WEBCAM SECURITY SYSTEM

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Abstract: This paper presents a security system based on the information given by four presence sensors which work in infra-red and which localize the person who penetrates the supervised area and command the having in view and filming of that one with a webcam coupled to a personal computer.

Keywords: muvement sensor, webcam, step by step motor, coil, driver, intruder, program.

1. INTRODUCTION

The proposed system utilizes four muvement sensors set as in fig. 1. Own to this way of setting and the fact that each sensor covers an angle of about 135º, the supervised circular area is shared in 8 zones (Z_1, Z_2, …, Z_8), 45º each one.

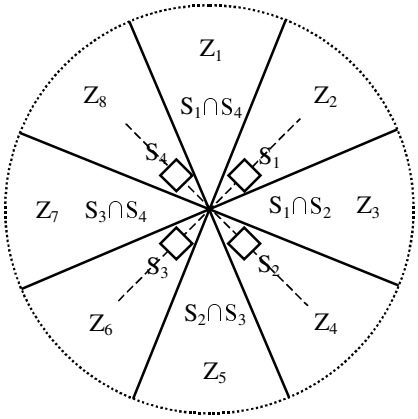

Fig. 1. Sensors disposing and zones sharing of the supervised area

So, if the intruder penetrates zone Z_1, his/her presence could be detected both by sensor S_1 and S_4, which activate the 10 and 15 pins of the computer parallel port, according to those presented in tab. 1. The computer will command the step by step motor movement by an electronic circuit placing the webcam on the attacked zone center and beginning the filming process.

Tab.1. Zones, sensors and activated pins correspondence

Zone	Sensor	Activated pin of P.P.
Z_1	$S_1 \cap S_4$	10+15
Z_2	S_1	10
Z_3	$S_1 \cap S_2$	10+12
Z_4	S_2	12
Z_5	$S_2 \cap S_3$	12+13
Z_6	S_3	13
Z_7	$S_3 \cap S_4$	13+15
Z_8	S_4	15

If the intruder leaves zone Z_1 and enters zone Z_2, his/her presence will be detected only by the sensor S_1 which will activate pin 10 of the parallel port and will generate, with the help of the programme, the movement of the webcam on the center of Z_2, a.s.o.

2. THE BLOCK SCHEME OF THE SYSTEM

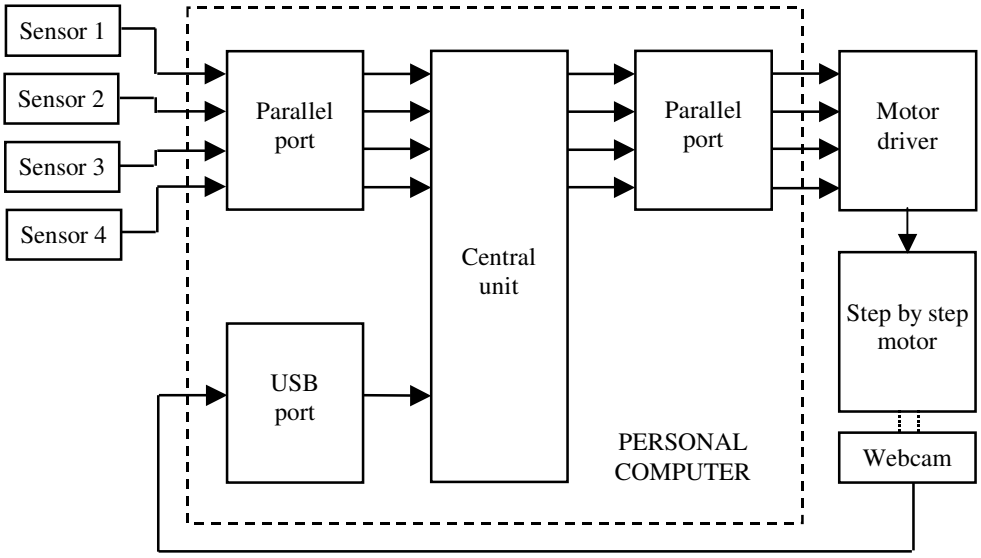

Fig. 2. The block scheme of the security system

The presented security system shown in fig. 2 is made up of a personal computer, four movement sensors, a driver for step by step motor, the step by step motor and a webcam placed on the vertical spindle of the motor.

