

“I hereby declare that I have read through this report entitle “Wireless Alert System For Machine” and found that it has comply the partial fulfillment for awarding the degree of Bachelor of Electrical Engineering (Power Electronic and Drives)”

Signature :

Supervisor’s Name : Nur Maisarah Bt Mohd Sobran

Date : 27 June 2012

WIRELESS ALERT SYSTEM FOR MACHINE

AMINATUL MUNAUWARAH BINTI YAHAYA

**A report submitted in partial fulfillment of the requirements for the degree
of Power Electronic and Drives**

Faculty of Electrical Engineering

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2011/2012

I declare that this report entitle “Wireless Alert System For Machine” is the result of my own research except as cited in the references. The report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature :

Name : Aminatul Munauwarah Binti Yahaya

Date : 27 June 2012

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ABSTRACT

Machine breakdown is a common phenomenon in a factory. This problem will affect the product quality and quantities for that day production. Machine condition monitoring is important to improve factory efficiency. Thus immediate action must be made in order to make sure factory will not facing any losses due to defect products. The same situation happens in Fujitsu factory that situated in Batu Pahat. From observation at Fujitsu factory, it is difficult to make sure twenty four hours machine monitoring could be done in person. Thus this project will provide the solution for Fujitsu problems where an alert system will be develop to detect which machine having a breakdown and immediately send the short message system (SMS) to the authorize person.

Machines at Fujitsu factory will produce warning signal when error occur. The Transmitter of Radio Frequency (RF) remote control that located near the machine will sent the error to Receiver of Radio Frequency (RF) that located in control room and immediately SMS were send to authorize person by using GSM. At the same time, alarm will be trigger and LED light turns on to indicate which machines are having a breakdown.

This Wireless Alert System For Machine project, can be shown that one alert system for Fujitsu machine are developed by using Radio Frequency (RF) remote control transmitter and receiver successfully achieved the main objective which is person in charge was able to get the message using SMS and it definitely can inform the person in charge if have the machine breakdown occurred. The person in charge also will know that machine at the part production breakdown by the alarm unit in the maintenance room. So, they also can trace which machine having breakdown based on the LED display. Other than that, the system also able to give warning to person in charge wirelessly via GSM modem.

ABSTRAK

Kerosakan pada mesin merupakan satu fenomena yang biasa berlaku di sesebuah kilang. Masalah ini akan memberi kesan terhadap kualiti produk dan kuantiti untuk pengeluaran pada hari tersebut. Pemantauan terhadap mesin adalah penting untuk memperbaiki kecekapan kilang. Oleh itu, tindakan segera perlu diambil untuk memastikan supaya kilang tersebut tidak berhadapan dengan sebarang masalah yang disebabkan oleh kecacatan pada produk. Ini menjurus kepada situasi yang sama berlaku kepada kilang Fujitsu, Batu Pahat Johor. Daripada pemerhatian saya di kilang tersebut, keadaan ini adalah sukar untuk membuat pemantauan dan memastikan bahawa mesin tersebut boleh beroperasi selama 24 jam sehari secara perseorangan.

Oleh itu, projek ini dibuat bagi menyelesaikan permasalahan yang berlaku di kilang Fujitsu, dimana satu isyarat sistem akan dibina untuk mengesan mesin yang mana mengalami kerosakan dan serta-merta menghantar sistem pesanan ringkas kepada pihak yang bertanggungjawab.

Apabila ralat berlaku, mesin tersebut akan menghasilkan isyarat amaran. Pemancar frekuensi radio berkawalan jauh yang terletak berhampiran dengan mesin akan menghantar isyarat kepada penerima frekuensi radio yang terletak di dalam bilik selenggaraan dan ia akan segera menghantar sistem pesanan ringkas kepada orang yang bertanggungjawab dengan menggunakan GSM modem. Pada masa yang sama, penggera akan memicu dan serentak dengan itu lampu LED akan dihidupkan untuk menunjukkan mana satu mesin yang menghadapi masalah kerosakan.

