

A new type of Embedded Autolevelling Control system based on ARM microcontroller for Carding Machine

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Topics

1. Carding Machine & Auto leveller
2. IPC based Autoleveller (existing system)
3. ARM based Autoleveller (new system)
 - Hardware development
 - Software development



Carding Machine [1]



Carding Machine

- Carding machine converts cotton to sliver. Sliver is bundle of fibre that is used to spin yarn
- The rotating speed of rollers has great influence on quality of output yarn
- Bad control can lead to low strength, poor degree of evenness and bad quality yarn

Autoleveller

- It is a control system which detects change in thickness of output sliver
- It adjusts the rotating speed of feed roller & draft roller

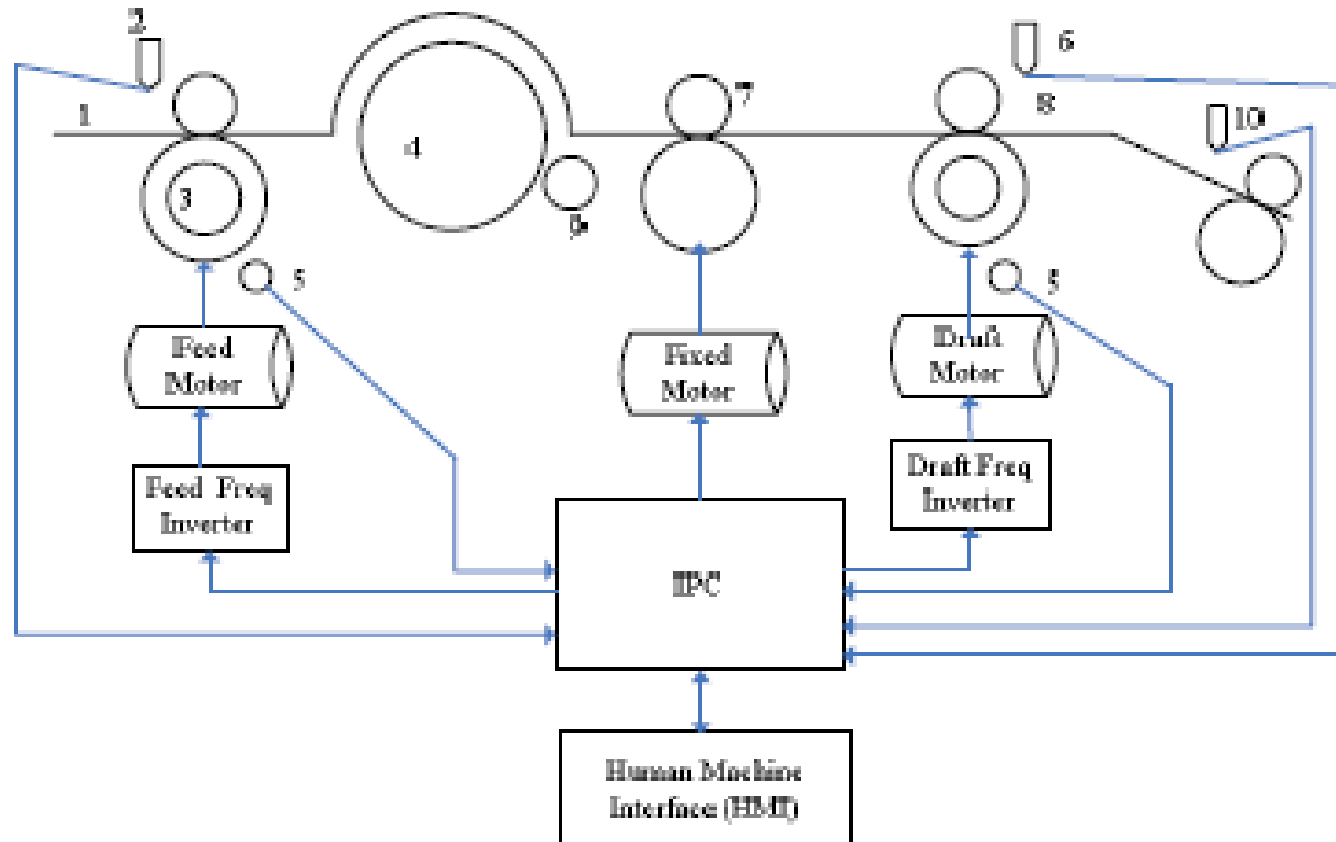


Fig 1 Structure Diagram of Carding Machine and Autolevelling Control System (1 Fed-in Layered Cotton; 2 Displacement Sensor; 3 Feed Roller; 4 Cylinder; 5 Proximity Switch; 6 Displacement Sensor ; 7 Fixed Roller; 8 Draft Roller; 9 Doff; 10 Photo-electricity Sensor)

