Implementation of A Home Embedded Surveillance Device with Majority Voting Mechanism

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Abstract: In this project we design and implement a home embedded surveillance system with ultra-low alert power. Traditional surveillance systems suffer from an unnecessary waste of power and the shortcomings of memory conditions in the absence of invasion. In this design we use Pyroelectric Infrared sensors (PIR) and pressure sensors as the alert group in windows and doors where an intruder must pass through. These low-power alert sensors wake up the MCU (Micro Controller Unit) which has power management for the ultrasonic sensors and PIR sensors indoors. This state transition method saves a large number of sensors required for the alert power. We also use the Majority Voting Mechanism (MVM) to manage the sensor groups to enhance the probability of multiple sensors sensing. After the MCU sends the sensor signals to the embedded system, the program starts the Web camera. Our sensing experiment shows is highly reliable.

Keywords: Raspberry Pi, USB Camera, Ultrasonic sensor.

I. INTRODUCTION

In this paper the alerting sensors with low-power consumption are placed near those home windows and doors where an intruder must pass through. When an intruder enters the sensing area, the sensors wake up the sleeping MCU (Micro Controller Unit) which starts the power supply for the indoor sensors and for the sensor signal transmission to the embedded system. For the indoor sensors we use the MVM to improve the sensing reliability. The embedded surveillance system determines the sensor results and then decides whether to start the Web camera to both capture images and upload these captured images to the Web page through the Internet. We use the MCU’s sleep mode to reduce the alert power consumption for our home embedded surveillance system when there is no intruder so as to improve the traditional surveillance system without wasting the power.

II. HARDWARE

A. Raspberry Pi (ARM 11)

The Raspberry Pi is a credit-card sized computer that plugs into your TV and keyboard. It is a capable for little projects, and for many of the things that your desktop PC does, like spreadsheets, word-processing and games. It also plays high-definition videos. We want to see it being used by kids all over the world to learn how computers work, how to manipulate the electronic world around them and how to program. The original Raspberry Pi is based on the Broadcom BCM2835 system on a chip (SoC), which includes, Video CoreIV GPU, RAM of 512 MB. The system has Secure Digital (SD) socket for boot media and persistent storage. A SoC consists of the hardware, described above, and the software controlling the microcontroller, microprocessor or DSP cores, peripherals and interfaces. The design flow for Soc aims to develop this hardware and software in parallel.

B. Power Supply

The input to the circuit is applied from the regulated power supply. The a.c. input i.e., 230V from the mains supply is step down by the transformer to 12V and is fed to a rectifier. The output obtained from the rectifier is a pulsating d.c voltage. So in order to get a pure d.c voltage, the output voltage from the rectifier is fed to a filter to remove any a.c components present even after rectification. Now, this voltage is given to a voltage regulator to obtain a pure constant d.c voltage.

C. Ultrasonic Sensor

Modern security systems utilize various types of sensors to detect unauthorized object access attempts. The sensor...
collection includes infrared, microwave and ultrasound devices, which are intended to detect moving objects. Each type of sensor is characterized by its own advantages and drawbacks. Microwave sensors are effective in large apartments because microwaves pass through dielectric materials. But these sensors consist of expensive super-high frequency components and their radiation is unhealthy for living organisms. Infrared sensors are characterized by high sensitivity, low cost and are widely used. But, these sensors can generate false alarm signals if heating systems are active or temperature change speed exceeds some threshold level. Moreover, infrared sensors appreciably lose sensitivity if small insects penetrate the sensor lens. Ultrasound motion detection sensors are characterized by small power consumption, suitable cost and high sensitivity. That it why this kind of sensor is commonly used in home, office and car security systems. Existing ultrasound sensors consist of multiple passive and active components and are relatively complicated for production and testing. Sensors often times require a laborious tuning process.

D. 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. PIRs are basically made of a pyroelectric sensor (which you can see above as the round metal can with a rectangular crystal in the center), which can detect levels of infrared radiation. Everything emits some low level radiation, and the hotter something is, the more radiation is emitted. The sensor in a motion detector is actually split in two halves. The reason for that is that we are looking to detect motion (change) not average IR levels. The two halves are wired up so that they cancel each other out. If one half sees more or less IR radiation than the other, the output will swing high or low.

III. SOFTWARE

A. Raspbian Operating System

Raspbian is a free operating system based on Debian optimized for the Raspberry Pi hardware. An operating system is the set of basic programs and utilities that make your Raspberry Pi run. However, Raspbian provides more than a pure OS: it comes with over 35,000 packages, pre-compiled software bundled in a nice format for easy installation on your Raspberry Pi. The initial build of over 35,000 Raspbian packages, optimized for best performance on the Raspberry Pi, was completed in June of 2012. However, Raspbian is still under active development with an emphasis on improving the stability and performance of as many Debian packages as possible. The Raspberry Pi; based on ARM hard-float (armhf)-Debian 7 'Wheezy' architecture port, that was designed for a newer ARMv7 processor (or one with Jazelle RCT/ThumbEE, VFPv3 and NEON SIMD extensions built-in) whose binaries would not work on the Raspberry Pi, but Raspbian is compiled for the ARMv6 instruction set of the Raspberry Pi making it work but run more slowly. It provides some available deb software packages, pre-compiled software bundles. A minimum size of 2 GB SD card is required, but a 4 GB SD card or above is recommended. There is a Pi Store for exchanging programs. The Raspbian Server Edition is a stripped version with other software packages bundled as compared to the usual desktop computer oriented Raspbian.

B. Qt (Qtopia)

Qt is a cross-platform application framework that is widely used for developing application software that can be run on various software and hardware platforms with little or no change in the underlying codebase, while having the power and speed of native applications. Qt is currently being developed both by the Qt Company, a subsidiary of Digia, and the Qt Project under open-source governance. Qt is used mainly for developing application software with graphical user interfaces (GUIs); however, programs without a GUI can be developed, such as command-line tools and consoles for servers. Qt uses standard C++ with extensions including signals and slots that simplifies handling of events, and this helps in development of both GUI and server applications which receive their own set of event information and should process them accordingly. Qt supports many compilers, including the GCC C++ compiler and the Visual Studio suite. Qt can be used in several other programming languages via language bindings. It runs on the major desktop platforms and some of the mobile platforms. It has extensive internationalization support. Non-GUI features include SQL database access, XML parsing, JSON parsing, thread management and network support.

IV. RESULTS&DISCUSSIONS

Project hardware setup implemented is as shown in fig 3, the hardware was developed using the data

Fig2. Raspberry Pi Board.
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Based on the changed value and voting mechanism will turn on the second module, and same applies for the second to turn on the third. Finally after third module is detected will turn on the live web cam streaming over web for surveillance purpose as shown in fig 5.

V. CONCLUSION

In this design we use multiple sensor groups with low power consumption for the detection of an intruder. The MCU stays in a sleep state, unlike the traditional surveillance system which stays in the detection state. We reduce the power consumption in the alert or sleep, and we use two sensor groups to improve the detection reliability of the alert state. In addition our home embedded surveillance system reduces unnecessary memory consumption for the capture of images without an intruder, compared to previous surveillance systems.

VI. REFERENCES

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