

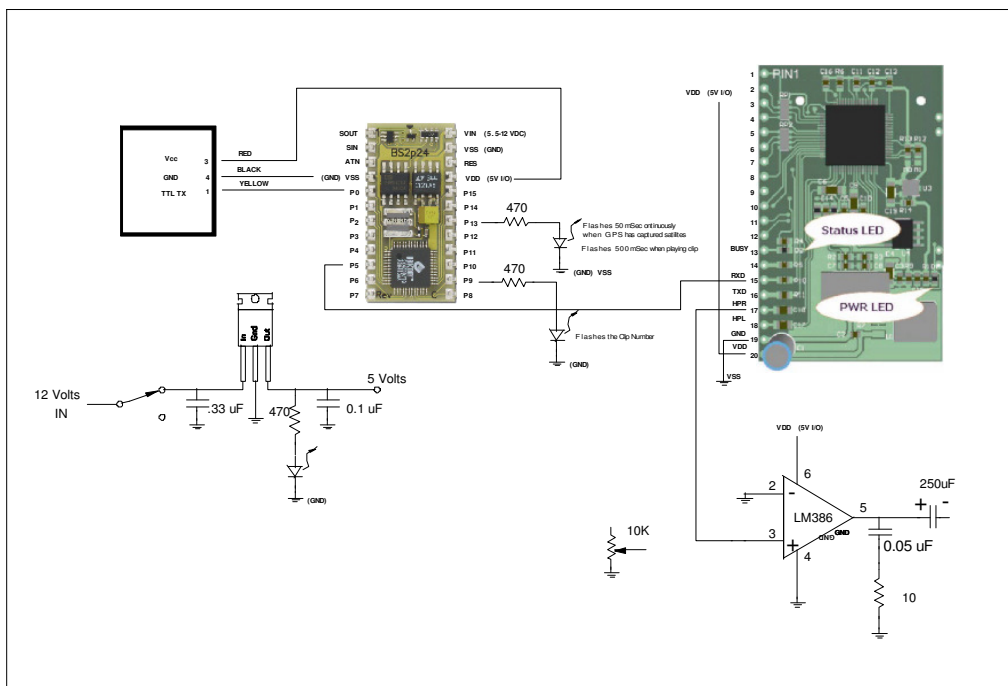
GPS System 9/15/13

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.

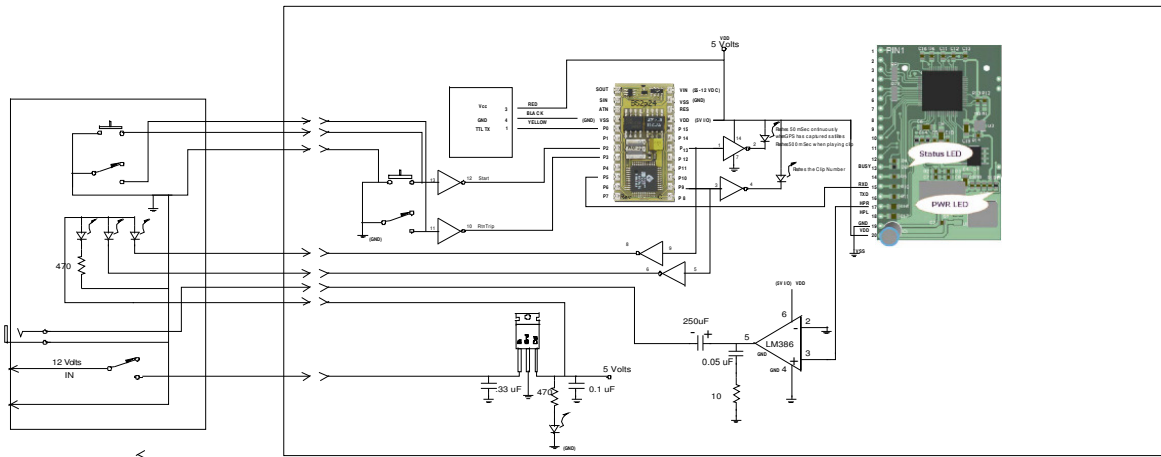
It is built around a Basic Stamp Microprocessor chip made by Parallax. They also have a GPS receiver that interfaces with their microprocessor. With these two units we can detect a location along the route and play a recorded message. The accuracy of this system can be as close as 10 feet. I chose the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

The screenshot shows two windows: 'EEPROM Map' and 'RAM Map'. The 'EEPROM Map' window displays a grid of memory addresses and their corresponding hexadecimal values. The 'RAM Map' window shows a bar chart representing the memory layout of various registers and pins, color-coded according to the legend.

