ENVIRONMENT CONTROL INTERFACE

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For my beloved parents

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ABSTRACT

The usage of control and monitoring system is not a strange thing in the world of science and technology. The use of such system has not only increased productivity but as an added bonus also decreased the cost of handling numerous machines and electronic devices. With current technological advancements, computers are no longer considered as a luxury item, but more as a necessity. In light of this situation, this project was conceived to exploit the computer's ability to communicate serially with an external component. In the process of developing the project, some considerations were taken into account. One of them is the human factor. The project was developed in such a way that it is user-friendly and useable by anybody regardless of his or her education background. The main objective for this project is to develop software that is capable of communicating with electronic devices.

ABSTRAK

Penggunaan sistem kawalan dan pemerhatian adalah sesuatu yang tidak asing di dalam zaman sains dan teknologi ini. Penggunaan sistem sedemikian bukan sahaja telah meningkatkan produtiviti malahan telah mengurangkan kos bagi mengendalikan pelbagai mesin dan peralatan elektronik. Dengan perkembangan teknologi sekarang ini, komputer bukan lagi dianggap sebagai suatu kemewahan, malahan ianya dianggap sebagai satu keperluan. Menyedari hakikat tersebut, projek ini dijalankan bagi mengeksploitasi kebolehan komputer untuk berinteraksi menggunakan sambungan sesiri dengan komponen yang lain. Di dalam membuat projek ini, beberapa faktor telah diambil kira. Antaranya ialah faktor manusia. Projek ini dirancang supaya dapat digunakan oleh sesiapa sahaja dengan mudah, tidak kira apa latar belakang pendidikannya. Objecktif utama projek ini ialah bagi membuat perisian yang mampu berinteraksi dengan peralatan-peralatan elektronik.

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CHAPTER 1

INTRODUCTION

Traditionally, all of the electrical devices are controlled individually. The situation is pretty much the same after years of development and the invention of more sophisticated electrical devices. Centralised device monitoring and controlling system will eliminate the trouble of having to actually be in a room in which the devices are place to operate it. There are currently a few of centralised monitoring and controlling systems available around the world. Most of the systems are custom designed to fit a specific floor layout. This means that the same system cannot be used in places other than the original site. The lack of flexibility makes the current system expensive as a new system had to be designed for every new building.

1.1 Problem Statement

As people increasingly become aware of the power of centralised device monitoring and control systems, the demand for it is expected to increase. The current inflexible system although good for highly dedicated functions, it not very suitable for end-users. A more flexible system that can be customised to fit almost any building layout would suit the end-users better. With the advent of Vision 2020 and the Multimedia Super Corridor (MSC), computers are fast becoming as

common as the television or radio sets. This situation gives a good jumping point for centralised monitoring and controlling systems.

The system to be created must be customisable in order for the manufacturing cost to be reduced through mass production. The system must also be simple to use, as the user cannot be burdened with the need to learn the system before using it. A good approach is to use the Windows environment as a platform for the system.

1.2 Objectives

The following is a list objectives for the project:

- To develop a customisable, easy to use Windows based control and monitoring system
- To utilise the computer's I/O ports in communicating with external devices
- To utilise the programming language taught to the students of Electronics & Telecommunications Engineering Programme

1.3 Description of Environment Control Interface (ECI)

The software would enable a Personal Computer operating with a 32-bit operating system (Windows 95 or Windows 98) to monitor and control devices attached to it via an RS-232 interface. The serial interface was selected due to the fact that it can be found in most Personal Computers. In most PCs, the serial port is idle, except when used by either an external modem or by a serial mouse. Nowadays, with the availability of internal modem and PS2 mouse, the usage of serial ports had become less. The serial line is also more economical compared to

the parallel line. With less cables to be terminated and used, the cost of buying cables would be significantly reduced.

The software was developed using the C++ programming language and the computer in which the software is to run on is an x86 class computer. The x86 platform was chosen due to its number in current use. Using an x86 class computer as the terminal would ensure that the user would not have to buy a new computer system just to run the software. C++ was chosen for the language because it is the language used to develop the Windows operating system itself (apart from the C language).

