A Sensor-Based Device To Identify Larger-Vehicles In Multi Domains

RABBANI SYED  
M.Tech Student, Dept of ECE  
Avanthi Institute of Engineering & Technology  
Hyderabad, T.S, India

M.GOVIND RAJ  
Associate Professor, Dept of ECE  
Avanthi Institute of Engineering & Technology  
Hyderabad, T.S, India

Abstract: Machine vision systems have lengthly been utilized in various industries, specifically in automatic inspection, process control and robot guidance. Such embedded systems, outfitted with camera sensors and contacts, and could be a useful gizmo at a lower price demanding programs, like object recognition and monitoring. The paper presents a minimal-power system for visual recognition of huge-objects coded in the frame of TULCOEMPA project. Its primary goal would be to identify possibly massive vehicles passing the bridge situated in Szczercowska Wies (Belgium). This facility uses the innovative strengthening system, which is assessed using data from number of sensors deployed. The overall image analysis concept for visual heavy automobiles recognition really is easy and is dependent on carrying out background subtraction and separation from the moving objects after. The presented vision system is part of wider triggering solution which consists of: audio-based recognition, vibration analysis, vehicle weighting, etc. Within the next sections the authors provide summary of approaches to provide fundamental large-vehicle visual recognition using low-power embedded system.

Keywords: Vision System; Embedded Systems; Monitoring; Object Detection; Image Processing;

I. INTRODUCTION

Lately, because of the more and more prevalent accessibility to efficient computational technology even an embedded system has enough processing capacity to do fundamental image processing. A minimal-power and occasional-cost vision system of the kind was created for that reasons of the lengthy-term monitoring of bridge situated in Szczercowska Wies (Belgium) within the frame of TULCOEMPA project. This facility continues to be outfitted using the unique technology of unanchored prestressed carbon fiber strengthened polymer (CFRP) laminates, where the potency of this strengthening technique is going to be under special consideration [1]. Thus, the bridge is instrumented with wide selection of sensors that offer the information about several physical values required for the assessment from the strengthening technology used. So that it was made the decision to trigger dimensions only during significant construction stress, which may be caused.

II. OVERVIEW OF SYSTEM

Apart of visual analysis this platform needs to perform other functions: acquisition and processing signals from number of sensors put on the bridge, i.e., vibration, seem, weight, etc. Nonetheless, it had been assumed that visual analysis is easily the most demanding task and imposes overall system architecture. But first and foremost, the machine should certainly have low power consumption because it is scheduled to be powered just from solar module and wind generator based on an accumulator. Among number of available solutions Beagle Board-XM system with different System-On-Nick OMAP3730 was selected. For that reasons of visual recognition of moving object two primary issues must be considered: capture volume for correct observation area and exposure here we are at moving objects capture. The lens focal length could be selected experimentally based on conclusions after initial installing of the machine in target location. Because of this, Computer 12-36mm zoom contacts were utilized in the prototype system. Leopard Imaging LI5M-CS-03 camera off-the-shelf module was selected for that Beagle Board-XM platform. The module consists of RGB-type sensor Aptina 5MPix MT9P031. The sensor dimensions are 5.70mmx4.28mm (4:3) and it has 12 items of radiometric resolution. The module consists of also: power, signal conditioning circuits and connector suitable for Beagle Board-XM camera socket. CS holder is supplied to be able to mount interchangeable contacts. The utmost pixel-clock frequency for OMAP3730 nick is equivalent to 148.5MHz. This signal should be produced within the sensor, where it's configured by establishing PLL registers. Including also setup of operating mode and resolution. For that selected sensor MT9P031 maximum pixel output frequency is 96MHz. Which means that the utmost resolution of 2592x1944 images is acquired with refresh rate of roughly 14 fps (fps) [2]?

The simplest method for image acquisition is moving-shutter mode, however the sensor enables also different modes: Global Shutter and Bulb, nonetheless they require additional systems not supported around the developed platform. Presuming that sensor is going to be utilized in a continuing image acquisition moving-shutter mode and presuming the resolution of image 800x600 enough for that preferred analysis, the recording rate of 90 fps could be
acquired. Which means that the exposure time of merely one frame is going to be 1/90sec? This appears to become enough to get sharp pictures of objects for example moving trucks, considering focal length in the plethora of 12-36mm. If, however, this time around is going to be too lengthy, the suggested configuration image acquisition and kind from the sensor enables very flexible selection of resolution that may be reduced to, e.g., 640x480. With this resolution, using similar computations, the frame rate in excess of 120 fps could be acquired. The machine: Beagle Board platform with sensor module attached and Computer 12-36 mm contacts. Supporting Libraries OpenCV library is really a comprehensive group of functions and calculations for image processing and analysis, including functions for image capture, files read/write in lots of image and video formats, straight line and nonlinear image filtering, segmentation, background estimation and lots of more [3]. The library functionality fits needs from the project, because it consists of features like system independent video capture configuration. That's the reason the author’s mix-put together this library for ARM Cortex core and employed for image processing. It's interface for C and C languages through which they could be created into more complicated techniques for image processing.

