

Detecting Sudden Pedestrian Crossings and Avoiding Accidents Using Arm 11

K. Sri Krishna Aditya¹, T. Surya Kavita², U. Yedukondalu³

¹Assistant Professor, ²Associate Professor, ³Head of the Department E.C.E.

¹Aditya Engineering College, ²Aditya Engineering College, ³Aditya Engineering College

Abstract

We are aware of the problem of detecting sudden pedestrian crossings to assist drivers in avoiding accidents. We design embedded system, the application has two major requirements: to detect crossing pedestrians as early as possible just as they enter the view of the car-mounted camera and to maintain alarm system to alert the Driver. Our Embedded system using ARM 32 bit Microcontroller has feature of image/video processing by using various features and classification algorithms have been proposed for pedestrian detection. It overcomes the performance in terms of sensors and hardware cost is also too high. So, our design Embedded system that detects partially visible pedestrians just as they enter the camera view, with low false alarm rate and high speed. This system takes capture image by means of web camera connected to ARM microcontroller through USB and the image is processed by using image processing technique. When any pedestrian is detected it alerts driver by providing alarm sound and also it stops vehicle automatically. The display unit in vehicle provides clear details at position it detects pedestrian either right or left.

Keywords: S3C6410 controller, USB device, USB camera and stepper motor.

I. INTRODUCTION

Pedestrian detection has been a focus of recent research due to its importance for practical applications such as auto-motive safety and visual surveillance, Advanced Driver Assistance Systems (ADAS), and many other places. ADAS is a challenging domain to work within. Braking systems take a short while to apply, and reaction times must be fast for driving, where fractions of a second can be the deciding factor between a collision and a near-miss. At the same time, the braking system is not deployed mistakenly (due to a false positive detection), which could itself lead to accidents. At the same time, the braking system is not deployed mistakenly (due to a false positive detection), which could itself lead to accidents. A statistical projection of traffic fatalities shows that an estimated 34,080 people died in motor vehicle traffic crashes in 2012. Over the past decade, the essential role of machine vision modules to realize active safety systems for accident prevention is clearly established in academic research and is also reflected in innovative systems introduced by industry. Now a days human action and activity detection/analysis [1], [2] has attracted much attention in computer vision because its of wide-range applications, including surveillance [3], [4], robotics[5], content-based image/video retrieval, video annotation, assisted living, intelligent vehicles[6], and advanced user interfaces. In this paper, we address a particular problem in this area that can have a significant impact on people's lives, namely, the detection of sudden pedestrian crossings to assist drivers in accident avoidance. Our work is motivated by two factors:

(i) The proposed problem has great social meaning and application value. According to the traffic safety data from the National Highway Traffic Safety Administration[7] and EU[8], many people are killed/injured each year in pedestrian-motor collisions, most of which occur when pedestrians attempt a road crossing at non-intersections.

(ii) The proposed problem has special requirements that make it different from existing related research. Drivers must be alerted to crossing pedestrians as early as possible for evasive maneuvers to be most effective. For this, crossing pedestrians should be identified even before they come into full view. The need for a combination of high processing speed, detection of partially visible pedestrians as they enter the scene, rejection of exiting pedestrians, and handling of unconstrained camera motion distinguishes this application from related work on event/action detection, generic(image/video based) pedestrian detection, and even current methods in intelligent vehicle systems[9]. With the rapidly decreasing costs of high resolution cameras, we believe that they will be the standard in intelligent vehicle systems. In summary, the major contributions of this paper are as follows: the first systematic study on sudden pedestrian crossings, the development of a real-time algorithm, the collection of a new data set suitable for this problem, and the new evaluation criteria. With this approach, we obtained a performance of 73% true positive detection with 0.01 false positives per-frame, which is an improvement over state-of-the-art image based pedestrian detection techniques[10], [11], even though our method

processes only partially visible pedestrians and provides real-time performance. The processing speed of our system is 55 fps, which is both suitable for practical applications in urban areas.

II. SYSTEM DESIGN MODEL

2.1 Hardware module implementation

Our Embedded system using ARM 32 bit Microcontroller has feature of image/video processing by using various features and classification algorithms have been proposed for pedestrian detection as shown in the figure1. It overcomes the performance in terms of sensors and hardware cost also. This system captures images by means of web camera connected to ARM microcontroller through USB and the image is processed by using image processing technique. Image processing is any form of signal processing for which the input is an image, such as a photograph or video frame, the output of image processing may be either an image or a set of characteristics or parameters related to the image.

