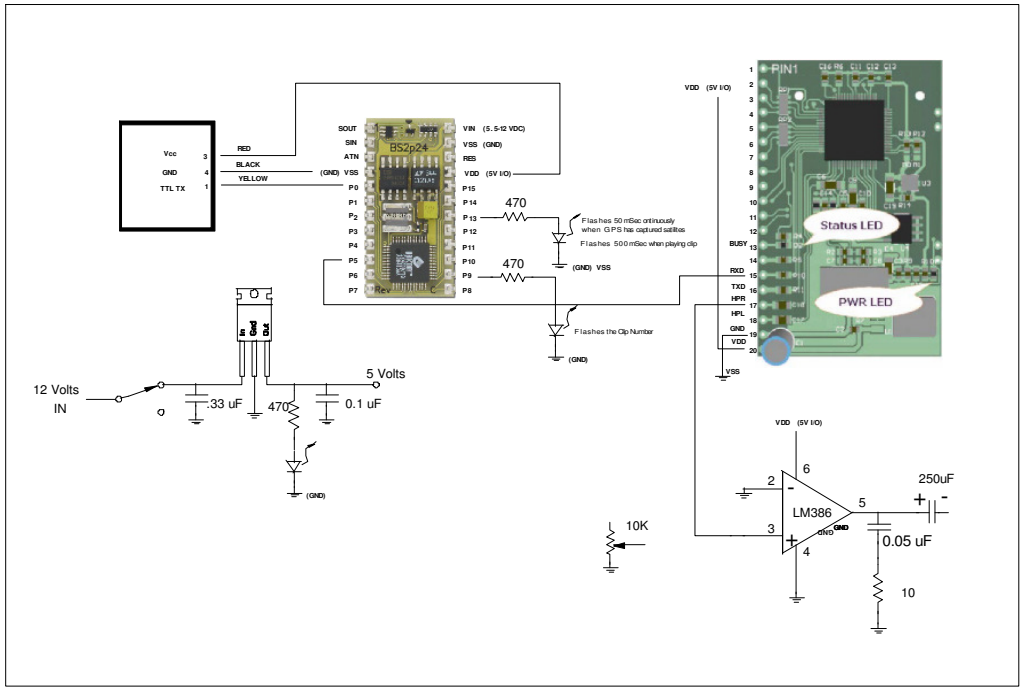
GPS System 9/15/13

The purpose of this proposed system is to provide the dialog to the public address system on the cars. At the present time this dialog is provided by a live speaker on board the train. It has been, with one exception, Mack Lacey for the last 5 years that I have been involved with the railroad. This system is set up to play recordings at specific locations on the route.

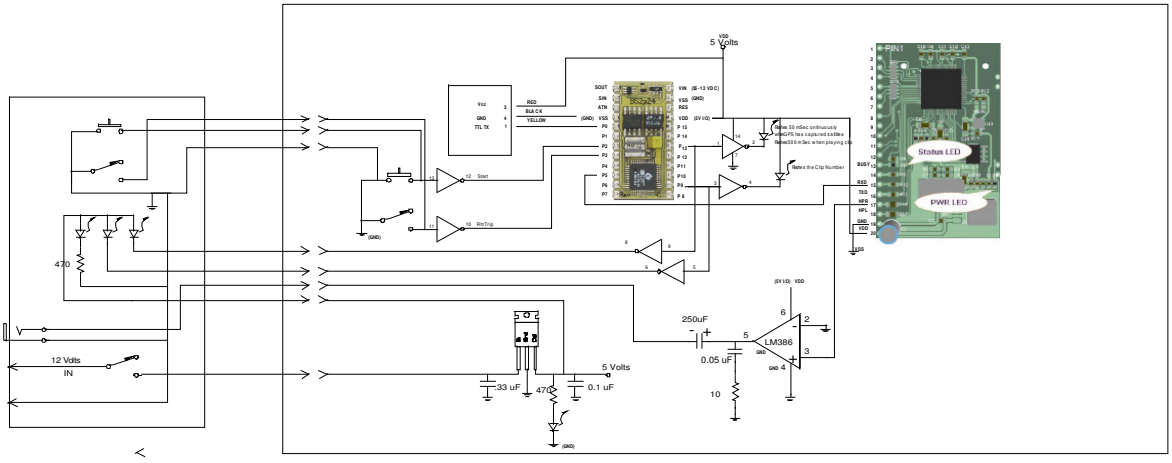
It is built around a Basic Stamp Microprocessor chip made by Parallax. They also have a GPS receiver that interfaces with their microprocessor. With these two units we can detect a location along the route and play a recorded message. The accuracy of this system can be as close as 10 feet. I chose the Parallax Basic Stamp because I am familiar with the Basic programming language.

