Live Demonstration: Asynchronous Time-based Image Sensor (ATIS) Camera with Full-Custom AE Processor

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Abstract—This live demonstration shows high DR, high temporal resolution, frame-free image/video acquisition based on asynchronous events. The presented camera features 9-bit gray-level imaging at up to 143dB DR and <0.25% FPN with hardware-based lossless video compression and time-domain correlated double sampling. The main components of the camera – an asynchronous, time-based image sensor (ATIS) and a general purpose Address-Event processor with 20-Bit 10ns-resolution sensor data interface – have been specifically designed for the application. The presented system optimally combines the advantages of time-based (PWM) imaging, bio-inspired temporal contrast dynamic vision and event-based (AER) information encoding and data communication.

I. DESCRIPTION

The presented camera, featuring a novel asynchronous time-based image sensor and a full-custom SPARC-compatible post-processor with hardware-accelerated AER data interface, draws on the combination of PWM imaging, bio-inspired temporal contrast dynamic vision and event-based information encoding and data communication. The vision/imaging system achieves exceptional performance in terms of dynamic range, FPN, temporal resolution, gray-level resolution and data reduction.

The CMOS image/video sensor is based on an array of asynchronous, fully autonomous pixels containing event-based change detector and PWM photo-measurement circuits. A gray-level measurement is initiated at the pixel-level only if a change has individually been detected by a pixel in its field-of-view. Pixels do not need any external timing signals and independently and asynchronously request access to an asynchronous output channel when they have new illumination values to communicate. Communication is address-event based (AER) and gray-levels are encoded in inter-event intervals. Pixels that are not stimulated visually do not produce output. This operation ideally results in optimal lossless video compression through temporal redundancy suppression at the focal-plane. Compression factors depend on scene activity. Due to the time-based (PWM) encoding of the illumination information, very high dynamic range (intra-scene DR: 143dB static and 125dB at 30fps equivalent temporal resolution) is achieved. A novel time-domain correlated double sampling (TCDS) method yields array FPN of <0.25%, SNR is >56dB for >10Lx at the sensor plane.

The general-purpose SPARC-compatible post-processor features a 20-bit parallel AER data interface with 10ns resolution time-stamping and hardware-accelerated event pre-processing including robust peak-rate handling, ROI/RONI filtering and flexible DMA functionality.

II. REFERENCES:


