TECHNICAL INSIGHTS

SENSOR

TECHNOLOGY ALERT

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1. SENSORS TO INTERPRET BEHAVIORAL ANALYTICS OF EMPLOYEES

With competition at the workplace becoming increasingly intense, employees are undergoing a great deal of stress. As this reflects on their productivity, companies need to take initiatives to ensure their employees are happy and productive and can handle stress well. Deriving employee behavioral data through primary interviews does not provide very accurate information. Thus, there is a need for a device that can track employee behavior and address the challenges faced by employees.

Resarchers from a Massachusetts-based company, Sociometric Solutions, a spin off from Massachusetts Institute of Technology, have developed a money ball for business. The money ball uses sensors and analytics tools to track employee behavior and identify ways to boost employee productivity.

The money ball for business is deployed with various sensors and Bluetooth. One of the sensors employed by the Sociometric Solution is an accelerometer. Accelerometers are used to track the speed of an employee, sensing spells of vigor and lethargy and the number of times an employee is engaged in conversation. Sensors deployed in the solution also tracks the location of the employee when he/she is busy in conversation. The solution uses a microphone to record how loud, fast and often an employee speaks, tracking employee stress levels with the help of their voice tones. The employee can access this information for their personal growth through the Web dashboard or smart phone. The company provides patterns and trends in the behavior of the employee to the management. Thus, by monitoring the behavior of the employee during work, lunch, and ongoing conversations, the Sociometric Solution can track employee productivity.

According to Ben Waber, co-founder of Sociometric, an individual can make use of money ball to boost performance, and the company can use money ball to establish an environment where everyone will get a chance to succeed.

The Sociometric solution can also be used to guide management and help ensure greater productivity levels in offices. The Sciometric solution is also used by the employer to track employee behavior during breaks and how the breaks will boost the productivity of an employee. The Sociometric Solution is used by more than twenty sales and consulting firms. In addition, the solution is also used across the globe by 60 research organizations for social psychology, computer science, management, and so on.

The project was self-funded by Sociometric Solutions. The researchers are currently working on tracking employee behavior in various instances, such as number of breaks. The Sociometric money ball solution has already been deployed at, for example, Bank of America, Deloitte & Touche, Steelcase, Cubit Pharmaceuticals, Aptima and many more. Sociometric Solutions is open to partnerships and licensing activities.

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2. THREE-PIXEL SENSORS TO CAPTURE IMAGES

There are various imaging platforms available in the market that are especially dedicated for medical imaging modalities, such as ultrasound, optical, and magnetic resonance imaging (MRI) platforms. As these imaging platforms are not cost efficient and vary in size, there is a need for thin and cost-effective imaging platforms. The device should be easy to use and flexible enough to enable various applications, such as scanners, bio medical devices and flat imaging devices.

To address the above challenge, researchers from Texas-based Rice University have developed a three-pixel prototype sensor to capture images by using a two-dimensional compound of copper indium and selenide (CIS) atoms.

The researchers fabricated CIS on a silicon substrate. On top of the CIS, three pairs of titanium/gold electrodes are fabricated and cut into three sections with a focused ion beam. CIS pixels are highly sensitive to light and ten times more efficient than other materials, such as chalcogenide compounds and molybdenum disulfide. The CIS layer is two-nanometer thick and consists of a

nine-atom thick lattice. When light hits the material, the device traps the electrons formed and releases those electrons for storage. The CIS-based sensor is ultra thin, flexible and transparent. Because of the transparency, the CIS-based scanner can use light from one side to illuminate the image on the other.

The material employed to develop the sensor is transparent and can be used as a scanner: one side will illuminate with the help of light and other side will capture light. The device can be combined with 2D-bio-imaging devices to monitor conditions in real time. The device is flexible and can be used in the focal imaging system as the curved surface. As the device can hold the light after hitting the material, it can be used as the base for flat imaging devices.

The project was funded by Microelectronics Advanced Research Association, The Defense Advanced Research Project Agency, and the Netherlands Organization for Scientific Research, Robert A. Welch Foundation, The Office of Naval Research, The National Security of Science and Engineering Faculty Fellowship, and the Army Research Office Multidisciplinary University Research Initiative. The researchers are currently working on enabling different applications with a three-pixel prototype sensor. The device is expected to be commercialized in one to two years' time. Once the device is successfully commercialized, it has opportunities to be well received in the consumer electronics and biomedical sectors because it is thin, transparent, flexible and cost efficient.

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3. OPTOELECTRONICS SENSORS FOR WEARABLE DEVICES

Wearable devices are gaining strong traction in sectors such as consumer electronics, healthcare, defense and various others. Universities are investing heavily on wearable devices for the healthcare environment. Sensors are playing a vital role in enabling wearable devices. Pulse oximeters available in the market tend to be thick and not cost effective. They often can only be applied to the fingertips and earlobes and not other parts of the body. There is a need for a thin, flexible, accurate, and cost-effective pulse measuring device that is easy to use and can be utilized for various applications in the medical sector.

