TECHNICAL INSIGHTS

SENSOR

TECHNOLOGY ALERT

04th April 2014

1. OIL MONITORING SOLUTION FOR MACHINES AND PLANT EQUIPMENT

Oil is a key component that enables the functionality of various machines and equipment in an industrial setting. The oil acts as a lubricant, which ensures smooth running of moving parts of the equipment. The oil is used not only to minimize friction, but to also reduce wear and tear of parts and prevent overheating of the components. With usage, the oil can get contaminated with fine particles and metal dust that are generated due to abrasive processes. The oil also gets oxidized, which causes significant degradation to the lubricating quality. Monitoring the condition of the oil is thus necessary as poor quality of oil can lead to significant damage to expensive machinery. To ensure the smooth running of equipment, oil is generally changed at periodic intervals. This method can result in oil changes even when it is not necessary, leading to increased cost of operations. On the other hand, oil samples are taken to laboratories for analysis, which can also prove costly. This is more pronounced in cases where the plant or the machine is located in difficult to reach areas, such as offshore wind turbines.

To address this challenge, researchers at Saarland University, along with various industrial partners, have developed an oil monitoring system that can be integrated into industrial installations and can provide continuous measurements regarding oil conditions. The system involves two methods that work on optical principles. In the first method, oil is monitored by projecting light from a laser diode. The presence of small particles in the oil results in the light getting scattered, which is then received by photodiodes. By analyzing the signals, the researchers have been able to distinguish and determine the concentration of suspended solid particles. In the second method, the absorption of infrared light by the oil is measured. Such analysis reveals the

chemical state of the fluid as well as detects the presence of water in oil. The sensor used in the system consists of nanostructured layers that can operate even at high pressures.

The data gathered by the sensors in the measurement system are currently transmitted to a distant server using mobile radio communication technology. Thus, analysis of data is done off-site. The researchers have also devised a portable version of the system, which can be used to monitor oil as per requirement. Such a version of the system will be presented at the industrial trade show Hannover Messe, between April 7 and April 11, 2014 at Hanover, Germany. The development of the system was carried out by collaboration with industrial partners HYDAC Electronic GmbH, Germany; and EADS Deutschland GmbH, Germany.

The system will allow plant operators to identify potentially damaging oil conditions at an early time. It can also predict the lifetime of oil so that maintenance work can be scheduled accordingly. Even though the system was designed for monitoring oil, it can be used for other fluids also. The technology realized in the collaborative effort is currently being developed as a commercial product by ZeMA, Germany.

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2. SENSOR FOR MONITORING NITROGEN FERTILIZERS

Sustainability in agriculture can be achieved by minimizing waste and maximizing yield of crops. Fertilizers are one of the key components that farmers use to supply vital nutrients to the plants. Nitrogen is extensively used as one such fertilizer. Normally, farmers apply these fertilizers based on rough estimates, which results in application of either inadequate or excess amounts of fertilizer. Excess application of fertilizers leads to wastage that affects the profit margin of farmers. Moreover, as nitrogen is dissolvable in water, it can get transmitted to waterways and cause water pollution. Thus, there is a need for a solution that can monitor the amount of fertilizer present in the soil and help ascertain the optimum quantity of fertilizer to be used.

SupraSensorTechnologies (Oregon, USA) , working with the University of Oregon, is commercializing a real-time wireless sensor capable of in-situ measurement of nitrate anion concentration in soli. a researcher at the University of Oregon (United States), The miniaturized nitrogen sensor that can provide real-time information on the concentration of nitrogen in fields was developed by a research team at the University of Oregon led by chemistry professors Darren Johnson and Michael Haley. Dr. Calden Carroll, co-founder and president of SupraSensor, served as the team's entrepreneurial lead. The sensors work wirelessly and can work with currently available soil moisture probes. The data collected by the sensor can be stored inside the device, as well as, transmitted wirelessly up to 200 times in a day. This allows farmers to monitor nitrate levels automatically without having to take samples of soil for periodic tests.

The sensor was developed on the basis of research done by Carroll after he discovered a molecule that could bind with chloride molecules. He was also able to find a molecule that binds with nitrate molecules. The invention of the sensor has led to the formation of the company SupraSensor Technologies, which is commercializing the product. SupraSensor Technologies has already received funding of about $650,000 from federal and state sources for testing and development purposes; and secured an additional $130,000 to help commercialize its product from the Oregon Built Environment & Sustainable Technologies Center.. The technology has been patented and field tests have begun from January 2014. The team at SupraSensor is also awaiting furtherpotential funding of $750,000 from the National Science Foundation (NSF) of United States, which will help in commercialization of the product.

