TECHNICAL INSIGHTS

SENSOR

TECHNOLOGY ALERT

14th March 2014

1. LOW COST AND BATTERY-LESS GESTURE RECOGNITION TECHNOLOGY

Gesture recognition has been a major area of research and commercialization for applications in the consumer electronics sector. With the inclusion of gesture recognition in the Samsung Galaxy S4 smartphone, various companies are trying to include similar offerings in other products too. Gesture recognition involves the interpretation of human gestures via mathematical algorithms. It enables individuals to interact and communicate more naturally with machines. Gesture recognition enables users to control certain functionality of an app by using, for example, simple hand or finger movements. The system essentially consists of a sensor (such as a vision sensor), which captures gesture information and processes it to identify the gesture. The system typically draws power from the battery, which can drain very soon if gesture recognition continues to operate. Even though low-power consuming sensors and microchips are available, the vast number of sensors, processing, and display consumes a lot of power from the limited battery capacity.

Researchers at the University of Washington, USA, have now developed an innovative technology that does not require power from the battery and is able to identify simple gestures at the same time. The researchers have created a sensor, which uses power from TV signals as a power source and for gesture recognition (for detecting a user's gesture command). . The created prototype, AllSee, uses a ultra-low power receiver, which extracts and classifies gesture information using wireless transmission sources in the environment. A specific (e.g., hand) gesture changes the amplitude of the signal, which is recognized by the sensor.

Currently available gesture recognition technology makes the user face the smartphone for gesture recognition interaction. By switching on the display, considerable power is also drained. The new sensor does not require this setup, can always be left on, and can operate even when kept inside the pocket of the user. In this way, power drainage due to display functions can be eliminated. Since the sensor does not require battery power, it will enable 'always on' gesture recognition capability.

The researchers believe that the sensor can be implemented for very low cost of less than a dollar. Such devices can then be easily implemented across a variety of household electronic items, which can be controlled using gestures. Thus, apart from mobile devices such as smartphones, the sensor can be used for the Internet of Things (IoT). Test results of the sensor show that it has an accuracy of more than 90% at distances above 2 feet. The prototype was able to correctly identify eight different hand gestures, such as pulling and pushing, which can be used to denote, for example, zooming out or in of an image. The response time of the sensor is less than 80 microseconds, which will enable it to be used for seamless interaction with the user. The technology is set to be presented at the Symposium on Networked Systems Design and Implementation Conference at Seattle, USA, between April 2 and April 4, 2014.

Some potential challenges that this sensor could encounter might include false recognition of gestures and directing gestures at a particular device when multiple devices fitted with this technology are present in an environment.

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2. MACHINE FAULT DETECTION USING WIRELESS ACOUSTIC EMISSION SENSOR

Maintenance of machines in an industry is critical, as it enables smooth running of operations. Breakdown of machines can lead to high costs and loss of productivity, which can affect multiple stakeholders in the value chain. On the other hand; intelligent maintenance of the machines; including employing condition-based maintenance and conducting tests for early fault detection; can lead to continuous operations, minimal downtime, as well as planned breaks in

operation. The most effective way of monitoring the machines is to have sensors that can continuously check for faults at an early stage. Early detection of faults can lead to proper maintenance so that the problem does not escalate to a complete breakdown of the machine.

Participants in a European Union project, Mosycousis (Intelligent Monitoring System based on Acoustic Emissions Sensing for Plant Condition Monitoring and Preventative Maintenance), have developed a new wireless sensor, which uses acoustic emission sensing technology to detect minute fissures in machines by detecting the transient elastic waves in materials under stress. Such minute cracks appear in machines due to impact, friction, wear, or when ultrasonic waves having a very high frequency and low amplitude are emitted. Such cracks become the weak spots, which further deteriorate over time and lead to breakage. The sensor is able to detect ultrasonic waves at the inception of the crack. It analyzes the ultrasonic waves using advanced digital processing and algorithms of artificial intelligence. The team was able to differentiate ultrasounds emitted by cracks from those emitted during normal operations. The sensor has a detection range from 50 KHz to 300 KHz , which is the range in which structural faults are found in mechanical systems.

Conventional systems monitor vibration of machines to detect faults, but noticeable vibrations can appear much long after the crack and vibrations can appear when a machine has reached the point of a serious breakdown . The developed sensor enables a preventive maintenance system for a plant, thereby making it more secure. By having the sensors present in-situ, human inspection is not required. This will lead to savings in terms of cost as well as shutting down operations for periodic maintenance. The sensors should ideally be fitted across machine parts, which are not easily accessible. The wireless transmission of the sensor will enable proper warning notification to a central computer so that appropriate actions can be taken. The sensor can use energy harvesting techniques to power itself by using thermal and vibration energy harvesting.

