SHADOW FAN

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INTRODUCTION

• Standard fans are widely used in personal office spaces.

• Typically provided with 2 modes – Static and a Preset swing mode

• The first mode requires physical effort for the fan to be directed to the changing position of the user

• The second mode can be wasteful as the fan may be directed to empty spaces due to preset swing.
GOALS

• Design an automated fan that follows the user's movement.

• Change the speed of the fan depending on the ambient temperature

• In case of more than a single user, provide automated oscillation of the pan, based on their positions.
CONSTRUCTION

• Components used:
  o BASIC STAMP 2 Microcontroller
  o Parallax Standard Servomotor
  o PIR (Passive Infrared) Sensors
  o Digital Potentiometer (AD5220)
  o Transistor
  o Temperature Sensor (DS1620)
CIRCUIT LAYOUT
CIRCUITS

- PIR (Passive Infrared) Sensor

- The PIR sensor will give a HIGH or LOW signal depending on whether it can detect motion or not.
• **Standard Servomotor**

• Based on the sensor that detects the motion, the servo head, carrying the fan, is moved to that particular position
• **Temperature Sensor (DS1620)**

• The output of the temperature sensor will indicate the ambient temperature.

• The speed of the fan is varied accordingly with respect to the increase or decrease in the temperature.
• Digital Potentiometer (AD5220)

• The potentiometer is used to vary the speed of the fan by varying the resistance.

• With every degree increase, the potentiometer varies by 20 steps.
• Miscellaneous Circuits
  o **Bicolor LED**

  Green – Increasing Temperature
  Red – Decreasing Temperature

  o **Brushless DC motor (Fan)**

  The output of the digital potentiometer is used to run the fan and vary the speed depending on the change in temperature
- **Pushbuttons**
  - **Start Switch** - Used to switch the circuit on or to restart the circuit.
  - **Kill Switch** - Used to stop the motion of the servo.
WORKING
PROBLEMS FACED

• Sensor Calibration
  o Difficulty in positioning the PIR sensors on the board to eliminate superposition of their sensing range
  o Overcome by designing a mechanical structure separating the three sensors
• Temperature sensitivity output
  
  o No observable change in fan speed corresponding to varying temperature
  o Solved by using an LED which shows the incorporation of temperature change on the fan speed
' {STAMP BS2}
' {SPBASIC 2.5}

DQ       CON 14             ' DS1620.1 (data I/O)
Clock    CON 13             ' DS1620.2
Reset    CON 12             ' DS1620.3

' Constants '---------------------------------------------------------------------
RdTmp    CON $AA            ' read temperature
WrHi     CON $01            ' write TH (high temp)
WrLo     CON $02            ' write TL (low temp)
RdHi     CON $A1            ' read TH
RdLo     CON $A2            ' read TL
StartC   CON $EE            ' start conversion
StopC    CON $22            ' stop conversion
WrCfg    CON $0C            ' write config register
RdCfg    CON $AC            ' read config register

' Variables '---------------------------------------------------------------------
tempIn   VAR Word           ' raw temperature
sign     VAR tempIn.BIT8    ' 1 = negative temperature
tSign    VAR Bit
tempC    VAR Word           ' Celsius
tempC1   VAR Word
tempF    VAR Word           ' Fahrenheit
counter  VAR Byte
counter1 VAR Byte
counter2 VAR Byte
counter3 VAR Byte
counter4 VAR Byte
counter5 VAR Byte
counter6 VAR Word
pulse    VAR Word
i        VAR Byte
' Initialization '  -------------------------------------------
Initialize:  HIGH Reset  " alert the DS1620
SHIFTOUT DQ, Clock, LSBFIRST, [WrCfg, %10]  ' use with CPU; free-run
LOW Reset
PAUSE 10
HIGH Reset
SHIFTOUT DQ, Clock, LSBFIRST, [StartC]  ' start conversions
LOW Reset
'  -------------------------------------------

' Program Code '  -------------------------------------------
i=40
DO
PAUSE 1
LOOP UNTIL IN10=1

DO
i=i-1
GOSUB Temperature
DEBUG HOME,"Warming up for 40s.... :",CR,
DEC2 i, "s",CR
PAUSE 1000
LOOP UNTIL i=0

