http://ansinet.com/itj

ITJ

ISSN 1812-5638

INFORMATION TECHNOLOGY JOURNAL

ANSInet
Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Information Technology Journal 12 (16): 3665-3669, 2013
ISSN 1812-5638 / DOI: 10.3923/itj.2013.3665.3669
© 2013 Asian Network for Scientific Information

A Study of Remote Monitoring of Wool Spinning

[1]Wang Huiran and [2]Ma Ruifang
[1]College of Computer Science, Xi'an Polytechnic University, 710048, Xi'an Shaanxi, China
[2]Software Engineering School, Xi'an Jiaotong University, 710049, Xi'an Shaanxi, China

Abstract: We construct architecture for monitoring of wool spinning. The architecture consists of monitoring centers, monitoring stations, WMIB (Monitoring Information Base for Wool Spinning), protocols and networks. We present the new concept of WMIB. WMIB takes a tree-like structure and its leaves store monitored data. We devise a proprietary network protocols, termed as WMP (Protocol for Monitoring of Wool Spinning). The message of WMP protocol consists of Access level, WMP PDU type and WMP PDU. WMP operates in four modes, i.e., monitor, monitor-next, set and trap.

Key words: Wool spinning, monitor, information model, protocol

INTRODUCTION

With increases of global competitions in textile industry, quality of yarns and fabrics become a crucial element to the success of a business (Wang, 2013). Engineers try to use computers and networks to monitor the process of textile industry. In this way, they get an accurate detect of product quality and furthermore can store monitored data into database for later analyses (Zhou, 2005). To meet the requirements of evaluations and controls of textile quality, online monitors are developed. Ma and Zhang (2006) have built a monitoring system to inspect looms over Network. Status of every loom is monitored, stored and analyzed. Monitors are connected together by CAN bus. Though a lot of work has been done in this filed, these work concentrated on developments of the application software for monitoring systems and not involved in the studies of the architecture and infrastructure of monitoring systems.

We have studied systematically the architecture and infrastructure of monitoring systems for wool spinning. We established an information base, referred to as WMIB (Monitoring Information Base for Wool Spinning) and devised a proprietary network protocol, termed as WMP (Protocol for Monitoring of Wool Spinning).

Our research is discussed in this study. The architecture of monitoring systems for wool spinning is put forward in section 2. WMIB is established in section 3. In section 4, we describe the proprietary network protocol for the monitoring system.

ARCHITECTURE OF THE MONITORING SYSTEMS

The physical structure of monitoring systems of Wool Spinning is depicted in Fig. 1. In a monitoring

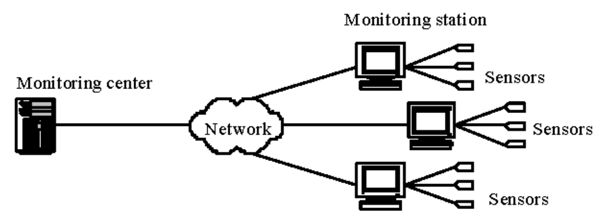

Fig. 1: Physical structure of monitoring systems

system, there are two kinds of computers. One kind of computers is referred to as monitoring centers. The other kind is termed as monitoring stations. Monitoring stations monitor the wool spinning process, for example, the machine status, the yarn quality. A monitoring station may be installed in, say, carding machine to monitor this machine's status. A monitoring station may also be used to monitor multiple machines. Varieties of measuring sensors are connected to a monitoring station. Sensors convert physical signals to electronic value. Monitoring stations digitalize this electronic value and transmit it to monitoring centers.

At monitoring centers, the measured data is stored, analyzed and processed. In a monitoring system, there is at least one monitoring center. The number and the distribution of the monitoring stations are dependent on the size of a woolen mill and on your requirements.

All of these computers involved in a monitoring system are connected together over network and communicate with each other on network protocols (Fig. 2). Network protocols ensure efficiency and security of communication of managed information. In the application layer, we devise a proprietary protocol, i.e., WMP (Protocol for Monitoring of Wool Spinning). WMP

Corresponding Author: Wang Huiran, College of Computer Science, Xi'an Polytechnic University, 710048, Xi'an Shaanxi, China

