Introducing APRSSpeak - an APRStt implementation

Douglas D. Quagliana, KA2UPW/5
dquagliana@aol.com

Abstract

APRSSpeak is a software implementation of Bob Bruninga's APRStt specification for translating DTMF digits into APRS AX.25 packets. The computer program runs on a generic PC with the sound card connected to a two meter transceiver and the serial port connected to a TNC, which is connected to a second two meter transceiver.

Introduction

The Automatic Packet Reporting System (APRS) allows amateurs to share information such as their current positions, or the position of some objects of interest. Typically this requires that the senders obtain their latitude and longitude from a GPS device and that the sender possesses a terminal node controller (TNC) as well as an appropriate radio transceiver required to transmit the data onto the APRS network. Most amateur radio operators have the transceiver, which can transmit voice and DTMF digits, but fewer amateurs have invested in the GPS and TNC needed to participate in APRS. APRSSpeak acts as a gateway that listens for DTMF digits from the amateur radio operators' transceivers, responds to the amateur radio operators with prerecorded voice prompts, and translates the DTMF digits into an appropriately formatted APRS AX.25 packet which the APRSSpeak system will then transmit onto the APRS network on their behalf.

Amateur radio operators frequently participate at public events such as races, marathons, and balloon festivals using APRS to report the positions of various assets and objects at the events. However, if the object of interest is moving, then it either needs to have an APRS "tracker" attached to it, or someone has to manually report the object's position. APRSSpeak helps with the latter scenario. APRSSpeak listens for DTMF digits and responds with voice prompts on a separate frequency which is neither the APRS national packet radio frequency nor the voice coordination frequency for the event. For example, at the 2010 Dayton Hamvention, APRSSpeak was listening on 146.580 MHz. This frees up the usual voice frequency for other uses. In addition, the position and callsign DTMF transmissions only take a few seconds to send to the APRSSpeak server, which can be shorter than the equivalent information relayed by voice. APRSSpeak then translates the DTMF digits into an appropriate APRS AX.25 packet which is transmitted by the TNC and a second transceiver onto the national APRS network. This allows everyone who has APRS capabilities to see the position reports. Similarly, anyone listening on 146.580 MHz will hear the position spoken by the APRSSpeak server.

In order to use APRSSpeak, an amateur radio operator needs to send it a sequence of DTMF digits. The digits can convey several different pieces of information including a position report, an amateur radio callsign, or a tactical callsign. Positions are sent in one of several formats that begin with a DTMF "B" digit and end with a DTMF asterisk. Callsigns are sent using a special "two-key" format that begins with a DTMF "A" digit and ends with a DTMF pound sign. Each letter of the callsign is sent as two DTMF digits. The first digit is the DTMF keypad button where that letter occurs. The second digit is one of the DTMF A, B, C, or D digits which signifies whether the desired letter is the first, second, third or fourth letter that appears on that button. For example, the letter "K" is sent as "8B" because "K" appears on the "8" button on the DTMF keypad, and the letter "K" is the second letter on that button. The scheme specified by the APRStt specification places "Q" on the "7" button

and "Z" on the "9" button, which is slightly different from some other similar encoding schemes. After the callsign, a DTMF digit is sent to specify the desired overlay letter or number. This is followed by a checksum digit which is the ones digits from the calculated sum of all of the previous digits. This is the same as the sum of the digits modulo ten. Any A, B, C, and D digits are added to the sum as their hexadecimal values (A is 10, B is 11, C is 12, and D is 13). Finally, a DTMF pound sign indicates the end of the callsign sequence.