The sensors have a wide range of applications in industrial settings, where they can be used to monitor, for example, rotating machines, gearboxes, pumps, engines, ventilators, and compressors. Other areas where the sensors can potentially be used include maintenance for wind turbines, fault detection in railway tracks and biomedicine. In biomedicine, the sensor can possibly be used

for bone fracture detection. The researchers are already working on implementing the sensor for such biomedical applications.

The project, which ended in September 2013, was funded by the 7th Framework Programme (FP7) of the European Union. It had a total cost of about €1.7 million (around $ 2.36 million using the current exchange rate). Project partners included CTM Centre Tecnologic, Spain; National University of Ireland, Ireland; Electroarges SA, Romania; Ardoran Ou, Estonia; Wire-Lite sensors Ltd., Ireland; Sitex 45 SRL, Romania; and the Polytechnic University of Catalonia, Spain.

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3. WIRELESS PARKING ASSISTANCE SENSOR SYSTEM

Safety is a primary area of concern when it comes to automobiles--safety with respect to the passengers, as well as road users and property. Many accidents happen while vehicles back up, especially when people or objects are present in a blind spot. The US National Highway Traffic and Safety Administration (NHTSA) has reported that people are injured annually by vehicles backing up. It has also noted that in the recent past that more than 6,000 blind spots are areas, which drivers are not able to see. The problems arising with blind spots at the rear of a vehicle are more pronounced in case of trucks and trailers. Such vehicles are larger than passenger vehicles and rear view mirrors may not be effective as the truck's body blocks vision.

Back up assistance systems generally use vision-based sensors or ultrasonic sensors that either provide a visual aid or provide a warning to drivers of obstacles present near the vehicle.

USA-based Mobile Awareness LLC provides sensing systems that assist drivers in preventing collisions and avoiding injuries. The company's SenseStat wireless obstacle detection system uses multiple ultrasonic sensors to detect obstacles at the rear end of commercial vehicles, such as lift trucks, single unit trucks, construction vehicles, and trucks with trailers.

Ultrasonic sensors are active sensors, which emit an acoustic signal, and detect the distance from the sensor to the object based on the time it takes for the sound wave to travel to the target and back.

The SenseStat system is comprised of four sensors, which provide information on the closest obstacle to the vehicle. By having four separate sensors, it becomes possible to monitor four different zones. The sensors can detect obstacles up to eight feet from the vehicle, which provides ample time and warning to the driver. The warnings are transmitted to the driver via audible and visual means. The visual display consists of a light-emitting diode (LED) monitor, which projects actual distance information of the closest obstacle as well as presence of obstacles in the four different zones. In case of trailers with hanging objects, it is possible to adjust the zero point up to 32 inches. This feature allows more accurate assistance while backing up/parking. The system has a accuracy of 1 inch, which is beneficial when operating vehicles such as a tractor.

The sensors as well as the wireless electronic control unit (ECU) are waterproof and can be mounted easily on the rear end of the trucks. The installation process is easy and can be done within one hour for most vehicles. Using digitally encoded transmission signals from the ECU are sent wirelessly to the dashboard mounted LED monitor. The sensors are suitable for use in harsh environments and use easily attachable rubber sleeves for protection. The system has an operating temperature range of -30 degrees C to + 80 degrees C, which makes it suitable for varied environments.

The SenseStat system provides advanced safety to large vehicles by aiding in preventing unwanted accidents and damage to people or property. As an aftermarket product, the sensor system will benefit commercial vehicles in reducing accidents.

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4. RECENT PATENTS IN THE FIELD OF PARKING ASSISTANCE SENSORS

Advanced driver assistance systems (ADAS), such as lane departure warning, night vision, blind spot detection, parking assistance, adaptive cruise control, and obstacle detection, help in providing assistance to drivers to mitigate accidents. One of the most used and established type of advanced driver assistance system is parking assistance, which has typically employed

vision-based systems (cameras) or ultrasonic sensors to detect obstacles and provide warnings to the driver.

Vision-based systems capture images and project them in real-time on a display screen. Computer vision algorithms can process the camera's captured images to detect obstacles in the field of view. Ultrasonic sensors emit a high-frequency sound wave and analyze the return interval of the reflected signal to determine distance to the object (or obstacle). Apart from these technologies, electromagnetic parking sensors are also used, which create a electromagnetic field near the vehicle and monitoring the voltage as a result of the presence of people, vehicles, or other objects.

Camera-based parking-assist systems can utilize a small camera mounted in a protected area on the rear of the vehicle. A wide-angle view of the vicinity immediately behind the rear bumper is projected on a small display on the instrument panel or dashboard. Some of the most sophisticated systems will plot the vehicle's projected path as the steering wheel is turned, making the system invaluable for difficult parking maneuvers.

