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Design of an Embedded Uneven Dual Core Processor Based Scheduling Among Electronic Devices

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ABSTRACT:

In this application, a set of two different processor units based smart surveillance system, is proposed to provide the collaboration among various embedded electronic devices (such as digital camera, printer, electronic toy, sensors and etc.).This smart surveillance application is a video/image processing system which consists of a video camera, an RFID reader, motion detection sensor and a buzzer. In this application, the dumb devices, such as video camera and buzzer are both made to be smart devices which can be used for video analysis and alarming which are controller by one processor unit and RFID reader with motion detection sensor are controlled by another processor unit. In order to meet the requirements of high energy efficiency and quick boot time, an uneven-dual-core architecture processor with RTOS support is proposed. As an full open system for making dumb device smart and multi-device collaboration, the proposed system is also applicable to emerging embedded devices from other areas such as Internet-of-Things, health care, and robotics.

Index-terms:

Raspberry Pi processor, AT89S52 controller, buzzer, USB camera, RFID reader, embedded technology.

1. 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.

Real Time Operating Systems are those which guarantee responses to each event within a defined amount of time. This type of operating system is mainly used by time-critical applications such as measurement and control systems. Some commonly used RTOS for embedded systems are: VxWorks, OS-9, Symbian, and RTLinux.

1.1 Uneven-Dual-Core Processor Architecture:

Consider the requirements of fast boot time and dynamic power characteristics, a loosely-coupled uneven-dual-core architecture design to support dual operating systems is proposed in this work. The detailed block diagram of uneven dual-core based processor is shown in Fig. 4. The proposed architecture deploys two distinguishing processor cores, a CPU (Central Processing Unit) core and a MCU (Micro-Controller Unit) core, in a single chip.

A normal mobile OS is running on the CPU core, which is used to execute computing-intensive tasks, such as image processing, video compression and etc. The MCU core is responsible for real-time tasks, such as response to dumb device, Flash memory access and etc.

An embedded operating system is running on the MCU so as to meet the requirement of quick boot time. Besides, since the MCU core maintains the basic functions while keeping the CPU core in sleep mode, dramatic power saving is acquired. For example, a smart SD card that is built with an uneven core processor will likely spend most of its time with only the MCU core supporting the basic SD Slave function for flash storage access. Only occasionally does the MCU core wake up the CPU core to execute higher-level application functions.

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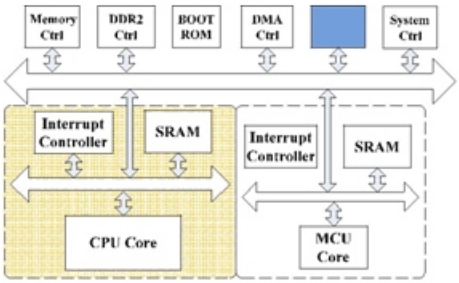

Figure-1: Uneven dual-core architecture.

II. IMPLEMENTATION OF PROJECT:

2.1 Block diagram:

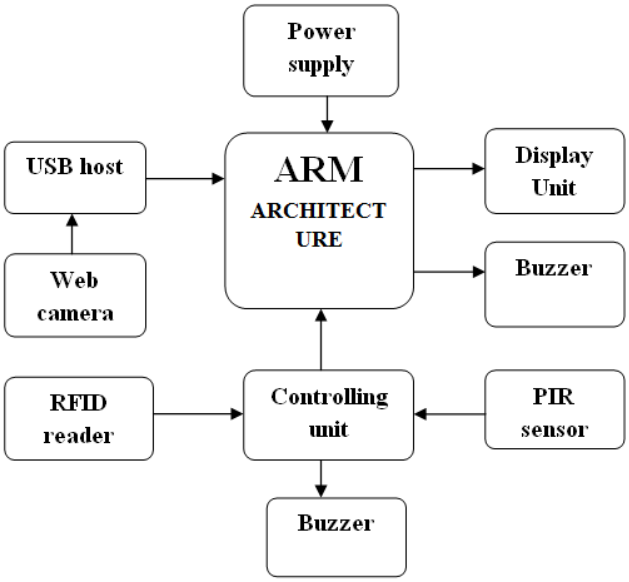

Figure-2: Block diagram of project.

2.2 Raspberry Pi processor:

In the proposed ALPR system we used the Raspberry Pi is a credit-card sized single board computer developed in the UK by the Raspberry Pi foundation. The Raspberry Pi has Broadcom BCM2836 system on chip (SoC), which includes an ARM1176JZF-S 700 MHz processor. Video Core IV GPU, and was originally 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 long term storage. A better-quality picture can be obtained using the HDMI (High Definition Multimedia Interface) connector, the only port found on the bottom of the Pi. Unlike the analogue composite connection, the HDMI port provides a high-speed digital connection for pixel-perfect pictures on both computer monitors and high-definition TV sets.

