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Municipal Autonomous Educational Institution "Lyceum – Engineering Center" of Soviet district, Kazan City

Practical project

Topic: "Charles Platt's Reaction Timer"

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Introduction

Project topic: “Mig” - timer of a person's reaction to a light stimulus.

Relevance of the problem: Sometimes a person's life and health depend on the speed of reaction, but even without extreme conditions, the ability to quickly respond to external events will be useful.

Reaction is the brain's ability to respond quickly to external stimuli.

The reaction rate is the time that passes from the moment of action of an external stimulus to the body's reaction to it.

With knowledge of the human response, you can not only prevent accidents, but also achieve certain success in various fields of activity (sports, gaming, certain professions).

Hypothesis: The average human response to a visual cue is approximately 100 to 300 milliseconds

The purpose of the study: To develop and test a timer for human response to a light stimulus.

Research objectives:

1. Assemble the timer detailed in Charles Platt’s Make Electronics.
2. Measure the reaction rate of people of different ages under the influence of certain factors.
3. Determine the main directions of practical application of the timer
4. Develop recommendations aimed at improving the speed of human reaction.

The practical component of the project is a timer for a person's reaction to a light stimulus.

Chapter I. Development and assembly of Mig reaction timer

1.1 List of components used, operating principle

The project was created at the "Fundamentals of Electronics" lessons when studying digital circuitry. To implement the project, 3 555 timer chips, 3 CD4026 counters, 3 светодиодных seven-segment LED indicators, buttons, LEDs, resistors and capacitors were installed. The device is assembled on a breadboard.

The device is controlled by three buttons. To get started, click the "Start" button. After that, the LED will light up after some time and the subject should press the "Stop" button as quickly as possible. The device measures the time that has elapsed from the moment the LED lights up to the moment the Stop button is pressed, and shows it on the indicator in milliseconds. This result is the measured human reaction time. Before using it again, press the "Reset" button, which resets the indicator reading.

A block diagram of the device is shown in Fig. 1.

The Start button starts the first timer 555, which operates in single-vibrator mode. The first timer sends a trigger signal to the second timer 555, which is running in trigger mode, after 2-3 seconds. The second timer turns on the LED at the signal of one hundred and outputs a signal for allowing the counter to work. The counter, built on CD4026 chips, starts counting the pulses coming to its input from the pulse generator. The pulse generator is based on the 555 third timer. In order to display the result in milliseconds, the pulse frequency of the generator is set to 1 kHz.

When the "Stop" button is pressed, a command is received that switches the trigger on the second timer 555 to the opposite state, which in turn prohibits the counter from working. The pulse count is frozen and the result is displayed on the indicator.

The "Reset" button resets the counter status and indicator readings before repeated measurement.