Because of the limited memory of the microprocessor I reduced the accuracy of the GPS system to make room for the additional code needed to produce the required results. This was done in two ways. The GPS system provides both latitude and longitude information. I discarded the longitude information entirely and use only the latitude coordinates. I also limited the accuracy by discarding the last digit in the latitude data. The circuit is rather simple. The devil is in the programming.

Here is the prototype system.



The final system will be a little more complex. Here is what I envision so far.



After recording Mack's dialog, I found that we need different messages for the steam trains and the diesel trains. If there is enough memory space available I can set this up using the time of day data provided by the GPS receiver.
In the diagram above I show three switches: 1-On/OFF switch, 2- leave and return trip switch and 3- a start switch. We also need to select which diesel engine is pulling the train. For this function I will have to add another switch.
The additional components are a 5V regulator chip, an audio amplifier chip and a hex inverter chip

The pre-recorded messages are stored on an SD chip and played on an MP-3 Player module. The prototype uses a $10.00 module from mdfly.com . This unit may not be available. The vendor has another module for $20. I have not tried it at this point.
There are three LED indicators on the unit: 1- Power 2- GPS active 3- File # playing
The GPS module can take sever minutes to acquire a lock on the satellites. The GPS Active LED will flicker every few seconds when it is locked on to the satellites. The File # LED will flash the number of the file being played.

Operational Procedure

Thirty seconds before leaving Bonsal, make sure that the GPS is locked, select LEAVE position and press start button. The leave warning will start to play. The system will run without further interaction.

Thirty seconds before leaving New Hill, select Return position and press start.

Notes and system description.

GPS software displays the Latitude as South > The GPS unit is receiving correct data.

Added constant delta which is the range of acceptable units of capturing a marker.
Delta CON 25 ' Plus or minus Latitude location
Added variables lattt and latttdeg.
Lattt is the decimal of the second to only 3 decimal places. ie 3547.7659 is the data from the GPS module. That corresponds to 35 degree, 47' and 45.9"
To conserve RAM memory, I have rounded the seconds to 0.765

Latttdeg is the units digit of the degrees and seconds. In this case 7. So, the Latitude is referece is 7.765.

Since the Stamp Basic does not deal with decimal numbers or negative numbers, I multiplied this by 1000 to deal with whole numbers.

The table below shows the latitude data used in the software.

			Miles	Acumulated
		Data for	Between	Miles
		Software	Marks	
1	Daisey Street	9658	0	
2	Bonsal Crossing	9801	0.21164	0.21
3	Mile Post 1	45	0.36112	0.57
4	Path 2	587	0.80216	1.37
5	Mile Post 2	796	0.30932	1.68
6	Horton Rd	873	0.11396	1.80
7	Stairway	1032	0.23532	2.03
8	Bridge	1258	0.33448	2.37
9	Path 4	1759	0.74148	3.11
10	New Hill South Switch	1849	0.1332	3.24
14	Mile Post 4	2105	0.37888	3.62
15	New Hill North Switch	2157	0.07696	3.70

Make Clip 11 1950 the stopping point.

1 Daisy Street move to 9640	Start warning
2 Bonsal Crossing	History
3 Mile Post 1 move to 400	Cars-Caboose
4 Path 2	Hands
5 Horton Rd	Horton Rd 6
6 Bridge	Bridge

7 Path 4	move to 1400	Volunteer Organization
8 New Hill South Sw		New Hill
9 Stopping point move to 1950		Train Stops

The code that added starts at the getdata subroutine\.

GOSUB getdata

```
getdata:       ' This reads the location from the Data statement
GOSUB STRobelite     ' Toggle light to show system is operating
 audfile=0                  ' restart audio file number (audfile)
FOR eeAddr= 67 TO 85 STEP 2      'Address 67 is the start of Data
  'eeAddr=69

  audfile =1+audfile         ' Increment audio file number (audfile)
     READ eeAddr,Word testt

          GOSUB checkdistance   '
      DEBUG MoveTo, 21, 22, DEC testt  ," Play Y/N: ",   SDEC   testt-
(latttdeg*1000+lattt) ," XXX    "
     DEBUG "Play=: ", DEC play
    GOSUB playout

     NEXT

     RETURN
```

The Stroblite routine flashes the LED for each cycle just to show that the system is running.'

The
FOR eeAddr= 67 TO 85 STEP 2   'Address 67 is the start of Data
'eeAddr=69

reads the DATA statements which are the distance markings that were logged. See above.
The step 2 in the ForNext Loop is because the word is stored in 2 bytes.

