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Accelerometer based Portable Wireless Human Computer Interface Device for Disabled People

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ABSTRACT--In recent years the development of Human-Computer Interface (HCI)devices have been developed to helppeople with disabilities, for communication. However, the disabled with severe paralysis have only few ways to control and work with the applications. For those people, methods based on eye movement or blinking and voice can be used to support for the exchange of informationor message. In this project, we focus on implementing an portable kit with an EYE blink sensor based HCI and voice to text processor which is cost effective , portable and non-invasive.

KEYWORDS:HCI,IRsensor, RF module, Android Handset

INTRODUCTION

The advancement in science and technology has led to numerous development of devices for supporting the person with disabilities for communicating their needs, inconvenience and requirements. Various research issues have been addressed in different aspects . Currently the device are based on human control interface, which forms the main part of any device which is designed .The main constraint is that many people in our society cannot operate the standard “mouse” used to move the screen cursor due to disabilities.Using motion of the head is an option to rectify this problem.

We have decided to Implement HCI as the techniques that can work with the help of EYE BLINK SENSOR and MEMS SENSOR

EYE BLINK SENSOR

“Statistical models of appearance for eye tracking and eye blink detection and measurement”. Active Appearance Model(AAM) a proof-of- concept model for the eye region is created to determine the parameters that measure the degree of eye blinks. After developing an eye model, a blink detector is projected.

The main advantage of using AAM technique is that the detailed description of the eye is obtained and not just its rough location. The main drawback of AAM technique is that it is designed to work for a single individual and additionally the blink parameters have to be identified in advance.

“Simultaneous eye tracking and blink detection with interactive particle filters”. Eye position is found using eye recognition algorithm. Then these filters are used for eye tracking and blink detection. For describing state transition, auto regression models are used. A statistical active appearance model (AAM) is developed to track and detect eye blinking. The model has been designed for variations of head pose or gaze.

To properly devise this paper, the model parameters which encode the variations caused by blinking are determine and analyzed. This overall model is further extended using a series of sub-models to enable independent modeling and tracking of the two eye regions. Many techniques to enable measurement and detection of eye-blink are proposed and evaluated. The results of various tests on completely different image databases are presented to validate each model. “Communication via eye blinks- Detection and duration analysis in real-time” [6] Initial eye blink is employed to find the eyes. The algorithm detects the eye blinks. The “Blink link” prototype can be used in order to get in touch with the device. Simply by considering the motion information among two consecutive frames and determining that if this motion is caused by blink, eyes

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are tracked and monitored constantly. This system is a real-time system. The disadvantage of this system is that it can only handle long blinks and is not able to handle short blinks.

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GOAL OF THE SYSTEM

- Hands - free computing
- Facilitating the handicapped in using the computer
- Controlling the mouse pointer through eye movement
- Eye based human computer interaction provides real time eye tracking and eye-gaze estimation

OBJECTIVES OF THE SYSTEM

- Easy interaction with computer without using mouse
- Limitation of stationary head is eliminated.
- Pointer of the mouse will move on screen where the user will be looking & the clicks will be performed by blinking.
- Face detection has always been a vast research field in the computer vision world. Considering that it is the back bone of any application that deals with the human face. The face detection method can be organized in two categories:

Pupil tracking

Pupil tracking is a technique of gaze detection that is commonly used often in conjunction with different forms of tracking. There are several reasons for this; however, the main advantage is the notion of the "bright spot". Like the situation associated with red eye when taking flash photographs at night, infrared can used in pupil detection to form a high intensity bright spot that is easy to find with image processing. This bright spot occurs when infrared is reflected off the back of the pupil and magnified by the lens. The main advantage of pupil tracking is that as the border of the pupil is sharper than the limbus, a higher resolution is achievable. Also, as the pupil is never really covered by the eyelid, x-y tracking is more feasible as compared to Limbus tracking.

The disadvantage is that the difference in contrast is lower between the pupil and iris than between the iris and sclera-thus making the border detection more difficult. Now input medium turns to eye movements as a real time. Eye movement input is distinctly faster than other current input. Before the user operates any mechanical pointing device, he or she usually looks at the destination to which he or she wishes to move. Thus the eye movement is available as an indication of the user's goal before he or she could actuate any other input device. The eye is, of course, much more than a high-speed cursor positioning tool. Because of the upper and lower eyelid, etc., it is difficult to find the complete circular shape of the pupil.

