A RECEIVER UNIT OF PHOTODETECTORS FOR A LASER POINTER AS A WIRELESS CONTROLLER

Jaemyoung Lee
Korea Polytechnic University, 2121, Jungwang, Shihung, Kyunggi, Republic of Korea

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Abstract: We propose a wireless receiver unit of photodetectors for a commercially available laser pointer. A controller in the receiver unit drives a multimedia player in accordance with the scanning direction of the laser pointer over photodetectors. A control algorithm is proposed for control of the multimedia player. We believe that the proposed receiver unit and the control algorithm for a laser pointer can be applied to other systems.

1 INTRODUCTION

A laser pointer has mostly been used in presentations, and has extended its application areas due to its portability, low cost, and visibility of the laser beam spot. Lots of papers have used it as an input device (Kelvin and Kelvin, 2003; Olsen and Nielsen, 2001; L. Zhang and Chen, 2008; X. Bi and Chen, 2006), and some papers have modified the laser pointer to afford other functions as such the functions of a mouse (Oh and Stuerzlinger, 2002; X. Bi and Chen, 2006).

In this paper, we use a commercially available laser pointer as a wireless controller to activate and control a multimedia player in a classroom. Multimedia players in classrooms are controlled by manual buttons or RF remote controllers. In case of manual operation, a lecturer should access to the control panel of a multimedia player each time he/she wants some operation. For an RF controller, a lecturer should carry it and not misplace it to control the player during his/her lecture. We propose a remote control system for multimedia players in classrooms using a laser pointer which most lecturers carry. To use a laser pointer as a wireless controller, we build a wireless receiver unit of photodetectors arranged in a rectangular shape. A controller in the receiver unit perceives the scanning direction of the laser pointer and determines a control mode in accordance with the proposed algorithm. The control algorithm and the proposed system scheme take into account problems due to hand jitter, and laser pointer's misdirection.

2 LASER POINTER AS A WIRELESS CONTROLLER

We propose a wireless receiver unit using a commercially available laser pointer in a classroom without any alteration to itself, which has only one on-off switch. Figure 1 shows a multimedia player in which the proposed receiver unit of photodetectors is attached to the multimedia player in a classroom.

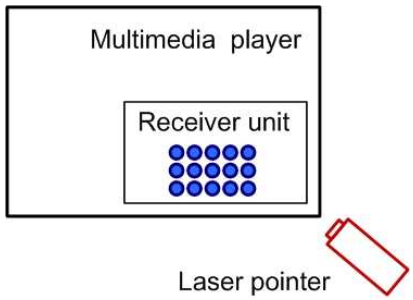

Figure 1: Multimedia player using the proposed receiver unit of photodetectors for a commercially available laser point.

Even though this paper takes an example of a multimedia player to apply the proposed scheme using a laser pointer, the proposed scheme can be applied to other systems.

2.1 Receiver Unit of Photodetectors

In the proposed scheme, the receiver unit of the multimedia player has a group of photodetectors which are arranged in a rectangular shape. A controller in the

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receiver unit monitors the resistance of each photodetector to determine the laser pointer's scanning direction over the photodetectors. The controller activates an action on the multimedia player based on the scanning direction of the laser pointer over the photodetectors, such as scanning to left, right, up, or down. The proposed scheme could also activate certain action by tying each photodetector for an action of the multimedia player. However, the tying of each photodetector for an action could cause unexpected actions due to laser pointer's misdirecting. Since it is hard to project a laser pointer's beam on a specific photodetector at a distance without any hand jitter, tying an action with a scanning direction on a group of photodetectors is less vulnerable to misdirection and to hand jitter, compared with tying an action with on- or off- status of a photodetector.

Scanning to right and scanning down in oblique directions are shown in Fig. 2 (a) and (b), respectively.

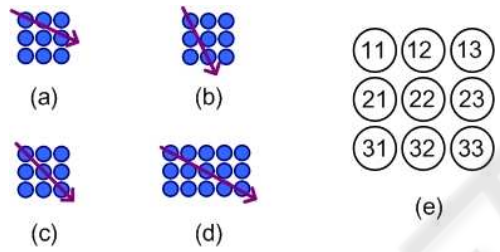

Figure 2: Scanning (a) to right (b) down (c) in diagonal directions in 3×3 photodetectors and (d) in a diagonal direction in 3×5 photodetectors (e) ID numbers of phtodetecors in 3×3 photodetectors.

