THE RAILWAY AUTOMATION

IDEA AND MOTIVATION

The theme of the project idea is to automate the railways.The train with the GPS module on board can be made to follow a specified path. This would enable us to free the railways not just by the use of driver but will also enable us to provide real time train tracking system.

There is a base station where the train movement will be mapped on a screen. Also, that will be the place from where instruction set, for the movement of the train, will be generated and sent to the train.

The motivation for the project came from the lack of control over railways in India as we hardly get to know the exact position of the train while standing at the station. The way Metro implements modern techniques to control the railways inspired us to design a system for the complete railway system of India.

COMPONENTS/HARDWARE USED

Atmega 16,

GLCD (128*64),

LCD (16*2),

GPS Module,

USB to Serial Connector.

IMPLEMETATION OF IDEA

We devided the implemetation part as follows

1) Familiarised ourselves with the working of GPS Module and GSM Module.

2) Collected GPS data for the track chosen. Displayed the path on the GLCD and assigned lattitude longitude values for each pixel of the path.

3) Used ISIS simulator to check the basic code before implementing on the the hardware.

4) Finally implemented the design on the hardware and displayed the real time train running information on the LCD along with the movement of train displayed on the GLCD.

So, we have a base station which has the command generation system. The position of the train is sent by the gps to the base station where the system generates command, and transfers back to the train, giving it directions to move.

BASIC OVERVEW OF THE CODE AND THE CONCEPTS USED FOR ITS IMPLEMENTATION

GPS :

GLOBAL POSITIONING SYSTEM is a process of establishing the location of any point on the globe. One's exact location and precise time (UTC- Universal Time Coordinated) can be determined anywhere on the Earth. The speed and direction of travel(course) can be determined by using the location coordinates as well as the time. The coordinates and time values are determined by using 28satellite orbitting the Earth.

In order to relay the computed GPS Variables to a peripheral, GPS Modules have a serial interface (RS-232) and the most important data of this receiver information are broadcast by this interface in a special data format (NMEA 0813).

The module we used made use of a Patch Antenna.

Example of data received from GPS Receiver:

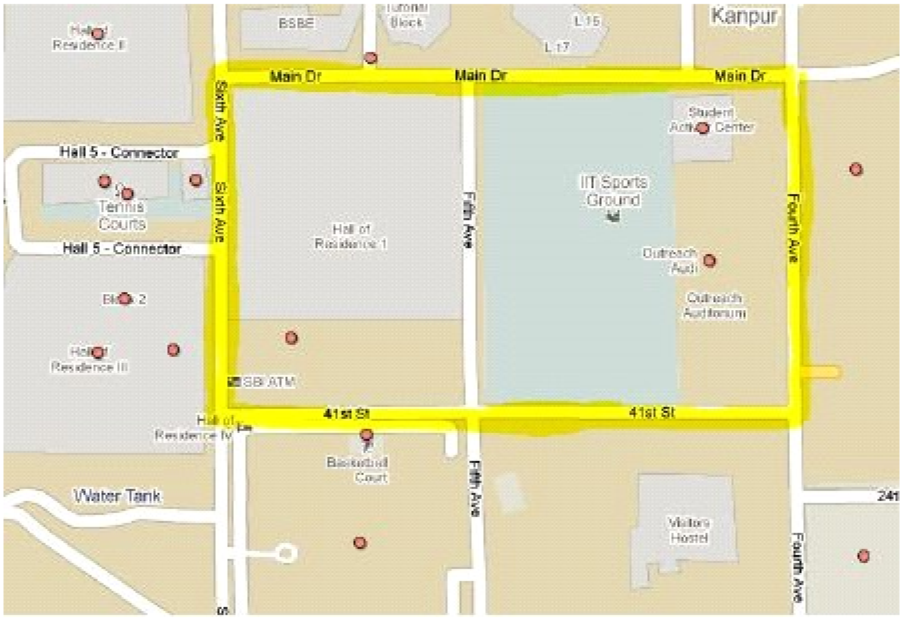
```
$GPGGA,184504.241,2630.6295,N,08013.8525,E,1,03,2.8,42.5,M,-
42.5,M,,0000*4C$GPGSA,A,2,25,29,05,,,,,,,,,,3.0,2.8,1.0*32$GPRMC,184504.241,A,2630.
6295,N,08013.8525,E,0.28,156.24,220611,,,A*62$GPVTG,156.24,T,,M,0.28,N,0.5,K,N*09
```

The first code requires to interpret the GPS data properly and according to its prototype a code has to be implemented that extracts the value of the longitude, lattitude and time from it.

