Robotic Educational Platform based on Ball Robots

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Abstract

The two recent decades witnessed educational robots being developed, and evaluated in schools, kindergartens, free-time centres and clubs. Resembling cars, bees, drawing turtles, walking androids, insects, or construction sets that allow building anything within the scope of imagination. Examples include BeeBot, Probot, and Roamer from Terapin, Mavin and Robonova from HiTec, Yeti and Asure from AREXX Engineering, Pololu3pi from Pololu Robotics and Electronics, Solarbotics Mini-Sumo, Scribbler and BoeBot with extensions from Parallax, LEGO NXT and LEGO WEDO construction sets. The main idea is to move the constructionist playground out to the real world, the natural environment of the learner, where he or she interacts more directly, utilizes more senses, works in 3D, explores real forces, shapes, volumes, etc. This is in a sharp contrast to scenarios locked inside of the computer screen. We move further on: we propose a creative and non-conventional platform, which goes beyond the traditional wheeled or legged robot morphologies. Alternate morphologies bear unprecedented educational potential and entertaining educational experience.

The idea of an autonomous ball robot is not new. Successful robots were built and put on the market. Examples include the cleaning Robomop robot by Robomop International, Groundbot from Rotundus. Mono-wheel sphere can roll forward and backward in a straight or bent trajectory. Differently, a ball can shift its centre of gravity along the three axes, in order to start free-rolling movement in a desired direction. Independently, a study of a similar navigation type has been performed in simulation by [1]. We propose the mass to be concentrated in coupled pairs of co-centric points as shown in Figure 1.

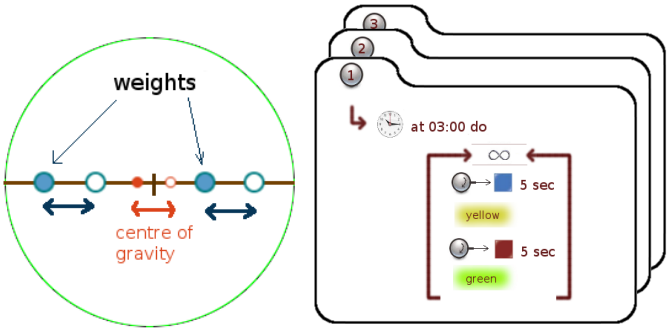

Figure.1. Principle of autonomous ball movement (left), concept of the programming paradigm: Iconic language, multiple balls, events, control structures (right).

Multiball Educational Platform

The set consists of 5 balls that can autonomously roll in an arbitrary direction. The balls can detect collisions with objects, and external displacement by a human. They sense the rotation along three perpendicular axes, emit light in changing colour (using multi-colour LEDs), produce sound, and detect the colours of light coming from all directions, typically from neighboring balls. The balls can communicate with each other, and receive program or messages from a master computer over BlueTooth. They will be programmed using iconographic programming language for children that is event-based, and contains simple control structures, timers, variables, integer arithmetics, motor and sensor control commands. Children can test their programs in simulation. Our position poster presents the platform idea and the early work on the prototype.

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References

[1] Der R,Martius G, and Hesse F (2006). *Let it roll – Emerging Sensorimotor Coordination in a Spherical Robot*. Artificial Life X, p. 192-198.