When any pedestrian is detected it alerts driver by providing alarm sound and also it stops vehicle automatically. The display unit in vehicle provides clear details at position it detects pedestrian either right or left. In this project we going use S3C6410 based microcontroller, which is the current dominant microcontroller in mobile based products. To reduce total system cost and enhance overall functionality, the S3C6410X includes many hardware peripherals such as a Camera Interface, TFT 24-bit true color LCD controller, System Manager (power management & etc.), 4-channel UART, 32-channel DMA, 5-channel 32bit Timers with 2PWM output, General Purpose I/O Ports, I2S-Bus interface, I2C-BUS interface, USB Host, USB OTG Device operating at high speed (480Mbps), 3-channel SD/MMC Host Controller and PLLs for clock generation etc. as shown in figure 2.

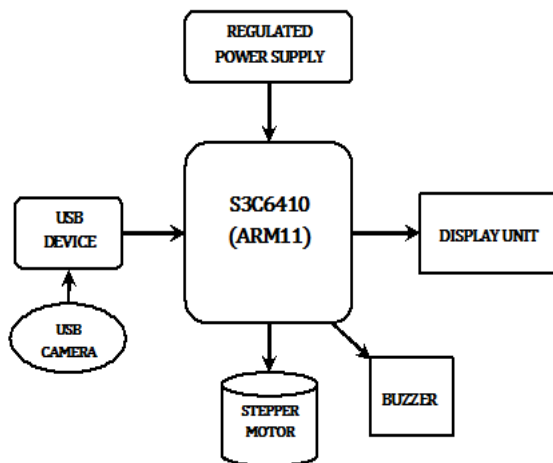


Figure 1: Implementation block diagram

The proposed motion detection system makes use of USB camera which is interfaced to lower power consumptive and highly advanced microcontroller like

S3C6410. S3C6410 is a Samsung company's microcontroller. This microcontroller works for an voltage of +3.3V DC and at an operating frequency of 533 MHz. The maximum frequency up to which this micro controller can work is 667 MHz. We cannot get S3C6410 microcontroller individually. We will get it in the form of FRIENDLY ARM board otherwise we can call it as MINI 6410 board.

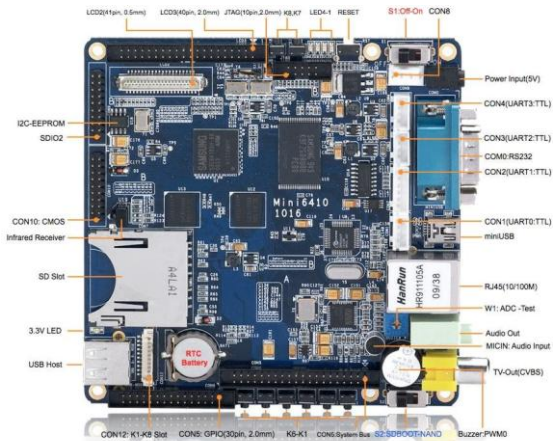


Figure 2: MINI 6410

2.2 Software module implementation

In order to work with ARM 11 micro controllers we require 3 things. They are listed below:

1. Boot Loader
2. Kernel
3. Root File System

Boot loader: The main functionality of boot loader is to initialize all the devices that are present on the mother board of MINI 6410 and at the same time to find out whether any problem or any other fault is there in the devices that are present on that mother board of MINI 6410. The other feature of the boot loader is to find out what are the different operating systems that are present in the standard storage devices and to show it on to the display device so that user can select between the operating systems into which he wants to enter. One other feature of the boot loader is to load operating system related files byte-by-byte into the temporary memory like RAM. In our current project we are using boot loader like Super vivi which is MINI 6410 specific.

Kernel: The core part of an operating system we call kernel. Operating system will perform its functionalities like File management, Process management, Memory management, Network management and Interrupt management with the help of the kernel only. Kernel holds the device related drivers that are present on the motherboard. FRIENDLY ARM board supports for operating systems like SYMBION, ANDROID, EMBEDDED LINUX, WIN CE. But in all these operating systems EMBEDDED LINUX will provide high security to drivers and files. So in our current project we are making use of kernel of EMBEDDED LINUX with

which device related drivers that are present on the mother board of FRIENDLY ARM board will automatically come when we load EMBEDDED LINUX related kernel.

