LONG RANGE MONITORING SYSTEM

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This report is submitted in partial fulfillment of the requirements for award of Bachelor of Electronic Engineering (Industrial Electronics) With Honours

Faculty of Electronic and Computer Engineering
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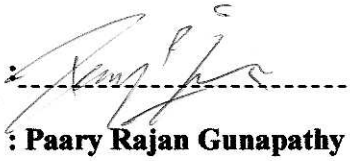
Signature : 

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Dedicated to my beloved family especially my father and mother, lecturer, and also to all my friends

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ABSTRAK

Projek ini bertujuan untuk memerhati dan memberi isyarat mengenai keadaan mesin-mesin di kawasan industri. Terdapat dua bahagian utama dalam sistem ini, iaitu bahagian pemancar dan bahagian penerima yang dihubungkan secara tanpa wayar menersi gelombang radio. Oleh itu, interaksi yang lebih jauh boleh dicapai melalui sistem ini mengikut kemampuan bahagian pemancar dan bahagian penerima. Bahagian pemancar akan disambungkan dengan litar mesin, manakala bahagian penerima pula akan diletak di bilik kejuruteraan di sesebuah syarikat. Jika mesin berhenti kerana kerosakkan, bahagian pemancar akan menghantar isyarat ke bahagian penerima, dimana penerima di papan memerhati akan memberi isyarat kepada jurutera di bilik tersebut. Jurutera boleh mengenalpasti mesin yang rosak melalui papan memerhati. Dengan bantuan sistem ini, keadaan berhenti mesin-mesin boleh dikurangkan dan secara tidak langsung boleh menaikkan keluaran produk sesebuah syarikat.

ABSTRACT

This project is to monitor and alert fault condition of the machines in an industrial company. The system is thus composed of two subsystems which are transmitter part and receiver part. There is no wiring involve in both subsystems. As both systems communicate using radio frequency. So the communication can be longer depends on the transmitter and receiver capabilities. Transmitter part will be connected to the machines and receiver part will be in the remote room of the company. So if there any fault in the machines, the engineer in-charge can attend the machine and no need to wait for technicians to alert him about the fault. There is also no need to search for the faulty machine as it can be identified from the monitoring board. With help of this system machine down time can be reduced. Indirectly this system can be used in any kind of industries to improve the production process and also the production output.

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FM	-	Frequency Modulation
ID	-	Identification
LED	-	Light Emitter Diode
AM	-	Amplitude Modulation
PAM	-	Pulse Amplitude Modulation
FSK	-	Frequency Shift Keying
VCO	-	Voltage Controlled Oscillator
SAW	-	Surface Acoustic Wave
RF	-	Radio Frequency
TE	-	Transmission enable

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CHAPTER I

INTRODUCTION

1.1 Project Introduction

The focus of this project is to monitor machines in industrial area. The basic idea is to indicate or alert the engineer in charge regarding the machine which status is down or in fault condition. The signals send from each machine to the monitor board in remote room where the engineer situated. The question is "how to link the machine to the monitor board?" The easiest answer is link with wire. But how far the wiring can be done to link both equipments? How much will it cost? To avoid all these questions a simplex communication between machine and monitor board was done. This communication transmits and receives without wire (wirelessly).

Guglielmo Marconi invented the wireless telegraph in 1896. In 1901, he sent telegraphic signals across the Atlantic Ocean from Cornwall to St. John's Newfoundland; a distance of 1800 miles. His invention allowed two parties to communicate by sending each other alphanumeric characters encoded in an analog signal. Over the last century, advances in wireless technologies have led to the radio, the television, the mobile telephone, and communication satellites. All types of information

can now sent to almost every corner of the world. Recently, a great deal of attention has been focused on satellite communication, wireless networking, and cellular technology.

This project which is named as Long Range Monitoring System (LoRaMoS) was created as a good and acceptable solution after considering into all these aspect in the real industrial world. This project invented based on wireless technology, where radio frequency (RF) is used as a transmission medium. The transmission length is around 50 meter. Counter is attached to the monitor board, so that each time the machine had fault the counter will count and recorded for the future improvement of the company's production. Using LoRaMaS faulty machines can be identified easily.