2.1. The personal computer

The maximum working parameters of the system imposes certain conditions for the personal computer:

- the existence of a USB port, necessary for the webcam connection;
- a processor with a minimal work speed of 700 MHz;
- a RAM memory of minimum 128 MB;
- a sufficient free space on the hard disk;
- an installed operation system – minimum Windows '95, for compatibility with the webcam drivers.

2.2. The movement sensors

The movement sensors are of PIR type (Passive Infra-Red) and detect the difference in temperatures of the intruder's body and the environment, commanding an execution element of relay or semiconductor device type. In the second case, to make the galvanic isolation, the sensors are connected to the computer parallel port through optocouplers.

2.3. The motor driver

To step by step motor driving by parallel port, there were used the ULN2803 circuit, fig, 3.

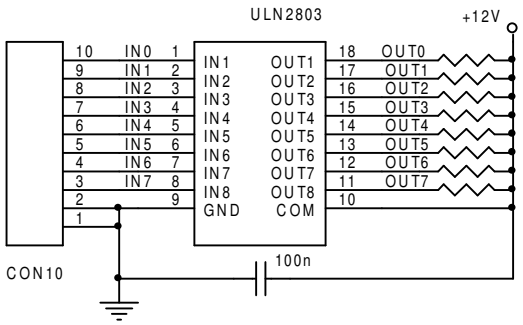

Fig. 3. The motor driver

To protect the driver outputs there were used TECMOS transistors IRF 840, fig. 4, which allow a maximum current of 8A.

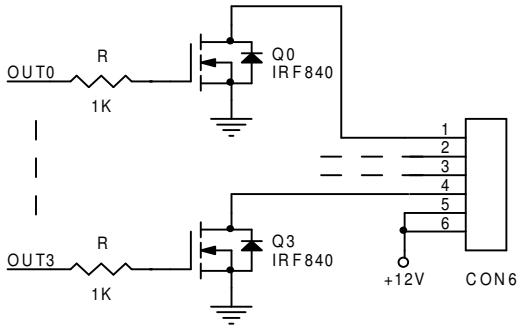

Fig. 4. The adaptor realized by IRF 840

2.4. The step by step motor

The step by step motor, schematically presented in fig. 5, has four coils, two by two symetrically to the + of the supply source.

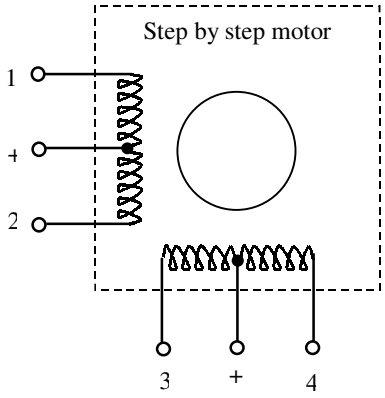

Fig. 5. The step by step motor scheme

To rotate the motor with one step it is necessary the simultan ground putting of two of the four coils, tab. 2.

So, for an opposite trigonometrical rotation of the motor spindle, it is applied the succession 1 … 4 shown in tab. 2, succession which must be repeated 6 times for a complete rotation of 360º.

Tab. 2. The motor coils activation order

Step nr. \ Coil nr.	1	2	3	4
1	x		x	
2	x			x
3		x		x
4		x	x	

It results that a complete rotation needs 24 steps, that is each step is 15º.

For a rotation in a trigonometrical way, there will be activated the coils groups in reverse order of the steps: 4, 3, 2, 1.

2.5. The webcam

The webcam is fixed on the vertical spindle of the step by step motor and it is connected to the USB port of the computer, giving this the filmed images to be stocked on the hard disk.

2.6. The supply source

The supply source, fig. 6, assures the necessary energy to work the whole system and it is realized with three terminals integrated circuit LM 7812.