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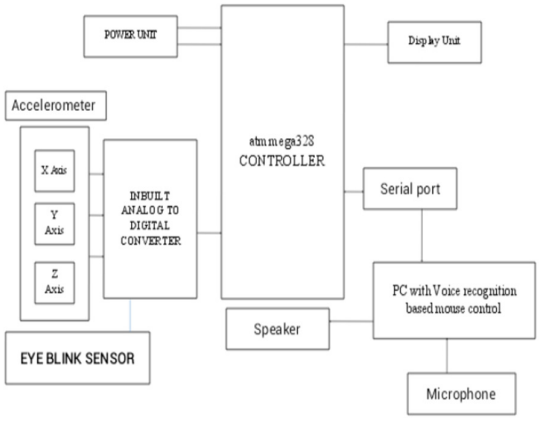
BLOCK DIAGRAM FOR HCI &VOICE TEXT



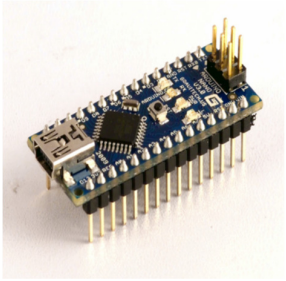
FEATUTRES

- EYE BLINK indication by LED
- Instant output digital signal for directly Connecting to microcontroller
- Compact Size
- Working Voltage +5V DC

MOUSE POINTER CONTROL

Left and right movement of the pupil in order to use the pupil to control the mouse pointer (cursor) on the screen, the central coordinate of the screen is set as a start point. This position is used as the base for gaze tracing, and the initial position of the mouse pointer is set as the centre of the screen. The moving position of the cursor takes the initial position as the base. As the pupil move to some direction, the coordinate of the mouse pointer on screen change according to the movement of the pupil. When the pupils return to the original position, the cursor stops moving. The horizontal movement of the pupil can be fully grasped by the movement of the circular objects. The vertical movement of the circular object is more subtle than the horizontal movement, so the size of the pupil is used for control. When people look upwards, the eyes are getting bigger. When looking downwards, the eyes are in slightly half-closed state. This phenomenon can be used for controlling the mouse pointer to move from top to bottom.

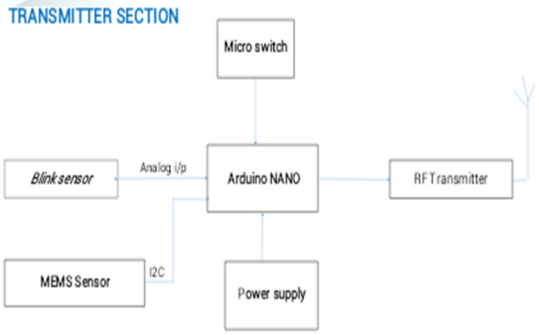
ARDUINO NANO



The Arduino Nano is a small, complete, and breadboard-friendly board based on the ATmega328 (Arduino Nano 3.0) or ATmega168 (Arduino Nano 2.x). It has more or less the same functionality of the Arduino Duemilanove, but in a different package. It lacks only a DC power jack, and works with a Mini-B USB cable instead of a standard one. The Nano was designed and is being produced by Gravitech.

The Arduino Nano can be powered via the Mini-B USB connection, 6-20V unregulated external power supply (pin 30), or 5V regulated external power supply (pin 27). The power source is automatically selected to the highest voltage source.

The FTDI FT232RL chip on the Nano is only powered if the board is being powered over USB. As a result, when running on external (non-USB) power, the 3.3V output (which is supplied by the FTDI chip) is not available and the RX and TX LEDs will flicker if digital pins 0 or 1 are high.



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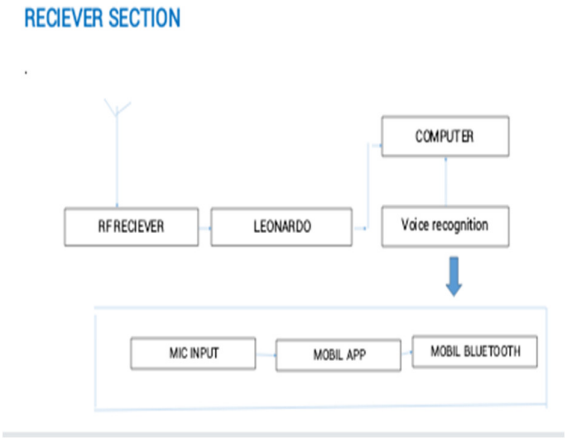
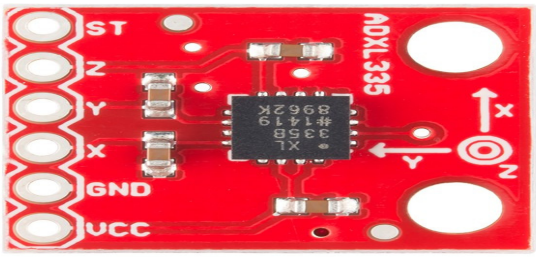


- 2 axis sensing (+x, -x, +y and –y axis).
- X axis for left and right motion.
- Y axis for forward and backward motions.
- Right and forward are the positive motions.