1.2 Objective

Although technology is high these days, still some companies using manual monitoring system because of budget factor. LoRaMoS project is started to overcome this problem. The main goal of this project is to invent low cost fault monitoring system for small companies. By using LoRaMoS delay of production in companies can be overcome. Some machines are very sensitive and have to troubleshoot very fast to avoid worst circumstance. This system can reduce the total fault time of a machine and display its frequency of fault for company's records.

1.3 Problem Statements

Wireless transmission is easier than wired transmission. Currently a lot of companies using wired monitoring which is very expensive for its installation and difficult to troubleshoot. New wiring has to construct if there is any changes in location of machine. But for wireless monitoring system, the machines can be relocate anywhere within the transmission coverage. But not all wireless monitoring system has this capability. Maybe infrared can be used to replace the wired system. But the problem is

there shouldn't have any blockage like walls, opaque and etc. This mean we have to clear and make sure there is no blockage along the transmission line. This method is not applicable to a industrial company where machines all over the place. And some more installing infrared system is very expensive.

Some of the giant companies using online monitoring system which is extremely expensive. Since budget is a main factor for most of the small companies, they couldn't effort to use the online system. If they manage to use the system also, they still have to spend money if there is any problem in the system in the future. As we know online system is completely high technology where software involved in it. If there is any problem occurs, the particular company has to consult the experts in that system for troubleshooting. And there will be big problem if the system's software corrupted or damage. The system's maintenance is very high and cant affordable by small companies.

In some other company manual monitoring system is used. This system is fully using man power to inform the engineer about the fault of machine. The technician plays the role of informer, where if there any fault in the machine, he has to walk to the remote room and inform the engineer in charge. Let's say the technician took 5 minutes to walk to the remote room and five minutes for the engineer to come to the faulty machine. Here the line production is stooped around ten minutes. That's mean for the particular ten minutes no output of productions. We assume the production line produce five output in a minute and one output cost RM 5. So for the ten minutes the company lost is RM 250. This is only for 1 machines lost. What will happen if two or more machines down? How much the company loss for the particular time? It is incredible loss.

1.4 Scopes of work

There are two sub-systems in this project which are connected via wireless. Radio Frequencies are used to communicate between the sub-systems. The block

diagrams in Figure 1.1 describe the actual operation method. The machines in the production line will be connected to the transmitter circuit so if any machine had fault, the signals will be transmit to the receiver circuit in remote room and alert the engineers there. Each machine has its own ID. ID is created using dip switch. At the receiver part, normally close relay is used. Each machine connected to the relay wirelessly. If fault happen in the machine it will straight away trigger the relay to normally open circuit and will activate the light indicator and counter. The range of transmissions is depends on the circuit. For this project the limit proposed is 50m. This can be expandable.