EEPROM Map

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
030	55	47	00	53	45	50	00	4F	43	54	00	4E	4F	56	00	44
040	45	43	00	BA	25	49	26	58	1E	2D	00	4B	02	1C	03	69
050	03	08	04	EA	04	DF	06	39	07	58	1E	00	00	00	00	00
060																
070																
080																
090																
0A0																
0B0																
0C0																
0D0																
0E0																
0F0																
100																
110	00	00	B0	F8	6C	BD	96	57	D0	4F	A3	65	50	8E	E9	83
120	EE	C5	B7	93	F0	B6	1A	DC	2D	D7	72	B4	DC	36	9A	B2

EEPROM Legend

- Def. Data (Light Blue)
- Program (Dark Blue)
- Unused (White)
- Undef. Data (Dark Green)

Display ASCII

RAM Map

15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0

INS: [Red]

OUTS: [Red]

DIRS: [Red]

REG0: [Blue]

REG1: [Blue]

REG2: [Blue]

REG3: [Blue]

REG4: [Blue]

REG5: [Blue]

REG6: [Green]

REG7: [Green]

REG8: [Green]

REG9: [Green]

REG10: [Green]

REG11: [Green]

REG12: [Grey, Blue, Green]

RAM Legend

- Pins (Red)
- Word (Blue)
- Byte (Green)
- Nibble (Light Blue)
- Bit (Purple)
- Unused (Grey)

Source Code: 0:GPS16NonRptse [Close]

Version 14

EEPROM Map

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
000	4E	6F	00	59	65	73	00	1F	1C	1F	1E	1F	1E	1F	1F	1E
010	1F	1E	1F	4A	41	4E	00	46	45	42	00	4D	41	52	00	41
020	50	52	00	4D	41	59	00	4A	55	4E	00	4A	55	4C	00	41
030	55	47	00	53	45	50	00	4F	43	54	00	4E	4F	56	00	44
040	45	43	00	BA	25	49	26	2D	00	4B	02	1C	03	69	03	08
050	04	EA	04	DF	06	39	07	44	53	74	00	42	6F	6E	58	00
060	4D	4D	31	00	50	61	74	68	32	00	4D	4D	32	00	48	6F
070	72	52	64	00	53	74	61	69	72	00	42	72	69	64	67	65
080	00	50	61	74	68	34	00	4E	48	59	64	00	00	00	00	00
090																
0A0																
0B0																
0C0																
0D0	00	00	00	00	00	00	00	00	00	00	00	16	8B	43	8F	2B 15
0E0	17	7A	BC	38	F4	B8	E4	B0	50	54	E8	A3	0B	3D	E6	78
0F0	13	11	6F	83	0B	8C	0F	5F	2C	3E	F8	78	60	83	3F	31

Display ASCII

EEPROM Legend

- - Def. Data
- - Program
- - Undef. Data
- - Unused

RAM Map

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
INS:	[Red]															
OUTS:	[Red]															
DIRS:	[Red]															
REG0:	[Blue]															
REG1:	[Blue]															
REG2:	[Blue]															
REG3:	[Blue]															
REG4:	[Blue]															
REG5:	[Blue]															
REG6:	[Green]															
REG7:	[Green]															
REG8:	[Green]															
REG9:	[Green]															
REG10:	[Green]															
REG11:	[Green]															
REG12:	[Green]															

RAM Legend

- - Pins
- - Word
- - Byte
- - Nibble
- - Bit
- - Unused

Source Code: 0:GPS14seletAudic Close

Version 13

EEPROM Map

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
000	4E	6F	00	59	65	73	00	1F	1C	1F	1E	1F	1E	1F	1F	1E
010	1F	1E	1F	4A	41	4E	00	46	45	42	00	4D	41	52	00	41
020	50	52	00	4D	41	59	00	4A	55	4E	00	4A	55	4C	00	41
030	55	47	00	53	45	50	00	4F	43	54	00	4E	4F	56	00	44
040	45	43	00	BA	25	49	26	2D	00	4B	02	1C	03	69	03	08
050	04	EA	04	DF	06	39	07	44	53	74	00	42	6F	6E	58	00
060	4D	4D	31	00	50	61	74	68	32	00	4D	4D	32	00	48	6F
070	72	52	64	00	53	74	61	69	72	00	42	72	69	64	67	65
080	00	50	61	74	68	34	00	4E	48	59	64	00	00	00	00	00
090																
0A0																
0B0																
0C0																
0D0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
0E0	58	1C	7A	5C	A9	B8	D0	E3	C5	A1	C7	15	FA	E8	42	8F
0F0	2F	AE	C4	C3	DF	E0	02	E3	C3	17	8B	0F	3E	1E	B8	E0

Display ASCII

EEPROM Legend

- - Def. Data
- - Program
- - Undef. Data
- - Unused

RAM Map

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
INS:	[Red]															
OUTS:	[Red]															
DIRS:	[Red]															
REG0:	[Blue]															
REG1:	[Blue]															
REG2:	[Blue]															
REG3:	[Blue]															
REG4:	[Blue]															
REG5:	[Blue]															
REG6:	[Green]															
REG7:	[Green]															
REG8:	[Green]															
REG9:	[Green]															
REG10:	[Green]															
REG11:	[Green]															
REG12:	[Green]															

RAM Legend

- - Pins
- - Word
- - Byte
- - Nibble
- - Bit
- - Unused

Source Code: 0:GPS13 flash.bsp Close

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