Virtual Mouse using Wireless Glove

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Abstract

This paper discusses design of Virtual mouse which is implemented by Visual Basic. The proposed project is to design a glove that allows a user to control the mouse pointer on a Windows, personal computer with simple hand, arm, and wrist movements. Mouse buttons, scroll functions are implemented with pressure and bend sensors on the fingers. The entire system includes two stations, a base station connected through a parallel interface to a computer running Windows OS, and a battery powered mobile station connected to the control glove. The stations communicate with each other between RF transceivers.

Keywords: HT12D Decoder, HT12EEncoder, SM TX – 433 AM/ASK Transmitter Module, SM RX – 433 Receiver Module, RF Transmitter, RF Receiver, Microcontroller AT89S51, Visual Basics Software

I. INTRODUCTION

The design for a Virtual mouse utilizing innovative techniques, hand movements translate user input, allowing for a highly intuitive user interface. Virtual Mouse was motivated by the need to create a highly intuitive control interface for a variety of applications. In accordance with such, an additional goal of the Virtual Mouse is to create a cost-effective alternative to virtual reality gloves currently available. It is capable of representing hand orientation in digital signals. It is composed of three distinct subsystems: vehicle, glove and wireless interface. The primary physical goals of the system were to be comfortable and wearable without interfering with other everyday activities while tracking particular hand movements that could be used to control a wearable mouse or aid in interaction with ubiquitous or other wearable devices. This paper presents a virtual mouse interface which is a gesture-based mouse interface for robust hand gesture recognition in real-time. Gesture Recognition provides an efficient human-computer interaction for interactive and intelligent computing. The Virtual mouse can easily be implemented in scientific and military explorations of uncharted regions with a variety of remote-controlled devices, including terrestrial, nautical and airborne vehicles. Furthermore, our Virtual mouse is an excellent marketable toy; the high degree of control achieved by the glove is sure to provide added enjoyment for any client.

II. BACKGROUND WORK

The Virtual Mouse is based on tracking the movement of a finger is presented. A method to implement virtual mouse through machine vision are proposed. We studied about the hand gestures such as use of index finger for cursor movement and angle between index finger and thumb for clicking events. A click of the mouse button was implemented by defining a screen such that a click occurred when a user's hand passed over the region. We have done research on all the parameters of our project .We found out that IR laser which we were supposes to use, will be harmful to humans so we have found out alternate for it by using sensor glove. On referring many sites we got to know more about sensor glove & techniques to implement it. Those techniques were finalized.

Sensor gloves are normally gloves made out of cloth with sensors fitted on it. Using data glove is a better idea over camera as the user has flexibility of moving around freely within a radius limited by the range of wireless connectivity. The glove is connected to a computer, unlike the camera where the user has to stay in position before the camera. The effect of light, electric or magnetic fields or any other disturbance does not affect the performance of the glove.

The motion of a data glove is one of the most commonly used technologies for gesture-based human-computer interfaces. The motion data glove helps users to interface with the virtual world, and serves as an input device in non-verbal human computer interaction. Motion data glove is manufactured by attaching optical indicators onto an inexpensive consumer glove and using an optical motion capturing system for motion analysis.

III. DESIGN IMPLEMENTATION

A. Working of Transmitter & Receiver Module:

This radio frequency (RF) transmission system employs Amplitude Shift Keying (ASK) with transmitter/receiver (Tx/Rx) pair operating at 434 MHz.

The transmitter module takes serial input and transmits these signals through RF. The transmitted signals are received by the receiver module placed away from the source of transmission. The system allows one way communication between two nodes, namely, transmission and reception. The RF module has been used in conjunction with a set of four channel encoder/decoder ICs. Here HT12E & HT12D have been used as encoder and decoder respectively. The encoder converts the parallel inputs (from the remote switches) into serial set of signals. These signals are serially transferred through RF to the reception point. The decoder is used after the RF receiver to decode the serial format and retrieve the original signals as outputs. These outputs can be observed on corresponding LEDs.