Projek “Wireless Alert System For Machine “ ini dapat menunjukkan bahawa satu sistem amaran untuk mesin di kilang Fujitsu dengan menggunakan pemancar frekuensi radio dan penerima frekuensi radio telah berjaya dilaksanakan berdasarkan kepada tujuan asal projek ini dilaksanakan. Orang yang bertanggungjawab akan mengetahui bahawa mesin di bahagian produksi berlaku kerosakan berdasarkan kepada penggera yang terhasil di dalam

bilik selenggaraan. Maka, mereka dapat mengenalpasti mana satu mesin yang mengalami masalah berdasarkan kepada paparan LED tersebut. Selain daripada itu, sistem ini juga mampu untuk memberi amaran kepada orang yang bertanggungjawab sekiranya beliau berada di luar kawasan dengan kaedah tanpa wayar iaitu menggunakan GSM modem kepada telefon bimbit.

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LIST OF ABBREVIATIONS

GSM	Global System for Mobile Communication
LED	Light Emitting Diode
LCD	Liquid Crystal Display
MCU	Microcontroller Unit
PIC	Peripheral Interface Unit
SIM	Subscriber Identity Module
RF	Radio Frequency
SMS	Short Message Services
PCB	Printed Circuit Board
GND	Ground
VCC	Common Collector Voltage
V _{pp}	Power from reset
XTAL	Crystal
TX	Transmitter
RX	Receiver
M	meter
V	Volt
A	Ampere
MHZ	Mega Hertz

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CHAPTER 1

INTRODUCTION

Machinery already becomes a backbone to factory in producing quality product. Failure of machines may not only lead to a loss of production, but also, in some serious situations, may cause human casualties. If the industry has more than one machines, it difficult to find which one machine that have an error unless person in charge for the machine was informed that the machine have an error. This situation will take longer time to take an action. Based on the previous system technology the machine will connect to the authorized person computer using wired system. This situation can minimize the time but it needs more costs in installation and maintenance. This system is widely used in many industries in the country, but these systems have their own disadvantage, that is why this project was purpose. This project has been developed to detect error machine. So that after detect the error machine, the operator can immediately diagnose a fault system in the processes of identifying a machine's operating condition and investigate its possible source of fault. These processes can help factories to reduce their overall production costs, improve the production reliability, minimize machine downtime, and increase operational efficiency.

1.1. Project Background

There are several types of machine error detection alarm systems. The first one is the error detect by the alarm that produce by certain machine which have an error. This system does not have a mechanism to inform the technician to take an action to repair the machine. So this is the biggest disadvantage because to take a long time to inform an authorized person to repair the machine. The second one is machine error is appearing at the authorized computer. The authorized person knows the machine have an error by reading the message at the computer. This system able to inform the technician which machine that has an error if the technician read the message. This system is not really effective if the technician did not read the message at the computer or he is at another place.

A variety of voltage signals analysis techniques have been used to diagnosis machine status. Contingency plans can be provided to reduce the loss of production due to unexpected breakdown of production machines. So, this based on this project Wireless alert system for machine will detect the voltage signal from the machine. The voltage signal from the machine will activate the relay and the signal will sent to the main controller board by using RF transmitter and receiver. The main controller board will activate alarm unit to emit aloud alarm sound after receive signal from RF receiver. The main role of LED light is to display, so person in charge know which machine are breakdown. At the same time message will sent to authorized person to take an action. This project makes the installation of wireless alert system easier than the commercial alert system using wire cable.

1.2. Problem Statement

In Fujitsu factory, machines always facing breakdown, so operator have to take a long time to tell to maintenance engineer when defect occurs in that machine. This case becomes more complicated when engineer maintenance is not in production line or not in maintenance room. Thus this will provide alert system via GSM.

Fujitsu did not have enough budget to buy an expensive machine which is automatically detect an error. So, an engineer give an idea to develop the project which is can be applied at the machine to trigger machine error.

