



US010616484B2

(12) **United States Patent**
Cohen et al.

(10) **Patent No.: US 10,616,484 B2**
(45) **Date of Patent: Apr. 7, 2020**

(54) **FRAME SYNCRHONIZATION IN A DUAL-APERTURE CAMERA SYSTEM**

(71) Applicant: **Corephotonics Ltd.**, Tel-Aviv (IL)

(72) Inventors: **Noy Cohen**, Tel-Aviv (IL); **Gal Shabtay**, Tel-Aviv (IL); **Oded Gigushinski**, Herzlia (IL); **Nadav Geva**, Giv'atayim (IL); **Anat Leshem**, Tel-Aviv (IL); **Gil Bachar**, Tel-Aviv (IL)

(73) Assignee: **Corephotonics Ltd.**, Tel Aviv (IL)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **15/570,346**

(22) PCT Filed: **Jun. 12, 2017**

(86) PCT No.: **PCT/IB2017/053470**

§ 371 (c)(1),

(2) Date: **Oct. 29, 2017**

(87) PCT Pub. No.: **WO2017/221106**

PCT Pub. Date: **Dec. 28, 2017**

(65) **Prior Publication Data**

US 2018/0359392 A1 Dec. 13, 2018

Related U.S. Application Data

(60) Provisional application No. 62/351,990, filed on Jun. 19, 2016.

(51) **Int. Cl.**

H04N 5/232 (2006.01)

H04N 5/247 (2006.01)

(Continued)

(52) **U.S. Cl.**

CPC **H04N 5/23245** (2013.01); **G02B 13/009**

(2013.01); **G02B 13/0015** (2013.01);

(Continued)

(58) **Field of Classification Search**

CPC H04N 5/04; H04N 5/0733; H04N 5/225; H04N 5/2258; H04N 5/2259;

(Continued)

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,199,785 A 4/1980 McCullough et al.

5,005,083 A 4/1991 Grage et al.

(Continued)

FOREIGN PATENT DOCUMENTS

CN 101276415 A 10/2008

CN 102739949 A 10/2012

(Continued)

OTHER PUBLICATIONS

Statistical Modeling and Performance Characterization of a Real-Time Dual Camera Surveillance System, Greienhagen et al., Publisher: IEEE, 2000, 8 pages.

(Continued)

Primary Examiner — Lin Ye

Assistant Examiner — Chriss S Yoder, III

(74) *Attorney, Agent, or Firm* — Nathan & Associates; Menachem Nathan

(57) **ABSTRACT**

A dual-aperture camera comprising a first camera having a first sensor and a first image signal processor (ISP), the first camera operative to output a first stream of frames, a second camera having a second sensor and a second ISP, the second camera operative to output a second stream of frames, and a synchronization and operation control module configurable to control operation of one camera in a fully operational mode and operation of the other camera in a partially operational mode and to output an output of the fully operational camera as a dual-aperture camera output, whereby the partially operational mode of the other camera reduces a dual-aperture camera the power consumption in

(Continued)

100

