UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF FOGGING ROBOT BY USING ARDUINO UNO AND HC-05 BLUETOOTH MODULE

This report submitted in accordance with requirement of the UniversitiTeknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Electrical Engineering Technology (Industrial Automation and Robotic) with Honours

by

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920104-08-6139

FACULTY OF ENGINEERING TECHNOLOGY

2016

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

TAJUK: **Development of Fogging Robot by Using Arduino Uno and HC-05 Bluetooth Module**

SESI PENGAJIAN: **2016/17 Semester 1**

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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 Engineering Technology (Industrial Automation and Robotic) with Honours. The member of the supervisory is as follow:

…….

(**MOHAMAD HANIFF BIN HARUN**)

ABSTRACT

Traditionally, the fogging process to control the vector was by using manpower to carry the fogging machine. As a result, the operator of the fogging machine will exposed to the hazard produced by the fogging machine. Therefore, this fogging procedure can cause harm to the operator of the fogging machine in the either for a long or short time period. The main hazard produces by this machine was the toxic substances that was used to kill the mosquito. The machine operators have a tendency to inhales the toxic mist if the not using the personal protective equipment or the personal protective equipments fail to protect the machine operator. Moreover, the fogging procedure are also used the high temperature to convert the liquid substances into the mist. Hence, the heat temperature are also can cause harm to the machine operator. Thereby, this fogging robot was developed to overcome this problem. This fogging robot will replaced the human for doing this fogging procedure in the future.

ABSTRAK

Secara tradisinya , proses pengasapan untuk mengawal vektor adalah dengan mengunakan tenaga manusia. Akibatnya, operator pengendali mesin pengasapan akan terdedah dengan bahaya yang terhasil daripada mesin pengasapan tersebut. Oleh yang demikian, proses pengasapan ini boleh mengakibatkan kemudaratan kepada opereator tersebut samaada dalam jangka masa panjang ataupun pendek. Bahaya utama yang dihasilkan oleh mesin ini adalah bahan toksid yang digunakan untuk membunuh nyamuk. Operator mesin mempunyai kebarangkalian untuk terhidu asap toksid ini jika tidak memakai alat pelindung diri atau alat perlindung diri tersebut gagal untuk berfungsi. Tambahan pula, mesin pengasapan ini juga mengunakan haba yang tinggi untuk menukar bahan cecair kepada asap. Jesteru itu, haba yang panas juga boleh mengakibatkan kemudaratan kepada opretor mesin. Dengan itu, robot pengasapan ini dibina untuk mengatasi masalah ini. Robot pengasapan ini akan menganti manusia untuk melakukan kerja-kerja pengasapan ini di masa akan datang.

DEDICATIONS

Special dedicated to

My beloved parents,
My wife and my son,
My friend and my siblings,

Who have encourage, guided and supported me throughout my study.

ACKNOWLEDGMENTS

A special thank for those who helping me to accomplish my PSM project especially to my project supervisor, Mr. Mohamad Haniff Bin Harun for helping and guiding me to completing this project. With his supportive attitude this project goes successfully by achieving the entire project objective. The success of this project is highly influenced by his information, suggestions and ideas

I also would like to take this opportunity to express my deepest gratitude to my family and friends who have given me support during my academic years. Without them, I might not be able to finish the project.

Thank you so much

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GUI	-	Graphical User Interface

CHAPTER 1

INTRODUCTION

1.0 Project Background

Nowadays, the dengue cases were rapidly increased in Malaysia by 120,836 cases last year (Ministry of Health Malaysia, 2016). The increasing statistic of the dengue cases demands more fogging process to eliminate the main cause of dengue. Basically, in Malaysia there are two basic methods on the vector control which is thermal and cold fogging. Vector control can be defined as any method was used to eliminate or eradicate the animal including insects or other arthropod which can transmit the disease pathogens. In the dengue cases, the vector that will be eliminate or eradicate is the Aedes mosquito. Traditionally, the fogging process used a fogging machine. There are several types of fogging machine such as mini fogging machine and thermal fogging machine. The fogging machine also divided into two major types which is oil-based fog and water-based fog. The fogging machine will be carried by the machine operator to perform the vector control process. Therefore this process may cause hazard to the operator. Hence, the major purpose of this fogging robot is to reduce the hazard taken by the machine operator.