1.3. Objectives

- i. To develop an alert system for machine this is connected by using Radio Frequency (RF) Transmitter and Receiver.
- ii. To develop a wireless system using GSM Modem to warning the personal in charge/authorize person.
- iii. To develop a circuitry for a wireless alert system.

1.4. Scope

To ensure this project achievable and realistic of the objectives that in require, so this project necessary cater to scope as follows:

- i. The first part is concerning to the distance between machine breakdown which is can send signals from radio frequency transmitter to the radio frequency receiver in scope over 30 meters.

- ii. The second part is determined number of machine can trace. So the maximum machine that can trace was two units. The machine have been choose based on the frequence machine have an error occurred. This system use PIC microcontroller as overall guard. PIC microcontroller used to give aloud warning sound system and led will be display which machine are breakdown and short messaging system (SMS) trigger to the mobile phone person in charge so that system can operate by systematic.

CHAPTER 2

LITERATURE REVIEW

This project was created to improve the idea from the previous project. The literature review for this project is important to study the previous project and the components that used on this project.

A case study is a research methodology common in social science. It is based on an in-depth investigation of a single individual, group, or event to explore causation in order to find underlying principles. Case study should be defined as a research strategy, an empirical inquiry that investigates a phenomenon within its real-life context. Case study research means single and multiple case studies, can include quantitative evidence, relies on multiple sources of evidence and benefits from the prior development of theoretical propositions. It provides a systematic way of looking at events, collecting data, analyzing information, and reporting the results.

As a result the researcher may gain a sharpened understanding of why the instance happened as it did, and what might become important to look at more extensively in future research. Case studies lend themselves to both generating and testing hypotheses. In this project, there are some cases that can be referring in doing this project. Each case is shown below.

2.1 Case Study

2.1.1 Case Study 1

In 2010, Huiping Huang [1] develops a project „A Remote Home Security System Based on Wireless Sensor Network and GSM Technology“. Data collecting unit consists of motion sensor, heat sensor, smoke sensor and gas sensor which is detect some parameter and will convert to another signal. This data collecting unit would be sent signal to main control board to activated the alarm by using wireless system. After main control board receive signal from detection unit it would be send signal to GSM Modem to enable GSM Modem sending Short Messaging Service (SMS) to the house owner’s mobile phone when some dangerous condition has been detected. To setting the GSM Modem, there are some AT commands which is relevant to sending short message. Table 2.1 below shows some AT Commands relevant to Short Message.

Table 2.1. : Some AT Commands relevant to Short Message

AT Command	Command Function
AT+CSMS	Select short message service
AT+CMGF	Set short message encoding mode (1 for text mode, 0 for PDU mode)
AT+CMGS	Send short message
AT+CSCA	Short message service enter number

2.1.2 Case Study 2

In 2011, Luay Fraiwan Khaldon Lweesy, Aya Bani- Salma and Nour Mani [2], develops a project “A Wireless Home Safety Gas Leakage Detection System” It consists of a few units such as sensing unit, transmission data unit and receiver data unit. Smoke sensor attach at the kitchen by using LPG gas. It will be function when gas sensor detect an excessive gas. The system consists of two major of two major modules: the gas leakage detection and transmission module, and the receiver module. The gas leakage detection and transmission module detects the change in concentration of LPG and natural gas and activates an audiovisual alarm when it exceeds a certain voltage. Furthermore, it sends another alarm message through a radio frequency (RF) system to the receiver module. The receiver module is a mobile unit that could be placed anywhere within the premises of the house so that the alarm can be detected and heard at a distance from the place of gas leakage.

