Feature Design Scheme for Kinect based Hand Written Recognition

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Abstract:
The main aim of the paper is to evaluate the performance of an operating system on an embedded system. Before delving into its implementation, an introduction is needed to the parts involved in the paper. The whole report is revolved around the field of embedded systems and the use of Linux to run applications on them. Hence an introduction to embedded systems using Linux OS is provided. Digital pen with trajectory recognition can be done by using accelerometer, the digital pen consists of a tri-axial accelerometer, a microcontroller, and an RF wireless transmission module for sensing and collecting accelerations of hand writing and gesture trajectories. Our embedded paper first extract the time and frequency-domain features from the acceleration signals and then transmits the signals by using RF transmitter. In receiver section RF signals can be received by RF receiver and given to microcontroller. The controller processes the information and finally the results can be displayed on Graphical LCD. In proposed system, we are going to use webcam, ARM microcontroller and display unit. Here, whatever we draw in front of the camera by using hand is going to be displayed on the display unit.

I.INTRODUCTION
Kinect simultaneously captures depth and color information and provides real-time, reliable 3D full-body human-pose reconstruction that essentially turns the human body into a controller. Kinect has opened a new era for more advanced and natural Human-Computer Interface (HCI), and many exciting applications, from gaming to the medical field, have been developed. In this paper, we present a finger writing system that recognizes characters written in the air without the need for an extra handheld device. This application would allow for brand-new Natural User Interaction (NUI) experiences, especially for remote applications. It is believed that Human-Computer Interface is becoming increasingly similar to the interaction among people. A traditional method to communicate with machines is by keyboard and mouse. In recent years, more advanced remote controller's such as the Nintendo Wii remote and touch screens have been widely used and enjoyed by users. However, a handheld device is still needed. We propose using a hand to write in the air by treating the finger tip as a virtual pen. Using Kinect system, users gives input characters by moving their hands, enjoying a full-body-controlled experience. The remote input could enable several real-world services such as remote signatures. Writing in the air with hands can serve as a fun way to teach young students how to write. The finger writing in the air system based on Kinect allows the user to write in the air in a natural, unconstrained way that might be an essential component for the next generation of HCI. The paper is aimed at evaluating the performance of an operating system on an embedded system. Before delving into its implementation, an introduction is needed to the parts involved in the paper. The whole report is centered around the field of embedded systems and the use of Linux to run applications on them. Hence an introduction to Embedded Systems and using Linux as an OS in them is provided. An embedded system is a special purpose computer system that is designed to perform very small sets of design at activities. In 1960s, Embedded Systems used control electromechanical telephone switches. The first recognizable embedded system was the Apollo Guidance Computer developed by Charles Draper and his team. Later they found their way into the military, medical sciences and the aerospace and auto mobile industries.

II.PROPOSED SYSTEM
In Proposed System, We are going to use webcam, ARM Microcontroller and display unit. Here, we are using pen or hand for drawing in front of the camera then whatever we are going to draw in front of it will be displayed on the display unit. Our Embedded System is capable of translating time-series acceleration signals into important feature vectors. Users can use the pen to write digits or make hand gestures etc. can be displayed on the display unit.

Block Diagram:

Fig: 1. Block Diagram

III.HARDWARE IMPLEMENTATION
A. Raspberry Pi:

Figure: 2. Raspberry pi
The Raspberry Pi is a credit-card-sized single-board computer developed in the UK by the Raspberry Pi Foundation with the intention of promoting the teaching of basic computer science in schools. The Raspberry Pi is manufactured in two board configurations through licensed manufacturing deals with Newark element14, RS Components and Egoman. These companies sell the Raspberry Pi online. Egoman produces a version for distribution solely in China and Taiwan, which can be distinguished from other Pis by their red coloring and lack of FCC/CE marks. The hardware is the same across all manufacturers. The Raspberry Pi has a Broadcom BCM2835 System On a Chip (SoC), which includes an ARM1176JZF-S 700 MHz processor, Video Core IV GPU, and was originally shipped with 256 megabytes of RAM, later upgraded to 512 MB. It does not include a built-in hard disk or solid-state drive, but uses an SD card for booting and persistent storage.

Figure: 3.Main Programming Language, With Support for BBC BASIC

The Foundation provides Debian and Arch Linux ARM distributions for download. Tools are available for Python as the main programming language, with support for BBC BASIC via the RISC OS image or the Brandy Basic clone for Linux, C, Java and Perl.

B. Display unit:
TFT stands for Thin Film Transistor, and is a type of technology used to improve the image quality of an LCD. Each pixel on a TFT-LCD has its own transistor on the glass itself, which offers more control over the images and colors that it renders. While TFT-LCDs can deliver sharp images, they also tend to offer relatively poor viewing angles, meaning they look best when viewed head-on. If you view a TFT-LCD from the side, it can be difficult to see. TFT-LCDs also consume more power than other types of cell phone displays.