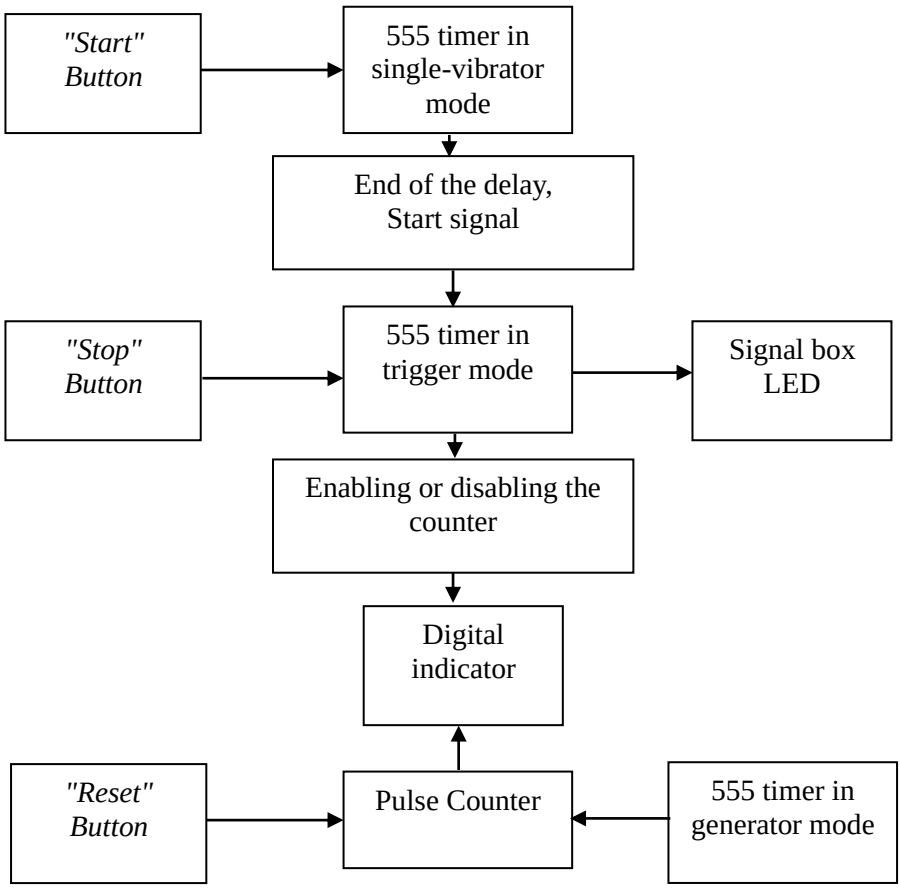

Figure 1 Block diagram of a timer for measuring human reaction time

1.2 Timer’s electrical drawing

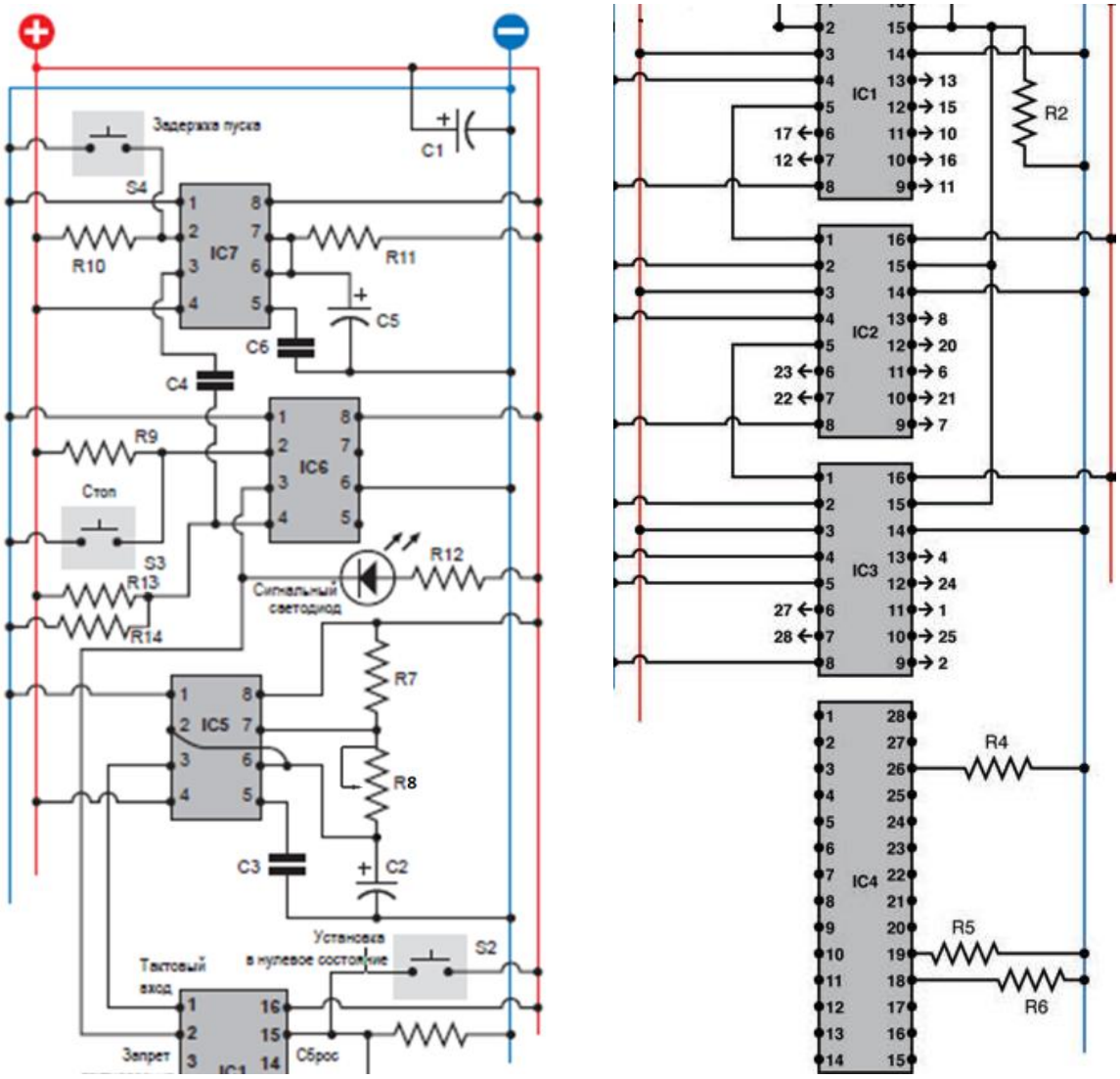

Fig. 2. Basic electrical diagram of the device

The experience of our use of the device assembled on a breadboard using jumper wires showed very low reliability. During transportation, any wire could fly out and the device lost its functionality. Therefore, it was decided to assemble a circuit using soldered joints.