1.1 Problem Statement

Currently in Malaysia, the most common fogging process was the thermal fogging machine. The machine will be carried by the machine operator to fog the suspected area. Based on the datasheet from the machine produced, the manufacturers strongly recommended wearing the personal protective equipment (PPE). This was because main hazards of this machine are the heat and the noise produced by the machine. Moreover, the chemical reaction between the liquid and the pesticide will also can cause harm to the machine operator. Due to the higher demand from the suspected area, it will limit the vector control because of the large area need to be covered.

1.2 Objective

In order to minimize the hazard towards the operator, overcome the labour issue and make the fogging process easier, the Fogging Robot will be develop with the three main objectives which is:-

i. To develop the mechanical and electrical part of the mobile Fogging Robot
ii. To develop the fogging mechanism so that it can be attached to the mobile Fogging Robot
iii. To analyze the full system of the fogging robot

1.3 Project Scope and Limitations

Hardware design:

i. Mechanical- For the mechanical main structure, this project will be used the mild steel bar 1inch x 1 inch as the mobile robot chassis material. There are also several basic mechanical component will design and attached to this fogging robot like tire, main body and others important mechanical component. This project will also use corrugated sheets as the main body of the fogging robot.

ii. Electrical and electronic - The main electrical component for this project was the SPG30-60K DC gear head motor. The DC gear head motor was used as the main driver of this fogging robot. As the controller, this fogging robot will used the Arduino UNO as the main board and HC-05 module as the Bluetooth transmission system. For driving the DC gear head motor, the MDD10A's Cytron technologies Dual Channel 10A DC Motor Driver will be used.

Software design - To program the Arduino UNO main board, the Arduino IDE software will be used. Besides that, to develop the Android application on the Smartphone, this project will used MIT App Inventor 2

Analysis design and limitation:

Load test experiment – this experiment to test the ability of the fogging robot ability to carry the load. This experiment is important to the fogging robot because the robot must have the ability to carry the fogging mechanism system which is the heaviest part in this fogging robot.

Time Response Vs Distance Experiment - this experiment to analysis the best working distance of this fogging robot.

CHAPTER 2
LITERATURE REVIEW

2.0 Introduction

Basically, in this chapter will discussed on the finding that have been done on the previous related project and experiment. The findings were gained from the journal reading, website and the previous project. The finding will be focused on the mobile robot development, the controller and also the wireless Bluetooth connection and Android app development as references to the fogging robot development.

In the others hands, beside as the references of the project the literature review of this fogging robot will also give some idea and guide line on the development of this fogging robot.

2.1 Journal

There are several journal have been choose to setup the literature review of this project. Every journal will be summarized based on the main objective of the journal, the method used, result and also the conclusion have been made for the project that have been done.

2.1.1 Mobile Inspection Robot for Heating, Ventilation and Air Conditioning (HVAC) Ducting Systems(Aisha et al. 2015)

The main objective of this project is to develop a robot that capable to do inspection the condition of ventilation ducts. The methods used for this project are this project will divided into two major part of development which is control panel part and robot part. The main controller of this project was the Raspberry Pi. It also used the Arduino UNO with the internet shield to below:-

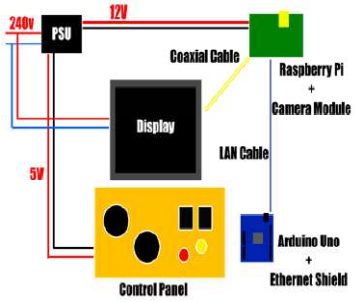
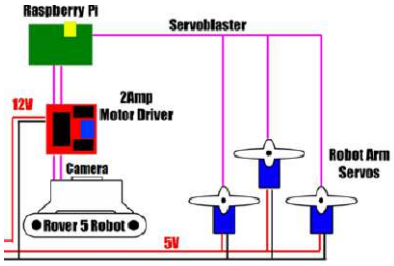


Figure 2.1 Control panel Schematic Diagram



Firgure 2.2 Robot Schematic Diagram

The robot used Rover 5 base robot as the main mobile to carry the all the equipment. The servo equipped to robot will acting as the robot arm which can change the function as the brush or mechanical gripper. To analyze the ability of robot, the researcher performed the load test toward the robot. Based on the experiment result the robot was able to carry the load of the cable that was attached on the mobile robot.

