"I admit that I have read this literature work through my observation which has fulfilled the scope and quality in order to be qualified for the conferment of Bachelor Degree in Electronic Engineering (Electronic Industry)."

Signature : .....

Supervisor's name: MR. NORIZAN BIN MOHAMAD

Date : 11/5/2006

MISSING HUMAN DETECTOR USING SHORT-RANGE RF SIGNAL

SULAIMAN BIN MUSA

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Fakulti Kejuruteraan Elektronik dan Kejuruteraan Komputer
Kolej Universiti Teknikal Kebangsaan Malaysia

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"I admit that this is done by my self except the discussion and extracts taken from other sources that I explained each in detail."

Signature : .....

Author's Name : SULAIMAN BIN MUSA

Date : 10/5/2006

Dedicated my to my beloved parents, families, my beloved best friend, my housemates and everybody who support me through my up and down to accomplish this project

Thanks for your love and care

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ABSTRACT

Sometimes people are missing in a forest or other places and are very difficult or time-consuming to find them out. In this project, a short-range transmitter and receiver will be demonstrated to find the missing people in shorter time. People usually search missing human in the forest by using helicopter and track them from the air or by tracking with dog. Sometimes they might take longer time to track the missing person because they didn't have any clue or hint where the missing person located. But with this device, we will find that it is much easier to track them by knowing where is the direction of the person is at that time from the tracker location. Logically we will find that it is smarter and faster to track the missing person compare with traditional way.

To track the missing person, they must first wear a device called transmitter where the transmitter will transmit a short-range signal at a frequency of 315MHz at all time to the receiver and the receiver will detect them if the receiver was turned on. The receiver also uses the frequency of 315MHz. To track the direction of the signal from the transmitter, the field strength meter were used to estimate the range of each signals received. Based on the project result, we can se that the higher the current measured the shorter distance transmitter from the receiver. The direction of transmitter was identified by comparing between multi directions of the signals measured. The highest value of the current measured from the Field Strength Meter circuit will be chosen as the direction of the transmission signals by using the principles of the directional antenna that will further discuss in this thesis.

ABSTRAK

Kadangkala apabila terdapat kejadian kehilangan orang akibat tersesat di hutan dan di kawasan lain berlaku, masa yang terlalu lama terpaksa digunakan untuk mencari dan menyelamat mangsa. Di dalam projek ini, satu sistem akan dibangunkan dengan menggunakan alat pemancar dan penerima RF berskala rendah untuk mencari kedudukan mangsa hilang berkenaan.Kebiasaannya kaedah pencarian manusia hilang adalah dengan menjejak melalui udara dengan menggunakan helikopter atau melalui darat dengan menjejak mengunakan anjing pengesan. Kadangkala kaedah ini memakan masa yang agak panjang kerana penjejak tidak mempunyai maklumat yang tepat dan cukup mengenai kedudukan manusia yang hilang terbabit. Tetapi dengan peralatan ini, operasi pencarian orang hilang dapat dilakukan dengan lebih mudah dengan mengetahui kedudukan dan arah mangsa hilang daripada lokasi penjejak dan penyelamat. Secara logiknya kaedah ini adalah lebih cepat dan pintar untuk diaplikasikan berbanding kaedah biasa secara yang tradisional.

Untuk menjejak mangsa hilang, mangsa terbabit terlebih dahulu perlu memakai satu peralatan yang dipanggil pemancar di mana pemancar ini memancarkan isyarat berskala rendah dengan frekuensi 315MHz pada setiap masa dan isyarat ini akan diterima dan dikesan oleh penerima bilamana terdapat arahan dibuat untuk mengesan lokasi mangsa hilang. Sistem penerima ini juga mestilah berfrekuensi 315MHz. Untuk menjejak arah dan lokasi isyarat pemancar, litar 'Field Strength Meter'(FSM) digunakan dimana kekuatan isyarat yang dihantar pemancar akan dibaca oleh litar 'field strength meter'. Litar 'field strength meter' ini akan mengira dan menganggar kekuatan isyarat pemancar yang diterima oleh komponen litar penerima. Semakin kuat nilai arus yang diukur oleh FSM maka semakin dekatlah jarak kedudukan pemancar ke penerima.

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CHAPTER I

INTRODUCTION

1.1 INTRODUCTION

From this project, I'm using a short-range RF link signal in a frequency of 315 MHz where the frequency is in Ultra High Frequency (UHF) signal. The main purpose of the project is to develop a device that can track a missing person, which they first must wear a device called transmitter. The transmitter will transmit a short-range signal at a frequency of 315MHz at all time to the receiver and the receiver will detect the signal. The receiver also uses the frequency of 315MHz. Each transmitter will have its own ID.

To track the direction of the signal from the transmitter, we will use field strength meter where the signal strength will be read by the field strength meter circuit. The used of field strength meter in this device is to accumulate and estimate the strength of the transmitter signal and will measure the strength of RF signal from the transmitter to receiver. The stronger the signal strength transmits, the shorter distance the missing human from the tracker's location.

