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WIRELESS POINTING DEVICE

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ABSTRACT

This paper represents research on a wireless computer pointing device with accelerometer based movement control. It is based on our final year project where we developed a glove unit that user wears during operation of mouse. The device is used for basic interface tasks like clicking, dragging and zooming.

In terms of basic functionality 2-D cursor movement and mouse clicking is successfully achieved. Accelerometers placed on the glove measure tilt very well, and thus allow the Glove Mouse to adjust the cursor speed based on the magnitude of tilt. The glove senses these user actions via two types of sensors: accelerometers and finger contact pads. After the glove's microcontroller processes the input data, it forwards a message a transceiver mounted on the glove unit the research concludes that glove mouse is better than the static optical mouse we generally use with our computer. It is more accurate and enhances the user interaction with no distance limitations.

INTRODUCTION

A pointing device is a type of input devices that allows a user to interact with a computer by moving a cursor on a monitor to select icons and trigger desired actions. A similar pointing device designed for desktop computers is a trackball an upside-down mouse that allows a user to control the cursor by rotating the ball in the direction of desired cursor motion. Another type of pointing device is an optical mouse which uses a light-emitting diode and photodiodes to detect movement relative to a surface. Although mouse has in general sufficed for the necessary interaction, one wonders how other styles of interaction would perform in doing tasks. With this in mind the research presented in this paper is in the direction of a wireless mouse using accelerometer.

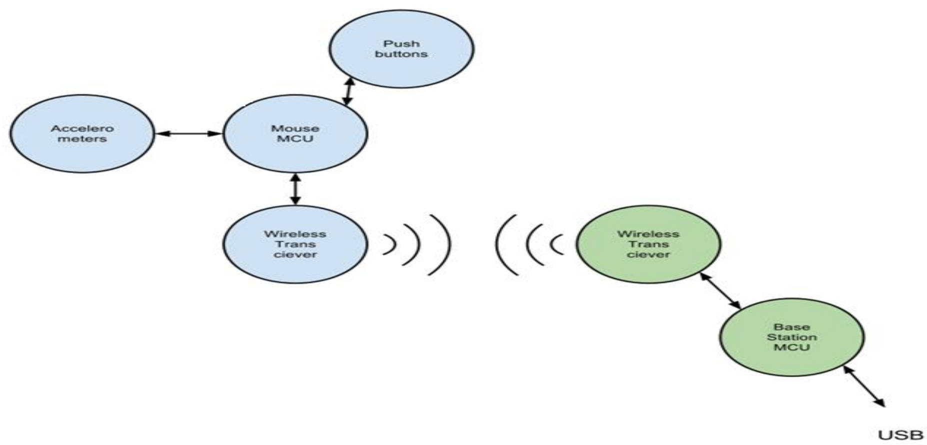


Figure 1BLOCK DIAGRAM

PROPOSED RESEARCH

Our design of wireless mouse consists of two main parts: a glove and a base station. Operation of our device begins with the glove. A user wearing the glove can use hand tilt orientation and finger presses to operate the glove. The glove senses these user actions via two types of sensors: accelerometers and finger contact pads. After the glove's microcontroller processes the input data, it forwards a message to a transceiver mounted on the glove unit. The transceiver then transmits this message wireless to a transceiver on the base station. The receiving transceiver forwards the message to the computer.

HARDWARE IMPLEMENTATION

The Glove Unit is the set of hardware that the user physically wears during operation of the Glove Mouse. It carries a PIC 16F 886 microcontrollers mounted onto a custom PCB designed. Connected to the glove's microcontroller are 5 contact pads, a 3-axis accelerometer, a wireless transceivers, 5different coloured LEDs, and a 4 pins of a 8-pin DIP switch. In order to detect and map user hand motions to mouse cursor movement, we chose to use accelerometers to measure hand tilt and orientation.