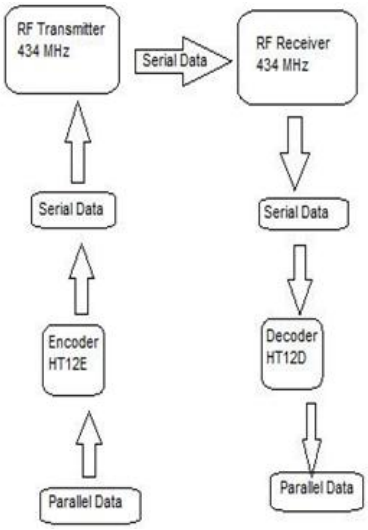

Fig. 1: Transmission of data from transmitter to receiver.

B. Working of Encoder IC (HT12E):

Encoder IC (HT12E) receives parallel data in the form of address bits and control bits. The control signals from remote switches along with 8 address bits constitute a set of 12 parallel signals. The encoder HT12E encodes these parallel signals into serial bits. Transmission is enabled by providing ground to pin14 which is active low. The control signals are given at pins 10-13 of HT12E. The serial data is fed to the RF transmitter through pin17 of HT12E.

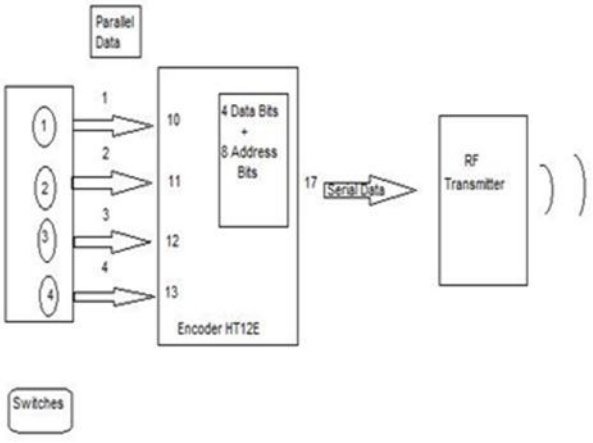

Fig. 2: Encoder IC interfacing with transmitter.

C. Working of Decoder IC(HT12D):

Transmitter, upon receiving serial data from encoder IC (HT12E), transmits it wirelessly to the RF receiver. The receiver receiving these signals and sends them to the decoder IC (HT12D) through pin2. The serial data is received at the data pin (DIN, pin14) of HT12D. The decoder then retrieves the original parallel format from the received serial data.

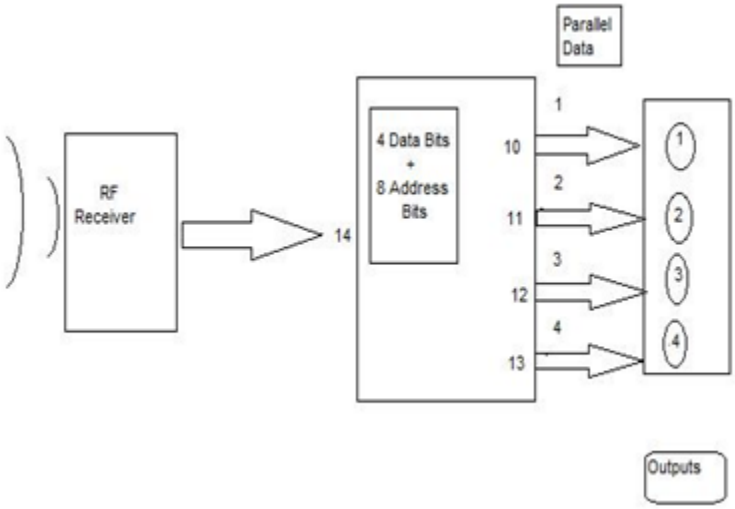

Fig. 3: Decoder IC interfacing with receiver.

