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DEVELOPMENT OF AN AUTOMATIC CONTROL SYSTEM FOR AN UNMANNED AERIAL VEHICLE BASED ON THE ATMEGA328P MICROCONTROLLER

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Intoduction

Unmanned aerial vehicles with remote control and operations performed by the automatic control system are specially programmed and provided with neural and robotic functions. Unmanned aerial vehicles are the cheapest and most affordable to use and the safest among spacecraft [1].

Due to space robotics development, unmanned aerial vehicles are beneficial for ground reconnaissance because they do not produce harmful emissions in nature [2].

At present, according to the level of development of electronics and radio communications, many types of unmanned aerial vehicles are found. However, for automation, all UAVs are considered by two types:

- Remote control [3-4];
- Fully automated [5].

Furthermore, UAVs of the Ski King type of aircraft by design is considered. Earth exploration is ten times larger, but the image quality will be high. We can fix this problem by reducing the speed.

Currently, the scope of UAVs is growing. This device, initially used for military purposes, allows using it in agriculture under the influence of GPS and radio communication systems [6].

In turn, agriculture is divided into two major parts, crop production, and livestock grazing[7]. UAVs used in crop production are of great importance in the market, but they are not applied to horse breeding [8].

An aircraft with an unmanned aerial vehicle «by itself» is equipped with an artificial intelligence system. Researchers provide an opportunity to independently solve artificial intelligence in an aircraft's block camera with the choice of object and other conditions. The results of the work of aircraft in neural-robotic unmanned flights are effective .

Figure 1. Photo of the prototype (unmanned aircraft), disassembled by students in the laboratory at the L. N. Gumilyov Eurasian National University

Robotic aircraft are used in scientific research, defense control, aerial photogrammetry research, etc.; obtained photos become more high resolution and high-quality. Obtaining photos from the earth's surface involves an image conversion algorithm to explain data about the earth and identify a specific object.

The intelligent robotic aircraft effectively performs hazard monitoring and trajectory correction in real-time to avoid danger. For this purpose, an intelligent robotic aircraft must know where the aircraft is relative to the Earth's surface (localization), which may pose a danger to the Earth, and the flying vessel must be operating in real-time. An intelligent robotic aircraft must assess its condition to reliably observe itself and ensure its good maneuverability [9].

We need to provide intelligent UAV programming: controlling the UAV's servo drive using the ATMega328P microcontroller and controlling signals from the aircraft's servo drive via the I/O port [10].

In AVR Studio 5.1, we track the software part of on-board system parameters from the 8xLEDBoard panel using the ATMegaAVR328P microcontroller.

For intelligent orientation of UAVs, it is necessary to provide пeneral rules: adjust the signals coming from the microcontrollers ATMega328P in the head under the unmanned aerial's servo control vehicle, type the operator's readings and/or sound signals.

To develop a visual signal from the sensor on the servo drive, only device B and C of the ATMega328P microcontroller is used with the 8xLEDBoard panel to the I /O port.

To simulate the start of sensors (position, angle, pressure, etc.), use the Keypad Matrix, the vertical 4-bit bus continues horizontally in the b - RB0-RB3 and also in RB4-RB7 terminals.