2.1.3 Case Study 3

In 2005, Lian Ai Fang [3], develops a project “ Mobile Fire Alert with SMS”. This system consists of fire detection system. This system of fire detection unit, alarm unit, water pump unit and display unit. There are three sensors and three water pumps used in the system. When a fire occurs, the sensors will send signal to the main control board, where a microcontroller is used to control the system. At the same time, the alarm will emit a loud siren to alert the house occupants and the panel will display location where the fire occurs. Then, it is followed by the water pump which will discharge water to put out the fire. A message will also be sent to the house inmate’s mobile phone. So that he/she could make necessary actions.

2.1.4 Case Study 4

In 2011, Wan Adlin Harris Wan Mohd Asmara and Noor Hafizah Abdul Aziz [4], develops a project “SMS Flood Alert System. The project about remote water level alarm system developed by applying liquid sensors and GSM technology. This system focuses on monitoring water level remotely and utilizes Global System of Mobile Connections (GSM) and Short Message Service (SMS) to convey data from sensors to the respective users through their mobile phone. The hardware of the system includes Micro Controller Unit (MCU) PIC18F452. There are three part which is liquid sensors, Inverter and Easygate GSM Module. This system used C compiler software through AT commands.

2.1.5 Case Study 5

In 2010, Zaid bin Sulaiman [5], develops a project “ Wireless Fire Alarm System Using Smoke detector and Heat sensor”. This project consist of several main parts such as two sensor (heat and smoke), main control board, power supply, alarm unit, water pump unit, display unit and mobile phone. This project would be function when detector detect some heat or smoke at the occur place. This sensor sending a signal to main control board by using radio frequency (remote Control RF). After that, the main control board will send signal to the alarm unit to activate the alarm (siren). At the same time, main control board will send the signal through to GSM Modem to be enable GSM Modem for sending Short Message Service(SMS) to the authorize’s mobile phone.

2.1.6 Case Study 6

In 2004, Mohammad Sharizan Bin Safuan [6], develops a project “ Sistem Amaran Banjir Automatik Berasaskan Teknologi SMS”. Initially this system to detect the level of water and will automatically send signals to GSM Modem circuit when the water level had reach a certain warning level. The signal will be prossessed and then the GSM Modem circuit will send a warning message via mobile phone using SMS. At the same time, the LCD display and siren will be activated. The system will only be activated automatically when the water level reaches certain warning level, so that the users will not be annoyed by this system all the time

2.2 Wireless Alert System for Machine

From the previous project that already done, this Wireless Alert System for Machine project has decided to use component such as relay (24V), RF remote control, PIC microcontroller, buzzer and GSM modem to developed this project. These projects use a relay as a switch which is to trigger the RF remote control to send a signal to the main control board. This relay will be operate when it receive a voltage from the indicator lamp at the machine detection unit. RF remote controls have been choosing because it more relevant than the wired system and it also can reduce the maintenance cost when installations are made. This project use a PIC basic programming to set PIC microcontroller to make sure that GSM modem can send the right message to the authorize person when machine error occurred. By using PIC microcontroller it easier to be write-erase until thousand times. It also consists of 40 pin by 33 paths of input and output. These project also using a GSM modem because GSM modem would be to send short message system (SMS) to the authorized person mobile phone. GSM Modem can be a quick and efficient way to get started with SMS, because a special subscription to a short message service provider is not required. In most parts of the world, GSM Modems are cost effective solution for receiving SMS messages. To make sure the person in charge in the maintenance room concern that machine having breakdown so this project use a buzzer as a output to emit loud sound. This buzzer very effective and available in the market.

2.2.1 Short Message Services (SMS)

Short message services (SMS) is the transmission of short text message to and a mobile phone, fax machine, and message must be no longer than 160 alphanumeric characters and contain no images or graphic. The short message service, in other words, short message are not send directly from sender to recipient, but always via SMS center (SMSC) instead [3]. Each mobile phone network that supports SMS has one or more messaging centre to handle and manage the short messages. Short messages can be sent and received by simultaneously with GSM voice, data and fax calls. This is possible because whereas voice, data and fax call take over a dedicated radio channel using signaling path. As such user of SMS rarely if ever busy or engaged signal during peak network usage time.