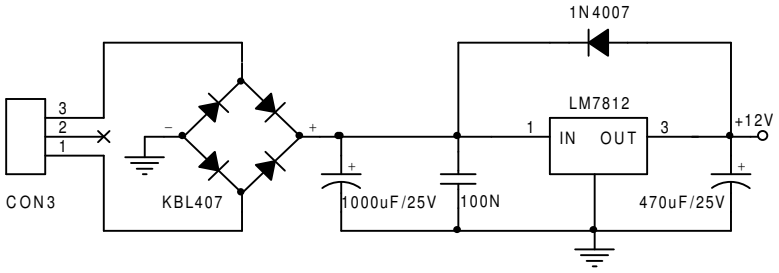

Fig. 6. The supply source

3. THE USED PROGRAMME

The programme is written in Visual C^{++} and it follows the logical scheme presented in fig. 7.

The first step consists in initializing the window in which we have the possibility to see the image received from the webcam.

After loading the webcam driver, there takes place the scanning of the parallel port where the sensors are connected to.

If the pin(s) corresponding to one of the eight zones is (are) activated, tab. 1, the command to film record on the computer is given and the difference between the number of steps corresponding to the present and next position is made. Depending of the difference sign and value, it is decided the rotation sense of the motor and the number of steps to be made.

If the intruder is detected in none of the eight zones, the four pins and the four combinations of pins of the parallel port used in this application will be in their logical state 1 (unactivated), the logic product will be N_K=1 (thus different from 0) and the recording will be stopped.

Next, we shall present a representative sequence of the programme:

```
void CVidTestDlg::OnTimer(UINT nIDEvent)
{
char in379;
```

