AYAB – All Yarns Are Beautiful

system design document

Last revised: 2014-8-13

Contents

1. Brief description

There are some similar projects on the interwebs, such as Knitic or, of course, ladyada's electro-knit.

The main drawback behind the existing projects is that they make use of the 930/40 series of the knitting machine - which are still pretty expensive. AYAB uses the older KH-910 model, which is cheaper than the other models, mainly because it features an error-prone scanner-mechanism for reading the image data (but we don't care because we won't use the scanner anyway...). The 930/940 series already use some kind of digital programming, which opens even more ways to hack them, other than what this project did.

Normally, the KH-910 is programmed using semi-transparent picture cards which are scanned by the machine line by line. Using this information, the machine sets the needles accordingly to achieve the knitting of the picture shown on the picture card. Probably due to memory restrictions, the machine only supports pictures of max. 60 needles (= pixel) width, although the machine has a total width of 200 needles. At least, it is possible to "copy and paste" the scanned image multiple times to achieve a

banner-like usage of the scanned data (useful for norwegian patterns).

With AYAB, you can just supply the knitting machine with an image from your computer. The restriction of 60 pixel image width has been abolished due to the improved control. You can just knit an image with up to 200 pixel width.

The control of the needles and needed identification of the current position and movement of the knitting carriage is substituted by a common Arduino microntroller, combined with a custom developed shield. You need to open one part of your knitting machine (warranty is void anyway...) and simply substitute the existing control board with the AYAB controller. Connect the Arduino with your computer and start knitting!

The API to the Arduino is designed in a straight forward way, so the control of the machine can be conducted by every piece of software which can access the serial port of your computer (or raspberry pi, or ...) The API consists only of three commands (request information about the controller firmware, request the start of a new picture, send line[x] to the controller when the controller requests it).

Due to the hardware constraints, it is possible to knit images with 1 bit color depth and a maximum width of 200 pixel. The height of the picture is only constrained by the amount of wool and power in your arms you have.

For test and demonstration purposes we provide two python scripts which enable you to check if the hardware (sensors, needle coils) works correctly and to knit images just from the terminal/commandline. But of course it is also possible to do some more sophisticated things like a GUI software with integrated image preprocessing.

2. Currently reached milestones

- Build hardware prototypes for 2 machine types (Brother KH-910 and KH-930)
- Prototype schematic and PCB layout published
- Published Test Software
- 2-color knitting fully functional
- 4-color knitting partly functional
- Created wiki and github repository

- Created instruction video
- Developed GUI-Software for Users with plugin-system
- Developed easy-to-use firmware update

3. Next steps and future goals

- Enhance GUI
- Create Plugins for more machine types
- Create Single-Board design
- Stabelize multicolor knitting

5. Bill of Materials

reichelt.de

ID	Amount	Order#	Description
LED1	1	SMD-LED 0805 RT	Power on LED
LED2	1	SMD-LED 0805 GE	Debug LED
LED3	1	SMD-LED 0805 GN	Debug LED
--	1	SUMMER 6V	Beeper
IC1,IC2	2	ULN 2803A	Driver module
IC3,IC4	2	PCF 8574 TI2C	Port Expander
R1,R2	2	SMD-0805 10K	I2C Pullups
R3,R4,R5	3	SMD-0805 150	LED Resistors
--	1	PSS 254/2G	Connector for beeper
JP6	1	PSK 254/2W	Connector for beeper
--	1	PSK-KONTAKTE	Contacts for beeper
--	2	GS 18	Socket for ULN2803A
--	1	SL 1X36G 2,54	Connectors for Arduino
S1	1	TASTER 9314	Reset button (optional)
JP2,JP3,JP4,JP5	1	SL 1X36G 2,54	Connectors for KH-910

rs-online.com (Connectors for KH-930)

ID	Amount	Order#	Description
J2,J7	2	687-8124	Molex 5267 Pin Header 2.5 mm 3 Pins
J8	1	687-8127	Molex 5267 Pin Header 2.5 mm 5 Pins
J3	1	720-6700	Molex 5267 Pin Header 2.5 mm 8 Pins
J4	1	720-6703	Molex 5267 Pin Header 2.5 mm 10 Pins

other

Amount	Description
1	Arduino UNO or MEGA
1	Brother knitting machine KH-910 or KH-930

6. Links to file repositories and useful resources

Homepage: http://www.ayab-apparat.com
wiki/repo: http://wiki.ayab-apparat.com
issues: http://issues.ayab-knitting.com

7. Notes regarding open-source licenses

The source code for this project is under a GNU GPL v3 license as mentioned in the files with the following information:
Copyright 2014 Christian Obersteiner, Andreas Müller

This program is free software: you can redistribute it and/or modify
it under the terms of the GNU General Public License version 3 as published by
the Free Software Foundation.

The Arduino libraries used are covered under their respective licenses as found on the Arduino site.