Among the recent patents in this field, patent no WO/2013/114027 by Peugeot Citroen Automobile Sa, pertains to sensors being attached to the wheel to detect the distance to objects such as a curb. Normally, parking assistance sensors are fitted at the rear end of the vehicle, which do not warn the driver of the proximity of a curb. Patent no KR 1020130072709, by Hyundai Motor Company, pertains to a park assist system that fuses ultrasonic and vision image recognition sensors to enhance the accuracy of parking assistance. This system is able capable of performing automatic parking.

PATENT TITLE	PUBLICATION DATE / NUMBER	APPLICANT/ ASSIGNEE	INVENTORS	ABSTRACT
ROCESS FOR THE MANUFACTURE OF A SENSOR DEVICE, IN PARTICULAR OF A SENSOR DEVICE USABLE IN PARKING-AID	15.01.2014; EP 2684186	META SYSTEM SPA	SIMONAZZI GIUSEPPE	The process for the manufacture of a sensor device (1), in particular of a sensor device (1) usable in parking-aid systems for vehicles comprises: manufacturing a support body (2) made of polymer material, substantially hollow and having an opening (4); manufacturing a metal element (9) having a substantially plate-shaped portion (10); associating the metal element (9) with the support body (2), with the substantially plate-shaped portion (10) of the metal element (9) in correspondence to the opening (4) of the support body (2); positioning inside

SYSTEMS FOR VEHICLES AND CORRESPONDING SENSOR DEVICE				the support body (2) a transducer element (12), in correspondence to the substantially plate-shaped portion (10) of the metal element (9); positioning inside the support body (2) electronic interface means (14) suitable for being connected to an electronic unit for the parking aid of vehicles; connecting electronically the transducer element (12) to the electronic interface means (14); filling the support body (2) with an insulating material (16).
SPACE SEARCHING METHOD OF AUTOMATIC STEERING PARKING SUPPORT DEVICE FOR CARS, USING AN ULTRASONIC SENSOR	25.09.2013; KR 1020130104206	HYUNDAI MOBIS CO., LTD.	RYU, JAE YONG	PURPOSE: A space searching method of automatic steering parking support device for cars, using an ultrasonic sensor is provided to improve efficiency and accuracy of space searching by performing an independent space searching when the ultrasonic sensor operates. CONSTITUTION: An automatic steering parking support device for cars comprises multiple slave ultrasonic sensors, and an LIN master controller. The LIN master controller transmits initialization and diagnosis orders to each slave ultrasonic sensor. The LIN master controller transmits a space searching order to the slave ultrasonic sensor which has completed the initialization and diagnosis. The LIN master controller asks the result data to one of the slave ultrasonic sensors. A method of automatic steering parking support for cars comprises the steps of: transmitting the initialization and diagnosis orders to the multiple slave ultrasonic sensors; transmitting the space searching order to each slave ultrasonic sensor which gas completed the initialization and diagnosis; asking the result data of space searching to one of the slave ultrasonic sensors connected to the LIN communications.
METHOD FOR CONTROLLING THE OPERATIONAL CYCLE OF AN ULTRASONIC SENSOR OF A SMART PARKING	12.08.2013; KR 1020130089458	HYUNDAI MOBIS CO., LTD.	RYU, JAE YONG	A method for controlling the operational cycle of an ultrasonic sensor of an SPAS (Smart Parking Assist System) is provided to improve the accuracy of space search by dynamically controlling the operational time of LIN (Local Interconnect Network) communication in the process of searching a parking space and to improve detecting performance without any specific external device. CONSTITUTION: A method for controlling the operational cycle of an ultrasonic sensor of an SPAS

ASSIST SYSTEM				comprises the step of: dividing the detection range of the ultrasonic sensor into three areas of Zone1, Zone2 and Zone3 and setting the operational time of Zone1 as Ztime1, the operational time of Zone2 as Ztime2, and the operational time of Zone3 as Ztime3; a first control step at which the ultrasonic sensor is controlled to measure the detection range of Zone3 during Ztime3; a first decision step at which an operational time and a detection area are decided based on the measured detection range at the first control step; a second control step at which the ultrasonic sensor is controlled to measure a detection range of the detection area during the LIN communication time decided at the first decision step. Herein Zone1 < Zone2 < Zone3, and Ztime1 < Ztime2 < Ztime3.
PARKING ASSISTANCE DEVICE COMPRISING A SENSOR FOR MEASURING THE DISTANCE SEPARATING SAID SENSOR FROM AN OBSTACLE SUCH AS A KERB	08.08.2013; WO/2013/114027	PEUGEOT CITROEN AUTOMOBILES SA	PALPACUER, Eric	The invention relates to a parking assistance device for a vehicle, comprising a sensor (2) for measuring the distance separating said sensor (2) from an obstacle such as a kerb, the vehicle comprising at least one wheel (1), such that the sensor (2) is positioned on said wheel (1). The invention also concerns a wheel (1) for a vehicle, comprising at least one sensor (2) for measuring the distance between said sensor (2) and an obstacle, the sensor (2) forming a part of such a parking assistance device. Finally, the invention also concerns a vehicle comprising such a parking assistance device.
METHOD USING AN AUXILIARY PARKING SENSOR TO DETECT A NEARBY OBJECT CAPABLE OF IMPROVING THE FUNCTION TO SENSE AN	19.07.2013; KR 1020130082291	HYUNDAI MOBIS CO., LTD.	PARK, JUNE SUNG	PURPOSE: A method using an auxiliary parking sensor to detect a nearby object is provided to improve the function to detect an object close to a vehicle and help a driver to park safely by detecting an object very close to a vehicle. CONSTITUTION: A method using an auxiliary parking sensor to detect a nearby object comprises the following steps: detecting the rear of a vehicle with an auxiliary parking sensor of the vehicle and determining whether an object exists in a detection area within a predetermined distance from the rear of the vehicle based on the detection result; detecting the rear of the vehicle only in an indirect sensing mode with a parking