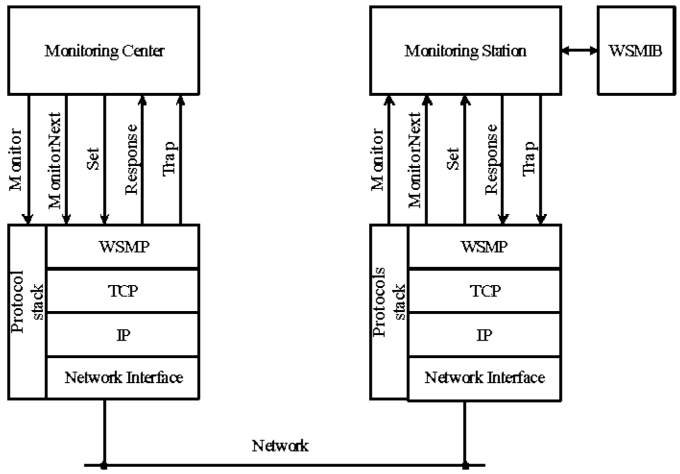

Fig. 2: Architecture of monitoring systems

defines the format and order of the messages exchanged between computers, as well as the actions taken on the transmission or receipt of a message. We take advantage of TCP/IP protocols in the underlying layers. Consequently, monitoring systems based on this protocol stack will work well on a variety of networks, either LAN or WAN, either wired or wireless.

In a monitoring system of wool spinning, the computers exchange a variety of information over network. We organize this information with WMIB (Monitoring Information Base of Wool Spinning). WMIB takes a tree-like shape.

MONITORING INFORMATION BASE FOR WOOL SPINNING

Managed objects: The basic unit of monitoring information is a monitored object. As seen in Fig. 3, a managed object has 6 attributes, i.e., a descriptor attribute, an identifier attribute, a syntax attribute, an access attribute, a status attribute and a definition attribute. The descriptor attribute is the textual name of a monitored object. The identifier attribute is self-explanatory and has to be unique in a whole WMIB of a monitoring station. It is of OBJECT IDENTIFIER data type. The syntax attribute specifies the data type and structure associated with this managed object. Table 1 lists several data types frequently used in monitoring systems. The access attribute specifies pattern the monitoring center access this monitored object. Its available values include read-only indicating that monitoring center may read this object only, read-write indicating that monitoring center may both read and write this object, not-accessible indicating that monitoring center can not access this object. The status attributes provides the current status of a monitored object. It has 3 optional values, i.e., mandatory, optional and obsolete. The mandatory status shoW that this object has to be implemented by the monitoring station. The optional status indicates that this object may be implemented optionally. The obsolete status means that this object has been replaced by other object. The definition attribute is a human-readable textual definition of the monitored object. We have to implement this monitored object exactly on this definition to keep its consistent semantics in different monitoring systems.

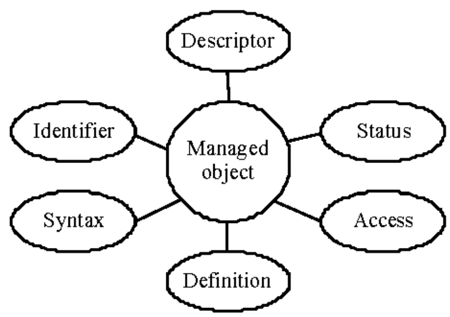

Fig. 3: Attributes of a monitored object

The monitoring information is described in ASN.1 (Abstract Syntax Notation version 1) and encoded using BER (Basic Encoding Rules). The BER specifies how instances of monitored objects are sent over the Internet. It adopts the so-called TLV (Type, Length, Value) approach.

Monitoring information base: The monitoring information base, abbreviated as WMIB, takes a tree-like shape

Table 1 Data types and their tags

Data type	Tag	Description
Integer	Universal 2	An arbitrary integer
Object identifier	Universal 6	A sequence of integer compnents that identify a monitored object
Real	Universal 9	An arbitrary real number
Sequence	Universal 16	An ordered collection of one or more types
Printabl string	Universal 19	An arbitrary string of printable characters
Generalized time	Universal 24	Time in generalized format

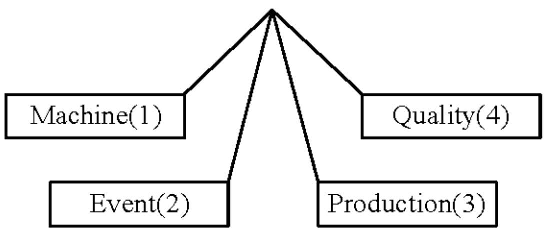

Fig. 4: Root and the branches at the first layer

(Fig. 4). It has one root, several branches and a lot of leaves. Each branch represents a group of monitored objects. Each leaf represents one monitored object. At the first layer of WMIB, there are four branches. (1) Branch machine: Stores information about the machine, say, carding engines, spinning frames, or looms that hosts this WMIB. The information includes the machine name, model, specification, manufacturer, manufacturing date and so on, (2) Branch event: Defines event arising in wool spinning and how to deal with it, (3) Branch Production: Store information about how this machine is configured, say, draft ratio, running time, running speed, productivity and total product and (4) Branch quality: Contains the quality information. It has three sub-branches, (4.1) Fiber quality, (4.2) Yarn quality and the (4.3) Fabric quality.

