Automatic Antenna Positioning System

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Automatic Antenna Positioning System

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ABSTRACT- The Automatic antenna positioning system primarily functions to identify the source of signal. The signal may be any type, identifies the presence of a particular signal and it change the position of the antenna to receive desired signal strength.Whenever the receiver receives the signal with minimum strength it automatically changes its position. Based on RSSI values from the receiver, it filtersout erroneous readings, anddetermines which direction to move the servo.This system also has connectivity with the LCD to indicate the signal strength.

Keywords: Antenna positioning, RSSI, arduino

INTRODUCTION

Wireless communication is being studied extensively and has attracted the attention of many researchers throughout the world. A major component in all wireless is the antenna.Positioning the antenna to receive the signal with maximum signal strength is very important to receive a desired signal.Particularly for locating and tracking radio frequency signals and for automatically positioning an antenna to receive a desired radio frequency signal.Depending on the application,one of several types of antennas can be utilized to implement a radio frequency link for a wireless communication system,Wherein the RF link may transmit and/or receive audio,encapsulatedata,compressedvideo,or other data.Types of antennas may include omni,sector and directional antennas.The system may comprise an antenna module with a transmitting and receiving antenna and hardware components to rotate the motor.Positioning the antenna mainly depends upon the Received Signal Strength.It is the measurement of power present in the received radio signal. It is a telemetry data sent from the receiver back to the transmitter.RSSI is a pulse width modulated signal.

Between the output of a transmit antenna and the input of a receive antenna, the RF signal propagates through the air gets attenuated and bounced off terrain, buildings, and/or water. In order for a receiving system to receive a desired signal, the signal typically must have enough power from the transmitter and gain from the receiver to overcome the attenuation due to air and satisfy the threshold signal level required by the receiver. Using an antenna with a narrowed beam-width may be required to minimize interference, as a narrowed beam-width corresponds with increased gain.

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For example a directional antenna, will generally allow a signal to be received from a greater distance, increase the strength of the received signal, and increase the resultant signal-to-noise ratio.

LITERATURE SURVEY

The source of signal[1] is simulated by an Infrared source and a corresponding IR receiver is used for detecting the signal.The controller circuit is developed on a Microcontroller and it mainly searches the availability of the signal, in the absence of the signal at the receiver.

The antenna positioner[5] rotates the antenna under test 180 degrees in both the x-z and y-z planes.Two servo motors control the antenna positioner.One servo motor rotates the antenna from 0-180 degrees at defined step sizes and the second servo rotates the plate at the top of the antenna mast from 0-90 degrees in one step.

