# Blockon: A block based buildable remote controller

*Kohei Matsumura and Yasuyuki Sumi*
Future University-Hakodate
116-2 Kamedanakano-cho,
Hakodate, Hokkaido, 041-8655, Japan
{matsumur, sumi}@acm.org

**ABSTRACT**
There are many consumer electronics placed on our home. When we control these consumer electronics remotely, we are often forced to switch between remote controllers. Further, the increased functions of electronics also increase a number of buttons of remote controllers. These complexities make it difficult for users to control consumer electronics. To simplify interaction between remote controllers and the electronics, we propose a user buildable remote controller device, called Blockon. The Blockon enables a user to build his own controller easily by placing button blocks on the board as building LEGO blocks. The Blockon not only supports placing buttons freely but also makes it possible to define macro commands by stacking button blocks. In this paper, we also present a prototype of the Blockon for technical verification along with our future plan.

**ACM Classification:** H5.2 [Information interfaces and presentation]: User Interfaces. - Input devices and strategies (e.g., mouse, touchscreen)

**General terms:** Design, Human Factors

**Keywords:** remote control, consumer electronics.

## INTRODUCTION
The amount of consumer electronics placed in our home has drastically increased over last decade such as digital TVs, digital video/audio players, air conditioners, and domestic robots. It can be confusing that determining which remote controller belongs to which consumer electronics. Furthermore, consumer electronics might have a lot of features and it raises a problem. The number of buttons on controller may be increased by an amount equal to the number of the features of the electronics. For the above reason, there are a lot of remote controllers that have a lot of buttons around us. We thus often fall into difficulties in controlling the electronics by remote controllers.

To address the difficulty, we propose a concept called Blockon that enables us to build a remote controller by ourselves as building LEGO blocks.



MUM '12, Dec 03-06 2012, Ulm, Germany
ACM 978-1-4503-1815-0/12/12.

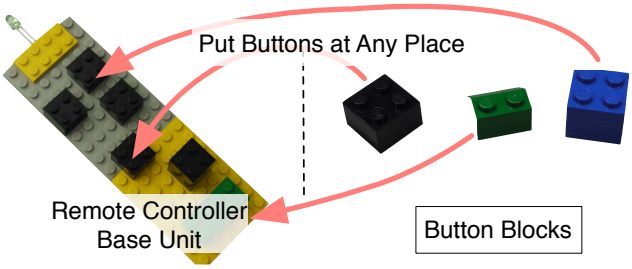


Figure 1: Left: a concept image of the Blockon. Right: blocks work as button.

## CONCEPT AND IMPLEMENTATION
The concept of Blockon enables us to build a remote controller by ourselves as shown in Figure 1. The Blockon consists of two parts, a base unit (Left) and blocks (Right). The base unit has a plate, a microcontroller (MCU) and an infrared LED. Users can put the blocks any place on the plate and can push it as buttons of a remote controller.

### Put buttons at any place
When a user puts the block on the plate, the block works as button. This feature makes it possible to free users from unnecessary buttons on remote controllers and relieve confusion caused by many unnecessary buttons. In addition, users can control multiple electronics by single Blockon controller by putting multiple blocks on the plate. It will reduce number of remote controller on our home and free users to switch between remote controllers.

The block consists of a push switch and EEPROM. The instruction code determines the sequence of infrared pulse and it will be preprogrammed into EEPROM via 1-wire protocol. The pattern will be modulated onto the carrier frequency (38kHz is commonly used in Japan).

### The Base Unit
The base unit consists of two main components, a MCU and an infrared LED and those are embedded on a plate. The plate has arrayed round studs on top and each stud has electronic contact. That is, the blocks are easily interlocked with the plate. Figure 2 shows the connection between the MCU, the infrared LED and blocks. When a user pushes a button block (or stacked button) on the plate, the 1-wire bus connection between the MCU and the block(s) will be established. Then, the MCU reads the instruction code from the block and sends the command via infrared LED.

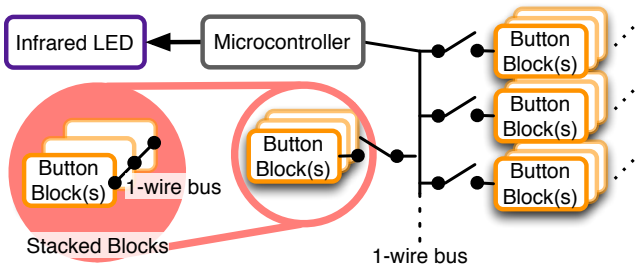


Figure 2: The Blockon consists of three components, an infrared LED, a MCU and button blocks. The MCU and the blocks are connected via 1-wire bus and the switches are in between the MCU and each block. Also, stacked blocks are connected via 1-wire.

