**DESIGN OF 3D SCANNER BASED ON ULTRASONIC TRANSDUCER AND RECEIVER USING DSP PROCESSOR**

**PURPOSE**

The purpose of this project is to develop a 3D scanning device for generating 3D map of the environment (such as the map of a room or a building) using the TMS320C6713DSK kit.

**WORKING**

The device will work by transmitting a known ultrasonic signal and recording the time delay of the received (reflected) signal to estimate the distance of the obstruction for known value of the speed of sound. The ultrasonic transducer and receiver would be design such that they could be capable of transmitting focussed waves and receiving them.

After the distance to the object is detected, it would then be mapped to a point in 3D space with the help of information gathered from accelerometer and gyrometer. These 3D points would then be fed to an external program running on the PC to generate 3D surfaces from the estimated points using OpenGL which would be displayed to the user.

**ALGORITHM**

Let,

The known signal to be transmitted from the ultrasonic transducer be ***x(t)***.

The received signal from the ultrasonic receiver be ***y(t)***.

To detect the time delay in reception of the known signal in the received signal, ***y(t)*** must be correlated with ***x(t)***. This also filters out most of the unnecessary noise in the received signal (noise will not correlate with ***x(t)***).

Since we only need the absolute value of the peaks, we take absolute of the correlated signal to obtain a decoded signal ***y\_dec(t)***.

***y\_dec(t) = abs[ corr[ x(t), y(t) ] ]***

Now, for detecting peaks in ***y\_dec(t)***, its envelope must be found by low-pass filtering it (to remove high-frequency oscillations in the peaks). Thus, the final signal from which the time delay of reception can be estimated is ***y\_det(t) = lpf[ y\_dec(t) ]***

The distance of the object can then be estimated by simply multiplying the time delay with half the speed of sound in air. The holding angle can be obtained from gyrometer and change in position of device can be obtained from accelerometer which finally allows us to calculate relative position of the point of reflection in Cartesian coordinate system.

The obtained points will be then passed to a PC based program (using Visual Studio). Out of those points, first three points would be selected and a plane would be made. Then which points lie on that plane would be checked. If more than three points satisfies the plane, then that plane will be finally created (in OpenGL graphics library).

DESIGN

We are using ultrasonic speakers(40 khz) and directional ultrasonic receiver to detect the lattice points of wall. Discrete points (x,y,z) and along a plane and those in other planes calculated with spherical transformation from the angle value through gyroscope will be fed to another system through JTAG. Points are calculated through accelerometer. The encoded points will be decoded by our graphic designer.