Siftables

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April 23, 2013

1 The Paper

We are presenting a paper titled “Siftables: Towards Sensor Network User Interfaces” by David Merill, Jeevan Kalanithi and Pattie Maes. They are all affiliated with the MIT Media Laboratory, and their paper can be found at `http://alumni.media.mit.edu/~dmerrill/publications/dmerrill_Siftables.pdf`

2 Summary of the Paper

Siftables is a novel tangible user interface platform, made possible by the miniaturization and availability of sensor networks. Siftables can be informally described as smart blocks or legos with screens. Each Siftables is a compact tile (36mm x 36mm x 10mm) with a color LCD screen, a 3-axis accelerometer, four IrDA infrared transceivers, an on-board rechargeable battery and an RF radio. Siftables work best in groups, as they are able interact with each other and the environment - they can be programed in multiple ways, to change their display depending on the presence and orientation of other Siftables.

Siftables provide an interface that better fit the way our brains naturally interact with the world. For instance, the Siftables can be programmed to show thumbnails of photographs, and a user can simply push them into piles to easily and intuitively sort them into groups. It's the exact same action as the user would take with printed photographs, with all of the conveniences of digital photos. Another example is a game similar to Scrabble or Boggle. Each Siftable displays a letter, and the user lines up the tiles to form words - each word created is automatically recognized and rewarded with points. This game is incredibly intuitive, and, since the letters can change, provides endless combinations and challenges.

The team that developed Siftables is also working on an interaction language for them, and other small, tactile user interfaces like them. This would provide a library of manipulations and metaphors analogous to point-and-click or drag-and-drop for the GUI, but particularly related to the multiple, small, distributed, manipulable tangible interface devices. This would allow developers to easily create programs for these sorts of interfaces, without having to worry about the gesture recognition stage, just as modern programers do not worry about the mouse position when a button or menu is selected.

Siftables could be improved by adding alternative outputs. For example, they could have:

1. built in speakers, to play sounds
2. pads that become hot or cold when touched
3. electromagnets to push and pull each other
4. a small motor attached to an unbalanced weight, allowing them to vibrate

Adding these extra components should't be too problematic. All of the parts exist, and almost all are already used in common consumer electronics. The difficulty comes with making these parts small and energy efficient enough as to not drastically increase the size or decrease the battery life of the Siftables.

Adding these components make Siftable even more effective for classroom teaching, especially in a science classroom. With the added magnets, they could be used to teach the properties of magnetism and electricity. The electromagnets also improve the Scrabble game we discussed earlier - when a valid word is formed they could pull tightly next to each other, providing each other to give a feedback about formation of valid word. Then they could push away from each other when a new game starts, providing extra feedback indicating that the letters on the screens have changed.

Our storyboard tells a design which uses Siftables and assumes they have ability to convey heat, vibrate and give sound.

3 Our Design - Chemistry Laboratory @ Home

Siftables could be programmed to teach chemical reactions. In our application Siftables will behave accordingly.

1. One Siftable will behave like a flask
2. One Siftable will decrease the temperature, which will be cool to the touch
3. One Siftable will increase the temperature, which will be warm to the touch
4. Other Siftables will allow the user to add or remove various elements.

The user will be able to add elements to the flask by moving a Siftable near the flask and tilting it off the table, just like pouring liquid in real life. Once the user has added elements to the flask, they can either heat it or cool it by putting it near the heating or cooling Siftables - just as if they put the flask on top of a Bunsen burner or into a refrigerator. They can continue to add elements as the flask changes temperature, and observe the reaction happening in the flask, just like in real life. The flask Siftable will be able to make noise, vibrate, or change temperature depending on the conditions its under or the reaction happening inside of it.