ACCELEROMETER

Specifically, we chose to use a Modern Device 3-Axis Accelerometer Module. The accelerometer consists of a surface capacitive sensing cell (g-cell) and a signal conditioning ASIC contained in a single package. The g-cell can be modelled as a set of beams attached to a movable central mass that move between fixed beams. The movable beams can be deflected from their rest position by subjecting the system to an acceleration .As the beams attached to the central mass move, the distance from them to the fixed beams on one side will increase by the same amount that the distance to the fixed beams on the other side decreases. The change in distance is a measure of acceleration.

The ASIC uses switched capacitor techniques to measure the g-cell capacitors and extract the acceleration data from the difference between the two capacitors. The ASIC also signal conditions and filters (switched capacitor) the signal, providing a high level output voltage that is ratio metric and proportional to acceleration.

The accelerometer reads the tilt of each axis and outputs each as an analog voltage. The three ports of MCU are connected to the tilt outputs of the accelerometer respectively. Then, each of the voltage value of tilt is converted to digital numbers. These numbers are converted to final mouse movement values by noise detection and scaling. In order to provide accurate mouse-motion and a user-friendly interface, several different types of post-processing are applied to the converted ADC values.

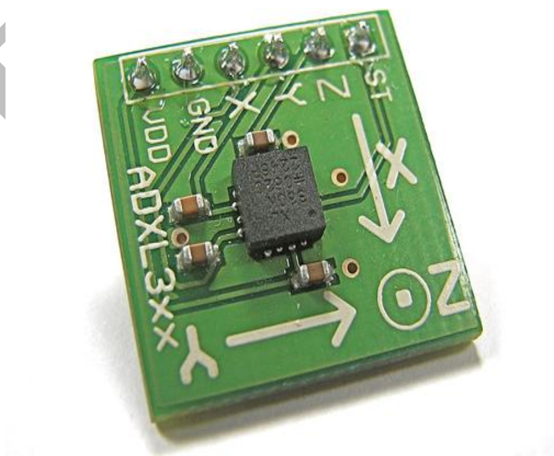


Figure 2 ACCELEROMETER

Analog-to-Digital Conversion

The PIC 16F 886 microcontroller contains several single-channel internal analog-to-digital converters (ADC), which each convert an analog input voltage signal to a digital value. The x, y, and z-axis tilt outputs of the accelerometer are connected to the ADC channel 2, 1, and 0. Once the ADC converts the tilt voltage value into digital bits, the digital numbers are stored in ADC data registers. The ADC channel modes are set up such that only the high byte of ADC data register is read.

TRANSMITTER SECTION

In the Transmitter part we use one RF module to send the data serially via radio frequency. We use 433 MHz radio frequency radio module to send data serially. Modulating frequency is 433 MHz and type is ASK .Whenever we want to send data we use encoder to convert the parallel data to serial. For selecting data base we use DIP switches. Here we use HT12E encoder IC to convert the parallel data to serial data.

