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LABORATORY APPLICATION OF MODERN ROBOTICS TECHNOLOGY

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Today robots are used in almost all fields — manufacturing, agriculture, medicine and military. There are robots assembling cars, surgical robots, drones, for space exploration. Robots are any electromechanical machine that performs a specific task. They can be autonomous or semi-autonomous. Robots are usually used whenever the task at hand is repetitive, dirty, hazardous or dangerous, and since most laboratory work usually covers most of these aspects, it seems essential for modern laboratory to use robots in order to increase efficiency and productivity.

The aim was to develop a simplified concept of:

- 1) how laboratory work can be done through the use of robots, in particular 2 multifunctional robots which are the manipulator and the smart controller;
- 2) how these 2 robots can perform all the tedious tasks allowing a scientist to escape wasting efforts on preparing and repeating experiments, since the robots would've already done that for him, and just concerning himself with the results and focusing on bigger picture and thus achieve more with less time.

Results and discussion

Some advanced laboratories already have versatile automated machines, but they suffer from 2 drastic drawbacks:

- 1) extremely expensive (costing 10 000–100 000 \$);
- 2) very specialized (only able to perform a few specific tasks).

It should be taken into consideration that some laboratory work would pose a risk to a stuff because of manipulation with hazardous materials and microorganisms. In order to work around this problem, robot should have a simple modular design, that is capable of performing tasks, and thus can be mass-produced. Since they are based on relatively affordable and available technology, these robots would cost in the 1000s of dollars, and thus can be purchased by all laboratories and each can program the robot according to their specific needs.

All laboratories have two things in common, the equipment and the scientists performing the work and operating the equipment. The scientists can be replaced by the manipulator which can perform most of the scientist's work such as moving items around and manipulate some of the equipment, while the smart controller monitors and controls most of the equipment. At the same time all the robots send feedback about their status to a main computer.

Laboratory Manipulator «LabMan», which is under development, can be either fixed (performing specific tasks) or mobile (performing multiple tasks around the laboratory). The tasks can be either pre-programmed or controlled directly via Wi-Fi so it can perform the tasks on its own if needed. Using exchangeable grippers, «LabMan» can manipulate many different objects such

as moving tunes and slides, mixing reagents and dispensing them into tubes, microtubes, PCR or ELISA plates.

The Smart Controller is a microcomputer in addition to some accessories (sensors and peripheral devices) which can be programmed to do any number of tasks and connects to existing laboratory equipment, such as incubators, centrifuges, PCR machines, microscopes, ventilation systems. All robots «LabMan» connect to a main computer from which they can be controlled and the whole laboratory can be monitored, this computer can also connect to the internet, so the lab can be controlled and monitored remotely.

Conclusions

Laboratory Manipulator «LabMan» was constructed and the concept of its application in diagnostic laboratory has been developed.

Йонис А.

Использование роботизированных технологий в диагностических лабораториях

Сегодня роботы используются практически во всех областях — производство, сельское хозяйство, медицина и армия. Роботы — это любой электромеханический аппарат, который выполняет определенную задачу. Они могут быть автономными или полуавтономными.

Цель — разработать упрощенную концепцию: как лабораторная работа может быть сделана путем использования роботов, в частности, 2 многофункциональных роботов — манипулятора и смарт-контроллера.

Разработанный экспериментальный образец лабораторного манипулятора «LabMan» может быть фиксированным (выполняет конкретные задачи) либо мобильным (выполняет нескольких задач по лаборатории). Задачи могут быть запрограммированы и контролироваться через Wi-Fi. Устройство «LabMan» таково, что он может выполнять разные задачи: переключение слайдов, смешивание реагентов, раскапывание жидкостей в микропробирки, ПЦР или ИФА планшеты. Смарт-контроллер представляет собой микрокомпьютер вместе с аксессуарами (датчиками и периферийными устройствами), которые присоединяются к существующему лабораторному оборудованию. Все роботы «LabMan» подключаются к основному компьютеру и через интернет могут контролироваться через удаленный доступ. Разработка может быть актуальной для выполнения трудоемких и монотонных операций.