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Design and Implementation of Finger Writing In Air by Using Open CV (Computer Vision) Library on Arm Platform

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Abstract:The Main Aim of the project is to design "A Kinect Sensor for Finger Writing in the Air" Evaluating the performance of an operating system on an embedded before delving into its implementation, an introduction is needed to the parts involved in the project. 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 asanOS in them 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. In receiver section RF signals can be received by RF receiver and given to microcontroller. Thecontroller processes the information and finally the results can be displayed on Graphical LCD. In proposed system, going to use web cam, ARM microcontroller and display unit. Here, using pen or hand for drawing in front of the camera then what ever going to draw in front of it will be displayed on the display unit

Keywords: Notebook computer, Desktop computer, Cemara, USB Cable, Common Unix Printing Method, Raspberry pi

I. INTRODUCTION

The project 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 project. 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 designated activities. Embedded systems date back as early as the late 1960s where they used to control electromechanical telephone switches. The first recognizable embedded system was the Apollo Guidance Computer developed by Charles Draperandh is team. Later they found their way into the military, medical sciences and the aerospace and automobile industries

II. LITERATURE SURVEY

With embedded systems fast expanding its reach, subject matter related to this field is available in abundance. While working on this project we have studied matter from various sources such as books, online articles and reference manuals. The knowledge gained from this activity has been of great help to us in understanding the basic concepts related to our project and has ignited further interest in this topic.

"Linux for Embedded and Real time Applications", by Doug Abbott has been of great help in providing an introduction to the process of building embedded systems in Linux. It has helped us understand the process of configuring and building the Linux kernel and installing tool chains. We understood the preponderance of the ARM processors in the field of embedded systems and the features of ARM processors from the document "The ARM Architecture" by Leonid Ryzhyk. The ARM architecture is a confluence of many useful features that makes it better than other peer processors. Being small in size and requiring less power, they prove useful in providing an efficient performance in embedded applications.

III. METHODOLOGY

A. Existing System

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

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trajectories. Our embedded project first extracts 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.

B. Proposed System

In proposed system, going to use web cam, ARM microcontroller and display unit. Here, using pen or hand for drawing in front of the camera then what ever 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.

IV. BLOCK DIAGRAM

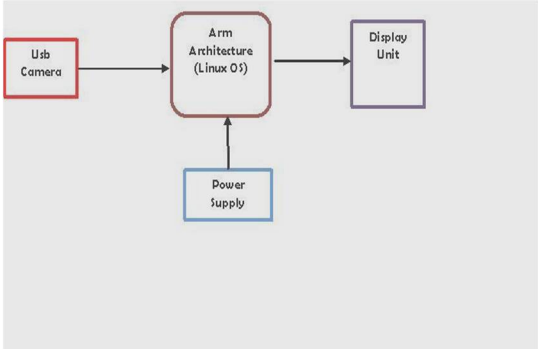

FIG 1.Block Diagram

V. HARDWARE MODULES

A. Raspberry Pi Board

The Raspberry Pi is a charge card estimated single-board PC grew in the UK by the Raspberry Pi Foundation with the expectation of advancing the instructing of fundamental software engineering in schools. The Raspberry Pi is made in two board arrangements through authorized assembling manages Newark element14 (Premier Farnell), RS Components and Egoman. These organizations offer the Raspberry Pi on the web. Egoman produces a form for appropriation exclusively in China and Taiwan, which can be recognized from different Pis by their red shading and absence of FCC/CE marks. The equipment is the same over all makers.

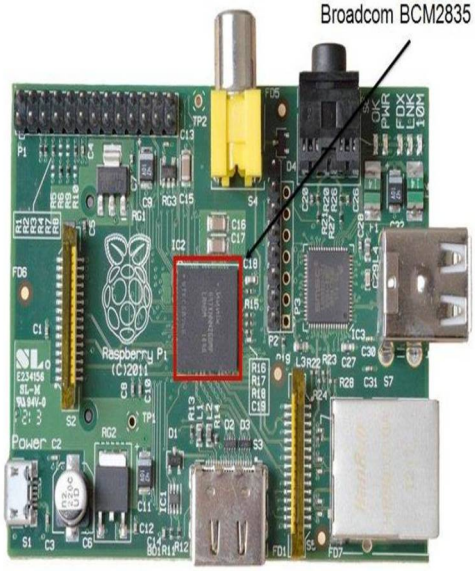

Fig 3.Raspberry Pi Board

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1) BCM2835 Features:

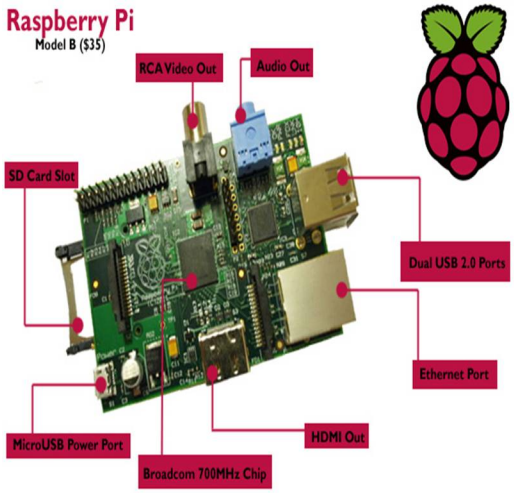

Fig 3.1: Raspberry pi features

a) Broadcom BCM2835 with 700MHz ARM1176JZFS processor with Video core 4 GPU and FPU.
b) 512Mega Bytes of RAM.
c) High-Definition Multimedia Interface video socket.
d) 2 x USB 2.0 sockets.
e) RCA composite video socket.
f) SDHC Class 6 Card.
g) StorageDevice card socket.
h) Powered with micro USB socket.
i) 3.5mm audio out jack.
j) Raspberry pi Size: 85.6 x 53.98 x 17mm.

B. Raspberry Pi Specifications

1) UVC Driver Camera: AUVC (or Universal Video Class) driver is a USB-category driver. A driver enables a device, such as your web cam, to communicate with your computer's operating system. And USB (or Universal Serial Bus) is a common type of connection that allows for high-speed data transfer. Devices that are equipped with a UVC driver, such as the Logitech® Quick Cam® Pro9000 for Business are capable of streaming video.

Fig 3.2 UVC driver camera

Chip	Broadcom BCM2835 SOC
Core architecture	ARM11
CPU	700 MHz Low Power ARM1176JZFS Applications Processor
GPU	Dual Core Video Core IV Multimedia Co- Processor Provides Open GL ES 2.0, hardware- accelerated OpenVG, and 1080p30 H.264 high-profile decode Capable of 1Gpixel/s, 1.5Gtexel/s or 24GFLOPs with texture filtering and DMA infrastructure
Memory	512MB SDRAM
Operating System	Boots from SD card running a version of the Linux operating system
Dimensions	85.6 x 53.98 x 17mm
Power	Micro USB socket 5V, 1.2A

2) Display Unit: HD TVs and many LCD monitors can be connected using a full-size 'male' HDMI cable, and with an inexpensive adaptor if DVI is used. HDMI versions 1.3 and 1.4 are supported and a version 1.4 cables is recommended. The RPi outputs audio and video via HMDI, but does not support HDMI input.

VI. SOFTWARE MODULES

A. Linux Operating System

Linux is, in simplest terms, an operating system. It is the software on a computer that enables applications and the computer operator to access the devices on the computer to perform desired functions. We have to download Linux OS source code version from kernel.org and it is cross compiled for Mini2440 boards.

B. Qt for Embedded Linux

Qt for Embedded Linux is a C++ framework for GUI and application development for embedded devices.It runs on a variety of processors, usually with Embedded Linux. Qt for Embedded Linux provides the standard Qt API for embedded devices with a

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lightweight window system.

C. GCC Compiler

GNU Compiler Collection (GCC) is a free softwareproject that includes compilers for Ada, C, C++, Fortran, Java, and Objective-C, as well as libraries for these languages. It is capable of generating executables for a variety of platforms including x86, ARM, MIPS, PowerPC, etc.

D. OpenCV

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.

VII. EXPERIMENTAL RESULTS

This figure shows the how all the devices which are connected to the Raspberry Pi Board

Fig 4: Raspberry Pi Board Connections.

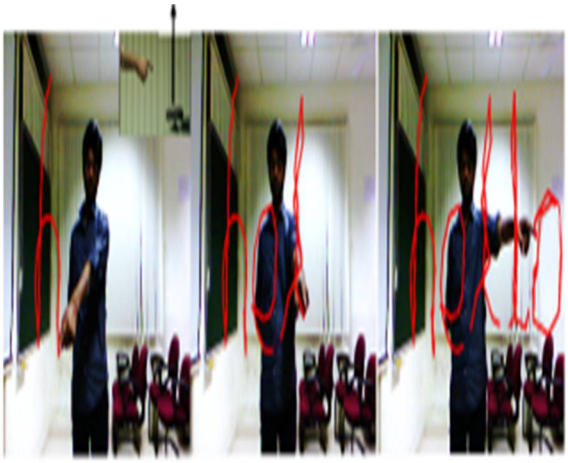

Fig5: User writes freely in front of a depth sensor (here Kinect). Our approach processes the trajectory and recognizes it in real time.