1.2 OBJECTIVES

The main objectives of this project are to develop detector that can detect human presence by using short-range RF signal.

1) To detect the direction and location of the missing human
2) To reduce cost while tracking missing human
3) To reduce time when tracking missing human
4) To know the used of Field strength meter in measuring the strength of frequency signal
5) To know the characteristic of transmitter and receiver

1.3 PROJECT SCOPE

In general, the scopes of this project are:

1) The used of 315MHz RF signal to apply on a short range
2) Constructing low power RF transmitter and receiver for short range transmission
3) Constructing simple Field Strength Meter circuit
4) Use a small TV antenna that suitable for direction detecting system (Directional antenna)

1.4 PROBLEM STATEMENT

Sometimes people are missing in a forest or other places and are very difficult or time-consuming to find them out. The major problem while we track missing people in the forest is the forest usually wide and thick. This will be much harder for us if the weather and the environment condition are bad. There will be a lot of time to spend to find the missing human and it will be much costly.

The major problem that we would faces if we used the traditional way to track missing human such as helicopter navigation or dog tracking is the forest usually wide and thick and this will be the major threat because we cannot find missing human easily in such environment.

Another main factor that affects the time-consuming while tracking is the current weather and the environment condition. If the current weather is rainy or snowy the tracking will be much harder because it will slow down the tracking progression. It will be much harder to track missing human at night because human visualization is very limited at night.

So if we didn't have any device that can help tracking the missing human, we need longer time to spend to track them and for sure the cost that we'll be spent is much expensive because the unlimited uses of the manpower and machinery.

1.4 PROJECT OUTLINES

The project is written to document the concept, activities and outcome of the project that is relevant to the project development progress. The report stresses more on the activities that have been done in order to complete the project. This report consists of five main chapters.

First chapter describes briefly about the introduction, objectives and the scopes of the project. The second chapter focuses on the literature review that consists of the transmission principles and components that be used in the project such as transmitter and receiver module, field strength meter, antenna outfit, the display circuit for signal indicator and the microcontroller that will be using

In third chapter, the discussion focuses more on the methodical approach where the project implementation will be divided into two stages. First stage is hardware designs and second stage is circuitry design. The fourth chapter covers the various stages in the hardware development and designs, involving and the analysis of the project outcome and pitfall and problems encountered when under construction the transmission device and solutions that have been taken to overcome the problems. Final chapter is the project conclusions and recommendation for future enhancement of the project.

CHAPTER II

LITERATURE REVIEW

2.1 WIRELESS TECHNOLOGY

Wireless is a term used to describe telecommunications in which electromagnetic waves (rather than some form of wire) carry the signal over part or the entire communication path. Some monitoring devices, such as intrusion alarms, employ acoustic waves at frequencies above the range of human hearing; these are also sometimes classified as wireless. [1]

The first wireless transmitters went on the air in the early 20th century using radiotelegraphy (Morse code). Later, as modulation made it possible to transmit voices and music via wireless, the medium came to be called "radio". With the advent of television, fax, data communication, and the effective use of a larger portion of the spectrum, the term "wireless" has been resurrected. [1,2]

2.2 DATA TRANSMISSION

Data transmission is very generally speaking, the conscious act of moving any kind of information from one space to another. Historically this could be done by courier, a chain of bonfires or semaphores and later by Morse code over copper wires. In recent computer terms, it means sending a stream of bytes from one location to another using any number of technologies to do so. Among them are lasers, optical fiber, infrared light or radio links (RF). [2]

2.2.1 Transmission Terminology

Transmission from transmitter to receiver goes over some transmission medium using electromagnetic waves

(1) **Guided media**: Waves are guided along a physical path; twisted pair, optical fiber, coaxial cable.
(2) **Unguided media**: Waves are not guided; air waves, radio
(3) **Direct link**: Signal goes from transmitter to receiver with no intermediate devices, other than amplifiers and repeaters
(4) **Point-to-point link**: Guided media with direct link between two devices, with those two devices being the only one sharing the medium
(5) **Multipoint guided configuration**: More than two devices can share the same medium
(6) **Simplex**, half duplex and full duplex transmission.

2.2.2 Transmission Impairments

A transmission impairment is a property of a transmission medium which causes the signal to be degraded, reduced in amplitude, distorted or contaminated. Impairment can introduce errors into digital signals. Examples of transmission impairments are attenuation, delay distortion, and several sources of noise including, thermal noise, impulse noise, and inter-modulation noise. [2]

It is important to understand transmission impairments for several reasons. Understanding the source of a transmission impairment like attenuation or dispersion will enable the user to partially correct for (equalize the signal) these effects. Understanding the source of transmission impairments (dispersion, attenuation, impulse noise, thermal noise) can also help the user understand some of the constraints placed on the transmission of data as a result of these effects. Such constraints include the maximum length of network links, the choice of physical transmission media, the choice of encoding methods, and the data rate supported by the medium. [2]

With any transmission systems, the received signal may be different from the sent signal. For analog signals, the signal quality may degrade and for digital signals, binary 1 and 0 may be interchanged and cause the bit error rates (BER). We will now look at some of the most significant impairments:

(1) Attenuation distortion

Attenuation is a property of the transmission medium. It measures how much energy is absorbed and/or radiated from the traveling signal due to it's interaction with the transmission medium. Attenuation is measured as a function of the distance traveled through the transmission medium. The transmission medium absorbs energy because the signal is influenced by small impurities within it. Such impurities have different sizes

and distributions depending on the type of medium. Impurities of different sizes effect different frequencies in the signal.