Fig.1. Framework of multithreaded processing

III. IMPLEMENTATION

The next thing is to determine size of the detected object and it is motion vector. Next, the trigger is started to have an exterior application accountable for gathering all recognition systems. After Return on investment selection, formula could be split into two pathways: one associated with background subtraction and object selection and latter accountable for fixing optical flow equation. Next contours of individual’s objects are believed by utilizing topological structural analysis. Next, their moments are calculated to get details about objects’ gravity center and area. For individual’s objects that meet zero order moment (area) requirements, the mean moving vector is believed based on optical flow analysis derived within the latter path. This vector will be transformed into polar coordinates, as this form works to pick objects with certain direction within the image. In this manner we are able to select only individuals objects that: are moving, are adequately sized and therefore are approaching the bridge instead of getting away [4]. As part of the job, the formula was outfitted with signaling/triggering mechanism to have an exterior application integrating all subsystems of recognition. The thought of triggering is dependent on TCP/IP Linux implementation. The authors used UDP socket for local host messaging to application accountable for primary triggering from the measurement system. Within the figure 5 three outputs from the formula are proven: detected vehicle, detected truck getting away and detected truck that will mix the bridge. It's important to organize atmosphere to build up and make programs that contains image processing flow for OMAP ARM CORTEX A8 processor. To use exactly the same source codes for PC-based prototyping and additional ARM processor mix-compilation, custom tool chain for ARM processors running the Linux operating-system was created. Also, the work continues to be prepared using Cake 2.8 utility. This enabled generation of project files for conditions VC on Home windows and gcc compiler for that ARM platform. The very first experiments with image processing around the selected OMAP platform have proven the necessity to optimize code to be able to obtain image reasonable analysis time. Thus, an important aspect of the acceleration from the developed program was: Removal of Graphical user interface (X-Window) interface of Linux- Angstrom (default Beagle Board-XM OS) - reducing the amount of operating-system processes. Producing programs using floating-point procedures support while using available hardware blocks: VFPv3 and NEON. Using integrated hardware support for image acquisition, especially: Auto-Exposure and White-colored-Balance (AEWB). Both compiler and also the C library were up-to-date for their latest versions - in those days: gcc 4.7 and glibc 2.16. Link-time optimization was switched on, that enabled optimizations between individually put together modules, and difficult-float support, which does allow compiler to pass through function arguments using floating-point registers rather than copying them back and forth from the primary register file on every function call. These changes led to modest performance enhancements within the calculations developed but machine code disassembly has proven the compiler optimizations weren't significant due to the modular C coding style adopted within our program. Multi-threaded application: Image acquisition within OMAP SC is completed using integrated ISP hardware module. It will support several camera connections connects and may handle raw pixel data recording, demos icing, color-space conversion, popping, scaling and gathering statistics concerning the image. This last
functionality may be used to provide Automatic Exposure and White-colored Balance correction (AEWB) [5]. To harness the strength of the ISP module extensive support in Linux kernel and user space support is required. With this project the authors used 3.2.34 Linux kernel with a lot more patches enhancing the ISP module support. To prevent implementing big areas of this functionality the authors made the decision to separate processing application into a double edged sword: first - accountable for image acquisition including AEWB processing and also the second - accountable for image analysis. This application, whose architecture is proven in figure 6, has two threads: image acquisition thread live-primary-module which is dependent on customized omap3-isp-live source code and exterior dynamic library carrying out image analysis dsp.so. The separation of the two bits of code into independent projects permitted less restricted software rise in two separate domain names.

IV. CONCLUSION

Majority of development effort was put into image acquisition domain and embedded system OS customizations associated with it. Thus, it had been easy to considerably reduce power use of the machine by utilizing devoted image sensor module instead of off-the-shelf webcam. Within the paper the authors presented the reduced-power embedded system with functionality needed for big-vehicle recognition using visual analysis. The SC’s DSP block was disabled since it is not being utilized for that formula now. Also, because of acquired fully controlled image acquisition when it comes to hardware support for AEWB, the formula was outfitted with a lot more support for on-line image parameters stabilization which was crucial support for background estimation calculations. The look processing formula applied isn't complicated and simple to acquire because of OpenCV library. The presented formula is safe from rapid weather changes and cloud shades relocating the scene because of the optical flow analysis. The formula is going to be further enhanced to be able to minimize pointed out problems when it comes to its parameter trimming as there's room for additional sophisticated calculations with a lot more intelligence. Estimation from the algorithm’s general reliability and it is further enhancements using bigger data set may be the future job for another research. Possible processing complexity is restricted, because analysis should be done not less than 2-3 fps to be able to capture and track fast paced automobiles. Actual image analysis is completed 3.3 fps.

V. REFERENCES


AUTHOR’s PROFILE

RABBANI SYED, He holds B.Tech degree in Electronics and Communication Engineering and M.Tech in Embedded Systems from JNTU, Hyderabad, at Avanthi Institute of Engineering and Technology, Hyderabad, India. His areas of interest are Embedded Systems, Embedded Networking, Mat Lab and Wireless Communication & Networks.

Mr. M. GOVIND RAJ
Assoc.prof , He holds B.Tech degree in Electronics and Communication Engineering and M.Tech in Embedded Systems from JNTU, Hyderabad. At present he is working as Associate professor in the Dept. of E.C.E in Avanthi Institute of Engineering and Technology, Hyderabad, India. His areas of interest are Embedded Systems, Embedded Networking, Hardware Software Co-design, Digital System Design and Wireless Communication & Networks.