Infra Red Cordless Mouse

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INTRODUCTION

Can anybody imagine that this little wonder, PIC12C509, be used to control a cordless mouse? Incredible! Just a handful of components, that's all! In fact the circuit is small enough and perfectly suitable to be fitted in the mouse housing with batteries. Current consumption is minimized by the power reducing SLEEP mode of the chip.

The circuit consists of two parts. A transmitter, which is enclosed in the mouse, and the receiver, connected to the PC via RS 232 link.

APPLICATION OPERATION

Transmitter

The PIC12C509 forms the heart of the circuit. Thanks to the PIC12C509, it's use greatly simplifies hardware design and the software. It senses the mouse movements, mouse buttons and transmits the information to the PC through infra red light emitting diodes (IR LED's). The internal oscillator of the PIC12C509 enables one to use all of the I/O pins. The power-on reset feature of the PIC12C509 rules out any need for external reset circuitry, thereby saving one precious I/O pin. Out of six I/O pins, one pin is configured to be output, while the rest of the five pins are used as inputs. The output pin drives two IR LED's through a MOSFET BS170. Note that the MOSFET and one IR LED can be saved and current consumption reduced by driving the IR LED directly through the PIC12C509 pin at the expense of limiting the range.

Three input pins out of the five are interfaced to the three mouse buttons. Of course, two mouse buttons can be used if desired. Flexibility of the design is evident. Thanks to the PIC12C509 again! The remaining two input pins are movement sensing inputs. Optical sensing is used, which consists of an opto coupler with a toothed wheel in between the LED and the phototransistor. There are two such wheels, one for horizontal movement and another for the vertical movement. The wheels are mechanically coupled to the mouse ball so that they rotate and electrical pulses are generated with mouse movement. PIC12C509 senses the pulses and converts the information into the appropriate format, to be transmitted to the receiver via IR LED's. The information, in the form of pulses, is then fed to the IR LED through the driving MOSFET BS170. Thus the information gets transformed into infra red light which is transmitted to the receiver. When the microcontroller transmits the motion information it produces exactly the same pulses as would be produced by a regular mouse.

Receiver

This is also a very simple circuit consisting of an IR receiver, SFH505A, for instance and an op-amp CA3140. The IR receiver receives the IR pulses and transfers them into equivalent electrical pulses. The op-amp acts as an amplifier cum lavel shifter so as to make these pulses compatible to RS 232 voltage levels. Note that no extra power supply is needed for the receiver circuit as it derives the power from the serial port itself. Since this arrangement appears as a regular mouse to the PC, there is no need to write device driver, and the mouse can be used with the existing driver. Just plug and play!

Software

In a microprocessor based project, software is equally important as hardware. In the present project, the single IC has to perform all the work. It is necessary to begin the design very carefully, keeping in mind that the code length should be as short as possible, since available program memory space is limited. Power consumption reducing SLEEP mode should be used whenever possible to keep the current drain to a minimum.

A suggested algorithm is depicted in the flowchart. The software performs the following tasks:

- Checks the two movement sensing inputs for any movement of mouse.
- Reads the inputs connecting to switches.
- Sends the information to the IR LED.
- Forces the SLEEP mode if mouse is idle for 5 seconds.

So in an idle state, the mouse consumes considerably less power. Hence no power ON/OFF switch is required. The circuit will recover from SLEEP mode whenever the mouse is moved or the mouse button is clicked.

FIGURE 1: FLOWCHART OF THE SOFTWARE