtual Risk
ARM	-	Advanced RISC Machine
PWM	-	Pulse Width Modulation
ICSP	-	In-Circuit Serial Programming
USB	-	Universal Serial Bus
IDE	-	Integrated Development Environment
SIM	-	Subscriber Identity Module
AuC	-	Authentication Center
ADC	-	Analog Digital Converter
PIC	-	Peripheral Interface Controller
GND	-	Ground
GUI	-	General User Interface

CHAPTER 1
INTRODUCTION

1.0 Background

Indoor air quality (IAQ) has been distinguished by the EPA as one of the best five most urgent environmental risks to public health [1]. The Centers for Disease Control and Prevention (CDC) gauges that the greater part of Americans spend around 90 percent of their time indoors [2]. All things considered, office workers spend roughly 40 hours every week in office buildings. These workers also study, eat, drink, and, in certain work settings, rest in enclosed environments where make-up air might be bargained. Thus, a few specialists trust that more people may experiences the ill effects of the impacts of indoor air contamination than from outdoor air contamination.

Carbon monoxide is a thing resultant of the divided natural materials burning. CO roughly has a similar air thickness, odorless, colorless, and tasteless. In light of CO characteristics, it isn't effectively distinguished unless by utilizing electronic sensor. Fragmented burning happens in all flames and even in the most effective appliances and heaters. Every single non-renewable energy source such as coal, fuel oil, petroleum contain carbon, as do other natural fuels like wood and charcoal. At the point when these powers consume, CO might be emitted as one of the gaseous side-effects. Over exposure to CO repress the flow of oxygen inside our body and can cause death in short time [3].

The "Development of Alert Notification of Indoor Air Quality Level Using GSM System" have proposed that allows us to monitor and alert notification of indoor air quality level contaminant in a particular area through GSM system. System uses gas sensors to sense presence of harmful gases/compounds in the indoor air and constantly transmit this data to microcontroller. If the air quality exceeds the required level of danger, specified message will be sent to specific authorities. The main function of this project is to provide safety to indoor air quality. The system uses GSM module, which acts as sending a message to a particular party.

1.1 Problem statement

The system "Development of Alert Notification of Indoor Air Quality Level Using GSM System", if the air quality exceeds the required level of danger, specified message will be sent to specific authorities. The most common causes of IAQ problems are:

1. Lack of alert notification of indoor air quality level.
2. Lack of proper ventilation system maintenance.
3. Lack of fresh outdoor air or contaminated air being brought into the building.

1.2 Objective

The objectives that should be achieved from this projects of development of alert notification of indoor air quality level using GSM system are as follows:

1. To study and understand the concept of Arduino and GSM module.
2. To setup an SMS based Alert Mechanism and send SMS (alert messages) to specified mobile numbers (input inside the Arduino program).
3. To design a prototype system for an alert notification of indoor air quality level using GSM system.

1.3 Scope

Carbon monoxide gaseous exposed in many places such as, industries, slow traffic area and even inside the offices. This project included hardware and software that used in this project. The focus of this project is to develop of alert notification of indoor air quality level using GSM system. The scope of this project is to use MQ7 gas sensor to detect carbon monoxide gas inside the indoor air and create an alert notification by using buzzer and GSM module. LCD display is used to show the concentration indoor air quality level in PPM. Arduino is used as the microcontroller used to monitor the sensor activities.

1.4 Summary / Conclusion

This chapter covers the background project, problem statement, objectives and scope of the project. The background of the project is relating to the alert notification of indoor air quality level using GSM system. This project is designed to alert notification of indoor air quality level using GSM system. The objective is discussed in detail, besides the scope was discussed about the hardware and software that used in this project.

1.5 Report Organization

This report consists of five chapters. The first chapter describes the project background, problem statement, objectives and the scope of this project. Chapter 2 discusses the literature review of the project and related works. In addition, various methods and approaches that related to the project are discussed and review. Chapter 3 exploring the research methodology used in the project development including data gathering and analysis, flow charts and other related diagram. Chapter 4 discusses the result and discussion related to the projects outcome. Finally, the fifth chapter concludes the overall project implementation, outcome and also include some future recommendation.

CHAPTER 2
LITERATURE REVIEW

2.0 Introduction

This chapter will explain the theory and fundamentals topic of indoor air quality and carbon monoxide that related to the project. The contains as a help to build a strong base knowledge about this project.