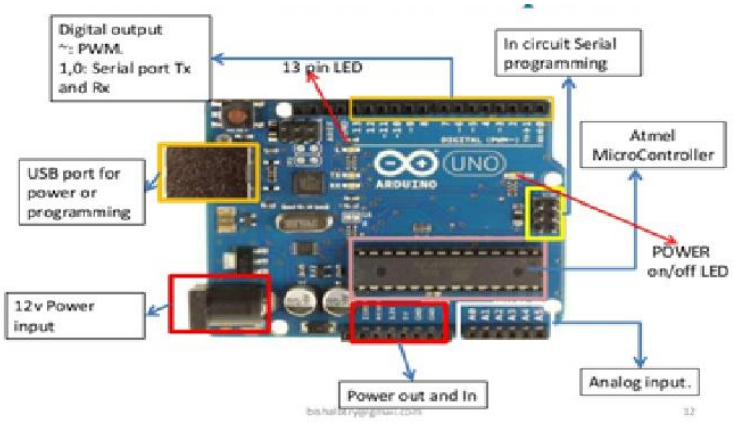
HARDWARE

The various components of antenna positioning system are as follows

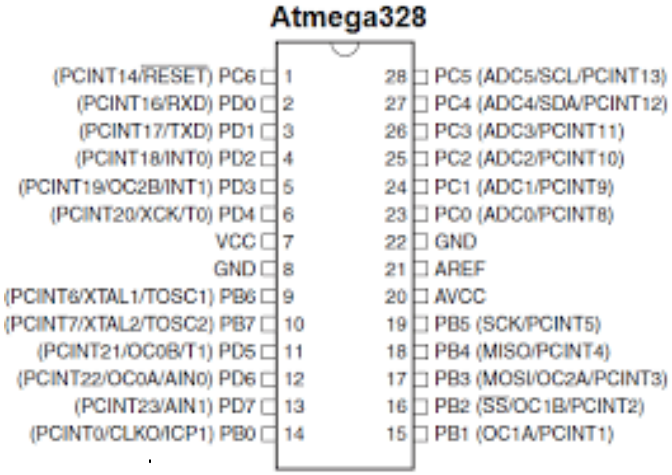
Microcontroller unit:

For implementing this device ATMEGA 328 microcontroller is used.The Arduino Uno is a microcontroller board based on the ATmega328 It has 14 digitalinput/output pins (of which 6 canbe used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, aUSB connection, a power jack, an ICSP header, and a reset button.

ARDUINO UNO DESCRIPTION



Atmega328 microcontroller:



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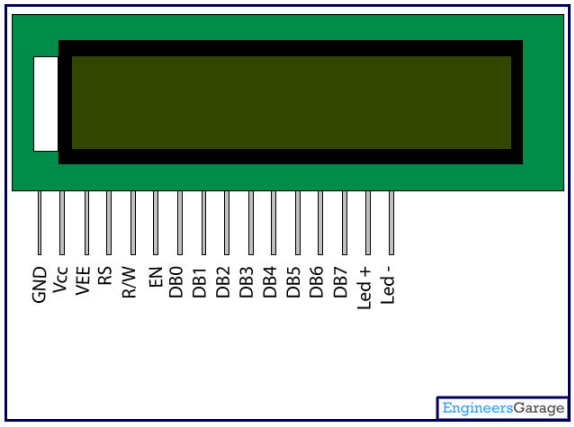
The Atmega328 has 32 KB of flash memory for storing code. It has also 2 KB of SRAM and 1 KB of EEPROM.Each of the 14 digital pins on the Uno can be used as an input or output.They operate at 5 volts. Each pin can provide or receive a maximum of 40 mA and has an internal pull-up resistor of 20-50 kOhms.

PARAMETERS	VALUE
Flash	32 Kbytes
RAM	2 Kbytes
Pin Count	32
Max. Operating Frequency	20 MHz
CPU	8-bit AVR
# of Touch Channels	16
Hardware QTouch Acquisition	No
Max I/O Pins	26
Ext Interrupts	24
USB Interface	No
USB Speed	No

LCD display unit:

To display the result and for interaction with the user an HD44780 Liquid Crystal Display is used. This is a 2 line LCD with 16 input pins. The connection of these pins with the microcontroller block is shown in



A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.

The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD.

Pin No	Function	Name
1	Ground (0V)	Ground
2	Supply voltage; 5V (4.7V – 5.3V)	Vcc
3	Contrast adjustment; through a variable resistor	V_{EE}
4	Selects command register when low; and data register when high	Register Select
5	Low to write to the register; High to read from the register	Read/write
6	Sends data to data pins when a high to low pulse is given	Enable
7	8-bit data pins	DB0
8		DB1
9		DB2
10		DB3
11		DB4
12		DB5
13		DB6
14		DB7
15	Backlight V_{CC} (5V)	Led+
16	Backlight Ground (0V)	Led-

Receiver(RC832):

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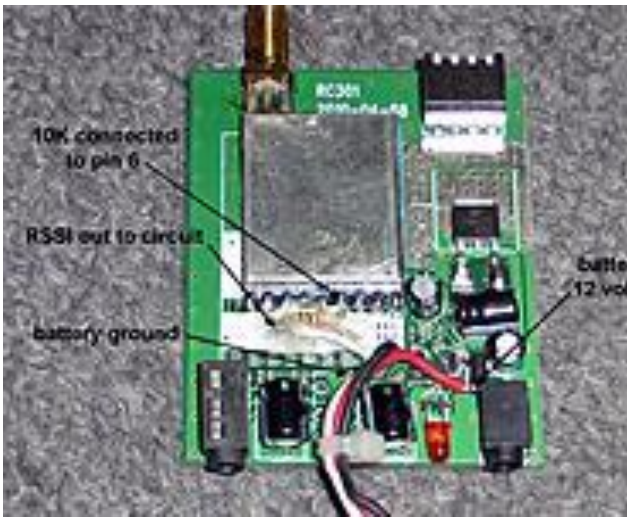
The receiver RC832 is small in size and easy for integration into the ground station.It has RSSI feature which measure the signal strength in specific direction.



