Square Dancer – Moving a Robot with Physical Tags

figure 1. Controlling the Square Dancer by attaching different markers to its surface.

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Abstract
The Square Dancer is a simplistic robot that moves in combined patterns according to physical markings attached to its surface. The work is part in a series of explorations concerned with new ways for controlling and interacting with robotic products. This work focuses in particular on the complexities involved in combining a series of conflicting commands in a playful way.

Keywords
Tangible Interaction, Robotics, End-user programming

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ACM Classification Keywords
H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

Introduction
We are exploring how a set of tangible markers can be used to let users control and at the same time make sense of various movement actions performed by a small robot.

The project draws on the design concept of actDresses [1], which has been defined as a kind of “physical markings that can be attached to a digital device, and that signifies some property, action, or behaviour of that device”. The design concept emphasises two main properties:

1. The items are shown in the *immediate physical context* of the objects that they control.

2. Items are used to represent and produce *perceivable actions*, in ways that end users may relate to and understand.

The specific problem addressed in this exploration concerns how different program instructions may be combined together, not only visually, but also in terms of how they may in meaningful ways be put together computationally.

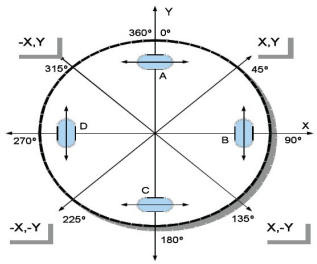

figure 2. Arrangement of the four omni-wheels to make the robot move in a rich combination of directions.

Implementation

The Square Dancer is a half spherical shaped robot that glides on a floor surface using a set of four 'omni-wheels' underneath. This allows the robot to move in any direction or pattern without having to turn around as with ordinary wheels. Internally, the custom made electronics is based on two circuit boards, one functioning as the master - reading and processing data from the RFID-slave circuit, driving the wheels and taking care of obstacle detection using a sweeping IR-sensor.

In line with the early explorations with the physical LOGO turtle in the 1970s [2], we played with a simple set of geometrical figures as the basis for these explorations. Thus we created a set of physical tags depicting a square, a circle, a triangle, etc, resulting in corresponding movement patterns if and while they were attached to the robot surface.

Our main focus in this study concerned aspects of program order and concurrency, and how the effects of several simultaneously connected tags could take effect at the moment of execution. Here this was done by dividing each geometrical figure into smaller parts of their paths, and taking turns between these sections rather than the whole figures. The behaviour combination function are build in a way in which arrays will be split up in selected parts and then merged together in a dynamically allocated array. These parts can be seen as patterns or steps in a dance.

Another aspect is to bring the programming up to the surface and make it both visible and manifested in existing practices around e.g. clothes and comics.

Conclusion

By designing and testing different sets of collections for different kinds of hardware platforms our goal is to explore the different themes of the actDresses concept [1]. The result is a platform that explores how physical tags can be used to make more complex behaviours based on a basic set of instructions while keeping the visible and physical manifestation.

Acknowledgements

Citations

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