To address the above challenge, researchers from the University of California Berkley have developed a new organic wearable pulse oximetry device. The pulse oximetry device includes green and red organic light-emitting diodes (OLEDs) and an optoelectronic sensor.

The carbon-based pulse oximetry device is on an organic, thin and flexible plastic substrate. The spin coating technique is used to deposit the active layer of the sensor and the green and red OLEDs on the substrate. Red and green OLEDs are deployed on the substrate to emit the light while a photodiode is employed to detect the light. Pulse oximeters deliver light to the tissues and analyze the light transferred through the tissue layers. Pulse oximeters employ LEDs to send red and infrared light. Blood absorbs light in proportion to the amount of oxygen present in it. Thus, the amount of transmitted light provides a measure of the blood oxygen level. The device is used to calculate the pulse rate by detecting the pattern of fresh arterial blood.

The device is thin and flexible and is expected to be used as a wearable device for medical applications. In the experiment conducted by students at the University of California Berkley, it was found that the pulse and oxygen readings of the flexible sensor were as accurate as the conventional oximeter.

The project was funded by Flextech and National Science Foundation. The researchers are currently working on identifying the applications of the pulse oximetry device. The device is expected to be commercialized in one to two years' time. Once the device is successfully commercialized, it is has potential to be well received in the healthcare sector as it is easy to use, thin, flexible, and cost efficient; moreover, it can be disposed of easily if the device is contaminated.

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4. RECENT PATENTS IN THE FIELD OF OPTOELECTRONICS

An optoelectronic device is capable of converting an electrical signal into optical signals or vice versa. The main functions of optoelectronics components include responding to optical power, emitting or modifying optical power, and utilizing optical radiation for internal operations. Optoelectronics helps to increase

the efficiency of electronic products. Optoelectronic sensors, which essentially respond to light incident on their active area, can be used for applications such as image sensing, ambient light detection and gas sensing. In the industrial segment, they can be used for proximity sensing and color quality control; in consumer electronics, for backlight control, display management and image sensing; and in healthcare for applications such as pulse oximetry, heart rate monitors, blood glucose sensing.

A recent patent in optoelectronic sensors (US20140333939) is assigned to SICK AG, pertains to an optoelectronic sensors for recognizing edges of objects.

From 1977 to 2014, approximately 601 patents have been registered in optoelectronic sensing**.** From 1988 to 2014, approximately 180 patents have been registered under SICK AG. In 2014, approximately 19 patents have been registered under optoelectronic sensing.

Rising awareness of energy conservation will drive the adoption of optoelectronic devices, such as LEDs in lighting applications. The market for optoelectronics is well-established; and newer applications, such as, for example, thermal imaging cameras for mobile phones, as well as ambient light sensing for building automation, and image sensors for automobiles are expected to grow.

Title	Publication Date/Publication Number	Assignee	Inventor	Abstract
OPTOELECTRONIC SENSOR FOR RECOGNIZING OBJECT EDGES	13.11.2014; US20140333939	SICK AG	MERETTIG Gerhard	An optoelectronic sensor for recognizing object edges of objects comprises at least three light transmitters which are arranged such that at least two different spacings result between two respective light transmitters. For recognizing an object edge, an evaluation unit is configured to carry out a common evaluation of an image taken by a light receiver of a light spot generated by the transmitted light beams of a first light transmitter and of an image taken by a light receiver of a light spot generated by the transmitted light beams of another light transmitter. The pair of light transmitters to be used for the common evaluation can be selected in dependence on a selection criterion from at least two differently spaced apart pairs of light transmitters.

OPTOELECTRONIC SEMICONDUCTOR COMPONENT, AND RADIATION SENSOR	07.08.2014; WO/2014/117970	OSRAM OPTO SEMICONDUCTORS GMBH	HALBRITTER, Hubert	In at least one embodiment, the optoelectronic semiconductor component (1) comprises an optoelectronic semiconductor chip (2) for the detection of radiation. In addition, the semiconductor component (1) contains a first filter element (31), which is a Bragg filter, and a second filter element (32), which is a metal plasmonic filter. The first and second filter elements (31, 32) are arranged in succession along a path (D) of radiation (R) that is to be detected and have different transmission spectra with at least one spectral transmission window each. The spectral transmission windows are delimited by absorption regions in such a way that the filter elements (31, 32) form band pass filters. The absorption regions of the first and second filter elements (31, 32) overlap and are situated on both sides of the at least one transmission window of each of the filter elements. Said filter arrangement produces a filter with a high contrast between radiation to be detected and radiation that is not to be detected.
Method for differentiating between a target object and an atmospheric component in a measurement with the aid of an optoelectronic sensor device of a motor vehicle, sensor device and motor vehicle	02.07.2014; EP2749899	VALEO SCHALTER & SENSOREN GMBH	HUE DAVID	The invention relates to a method for operating an optoelectronic sensor device (3) of a motor vehicle by emitting an optical sensor signal (1) into an environmental region (9) of the motor vehicle by means of a transmitter (4) of the sensor device (3); by receiving a sensor signal (2) reflected in the environmental region (9) and providing an electrical received signal (11) depending on the received sensor signal (2) by means of a receiver (5) of the sensor device (3); and by determining if the reflected sensor signal (2) originates from a target object or from atmospheric components by means of an evaluation device (6) of the sensor device (3) based on the electrical received signal (11), wherein based on the electrical received signal (11), a propagation time (R) of the sensor signal (1, 2) is determined and the reflected sensor signal (2) is interpreted as originating from a target object if the propagation time (R) is greater than a preset limit value (GR).
OPTOELECTRONIC INCLINATION SENSOR	15.05.2014; WO/2014/072205	SARTORIUS LAB INSTRUMENTS GMBH & CO. KG	MÜLLER, Ralf	The invention relates to an inclination sensor (1) with a housing which is filled with a liquid (5) and a gas bubble (6), and is closed off by a convex-curved cover layer (4), along which the gas bubble (6) moves when the inclination sensor (1) is tilted relative to a horizontal reference plane. The inclination sensor (1) comprises a light source (7) and at least one photodetector (8) that is arranged opposite the cover layer. The liquid (5) has an absorption coefficient greater than 0.05 mm-1 for the wavelength of the light source (7).