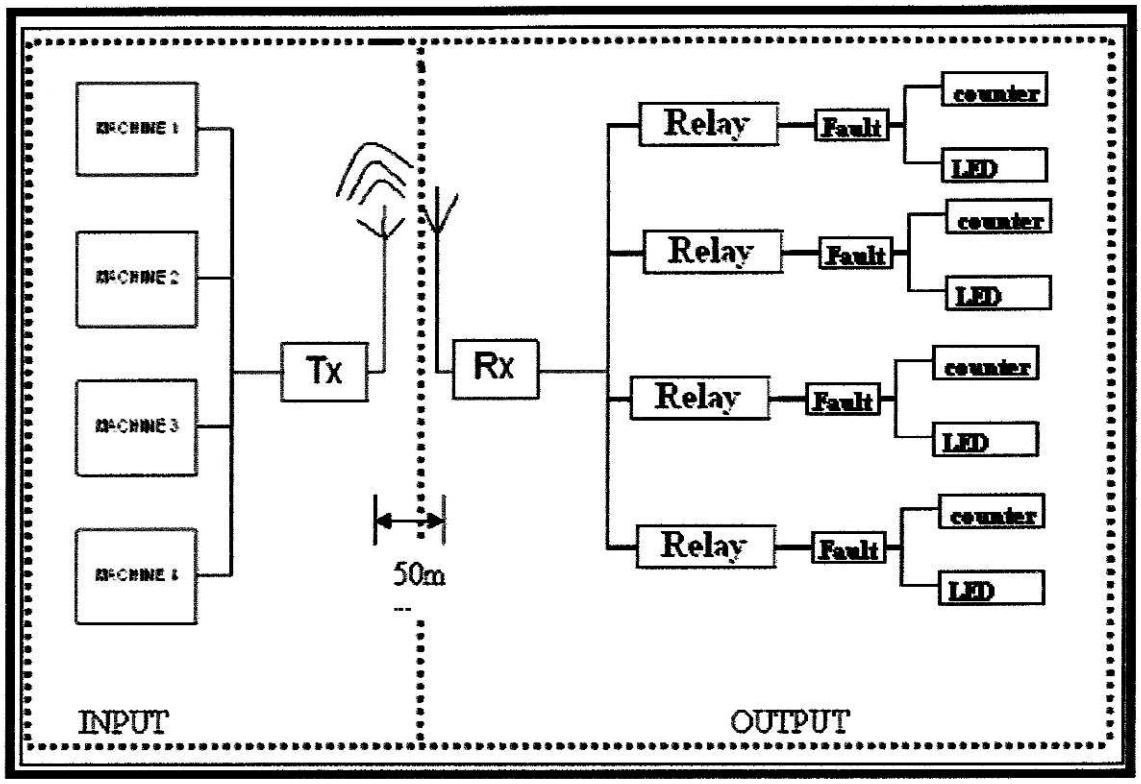

Figure 1.1: Project Block Diagram

1.4.1 Hardware Development

The scope of work in this part is to adopt a FM Transmitter which can transmit signal for 50 meters. Inputs of the transmitter also have to consider, because according to the project there are more than one input with encryption device is integrated to the

transmitter and receiver part.. So 4 inputs transmitter was construct and as for FM Receiver 4 outputs receiver were constructed where each output contact with relay. The relays connected to counter circuit and LED. Each time the relay activate, the counter will count and LED will ON. Reset button was placed in the LED circuit so it can be reset after the troubleshooting of the machine done. For the whole system, the main consideration is the cost of the components. As stated in objective which is to invent a low cost fault monitoring system, all the components that used in this project were cheap. Although cheap but the quality of the components were also considered.

1.4.2 Simulation

Simulation is to construct circuit using software, so that if any errors can be detect easily. Not all circuit in this project created in simulation. This is because some components in the circuit couldn't find in the MultiSim software. Only counter circuit was done in simulation.

CHAPTER II

LITERATURE REVIEW

2.1 Background Study

There could be many signals transmitting at the same time, for example, there are many different signals transmitted by radio stations and TV stations at the same time [6]. Figure 2.1 shows that there are several signals exist at the same time, and those signals are displayed by a spectrum analyzer. For the receiver able to receive

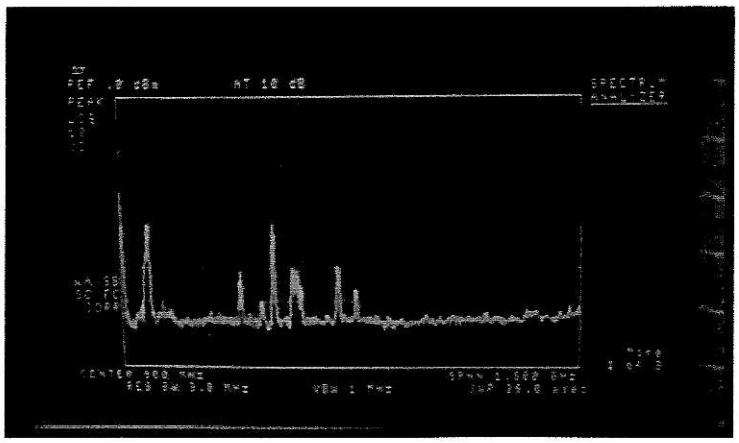

Figure 2.1: Several signals displayed by the spectrum analyzer

the desired signal, the desired signal is need to be modulated before it is transmitted. Explain it in simple way, modulation is like multiplying the message signal, *m(t)*, and the carrier signal, *c(t)*, and become a modulated signal, *u(t)*. Depending on the carrier frequency, the modulated signal will be picked up by the receiver tuned at a specified channel or frequency.

