# BAŞ HAREKETLERİYLE KLAVYE VE FARE KONTROLU

## CONTROLLING COMPUTER MOUSE AND KEYBOARD USING A HEAD MOUNTED ACCELEROMETER

**Cihat Keser , Esin Onbaşıoğlu**

**Bilgisayar Mühendisliği Bölümü, Yeditepe Üniversitesi**

## Özet

Bu projede, klavye ve fare hareketlerinin başa takılan bir kablosuz sensör (akselerometre) aracılığıyla kontrol edilmesi hedeflenmiştir. Başın sağa, sola, öne ve arkaya hareket ettirilmesiyle elde edilen konum bilgisi ekranda farenin hareketini sağlamaktadır. Tıklama işlemi başın bir yöne hızlıca hareket ettirilmesiyle olmaktadır. Ayrıca ekranda görünen ve özel olarak tasarlanmış bir sanal klavye mevcuttur. Baş hareketleriyle bu klavye üzerinde imleç (cursor) hareket ettirilerek harfler seçilebilmekte, böylece metin yazmak mümkün olmaktadır.

## Abstract

This project aims to provide an alternative way of interaction with a computer, for those who do not prefer or unable to use the traditional human computer interfaces, namely mouse and keyboard, and this goal is achieved by utilizing an untraditional hardware instead, the accelerometer. A head mounted and wireless accelerometer device is used to detect acceleration caused by head movements of the user in three axes and the provided data are collected by software on the target computer. Software, then, estimates the pitch and roll tilt in degrees by analyzing the collected acceleration data. These tilt data are then used to simulate mouse cursor movement and clicking on target computer. Also, to simulate keyboard input, software provides an on screen keyboard interface to user where, the cursor movements are used to navigate through keys. Software, also, has a calibration process that, determines the system's current conditions and user's movement characteristics.

## Introduction

There is a need for alternative human computer interface (HCI) channels other than the traditional mouse and keyboard, to make computers easily accessible by everyone including disabled people.

