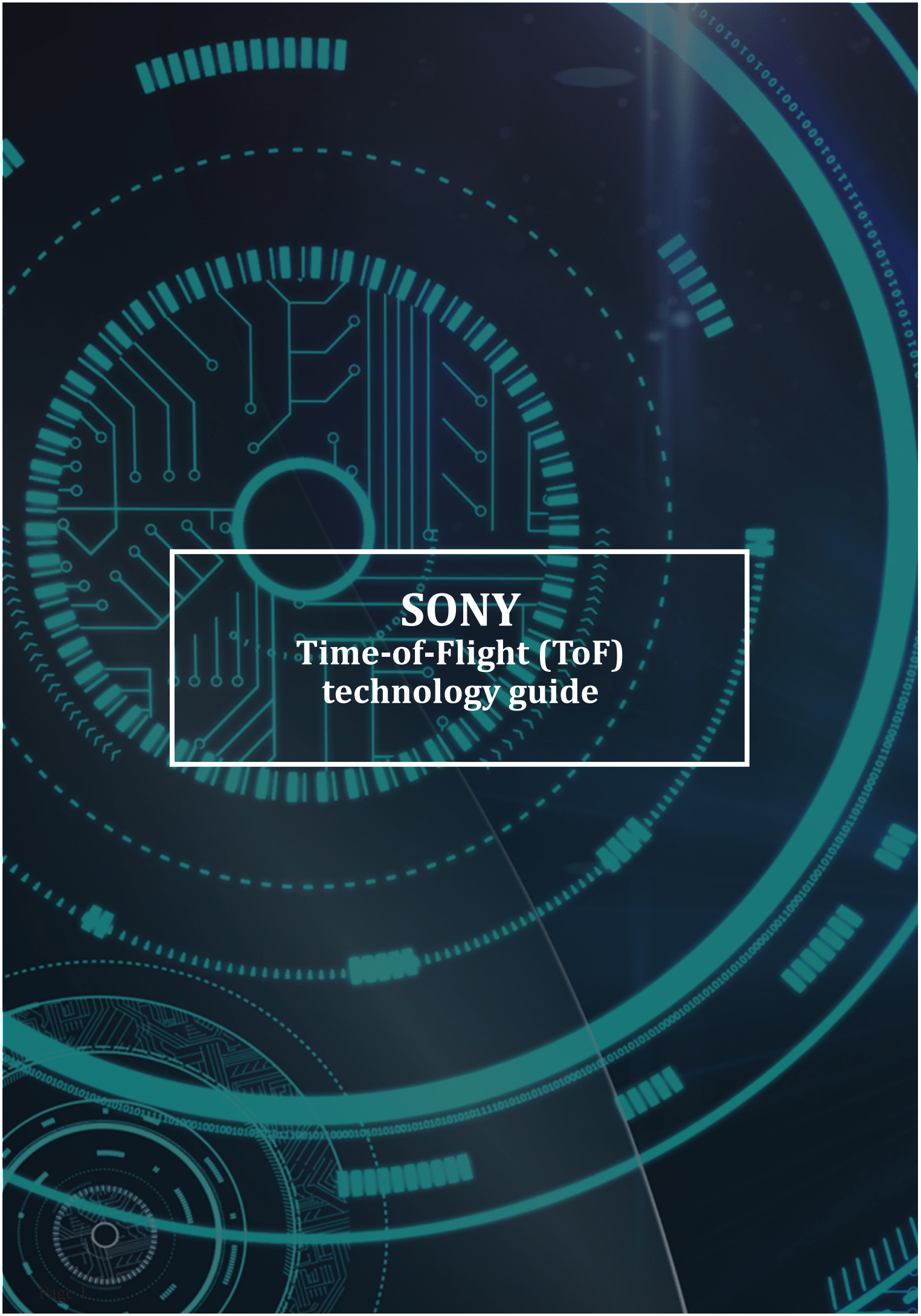
SONY
Time-of-Flight (ToF)
technology guide

SONY

Time-of-Flight (ToF) Image Sensor Technology

OVERVIEW

In addition to imaging in X and Y directions, ToF image sensors also acquire the Z-direction information, enabling 3D sensing. 3D sensing opens up the possibility of discerning things that are difficult with conventional 2D images, as in inspection based on volume or shape, or discerning overlapped objects. It is also a promising technology for applications utilizing relative distance information in real time, such as automated control or collision avoidance systems.

