TECHNICAL INSIGHTS

SENSOR

TECHNOLOGY ALERT

21st March 2014

1. RADAR-BASED TRAFFIC DETECTION FOR INTELLIGENT TRANSPORTATION SYSTEMS

The Intelligent transportation system (ITS) is a concept in which traffic and transportation are managed using a host of sensors, software, analytics, and communication technologies. The systems are able to overcome shortcomings of humans in monitoring traffic in specific areas as well as gather overall congestion information over larger areas. By getting an accurate estimation of traffic, proper management of flow and routing can be done to achieve a smoother flow of traffic. The increasing trend of urbanization has led to increase in automobile congestion in various parts of the world. This is primarily because the roads cannot be widened to accommodate the increase in traffic. The problem becomes more prominent during peak hours when commuters go to or return from workplaces, schools and colleges.

Image Sensing Systems Inc., is a Minnesota, USA-based company specializing in technologies for advanced traffic management solutions. The company has recently introduced a new radar-based vehicle detection unit, the Autoscope RTMS Sx-300, which is able to provide traffic information in multiple lanes simultaneously. The radar is capable of detecting up to 12 lanes and provides traffic information such as volume, speed, occupancy, and classification up to a range of 250 feet (76 meters).

Apart from radar-based systems, vision-based systems are also capable of providing similar functionality. However, in adverse weather conditions, such as heavy rainfall, snow, mist, and fog, these systems may fail to accurately detect traffic conditions. The RTMS Sx-300, as a radar-based system, may not be so affected by such atmospheric conditions, making it an all-weather detection system. The RTMS Sx-300 needs to be mounted on a pole in a suitable location on the road side. It operates by sending and receiving signals

in the microwave band of the electromagnetic spectrum. A single such unit can easily replace several inductive loop traffic detectors. The systems need to be installed on the road itself and requires a longer time for installation as well as temporary stoppage to traffic.

The Autoscope RTMS Sx-300 provides users with an automated set-up feature, which is able to automatically detect zones and calibrate accordingly. The installation of the device is also simple and is cost effective. The device weighs only 1.5 kilograms and has a compact form factor of 21 cm x 21 cm x 16 cm. The device has an operating temperature range from -37 degrees C to +74 degrees C, and is resistant to wind speeds upto 190 km per hour. The Autoscope RTMS Sx-300 comes with the CitySync Metro software, which provides analytics for making proactive decisions based on real-time information.

This new device is expected to help cities and traffic controllers better manage traffic and realize an intelligent transportation system.

Details: Dan Skites, Vice President--Sales and Marketing, Image Sensing Systems Inc., 500 Spruce Tree Centre, 1600 University Ave. West, St. Paul, Minnesota 55104. Phone: +1-651-603-7700. E-mail: info@imagesensing.com. URL: www.imagesensing.com.

2. HANDHELD RADIATION DETECTOR FOR NUCLEAR PLANT SAFETY

Radiation is one of the major concerns to safety in nuclear plants. The radiation is not only dangerous for on-site workers, but also to the public in areas nearby the plant. Plant operators need to locate potentially dangerous radiation hot spots to take proper measures to rectify faults and contain radiation.

Research at the Nuclear Engineering Department of the University of Michigan, USA, has led to the development of a handheld radiation camera, which is being commercialized by a spin-off of the university, H3D. The detector, Polaris-H, is an imaging device, which maps gamma radiations onto visible light images to enable operators to detect radiation hot spots and leakages in fuel rods.

The Polaris-H enables easy and early detection of leakage by pinpointing abnormalities in radiation. This can be used to initiate necessary maintenance, ensure proper safety of workers, and used as a tool during clean-up of nuclear

fallout. Using the Polaris-H reduces the time taken to locate problems such as stray radioactive particles, radioactive build-up in pipes, and leakages in fuel rods. Apart from assisting in regular maintenance, the device can also prove helpful during accidents in monitoring radiation hot spots and identifying contaminated areas.

The sensor in the device is based on a three-dimensional position-sensitive cadmium zinc telluride (CdZnTe) compound. CdZnTe is a wide band gap semiconductor material that can be operated at room temperature and shows high efficiency in gamma ray detection. Unlike bulkier detectors, which require cryogenic cooling, the Polaris-H can be operated at room temperature and weighs about 10 pounds. It was developed specifically for identifying, quantifying, and localizing gamma ray sources. The device can scan sources in all directions at the same time and has minimal set-up time of around 5 minutes. The camera is connected to a touchscreen display via a 15 foot cord to enable the controller to stay away from any potentially affected area. The data collected can be stored in an USB (universal serial bus) drive, which can be transferred to a computer for further analysis.