The effect of attenuation is, therefore, a function of frequency. The frequency variation of attenuation can be partially corrected, or equalized, by applying corrections based on a physical model. When a signal is attenuated it's amplitude is reduced. The interpretation of a received signal depends on being able to tell the difference between different signal levels. If the amplitude is reduced too much by attenuation it becomes impossible to accurately tell the difference between the different signal levels, and the information in the signal is lost. To prevent this from happening repeaters (digital) or amplifiers (analog) are used. These devices increase the amplitude of the signal by decoding and retransmitting the signal or increasing the received amplitudes respectively. By inserting amplifiers or repeaters in the transmission media, the maximum signal propagation distance (a property of the attenuation of the medium) is increased.

(2) Limited bandwidth

Bandwidth is the range of frequencies that the equipment or channel is capable of processing. If there is not enough bandwidth, some of the frequencies will be lost and the signal will be distorted.

(3) Dispersion

Dispersion is also a property of the transmission medium. Signals with different frequencies will travel through a transmission medium with slightly different velocities. Therefore, the signal will be smeared or distorted when it reaches the destination. The longer the transmission medium the larger the time difference in the arrival times of the parts of the signal with different frequencies and the more severe the smearing or distortion of the signal. Like attenuation, the physical properties of dispersion can be

modeled. Thus it is also possible to develop an equalization model to partially compensate for dispersion.

(4) Delay distortion

In a waveform consisting of two or more wave components at the different frequencies, distortion caused by the difference in arrival times of the frequency components at the output of a transmission system. The propagation velocity of a transmitted signal depends on the frequency of the signal and the characteristics of the transmission system, so different frequencies can arrive out of step. When digital signals travel long distances, some of the components signals of one symbol or bit can be delayed for so long that they interfere with the start of the following bits, causing inter-symbol interference.

(5) Noise

Noise of different types will affect a transmitting signal. Thermal noise, low amplitude random noise at predictable low amplitude (amplitude related to the temperature of the transmission medium), is caused by the thermal vibration of the molecules within the transmission medium. The difference between signal levels in a transmitted signal will generally be much larger than the amplitude of the thermal noise. Thermal noise sets a limit of how close different signal levels can be at the receiver (larger than the 2X amplitude of the thermal noise). Thermal noise will not usually be of high enough amplitude to cause the introduction of bit errors in an encoded signal (unless attenuation has been excessive).

The amount of thermal noise to be found in 1 Hz of bandwidth in an actual device is:

$$N_o = k.T \text{ W/Hz} \qquad (2.1)$$

Where N_o = noise power density in watts per 1 Hz of bandwidth.

k = Boltzmann's constant, 1.3803×10^{-23} J/K.

T = absolute temperature in Kelvins.

However, impulse noise picked up from the environment can have high amplitude for significant lengths of time. Such impulse noise can be caused by interference from other signals in the environment including other transmitted signals, or electrical fields natural (lightning, aurora) or manmade (signals emitted by other electrical equipment). The amplitude of impulse noise may reach or exceed the magnitude of the signal.

It also can be define as sudden bursts of irregular pulses or noise spikes and generated from rapid changes in electromagnetic energy and causes noise spikes that interfere with communications for short periods

The duration of a pulse of impulse noise may be several time the duration of a single signal. Because of the large amplitude of the impulse noise pulse it is possible that, when added to the real signal, the resultant received signal may appear to have been transmitted at a different level that it actually was. For example, for a signal with three levels (1 , 0, -1) and impulse noise has an amplitude of 1 added to a signal, the resulting received signal will have a level of (0, 1, 2). During the noise pulse a signal transmitted at level 0 will arrive at the receiver with an amplitude of 1,.

Similarly a signal transmitted at level -1 will arrive at the receiver with an amplitude of 0. In both cases the level of the received signal will be different from the signal that was sent. When the signal is decoded the resulting value of the data bit will have changed in transmission. A bit error has been introduced into the received signal. Some protection can be afforded by using filtering and smoothing circuits and apparatus. Intermodulation (IM) noise occurs if signals with different frequencies share the same medium. Interference caused by a signal produced at a frequency that is the sum or difference of original frequencies. IM noise may result from a number of causes:

a. Improper level setting. If the level of input to a device is too high, the device is driven into its nonlinear operating region (overdrive).