Root File System: File system will tell how the files are arranged in the internal standard storage devices. In embedded Linux, kernel treats everything as a file even the input and output devices also. In embedded Linux, Root is the parent directory it contains other sub directories like dev, lib, home, bin, sbin, media, mnt, temp, proc, etc, opt and etc. According to our application we will interface some external devices also. All the devices means internal devices that are present on the motherboard of MINI 6410 will get their corresponding drivers when we load Embedded Linux related kernel. But these device drivers require micro controller related header files and some other header files which will be present in the lib directory which is present in the root directory and also the devices related drivers will be present in the device directory which is again present in the root directory. So whenever we will load the Root File System then we will get different directories which will be helpful to the kernel. So compulsorily we need to load the Root File System. MINI 6410 specific Root File System is Root Qtopia.

The essential programs that are required in order to work with MINI 6410 like Boot loader, Embedded Linux related Kernel, Root File System will be loaded into the NOR flash which is present on the MINI 6410 board itself. The program that is related with the application will be loaded into NAND flash which is also present on the MINI 6410 board itself. By using boot strap switch that is present on the MINI 6410 will help the user to select either NOR or NAND flash. After that by using DNW tool we can load Boot loader, Embedded Linux related kernel and Root File System into NOR flash by using USB cable and the application related program into NAND flash.

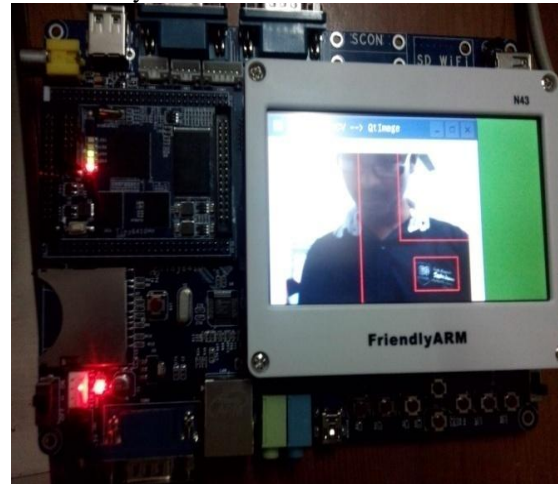
Once loading everything into MINI 6410 board it will work based on the application program that we have loaded into the NAND flash. Now the USB type camera will be interfaced to the MINI 6410 board itself. The camera will continuously record the video and continuously it will send them through Ethernet technology frame by frame. If any motion is detected, it can be either related to any person or related to any object at that moment it will capture that image and stores into the internal memory of the micro controller. So it will reduce the power consumption when compared to the normal Motion detecting Systems.

In this way we can design a low power working Motion Detection System by using MINI 6410 board and Embedded Linux.

2.3 Design model operation

The system uses web-camera which is connected to ARM11 board through USB device. The webcam draw one region before capturing the

pedestrian. The webcam captures the pedestrian present in the region only in the form of frames by using Open CV library later it retrieves image pixel data. It compares the captured image with Haar features of a pedestrian image which is stored in the form of .xml file. Haar like features are digital image features used in object recognition. If the Haar features are matched with captured image, buzzer will turn on as well as the controller apply breaks to stop the DC motor through L293D driver IC to indicate the vehicle is in danger condition. If any pedestrian is not detected by webcam in the region, the motor will run in normal way.



In this way we can design a lower power working Motion Detection System by using S3C6410 board and Embedded Linux.

III. EXPERIMENTAL RESULTS



When webcam captures moving pedestrian, the image is sent to board. The board will compare captured image with haar image which is loaded in form of .xml file. If the captured image is matched with haar features, then, buzzer will turn on as well as the controller apply breaks to stop the DC motor.

IV. CONCLUSION

The project "DETECTING THE SUDDEN PEDESTRIAN CROSSINGS AND AVOIDING ACCIDENTS USING ARM 11" 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 11 board and with the help of growing technology the project has been successfully implemented.

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