Carding machine & Auto leveller

IPC based Autoleveller

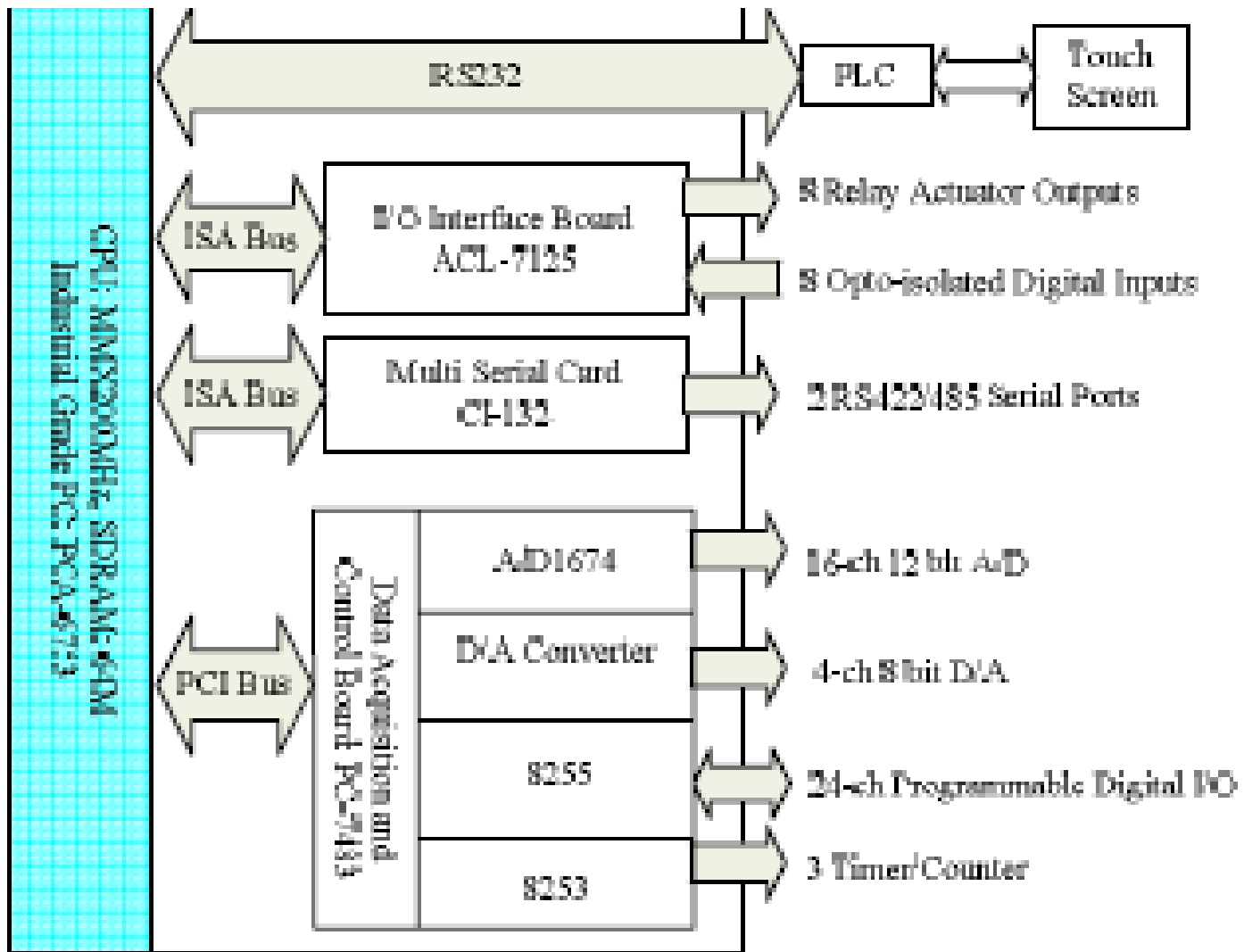
- IPC= Industrial-grade Personal Computer
- It is the prevalent form of implementing autoleveller