In the industrial equipment area, movements towards automation and reduction of manpower are rapidly spreading in various application. These include the «smartification» of manufacturing lines, logistics systems, agriculture, and farming. ToF image sensors, which are small in size and can instantly acquire 3D information, are anticipated for use in a wide range of areas and applications as sensors well-suited to respond to rising demands for recognition, measurement, and automation.

TECHNICAL FEATURES

Two types of ToF

ToF image sensors measure the distance by using the time difference until the reflected light is detected by the sensor. The light is typically generated by a laser or a LED.

There are two main types of ToF. Direct ToF (dToF) involves a simple, direct measurement of the time until reflection is detected. Indirect ToF (iToF) measures distance by collecting reflected light and discerning the phase shift between emitted and reflected light. The iToF products such as IMX556/IMX570 are especially effective in high-speed, high-resolution 3D imaging of objects at short and long distances.

Accurate, stable high-performance measuring technology

ToF image sensors detect distance information of each pixel, creating highly accurate depth map. Sony's ToF image sensors is combined with a pixel technology which highly accurately detects reflected light and the back-illuminated CMOS image sensor technology with high sensitivity and low-noise performance. The back-illuminated CMOS image sensor technology is also designed for faster processing from advances such as multilayer wiring. Greater efficiency of collecting reflected light and faster processing speed lead higher accuracy of distance measurement.

APPLICATIONS

Various types of automation in logistics

ToF image sensors can contribute to automation in various applications uniquely suited to them, from improving efficiency of material handling by measuring pallet and cargo positions, sizes, and content ratios; to detect collisions and recognizing external conditions of moving bodies such as AGVs (Automated Guided Vehicles), AMRs (Autonomous Mobile Robots) and «last one mile» robots.

Factory automation

ToF image sensors can be used in various applications such as management of shortages according to content level; automation of tasks such as target position detection for robotic picking; improvements to process efficiency by monitoring the operations of site workers; and safety assurance by detecting intrusion into hazardeous areas.

Recognition of humans at industrial and public facilities

Even in settings where judgment by two-dimensional sensors is difficult, such as where the images of people overlap each other at high density, ToF image sensors easily recognize humans. Therefore, they can be used in applications such as identifying crownding conditions in locations such as shops, airports, and theme parks, carrying out advanced-level recognition of the open/closed status of automatic doors, and managing room entries and exits. By estimating the poses of human bodies in a three-dimensional manner, they can also support customer behavior data analysis in shops.

Support for harvesting in farming and agriculture

ToF image sensors can be applied to quality management and productivity improvements by monitoring automatic milking of dairy cows, as well as the body shape, walking patterns, and amount of feed consumed by livestock. In the field of agriculture, they can contribute to automatic thinningand harvesting of fruits through three-dimensional picking, and automatic operation of agricultural equipment through three-dimensional monitoring of the surroudnings.

Support for civil engineering work

ToF image sensors can be applied to the ICT conversion of heavy machinery, which can include operator support, automation, and safety assurance by monitoring the surrounding conditions. They are also anticipated to be applied to visualization and record-keeping of construction conditions, through three-dimensional measurements of soil volume in civil engineering work, construction conditions in building construction work, and infrastructure installation status.

Monitoring with consideration for privacy

ToF image sensors acquire information on people and objects as 3D data. If applied to the nursing care facilities, for example, this feature will make it possible to capture the existence or poise of the care recipients accurately without using RGB images to prevent them from failing or to detect the accidents early. They are expected to be applied to privacy-conscious safety monitoring.

Sony's Time-of-Flight (ToF) sensors are available through Macnica ATD Europe.

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