Wireless communication of microcontrollers using Amplitude Shift Keying (ASK)

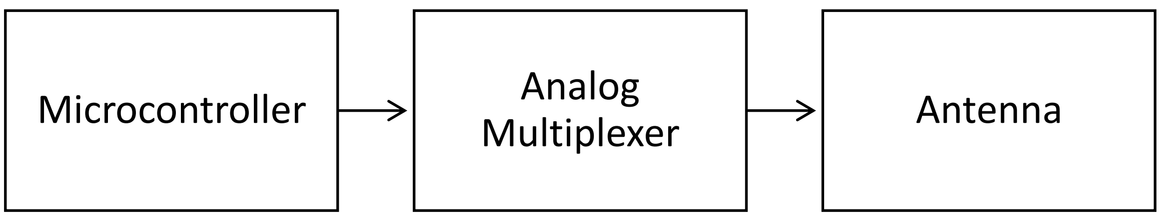
GROUP – 10: SASANK CHILAMKURTHY (110070051), ANURAAG REDDY (110070052), CHANDRAKANTH (110070053)

Aim:

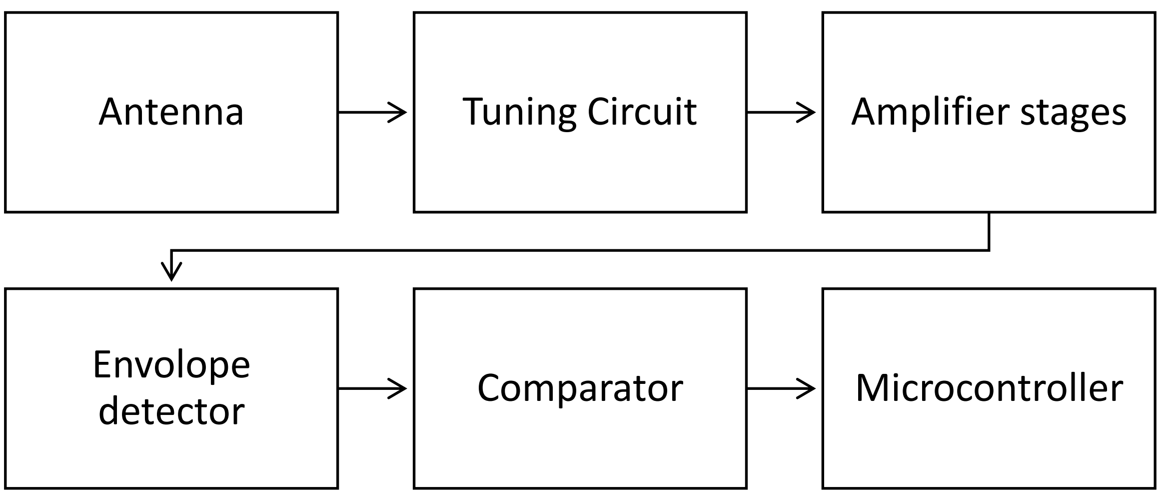
Establish a digital communication link wirelessly between two microcontrollers in medium wave band

Block diagram:

Transmitter Circuit:



Receiver Circuit:



Explanation and Problems faced

Analog Multiplexer multiplexes between ground and carrier signal as controlled by microcontroller. We tried to make our own carrier wave. But we couldn't make 1.3 MHz oscillator (our carrier frequency). We tried 555 timer. Maximum frequency that can be generated from it is about 700 KHz. We tried OPAMP oscillator. We even used 2 different high performance OPAMPs. They couldn't stand high slew rate and have very high output impedance. So high that buffering it using BiCMOSOPAMP buffer did not work. So, we had no other option but to use sine wave from signal generator for carrier signal.

Antennas are simple monopole antennas. Because of low frequency, we couldn't transmit much power. Antennas had to be close for reception.

Tuning circuit is simple LC – band pass filter centered at 1.3 MHz. Then there are two OPAMP amplifier stages. Problem here is limited gain-bandwidth product. We need high gain to amplify signal from antenna. But high frequency limited the operation and it took trial and error to decide OPAMPs to be used.

