Handheld Mobile Devices for Remote Monitoring of Factory

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Abstract

In this paper, a handheld mobile device system is presented for remote monitoring of the factory to short the downtime of machines and recovery more quickly. The human–computer interaction of the system is developed by GP-Por EX, and operates by using commercial or free distal APP combining with sign-in-website of the company. The way for the program connected can be connected with multi-way links, such as long-distance link (3G/4G or Wi-Fi wireless INTERNET), medium distance (LAN) and short distance (ETHERNET) and can be chosen in the company portal page. With supplemented Internet browser program for remote monitoring, the distal end operator or the person in charge can confirm the machine condition through the distal end of the server, port, user name and password settings. Therefore, the operational efficiency and system transparency can be improved with the handheld mobile devices for remote monitoring system.

Keywords: Human Machine Interface, Remote monitoring, GP-Por EX, GP-Viewer EX.

1. Introduction

Human Machine Interface, often used with touch panel, is a control equipment connecting with human and machines. Because of within CPU, memories and connect interface units, it can connect to other hardware, such as PLC, PID controller and servo controller, so that theirs information can be shown on the screens for the operators to understand the state of machines. Developed by different companies and different purposes, HMI may have different functions.

In early stage, the aim of developing HMI is only for simplifying the control interface, reducing the risk of design, and increasing the modification of electrical panel design. As technology advances, HMI now is not the button-only panel, but with logic control,

Multi-machine interconnected communication. Therefore, due to its versatility, wide adaptation, high reliability and other advantage, HMI has widely used in the automated machine equipment control to propose high quality automated machine service.

The inner workings of monitoring and abnormal maintenance both need engineering staff to maintenance in site in the past, which is time-consuming and effortless. If we can use the network function, and with the internet and wireless network, the dream of remote monitoring may become true [1-2]. For our case as example, due to the technology limit for the early construction of the

factory, only few machines can be connected to internet. However, thanking for the continuous evolution of network technology, now we can use the free APP with handheld devices to connect to the program of company entrance, build the HMI by GP-Por EX software for coordination, so that all the automation equipment have the abilities of remote monitoring.

The different HMIs are used in different location. 3G/4G and Wi-Fi is for where is far away from factory. Therefore, if the data of company entry, such as server IP, port, user name and password are known and already preset, then we can achieve remote monitoring to get the information about the states of automation equipment in the factory.

This paper is organized as follows. The methodology is proposed in Section 2. Section 3 presents experiment results. Finally, some conclusions are summarized in Section 4.

2. The Main Text

2.1. *HMI Monitoring program*

Our HMI program is developed by GP-Por EX software, and import the network components form the communication software named GP-Viewer EX. With connecting to the server of factory, GP-Viewer EX will read the HMI after running, and check this link is Connect or not. If the link is correct, all the state of automation equipment will be shown on the screen by switching the screen. However, if the link is not correct, this program will try to do malfunction reset to recover its production. The screen of monitor program is shown in fig. 2.

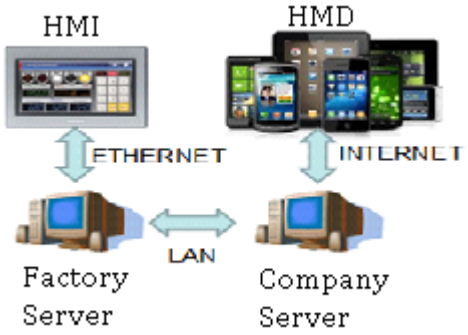


Fig. 1. The diagram of communication equipment

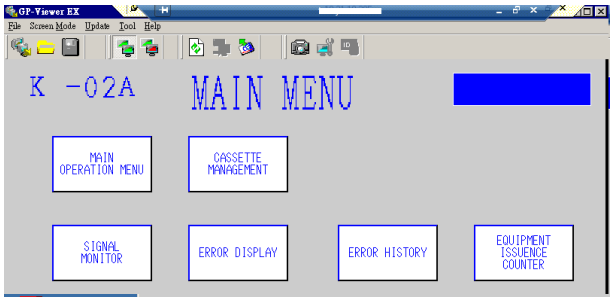
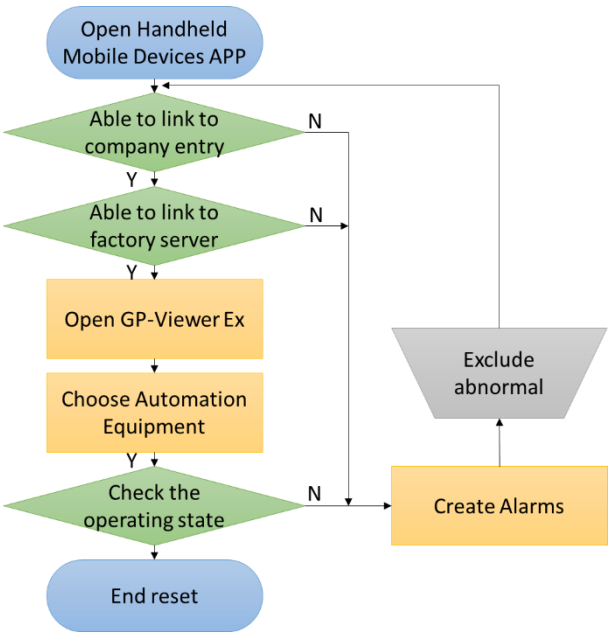