Examples of monitored objects: Under yarn quality branch (4.2), there is a sub-branch, i.e., weight unevenness (4.2.1). It contains another sub-branch, AverageWeight (4.2.1.2). This sub-branch stores information about average weight unevenness of wool yarn. Under it, there are two tables, (1) AvrWeightCtrlTable and (2) AvrWeightTable (2) (Fig. 5). The first table, AvrWeightCtrlTable, define the algorithm for calculation of the content of average weight unevenness. One leaf object, AvrWeightSmplNum, specifies the sample number for calculation of average value. The other leaf object, (1) AvrWeightCtrlIndex, is an index of this algorithm. We may define several types of average weight unevenness, say, hourly average, daily average, or monthly average.

The second table, (2) AvrWeightCtrlTable, contains various average values of weight unevenness. The leaf (2) AvrWeight stores average values. The other leaf, (1) AvrWeight, references the algorithm for calculation of the average values. It has the same meaning as

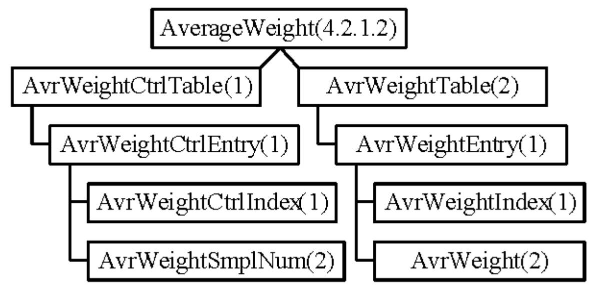

Fig. 5: Branch average weight

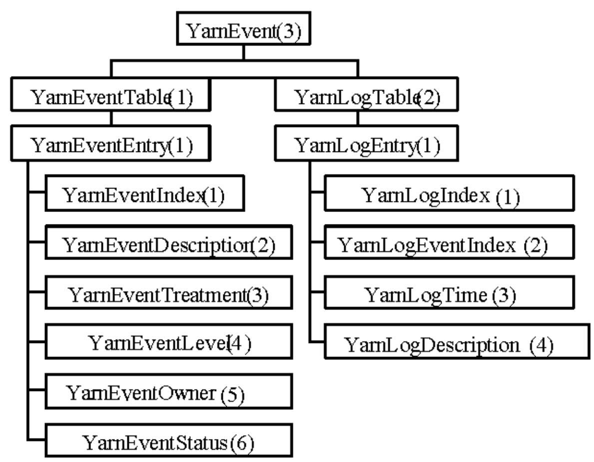

Fig. 6: Event branch

AvrWeight CtrlIndex(1) in table AvrWeightCtrlTable(1). As we see, there is a relationship between these 2 tables. One table specifies the algorithm and the other table stores the value of the content of average weight unevenness of wool yarn. Under branch Event (2) at the first layer, there is a sub-division, YarnEvent (3) (Fig. 6). This sub-division defines the event on the yarn quality; for example, the weight unevenness exceeds a given level. As illustrated in Fig. 6, we would find 2 tables under this branch. The first table, YarnEventTable (1), defines the types of events. The leaf object YarnEventTreatment (3) specifies how an event is treated. There are 2 kinds of treatment of events. One kind of treatment only keeps records of an occurred event under branch YarnLogTable (2). The second kind of treatment is known as "trap", in which the monitoring station sends information about an event to the monitoring center actively besides taking records of this event. The leaf object YarnEventLevel (4) specifies to which monitoring center the event information is sent when the trap treatment is taken, since there is more than one monitoring centers in one monitoring system sometimes.

The second table, YarnLogTable (2), takes records of information about events concerned with yarn quality. Under this table, we find 4 leaf objects. The leaf YarnLogEventIndex (2) means the same as the leaf YarnEventIndex (1) under YarnEventTable and indicates the type of events. Leaf YarnLogTime (3) records time when the corresponding event occurred. Leaf YarnLogDescription (4) provides information about the event in detail.