4 Storyboard

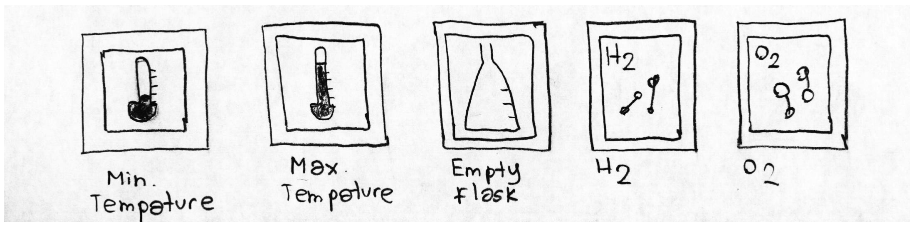

Figure 1: Setup of the Siftables

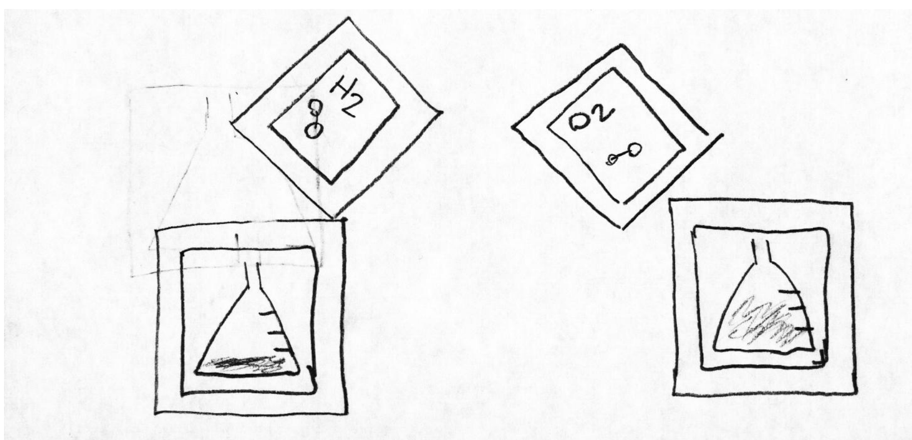

Figure 2: Adding elements to the flasks

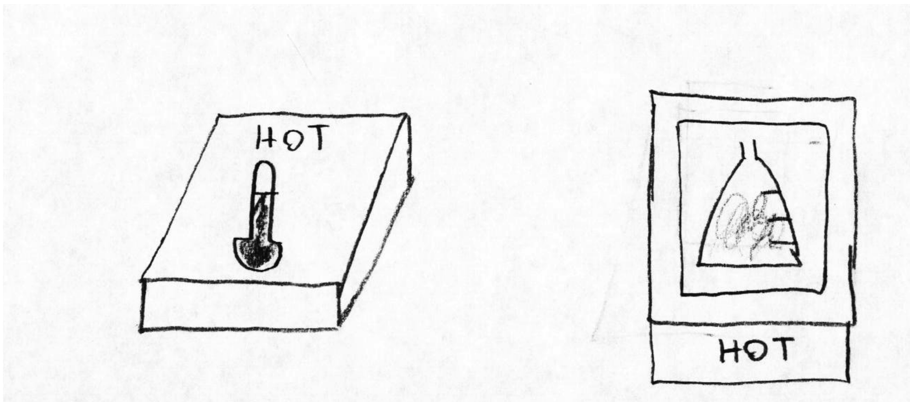

Figure 3: Placing the hot or cold Siftable near the flask Siftable causes the flask's temperature to raise or lower. You can continue to add elements as above.

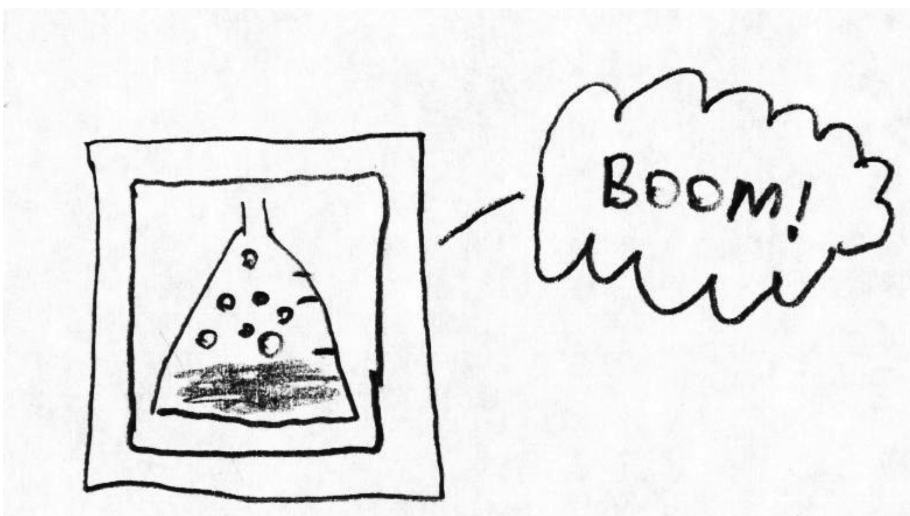

Figure 4: As the reaction takes place, it is shown on the screen, as well as other feedback, such as sounds and vibrations.

5 Design Rationale

This is a good application for Siftables for many reasons. It provides multiple avenues for user feedback, many more than a standard personal computer, while mimicking laboratory conditions and actions without requiring messy, dangerous and expensive equipment and chemicals. This is an ideal application for home schooled students or schools that do not have the resources to maintain a full chemistry lab. It could also be used to teach very young students about chemistry, as there is much less risk to using this system then there is with a standard chemistry lab. This system also allows students to experiment and play with chemicals, without risking harm to themselves or others.