Robust Auto White Balance System for Real-Time Video Capturing

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Abstract

To match the brightness of the scene, the Auto White Balance system of a video camera selects the optimum aperture size, gain setting, and exposure length. Although CMOS (Complementary metal oxide semiconductor) technology has enabled techniques such as automated white balance and automatic exposure, sophisticated systems to quickly determine the right exposure when users change the scene are absent. The problem becomes more serious when sections of the recorded video frame are overexposed or underexposed. The suggested system includes a robust AWB approach for real-time video capture. This includes a well-designed control flow as well as some heuristic approaches for changing exposure and evaluating scene brightness. To produce a more accurate estimation of scene brightness, the system adaptively selects appropriate sensor operational modes. Devices to detect moving objects and fluorescent light flicker are also included in the auto exposure system. The dependable AWB system works well in a range of situations and helps to improve the quality of recorded footage.

Introduction

The video colour representation is described by the name of the colour model. In NTSC television, YIQ was utilised. It closely resembles the YUV system used in NTSC and PAL television, as well as the YDbDr scheme used by SECAM. The amount of unique colours that a pixel may represent is determined by the number of bits in the pixel (bpp). Chroma subsampling (e.g. 4:4:4, 4:2:2, 4:2:0/4:1:1) is a typical approach to minimise the amount of bits per pixel in digital video.

However video system was originally developed for cathode ray tube (CRT) television sets, several alternative technologies for video display devices have subsequently been constructed. The first usable video tape recorder (VTR) was created by an Ampex research team led by Charles Ginsburg.

PAL (Europe, Asia, Australia, and other parts of the world) and SECAM (France, Russia, parts of Africa, and other parts of the world) standards provide 25 frames per second, whereas NTSC (USA, Canada, Japan, and other parts of the world) specifies 29.97 frames per second. Film is shot at a slower frame rate of 24photograms/s, which makes converting a cinematic motion image to video significantly more difficult. A frame rate of roughly fifteen frames per second is required to create the appearance of a moving image. PAL video format, is typically stated as 576i50, where 576 denotes the total number of horizontal scan lines, I denotes interlacing, and 50 denotes 50 fields (half-frames) per second. When producing a natively progressive broadcast or recorded signal, both the stationary and moving sections of the image have optimal spatial resolution.

Literature Survey

Understanding the capture, processing, and presentation of colour pictures necessitates knowledge of numerous fields, including image generation, radiometry, colorimetry, psychophysics, and colour reproduction, which are not covered in typical engineering training. Nonetheless, with the advancement of sensor, computing, and display technology, engineers now regularly deal with components of colour imaging, some more frequently than others. This paper is meant for engineers and scientists as an introduction to colour imaging science. It will be valuable for people who are about to enter or are currently working in the field of colour imaging, as well as those in other fields who would benefit from learning the fundamental processes of colour imaging.

This study describes a sophisticated video camera system with robust automated focus (AF), automatic exposure (AE), and automatic white-balance (AWB) management. Even when the scene is obstructed by high light intensity, the suggested AF algorithm determines the right movement direction of the lens and recognises the accurate in-focus condition. The experimental findings show that the suggested system can be a viable alternative to existing systems that use the hill-climbing approach.

For digital still cameras, the suggested method provides rapid and precise auto-exposure capabilities. The number of preview frames and the exposure error are both within 3.5 frames and 3.92 percent under typical lighting circumstances. The number of preview frames and the exposure inaccuracy are both within 8.8 frames and 6.56 percent under high contrast lighting situations. Furthermore, it provides reliable detection for both backlit and excessively frontlit settings at the same time, resulting in optimal exposures to the main object.

This article describes the design and hardware implementation of a video camera with a CMOS sensor that includes a module that combines the functionalities of automated white balancing (AWB) and automatic exposure management (AWB). The capability is provided by the use of dynamic control of sensor registers via the I2C sensor interface. A field programmable gate array is used to process picture data (FPGA). A combined AWB/AEC module with a gate count of 10k can be constructed. The findings show that the integrated video camera provides the needed functionality with a quick response time.

Methodology

Formal measures like as PSNR can be used to assess video quality, while subjective video quality can be assessed by expert observation. A video processing system's subjective video quality can be assessed as follows:

- Select the video sequences to be tested (the SRC).
- Select the system's parameters for evaluation (the HRC).
- Select a test technique for presenting video sequences to experts and collecting their feedback.
- Invite a significant number of specialists, preferably at least 15, to the meeting.
- Carry out the tests.
- Calculate the average scores for each HRC based on the assessments of the experts.

