PROJECT PROFILE

16014

Infrared-sensing platform will grow detection markets and drive smart applications in medical, lighting and automotive [MIRS]

MIRS (Midget InfraRed-based Sensor systems) is developing a generic technology platform to reduce the cost of infrared (IR) sensing systems through extreme miniaturisation, and to enable the mass-manufacturing of low-cost, high-volume infrared-detector devices. This project will demonstrate this technology platform with the creation of a highly accurate contactless spot thermometer for mobile devices, as well as a demonstrator of a low-resolution infrared focal plane-array to track and count people in a smart building. This will prepare the ground for advanced automotive and other detection applications.

As markets and technical requirements grow, smart systems for people detection, activity-context interpretation, as well as, surveillance and gesture recognition, are becoming increasingly sophisticated. Although wafer-level cameras have become relatively cheap, their application still suffers from inherent problems. Fortunately, far-infrared (FIR) sensors have a high potential to resolve these issues, but technologically they lag behind consumer cameras. However, although bolometer arrays are still on the higher-end of many mass applications, thermopile sensors have the best chance to provide functional enhancements for increased ambient intelligence, smart vehicles and a broad variety of other applications.

Developing core technologies for healthcare and people detection

Project MIRS' main goals are to develop a generic innovative technology platform in order to reduce the cost of infrared (IR) sensing systems, and ultimately enable the low-cost mass manufacturing of emerging, high-volume infrared-detectors. In order to address these challenges and bring technology to a higher system-level, the MIRS project will investigate key enablers: from wafer to application system.

To achieve this, MIRS will focus on the development of a general infrared-sensor MEMS (micro-electro-mechanical system) technology platform to enable two distinct types of infrared sensors: a single-pixel infrared spot thermometer with narrow optical field-of-view (FOV); and an infrared pixel-array detector for people detection, which can ultimately be integrated in a smart building's lighting system. Now, the strength of the project is that both types of sensors are served with the same main MEMS technology platform (70% of the required modules are common to both types of sensors).

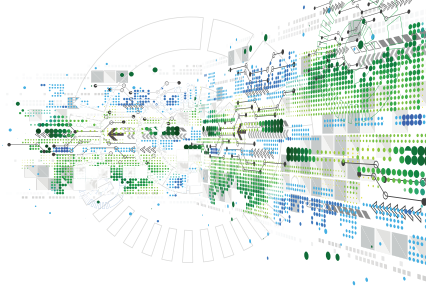
The main project element is the thermopile sensor, used to develop and deliver the two types of infrared-sensor applications:

Spot thermometer: using a single-pixel infrared thermopile sensor in combination with current applications, such as the ear-thermometer. An application demonstrator will also be developed to show the workings (on a component level) of a small-footprint, low-cost, single-pixel infrared sensor, the core of the spot thermometer. It should be noted that sensors currently available don't yet use the wafer-level-packaging (WLP) technology, but instead use a large TO39 package. This makes the end product both bulky and pricey. The large packaging is required because CMOS and the infrared sensors are not integrated, and because the pixel size of the infrared sensor is a bit large. These issues impede the integration of this kind of sensor in high-volume applications, like mobile devices.

People-detection sensor: using an infrared thermopile pixel-array and discrete optical lens, working together with such current applications, as heating, ventilation and air-conditioning (HVAC) systems. Similarly, these sensors don't yet use WLP technology, which means bulky TO39 packaging is also deployed. The current limitation of these detectors is their high cost, which impedes their use in high-volume applications, like smart building. An application demonstrator will be developed to show the workings of an infrared pixel array to track and count people in a smart building.

Prepared for challenges

The project consortium has the necessary experience and expertise to deal with key advanced concepts, such as sensor design, CMOS and MEMS integration, and wafer-level packaging with optical integration, as well as, final assembly, packaging and innovative signal processing. It is also prepared to respond creatively to typical challenges – such



KEY APPLICATION AREAS

- Transport & Smart Mobility
- Health & Well-Being
- Digital Life

ESSENTIAL CAPABILITIES

- Systems and Components Architecture, Design & Integration
- Safety, Security & Reliability
- Computing & Storage
- ECS Process Technology, Equipment, Materials & Manufacturing

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KEY PROJECT DATES

01 May 2017 - 30 April 2020

as miniaturisation of detectors using deep-vacuum eutectic wafer-bonding technology; integrating optics using silicon lenses; and moulding with packaging and assembly.

Exploiting the temperature market

Infrared temperature detectors have very broad application and market potential. That is not surprising considering temperature is a fundamental variable which plays a key role in numerous mechanical, chemical, physical, industrial and medical processes. Two technologies – pyroelectric and thermopile, which MIRS is exploiting – can be found in this market. Thermopile technology can serve almost all market segments, but in monetary value represents a smaller market share (US$82m in 2014). Although applicable in a lot more market segments, thermopile technology is currently more expensive, thus limiting penetration in massive-volume, low-cost markets. That said, growth in the thermopile market – with an estimated compound annual growth rate (CAGR) of 30% – is expected to improve in 2015-2020, thanks to smart buildings and mobile devices. The sales forecast for contactless spot thermometers for mobile devices is US$108m by 2020.

Opportunities in lighting and detection

People-detection sensors have targeted applications in smart lighting systems for office or home, and a market forecast of US$34m by 2020. It is therefore useful to look at the total lighting market for professional luminaires, systems and services, which is expected to grow from €32.5 billion in 2014 to €39.7 billion in 2020, representing a 3% CAGR over the same period. The expected growth in the professional market is primarily driven by the transition to LED and connected lighting, where professional customers are rapidly replacing conventional luminaires with LED ones, and where a significant part of the connected lighting systems will have infrared-based presence sensors embedded.

The growth of professional connected lighting systems is expected to create new opportunities in high-end, professional services. As a result, the total market size for systems and services is expected to grow from €5 billion in 2014 to €10.6 billion in 2020, measured by sales. This represents a 13% CAGR over the same period, with systems and services representing approximately 20% of the total professional market by 2020. This corresponds to a similar growth in the volume of integrated sensors.

One of the contributing factors to the increased use of LED technologies is the expanding offering of systems with sensors and networks. This trend can be defined as digital light, connected lighting systems or smart systems, which offer multiple applications for professionals and consumers, and which deliver energy-savings, among other benefits. However, these applications currently deploy pyroelectric sensors

A new emerging market is the illumination market that goes beyond providing energy savings, and addresses applications, like optimisation of office space and overall safety. Both markets are highly competitive. With new innovations in infrared-sensor technologies targeted in MIRS, European lighting suppliers can outpace the industry and offer new systems and services to defend and further grow their global leading position.

And there is an interesting spin-off from this project. Thanks to application similarities, detection sensors used to track and count people will in fact prepare the ground for advanced automotive scene detection in assisted or autonomous driving, and other applications involving motion detection.

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