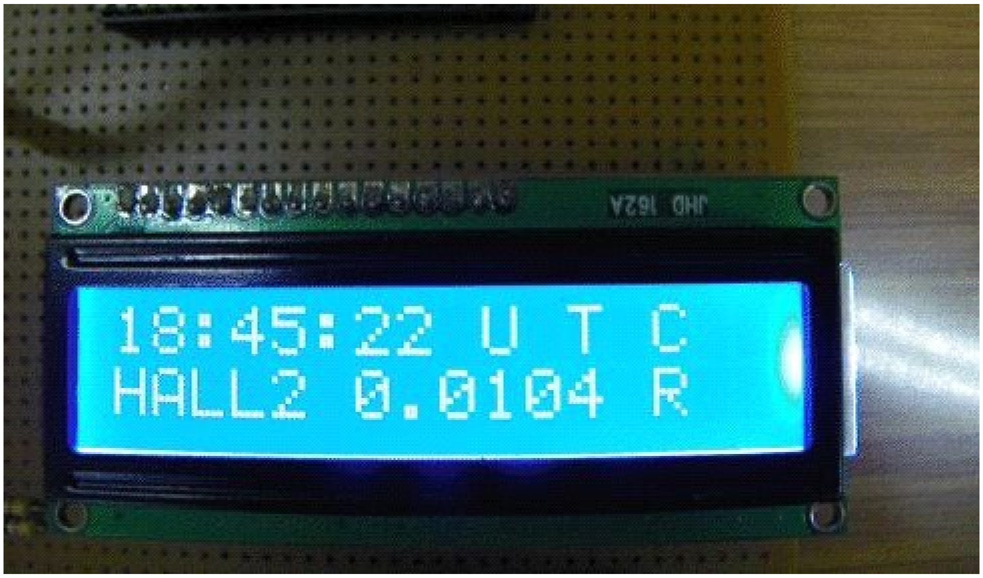
SELECTING PATH AND DISPLAY ON LCD:

After the position coordinates of the path are selected it is required to be fed in the microcontroller memory. The code implementing command generation needs to take into account the spherical nature of the Earth’s surface. While executing a turn, it is required that we give the directives of turning some distance before the turning point. All of this requires use of haversine formula.This is an equation which gives distances between two points on a sphere by its Latitudes and longitudes.

The following is the track we selected for our project :



The code for running the train according to the received values is written in CVAVR. This has to include the data extraction code, haversine function code and direction generation code. This enable us to show the real time , location , distance from nearest station and the direction to chose on the lcd screen.



```
18:45:22 U T C
HALL2 0.0104 R
```

RUNNING TRAIN ON GLCD :

This code needs to be written in AVR Studio. The position coordinates matching the coordinates of the track path makes that pixel goes off. This enables us to map the movement of train on our screen.

This program requires inclusion of buffer to store the memory of the the previous position of the train. It is required to compare the lattitude and longitude of the present location of the train with that of the path.

PROBLEMS FACED

While execution of the GLCD program the major problem we faced was inclusion of buffer. The code had to compare the latitude and longitudes of the present location of the train and that of the path.The program memory always exceeded the space available. Finally we alternatively used cvavr code to compare the coordinates and then transferred the calculated pixel coordinates to the glcd code. As the code size in cvavr increased considerably, we had to configure the c compiler by increasing its data stack size to 512 from 296 originally.

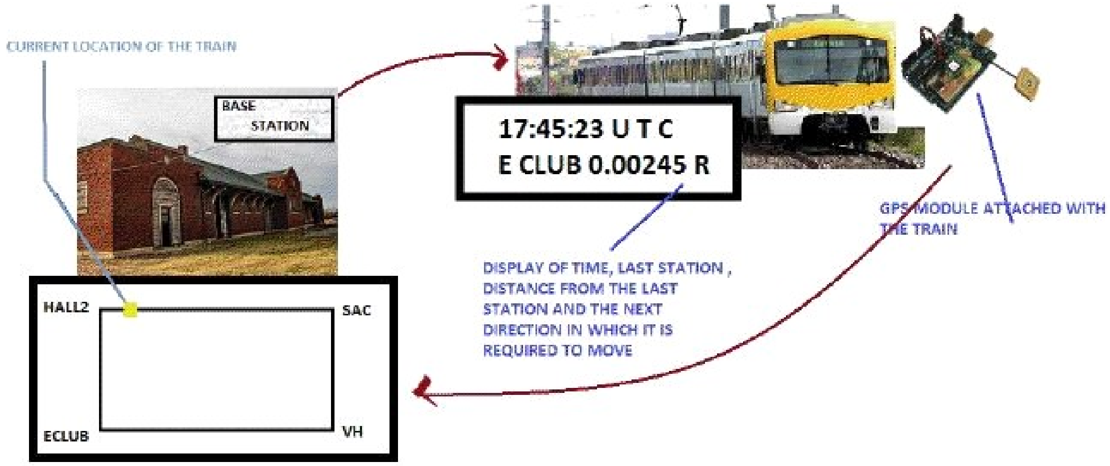
CONCLUSION

We started the project with a much bigger aim in mind, but the complexities that arose during its implementation forced us to cut down the actual implementation to the one mentioned above.

This idea can be much more expanded to include more trains, more functions and thus one day can actually give India automatic control over its railways.

PROJECT PIC

The entire project theme can be summarised in the following picture :


CURRENT LOCATION OF THE TRAIN
BASE STATION
17:45:23 U T C
E CLUB 0.00245 R
GPS MODULE ATTACHED WITH THE TRAIN
DISPLAY OF TIME, LAST STATION , DISTANCE FROM THE LAST STATION AND THE NEXT DIRECTION IN WHICH IT IS REQUIRED TO MOVE
HALL2
SAC
ECLUB
VH

More about GPS can be learnt from http://geology.isu.edu/geostac/Field_Exercise/GPS/GPS_basics_u_blox_en.pdf

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