- System : IPC PCA 6753
- Interfaces :
 - 3-channel A/D converter
 - 2 counter inputs
 - 3 serial communication ports

System is divided on 3 interface boards :

- 1) Data acquisition Control board PC-7483
- 2) Digital I/O board ACL-7125
- 3) Multi serial card CI-132 (for RS-485 ports)

This system is connected to PLC via RS-232 . A touch screen is used for user commands



IPC based Autoleveller control system



ARM based Autoleveller embedded system

Need :

IPC based system is big, costly, power consuming & has poor flexibility

SoC : S3C44B0

Processor : 32-bit ARM7 TDMI

SoC peripherals

2MB Flash memory

8MB RAM

2 channel UART

8 channel 10-bit ADC

8 external interrupt sources

LCD controller

IIC bus controller

Watch dog timer

RTC

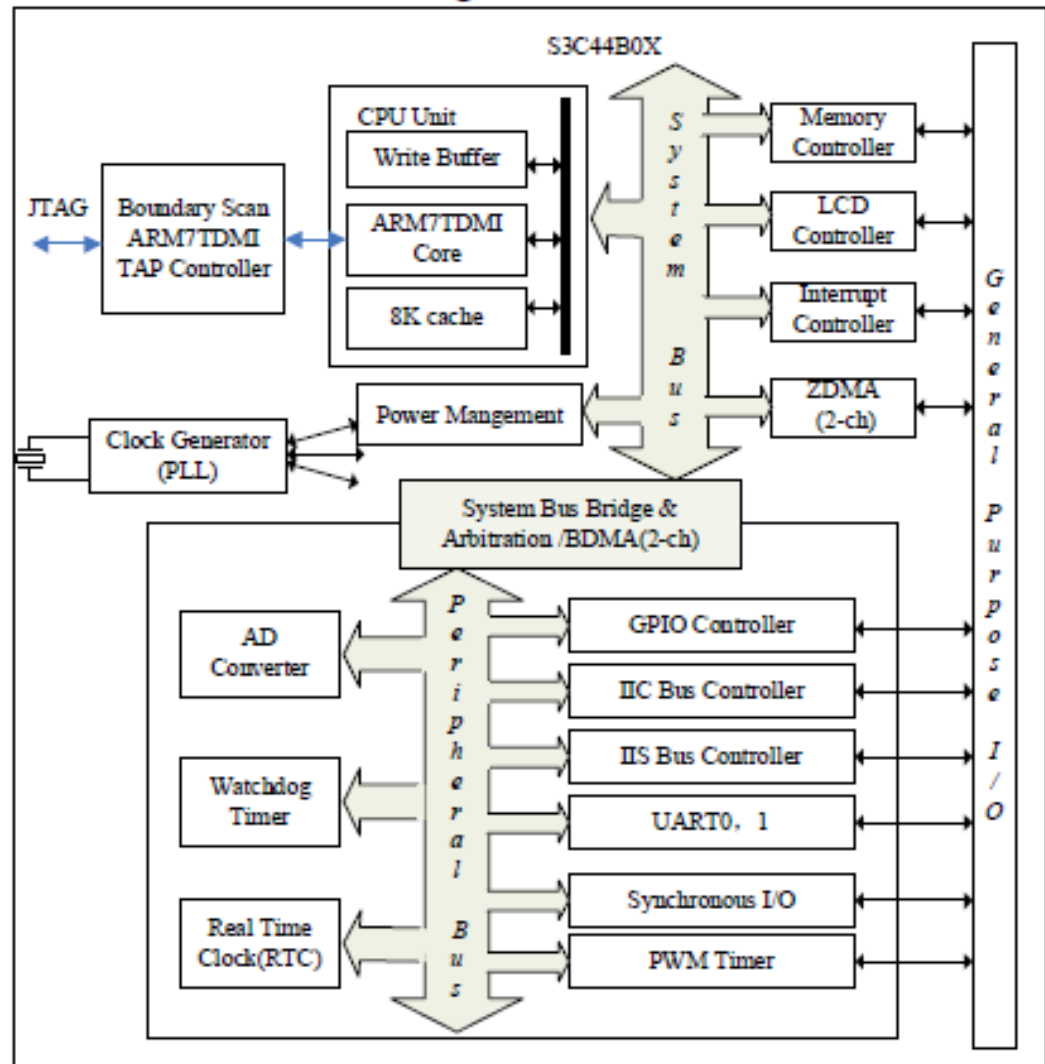


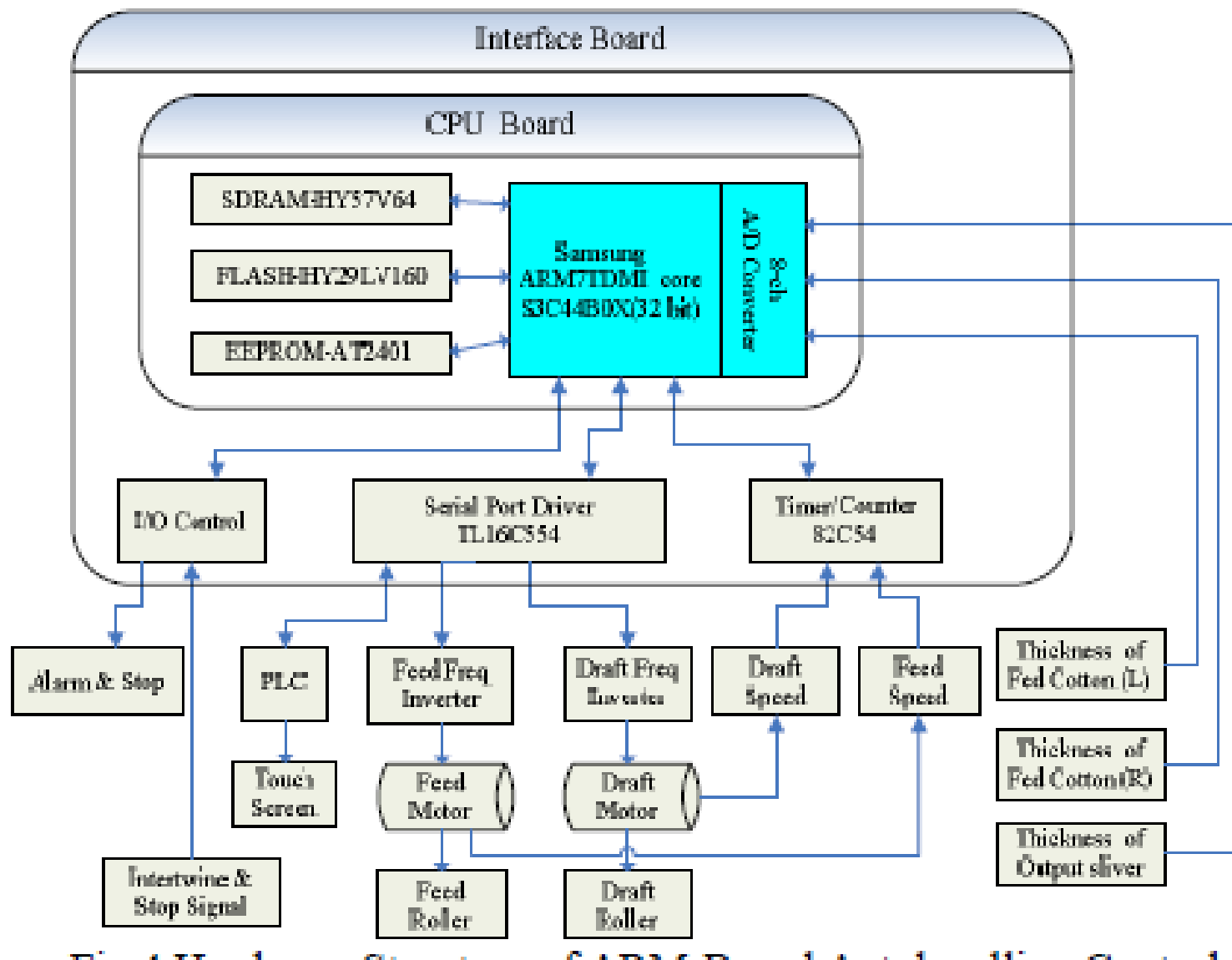
Fig 3 Internal Diagram of S3C44B0



ARM based Autoleveller embedded system

Interfaces to SoC :

1. Memory chips: for main memory, program memory, EEPROM for user information & other data.
2. Serial driver chip: contains 4 RS-485 ports
3. High speed counter : to calculate motor speeds
4. A/D converter: to interpret sensor data
5. I/O control: for general control signals