The ITU-T guideline BT.500 discusses a variety of subjective video quality methods. The Double Stimulus Impairment Scale is an example of a standardised procedure (DSIS). Each expert in DSIS watches a reference video that isn't impaired before watching an impaired version of the same film. The expert then assigns a rating to the impaired video, ranging from "impairments are imperceptible" to "impairments are extremely unpleasant."

VIDEO COMPRESSION METHOD (DIGITAL ONLY)

Video streams are compressed using a variety of techniques. Uncompressed video streams are inefficient due to spatial and temporal redundancy in visual data. Spatial redundancy is minimised in general by detecting changes between regions of a single frame; this process is known as intraframe compression and is closely connected to picture compression. Interframe compression, which includes motion correction and other approaches, can also minimise temporal redundancy by capturing variations across frames. MPEG-2, which is used for DVD, Blu-ray, and satellite television, and MPEG-4, which is used for AVCHD, mobile phones (3GP), and the Internet, are the most prevalent current standards.

BIT RATE (DIGITAL ONLY)

The bit rate of a video stream is a measurement of the information content rate. The bit per second (bit/s or bps) or Megabits per second (Mbit/s) unit is used to measure it. Video quality is improved with a greater bit rate. VideoCD, for example, has a lesser data rate of around 1 Mbit/s than DVD, which has a maximum bit rate of 10.08 Mbit/s for video. With a bit rate of around 20 Mbit/s, HD (High Definition Digital Video and Television) offers an even greater quality. Variable bit rate (VBR) is a technique for maximising visual video quality while reducing bit rate. A variable bit rate consumes more bits on rapid motion sequences than it does on slow motion pictures of same duration while maintaining a consistent visual quality. When the available bandwidth is fixed, such as in videoconferencing transmitted on fixed bandwidth channels, a constant bit rate (CBR) must be employed for real-time and non-buffered video streaming.

SCREENCAST

A screen cast, also known as a video screen capture, is a digital recording of a computer screen output that typically includes audio commentary. Screencast is similar to the related phrase screenshot; although a screenshot is a snapshot of a computer screen, a screen cast is basically a video of the changes on a computer screen over time, augmented by voice commentary. Screencasts may be used to show and teach how to use software applications. Making a screencast is a great way for software engineers to showcase their work.

Educators can also utilise screencasts as a way to incorporate technology into the classroom. On an interactive whiteboard, students may capture video and audio as they illustrate the right technique for solving an issue. Screencasts are also beneficial to regular programme users: They assist in the submission of bug reports by replacing possibly ambiguous textual explanations with screencasts; they assist in demonstrating others how to do a task in a specific software environment.

Result and discussion

The installation of product software, as the final link in the software production deployment chain, is a huge cost challenge. The Implementation process is divided into four stages: Discovery, System Development, User Acceptance Testing, and Production Rollout. It's easy to become overwhelmed by sophisticated marketing presentations, especially when the sales team is discussing topics that most consumers don't fully comprehend.

These phases of deployment are intended to give clients with a smooth transition from an existing electronic or paper-based system to Sigmund while ensuring that the software accounts for all elements of the client's activities. The Sigmund project team, which includes personnel with clinical, billing, and operations experience, is prepared to oversee the full process, from system requirements collection through implementation.

