What it is intended to be?

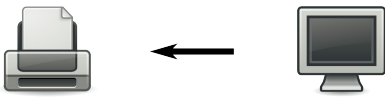
A Internet thermal grayscale printer which could function standalone or in form of a shield (Arduino compatible). What distinguishes it from other printers is the unusual technology used, and features that will be available:

- 4 inch wide thermal printer commonly used in financial and medical equipment.
- Fast Cortex-M4F microcontroller (120MHz) with Ethernet MAC & PHY built in.
- Additional 4 or 8 MB of RAM for image data buffering.
- Ethernet, USB and serial connectivity.
- Prints full scale images in 2 bit "color". Black, white and 2 shades of gray.
- Can work standalone continuously polling some external, configurable data stream which could be fed by the users from all over the Web.
- Simple Web interface app to feed the stream and the printer.
- Can work as a printer shield connected to a Arduino (via serial communication).
- Can work as a regular printer connected to the host computer (I plan to make it compatible with some Epson flavored printers).

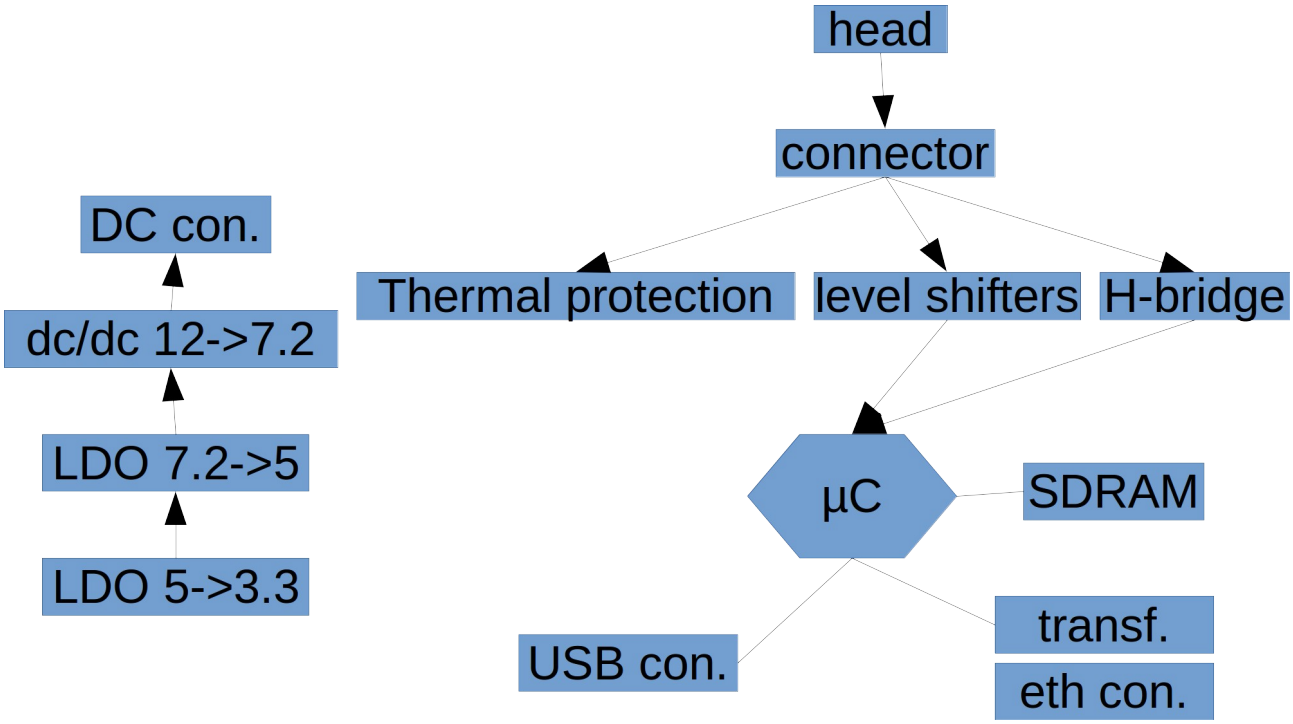
How the project meets the connected device requirement?

Among other types of local connectivity like serial, USB and home network connections, the device will have a unique (not that unique, but it sounds so marketing-cool) polling mechanism, which will continuously check some destination on the Internet for new data. This intermediate data stream would be then fed with data provided by the user in one way or another. For example users could make some form of web interface which would post the data to the stream, or some cron script which would copy some data (possibly a Twitter or Facebook messages) on regular basis. This idea could be depicted like this:

Furthermore local connection will be also available via serial, USB or local network connection:



Functional diagram



On the left you can see the power stuff. The printer will be powered from 12V power supply. 7.2V is for the head and the head's stepper motor. Next, 5V is for the head's logic, and finally 3.3V is for the Cortex.

On the top you can find the head which will be connected via flat cable to the board. Lower tier consists of motor controlling chip, the level shifters which convert 3.3V to 5V (µC speaks 3.3V, but head understands only 5V). Finally the thermal protection will be made using probably some voltage comparators. Overheating protection will be done both in hardware and software.

The hexagon represents the Cortex-M4F microcontroller with 8MB of additional RAM, serial, USB and Ethernet connectors.

Component list for stage 2 prototype

EK-TM4C123GXL	Tiva™ C Series LaunchPad Evaluation Kit	1
SII LTP-3445 thermal head	832 pixels wide, 203 dpi	1
TI CD40109b	CMOS Quad Low-To-High Voltage Level Shifter	2
DRV8835	DUAL LOW VOLTAGE H-BRIDGE IC – a Pololu breakout	1

Preliminary prototype

As for now I made a 2nd stage prototype on breadboard (photo included on my project page). For now communication with the host PC is USB only, and is two way i.e. printer sends back some debugging information to the user. After turning the device on, it immediately starts to print a test image which also can be found on my project page. This helped me to establish a working algorithm and test the idea.

Preprocessing of images is done on the host using ImageMagick command line tools.

Licenses

My firmware is available under terms of the GPL license, and uses the TivaWare library which is available either under TI TivaWare for C Series Source and Object Code Software License Agreement or so called BSD-3-Clause license. The code of TivaWare is open, and available on the Texas Instruments page : http://www.ti.com/tool/sw-tm4c