MICROCONTROLLER BASED WIRELESS AUTOMATIC ANTENNA POSITIONING SYSTEM

SURYA DEO CHOUDHARY*, PANKAJ RAI, ARVIND KUMAR, IRSHAD ALAM

Abstract

The automatic Antenna Positioning system primarily functions to identify the source of signal. The signal may be of any type and any kind, it automatically identifies the presence of a particular signal and the antenna will remain stationary as long as the signal link is established. Whenever the signal link breaks between the antenna and the satellite or source the antenna revolves continuously in search of the signal. This system also has advance connectivity with the monitor/LCD screen to indicate the antenna position.

In this project the source of signal is simulated by an Infrared (IR) source. And a corresponding IR receiver is used for detecting the signal. The receiver part includes one mono-stable that improves the stability of the system, against the transient interruption and momentary absence of the signal. The controller circuit is developed on a Microcontrollers–51-core micro controller. This controller mainly searches the availability of the signal, whenever the signal is found absent at the receiver. The controller drives the DC motor to rotate and this rotation goes on till the receiver found the signal. The controller provides necessary signal to the motor driver on which the antenna is mounted. The driver circuit provides adequate current and necessary voltage level to drive the motor in turn to move the antenna.

The interfacing between the transmitter unit and the receiver unit is done through DTMF Encoder and Decoder which gives the coding and decoding scheme that is flexible signaling scheme with high reliability just as that used in telephone communication technology.

The transmitter used here employs FM technology which eliminates possibility of any distortion. The receiver used here employs Super-Heterodyne FM receiver with automatic amplification regulation and it is ensured that the whole system rejects distortion due to parasitic modulation and demodulation.
The decoded message at the receiver unit is fed to the controller unit which after requisite signal processing displays the position of the antenna by exhibiting the degree of rotation of the antenna with respect to a certain reference point.

**Objective of the project**

In modern scientific world, there are threat perceptions to air defence from the enemy. Major establishments such as government buildings and offices, various sites of industries, places of financial importance, residence of ministers and VIP’s, heritage centres and tourist places and pilgrimages need to be guarded against any possible attacks from the enemy. For this the air defence system in and around these sites need to be monitored continuously through Radar Surveillance System. A particular target object needs to be detected and monitored. For this the Automatic Antenna Positioning Systems are necessary.

**Details of project design**

The design principles are based on simple phenomena. The tracking system has an antenna which contains a receiver, a delay circuit and a base transmitter.

The receiver is placed at the center point of the antenna. Whenever the receiver receives a signal with adequate strength, a logic high pulse is generated by a mono-stable configured around a 555 Timer.

To avoid interference and unnecessary triggering, a time delay is provided. And 8nos. of IR receiver (photo diode) arranged around the antenna to detect the position of antenna.

All the receivers output are connected to the microcontroller through a signal conditioning circuit for a compatible output to the Microcontroller.

The logic level is continuously checked with proper time delay. As long as the controller senses the logic high the motor will stay at that place assuming the signal is available to the antenna and the position of antenna will display on LCD in degrees.
Whenever there is no signal or logic low level appearing, the controller will drive the motor to search a signal i.e. logic high at the controller input port. The controller will continuously repeat this process to track the antenna for a particular signal.

Figure shows a Complete Block Diagram of the Project. In this Project an IR transmitter is used to transmit the signal which can be received by an IR receiver placed at the origin of the Antenna. This signal is passed through a monostable circuit to the photo Diodes which are used to convert the light energy into the electrical energy.

Now signal from photo diodes is fed to the Microcontroller by the help of Voltage Comparator through Signal Conditioning Circuit. Simultaneously an Interrupt Signal is given to the Microcontroller through OR Gate which is also operated by the Voltage comparator.

To activate DTMF encoder the input is given by the Microcontroller for the purpose of wireless communication. Relay is used to shorting the DTMF encoder.

FM transmitter is used to transmit the encoded signal through a simple antenna.

At the receiving station a FM receiver is used to receive the signal transmitted from the transmitter station and given to the DTMF decoder to decode the DTMF signal and the output is given to the Microcontroller as an Input signal through Signal Conditioning Circuit.

An LCD is interfaced with the Microcontroller to display the position of the antenna.
An audio amplifier is also used for testing purpose.

**Programming**

**Program For Transmitting Section Microcontroller:**

;;; WIRELESS AUTOMATIC ANTENNA POSITIONING SYSTEM ;;;

$MOD51

;:p0.5------signal input(IR RECEIVER)PIN-34
;:p0.0------motor(DC MOTOR)PIN -39

org 000h

mov p0,#0ffh
mov p1,#0ffh
mov p2,#00h
mov p3,#00h

main: jb p0.5, x1 ; IR RECEIVER SIGNAL INPUT
    acall deco
    acall delay
    sjmp main

x1:   acall driv
    ajmp main

;.................................. SUB routine ..................................

deco:
    mov a, p1 ; led array
    jb  acc.0, y0 ; p1.0 ir rx-1
    setb p2.0 ; switching network of dtmf encoder digit-1
    acall delay
clr p2.0 ; then off the dtmf signal
ret ; then return to deco subroutine

y0: jb acc.1, y1
setb p2.1
acall delay
clr p2.1
ret

y1: jb acc.2, y2
setb p2.2
acall delay
clr p2.2
ret

y2: jb acc.3, y3
setb p2.3
acall delay
clr p2.3
ret

y3: jb acc.4, y4
setb p2.4
acall delay
clr p2.4
ret

y4: jb acc.5, y5
setb p2.5
acall delay
clr p2.5
ret
y5: jb acc.6, y6
setb p2.6
acall delay
clr p2.6
ret
y7: jb acc.7, y7
setb p2.7
acall delay
clr p2.7
y8:
ret
driv:
setb p0.0 ; motor on bit
acall delay
clr p0.0
ret
delay: mov r0, #150d
loop1: mov r1, #200d
loop2: djnz r1, loop2
djnz r0, loop1
ret
end
Program For Receiving Section Microcontroller:

;;; WIRELESS AUTOMATIC ANTENNA POSITIONING SYSTEM USING LCD ;;;

$MOD51

; p3.5------signal input(IR RECEIVER)
; p3.6------motor(DC MOTOR)

org 000h
acall init

main: jb p3.5, x1 ; IR RECEIVER SIGNAL INPUT
acall deco
acall delay
sjmp main

x1: acall driv
ajmp main

…………………………SUB routine ……………………………

init:

mov p0,#0ffh
mov p1,#0ffh
mov p2,#00h
mov p3,#0ffh
mov a,#38h ; initialise lcd 2 line 5*7 matrix
acall cmd
mov a,#0Eh ; display on cursor on
acall cmd
mov a,#01 ; clear lcd
```assembly
acall cmd
mov a,#06h ;shifcurser right
acall cmd
clr 00
clr 01 ;clr p0.7
mov dptr, #msg1
acall line_1
ret
line_1:
    mov a,#080h ;curser at line 1 ,position 1
    acall cmd ;acall delay
    ;mov dptr,#0200h
y11: clr a
    movc a,@a+dpt
    jz exit1
    acall dat
    acall delay
    inc dptr
    sjmp y11
exit1: cpl 00
ret
line_2:
    mov a,#0C0h
    acall cmd ;acall delay1
    ;mov dptr,#0250h
```
y21:    clr a
        movc a,@a+dptr
        jz exit2
        acall dat
        acall delay
        inc dptr
        sjmp  y21
exit2:
    cp100
ret
cmd:
    mov p0,a   ; port-0 is taken as data bit for LCD
    clr p2.0   ; rs=0 for command mode
    clr p2.1   ; r/w=0 for write
    setb p2.2  ; E=1 FOR HIGH PULSE
    acall delay
    clr p2.2   ; E=0 for H-L pulse
    ret
dat:
    mov p0,a
    setb p2.0   ; rs=1 for data mode
    clr p2.1    ; r/w=0 for write
    setb p2.2   ; E=1 for high pulse
    acall delay ; acall delay
    acall delay1 ; acall delay1
clr p2.2
ret
deco:
    mov a, p1 ; led array
    jb acc.0, y0
    mov dptr, #msg2
    acall line_2
ret
    y0: jb acc.1, y1
    mov dptr, #msg3
    acall line_2
ret
    y1: jb acc.2, y2
    mov dptr, #msg4
    acall line_2
ret
    y2: jb acc.3, y3
    mov dptr, #msg5
    acall line_2
ret
    y3: jb acc.4, y4
    mov dptr, #msg6
    acall line_2
ret
    y4: jb acc.5, y5
mov dptr, #msg7
acall line_2
ret
y5: jb acc.6, y7
mov dptr, #msg8
acall line_2
ret
y7: jb acc.7, y8
mov dptr, #msg9
acall line_2
y8:
ret
driv:
    setb p3.6
    acall delay ;nc: jb p0.5, nc
    clr p3.6
ret
delay:
om v r0, #150d
loop1: mov r1, #200d
loop2: djnz r1, loop2
djnz r0, loop1
ret
org 0100h
msg1:
db 'Antenna Position'

db 0

msg2:
    db 'At 0 Deg'
    db 0

msg3:
    db 'At 45 Deg'
    db 0

msg4:
    db 'At 90 Deg'
    db 0

msg5:
    db 'At 135 Deg'
    db 0

msg6:
    db 'At 180 Deg'
    db 0

msg7:
    db 'At 225 Deg'
    db 0

msg8:
    db 'At 270 Deg'
    db 0

msg9:
    db 'At 315 Deg'
Applications

This project is limited to its applications due to the constraint of time and cost. This project can be developed with more sophistication and advanced facilities and its application can be improved.

The following areas where it can be applied are:

1. To monitor any attacking object.
2. In missile launching systems.
3. In monitoring of systems in satellite communication systems.
4. To monitor anti-missile system.
5. In mass communication systems in moving vehicles.

Conclusion

This project worked satisfactorily in the laboratory condition. The following points are concluded from the operation of the project:

1. The antenna movement depends on the precession of the motor. In this case the motor used is having a step size of 7.5 degree. So the precession is not that accurate but it is quit below the experimental acceptance level.
2. The antenna detects an object from a distance of 10 ft. Adjusting the transmitter and receiver power can increase range of detection.
3. Improvement from the prototype can be done by removing the limitations of the present circuit.

Future Expansion

This project is limited to its scope due to the constraint of time and cost. This project can be developed with more sophistication and advanced facilities as follows:
1. The present algorithm is developed on scanning method there is no procedure to optimize the antenna position for receiving maximum signal. A fuzzy logic algorithm can be implemented for precession control of antenna position.

2. The antenna designed in this project moves in one plane and don’t give any information regarding the axial movement of the target and also the distance of the target. A work on that regard can be carried out.

3. The target search and follow up is carried out in one plane but that can be extended in multiple planes.

4. FSK can be used at the place of FM and there should not any requirement of DTMF encoder and decoder.

5. By the help of Serial Interface Unit result can be appeared on the system screen instead of LCD.

Computer interface also can be implemented to see the position of the target in the computer screen.

References

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