ARM based Autoleveller hardware



Software flowchart

1. Initialization

- On-chip peripherals : interrupts, general I/O, watchdog timer, etc
- External peripherals: RS-485 serial ports, frequency inverter, 8254 timers, PLC, touch screen

2. Data acquisition: cotton thickness, roller speed

3. Real-time control: adjusting roller speed

4. Performance display: parameters like cotton thickness, roller speed

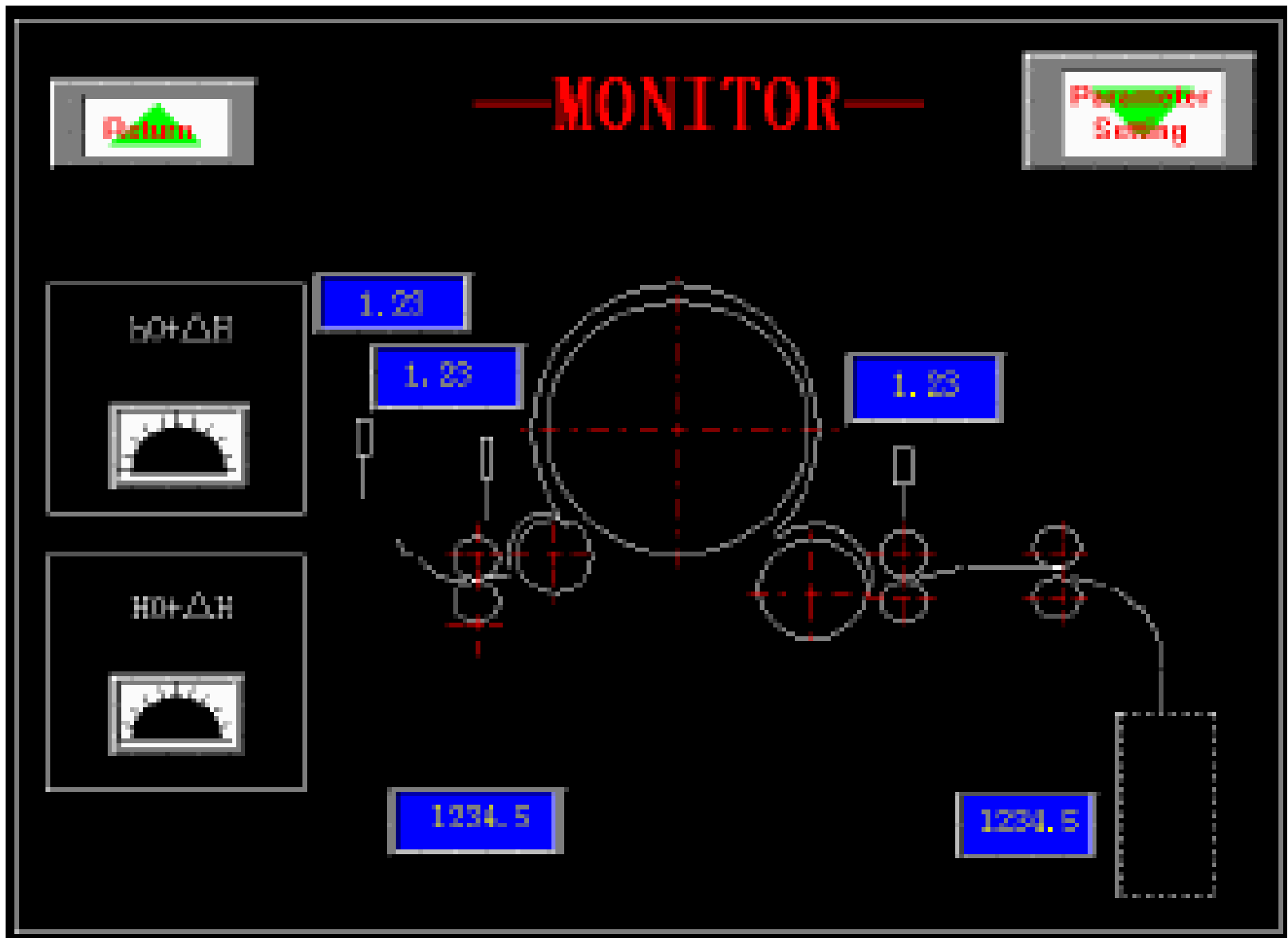


Fig 10 Monitor Page in Touch Screen

5. Data storage: storing important parameters in EEPORM

References

1. Old Mills (oldmills.scificincinnati.com)
2. IEEE Xplore