As the conclusion, the robot was able to do the inspection on the HVAC ducting system. Moreover, the robot was able to send the forward vision feedback to the user. Others than that, the robot also able to be attached the mechanical gripper and brushes. Therefore, the robot can retrieve hazardous or suspicious item from the duct and also clean the duct if necessary.

2.1.2 Wall Following Control Algorithm for a Car-Like Wheeled-Mobile Robot with Differential-Wheels Drive(Prayudhi et al. 2015)

The main objective of this project is to develop a car-like wheeled-mobile robot with differential–wheels drive. Other than that, the robot also developed to be a wall followed mobile robot. Besides that, the researchers also design the control algorithm of the robot. In this project, the researchers introduced are new type of the mobile robot design which car-like wheeled-mobile robot with differential-wheels drives.

The mobile are design with the front wheel performing the differential drive motion and also working as the steering mechanism to the mobile robot. For the rear side, two fixed wheels are attached for followed the movement the front wheels. For measuring the turning angle, the robot are attached the encoder to the steering mechanism. Furthermore, the mobile also equipped with the laser range finder sensor to detected the obstacle, measured the distance and also to measure the orientation of the robot to the wall. The mobile platform is as shown in Figure 2.3.

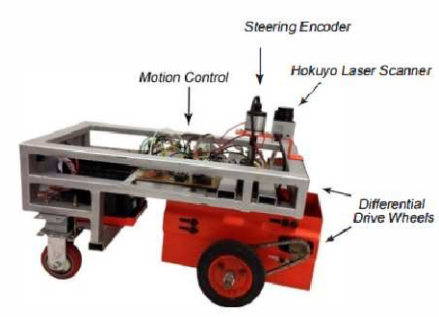


Figure 2.3 Mobile robot platforms

Based on the experiment and simulation done by the researcher, the robot move was very precise since the robot has the feedback signal to correct the error.

2.1.3 Development and Evaluation of Two-Parallel Crawler Robot by Using Proportional Controller(Azni et al. 2015)

The main objective of the project is to design and develop the crawler type robot that was able to pass several types of terrain. Other than that, the researcher want to analyzed and evaluate the performed of the crawler robot by using the Proportional controller in term of accuracy and repeatability. The robot system schematic as shown below in Figure 2.4:-

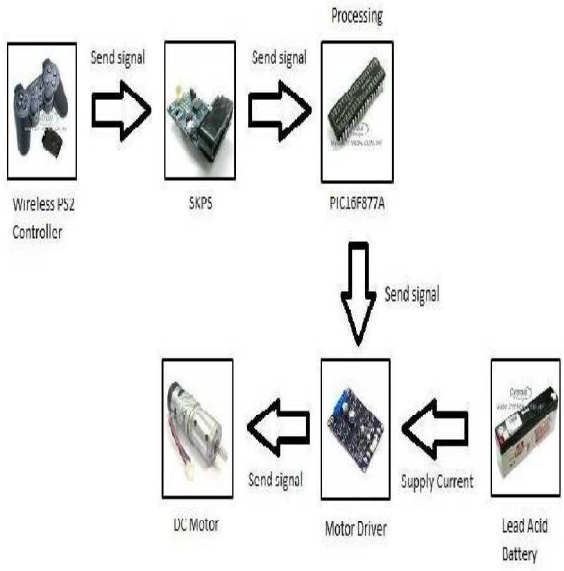


Figure 2.4 Two-Parallel Crawler Robot system schematic diagrams.

