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Adjust the un-number clock with APP program

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ABSTRACT: *This paper used LEDs to represent the numbers on a non-digit clock, where 12 LEDs on the outer ring to represent the hour, 12 LEDs in the middle circle for minutes, and 5 bi-color LEDs in the inner circle to represent the bi-session (AM/PM) of a day, as well as the precision of minute scale (+1, +2, +3, +4). The clock could fully function with night light at night and it also served as an alarm clock. Exclusive APP with simple and convenient interface was available for setting and calibrating the clock. The non-digit clock uses the mobile phone network with an exclusive APP to transmit data to the microprocessor for analysis to achieve automatic calibration function. The Bluetooth can remotely set the clock that it is not confined by height and venue, as it is no longer necessary to remove the clock from a height to adjust time and error. The use of a mobile APP also directly removes the need of a calibration interface on the clock.*

KEYWORDS: *The un-number clock、Bluetooth、APP、MCU、Bi-color LED*

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I. INTRODUCTION

Reading time during midnight is often obscured by darkness in the room. The watch cannot be seen clearly, the mobile phone is not nearby and it is a challenge to see clearly in dark. Therefore, a combination of LEDs in a clock should allow clear view of time in darkness and the device can be used as a night lamp and alarm, as the numbers are all displayed by LEDs without words. In many public places, clocks on the wall are showing delayed time, often because they are placed at a height that requires a ladder for adjustment and it thwarts people to do so. Thus, a clock with remote calibration capability will not only provide convenience, regardless of its height placement, that it can be placed as high as possible for better viewing by the people below. Constant calibration also solves the problem of time delay. With modern high-tech development, many products use APP with bluetooth to monitor and control the system, such as measurement of blue light intensity to warn the user of excessive usage, detection of UVB index, height detection sensor, improvement on the navigation system,low-energy bluetooth version 4.0 technology for wireless infusion monitor and solar panel fault detection and identification.

The rapid development of electronics industry in modern society allows everyone to own one or even two smart phones. The mobile phone is an indispensable product in modern society, and in turn, APPs are important, too, which are indispensable softwares for smart phone. For photo retouch, there are hundreds of apps available, let alone gaming APPs for killing time. The underlying business opportunity is huge and it will help the entire society. For example, in many public facilities, exclusive APPs are available for buying high-speed railway ticket, where even QR code of the ticket can be displayed on the APP for scanning to enter the platform. Therefore, APP programming is an essential skill in modern time. The clock in this paper can also connect with the mobile phone by pressing a button for effective time calibration. The APP interface is extremely simple that even elderly or children can use it without problem. It will always keep the most accurate time updated instantly.

II. SYSTEM DESIGN

This thesis used HT66F70A MCU as control terminal for regulating a timing module, UART bluetooth transmission and signal for LED display. In term of circuitry, the circuit diagram and PCB design drawing by Altium Designer were used. In combination with HT66F70A MCU for data integration and calculation, the smart phone could connect to the network to obtain the correct time, in which through the APP program, the data were transmitted to the MCU for analysis and passed to the LED CLOCK for time display. All were illustrated in Figure 1.

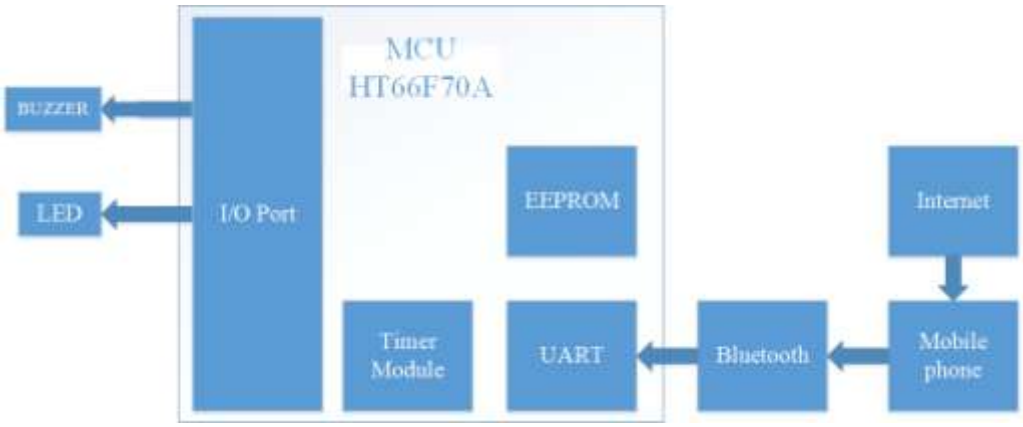

Figure 1: The system architecture

III. METHOD

The 12 LEDs on the outer ring represented the hour, the 12 LEDs in the middle circle were for minutes and LEDs of bi-color in the inner circle would represent the bi-session (AM/PM) of a day. There was no need for addition of minutes if the first LED showed the whole time, while the rest would be for adding minutes, as shown as 12 o'clock in the morning in Figure 2, 12 o'clock in the noon in Figure 3 and 6:19pm in Figure 4.