Precision agriculture, which involves implementation of technology for assisting farmers, has been garnering a lot of interest. Soil monitoring is a key aspect of precision agriculture. SupraSensor’s device has a small footprint and can be inserted at various depths in the field. By having real-time data on nitrate levels, farmers can apply fertilizers based on actual data rather than by relying on rough estimates. This can save significantly on the costs associated with fertilizer application, as well as, indicate whether the fertilizers present in the soil are of insufficient amounts. Commercial devices are expected to be available around 2015 or 2016. The sensor is expected to benefit farmers

dealing with different field sizes, ranging from small farms to large agricultural tracts.

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3. FLEXIBLE SKIN PATCH FOR SENSING AND DRUG DELIVERY

Wearable medical device technology offers numerous potential benefits in personalized health care. The wearable technology will benefit from flexible electronics that can be applied on the skin and do not interfere with the daily activities of a patient. Currently available medical devices are rigid, which leads to bulky packaging that is strapped on patients. Flexible electronics enable ultrathin patches that can be unobtrusively applied to users. Among the various disease treatments that can benefit from wearable electronics are Parkinson's disease and other movement disorders.

Researchers at the Institute for Basic Science's Center for Nanoparticle Research (South Korea) have developed a wearable skin patch that can sense sudden tremors and release stored drugs. The patch was developed by stretchable electronics provider MC10 Inc. (United States). MC10 has already received investments from companies such as Medtronic Inc. that deal with medical devices. It is exploring application of its flexible electronics platform for monitoring human parameters, such as, heart rate, respiration, tremors, and temperature. These data can be used by doctors in monitoring cardiovascular and neuromuscular disorders.

The device developed by the researchers consists of strain gauges that monitor muscle activity. The strain gauges are silicon nanomembranes that have a serpentine shape, with each curve situated hundreds of micrometers from each other. When the flexible device stretches, it leads to variance in electrical resistance of these filaments. The frequency of the signals is analyzed to determine whether the stretch resulted from normal movements or from a tremor associated with diseases such as Parkinson's. The data is recorded in nanomemory cells having a thickness of only 30 nanometers. The cells record high resistance or low resistance information as a result of the stretch. The device also consists of minute heating elements that can be triggered remotely.

As the temperature of the device increases, the bond between drugs and porous silicon nanoparticles breaks. This leads to the release of drug molecules through the skin following the principle of diffusion.

The skin patch is currently in the prototype form and can detect only muscular movements. In the future, advancements can be made to enable the device to sense other parameters, such as, blood oxygen, temperature, and perspiration. Sensing of these parameters can then be used to trigger mechanisms for different therapies. The researchers are presently working to clear regulatory and clinical hurdles to develop a commercial product.

The final device is expected to help people suffering from movement disorders and Parkinson's disease. The platform can also be used to administer other therapies related to personalized health care. It is expected that commercial products would be available within the next 3 to 4 years.

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4. RECENT PATENTS IN THE FIELD OF TOUCHLESS GESTURE RECOGNITION

Gesture recognition has generated a lot of interest for applications related to gaming, human-computer interface, smart televisions, and so on. Touchless gesture recognition employs technologies, which do not require the user to provide a touch-based input (such as touch screens) or maneuver a device (such as mouse or joystick) to provide an input. Touchless gesture recognition can encompass recognizing and analysing voice inputs as well as human body movements. A voice recognition system use a microphone to record the voice of the user and uses speech recognition software to understand the commands. For recognizing human body movements the key technologies that are used include two-dimensional (2D) vision, three-dimensional (3D) vision, ultrasonic, and electric field sensing. 3D image sensors can use, for example, time of flight techniques and provide a more accurate representation of a scene, than the widely used 2D vision-based systems, but are generally more expensive.

Recent patents in this field indicate that organizations are focussing on vision- or image sensor-based systems. However, patent No WO/2014/019505 by Huawei Device Co. Ltd., describes the usage of an ultrasonic system consisting of a transmitter and a receiver, where the number of receivers is more than the number of transmitters. Patent No WO/2014/005722 by Audi AG indicates the usage of voice control in a vehicle. Automobiles constitute a key application sector for touchless gesture control where voice-based systems have opportunities to be more prominent than human movement-based gesture recognition.

PATENT TITLE	PUBLICATION DATE / NUMBER	APPLICANT/ ASSIGNEE	INVENTORS	ABSTRACT
GESTURE RECOGNITION SYSTEM AND METHOD	27.02.2014; US 20140055566	PixArt Imaging Inc.	HSU En-Feng	A gesture recognition system includes an EDOF lens, an image sensor, and a processing unit. The image sensor successively captures image frames through the EDOF lens. The processing unit is configured to perform gesture recognition according to at least one object image within a sharpness range in the image frames thereby eliminating the interference from background objects.
BACKGROUND DETECTION AS AN OPTIMIZATION FOR GESTURE RECOGNITION	27.02.2014; WO/2014/031538	GOOGLE INC.	CARPENTER, Thor	Methods and systems are provided allowing for background identification and gesture recognition in video images. A computer-implemented image processing method includes: receiving, using at least one processing circuit, a plurality of image frames of a video; constructing, using at least one processing circuit, a plurality of statistical models of the plurality of image frames at a plurality of pixel granularity levels; constructing, using at least one processing circuit, a plurality of probabilistic models of an input image frame at a plurality of channel granularity levels based on the plurality of statistical models; merging at least some of the plurality of probabilistic models based on a weighted average to form a single probability image; determining background pixels, based on a probability threshold value, from the single probability image; and determining whether the plurality of image frames, when examined in a particular sequence, conveys a gesture by the object.
COMPUTER VISION GESTURE BASED CONTROL OF A DEVICE	20.02.2014; US 20140053115	POINTGRAB LTD.	Perski Haim	A system and method are provided for controlling a device based on computer vision. Embodiments of the system and method of the invention are based on receiving a sequence of images of a field of view; detecting movement of at least one object in the images; applying a shape recognition algorithm on the at least one moving object; confirming that the object is a user hand by combining information from at least two images of the object; and tracking the object to control the device.
GESTURE RECOGNITION USING DEPTH IMAGES	19.02.2014; EP 2697743	INTEL CORP	TONG XIAOFENG	Methods, apparatuses, and articles associated with gesture recognition using depth images are disclosed herein. In various embodiments, an apparatus may include a face detection engine configured to determine whether a face is present in one or more gray images of respective image frames generated by a depth camera, and a hand tracking engine configured to track a hand in one or more depth images generated by the depth camera. The apparatus may further include a feature extraction and gesture inference engine configured to extract features based on results of the tracking by the hand tracking engine, and infer a hand gesture based at least in part on the extracted features. Other embodiments may also be disclosed and claimed.

PATENT TITLE	PUBLICATION DATE / NUMBER	APPLICANT/ ASSIGNEE	INVENTORS	ABSTRACT
SEARCH USER INTERFACE USING OUTWARD PHYSICAL EXPRESSIONS	13.02.2014; WO/2014/025711	MICROSOFT CORPORATION	CROOK, Aidan C.	The disclosed architecture enables user feedback in the form of gestures, and optionally, voice signals, of one or more users, to interact with a search engine framework. For example, document relevance, document ranking, and output of the search engine can be modified based on the capture and interpretation of physical gestures of a user. The recognition of a specific gesture is detected based on the physical location and movement of the joints of a user. The architecture captures emotive responses while navigating the voice-driven and gesture-driven interface, and indicates that appropriate feedback has been captured. The feedback can be used to alter the search query, personalize the response using the feedback collected through the search/browsing session, modifying result ranking, navigation of the user interface, modification of the entire result page, etc., among many others.
METHOD FOR GESTURE RECOGNITION AND DEVICE THEREOF	06.02.2014; WO/2014/019505	HUAWEI DEVICE CO., LTD.	KANG, Junteng	Disclosed are a method for gesture recognition and device thereof, which relates to the technical field of recognition. The method comprises: acquiring ultrasonic information transmitted by an ultrasonic transmitter, and acquiring ultrasonic information received by an ultrasonic receiver, the ultrasonic transmitter being fixed to an object to be recognized, the number of the ultrasonic transmitters being at least one, and the number of the ultrasonic receivers being at least three; recognizing the gesture of object to be recognized according to the acquired ultrasonic information transmitted by the ultrasonic transmitter and the acquired ultrasonic information received by the ultrasonic receiver. By fixing the ultrasonic transmitter to the object to be recognized, the invention realizes gesture recognition according to the ultrasonic information transmitted by the ultrasonic transmitter and the ultrasonic information received by the ultrasonic receiver. Because the ultrasonic waves are not interfered by factors such as light and heat source, the reliability of gesture recognition is improved. Because of the good directionality and strong penetrability of ultrasonic waves and higher accuracy for uniform-speed motions and micro motions, the accuracy of gesture recognition is enhanced.
METHOD AND CONTROL SYSTEM FOR OPERATING A MOTOR VEHICLE	09.01.2014; WO/2014/005722	AUDI AG	EBNER, André	The invention relates to a method for operating a motor vehicle (10), having the steps of: detecting a gesture of a vehicle occupant (28) aimed at an object (32, 36) using a gesture recognition unit (14); interpreting the gesture and identifying the object (32, 36) using a data processing unit (18); generating a corresponding control command on the basis of the interpreted gesture and the identified object (32, 36) and controlling an assistance system (20) of the motor vehicle (10) according to the control command using the data processing unit (18), wherein the invention is distinguished by the following steps: detection of a voice command which is uttered by the vehicle occupant (28) before, during or after the detection of the gesture using a voice recognition unit (16), and combined interpretation of the gesture, the identified object (32, 36) and the voice command and generation of the control command on the basis of the combined interpretation using the data processing unit (18). The invention also relates to a control system (12) for operating a motor vehicle (10).

Exhibit 1 lists some of the recent published patents related to touchless gesture recognition.

Picture Credit: WIPO/Frost & Sullivan

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