The typical applications for which the Polaris-H can be used include identification of fuel failures, locating crud in valves and pipes, verification of clean-up activity after a leakage, locating faults, optimizing shielding designs, and assisting in evacuation. The device is already being used in multiple nuclear power plants in the USA, such as Cook Nuclear Plant, Michigan, USA. Apart from nuclear plant operators, the device is also being used by National Aeronautics and Space Administration (NASA) and the United States Department of Defence (DoD).

Details: Zhong He, Professor, Nuclear Engineering and Radiological Sciences, University of Michigan, 2355 Bonisteel Blvd, 1906 Cooley Bldg., Ann Arbor, Michigan 48109-2104. Phone: +1-734-764-7130. E-mail: hezhong@umich.edu. URL: www.umich.edu.

3. DRIVER MONITORING USING EMOTION DETECTION

Advanced driver assistance systems include lane departure warning, parking assistance, blind spot monitoring, adaptive cruise control, and obstacle detection and avoidance. These systems are aimed at providing warnings of potential dangers and assisting drivers in avoid such accidents. Currently, there

has been a lot of interest in monitoring the driver apart from only providing assistance. Highly accurate alcohol detection systems inside a vehicle can stop drivers who are under the influence of alcohol from starting the car and have potential in reducing the number of accidents. Apart from that, a lot of accidents occur when the driver has a lapse in concentration. This lapse can be a result of various factors such as fatigue, as well as the emotional state of the driver. Emotional states can include anger, surprise, sadness, and so on. Currently emotion detection has potential application in medicine, video game development and marketing. But, there is increasing interest in such biometrics technology to warn drivers of potential concentration lapses and provide warnings.

To further investigate into the potential of emotion detection of drivers, researchers at the École polytechnique fédérale de Lausanne, Switzerland, have collaborated with PSA Peugeot Citroen, to develop an on-board driver emotion detector. The device analyses facial expressions of drivers to deduce their emotional state. It uses infrared cameras to capture images of the driver and analyses them.

The main challenge faced by the researchers was to identify irritation from the face of the driver. They concentrated on two broad forms of emotion--anger and disgust. The researchers carried out the testing of their system in two phases. First, emotions were identified using photos of subjects. Then, videos were used for identification. The images used in these tests were captured in an office environment as well as in a car. The system was able to detect angry emotions in most of the cases. The instances when the test failed were attributed to the variance of expressing emotion from person to person. This challenge will persist as every person expresses anger or irritation in different ways. To counter this, a self-learning machine learning software is required, and researchers are currently working on this software.

The researchers also used a fatigue monitoring system, which monitors the eyelid closure of drivers. For a system to be incorporated in a vehicle, it is important to have multiple capabilities. Moreover, machine learning should also be adapted so that the software can adapt to different individuals in real-time. It is expected that systems that monitor driver emotions could be used in commercial vehicles around 2020 or so. Such systems will enable reducing the number of accidents due to driver errors.

Details: Hua Gao, Scientist, Signal Processing Laboratory 5 (LTS5), École polytechnique fédérale de Lausanne, ELD 239 (Batiment ELD), Station 11, CH-1015 Lausanne, Switzerland. Phone: +41-21-693-30-43. E-mail: hua.gao@epfl.ch. URL: www.epfl.ch.

4. RECENT PATENTS IN THE FIELD OF WATER QUALITY MONITORING

The demand for fresh and clean water is increasing as pollution levels in water bodies are increasing with increased urbanization and industrialization. Particularly in developing economies, restrictions on dumping waste in water bodies are not very strictly followed. Because of this, a lot of water-borne diseases affect millions around the globe. Moreover, pollution in water affects aquatic life severely. The various application areas under water quality monitoring include drinking water industry, waste water management, environmental monitoring, and industrial process water monitoring. Other areas include recreational water bodies such as swimming pools and water parks.