CHAPTER 2

LITERATURE REVIEW

Serial communication is a type of data transmission using a stream of electrical pulses. In Data Communications Theory, data transmission is defined as transmission of data that was originally digital in nature. Various type of transmissions can be used, such as:

i. simplex (e.g. Television)

ii. half duplex (e.g. Walkie-talkie, wireless)

iii. full duplex (e.g. Telephone)

In a serial communication, each byte or character sent or received is sent a bit at a time. The bits are either *on* or *off*. The speed of the serial data is expressed as bits-per-second (bps). The unit represents the number of ones and zeroes that can be sent in a second. For example, with a 2400 serial modem, the computer would be able to send 2400 bits of information to the telephone line in a second. Basically there are two types of serial transmission. Data can either be sent synchronously or asynchronously. In synchronous serial transmission, the data are sent continuously over the line. However, this method requires a good synchronisation between the transmitter and the receiver. Asynchronous serial transmission on the other hand can be utilised by systems that do not have good synchronisation between the transmitter and receiver. In asynchronous serial transmission, every character is sent independently. The characters will be preceded with a start bit and one or two stop bits. In comparing the two methods

of transmission, it is noticeable that the asynchronous transmission provides a more reliable data transfer compared to the synchronous method. This is because the asynchronous serial data transmission will 'synchronise the receiver for every character send'. The repetitive 'resynchronisation' will avoid drift of synchronisation, ensuring the data transmitted is interpreted correctly.

2.1 Basics of Universal Asynchronous Receiver Transmitter

Universal Asynchronous Receiver/Transmitter (UART) provides data transmission capability between Data Terminal Equipment (DTE) and Data Communication Equipment (DCE). There are three main functions for the UART. They are:

- Serial to parallel & parallel to serial conversion
- Error detection (insertion/checking of parity bit)
- Start & stop bit insertion and detection

Before the UART can be used, it has to be programmed for the nature of data (number of data bits, parity (odd/even), number of stop bits) it is to handle. The only thing that cannot be manipulated is the start bit. The start bit is a single *low* bit in the beginning of a data transmission.

There are essentially two different parts in the UART, which are the UART transmitter and UART receiver. UART transmitter in general converts parallel data to serial data while the UART receiver converts back the serial data to parallel data.

Serial data coming into the UART is ignored until a valid start bit is detected. To ensure that any low bit received when the UART is idle is a valid

start bit (not a *negative-going* noise spike), the UART's receive clock is created 16 times higher than the receive data rate.

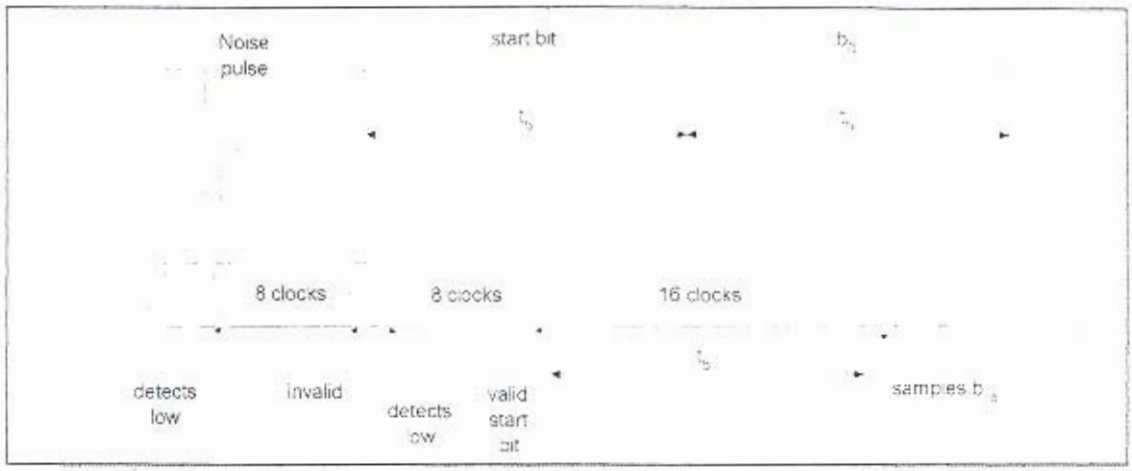

Figure 2.1: Typical UART timing diagram

Seven clock pulses after a *low* is detected, the signal will be sampled again. If the bit is still *low*, the start bit is confirmed. If the bit changes back to high after seven clock pulses, the low is considered as a noise pulse and therefore ignored.

There are several UARTs that is used by an IBM PC/XT/AT and its compatibles. They are the 8250, 16450 and the 16550 UART. There are two modes in which the UARTs can operate in, the 'polled' method and the 'interrupt driven' methods. In the polled method the CPU is typically in a loop asking the UART over and over again if it has a byte ready. In the case when there is a byte ready, the polling will return the byte. The most obvious drawback of this method is that if a new byte comes in prematurely (before the polling code is executing again), the new byte will be lost.

In the interrupt driven method, when a byte is received by the UART, an 'Interrupt Service Routine' (ISR) is executed instantaneously. This routine will put any other executing codes to halt. The ISR will then move the received byte to