WOOL SPINNING MANAGEMENT PROTOCOL

Messages of WMP: The message of WMP protocol consists of Access level, WMP PDU type and WMP PDU (Fig. 7). Access level defines the priority for monitoring centers to access the WMIB in monitoring stations. WMP PDU stands for the protocol data unit of WMP protocols and contains data to be communicated between monitoring centers and monitoring stations. WMP PDU type specifies the types of this message. There are 5 types of WMP PDUs, i.e., MonitorRequest PDU, MonitorNextRequest PDU, SetRequest PDU, Response PDU and Trap PDU.

The first 4 types of WMP PDUs are known as the basic PDUs. As shown in Fig. 7b, the basic PDU is composed of Monitor-id, Monitor Status and Object-bindings. Monitor-id identifies uniquely every monitoring request. Monitor Status is designed for Response PDUs and provides information about how monitoring stations deals with monitoring request messages. Optional values for Monitor Status are noSuchObject, tooBig, badValue, etc. The noSuchObjec status indicates there is no the monitored object requested by a monitoring center in the WMIB. The tooBig status means that too many objects are requested in one message. The badValue status indicates that a monitoring center attempts to set an invalid value to a monitored object. In object-bindings part of WMP message, there are object-ids and object-values in pairs. The object-ids specify the monitored objects to be accessed by a monitoring center. The object-values provide values to be sent to a monitoring center, or to be written to monitored objects in a monitoring agent.

Access Level	WMP PDU Type	ARMT PDU

(a) WMP Message

Monitor-id	Monitor Status	Object-bindings

(b) Basic PDU

Station-name	Trap-type	Time-stamp	Object-bindings

(c)Trap PDU

Fig. 7(a-c): Message format for WMP protocols

Monitoring stations send Trap PDUs to monitoring centers as an alarm in case an emergency event arises. As depicted in Fig. 7c, the Trap PDU consists of 4 components. Station-name indicates the station that issues the Trap PDU. Time-stamp indicates the time when the Trap PDU is issued. Trap-type specifies the type of this Trap PDU. For Trap-type, are there several optional values, e.g. stationstart value (indicating that this monitoring agent is restarted), authentitionFailure value (indicating that the monitoring center fails to be authenticated), alarm value (indicating that woll quality exceed some thresholds) and so on. Object-binding in the Trap PDU provides details about this trap.

Operations of WMP: As illustrated in Fig. 2, WMP operates in 4 modes that is, Monitor, Monitor-next, Set and Trap.

In Monitor mode, a monitoring center first send a Monitor-Request PDU to monitoring stations and specify a monitored object to be measured by object-id in object-bindings of this PDU. After receiving this PDU, the monitoring stations search for values of the requested objects in the local WMIB and fill these found values into the object-bindings. Finally, the monitoring stations send the PDU with requested values back to the monitoring center that has issued the monitor-request command.

The Set mode is designed for a monitoring center to write values to monitored objects in a monitoring station. In this way, monitoring centers can configure monitoring stations remotely. A monitoring center may write a value to, for example, YarnSampleInterval (1) To change the sampling interval for measurement of yarn content. After Set operation, the monitoring station will return to the monitoring center a response PDU with the same value in the object-bindings and with status information indicating whether the Set operation is successful in addition.

It should be noted that the monitoring station, instead of the monitoring center, is active in the Trap operation. The monitoring station initiates a communication session with a monitoring center when any emergency occurs, for example that an instrument is out of order, or the daily mean of yarn exceeds the threshold. In this case, the monitoring station issues a Trap PDU with related information about the emergency in it. The Access-level part of the trap PDU specifies the priority required for monitoring centers to access this PDU.

CONCLUSION

We construct architecture for monitoring of wool spinning. The architecture consists of monitoring centers, monitoring stations, WMIB (Monitoring Information Base for Wool Spinning), protocols and Networks. The basic unit of monitoring information is a monitored object. A managed object has 6 attributes. WMIB takes a tree-like structure and its leaves store monitored data. We devise a proprietary network protocols, termed as WMP (Protocol for Monitoring of Wool Spinning). The message of WMP protocol consists of Access level, WMP PDU type and WMP PDU. WMP operates in four modes, i.e. monitor, monitor-next, set and trap.

REFERENCES

Ma, X.H. and X.A. Zhang, 2006. Monitoring of loom JZW- over network. Textiles Shaanxi, 1: 47-48.

Wang, J., 2013. Current status and development trend of quality inspection technique of ring spun yarns. J. Textile Res., 34: 131-136.

Zhou, F.L., 2005. Mechtronics in textile machines. China Textile, 3: 154-156.