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## Scoreboard wireless universal based on microcontroller

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**Abstract.** The scoreboard is designed and made for a universal use that can be used in matches in some sports such as basketball, futsal, ping pong, badminton, and others. The scoreboard is designed and made based on the needs of several sports in the Student Activity Unit at HKBP Nommensen University which can be easily moved. Scores displayed on the scoreboard is not only the result of the game but also displayed time in the countdown. This scoreboard can be operated by using a cable and can also without using a cable by using a mobile phone through communication using bluetooth. This scoreboard is based on a microcontroller and uses backup power through rechargeable batteries that can be automatically charged. In trials in several games, this tool works well with a few drawbacks in case of a match that takes more than 100 minutes because the time display can only display a maximum time of 99 minutes.

### 1. Introduction

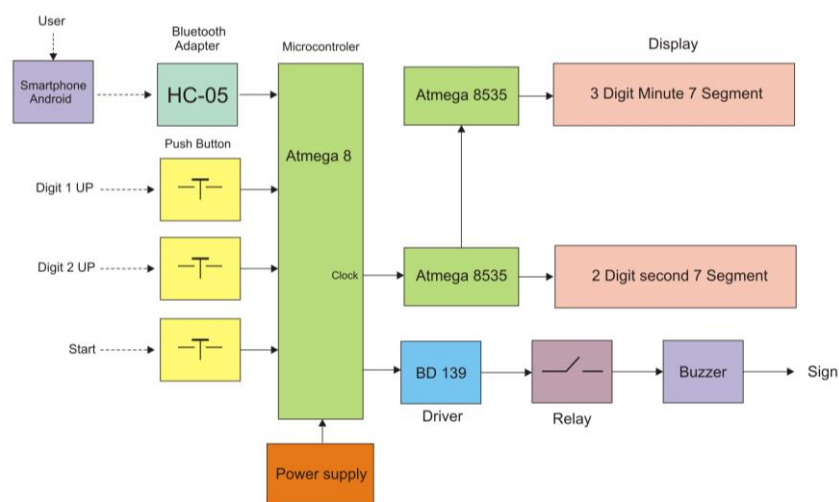
The match in sports is held for the specified time of the sporting event, for example the length of time in a soccer match is for 90 minutes. The timers used are often used by watches or stopwatches that can only be seen by the referee and some are using digital clocks displayed on a large display. In addition to the length of time specified in a sporting event, also recorded the score obtained by each team. These scores are recorded manually or digitally displayed on large displays to be viewable by all spectators of matches around the match field. Usually each type of sport requires a separate scoreboard for score calculation and there is also a scoreboard while displaying the game time. For cost efficiency, it is designed and made scoreboard that can be used for some kind of sports match based on microcontroller which can be controlled by using cable or also can be controlled from certain distance without cable by using bluetooth. This scoreboard can be used for several sports games such as basketball, futsal, ping pong, badminton, and others. This scoreboard uses a power supply that is backed up battery power that can be automatically charged. This scoreboard can also be easily moved. This scoreboard has a high accuracy because both timing and score calculation is done by using a microcontroller, this scoreboard has been used by student activity units in the Universitas HKBP Nommensen Medan, Indonesia.

### 2. Methodology

The scoreboard system has 2 separate main parts, the first part is the timer circuit and the second part is the score count. In the timer circuit (figure 1), the game time is displayed in the display time in minutes and seconds. Counter time is done by count down where the number



of digits for minutes as much as 3 digits and the number of digits for seconds as much as 2 digits, so that the maximum length of time that can be set for 999 minutes 99 seconds. Setting the start time is done with 2 push button each for minutes and seconds, in addition to setting the length of time that is done with push button pressing can also be done wirelessly using smartphone with bluetooth facility so it can be controlled from 10-50 meters distance from scoreboard. In order for this scoreboard system to communicate with the smartphone then installed bluetooth adapter on the input system scoreboard. The start button is used to initiate count down time which has been pre-set by digit 1 and digit 2 key or using smartphone. Atmega 8 microcontroller [3] is used to process input data given digit 1 and digit 2 or via bluetooth adapter. The microcontroller output is assigned to the Atmega 8535 microcontroller [2] and to the relay driver to turn on the buzzer. Atmega 8535 microcontroller is used to process time data in seconds whose output is displayed on 2 pieces of 7 segment display, while other Atmega 8535 microcontroller is used to process time data in minutes whose output is displayed on 3 pieces 7 segment display. Atmega 8535 microcontroller input for minutes is obtained from Atmega 8535 microcontroller seconds after 2-second display of seconds shows 59.