Based on the schematic diagram, the robot used the wireless PS2 controller to control the movement of the robot. The PS2 controller will send the instruction data to the SKPS module. The SKPS module will receive the instruction data from the PS2 controller and processed it so that the data can be read by the PIC 16F877A microcontroller. The microcontroller will receive the processed data and interpreted into the move of the robot through the motor driver and the DC motor movement. Based on the experiment conducted to this project, the robot are able to do error correction since it's used the proportional controller. The best result of this robot is when it has

the highest speed. Moreover, this crawler Robot compensated system is effective on the regular terrain rather than grass train. Therefore, this system is not suitable to the sub-urban area.

2.1.4 Navigation Method of PLC Based Mobile Robot (Saffar et al. 2015)

The main objective of this project is to develop an algorithm and analyze the navigation of mobile robot using PLC. The mobile was designed base on the 3 wheels 2 wheels drive (3W2WD) mobile robot. This means that the mobile robot wills consisting 3 main wheels which single wheels at the front and the others two will be at the rear side of the mobile robot. For this project the front wheels used the castor wheel also acting as the steering to the mobile robot while the others rear wheel will drive the mobile robot. For controlling the mobile robot, this project used the Keyence PLC KV-16T. This mobile robot also will equipped with the three diffuse sensor, relay, two DC motor, switches, indicator lamp, emergency stop button and 12VDC batteries. To investigate the navigation of this robot, the navigation experiment was setup by the researcher. Base on the experiment done by researcher, the mobile robot able to be controlled by the PLC.

2.1.5 Study and Development of Android Controlled Wireless Pole Climbing Robot (Megalingam et al. 2015)

The main objective of this project is to develop multipurpose wireless pole climbing robot by using the embedded system. The robot system schematic diagram as shown in Figure 2.5, where the climbing robot is controlled wirelessly though the smart phone.

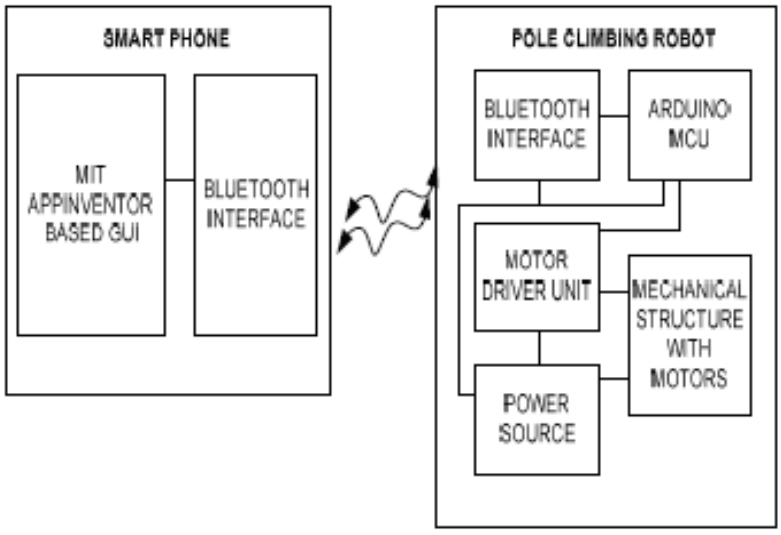


Figure 2.5 Pole Climbing Robot system schematic diagrams

Base on the schematic diagram, the climbing robot are divided into two major part which is smart phone controller part and pole climbing robot part. For the smart phone controller part, this project used the MIT AppInventor to create the Android base GUI. The smart phone will connected to the pole climbing robot by using the Bluetooth interface that are already build up inside the smart phone. The HC-05 Bluetooth module has used in this project to the interfaced the Bluetooth wireless connection between the smart phone and the pole climbing robot. The main controller for this pole climbing robot is the Arduino UNO. After receiving the data from HC-05 Bluetooth module, the Arduino UNO will interpret the data into the mechanical movement though the motor driver and DC motor.

2.1.6 An Implementation of Mobile Control Room Environment in Android Platform for Industrial Application (Alexander 2015)

The main objective of this project is to acquire the temperature and the level sensor reading though the Smartphone. The project used the RTD sensor and Ultrasonic sensor to get the reading. The Arduino Mega also has been used as the microcontroller of this project. To transmit the data to the smart phone the Bluetooth shield has been used. The system schematic is as illustrated on the Figure 2.6.