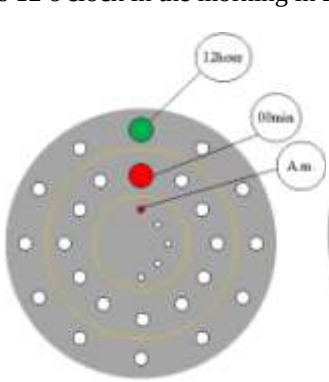

Figure 2: 12:00 a.m.

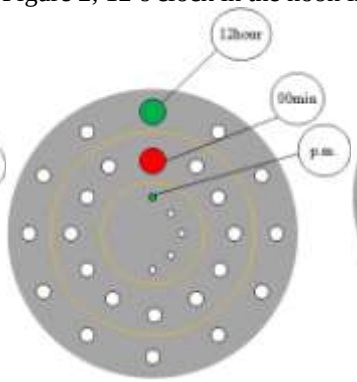

Figure 3: 12:00p.m.

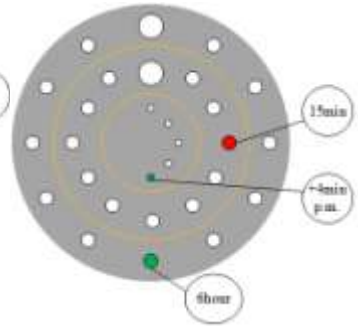

Figure 4: 6:19p.m.

The appearance of the clock was designed by using SOLIDWORKS and printed on a 3D printer, as seen for the top layer in Figure 5 and the bottom layer in Figure 6.

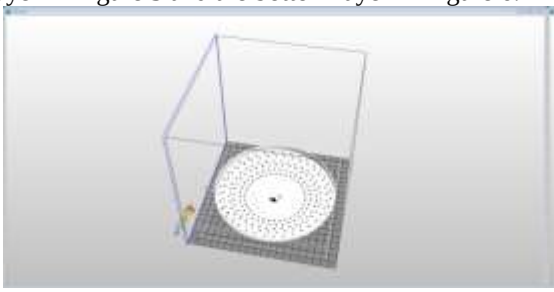

Figure 5: The top layer

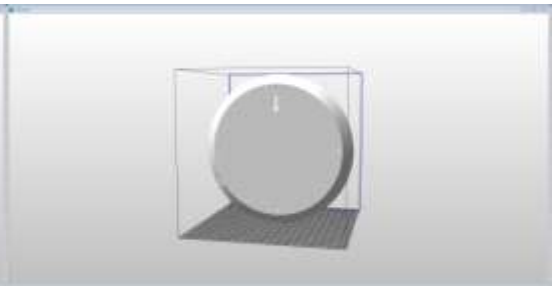

Figure 6: The bottom layer

IV. RESULTS

The circuit board of the digitless clock was shown in Figure 7 and it was installed within the box printed by the 3D printer. Once turned on, the default time was preset at 12 o'clock in the morning as seen in Figure 8. The mobile phone with APP should be used to calibrate the time as seen in Figure 9. Once completed the calibration, the digitless clock was as seen in Figure 10.

Figure 7: Circuitry

Figure 8: Default time, 12:00a.m.

Figure 9: APP Interface

Figure 10: Completion of calibration

When comparing the digitless clock with modern clock with dials or 7-segment display, as seen in Table 1 Product Comparison, its convenience in calibration, night viewing capability and remote control function all excel in excellence.

Table 1: Product Comparison

Pr / Co / It	Digitless Clock (This product)	Mechanical clock (With dials)	Electronic clock (With seven-segment display)
Convenient calibration	Can connect with mobile APP for time calibration	Requires manual adjustment with knobs	Requires manual adjustment with buttons
Night view clarity	Yes	No	Yes
Remote control	Yes	No	Yes

V. CONCLUSIONS

The digitless clock was an innovation to remove the traditional figures to display time by 24 LEDs. The outer ring represented the 12 hours and the middle ring displayed the minutes by 12 LEDs. The bi-color LEDs in the inner circle specifically represented the morning and the afternoon, as well as the precision of minute (+1, +2, +3, +4). Such a unique idea was combined with modern technology of APP for time calibration. The time used to be adjusted manually that often failed due to moisture and frequently repetitive presses of buttons or knobs. In some large public places, such as airports, hospitals, cinemas and many others, it is necessary to place clocks in several locations. If digitless clock were used, there will be no need to adjust each clock manually, but instead requires only a mobile phone with APP for connecting every digitless clock for calibration. There is also no need of ladder for climbing and acquiring clocks. A button on the mobile phone will suffice the work.

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