Fig. 2. The main window of monitoring program

2.2. *Automation equipment malfunction reset*

To describe reset process in detail, we propose the diagram of malfunction reset in fig. 3.



malfunction reset

Fig. 3. The diagram of abnormal reset

2.3. *The choosing of monitoring HMI*

Porface company has developed many HMI. With different developing targets, theirs types are also different, and the connecting ways need to be used are different, too. Therefore, it is necessary to choose the types of HMI at the program beginning, so that this program can make correct choice for different type. For our monitoring program, it can work for the series of GT3000 and series of GT4000.

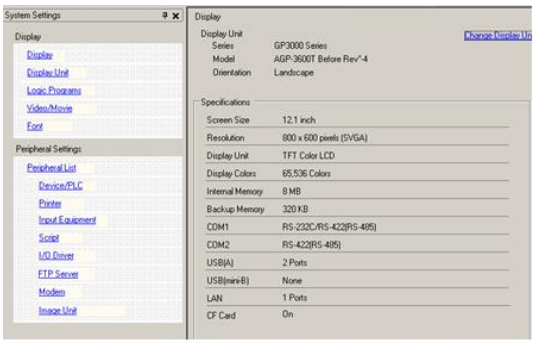


Fig. 4. The illustration of system setting

2.4. *The handheld mobile devices and the communication interface*

The handheld mobile devices APP requests the connecting data, including server IP, port, user name and password, shown in fig. 5. The select settings of communication interface of HMI against the ETHERTER internet is shown in fig. 6. With the correct setting IP, network number and station number shown in fig. 7, and all correct data in fig. 5 and fig. 6. The connecting between GP-Viewer EX program and HMI could be successfully.

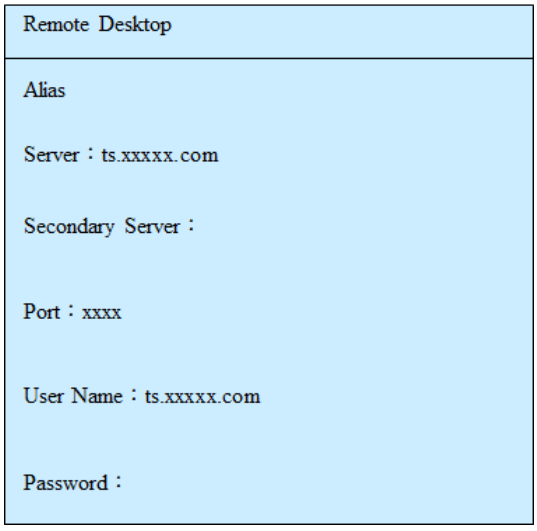


Fig. 5. The communication preferences page of handheld mobile devices

2.5. *The connect between monitor APP and HMI*

In the handheld mobile devices monitor APP, the interface connecting to HMI needs through the company entry and the network of factory. Finally, the interface uses the communication software to connect the functions proposed from GP-Viewer EX, so that all the states of automation equipment appear in the software window at handheld mobile devices shown in fig. 8, or at PC shown in fig. 9. If the link is successful, it will return a running normally message and able to observe all the states of automation equipment. Otherwise, it will stop the foregoing actions.