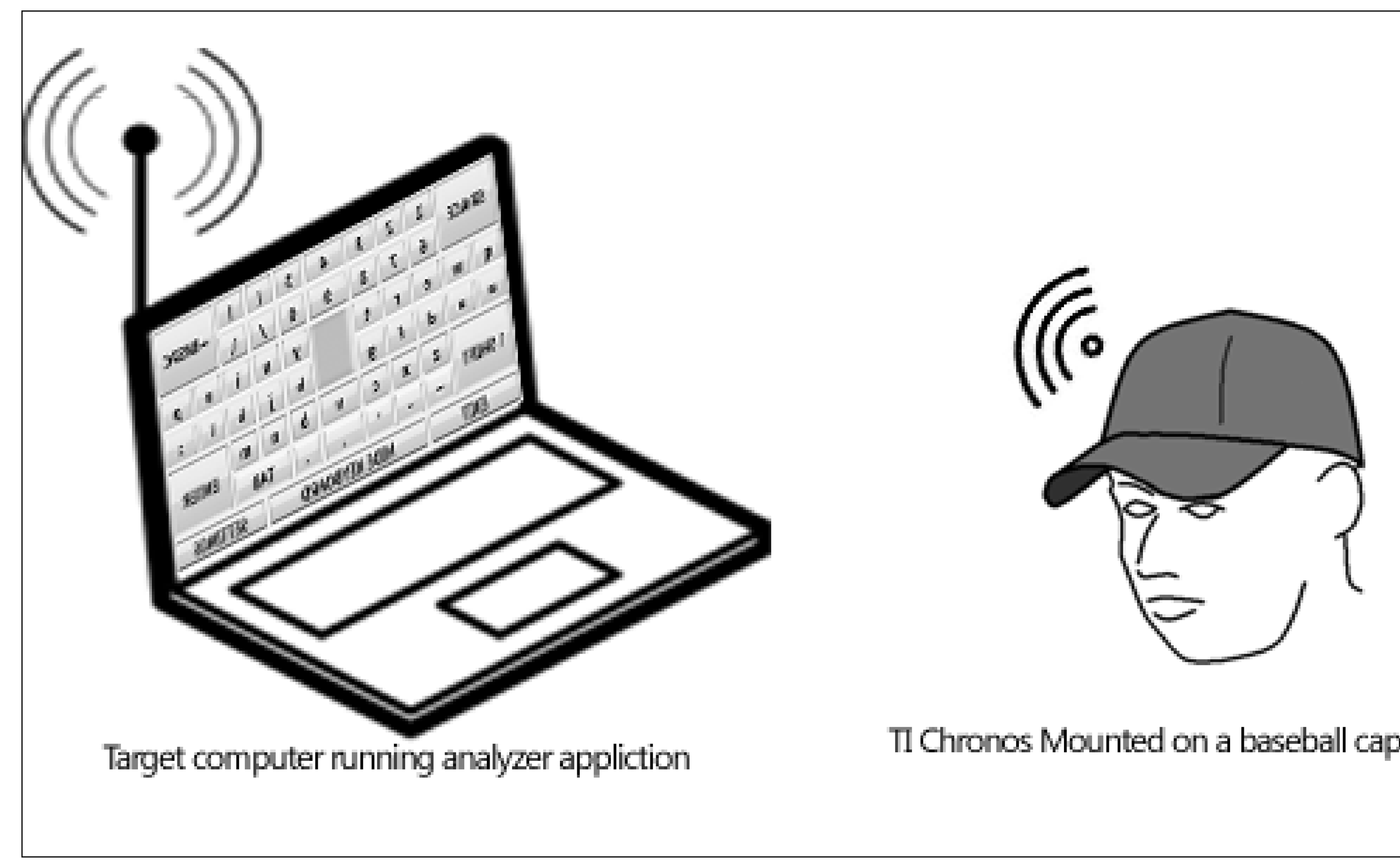
The main purpose of this project is to provide a feasible alternative HCI channel for disabled people. Since, there are many different set of requirements from different user groups, this project mainly focuses on users who are at least able to move their heads.

## Materials and Methods

Considering the intended user base's input (head movements), this project uses an accelerometer (to be precise, a reference development platform for a microcontroller unit, which includes an accelerometer, the Texas Instruments eZ430-Chronos Wireless Watch Development Tool (TI Chronos)) to detect that input without requiring expensive hardware. Acceleration data caused by head movements are transferred wirelessly from TI Chronos to the computer to be controlled (the target computer) and an analyzer application runs on the target computer to translate head movements to mouse and keyboard events. This application provides the user with two operation modes: mouse control and keyboard control modes.

## Contacts:

ckeser@gmail.com
esin@cse.yeditepe.edu.tr




Mouse cursor movement is controlled by user simply tilting his/her head in the direction he/she wants to move the mouse cursor to. To provide movement asisstance, a simple speed adaptable relative mapping algorithm is used, which allows movement speed of mouse cursor to increase as the user tilts head more and decrease as the user tilts head less. Mouse click events are triggered when the user quickly tilts head in a direction, which defines the mouse button (left/right) to be clicked, and returns to normal position.

Keyboard control is achieved by the application by providing a customized on screen keyboard (OSK) to the user. To select keys on this OSK, user tilts his/her head at the direction of the desired key. To press on a key, user needs to wait for a customizable amount of time in the tilted head position, where the desired key is shown as selected on screen.


## Conclusion

Keyboard typing performance is on par with similar (commercial) systems, scoring an average 12 characters per minute. Precision of the input data obtained by using a single accelerometer was barely enough to provide smooth key navigation. Using two accelerometers would benefit the system accuracy as well as the jitters with the keyboard navigation.

Mouse cursor control is adequate for basic usage. As a future work speed adaptation algorithm can be improved to provide more dynamic behavior.