Tangibot – Augmenting food printing experience of kids using smart blocks

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ABSTRACT

The Tangibot system facilitates learning for children (aged 7-11 years) from 3D form creation and exploration, while helping them consume nutritional food in an interactive, pleasurable and playful environment. We believe that providing kids with the freedom to build any structure while customizing it with their food choice, not only motivates them towards consuming the printed food, but also will act as a great source of inspiration to try new ideas. This engages multiple senses like touch, sight, taste and smell, thus connecting Food Fabrication to the domain of tangible interfaces.

Author Keywords

Organic; Food Printing; Digital Manipulatives; Tangible Interface; Children; Learning; Internet of Things

INTRODUCTION

Food printers have found a great utility in preparation of compact, nutritious, quick and lightweight foods with ultrasonic agglomeration for army soldiers and astronauts. This comes at the cost of refrigeration, freezing and processing with technologies that degrade the micronutrients in the foods, thus making it non-organic. We would like to explore this technology in the context of printing organic foodstuffs like fruits and vegetables (NASA, 2013) (Extreme Tech, 2014). Lipton et. al. while experimenting with the creative food shapes and different ingredients, discovered that these can be more appealing than the conventional shapes(Lipton J. et. al., 2013). Our work builds on this result to augment the experience of printing and consuming food. Wei & Cheok proposed Foodie which augments people's current food practices by actually printing the form created on a digital device(Wei & Cheok 2012).We are interested in using tangible interfaces for the input side, thus introducing interactivity, playfulness and creativity which also promotes learning.

Children often perceive fruits and vegetables as unpleasant, majorly because of the negative connotations amongst their peer cultures. Also, working parents have little time to take care of the nutritional requirements of their kids. On the other hand, playing with toys is engaging and playful for children. Resnick et. al. developed the computationally-enhanced version of traditional children's toys known as Digital Manipulatives(Resnick et al. 1998). Model making and creative experimentation with the building blocks helps children in understanding the surrounding physical systems and space. Additionally, direct manipulation of physical objects to explore scientific concepts such as shape play an important role in children's learning(Raffle et al. 2004).

There are a range of digital and non-digital technologies including digital-games which allow kids to make their own food. However, most of them lack either the 'engagement' factor or the 'creation/building' factor. Digital Manipulatives(Resnick et al. 1998) has been able to achieve both of these. Additionally, the cultural significance of kids making interesting shapes and forms from dough (a form creating material) helped us establish the connection between 'food' and the 'manipulatives'.

Tangibot connects Food Fabrication with these manipulatives, to offer a pleasant food printing experience for kids while giving them the freedom of choosing the fruits according to their liking. Children connect basic 3D shapes such as spheres, cylinders, cuboids, prisms and cones to build physical structures like a bot or a car which gets printed with the fruit flavours of their choice.

THE TANGIBOT SYSTEM

Food Printer

The printer is designed so as to appeal to the imagination of the children. The upper part holds the structure created by the child while the printed food is delivered from the lower part. There is a digital display in the middle which shows the mapping of the five fruits (which can be any five fruit pastes fed into the printer) to the five 3D shapes.

Smart blocks

The smart blocks are the Digital Manipulatives. We have defined five basic 3D shapes namely a cuboid, cylinder, sphere, cone and prism to allow a variety of physical structures to be built(Fig. 1). These are 'smart blocks' i.e. they are embedded with sensors which communicate with the food printer. Thus, each shape is mapped to a unique food item on the printer. Also, this allows automatic triggering of the printer once the physical structure is kept by the child and subsequently the input file for printing is generated by the printer. The child can connect the blocks to form any physical structure (for eg. a human bot, car) while being able to define the amount of each fruit that should be included.

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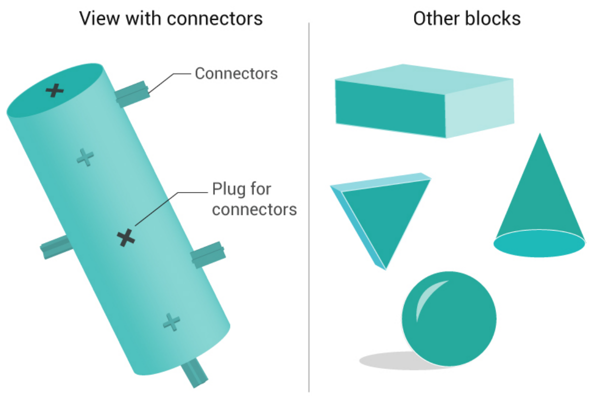

Figure 1. smart blocks

Mobile Application

The mobile application is used by the mother to communicate with the printer over a distance. It helps the mother to monitor the child's health by showing his nutritional chart based on his past food intake. Also, the structures created by the child are saved as presets which can be directly printed whenever needed. It also has an option of printing natural organic fruits. In both of these cases, the mother can choose to alter the ingredients to manipulate the nutritional value according to the child's health needs.

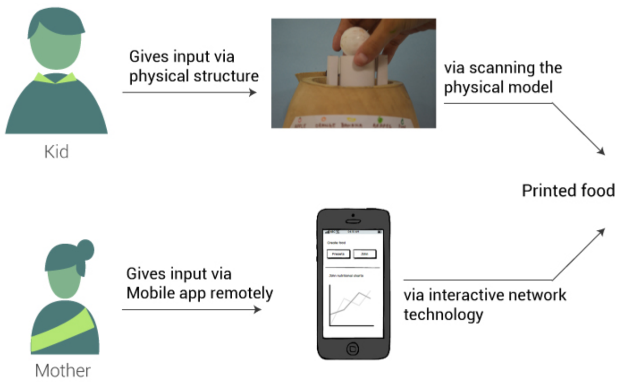

Figure 2. The two types of inputs.

Thus, the food printer accepts two types of inputs(Fig. 2). (1) The 'fruit structure' built by the child using the tangible blocks. (2) The input provided by the mother via the mobile application.

CONCLUSION

In this paper, we described the Tangibot system which helps kids consume nutritional food in an interactive, pleasurable and playful environment which also facilitates learning. Our system helps connect the dots between learning, engagement and playfulness while achieving the aim of having the kids eat nutritious food both by 'motivation' and 'deception.' Mapping fruits to the shapes gives the liberty to the child to control the amount of each fruit and creatively build something which gets printed. This would motivate them to eat the food because it's them who have created it and it has a creative form in contrast to the regular apple or banana. Additionally, he might also include those 3D shapes corresponding to the fruits he doesn't like. For example, he would use the sphere to complete the human bot even if it is mapped to such a fruit which is not of his liking. Even if he decides not to use one or two shapes, it puts him under a harder test of creativity of coming up with interesting forms with limited objects.

We imagine to enhance the kids building and learning experience by introducing a larger variety of blocks with more interesting, complex shapes that promote higher order thinking. These blocks can be enhanced with more advanced technology and sensors in the future. Additionally, the manipulation of nutrients in the printer could be made 'smarter' by having the printer monitor the child's health automatically. We are also interested in seeing the implications of our system in a collaborative environment with multiple kids.

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