To configure the pressing of any of the 16 buttons, we must select the RB0-RB3 wires as the digital output, as well as the inputs with the RB4-RB7 DDRB direction register:

```
LDI R16,0x0F
OUT DDRB,R16
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Port B setting the single signal RB0-RB3 «1», when the button is pressed, this signal is transmitted to the corresponding input RB4-RB7.

ATMega328P microcontrollers internal structural block diagram of the destination and applied circuit presented in Figure 2-3.

System simulation of signals from the UAV.

1. Visual alarm program on the servo drive sensor based on the following steps:

- Run the IDE simulator in AVR Studio;
- click to the Options / Select Microcontroller;
- select ATmega328P and press the button Select;
- press File / Load Program;
- select sig-avr.hex file, and press the Open button. The program starts loading into memory.
- press Tools/Keypad Matrix - the keyboard opens (default port B);
- press Tools/8xLED Board panel - LED panels open (port C will download);
- To change the port, we can select the LKM key alternately PORTB, we must press with 0;
- A Select Pin window will appear where we can select the desired port, for example, 0,PORTC; then PORTB, 1, and so on.
- choose Rate / Fast;
- press the Simulation / Start button - the simulation starts.

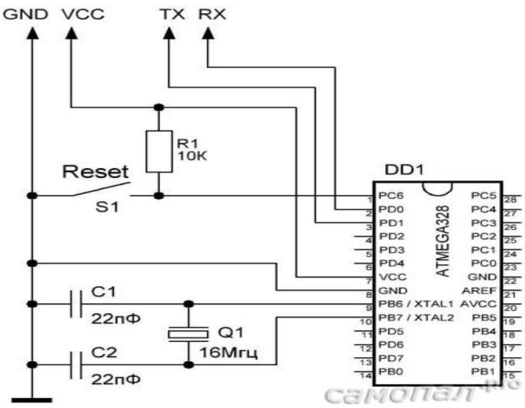

Figure 2. ATMega328P represented by an internal structural block diagram

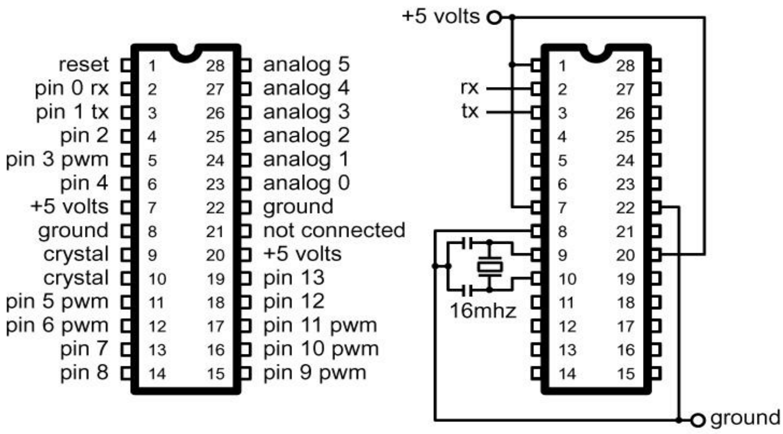

Figure 3. Purpose of the final indicator of the ATMega328P microcontroller

By default, all LEDs will be green. To change the 8xLEDBoard panel, click the green window located opposite the selected outgoing port. The AVR Simulator IDE-register window will appear, displaying the possible colors: Green, Red, Yellow, Blue [11-12].

2. «Signals of sensors for determining the state of the servo drive» programbased on the following steps:

- Run the AVR IDE simulator;
- click to the Options / Select Microcontroller;
- select ATmega328P and press the button Select;
- press File / Load Program;
- select beg-avr.hex file, and press the Open button.

The program starts loading into memory.

- press Tools / 8xLED Board panel - LED panels open;
- to adjust the position of the window for a better vision;
- choose Rate / Fast;