High frequency operation debugging took the most of our time. 1.3 MHz may be too limited a frequency for good bandwidth, but we couldn't go any higher.

Demodulator is simple envelope detector. We compared the output of envelope detector with a fixed DC voltage and output will be the input signal to microprocessor.

We used UART protocol to communicate between microcontrollers. We sent a text message from transmitting microcontroller and received and showed it on LCD on receiving microcontroller. We tested for various Baud Rates possible. Maximum baud rate we tested to be working is 31,250 – highest the microcontroller we used can operate.

Once high baud rate communication link is established, we could've transmitted almost anything. But in this project, we were seriously limited by processing power and hardware. We tried to transmit digital audio. There are codecs available which can compress voice to 2400 Baud! In the first place, we do not have 3.5 mm jack to get analog waveform of sound from computer/phone. Then we need to sample at reasonable frequency. We cannot transmit this directly without compression. We had neither time nor processing power to do that. We tried using PC's COM port. But it didn't work out. We were using 8051 based microcontroller. It has very low RAM. So, we had to stop at transmission of simple text messages.

Working circuits

Transmitting 'A' continuously using highest baud rate:

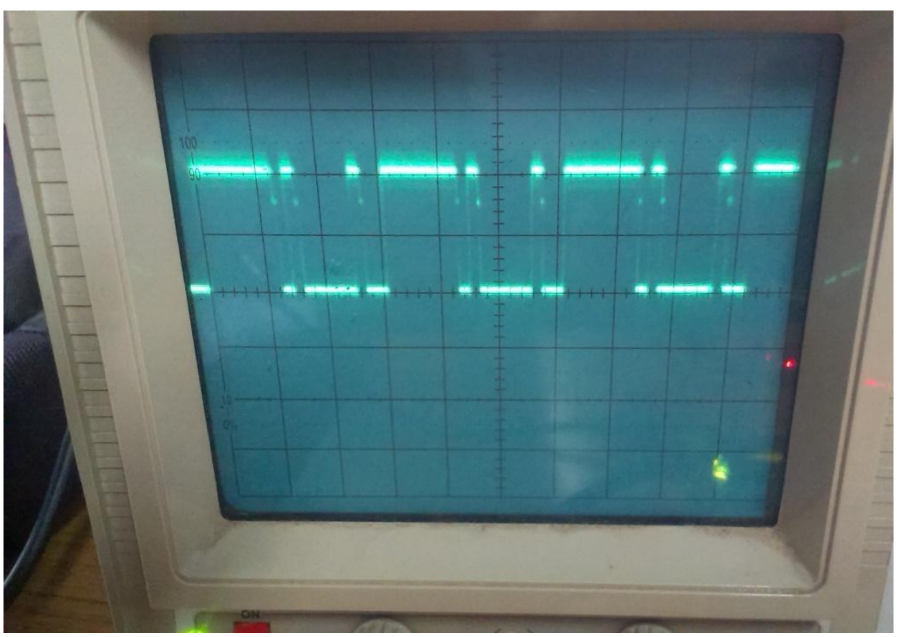


Figure 1Waveform at receiving pin of microcontroller. We've given delay between two transmissions so that frame can be seen clearly. ASCII code of A - 41h – 0010 0100 should be the bits in one frame. Observe that it matches the waveform.

