Artificial Intelligent Partner System (AIPS) with Pinned Buried Photodiode used for Robot Vision and Solar Cell Panel

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***Abstract*— The future of real-time computing will include massive assemblies of parallel processors over mesh-connected wireless networks to execute the vast amounts of computation with vast number of sensors of all types in order to change the way humans and computers interact in order to meet our human needs. This paper explains the details of the artificial intelligent partner system (AIPS) which was originally introduced in 2008 by Sony, using Play Station III Cell Processor and the intelligent image sensor real-time system, using the Sony Original Pinned Buried Photodiode for future robot vision and solar cell panels with the excellent short-wave blue light sensitivity and the electronic and global shutter function capabilities for fast action pictures.**

Keywords*— *Cell Processor, Pinned Photodiode, Real Time, Robot Vision, Solar Panel, Play Station III, Electronic Shutter

I. INTRODUCTION

The concept of the video assistant referee (VAR), now applied and used worldwide, is very similar to the original concept of the Artificial Intelligent Partner System (AIPS) introduced by Hagiwara in 2008 [1-2]. The first AIPS used Play Station III Cell Processors together with a large number of video cameras to realize a real-time fast-action friendly assistant and care system, supported by the wire-less real-time communication network. Many semiconductor device elements are needed. See Fig.1.

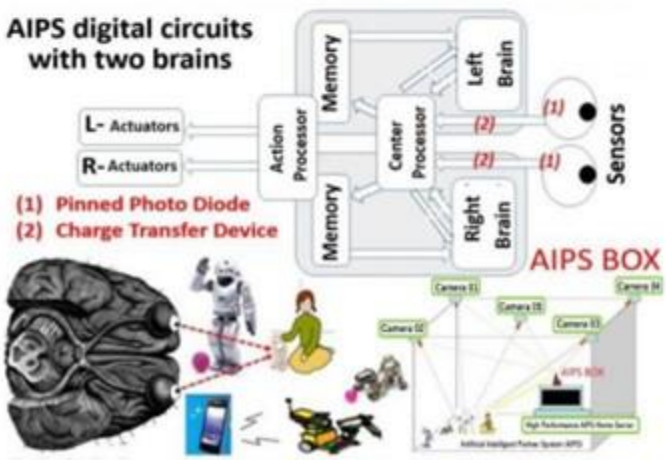

Fig.1 Artificial Intelligent Partner System (AIPS) introduced in 2008

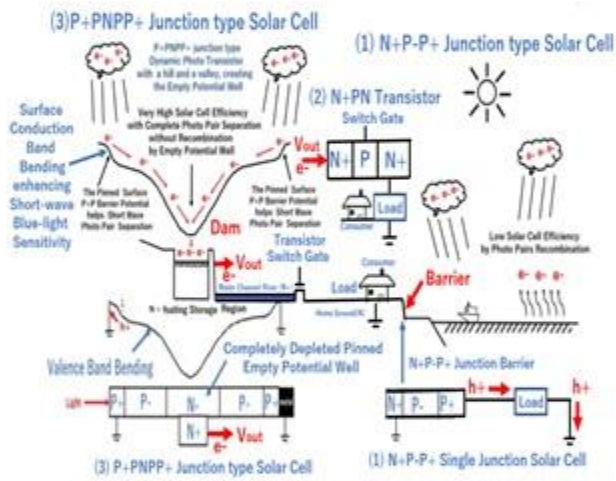

Fig.2 Water Barrier, Water Gate and Water Dam Analogy of Semiconductor.

In the January 2023 issue of IEEE EDS Newsletter [3], an article was published that explained important semiconductor device aspects, focused on "chronology of silicon-based image sensor development" [4]. The details of development efforts of different types of the pinned photodiodes, now widely used in consumer video cameras, smart phones and real time robot vision system (AIPS) were described in details. Steps towards achieving the excellent short-wave blue-light sensitivity are emphasized. These steps were followed by many successful realizations of the Pinned Buried Photodiodes and their applications in different image sensors and equipment. It concluded that the excellent short-wave blue light sensitivity is the most important feature of Pinned Buried Photodiode.

Fig.2 shows analogy in behaviors of water molecules and charge carriers (electron and hole pairs) in semiconductor devices. It explains the concepts of the N+P-P+ single junction diode as Water Barrier, the P+PN+ double junction bipolar transistor as Water Gate, the P+PN-PP+ double junction Pinned Buried Photodiode as Water Dam and the N+ diffuion buffer capacitor used as Underground Water Storage. The silicon-based P+PNP double junction type solar cell structure, by careful engineerings of the silicon surface P+P impurity doping profile, is expected to have a good quantum efficiency.