When no signal is received at data pin of HT12D, it remains in standby mode and consumes very less current (less than 1µA) for a voltage of 5V. When signal is received by receiver, it is given to DIN pin (pin14) of HT12D. On reception of signal, oscillator of HT12D gets activated. IC HT12D then decodes the serial data and checks the address bits three times. If these bits match with the local address pins (pins 1-8) of HT12D, then it puts the data bits on its data pins (pins 10-13) and makes the VT pin high. An LED is connected to VT pin (pin17) of the decoder. This LED works as an indicator to indicate a valid transmission. The corresponding output is thus generated at the data pins of decoder IC. A signal is sent by lowering any or all the pins 10-13 of HT12E and corresponding signal is received at receiver's end (at HT12D). Address bits are configured by using the by using the first 8 pins of both encoder and decoder ICs. To send a particular signal, address bits must be same at encoder and decoder ICs. By configuring the address bits properly, a single RF transmitter can also be used to control different RF receivers of same frequency. To summarize, on each transmission, 12 bits of data is transmitted consisting of 8 address bits and 4 data bits. The signal is received at receiver's end which is then fed into decoder IC. If address bits get matched, decoder converts it into parallel data and the corresponding data bits get lowered which could be then used to drive the LEDs. The outputs from this system can either be used in negative logic or NOT gates (like 74LS04) can be incorporated at data pins.

IV. EVENT GENERATION VIRTUAL MOUSE APPLICATION:

Depending on the gesture the cursor may be moved or not and the appropriate event will be generated.

Table - 1
Hand gestures and their related mouse movements actions.

Hand Gesture	*Mouse action*
0	*Move Mouse*
1	*Right click*
2	*Left click*
3	*Double click (scrolling up/down)*

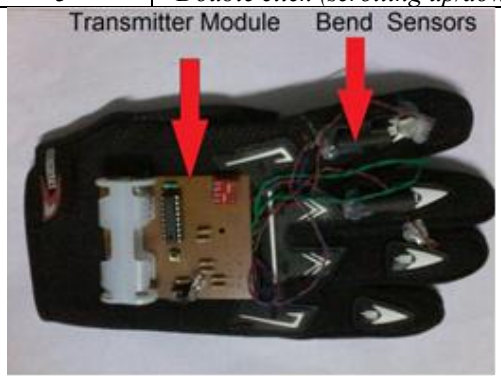

Fig. 4: Control glove at the transmitter side.

V. SOFTWARE IMPLEMENTATION

A. Visual Basic:

Visual Basic (VB) is an event driven programming language and associated development environment from Microsoft for its COM programming model. VB has been replaced by Visual Basic .NET. A programmer can put together an application using the components provided with Visual Basic itself. Programs written in Visual Basic can also use the Windows API, but doing so requires external function declarations. Visual Basic was designed to be easy to learn and use. The language not only allows programmers to easily create simple GUI applications, but also has the flexibility to develop fairly complex applications as well.

Table – 2
Algorithm for Cursor Movement

Data type	*Description*
SYNC (0xFF)	*This byte allows the receiver to synchronize and thus receive a packet in order.*
ADDR (0xAA)	*This byte prevents the receiver from reading data packets of transceivers other than the glove transceiver.*
X axis	*The change of the cursor moves on the x axis.*
Y axis	*The change of the cursor moves on the y axis.*
Scroll	*The change of the scroll moves.*
Clicks	*The click status for left click, middle click and right click.*

VI. RESULTS

The Virtual Mouse is still in the development stage. The implementation of the LCD interfacing, transmitter & receiver module design & the glove implementation is almost completed. The LCD display is tested for working by displaying a sting with 'Virtual Mouse 'written on it. The work is going on the Visual Basic software for the USB interfacing for the communication with PC.

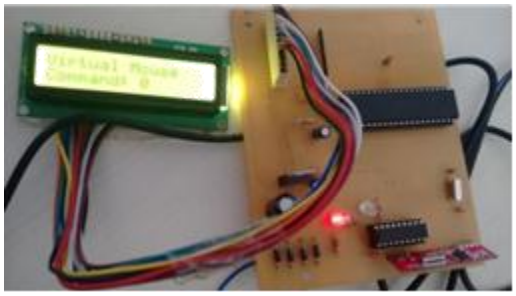

Fig. 5: LCD Display Showing Virtual Mouse.

VII. CONCLUSION

This technical paper presents Virtual Mouse which is implemented by using the most compatible Visual Basic technology. This system is based on the computer vision algorithms and can perform all mouse tasks. The system could be useful in presentations and to reduce work space. For the future scope we can also plan to add more features such as shrinking windows, enlarging & also closing windows etc. by using palm and multiple fingers.

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