Even though the scanning directions are oblique in Fig. 2(a) and (b), both cases are judged as scanning to right and down by the controller. In case of Fig. 2 (a), photodetectors of 11, 12, and 23 can be regarded as being scanned by a laser pointer (ID numbers of photodetectors are listed in Fig. 2(e)). In Fig. 2(b), the laser pointer projects a beam on the photodetectors of 11, 21 and 22, 32. Since the spot size of the laser point is comparable to the size of photodetector, the spot of a laser pointer can spread over two photodetecors along its scanning such as photodetectors of 12 and 22, and photodetectors of 21 and 22 in Fig. 2 (a) and Fig. 2 (b), respectively. The problem of laser pointer spot's spreading over photodetectors can be solved by the algorithm of controller's.

The square shape of the group of photodetectors may cause unexpected results, because the diagonal scanning in Fig. 2 (c) can be perceived as scanning to right , down. In the proposed scheme, we eliminate this situation by arranging the photodetectors as a rectangular shape. The scanning direction shown in Fig. 2 (d) is rightward, because the laser pointer beam scans photodetectors at both left and right sides. The vertical length of the rectangular can also be arranged longer than the horizontal length in the proposed scheme.

2.2 Control Algorithm for the Proposed Scheme

To control a multimedia player using a laser pointer, we propose a simple control algorithm, (Fig.3).

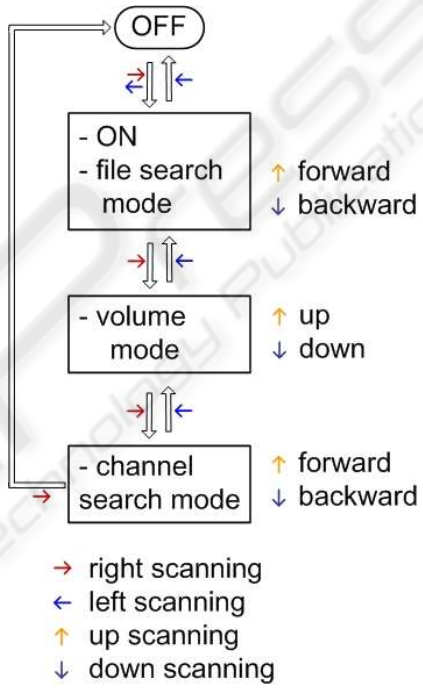

Figure 3: A proposed control algorithm to control a multimedia player using a laser pointer.

Scanning of a laser pointer to either right or left through a receiver unit in which a group of photodetectors are arranged in a rectangular shape activates the multimedia player, leading to a file search mode. Forward and backward file searches can be made by laser pointer's scanning the receiver unit up and down, respectively. Another scanning to right changes the mode into a volume control mode, in which scanning up and down turn the volume up and down, respectively. Scanning to right at the volume mode leads to a channel search mode in which scanning up and down tune to the next adjacent channel forward and backward, respectively. Further scanning to right at the channel search mode deactivates the player. Scanning to left at any mode returns the mode back to the previous mode in the proposed algorithm. Various algorithms can be suggested and realized for control-

ling the multimedia player using a laser pointer as a wireless controller.

3 EXPERIMENT

We investigated the feasibility of the proposed scheme by measuring the resistances of photodetectors being projected by a laser pointer, (Fig. 4). Measured resistances in Fig. 4 show a linear increase as the laser pointer moves away from the photodetector. Because of the laser pointer's electrical jitter, we observed variations in resistances, which are shown as error bars in Fig. 4. However, we could drive the multimedia player with a laser pointer at the distance of more than 20 m away from the receiver unit.

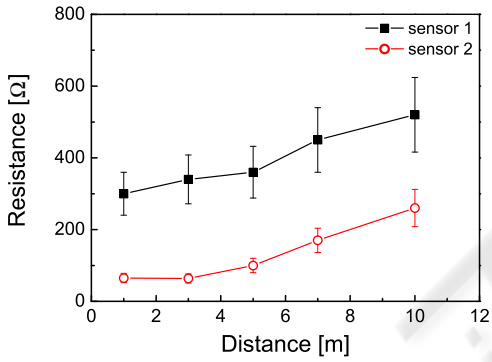

Figure 4: Measurements of resistance for different distances.

4 CONCLUSIONS

In this paper, we propose a wireless receiver unit of photodetectors using a commercially available laser pointer. To use a laser pointer as a wireless controller without any alteration to itself, we build a receiver unit of photodetectors. Experiment shows that resistances of photodetectors linearly increase as the laser pointer moves away, and that the laser pointer can send enough power to activate the multimedia player at the distance of more than 20 m from the laser pointer. The controller in the receiver unit acts on the scanning direction of a laser pointer in the proposed scheme. We believe that the proposed control algorithm can further afford other control modes and be applied to other systems.

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