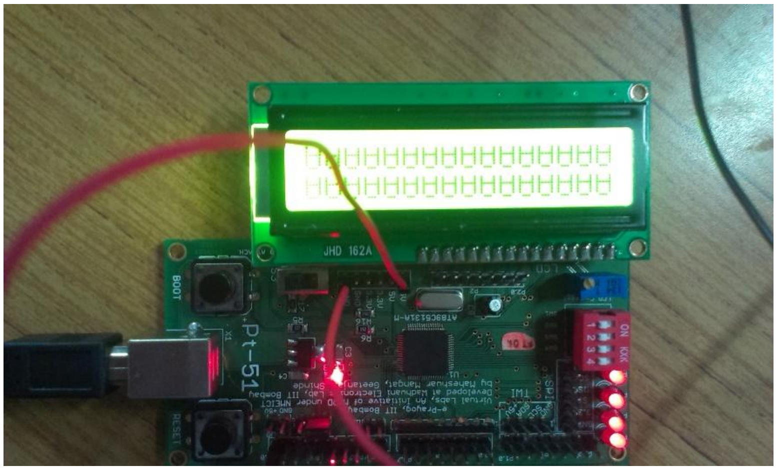


Figure 2 Receiving microcontroller

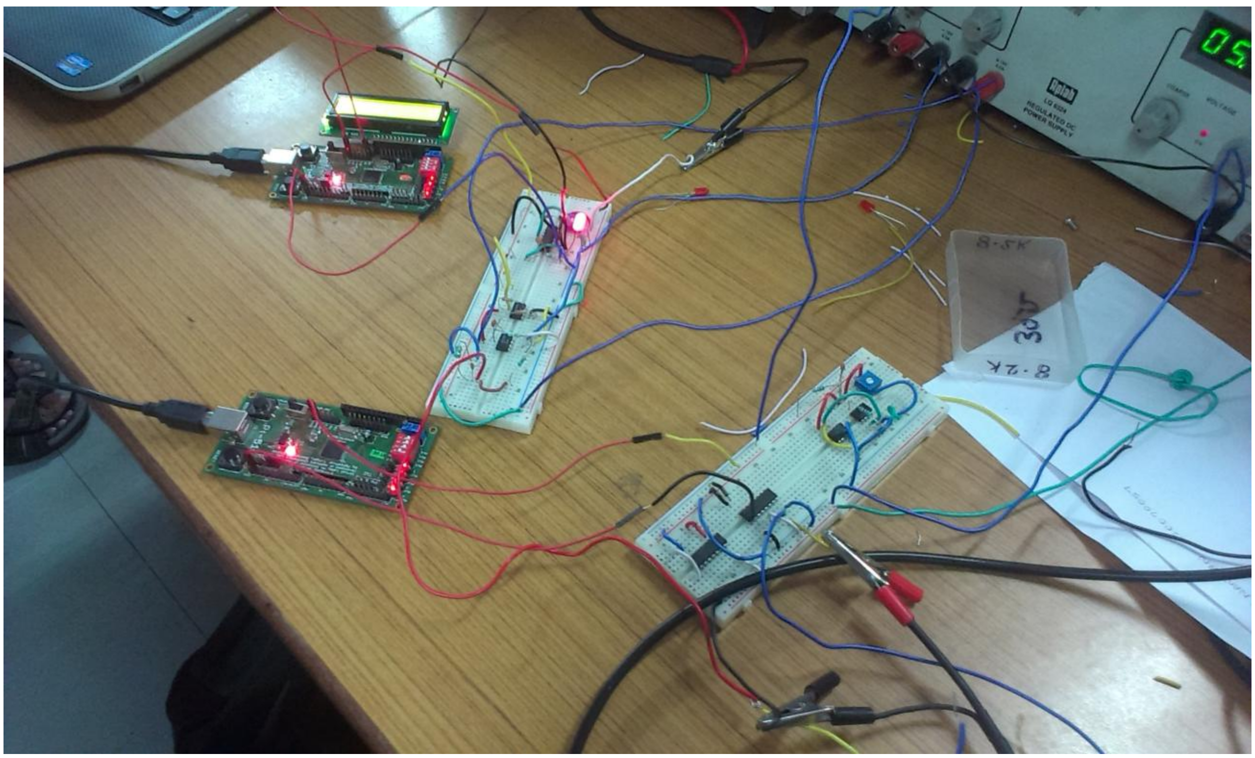


Figure 3 Microcontroller without LCD is transmitter. One with LCD is receiver.

Further improvements that can be done

1. Use higher frequency
2. Improve antennas to transmit for longer distances
3. Sample and compress audio (using DSP?) and transmit it
4. Reconstruct the audio from received bits