Using the HDMI port, a Pi can display images at the Full HD 1920x1080 resolution of most modern HDTV sets.

2.3 AT89S52 Microcontroller:

The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in system programmable Flash memory. The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry-standard 80C51 instruction set and pin out. The on chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with in-system programmable Flash on a monolithic chip, the Atmel AT89S52 is a powerful microcontroller which provides a highly flexible and cost-effective solution to many embedded control applications.

The AT89S52 provides the following standard features: 8K bytes of Flash, 256 bytes of RAM, 32 I/O lines, Watchdog timer, two data pointers, three 16-bit timer/counters, a six-vector two level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry. In addition, the AT89S52 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port, and interrupt system to continue.

2.4 RFID Reader:

Radio frequency identification is a powerful emerging technology that enables companies to achieve total business visibility. By knowing the identity, location and conditions of assets, tools, inventory, people and more, companies can optimize business processes and reduce operational costs. Radio frequency identification (RFID) is a generic term that is used to describe a system that transmits the identity (in the form of a unique serial number) of an object or person wirelessly, using radio waves. RFID reader module, are also called as interrogators.

They convert radio waves returned from the RFID tag into a form that can be pressed on to controllers, which can make use of it. RFID tags and readers have to be tuned to the same frequency in order to communicate. RFID systems use many different frequencies, but the most common and widely used and supported by our Reader 125 KHz.

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2.5 PIR sensor:

PIR sensors allow you to sense motion, almost always used to detect whether a human has moved in or out of the sensors range. They are small, inexpensive, low-power, easy to use and don't wear out. For that reason they are commonly found in appliances and gadgets used in homes or businesses. They are often referred to as PIR, "Passive Infrared", "Pyroelectric", or "IR motion" sensors.

III. WORKING PRINCIPLE:

In Microcontroller unit, the PIR sensor whenever detects a person gets to the RFID module to check whether the person entered is authorized or not. If RFID module detects any unauthorized person i.e., invalid tag, then the controller unit wakes up the CPU i.e., Raspberry pi board, to capture the unauthorized person's picture using camera and stores in CPU. If RFID module detects any authorized person then it goes back to PIR sensor for other input.

IV. RESULTS:

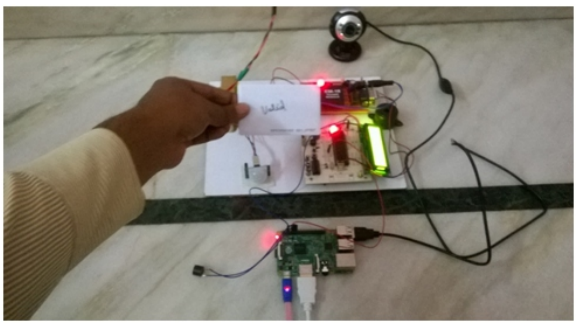

Figure-3: Hardware Implementation of project

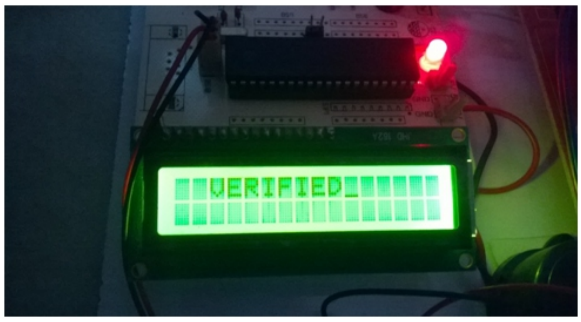

Figure-4: Hardware Implementation

V. CONCLUSION:

Aiming at building a heterogeneous multi-device based personal computing environment, a universal mobile platform is proposed to make existing dumb devices smart without any HW/SW modification to dumb devices. With the proposed system deployed, dumb devices are all turned to be smart objects with additional processing power and wireless connectivity brought in. These newly formed smart objects can cooperate with existing smart mobile devices or cloud platform together to provide novel mobile services and richer applications. A series of techniques ranging from hardware, software to middleware are proposed. Uneven-dual-core based processor provides quick boot time while keeping a very low system power consumption. In the proposed system based computing paradigm, smart mobile devices are released from the high computation overhead and tedium driver updating. Based on these work, dumb devices and smart mobile devices are federated into a unified platform to enable more innovative mobile application development.

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