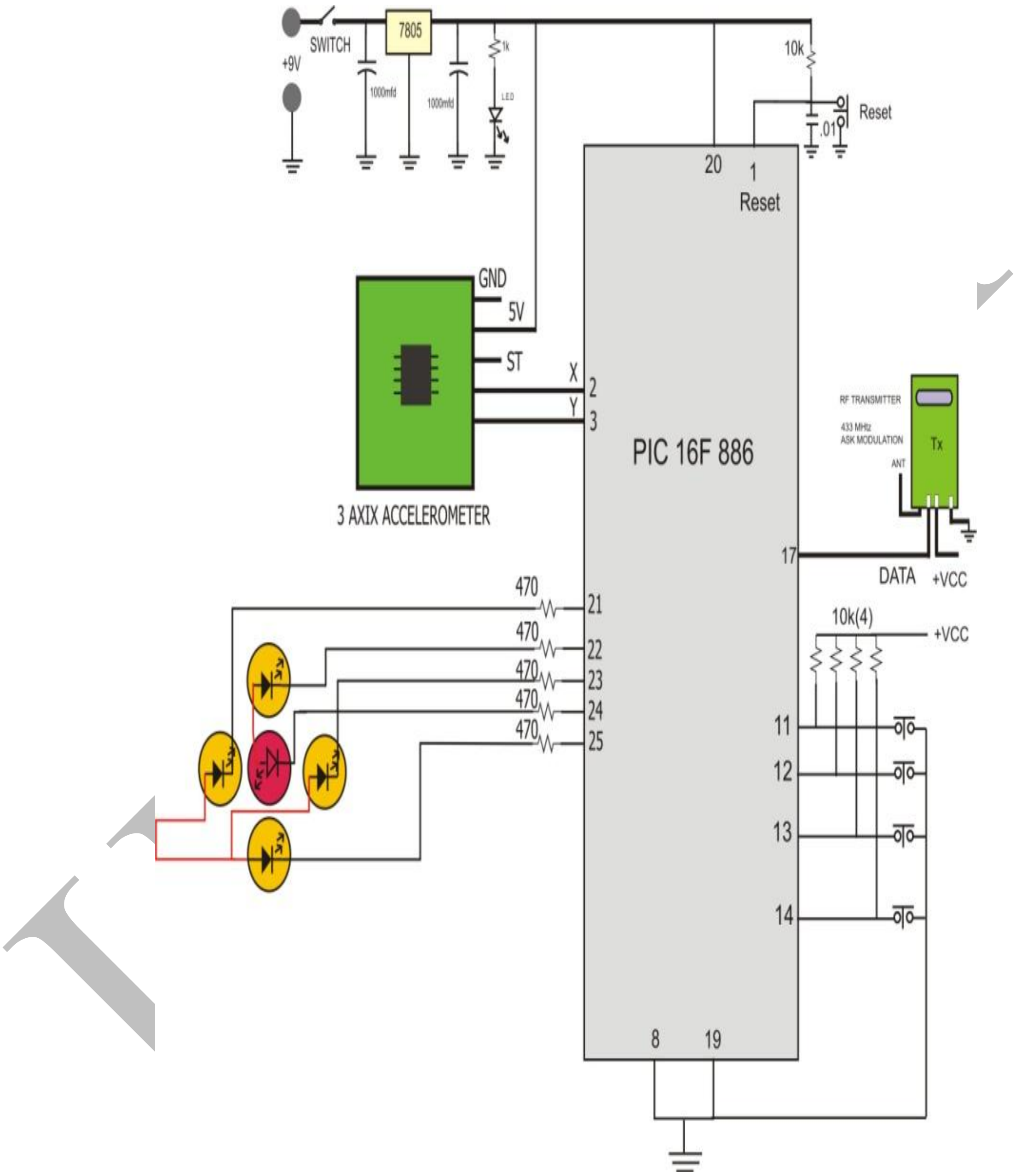
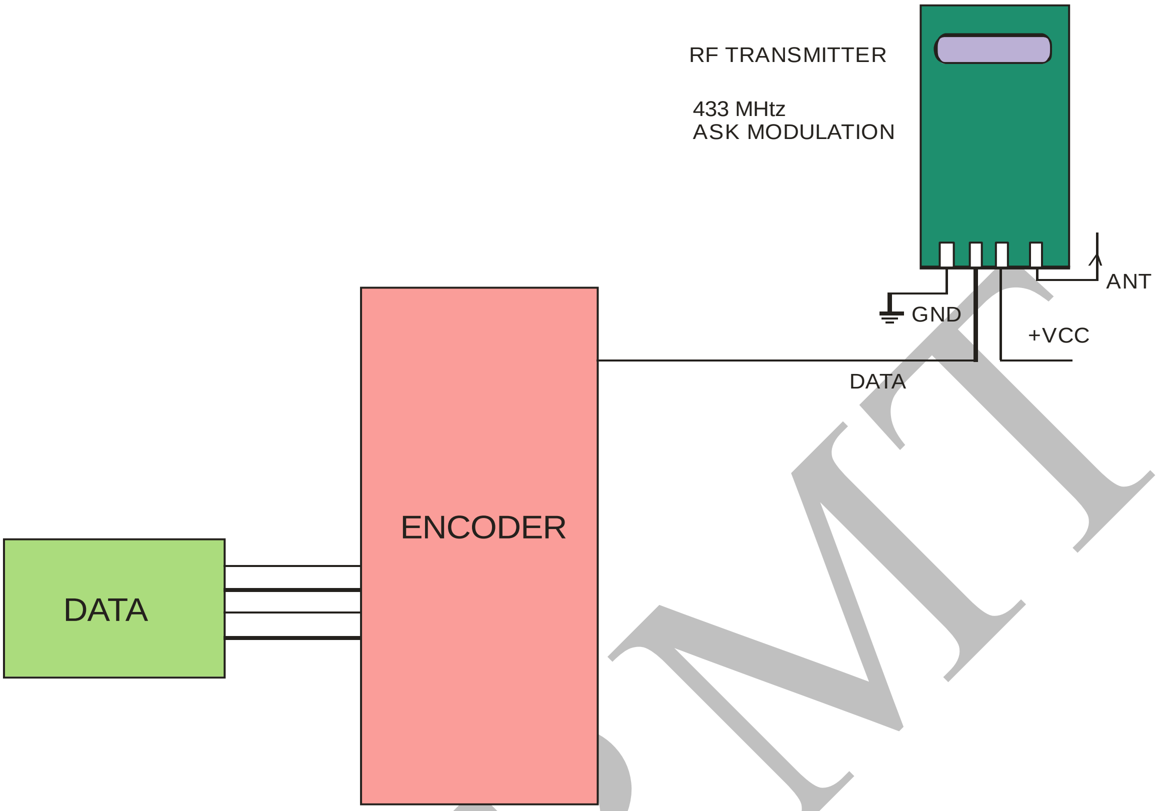
