

AVR Electronic Metronome (AVR 2004 Design Contest Entry A3721)

Overview

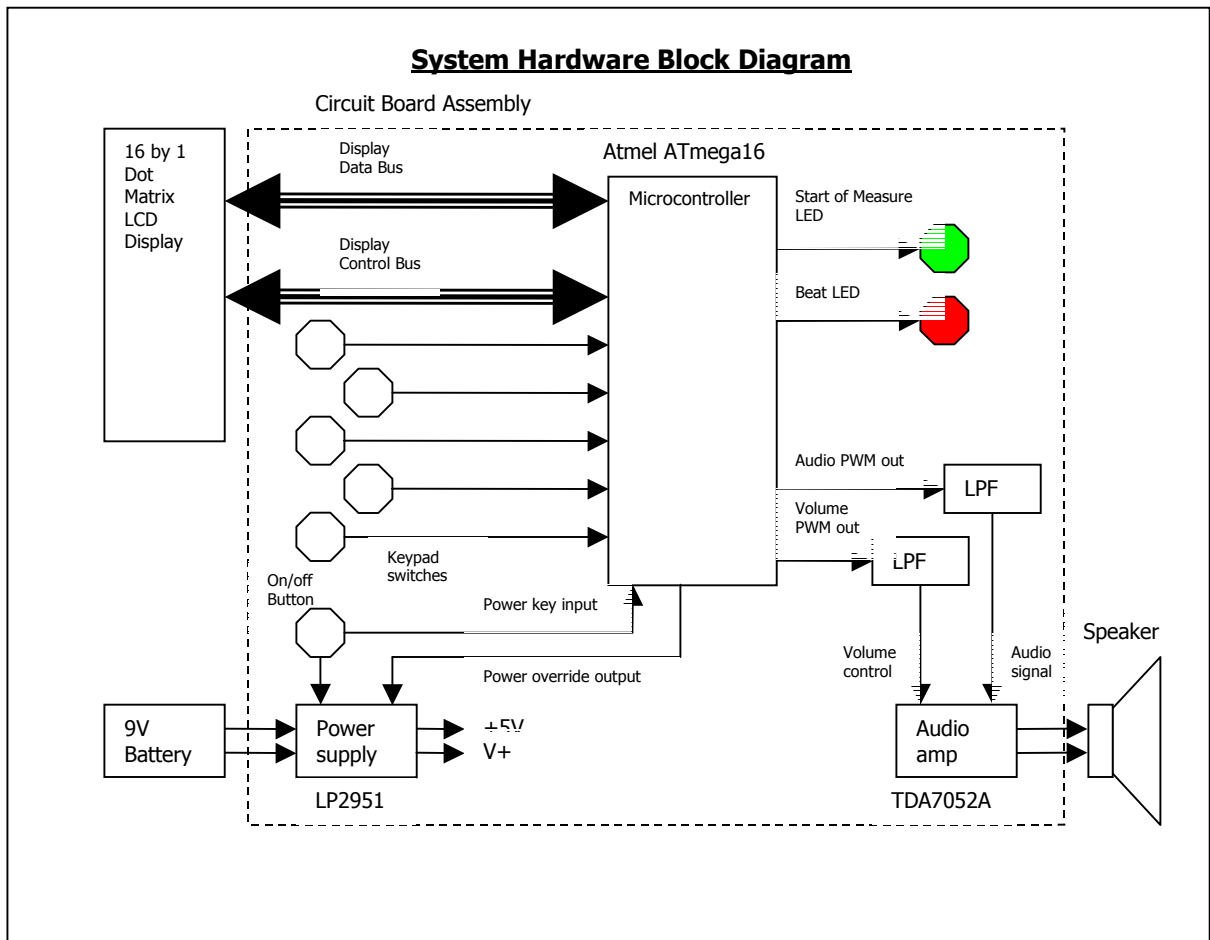
Sometimes musicians are not aware of their shortcomings. For example, one of the major television networks ran a show called "WB Superstars", where contestants were convinced they were entering a talent contest similar to the popular "American Idol" show. The goal of the show, however, was not to try to find the best singers (like "American Idol"); instead, they try to find the worst singers. What amazed me was the contestants actually thought they were good, even though anybody else who listened to them sing knew otherwise. It is possible the show was a farce, and the contestants knew they sang bad or sang bad on purpose just to play along with the story. On the other hand, I have listened to people doing karaoke who thought they were great singers, even though they were not.

One of my shortcomings, as pointed out recently by my piano teacher, is my labile sense of tempo. It seems I have difficulty playing anything with a steady tempo, even though I perceive that I am. The way to fix this problem is to use a metronome. A metronome, for those of you who never took music lessons, is a device which generates a clicking sound at a steady rate which can be preset. Many pieces of music will have tempo markings on them, either in beats per minute or in fancy musical terms such as "grave" (very slow), or "presto" (very fast). A traditional metronome is a mechanical device which uses a windup spring and a dual-pendulum arm to produce the clicks at the desired rate. Electronic versions of the metronome, however, are more popular because of their lower cost, ease of use, and added functionality (such as programmable beats per measure, measure counting and distinctive sounds for the 1st beat of the measure).

