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CBRN add-ons for EOD UGVs

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UGVs more and more often replace humans when it comes to the most difficult and dangerous tasks and the scope of such applications is still growing. It shouldn't be then something unusual that the Polish Industrial Research Institute for Automation and Measurements (PIAP) designed a set of accessories, which allow robots perform recognition within the scope of the CBRN tasks.

Expansion of applications for own products is something natural for every company that wants to expand the group of customers. Such company flexibly react to the needs of recipients. Such growing demand of many customers, especially the police and firefighters, enable PIAP to develop a series of accessories used for recognition during the CBRN risk.

In the case of firefighters, especially of the unit of technical rescue services, the necessity for introduction of improvements has been an obvious obviousness – the robots used by firefighters have a frequent contact with substances of potential risk, while the quick identification of such substances allows to properly secure and neutralize the risk.

In the case of police, the ability to identify unconventional risks, the one that UGVS have, is also invaluable, especially in the case of risk of terrorism. We are never 100% sure that the suspicious package will not have a so-called dirty bomb, which should be neutralized in a different way than the regular ones.

In response to such situations, a series of accessories has been developed to be used for identification of CBRN risks that consists of five working probes and one additional component. The tools are: ground sampler, environmental swab, SPME adsorber, R-Sensor with an integrated display of EKO-C pollution (with a Geiger-Müller detector), and a set of forensic samplers. Additional accessories

consist of grips for fixture on the hull of robots, as well as a steering console to operate the tools facilitated with radio modules.

The main feature of all the accessories is the possibility of making easy adjustments to use the robot with a smaller model (e.g. PIAP GRYF) and a bigger gripper (e.g. PIAP IBIS) thanks to the replacement of grips working with the jaws of the gripper.

GROUND SAMPLER

This is a tool designed for taking samples which, after return of the robot to the operator, are then analyzed. It helps in taking samples of various types of surface (ground, sand, ice, surface with vegetation etc.), which can be penetrated thanks to proper working attachments. The set include three attachments – for dense surface, loose surface, and turf (or similar). In the transport position, the device is carried in a container mounted on MIL-STD-1913 rail, with a maximum volume of 300 cm3 of the sample, with a discharge hole secured with brushes. The device is held in the container with a strong magnet that prevents it from accidental falling out of the grip, as well as helps in easy placing the attachment after the work.

ENVIRONMENTAL SWAB

This tool is used to take samples of material for laboratory analysis by performing environmental swabs on the surface of objects. It includes a working attachment, which has a sponge (sterile, dry, or soaked in neutralizing buffer) mounted with a spring-loaded clamp and a transport container attached to a rail on the body of the robot. The container is to hold the working attachment in a position easy for the gripper of the robot (thanks to magnets) and, after collecting the sample, to secure it against influence of the environment, which may distort the analysis later on.

FORENSIC SAMPLERS SET

Those are standard samplers used by forensics technicians (swabs and indentures) adjusted to be operated with the gripper of the robot by adding a proper base and a handle. It should be mentioned that placing the sampler in the handle does not require any adjustments in the sampler, as well as do not interfere with its construction. The handle was designed in such a way, so that the replacement of the sampler is easy and quick, and does not unseal it, which could distort the results of analysis later on. Moreover, design of the handle helps in operating the sampler with the gripper and in the further decontamination activities.

The handle is attached t the UGV body with MIL-STD-1913 mount.

SPME ABSORBER

It is an electronic device used for adsorption of chemical molecules from air and fluids with the solid phase micro-extraction (SPME). The device

includes a fiber with sorbent that is exposed in a liquid or gas medium that accumulates chemical molecules, which than can be processed in further analysis, e.g. in a gas chromatograph. The adsorber is remotely controlled via console or manually with a user's interface that is located on the casing. The device is transported in the tool bank located inside the robot. The tool bank is available in two variants – with one or two places for tools. A single bank is mounted to quick-attaching rail, the double bank, along with the frame, is attached to rails thanks to fixings with screw terminal.

The adsorber is provided with additional fibers and a tool to take them out from the device, as well as with a transport case, which includes a wireless inductive charger.

R – SENSOR (INTEGRATED EKO-C)

R-Sensor is a radiometer designed to identify and measure α, β, γ and X-rays radiation. It is facilitated with an integrated monitor for identifying EKO-C pollution. It is transported in the bank tool in the hull of the robot (with a frame or fixing on a rail – the same as in the case of SPME Adsorber) and operated by the gripper. Operation of the meter is conducted via a steering console or a user's interface in its body. The measurement can be read on the operator's console or – via a camera placed on the arm of the robot – on the steering console of the robot. Similarly to the Adsorber, the Radiometer is supplied with a transport case facilitated with an integrated wireless inductive charger. R-Sensor is the first device from the series of radiology and chemical sensors by PIAP for mobile robots.

ACCESSORY CONSOLE

The console is used to steer the CBRN accessories that have radio modules (Adsorber SPME and R-Sensor) and to display results of measurement with environmental sensors. It has a form of a tablet of increased resistance with an attached radio module, which communicates with accessories, and a GPS module. The console also has an access module authorized with an RFID card. The user's interface is a graphical environment, in which the system of accessories is fully operated via a touchscreen.

When switched on, the console shows the operator the list of accessories that can be paired with the console. After the accessories are paired with, the operator may switch the control windows with icons representing respective devices. Via the windows, it is possible to i.a. switch the device on and off, display measurement data from the sensors as text or/and in a graphical form, and check the charge level of the internal batteries of devices.

The console is facilitated with a map sub-system, which has been currently used to display the current position of the console according to the indications shown in the GPS module. At any time, the operator may open the accessory list and disconnect the selected ones (e.g. in order to spare energy or after completing the task) or pair with additional accessories to increase the range of possible tasks.