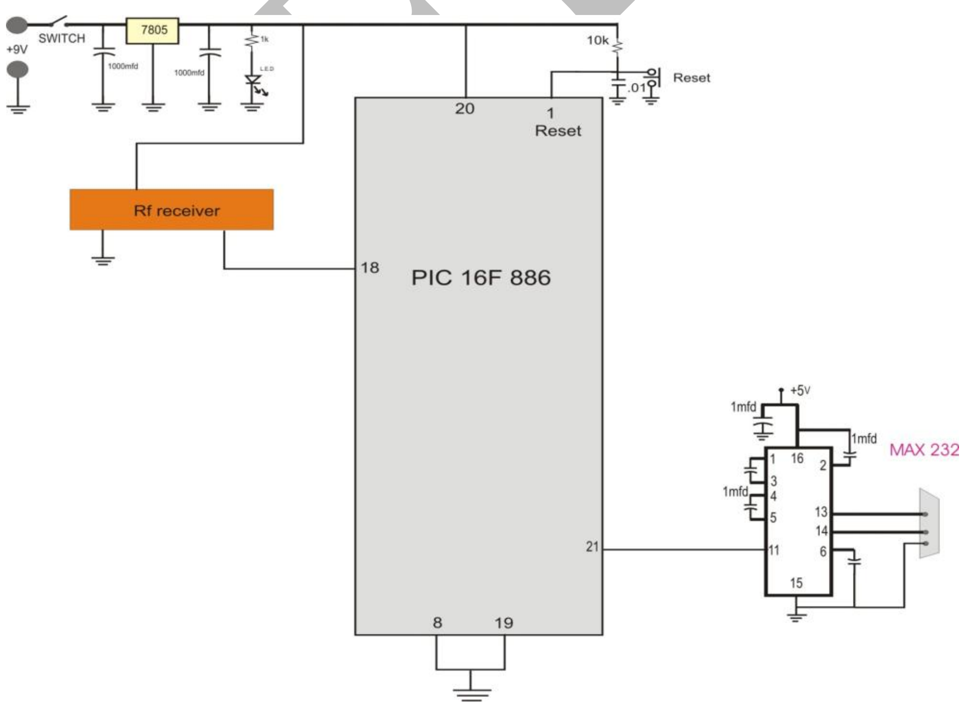