Traditionally water was monitored using samples taken from the source and analyzed at a laboratory. This was a time consuming and costly process, and there was a need for developing *in-situ* (on-site) water monitoring solutions. Currently, there is an interest in developing miniaturized, portable, and wireless sensor solutions that provide numerous benefits as compared to the traditional solutions. Different technologies, such as electrochemical, nanosensors, optical sensing, biosensing, and micro-electromechanical system (MEMS) sensors, are being scrutinized or implemented for water quality monitoring. Multiple parameters such as pH, salinity, and chemical concentration are required to be monitored. Thus, the solutions possess multi-parameter sensing capabilities. Majority of the patents related to water quality monitoring have been filed in the Asia Pacific region, with most patents being published in Korea.

PATENT TITLE	PUBLICATION DATE / NUMBER	APPLICANT/ ASSIGNEE	INVENTORS	ABSTRACT
SYSTEM AND METHOD FOR CONTROLLING WATER QUALITY IN A	28.11.2013; US 20130313204	Shalon Tadmor	Shalon Tadmor	A system for monitoring water chemistry of a recreational water installation includes a sensor configured to detect bather load in the recreational water installation and a controller configured to determine a required adjustment to the water chemistry of the

RECREATIONAL WATER INSTALLATION				recreational water installation based upon the detected bather load.
UNDERGROUND WATER MONITORING SYSTEM CAPABLE OF OBSERVING WATER QUALITY OF UNDERGROUND WATER AND CHECKING AN UNDERGROUND EVENT	11.10.2013; KR 101316929		LEE, JUN JEONG	PURPOSE: An underground water monitoring system capable of observing water quality of underground water and checking an underground event is provided to accurately determine occurrence of the underground event by detecting data such as a water level, a temperature, conductivity, vibration and an image of the underground water. CONSTITUTION: Sensor probes (10-1,10-2,10-3) are installed within underground water observation holes (1,2,3) penetrated in the ground. The sensor probes detect water quality of the underground water in the underground water observation holes on a cycle of first predetermined time. Local control panels (20-1,20-2,20-3) connected to the sensor probes manage the sensor probes and data detected by the sensor probes. A memory (30) connected to the local control panels stores the data detected by the sensor probes. A control center (40) monitors the data stored in the memory. The memory includes a sub volatile memory and a non-volatile main memory
EXPERT DECISION-MAKING SYSTEM BASED ON THE WATER QUALITY SENSOR AND REMOTE MONITORING SYSTEM OF A WATER TREATMENT PLANT WHICH ANALYZE AND MANAGE WATER QUALITY OF THE WATER TREATMENT PLANT	28.08.2013; KR 101301072		KANG, HYEONG SEOK	PURPOSE: An expert decision-making system is provided to input decision information about injecting chemicals by an expert into a remote monitoring system, thereby implementing optimized operation. CONSTITUTION: A water treatment plant (W) is equipped with a water-purifying chemical injecting unit (113) and a water quality sensor (111). A first control part (11) controls the water-purifying chemical injecting unit and water quality sensor of the water treatment plant. A database server (15) stores water quality information measured by the sensor. A first communications part (13) transmits the water quality information in the database server to the outside. A second communications part receives the water quality information of the water treatment plant through the first communications part. A calculation part (213) processes the water quality information received through the second communications part. COPYRIGHT KIPO 2013 null [Reference numerals] (111) Water quality

				sensor; (113) Water-purifying chemical injecting unit; (133) Second modem; (135) Second router; (13A) Main communication server; (13B) Auxiliary communication server; (15) Database server; (17) Monitoring; (211A) First router; (211B) First modem; (213) Calculation part; (215) Display; (217) Automatic control device; (23) Monitoring device; (25) Calling device
LIGHT SENSOR DEVICE FOR MEASURING A WATER QUALITY USING AN RGB SENSOR MEASURING CRITERIA OF THE WATER QUALITY BASED ON FLUORESCENCE EMITTED BY A FLUORESCENT FILM	06.08.2013; KR 101293690		LEE, JAE SEONG	PURPOSE: A light sensor device for measuring a water quality using an RGB sensor is provided to integrate light emitting diodes, the RGB sensor, and a light source filter into a sensor holder and to detachably insert the sensor holder into a sensor casing, thereby miniaturizing and lightening the sensor device at low costs. CONSTITUTION: A light sensor device (10) for measuring a water quality using an RGB sensor (11) includes light emitting diodes (9), a light source filter (12), a fluorescent film (8), a substrate (7), a fluorescent filter (13), and a measurement device. The light emitting diodes are installed on the front end surface of a sensor holder (14) at a predetermined interval. The light source filter is installed between the outer periphery of a light collecting pipe (14a) and the inner periphery of a sensor casing (1) and controls the frequencies of lights emitted by the light emitting diodes. The fluorescent filter emits the fluorescence of a specific frequency by reacting with the lights projected via the light source filter. The fluorescent film is coated on the substrate, and the substrate is installed inside a front cap. The fluorescent filter is installed inside the front end portion of the light collecting pipe and controls the frequencies of the fluorescence emitted by the fluorescent film. The measurement device is composed of the RGB sensor. The RGB sensor is arranged on the center of the sensor holder and inserted inside the sensor casing. The RGB sensor directly detects the colors of the light projected via the fluorescent filter, thereby measuring dissolved oxygen or pH.