MOTOR DRIVER:

For rotating the motor MC33926 motor driver is used. The dual MC33926 motor driver carrier is a breakout board featuring two Freescale MC33926 H-bridge ICs. It can supply up to almost 3 A continuous current per channel to two brushed DC motors at 5 – 28 V, and it can tolerate peak currents up to 5 A per channel. The MC33926 supports ultrasonic (up to 20 kHz) pulse width modulation (PWM) of the motor output voltage, which eliminates the audible switching sounds caused by PWM speed control, and a current feedback circuit for each motor outputs an analog voltage on its respective FB pin that is proportional to the output current

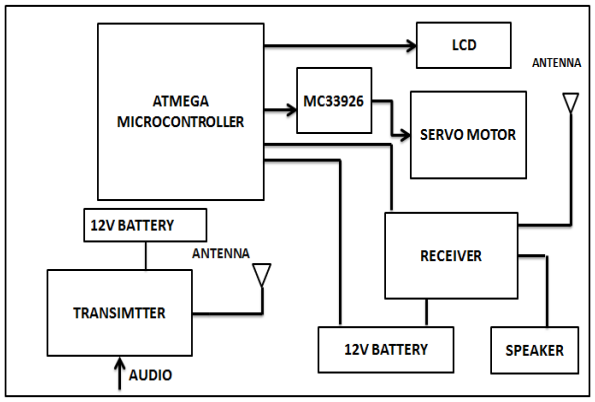


Fig:Block diagram for antenna positioning system

The transmitter transmits an audio signal. RSSI pin in the receiver measures the power in the received signal and convert it as voltage. The RSSI value is displayed in the LCD as percentage. The RSSI value is compared to the preset threshold value and the decision is taken if the antenna position has to be changed or remain the same.

The controller drives the servo motor rotates 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.

FLOWCHART:

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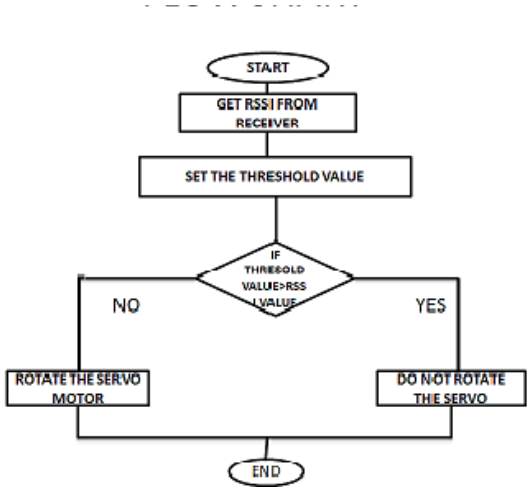

The description of the flowchart is,after switching the powersupply the RSSI pin in receiver measures the power in terms of voltage. The RSSI value is compared to the preset threshold value.If it is below the threshold value the servo motor rotates otherwise it remains in the same position.

RESULT/EXPERIMENTAL
OBSERVATION

When the power is switched on the transmitter start transmitting the signal. The RSSI pin in the receiver measures the power in turns of voltage and display the received signal strength in liquid crystal display.If it is lesser than the threshold value it changes its position otherwise it remains in the same position.

CONCLUSION:

The automatic antenna positioning system is mainly used to position the antenna without any human interface it automatically position itself depending upon the received signal strength. The antenna position mainly depends upon the precision of the motor. Improvement from the prototype can be done by removing the limitations of the present circuit.

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