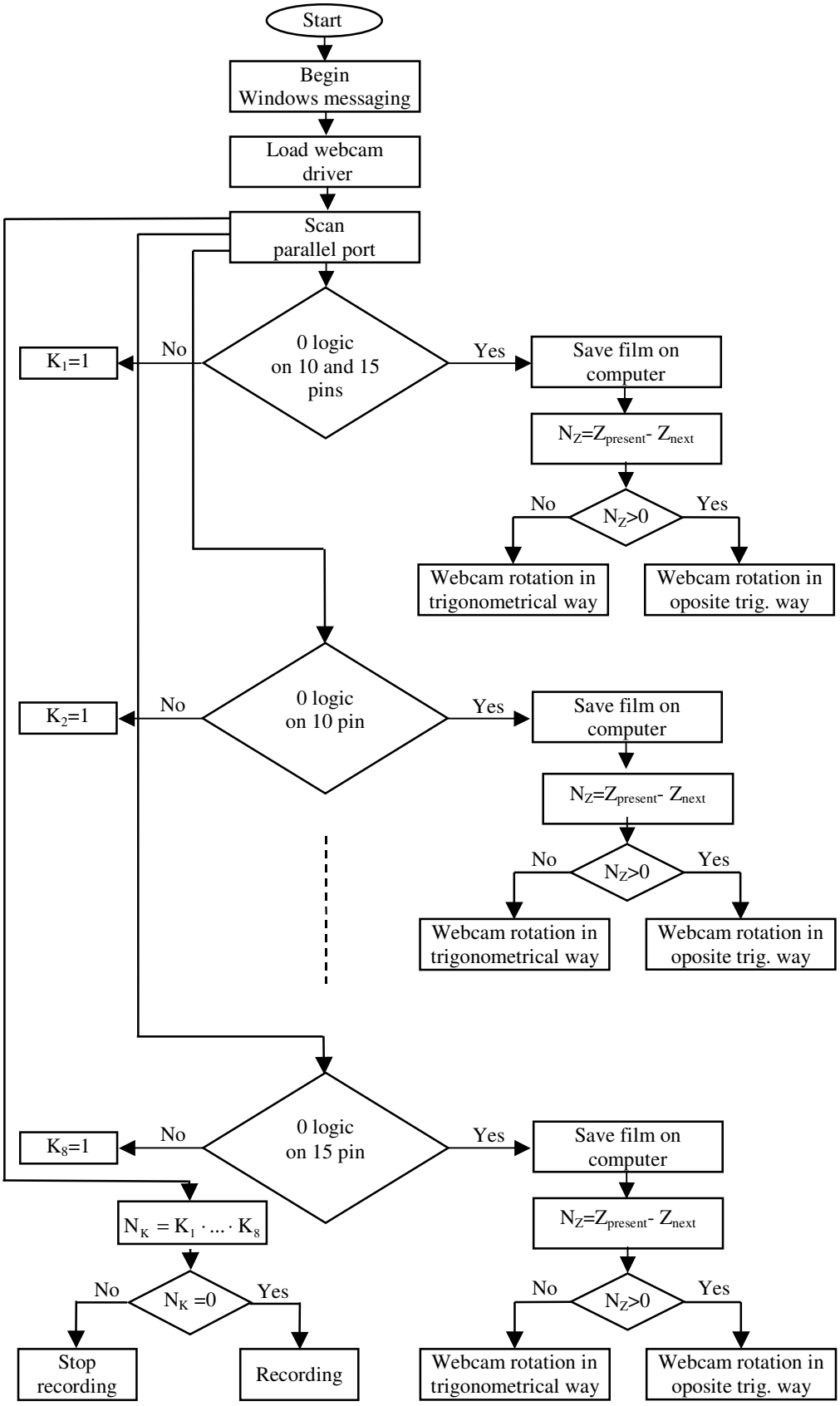

Fig. 7. The programme logical scheme

```
int nPin11,nPin12,nPin13, k[5],p[9],inc;;
 CString Filter;
 CString Filename;
CRect Rect;


// pins initialisation with 1

in379=Inp32(0x379);
            nPin10=in379 & 64;
            nPin12=in379 & 32;
            nPin13=in379 & 16;
            nPin15=in379 & 8;


// pins state check ing

   for(inc=1;inc<=4; inc++)
            k[inc]=0;
            if(nPin10==0) k[1]=1;
            if(nPin12==0) k[2]=1;
            if(nPin13==0) k[3]=1;
            if(nPin15==0) k[4]=1;


// activated sensor or pair of sensors determination

for(inc=1;inc<=4; inc++)
if (k[inc]==1) p[2*inc-1]=1;
if (k[inc+1]==1)  p[2*inc]=1;
      if (k1=!4)


// step number calculation for webcam rotation

for(inc=1;inc<=8; inc++)
if (p[inc]==1) { pas=p[inc];
                 mempas=pas;}
rd=mempas-pozcurenta
rs=pozcurenta-mempas


//oposite trigonometrical rotation

if (rd>0) nrpas=rd*3;
if (rs>0) nrpas=rs*3;
         for(inc=1;inc<=4; inc++)
            sk++=k[inc];
if (sk>0) if (rs>0) stg=1;
if (nrpas>0){
if (stg==1)  if (tu==1){tu=0;
                        _outp(888,0);
                             }
                        else
if (k==0) { k=1;tu=1;
             _outp(888,10);
            nrpas=nrpas-1;}
            else
              if (k==1) { _outp(888,6)
                        ;tu=1;k=2;
nrpas=nrpas-1;
                             }
                        else
 if (k==2) {_outp(888,5);
                nrpas=nrpas-1;
                tu=1;k=3;
               }
            else
if (k==3) {_outp(888,9);
              tu=1;k=0;
             nrpas=nrpas-1;
             }
if (senzdractiv==1) { kdr=kdr+1;
                        inactiv=1;
                        }
if (kdr==20) {senzdractiv=0;_outp(888,0);
                        }
if (kdr==20)
 if(nPin12==0)  hhhh=1;
            else {inactiv=0; kdr=0;
            }
}


// trigonometrical rotation

if (sk>0) if (rd>0) dr=1;
if (nrpas>0){
if (dr==1 )
         if (tu==1){ _outp(888,0);
                        tu=0;
                        }
                        else
 if (k==0) {_outp(888,5);
              k=1;tu=1;
             nrpas=nrpas-1;
                        }
            else
 if (k==1) { _outp(888,9);
              tu=1;k=2;
            nrpas=nrpas-1;
                        }
               else
 if (k==2) {_outp(888,10);
                tu=1;k=3;
            nrpas=nrpas-1;    }
            else
if (k==3) {_outp(888,6);
            tu=1;k=0;
            nrpas=nrpas-1;    }
}
```

4. CONCLUSIONS

The presented system is cheap, fiable and it may provide security by day and/or by night to a circular zone with a diameter of about 25 m, or to any other poligonal zone which can be included in such circle.

In case that it is desired not only to take images but also to discourage the intruder, the system can release different acoustic and light signals.

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