OBJECT CLOSE TO A VEHICLE				auxiliary sensor when an object does not exist within the area, based on the detection result; and giving an alarm for safe parking if an object exists in the rear of the vehicle. COPYRIGHT KIPO 2013 null [Reference numerals] (AA) If an object exists within 2ms from a sensor, the sensor receives a reflected wave with a voltage of 3V or more, so the sensor detects a reference with a voltage of 2V; (BB) Proposed indirect reference; (CC) Ignore a waveform which comes with a voltage of 2V or less within 2ms from the sensor in case of an indirect logic
PARKING ASSIST SYSTEM, CAPABLE OF BEING BASED ON A TECHNICAL COMPOSITION OF AN IMAGE RECOGNITION AND AN ULTRASONIC SENSOR	02.07.2013; KR 1020130072709	HYUNDAI MOTOR COMPANY	YOON, DAE JOONG	PURPOSE: A parking assist system based on a technical composition of an image recognition and an ultrasonic sensor is provided to control a parking more minutely, to induce a parking more safely and correctly, and to perform an automatic parking. CONSTITUTION: A parking assist system based on a technical composition of an image recognition and an ultrasonic sensor comprises a camera (10) which records an image of a vehicle periphery, an ultrasonic sensor (20) which detects a space within a prescribed distance from a vehicle, a space interpretation unit (40) computing a park possible area from a detection target area, an user input unit (30) for a control command input or a data input from a user, a parking area setting unit (50) which stores target parking section information which a user confirms through the user input unit, a guideline message display unit (60) outputting an announcement related with a park guideline and an automatic parking function execution, a parking control unit (70) which performs an automatic park through an acceleration /deceleration control, a steering of a wheel according to a designated control signal, and a control unit which guides a park possible area computed by the space interpretation unit to a user through the guideline message display unit, and which controls an execution of an automatic park by controlling the parking control unit based on target parking section information which a user confirms through the user input unit. COPYRIGHT KIPO 2013 null [Reference numerals] (10) Camera; (20) Ultrasonic sensor; (30) User input unit; (40) Space interpretation unit; (50) Parking area setting unit; (61) Display unit; (62) Voice output unit; (70) Parking control unit

APPARATUS FOR DISPALYING FAULT DIAGNOSIS OF A PARKING ASSISTANCE SYSTEM (PAS) SENSOR AND A METHOD THEREOF	28.06.2013; KR 1020130070681	SSANGYONG MOTOR COMPANY	JUNG, SU YOUNG	PURPOSE: An apparatus for displaying fault diagnosis of a parking assistance system (PAS) sensor and a method thereof are provided to enable a driver to recognize fault state of the PAS sensor more rapidly and easily. CONSTITUTION: An apparatus for displaying fault diagnosis of a parking assistance system (PAS) sensor includes a parking assistance system sensor part (110), a fault diagnosis part (120) and a dashboard apparatus (130). The PAS sensor part includes a plurality of parking assistance system sensors sensing objects in the front and rear of a vehicle for parking assistance. The fault diagnosis part diagnoses fault of the plurality of PAS sensors, and outputs fault diagnosis result. The dashboard apparatus analyses fault diagnosis result outputted from the fault diagnosis part, and displays fault state of the sensor by displaying an abnormal sensor discriminatively from normal sensors. COPYRIGHT KIPO 2013 null [Reference numerals] (110) Parking assistance system sensor part; (120) Fault diagnosis part; (130) Dashboard apparatus; (131) Control part; (132) Information display part

Exhibit 1 lists some of the recent published patents on parking assistance sensors.

Picture Credit: WIPO/Frost & Sullivan

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