The checkdistance subroutine checks if the location detected by the GPS unit is with 25 units of one of the data points

MP-3 Player board

NOTE: This module, the MDFLY model AU5121 plays the clips in the order that they were installed on the memory chip, NOT by the clip name!
The AU5032 will play the file by its name.

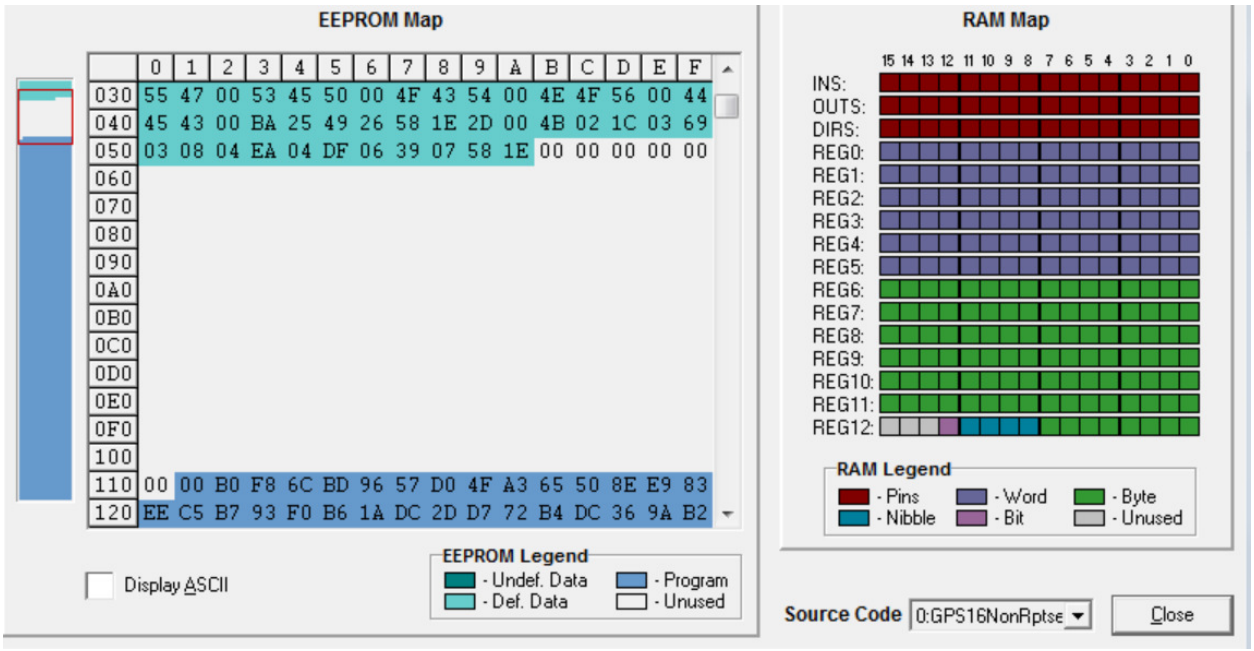
```
'E8 Volume up  232
'E9 Volume Down 233
'EA  pause play  234
'EB  Hold    235
'EC Resume   236
'EF  Stop   239
```

Volume up and down commands.

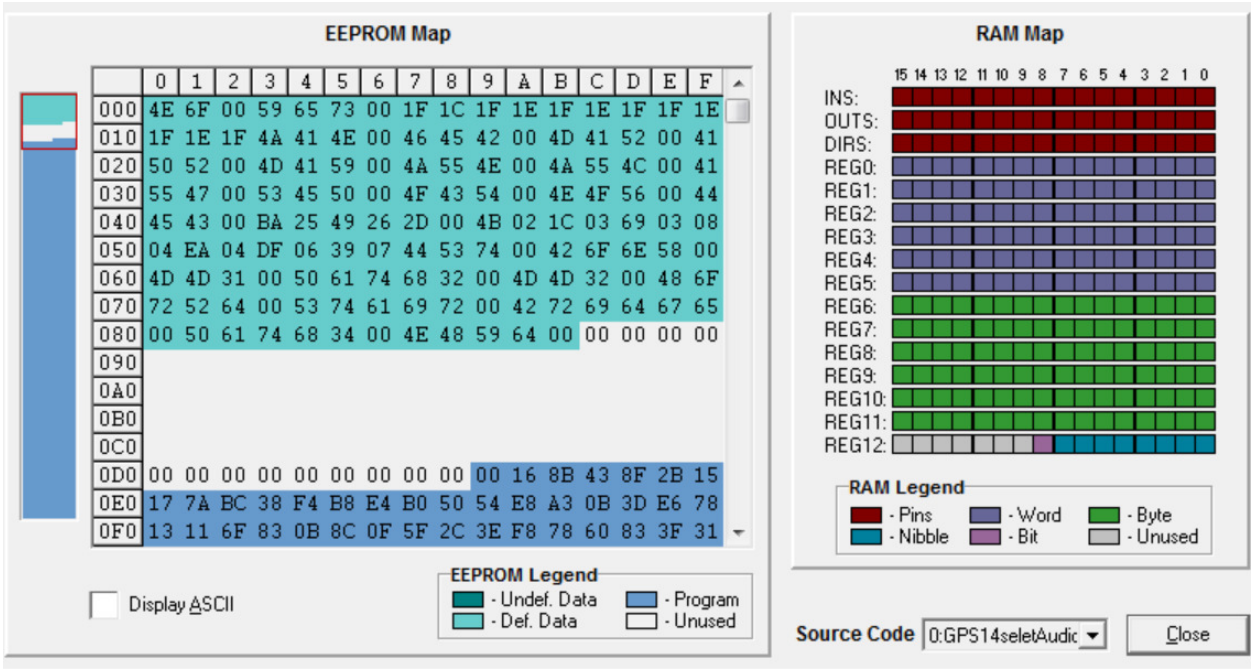
```
SEROUT 5,500,[233]      'vol Down
SEROUT 5,500,[232]      'vol UP
```