LOW 5
  FOR counter = 0 TO 127
  PULSOUT 6, 1
  PAUSE 10
  NEXT

HIGH 5
  FOR counter = 0 TO 80
  PULSOUT 6, 1
  PAUSE 10
  NEXT

LOW 3
LOW 4
MAIN PROGRAM:

```
main:
    DO
    GOSUB Temperature
    GOSUB Temp_Check
    DEBUG CLS, HOME
    DEBUG "DS1620", CR
    DEBUG "------", CR
    DEBUG SDEC tempC, " C ", CR
    DEBUG SDEC tempF, " F ", CR
    DEBUG CRSRXY, 0, 6, TAB, BIN1 IN0,
    TAB, BIN1 IN1,
    TAB, BIN1 IN2
    PAUSE 100
    IF IN0=1 AND IN1=0 THEN
        IF IN2=0 THEN
            GOSUB kill
        ELSE
            DO
            GOSUB kill
            GOSUB position1
            PAUSE 3000
            GOSUB kill
            GOSUB position5
            PAUSE 3000
            LOOP UNTIL ((IN0=1) OR (IN1=1) OR (IN2=1))
        ENDIF
        ELSEIF IN0=0 AND IN1=1 THEN
            IF IN2=0 THEN
                GOSUB kill
                GOSUB position3
            ELSE
                GOSUB kill
                GOSUB position4
            ENDIF
        ELSEIF IN2=1 AND IN0=0 THEN
```

```
ELSEIF IN2=1 AND IN0=0 THEN
    IF IN1=0 THEN
        GOSUB kill
        GOSUB position5
    ENDIF
ELSEIF IN0=1 AND IN2=0 THEN
    IF IN1=1 THEN
        GOSUB kill
        GOSUB position2
    ENDIF
ELSEIF ((IN0=1) AND (IN1=1) AND (IN2=1)) THEN
    DO
        GOSUB swing
    LOOP UNTIL ((IN0=1) OR (IN1=1) OR (IN2=1))
ELSE
    GOSUB kill
    PAUSE 2000
ENDIF
LOOP
SUBROUTINES:

position1:
FOR counter1 = 1 TC 100
PULSOUT 15,1050
PAUSE 20
NEXT
RETURN

position2:
FOR counter2 = 1 TC 100
PULSOUT 15,900
PAUSE 20
NEXT
RETURN

position3:
FOR counter3 = 1 TC 100
PULSOUT 15,750
PAUSE 20
NEXT
RETURN

position4:
FOR counter4 = 1 TC 100
PULSOUT 15,600
PAUSE 20
NEXT
RETURN

position5:
FOR counter5 = 1 TC 100
PULSOUT 15,450
PAUSE 20
NEXT
RETURN
kill:
IF IN11=1 THEN
DO
PAUSE 1
LOOP UNTIL IN10=1
ENDIF
RETURN

swing:
pulse = 450

FOR counter6 =1 TO 120
PULSOUT 15,pulse
PAUSE 20
pulse=pulse+5
NEXT
PAUSE 1000
IF ((IN0=1) OR (IN1=1) OR (IN2=1)) THEN
GOTO main
ELSE
FOR counter6= 120 TO 1
PULSOUT 15,pulse
PAUSE 20
pulse=pulse-5
NEXT
PAUSE 1000
IF ((IN0=1) OR (IN1=1) OR (IN2=1)) THEN
GOTO main
ENDIF
ENDIF
RETURN
TEMPERATURE:  

HIGH Reset  
SHIFTOUT DQ, Clock, LSBFIRST, [RdTmp]  
SHIFTIN DQ, Clock, LSBPRE, [tempIn\9]  
LOW Reset  
tSign = sign  
tempIn = tempIn / 2  
IF (tSign = 0) THEN No_Neg1  
tempIn = tempIn | $FF00  
No_Neg1:  
tempC = tempIn  
tempIn = tempIn * $01CC  
IF (tSign = 0) THEN No_Neg2  
tempIn = tempIn | $FF00  
No_Neg2:  
tempIn = tempIn + 32  
tempF = tempIn  
RETURN  

Temp_C_check:  
IF tempC=tempC1 THEN  
    PAUSE 1  
    LOW 3  
    LOW 4  
ELSEIF tempC>tempC1 THEN  
    HIGH 5  
    FOR counter = 0 TO 20  
    PULSOUT 6, 1  
    PAUSE 10  
    NEXT  
    HIGH 3  
    LOW 4  
ELSEIF tempC<tempC1 THEN  
    LOW 5  
    FOR counter = 0 TO 20  
    PULSOUT 6, 1  
    PAUSE 10  
    NEXT  
    LOW 3  
    HIGH 4  
ENDIF  
PAUSE 1  
tempC1=tempC  
RETURN  

' alert the DS1620  
' give command to read temp  
' read it in  
' release the DS1620  
' save sign bit  
' round to whole degrees  
' extend sign bits for negative  
' save Celsius value  
' multiply by 1.8  
' if negative, extend sign bits  
' finish C -> F conversion  
' save Fahrenheit value  

' pause between readings
## COST ANALYSIS

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<tr>
<th>No.</th>
<th>Component</th>
<th>Quantity</th>
<th>Cost</th>
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<td>1.</td>
<td>BASIC STAMP 2 Microcontroller</td>
<td>1</td>
<td>$106.00</td>
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<td>2.</td>
<td>PIR (Passive Infrared) Sensor</td>
<td>2</td>
<td>$20.00</td>
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<td>3.</td>
<td>PIR (Passive Infrared) Mini</td>
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<td>$9.00</td>
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<td>4.</td>
<td>Standard Parallax Servomotor</td>
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<td>5.</td>
<td>RadioShack Microfan</td>
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<td>6.</td>
<td>Temperature Sensor (DS1620)</td>
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<td>$5.00</td>
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<td>7.</td>
<td>Digital Potentiometer (AD5220)</td>
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<td>8.</td>
<td>Misc. (Pushbuttons, Transistor, Resistors, etc.)</td>
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<td></td>
<td>Total</td>
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<td>$167.00</td>
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Approximate Mass Production Cost = $70.00
FUTURE SCOPE

• Increase the range by incorporating a 360° field of operation

• Increasing the precision by addition of multiple sensors

• Integration of the fan into a home automation system
Thank You.