OPTOELECTRONIC SENSOR FOR DETECTING ONE OR MORE FEATURES OF AN OBJECT	03.04.2014; WO/2014/049544	DATALOGIC IP TECH S.R.L.	FABBRI, Alberto	An optoelectronic sensor for detecting one or more features of an object comprises means for controlling the operation of said sensor and a face (20) for interaction with an operator provided with adjusting means (22, 23) for adjusting operating parameters of the sensor. The means for controlling is connected to the adjusting means (22, 23) to detect a setting of the operating parameters and the adjusting means (22, 23) comprises a knob (22) which is rotatable around an axis (A) for adjusting at least one predetermined parameter among said operating parameters. The sensor comprises a multiturn encoder (28) that is actuatable by the knob (22) and the means for controlling are connected to the multiturn encoder (28) to obtain a rotation mode of said knob, for example a rotation direction and further/or a rotation speed, so as to associate with said detected rotation mode a corresponding setting mode of the predetermined parameter, for example a setting with a first coarse sensitivity, or a second fine sensitivity.
Self-correcting optoelectronic integration electric field sensor system	05.03.2014; CN103616570	TSINGHUA UNIVERSITY	ZENG RONG	The invention relates to a self-correcting optoelectronic integration electric field sensor system, and belongs to the technical field of electric field measurement. The output end of a laser source is connected with the input end of a sensor sequentially through a polarizer and an input polarization maintaining optical fiber, and the output end of the sensor is connected with the input end of a detector sequentially through an output polarization maintaining optical fiber, a polarization beam splitter and a Y-waveguide modulator. Electric signals output by the detector pass through the processor to generate control signals of an adjustable direct current power module and generates the signals of an electric field to be detected backwards through arithmetical operation of the processor, the adjustable direct current power module is controlled to provide voltage signals for the Y-waveguide modulator, and closed-loop control is formed. The self-correcting optoelectronic integration electric field sensor system achieves field calibration of a system transfer function through the feedback control of the Y-waveguide modulator, and improves measurement accuracy. The quiescent operating point of the system is adjusted to pi/2, and the sensor is made to work in the best state.

LIGHT-RECEPTION-PURPOSE INTEGRATED CIRCUIT AND OPTOELECTRONIC SENSOR USING THAT INTEGRATED CIRCUIT	26.02.2014; EP2700901	OMRON TATEISI ELECTRONICS CO	TSUZUKI RYOSUKE	Provided is an integrated circuit for light reception 1 which can be used in both a light quantity detection type photoelectric sensor and a distance setting type photoelectric sensor. The integrated circuit for light reception 1 includes: a pair of light receiving amount signal input parts (for example, terminals 10A and 10B) that externally takes in a light receiving amount signal; an amplifier circuit 100 that includes a function of amplifying a single light receiving amount signal, a function of summing up and amplifying a pair of light receiving amount signals, and a function of differentially amplifying a pair of light receiving amount signals; a setting signal input part (for example, a terminal 105) inputting a setting signal in order to enable one of the three functions of the amplifier circuit 100; a switching processor 10 that relays the light receiving amount signal or signals of an amplification target or amplification targets to the amplifier circuit 100; a signal processor 16 that controls an operation of the switching processor 10 in accordance with the setting signal input from the setting signal input part such that the switching processor relays the light receiving amount signal or signals, which is or are to be amplified by the function enabled by the setting signal, the signal processor 16 performing signal processing to the post amplification signal based on an operation definition determined by the enabled function; and an output part 18 that outputs a signal representing a processing result of the signal processor 16.

Exhibit 1 lists some of the patents related to optoelectronic sensors.

Picture Credit: Frost & Sullivan

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