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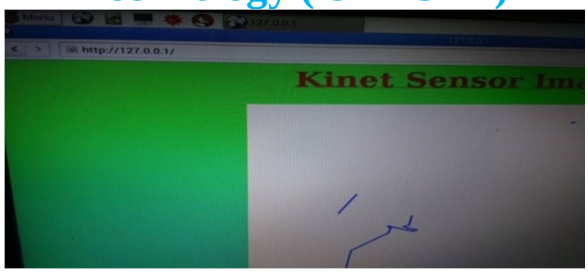

Fig6: Implemention Result

VIII. CONCLUSION

The project **"Design and implementation of finger writing in air by using Open CV(computer vision)Library on Arm Platform "** 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 Raspberry pi board and with the help of growing technology the project has been successfully implemented.

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BIOGRAPHIES

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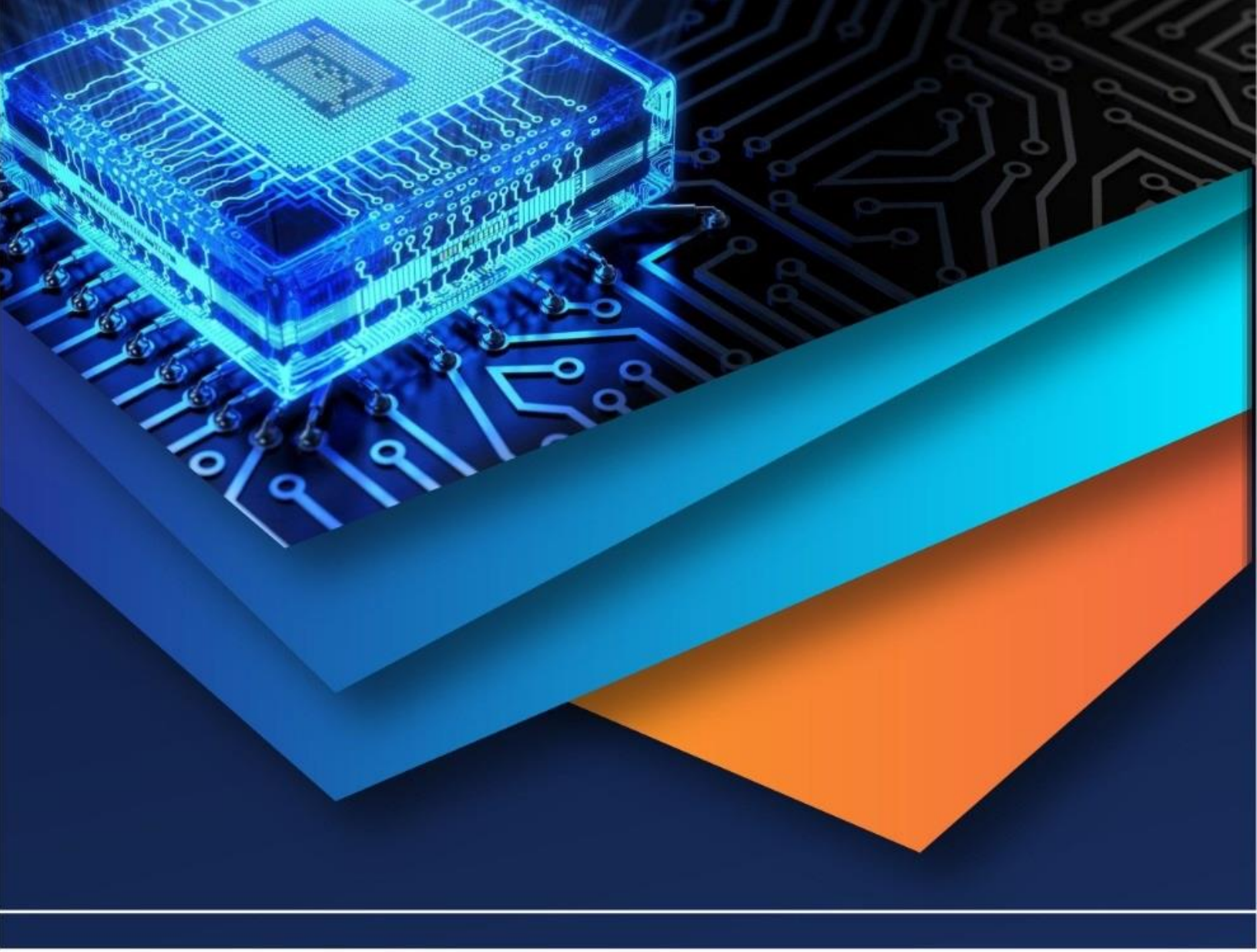

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