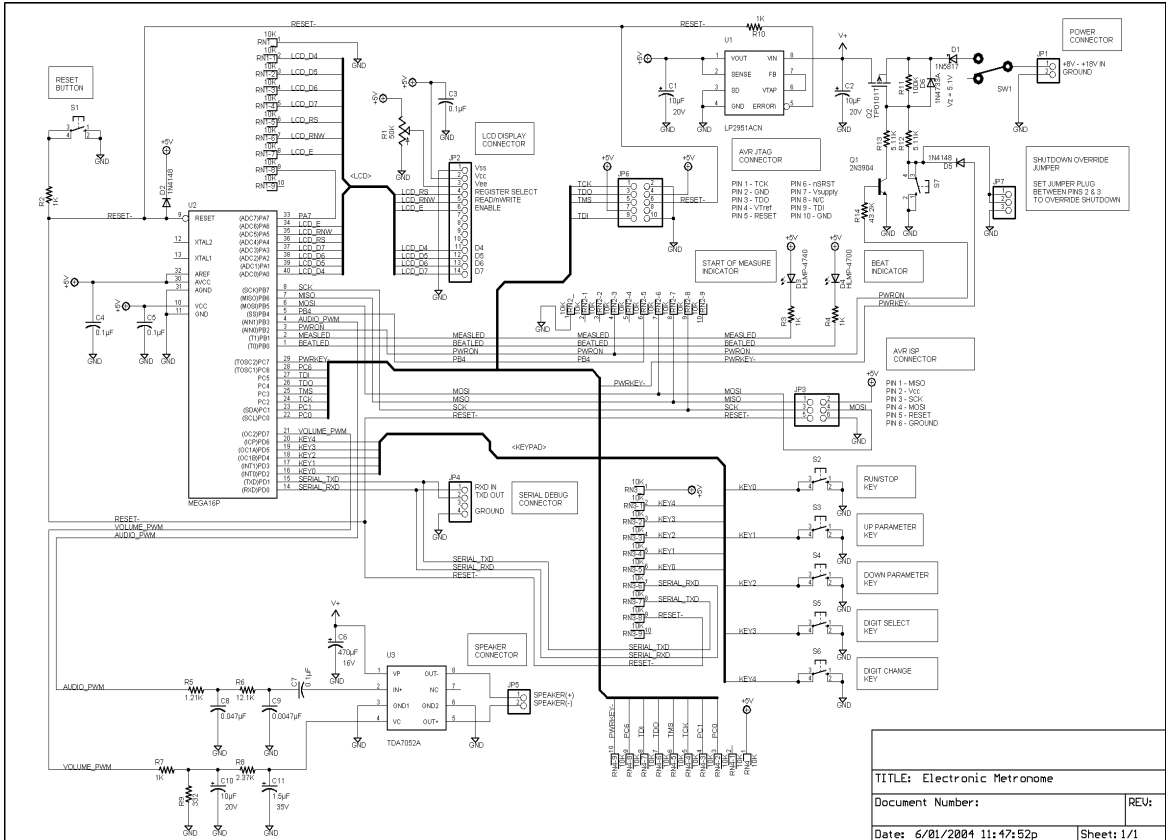
Eager to fix my labile sense of tempo, I looked at the various electronic metronomes available on the market. Just about all of them have a major shortcoming - they sound horrible! Then I thought, "I'm an electronics engineer - can't I make one that sounds good and does everything else I want?" At the same time, I had signed up for a sample kit for the AVR 2004 Design Contest and needed to come up with a project to do for the contest. The end result is my latest creation - the AVR *Electronic Metronome*. This device, built around an AVR ATmega16 microcontroller, has the following features:

- Programmable tempo from 40 to 240 beats per minute
- Programmable beats per measure from 2 to 16
- Programmable sound volume from 0 (mute) to 100%
- Programmable measure counter which can count from 0 to 9999
- "Tap tempo" feature which allows the user to set the tempo by tapping (pressing and releasing) a button at the desired tempo
- 8 bit digitized sound sampled at 11.025KHz
- Unique sound for 1st beat of each measure

- Metronome settings (tempo, beats per measure, measure count, sound volume) are saved in non-volatile memory on shutdown and restored on power up
- 16 character by 1 line dot matrix LCD display for displaying/editing metronome configuration as well as displaying measure count, beat count, and tempo while metronome is in "run" mode
- Green LED indicator which flashes on 1st beat of each measure
- Red LED indicator which flashes on all beats except the 1st beat of each measure
- Operates from a 9V alkaline battery



AVR Electronic Metronome Hardware Block Diagram



AVR Electronic Metronome Circuit Board Schematic Diagram