MEMS

Micro-electro-mechanical systems miniaturized mechanical and electro-mechanical elementshaving some sort of mechanical functionalityconvert a measured mechanical signal into an electricalsignal

The origins of what we now know as micro-electromechanical system (MEMS) technology can arguably be traced back to 1 April 1954, when a paper by Smith (1954), then at the Bell Telephone Laboratories, was published in Physical Review. This described for the first time certain stress-sensitive effects in silicon and germanium termed piezo resistance. During the mid-1950s, researchers were starting to investigate whether the same technologies that had yielded the transistor, which subsequently revolutionised the fledgling electronics industry, could be applied to sensors.

Accelerometers have undergone a similar technological evolution and many are fabricated by Advance d surface micromachining techniques which allow them to sense in one, two or three axes (Figure 3). Many also feature on-chip electronics, over-range stops and self-test functions but the previously mentioned yaw-rate sensors, which feature very complex geometries, are probably the most sophisticated MEMS sensors yet to enjoy high volume production (Figure 4). However, these do not even approach the complexity of

Texas Instrument's digital micromirror devices (DMDs). An accelerometer is needed to sense the head motion.

RF Module

The TX is an ASK transmitter module. The result is excellent performance in a simple-to-use. The TX is designed specifically for remote-control, wireless mouse and car alarm system operating at 315/433.92 MHz's The RX is a miniature receiver module that receives On-off keyed modulation signal and demodulated to digital signal for the next decoder stage.The result is excellent performance in a simple-to-use, with a low external component count. The RX is designed specifically for remote-control and wireless security receiver operating at 315/434Mhz.

Transmitter: Power supply and/or modulation input voltage: 2.2 to 5.5V.

Operating temperature: -40 to +80C.

Receiver: Power supply and/or modulation input voltage:5V.

Operating temperature: -20 to +80C.

HARDWARE COMPONENT

- AURDINO NANO (ATMEGA328) MICROCONTROLLER
- EYE BLINK SENSOR
- MEMS USING IN ACCELEROMETER
- LEONARDO
- MICRO SWITCH
- POWER SUPPLY
- RF TRANSMITTER, RECEIVER

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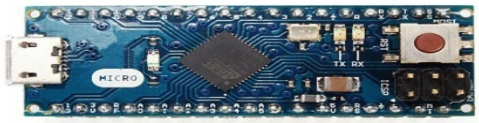
- ANDROID MOBILE
- Input Voltage (limits)6-20V

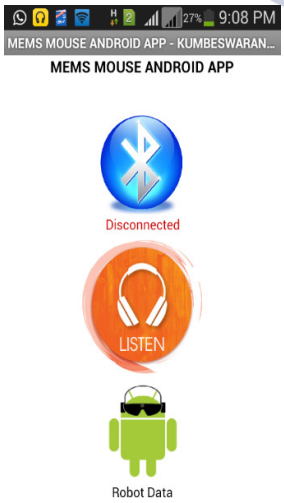
LEONARDO

- ATmega32u4 it has 20 digital input/output pins (of which 7 can be used as PWM outputs and 12 as analogy inputs), a 16 MHz crystal oscillator.
- Microcontroller ATmega32u4.
- Operating Voltage 5V.
- Input Voltage (Recommended)7-12V.



VOICE TEXT

- Mems mouse android app helps us to starts the system software applications by pairing Bluetooth connection.
- The Bluetooth connection is between the pc and android mobile.
- Mems mouse android app has the listen option to hear the voice.



ADVANTAGES

- Comfortable to use for disabled.
- Possibilities for error is minimum.

APPLICATION

- Hand free mouse for disabled persons.
- physically challenged people
- Used in teaching field

CONCLUSION

The main advantage of this paper is to eliminate the disability for the handicapped people so that they can enjoy this world as a normal human being are enjoying. Those people can control or operate all the computer application by the gesture of their eye movement and the interactive application are done by their tooth click and also gaming, swapping, page scrolling, etc.

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