WATER QUALITY SENSOR CONTROL DEVICE USING FLOW DATA, CAPABLE OF CONTROLLING A WATER QUALITY SENSOR NODE FOR ESTIMATING THE WATERLOGGING OF THE SENSOR NODE USING FLOW SENSOR DATA AND CONTROLLING THE WATER QUALITY SENSOR NODE ACCORDING TO THE ESTIMATED RESULT AND A METHOD THEREOF	02.08.2013; KR 1020130086497	ELECTRONICS AND TELECOMMUNICATIONS RESEARCH INSTITUTE	PARK, HYEON	PURPOSE: A water quality sensor control device using flow data and a method thereof are provided to estimate the waterlogging time of a flow sensor node and a water quality sensor node in the predetermined distance from the flow sensor node using flow sensor data transmitted by the flow sensor node. CONSTITUTION: A water quality sensor controlling device (130) can comprise a data receiving part (210), a waterlogging estimation time determining part (230), and a sensor data reception controlling part (250). The data receiving part receives waterlogging water level alert data informing flow sensor data and flow sensor node waterlogging possibility from a flow sensor node. The waterlogging estimation time determining part determines flow sensor node waterlogging estimation time using flow sensor data when waterlogging water level alert data is received. A flow sensor data reception controlling part controls the receiving of flow sensor data according to waterlogging estimation time. COPYRIGHT KIPO 2013 null [Reference numerals] (110) Water quality sensor controlling device; (210) Data receiving part; (220) Water quality evaluation part; (230) Waterlogging estimation time determining part; (240) Database; (250) Sensor data reception controlling part
METHOD TO MEASURE QUALITY OF WATER, CAPABLE OF RAPIDLY CHECKING THE SAME BY RECEIVING A SAMPLING DATA, A SYSTEM THEREFOR, A ROBOT THEREFOR, AND A MANAGING DEVICE THEREFOR	04.07.2013; KR 1020130074016	KOREA ELECTRONICS TECHNOLOGY INSTITUTE	LEE, JEONG GI	PURPOSE: A method to measure quality of water, a system therefor, a robot therefor, and a managing device therefor are provided to generate hydraulic power using currents and to save energy by driving the robot using the same. CONSTITUTION: A robot (10) to measure quality of water comprises a driving unit, a sensor unit, and a control unit. The driving unit supplies power to move under the sea or on surface along a moving path. The sensor unit senses the quality of water with respect to specific position for moving. The control unit moves along the moving path based on position information according to control of a managing device and analyzes quality of water in the specific position for moving. The control unit generates sampling data with respect to the analyzed result and transmits the generated sampling

				data to the managing device. COPYRIGHT KIPO 2013 null [Reference numerals] (10) Robot; (20) Managing device; (30) Position information providing device; (40) Communications network
INTEGRATED SYSTEM FOR MONITORING PERMEATE QUALITY IN WATER TREATMENT FACILITIES	19.06.2013; EP 2603308	SAUDI ARABIAN OIL CO	KARABELAS ANASTASIOS J	The invention provides a method and apparatus for continuous monitoring of permeate from membrane elements in a water treatment plant, including a desalination plant. The apparatus includes a probe that includes multiple sensors such that at least one sensor is associated with each membrane element. Each sensor is coupled to a node, which is configured to communicate a signal associated with the permeate quality to a central node sink. The node may communicate wirelessly with the node sink.

Exhibit 1 lists some of the recent published patents related to water quality monitoring.

Picture Credit: WIPO/Frost & Sullivan

Back to TOC