Chapter II. Testing the Mig response timer

2.1 Research results

Reaction speed of schoolchildren depending on the time of day

Students come to school early in the morning not fully awakened from sleep. This affects the concentration of their attention, visual acuity, and as a result, the reaction speed. At noon, all internal processes are activated, the body begins to work at full capacity, which has a positive effect on the reaction rate.

Age-dependent reaction rate

Many schoolchildren have a less developed brain than most mature adults, so their reaction speed is slightly less than that of an adult.

In older people, the brain atrophies without exercise, because of this, the reaction rate is significantly reduced.

Reaction speed depending on bad habits

Alcohol significantly reduces the speed of a person's reaction, as well as prevents him from concentrating and controlling his behavior. So, after taking 75 g of pure alcohol, the speed of a person's overall reaction decreases by 2-2. 5 times, when taking 100 g by 2-4 times, 150 g by 3-5 times, 175 g by 6 - 9 times.

2.2 Practical application of the Mig timer

Based on the research results, we have identified a number of areas and areas of human activity where practical application of the "Mig" timer is possible and appropriate.

1. Sport. Any athlete, be it a football player, hockey player, tennis player, boxer, must have a good reaction speed not only to set records, but also to avoid injuries.

2. In everyday life. Anyone can use the "Mig" timer to measure their reaction speed at different times of the day and in certain emotional and psychological situations. This will help them make a decision to commit certain actions or omissions.

3. People of certain professions. Quick response is required for many professions – police officers, firefighters, pilots, drivers, surgeons, etc. By having a good reaction, they save their own health and life, or the lives of others. People with quick reactions are also preferred by many employers, for example, in areas where you need to quickly respond to market changes.

4. In the traffic police, when issuing cadets-students of driving schools rights to drive vehicles. The driver driving a vehicle that is a source of increased danger must have a good reaction speed.

2.3 Recommendations for improving the reaction rate.

You can and should increase your reaction speed by following these tips.

1. Load your brain with work

In older people, the process of processing information coming to the brain from the senses slows down.

So that the brain does not atrophy over time, it needs to be constantly loaded with work.

2. Avoiding bad habits

Under the influence of alcohol or drugs, a person's concentration and reaction speed decreases.

3. Getting enough sleep

With a lack of sleep, visual acuity decreases, which also negatively affects the reaction speed. Periods of concentration should alternate with periods of relaxation. A full-fledged sleep is a great opportunity to give the nervous system a "reboot", to replenish its energy reserves.

4. Controlling emotions

Correctly and quickly respond to the stimulus can only be in a state of absence of fear. Thanks to special training that simulates danger in real life, you can get rid of some fears and acquire quick response skills that will be useful in a difficult situation.

5. Playing sports games

Playing football, volleyball, table tennis, lawn tennis, and juggling perfectly develops a quick reaction, so you should choose the one that you like and start playing.

6. Training subconsciousness

Our subconscious, intuitive reactions are fasterpee than our conscious, analytical ones. And since it is the subconscious mind that first responds to the stimulusподсознание, you can train the reaction speed by repeatedly repeating the same movements – up to 200 at a time.

Conclusions

The device is built on the basis of the so-called cruel logic and, accordingly, has its advantages and disadvantages compared to the microprocessor implementation. The advantages include low cost, the ability to independently assemble the device for students even on a breadboard, the absence of problems associated with program failures, the ability to learn the basics of digital circuitry in practice, etc. Disadvantages: rather large dimensions, due to the use of outdated chips with a low degree of integration, the inability to reprogram the logic of the device and add additional tasks performed. With its help, we found that all people have different reaction speeds. The most rapid reaction occurs in people aged about 18 to 40 years. In older people, the reaction rate decreases, which is due to a decrease in the load on the brain and its atrophy. The reaction rate increases in the middle of the day – during the period of highest efficiency. In a tired person, it decreases. The reaction also slows down under the influence of alcohol and drugs. In addition, the mental state of a person is important. You can and should train and improve your reaction speed.

References

1. Platt Ch. Electronics for beginners: Translated from the Academyгл. — СПб.: of Sciences of St. Petersburg: BHV-Petersburg, 2012. - 480 p.

2. http://www.bmw-parts.ru/alkogol-i-auto/vliyanie-alkogolya-na-reakciyu-voditelya.html (The effect of alcohol on the reaction rate).

3. https://bbf.ru/magazine/26/6953/ (6 tips to increase your reaction speed).