- press the Simulation / Start button - the simulation starts.

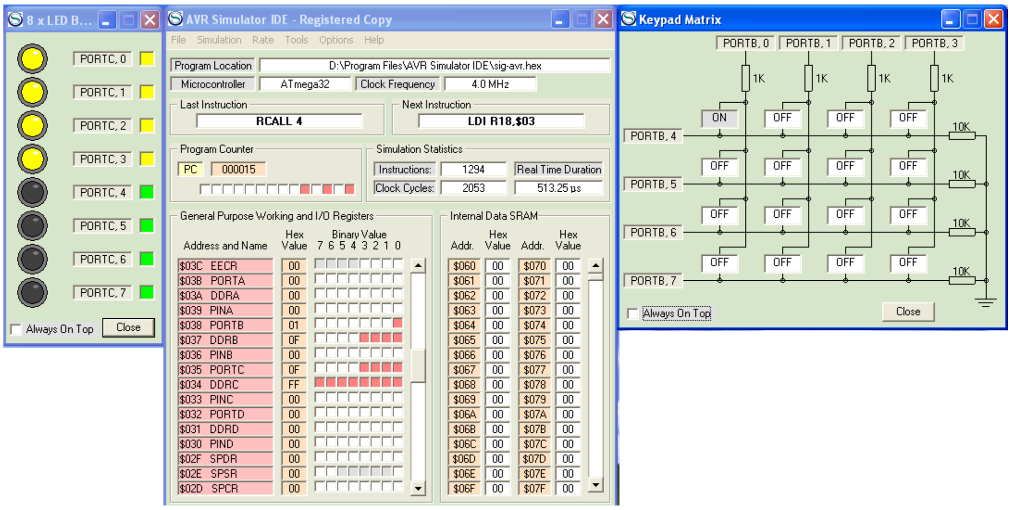

Figure 4. AVR Studio 5.1 screen representation of the program

PRACTICAL PART

UAV capabilities. Currently, the UAV has high potential in agriculture, the defense sector, and scientific research. This is due to the onboard and target installations installed on the UAV. Depending on the target hardware, in which area, and for what purpose, we can include it in this work. As an example: shooting with a multispectral camera in the air can determine: determining the nitrogen content of the Earth, monitoring the state of the crop, forecasting the harvest, monitoring the humidity level, etc.

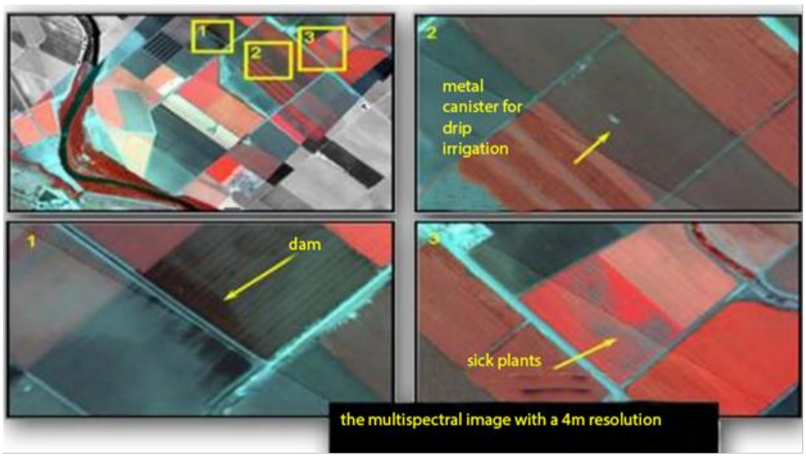

Figure 5. Remote sensing multispectral image

The above multispectral survey is not necessary for horse breeding, and we adapt the finished design to the horse farm. This work will conduct a heat-sensitive UAV camera (thermal imager), GPS, and an audio signal [13].


Figure 6. Illustration the process of performing work through the UAV

The basic principle of a UAV adapted to a horse farm is that first, the horse owner will install a GPS search sensor to find their location. When the herd was detected, the horse owner can be seen on display using the UAV's remote control. After detection of the herd, the counting of the population begins. We can work through a heat-sensitive camera at night and in hard-to-reach places. After that, we predict the circle's future activities, and, if necessary, we can use a powerful sound signal to turn head in the right place for us.

Conclusion

Unmanned aircraft is instrumental. Economic losses from all UAV aircraft are cheaper and do not require any costs due to unmanned flight, and the performance of work on the task will be fast and high-quality when remote earth exploration provides high -quality shooting. By the task of the work, a large role is assigned in scientific research, in the field of defense, in the field of weather, archeology, and the exploration of emergencies in nature. We can load more space on board where a person is sitting, where restrictions on the volume of unmanned vehicles are not allowed. Moreover, the essential advantage is that we can fly up to a distance where a person cannot move.

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