C. UVC Driver Camera:

Figure: 4. UVC Driver camera
A Universal Video Class (UVC) driver is a USB-category driver. A driver enables a device, such as your webcam, to communicate with your computer’s operating system. And Universal Serial Bus (USB) is a common type of connection that allows for high-speed data transfer. Most current operating systems support UVC. Although UVC is a relatively new format, it is quickly becoming common.

There are two kinds of webcam drivers:
1. The one included with the installation disc that came with your product. For your webcam to work properly, this driver requires some time to install. It is specifically tuned for your webcam, designed by your webcam manufacturer and optimized for webcam performance.
2. A UVC driver:- You can only use one driver at a time, but either one will allow you to use your webcam with various applications.

The following Logitech webcams support UVC: Logitech QuickCam Pro 9000 for Business, Logitech QuickCam Pro for Notebooks Business, Logitech QuickCam Communicate MP for Business, Logitech QuickCam Deluxe for Notebooks Business, Logitech QuickCam 3000 for Business.

IV. SOFTWARE REQUIREMENTS

A. Linux Operating System:

Linux or GNU/Linux is a free and open source software operating system for computers. The operating system is a collection of the basic instructions that tell the electronic parts of the computer what to do and how to work. Free and Open Source Software (FOSS) means that everyone has the freedom to use it, see how it works, and changes it. There is a lot of software for Linux, and since Linux is free software it means that none of the software will put any license restrictions on users. This is one of the reasons why many people like to use Linux. A Linux-based system is a modular Unix-like operating system. It derives much of its basic design from principles established in UNIX during the 1970s and 1980s. Such a system uses a monolithic kernel, the Linux kernel, which handles process control, networking, and peripheral and file system access. Device drivers are either integrated directly with the kernel or added as modules loaded while the system is running.

Figure: 5. Architecture of Linux Operating System

B. Qt for Embedded Linux:

Qt is a cross-platform application framework that is widely used for developing application software with a Graphical User
Interface (GUI) in which cases Qt is classified as a widget toolkit, and also used for developing non-GUI programs such as command-line tools and consoles for servers. Qt uses standard C++ but makes extensive use of a special code generator called the Meta Object Compiler (MOC) together with several macros to enrich the language. Qt can also be used in several other programming languages via language bindings. It runs on the major desktop platforms and some of the mobile platforms. Non-GUI features include SQL database access, XML parsing; thread management, network support, and a unified cross-platform application programming interface for file handling.

C.Open CV:
Open CV (Open Source Computer Vision) is a library of programming functions for real time computer vision. It is developed by Willow Garage, which is also the organization behind the famous Robot Operating System (ROS). Now you’d say MATLAB also can do Image Processing, then why open CV? Stated below are some differences between both. Once you go through them, you can decide for yourself. Advantages of OpenCV over MATLAB (Collected from various blogs/forums):

- **Speed**: Matlab is built on Java, and Java is built upon C. So when you run a Matlab program, your computer is busy trying to interpret all that Matlab code. Then it turns it into Java, and then finally executes the code. Open CV on the other hand, is basically a library of functions written in C/C++. You are closer to directly provide machine language code to the computer to get executed. So ultimately you get more image processing done for your computers processing cycles, and not more interpreting. As a result of this, programs written in Open CV run much faster than similar programs written in Matlab. So, conclusion? Open CV is damn fast when it comes to speed of execution. For example, we might write a small program to detect people’s smiles in a sequence of video frames. In Matlab, we would typically get 3-4 frames analyzed per second. In Open CV, we would get at least 30 frames per second, resulting in real-time detection.

- **Resources needed**: Due to the high level nature of Matlab, it uses a lot of your systems resources. And I mean A LOT! Matlab code requires over a gig of RAM to run through video. In comparison, typical Open CV programs only require ~70mb of RAM to run in real-time. The difference as you can easily see is huge!

- **Cost**: List price for the base (no toolboxes) MATLAB (commercial, single user License) is around USD 2150. Open CV (BSD license) is free!

- **Portability**: MATLAB and Open CV run equally well on Windows, Linux and Mac OS. However, when it comes to Open CV, any device that can run C, can, in all probability, run Open CV.

V.RESULTS
CONCLUSION
The project titled “Feature Design Scheme for Kinect Based Hand Written Recognition” has been successfully designed and tested. It has been developed by integrating features of all the hardware components and software used. Presence of every module has been reasoned out and placed carefully thus contributing to the best working of the unit. Secondly, using highly advanced ARM board and with the help of growing technology the project has been successfully implemented.

REFERENCE