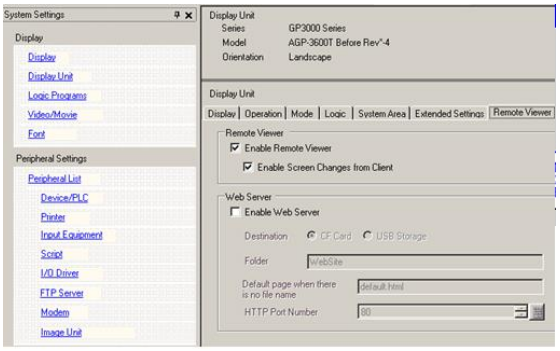


Fig. 6. The communication preferences page of HMI

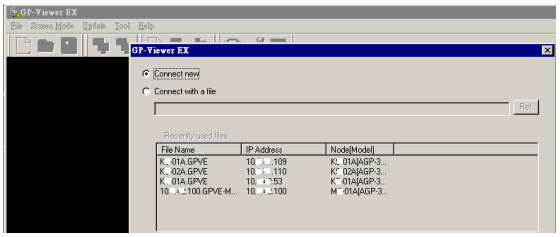


Fig. 7. The communication page of GP-Viewer EX

Fig. 8. The monitor program at handheld mobile devices

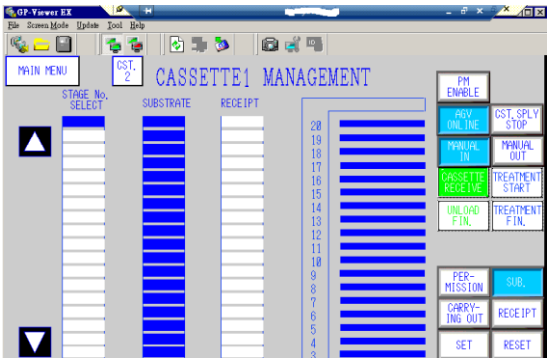


Fig. 9. The monitor program at PC

2.6. *Exception Handling by HMI*

When the online staff or equipment engineer find there are some errors which can't be solved, and the major engineer is also not in the factory at the same time, then he/she will start the remote monitoring program from his/her handheld mobile devices, and get the alarm by the HMI screen. With this information, the major engineer can try to analysis which parts are going wrong and do abnormal reset, so that the production equipment can recover to the normal state as soon as possible.

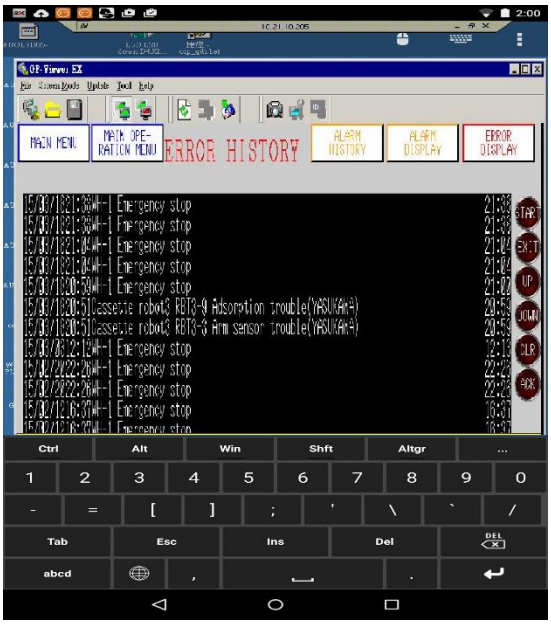


Fig. 10. The monitor program when get alarms

3. Experiment Results

In our research, we use the tablet Nexus II with 2X RDP APP as our handheld mobile devices for remote monitoring. In the local part, we use the server PC with GP-Viewer EX software to get the information of HMI through intranet. This server PC also connects to the entry of company. The handheld mobile devices are more popularize now, and the bandwidth of mobile network is larger and larger, so the location can be for grasping the operating of factory is not limited at established place. We test the time cost of start-up with different connection ways, including Wi-Fi, 3G and 4G. The result is given in Table 1, and can learn that the time cost will be shorter with larger download speed.

Table 1. The cost time with different connection mode.

Mode	Update	Download	Cost time
3G	1.12 Mb/s	9.15Mb/s	120s
4G	17.86Mb/s	21.23Mb/s	96s
Wi-Fi	2.78Mb/s	25.18Mb/s	90s

4. Conclusion

In this paper, we develop a handheld mobile device program using mobile internet through the entrance of company to the HMI of automated production equipment for remote monitoring. In the beginning, because of the firewall of server PC, we need to find some method, such as VNC, to connect the server PC. However, it will cause significant delays and only with the monitor screen and unable to fulfil the requirements of remote monitoring. Therefore, we change our research to replace the HMI of equipment with independent development of connection systems to accomplish mission.

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