While the two-key sequence is non-trivial, it has several advantages. It reduces the length of the callsign transmission to a maximum of sixteen digits, assuming a maximum length callsign of six letters. Other callsign encoding schemes, such as a multiple digit scheme where the digit is sent one to four times to indicate the desired letter, would result in DTMF sequences callsigns that are longer than sixteen DTMF digits for callsigns containing "S" or "Z" which would be "7777" and "9999" respectively. Because the two-key sequence is constrained to sixteen characters, it can be stored into the DTMF memories of many common transceivers, which have a limit of sixteen DTMF digits. Once stored in the transceiver, it can usually be recalled and retransmitted with less effort than sending the entire sequence manually. Because callsigns change infrequently, the DTMF sequence for the callsign can be calculated once, and then it can be treated as a "set and forgot" parameter, provided that the operator does not forget how to recall and transmit it using the radio. Additionally, there are at least two online websites which will calculate the DTMF callsign sequence. I have written one such translator in Javascript which is available at www.aprsspeak.com. There is also another callsign to DTMF translator by David Kindred available at http://www.retroscape.com/aprstt/. In addition, there are step-by-step directions at www.aprsspeak.com for how to take the DTMF sequence from the website and save it into a DTMF memory on either the HTX-202 or Alinco DJ-G7 radios. I would welcome submissions from other amateurs on similar procedures for other common radios.

APRSSpeak Usage

Just sending a DTMF callsign sequence provides several pieces of information besides the callsign. The APRSSpeak server knows the date and time that this callsign transmission was heard, and, since the APRSSpeak server knows its own location, the approximate location of that callsign is also known. Lacking a matching DTMF position report, the APRSSpeak server can transmit just the callsign as an APRS packet. In normal usage, the position report is sent first, and then, the transmission is "signed" by sending the callsign DTMF sequence. Position reports can take one of multiple formats. By prior agreement of the participating amateur radio operators, the local area for the event can be divided up into a ten-by-ten grid using a simple map with the x-axis and y-axis of the map labeled zero through nine. Once an amateur radio operator determines their location using the map, they can send a "B1" style position report by sending the DTMF digits "B1" and then the single x and y DTMF digits for the coordinates where they are located on the map. APRSSpeak can then translate the x and y digits into latitude and longitude since it has been previously configured with the information. Similarly, if there are a set of continuous numbered objects such as parking spaces or booth numbers, then an amateur radio operator could send a "B9" position report. For example, if the amateur radio operator was at parking space 2345, they could send their position report as "B92345#" after which they would send their callsign from the radio's memory using just a few more button presses. Note that both of these methods allow the amateur radio operators without a GPS or a TNC to generate an APRS AX.25 packets on the national APRS frequency. This would allow may more amateurs to participate, with APRS, at an event than would normally be possible if everyone was required to carry a GPS and a TNC.

When APRSSpeak hears a callsign report, it will respond with a prerecorded voice message such as "Welcome! I heard Kilo Alpha Two Uniform Papa Whiskey." It then performs any necessary translation on the position report and sends the packet to the TNC for transmission on the national APRS frequency. APRSSpeak can accept full amateur radio callsigns or tactical callsigns. In addition, once APRSSpeak has heard a full complete callsign, then the amateur radio operator can use a shortcut callsign on future transmissions. The shortcut is just the last three letters/numbers of the callsign such as "APR" for WB4APR.

APRSSpeak can also make announcements are predetermined times. At the Dayton 2010 Hamvention, APRSSpeak was preloaded with a list of times for the AMSAT satellite demonstrations and made announcements at the appropriate times to inform everyone of the demonstrations.

Conclusion

This paper introduces the APRSSpeak software and some of the features of the first version of the software.

References

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Douglas Quagliana, KA2UPW. Douglas holds an Extra Class Amateur Radio license and has been chasing amateur radio satellites since 1996. His writings have appeared online and in amateur publications including QRPp, QRP Quarterly, the AMSAT Journal, AMSAT UK Oscar News, and the Proceedings of the AMSAT-NA Space Symposiums. His other amateur radio interests include digital signal processing, APRS, QRP, and mobile HF. His current amateur radio work includes a 38k4 baud DSP sound card modem and a matching telemetry program for the amateur radio satellite AO-51 (Echo), APRSSpeak, and a telemetry program for the future ARISSat-1 satellite.

Douglas holds a Bachelors Degree in Computer Science from St. Bonaventure University and a Masters Degree in Computer Science from Stevens Institute of Technology in Hoboken, New Jersey. He has one patent.