22 pulses swings the entire range from min to max.
For the LM386 set to gain of 20 volume up 14 times works well.
Yes, the AU5032 plays the actual file#, not like the AU5121

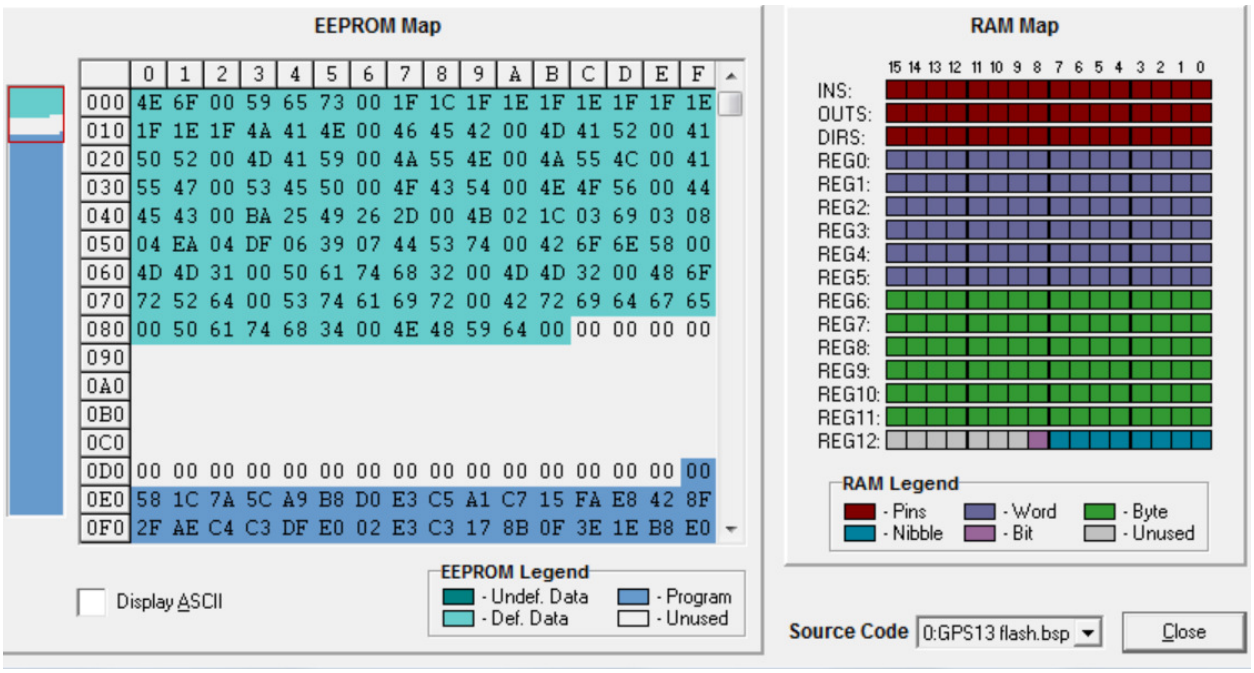
You can use **Sound Recorder** to record the clips. The **.wma** files will have to be converted to **.mp3** files. You can use the free program Free Mp3 Wma converter. This can be downloaded from:
http://lp.koyotesoft.com/?sysid=410&appid=100&gclid=CI2_8_f9m7kCFUyk4Aodcj4AcA



Version 14



Version 13



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