2.1 Indoor Air Quality

Great indoor air quality (IAQ) is desired for a healthy indoor environment. Poor indoor air quality can cause an assortment of health issues running from brief to long haul. Health issues ordinarily connected with poor IAQ incorporate allergic responses, respiratory issues, eye disturbance, sinusitis, bronchitis and pneumonia [4]. Indoor air quality issues emerge in non-industrial buildings when there is a lacking amount of ventilation air being accommodated the measure of air contaminants display in that space. Henceforth, indoor air quality and heating, ventilating and air conditioning systems (HVAC) are firmly related.

2.1.1 Indoor Sources

Inhalation is the main exogenous exposure course for carbon monoxide. Anthropogenic emissions are in charge of around 66% of the carbon monoxide in the atmosphere and common emissions represent the staying 33%. Small amounts are also produced endogenously in the human body [5]. Exposure to low levels of carbon monoxide can happen outside close streets, as it is likewise delivered by the fumes of petroleum and diesel controlled engine vehicles [6].

Carbon monoxide is delivered indoors by burning sources like cooking and heating and is likewise presented through the penetration of carbon monoxide from outside air into the indoor environment [7]. In created nations, the most vital source of exposure to carbon monoxide in indoor air is emissions from defective, inaccurately introduced, ineffectively maintained or inadequately ventilated cooking or heating appliances that consume non-renewable energy sources. In homes in creating nations, the consuming of biomass fuels and tobacco smoke are the most imperative sources of exposure to carbon monoxide. Clogged chimneys, wood burning fireplaces, decorative fireplaces, gas burners and supplementary warmers without legitimately working wellbeing highlights could vent carbon monoxide into indoor spaces. Tobacco smoke can be a major source of indoor exposure, as can exhaust from engine vehicles working in attached garages [6]. Incense consuming in homes and open structures, for example, stores and shopping malls can be a source of exposure to carbon monoxide. The emission rates of 23 unique sorts of incense, for example, rope, cones, sticks, rocks and powder, that are regularly utilized indoors [8]. The measured emission rates of carbon monoxide extended from 144 to 531 mg/hour. The creators assessed a peak concentration of 9.6 mg/m3 caused by incense consuming and in this manner reasoned that carbon monoxide concentrations could surpass the USEPA's National Ambient Air Quality Standard of 10 mg/m3 for 8-hour normal, contingent upon the room volume, ventilation rate and the measure of incense burned.

2.1.2 Health Effects Due to Poor IAQ

Symptoms identified with poor IAQ are shifted relying upon the sort of contaminant. They can without much of a stretch be mixed up for side effects of different sicknesses, for example, sensitivities, stress, colds, and flu. The typical hint is that individuals feel sick while inside the building, and the symptoms leave soon after leaving the building, or when far from the working for a timeframe, for example, on ends of the week or a get-away.

Failure of building proprietors and administrators to react rapidly and successfully to indoor air quality issues can prompt various unfriendly health outcomes. Health impacts from indoor air contaminants might be experienced not long after exposure or, conceivably, years after the fact [9]. Symptoms may incorporate irritation of the eyes, nose, and throat; migraines; dizziness; rashes; and muscle pain and exhaustion [10]. Sicknesses connected to poor IAQ incorporate asthma and extreme touchiness pneumonitis [11]. The particular contamination, the concentration of exposure, and the recurrence and length of exposure are terrifically vital factors in the sort and seriousness of health impacts coming about because of poor IAQ. Age and prior medicinal conditions, for example, asthma and sensitivities may likewise impact the seriousness of the impacts. Long haul impacts because of indoor air toxins may incorporate respiratory sicknesses, coronary illness, and cancer, which can all be extremely crippling or lethal [11].

2.1.3 Common Pollutant Categories

Although there are numerous indoor air contaminants that can be spread through a building, they typically fall into three basic categories: biological, chemical, and particle [12].

i. Biological

Over the top centralizations of microorganisms, infections, growths, tidy bugs, creature dander, and dust may come about because of deficient maintenance and housekeeping, water spills, lacking stickiness control, condensation, or water interruption through breaks in the building envelope or flooding [12].

ii. Chemical

Sources of compound contaminations like gasses and vapors incorporate emissions from items utilized as a part of the building, for instance the office equipment; furniture, divider and floor covers; pesticides; and cleaning and customer items, coincidental spills of chemicals, items utilized construction development exercises, for example, cements and paints, and gasses, for example, carbon monoxide, formaldehyde, and nitrogen dioxide, which are results of combustion [12].

iii. Particle (Non-biological)

Particles are solid or liquid, non-organic, substances that are sufficiently light to be suspended noticeable all around. Tidy, dirt, or different substances might be drawn into the working from outside. Particles can likewise be delivered by exercises that happen in structures, for example, development, sanding wood or drywall, printing, duplicating, and working hardware [12].