There are several different modulation technologies, for instances, amplitude modulation (AM), frequency modulation (FM), pulse amplitude modulation (PAM), and frequency shift keying (FSK) [3]. The AM and FM are used for analog communication. On the other hands, PAM and FSK are used for digital communication. In this project FSK is used. FSK is a method of transmitting digital signals. The two binary states, logic 0 (low) and 1 (high), are each represented by an analog waveform. Logic 0 is represented by a wave at a specific frequency, and logic 1 is represented by a wave at a different frequency. Refer figure 2.2.

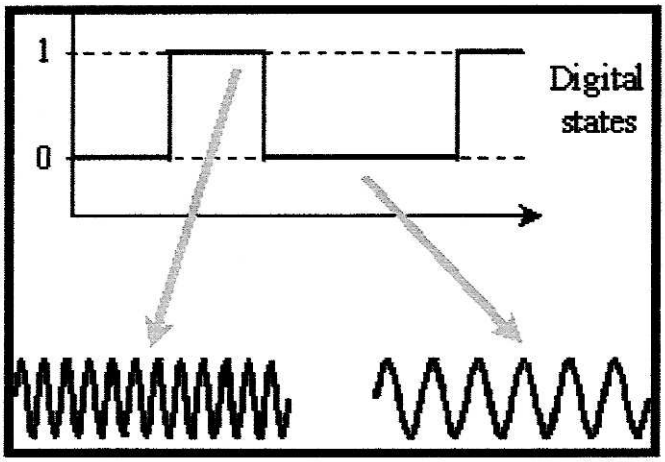

Figure 2.2: Analog waves

The concepts of the amplitude modulation and pulse amplitude modulation are similar. The amplitude of the modulated signal varies, and different amplitudes represent different data. Vice versa, the frequency modulation and the frequency shift keying are similar. Instead of the amplitude, the frequency of the carrier signal is varies, and different frequencies correspond to different data. Certainly, there are many other

different modulations like phase modulation for analog and phase shift keying for digital. Sending and receiving an audio signal is one of the analog communications. So, in this project, either amplitude modulation (AM) or frequency modulation (FM) can be used.

One of the primary advantages of FM is that the modulation is contained in carrier frequency variations and not in amplitude changes like AM, which would be susceptible to noise and interference [6]. This means that it can remove any noise and not affecting the desired information. Using FM to send and receive the audio signal in this project is more appropriate. In angle modulation, the spectral components of the modulated waveform are not related in any simple fashion to the message spectrum. Furthermore, superstition does not apply, and the bandwidth of the angle-modulated signal is usually much greater than twice the message bandwidth. The increase in bandwidth and system complexity is compensated for by the improved performance in the face of noise and interference.

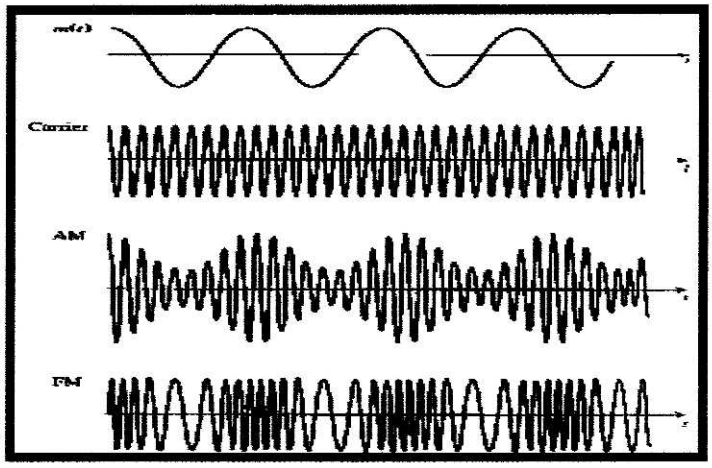

Figure 2.3: The typical waveform of the AM and FM signals.

The idea of frequency modulation, where the carrier frequency would be varied in proportion to message m(t). The carrier frequency:

$$\omega(t) = \omega c + km(t) \quad (2.1)$$