Fig.1 Applying Frame grabber Technique

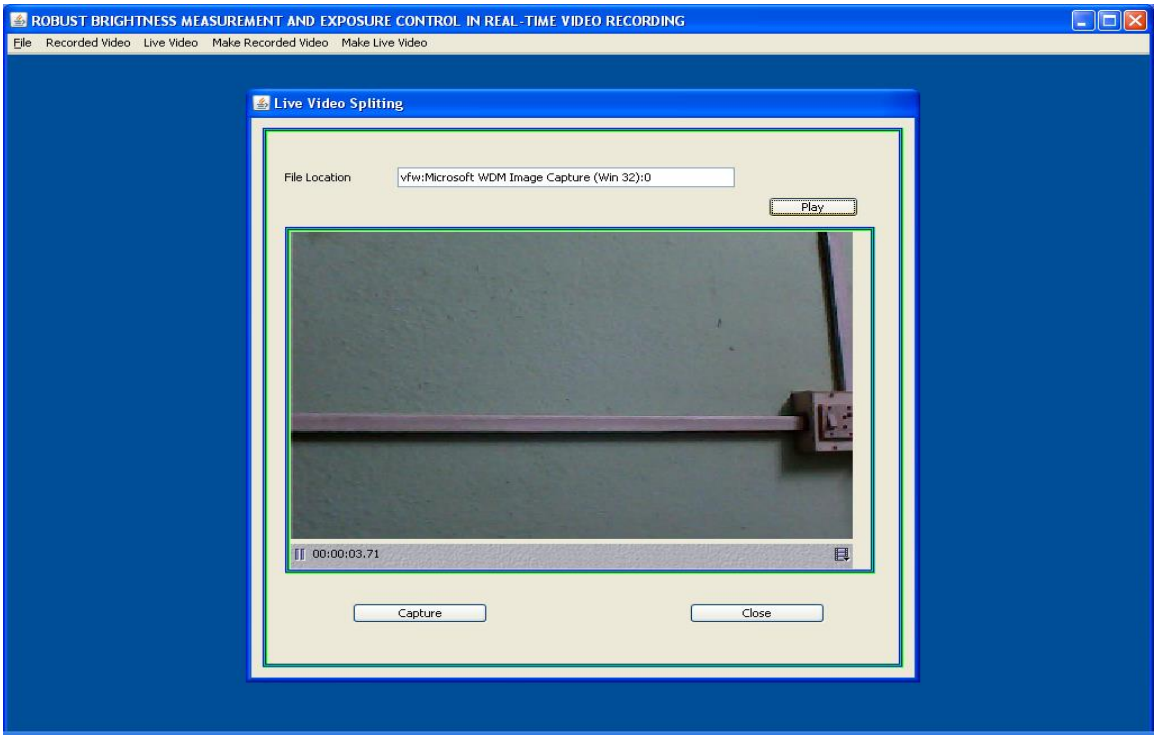
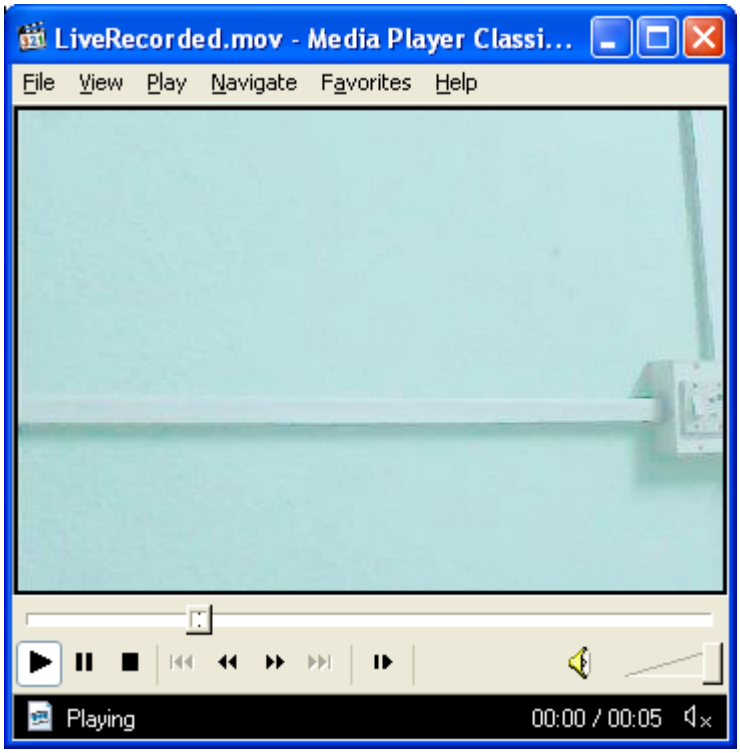


Fig.2 Playing Original Live Video

Fig.3 Playing Enhanced Live Video



Conclusion

The video quality of a real-time video recording system is strongly dependent on the accuracy of scene brightness measurement as well as the speed of exposure adjustment. A comprehensive AWB system with more exact scene brightness estimations and high speed exposure adjustment has been provided. The accuracy of brightness measurement has been substantially improved by adaptively selecting the sensor's subsampling modes and applying histogram analysis to further improve brightness measurement accuracy. As a consequence of a more exact evaluation of scene brightness, the speed and precision of exposure adjustment have been enhanced.

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