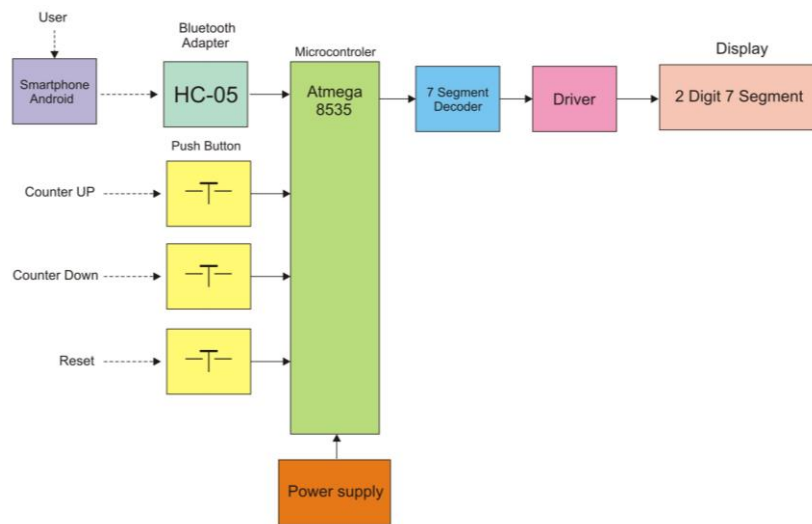


**Figure 1.** The match circuit timer

Work scoring system begins with the input given by the user that is the timing of the game (in minutes). Once started through the push button start, the timer starts to work with the pre-set time countdown. Microcontroller timer atmega 8 provides clock signal on regulator microcontroller 7 segment (atmega 8535). The clock pulse period is 1 second so that every 1 clock will make counter 7 segment countdown seconds 1 unit. After counter seconds reach 0 count then microcontroller counter second will reset counter to 59 and give 1 clock pulse to microcontroller minute. The minute microcontroller that receives 1 clock pulse will count down the counter minutes. Thus the works process of the timer until the counter minutes reach 0. When the counter will reach 0, buzzer will start to sound.

The second part is two score set circuit to calculate the score up or down as shown in figure 2. The match score is displayed on 2 pieces of 7 segment display. Calculation of score by jury by pressing counter and counter down button or through smartphone by using bluetooth facility so that can be controlled from 10-50 meter distance from scoreboard. In order for this scoreboard system can communicate with smartphone then this circuit also

installed bluetooth adapter [1]. Reset button is used to reset the score to start from score 0. Microcontroller Atmega 8535 is used to process input data provided through counter up and counter down button or via bluetooth adapter. The microcontroller output is assigned to the 7 segment decoder and then to the 7 segment driver [6]. The maximum score that can be displayed on the 7 segment display of this series is 99



**Figure 2.** Score count circuit

Aside from being a counter, the microcontroller also converts decimal value coding into 7 segment codes by 3 digits [4][5]. Input microcontroller is 2 push buttons to count up and count down. In addition to the input with keystrokes, the input can also be derived from the bluetooth adapter that is through the serial port, where the user can access counter through smartphone. The circuit shown is only for 1 counter counter counter. For counter B, it takes 1 set of circuits identical to the counter circuit A. The blue tooth serial control software application must be installed on the smartphone when used as a time and score controller, blue tooth serial control on the smartphone as shown in figure 3.

	<p>Reset Start Pause D1 UP D2 UP Score A+ Score B+ Score A- Score B-</p>	<p>Reset all score and time Start countdown time and score Pause the countdown timer Increase time in seconds Increase time in minutes Add score A Add score B Decrease score A Decrease score B</p>
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**Figure 3.** Display bluetooth serial control on smartphone

### 3. Result and Discussion

The results of the scoreboard design are shown in Figure 4. This device has been tested with very satisfying results and has been used in basketball, ping pong, futsal, badminton matches at the student activity units at Universitas HKBP Nommensen. The timer test on the scoreboard is done by comparing it with the stopwatch, no difference in time difference, this timer test is done 5 times with the time setting for 30 minutes and on each countdown time is complete or up to zero, then the alarm will sound.



**Figure 4.** Scoreboard design

Similarly, for score testing, it is done by pressing push button up to increase score and push button down to decrease score, and also test point score using smartphone through bluetooth media. The response of score display obtained is very good and fast, either using push button or using a smartphone.

### 4. Conclusion

The results of this scoreboard design are very helpful for the jury in recording the points obtained in a sports competition held by students at the unit of student activities at HKBP University Nommensen. Operating time efficiency, point display clarity, wireless operation, and accuracy in calculating match results are the main things that these devices used by students

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