Figure 3 TRANSMITTER

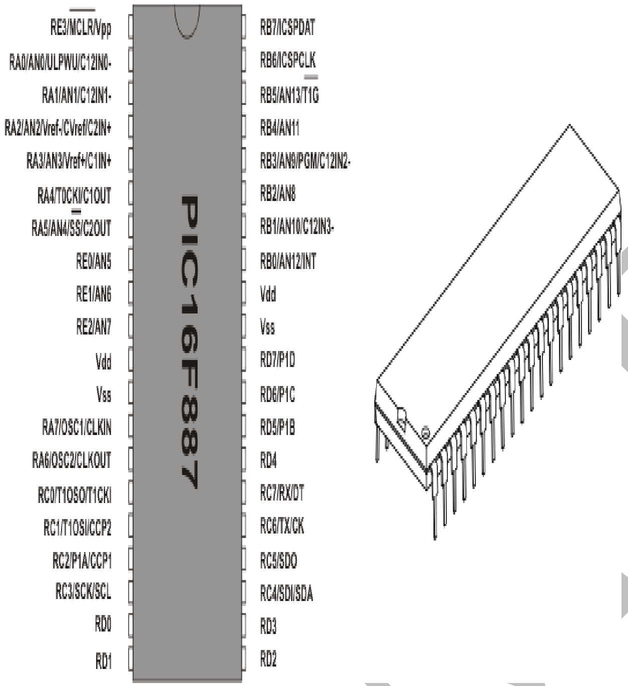
Whenever we want to send the data use encoder IC to convert the parallel data to serial data. This serial data is transmitting by radio frequency module in air. For selecting a database we use DIP switches. In actual practice we use external data base to selection. Here we use HT12E encoder IC which converts parallel data to serial data.



RECEIVER PART



RWS-434: The receiver also operates at 433.92MHz, and has a sensitivity of 3uV. The RWS-434 receiver operates from 4.5 to 5.5 volts-DC, and has both linear and digital outputs.



Microcontroller Core Features:
- High performance RISC CPU
- Only 35 single word instructions to learn
- Power saving SLEEP mode
- Selectable oscillator options
- Low power, high speed CMOS FLASH/EEPROM technology
- Fully static design
- Processor read/write access to program memory
- Wide operating voltage range: 2.0V to 5.5V
- Low-power consumption:

LIMITATIONS

The research is applicable to certain constraints and limitations. We developed only one hand's glove. More notably, users with differently sized hands/fingers, unable to fully control their fingers may, or unable to comfortably turn their wrists in all directions may have some difficulty in operating the glove. Primarily, we believe that a smaller wearable unit would be more practical for everyday use. Our project is built with a small budget in mind and with easily usable, but not necessarily the smallest, parts. A custom PCB could be used to simplify the physical construction. Additionally, higher resolution cursor movement could be attractive for commercialization.

Conclusion

This paper is designed to research on how accelerometer is used to sense hand movements and give response as mouse and how it is used as interface between human and machine. It is found that the static keyboard and mouse are having many limitations with them, while in the case with this device can be used for the same purpose removing certain limitations. The resulting found to be very good and efficient with real-time. This experiment proves that such devices are a good technological for interacting and controlling the devices, software or hardware. The device is usable to anyone who is able to use a standard computer mouse is able to pick up the glove and learn to use it. The device responds to user input fairly quickly. There is a slight delay on the order a several milliseconds when clicking and changing cursor direction. This very small and barely noticeable delay is due to how tightly we bound the several computations that take place in our interrupt service routine.

FUTURE WORK

The research described in this paper ends here, but there is enough research for the future. Throughout the research, which has been created by a single person's movement of the hand. The glove output is therefore limited to a single hand and since hands differ in size and freedom of motion, the question arises how the recognizer performs if used by others. In other words, there is a chance that the current hardware unit only performs accurate and fast for that single user, limiting its application. Eventually it is interesting to find out how users are able to perform with glove based gesturing. It can be used to type characters making computer independent of static keyboard and mouse. It can further be used for 3D mapping and sketching.

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