Project Proposal

By Tolle Sudore

Project Name:

Controlling Mobile Devices via Gesture Recognition

Group Name:

Tolle Sudore

Project Developers (Group Members):

Name	Id	Role	E-mail	GSM
Mehmet Çağdaş Akar	1630524	Designer	cagdas.akar@gmail.com	+905066197815
Çağrı Aslanbaş	1630607	Devil's Advocate	aslanbascagri@gmail.com	+905552949494
Uğur Baltacı	1559962	Leader	me@ugurbaltaci.com	+905416258925
Cem Ekici	1560119	Reporter	cemekici@gmail.com	+905555623644

Sponsor:

Kade Bilişim Tekonolojileri ve Güvenlik Sistemleri Ltd. Şti.

KADE information technology is the leading company in the video analysis and image processing sector with its projects and products about security, data collection and process-system recovery for military, civil and private sector.

Motivation and Purpose:

With the improvement of technology, Human Computer Interaction (HCI) is getting more and more important. In order to interact with computer based systems, static keys/buttons, track path devices and touch screens have developed respectively. Below are the two important inventions in human computer interaction era in the past:

1. The mouse was invented in Stanford Laboratory and was made famous as a practical input device by Xerox PARC in the 1970's. It first appeared commercially as part of the Xerox and Apple[1]. Then Apple asked a group of guys fresh from Stanford's product design program to take a $400 device and make it mass-producible, reliable and cheap. Their work transformed personal computing[2].

2. After Apple developed multi-touch technology and produced portable media players, smartphones and tablet computers, the market share of these productions increased rapidly. For example, iPhone was invented in 2007 and Android was invented in 2008, smartphones world had met a new concept. In 2008, market share of iPhone and Android was only 14%, but in 2009 market share grew more than two times, it was 31%[3].
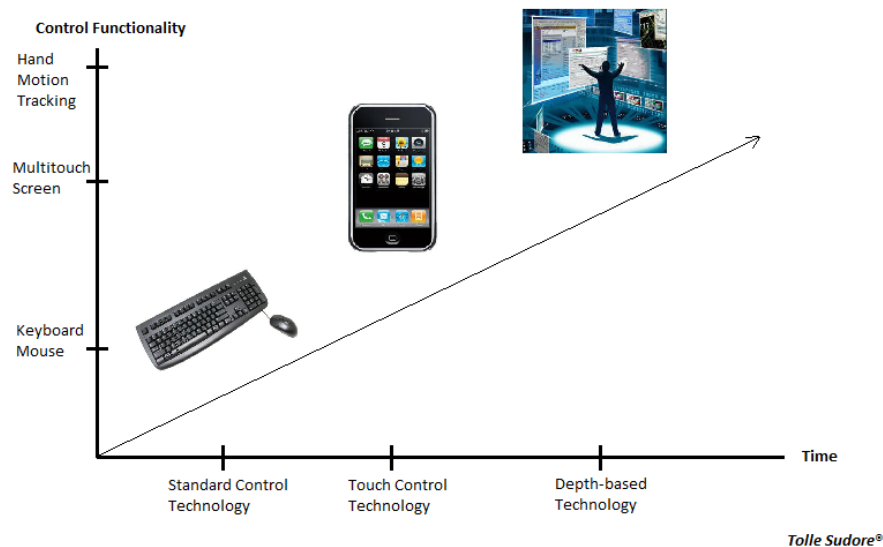

Figure 1. Human Computer Interaction History

We believe that the next concept will let people use computers without touching. Gesture recognition and motion tracking are the next improvement of interaction with computers. Moreover, we know that in near future, smartphones will have more powerful "new generation" processors (like Intel Atom) since KADE is the gold partner of Intel. Control of these smartphones will be done via gesture recognition.

Besides, many companies that produce mobile devices make use of stereovision technology for better recognition of hand gestures. This stereovision technology extracts 3D depth information map by images provided from two parallel cameras. One pioneering company in this technology is Lenovo which had developed Lenovo Ideapad U1 Hybrid[4], a new generation smartphone that has two integrated cameras.

The main goal behind this project is to recognize basic human gestures (hand and face gestures) with two cameras and process them to control a mobile device.

Project Description:

The technologies available about this topic are not efficient meaning that current processors in mobile devices are not enough to compute very complex pattern recognition algorithms in real time. Basic solutions which process static images are available on mobile devices and most of them are using extra equipment to recognize gestures such as special gloves or pointer devices.

We are implementing this project on processors which offer more computing power; but our project cannot be run on mobile devices right now, therefore, we are going to implement this project by using Intel's desktop processors on MeeGo Operating System.

- MeeGo is an open source mobile operating system of Intel and Nokia, which is based on Linux. It is the combination of Intel's Moblin and Nokia's Maemo in one project. Main goal of MeeGo is to act as an operating system for hardware platforms like mobile phones, tablet PC's, smart phones.

System will use pattern recognition algorithms for gesture recognition. Hand tracking, gestures of hand and face recognition are the core of our project. We are aiming to reduce effects of complex backgrounds while recognition process. If we achieve that, we will come up with a new algorithm and may publish academic paper. Obviously, our project has some limitations like gestures with little differences cannot be differentiated. Also, arranging the optic flow will be tough, background of user will be dynamic since our solution will used in mobile devices.

We are going to implement a smartphone menu on computer and take advantage of stereovision by using two cameras. By using this menu we are going to implement, users can make calls or send text messages, control his/her personal music or image libraries via hand gestures, namely without touching the phone. Furthermore, lock screen of the phone will be unlocked by face recognition.

Briefly, below are the software tools we are using:

Language: C++

Libraries: OpenCV[5], QT[6]

Operating System: MeeGo[7] and Ubuntu

Literature Research:

1. A Robust Method for Hand Tracking Using Mean-shift Algorithm and Kalman Filter in Stereo Color Image Sequences - Mahmoud Elmezain, Ayoub Al-Hamadi, Robert Niese, and Bernd Michaelis[9].

2. A Hidden Markov Model-Based Isolated and Meaningful Hand Gesture Recognition Mahmoud Elmezain, Ayoub Al-Hamadi, Jörg Appenrodt, and Bernd Michaelis[10].

Market Research:

1. **NIPPON SYSTEMWARE's Gesture Recognition Software:** *DigInfo*

   NSW, a company that develops computer hardware, software and various IT solutions, has developed Gesture Recognition Software which can recognize the shape and color of the operator's hand and can differentiate the movement of the hand from other moving objects in the background.

   NSW is using this as an input method for controlling computers via cursor as the hand moves.

2. **Evoluce:** *Evoluce ONE*

   Evoluce, a German company pioneering display technology, has developed Evoluce ONE, a 47-inch Multi-touch HD LCD Screen with gesture recognition which enables users to control multi-touch applications through gestures made right above the screen, without touching it. Hand gestures such as mid-air scrolling, rotating, stretching, shrinking, or pivoting motions are immediately registered and translated into screen actions such as pinch and zoom, screen transition or application dismissal.

The examples market research stated above are working on only PCs and do not give a good result or use extra equipment for fully functioning. As we said above, hopefully our innovative solution opens new market area for mobile devices.

References:

(1) A Brief History Human Computer Interaction Technology, Brad A. Myers
http://www.cs.cmu.edu/~amulet/papers/uihistory.tr.html

(2) Mighty Mouse, Alex Soojung-Kim Pang
http://www.stanfordalumni.org/news/magazine/2002/marapr/features/mouse.html

(3) Gartner Says Worldwide Mobile Device Sales Grew 13.8 Percent in Second Quarter of 2010, But Competition Drove Prices Down
http://www.gartner.com/it/page.jsp?id=1421013

(4) New chips power smart books, tablets and smartphones
http://lenovoideapad.org/content/new-chips-power-smartbooks-tablets-and-smartphones

(5) OpenCV
http://opencv.willowgarage.com

(6) QT Library
http://qt.nokia.com

(7) MeeGo
http://www.meego.com

(8) Hidden Markov Model
http://en.wikipedia.org/wiki/Hidden_Markov_model

(9) Kalman Filter
http://en.wikipedia.org/wiki/Kalman_filter