Matrix LED Unit with Pattern Drawing and Extensive Connection

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1 Introduction

Matrix LED unit, the array of small LEDs, is widely used for display systems, such as indicator in public transportation vehicles and toys. In these cases, the patterns displayed on the matrix LED unit is stored in the memory card or the host computer systems, and it is impossible for the user to draw the patterns on the matrix LED displays. It is known that LED can also be used as photo sensor, since LED is a kind of the diode, which produces the electric current by the incident light[1]. This paper describes the matrix LED unit system for pattern display and interacting with users. The user can draw patterns by using light source, such as laser pointer, which is implemented by using LED arrays both for displaying and light sensing. Each unit has the communication channel for connected neighboring unit, which enables the system to extend the larger display areas by connecting the units as desired. The drawn pattern is morphed by user's interaction, which is enabled by the tilt sensor equipped in each unit. The pattern morphing is also performed by scrolling patterns across the connected units or so-called 'life game' pattern transition.
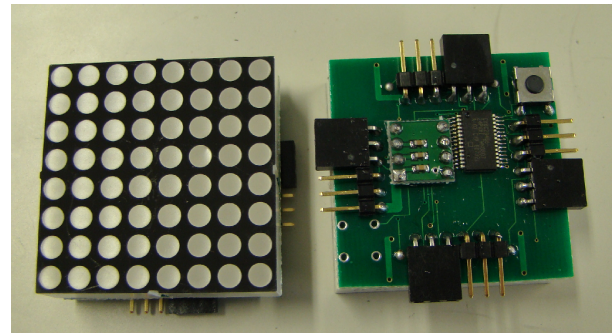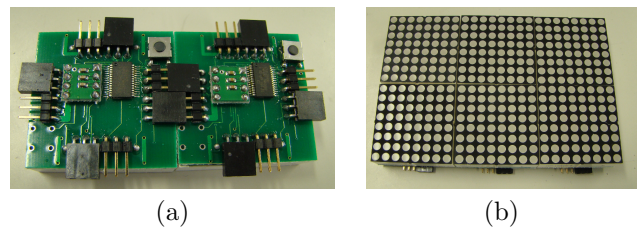
2 System Implementation

The following functions are pointed out in the system design.

1. Pattern drawing capability by light sources, such as laser pointer, by using LED's light sensitivity.

2. Connecting neighboring units, with communication channel.

3. Unit size is set to be equal to the size of matrix LED unit, in order to realize condensed arrange of the units.

Figure 1 shows the developed matrix LED unit, which is named as "LED Tile (LT)." The micro controller (CY8C29466, Cypress) and tri-axis acceleration sensor (MMA7361L, Freescale) are mounted on the board, whose size is equal to the size of the matrix LED unit. The LT unit has four connectors at the four edges of the unit for extending the unit connections and display area, as shown in Fig. 2. The communication between the neighboring LTs is carried out in the asynchronous half-duplex serial protocol, which is used for pattern morphing across the LTs.

The LED produces the weak electric current by incident light, and this fact can be used for light sensing, as well as emitting light for displaying. The LTs controls the matrix LED unit as the light sensing, followed by the light emitting. Light sensing time and light emitting time is set as 1 milli second for one column of LED matrix.

Figure 1: Matrix Unit, LT

(a)   (b)

Figure 2: Connection of LTs

3 Pattern Morphing

The following three functions of pattern morphing are implemented in the current LT system.

- Flowing: The drawn pattern flows across the connected LTs when the user tilts the LTs.

- Scrolling: The drawn pattern scrolls for the specified direction across the connected LTs. Speed and direction can be changed by tilt sensor.

- Life Game: The drawn pattern makes transition based on the life game rule, a kind of cellular automata.

References

[1] J.Lee *et al.*, Proc. of UIST2004, pp.123–126, 2004.