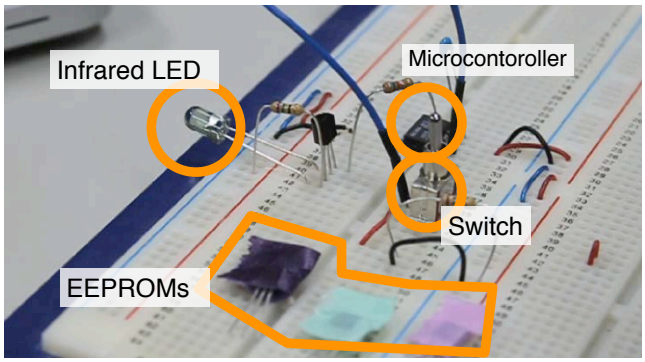


Figure 3: A Prototype consists of a microcontroller, an infrared LED, a switch, three EEPROM ICs and some passive devices.

**Stack the buttons = define macro**

The Blockon not only supports placing buttons at suitable place on the plate but also supports defining macro by stacking buttons. When we want to see a DVD video on a television, we are forced to operate remotes in the order as below. Firstly, take a TV remote and press *power* and *change inputs* buttons, then, switch to a remote for a DVD player and press *power* and *play* buttons. Blockon simplifies the process by using macro that is defined by just stacking blocks. In addition, multiple button press actions can be defined by stacking the same block vertically.

In order to maintain the stacking order (i.e., sequence of the instruction codes), the time-delay relay mechanism is needed. Using the mechanism, the 1-wire bus connection between the MCU and each block will be established in order corresponding to the order of stacked block.

## RELATED STUDIES

There are several studies concerning the problem we have been trying to address. Seifried et al. proposed a tabletop interface, called CRISTAL [1]. The CRISTAL supports multi-touch interaction and control the electronics displayed on the tabletop display using gestures. However, the CRISTAL cannot replace traditional remote controllers since the CRISTAL only supports interactions around a table. Our Blockon concept aims to replace traditional remote controllers by integrating the controllers through building a controller with blocks like LEGO.

A traditional universal remote control allows the user to program in new instruction codes to buttons. However, the placement of the buttons is fixed. On the other hand, touch screen devices can also be used as universal remote controls (e.g. [2]) and the placement of the buttons is customizable. However, to use these devices as remote controller, the user need to start-up the application. Also, it lacks tangibility and the user need to see the display to push a virtual button. Some scholars argued that the tangibility makes it easier for users to focus on the controlled object (e.g. [3]) and we agree their suggestion.

## PROTOTYPE

We have developed a prototype based for technical verification. In order to implement our Blockon concept, we employed a MCU (Cypress PSoC CY8C27143), an infrared LED, a switch, and three 1-wire EEPROM ICs (Maxim DS2431) and several passive devices. Three instruction codes for Apple Remote, “go to menu”, “next” and “play/stop”, are stored in EEPROM ICs. All the devices are placed on a breadboard (Figure 3). The remote command will be send when one of EEPROM ICs is connected to the circuit and the switch is turned on.

We confirmed that our prototype works well with a Macbook. In the test, we swapped the three EEPROM ICs on the breadboard and each command stored in the EEPROMs was successfully sent to the Macbook. The stacking button feature (making macro command) was not implemented in the prototype.

## CONCLUDING REMARKS

In this paper, we described a concept of the Blockon that enables us to build a tangible remote controller by ourselves. We also developed a prototype based on our concept and confirmed that the prototype works well. We have been developing a new prototype that consists of actual blocks and a base plate. We will conduct user studies employing the new prototype in the future.

## REFERENCES

1. Seifried, T., Haller, M., Scott, S.D., Perteneder, F., Rendl, C., Sakamoto, D., and Inami, M. CRISTAL: a collaborative home media and device controller based on a multi-touch display. In *Proceedings of the ACM International Conference on Interactive Tabletops and Surfaces* (ITS '09). ACM, New York, NY, USA, 2009. pp. 33-40.
2. L5 remote. L5 Technology. http://www.l5remote.com/.
3. Jansen, Y., Dragicevic, P., and Fekete, J.D. Tangible remote controllers for wall-size displays. In *Proceedings of the 2012 ACM annual conference on Human Factors in Computing Systems* (CHI '12). ACM, New York, NY, USA, 2012. pp. 2865-2874.