

Mobile Environment for Industrial Automation

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Abstract— from the last two decades many automated machines are introduced which will not only reduce manpower, also it produces high quantity. Even though automation takes place, the user presence becomes mandatory to monitor the environment in control room. To evade this situation we have designed a project with a fine combination of android and embedded system. The main objective of industrial automation is security and is to reduce the user efforts to save money, energy and time. It is also used to help handicapped and old aged people who will enable them to control machine parameters automatically and alert them in critical situations. This paper put forward the design of industrial automation and security system using cortex m3 board and General Packet Radio Service (GPRS) module with android mobile. Here everything will be done by automatic. Also user can monitor machine parameters anywhere at any time in his mobile through GPRS. If he/she notices any changes he can make a call to control machine parameters manually.

Keywords: - CORTEX M3 Board, GPRS, Android Mobile.

I. INTRODUCTION

Now a day's so many technologies are coming out to make our life style more comfortable, luxurious and secure. Today we are living in 21st century where automation is playing an important role in human life. In our project we are mainly concentrates on user comfort and security. Here the controller is used to collect the process control parameters with the help of sensors and these results will be sent to mobile phone through GPRS module. When user opens webpage he can monitor the live updates of entire process of whole plant. So user presence is not necessary at all times nearby monitoring process control stations. Previously many technologies have been used in industrial automation like RF, ZIGBEE, and Bluetooth.etc with limited parameters. The limitations of all these technologies are, the user can only monitor the machine parameters within the short range. With advanced technology we have used GPRS module so that the user can monitor the process from anywhere. Hence an effective system has to be developed for avoidance of difficulties to user in monitoring the process.

The proposed system is implemented on powerful microcontroller CORTEX M3-android platform which is more useful to extend for future applications. The main objective of industrial automation is to control all the

machine parameters automatically, also to monitor the machine parameters in user mobile phone at anywhere at any time to check whether everything will be in normal condition or not. If user notices any abnormal changes he can take immediate actions by conveying his message to the person who is in industrial plant. This process will make the user to prevent the risks in large industrial plants.

II. METHODOLOGY

In this project we have used two main technologies.

- GPRS
- MEMS Accelerometer

A. General Packet Radio Service (GPRS)

GPRS is mainly used for wireless communication in industrial automation with the help of GPRS we can monitor the parameters from long distances. GPRS is a packet based wireless communication service that promises data rates from 56kbps to 114 kbps and continuous connection to the internet for mobile phone. It is an upgrade over the basic feature of GSM. It is the most widely used technology in the world for mobile communication. GPRS providing a move from circuit switched technology to packet switched technology. The GPRS network architecture added new elements including the Gateway GPRS Supporting Node (GGSN) and Serving GPRS Supporting Node (SGSN) to existing GSM network to be able to accommodate this.

The main reasons for choosing GPRS is

- It is more effective for long data packet transmission than short ones.
- Multi-slots operation in GPRS leads to efficient channel utilization.
- Available resources shared by active users
- Standard data network based on IP applications
- High capacity internet access
- Quick access to internet
- Low cost via volume based billing.

Hence to monitor the machine parameters GPRS is the best technology for communication

B. MEMS Accelerometer

In this project we have used accelerometer under Micro Electro Mechanical System (MEMS) technology. In industrial automation accelerometers are mainly used for machinery health monitoring. MEMS or micro electro

mechanical system is a technique of combining electrical and mechanical components together on a chip to produce a system of miniature dimensions. It is the integration of a number of micro components on a single chip which allows the micro-system to both sense and control the environment. To report the vibration in machines and also its changes in time shafts at the bearing of rotating equipment such as turbines, pumps, fans, rollers and bearing faults, which if not attended promptly can lead to costly repair. This accelerometer vibration data allows the user to monitor machines and detect these faults before rotating equipment fails completely. Hence MEMS promises to be an effective technique of producing sensors with high quality at low cost.

III. BLOCK DIAGRAM OF THE SYSTEM

The project here is divided into two sectional units.

- Data storage section
- Mobile for monitoring and controlling

In the industrial automation there is an android mobile which is maintained with front end application also as database as per project requirement. The communication between the controller and android mobile can be done using GPRS module which is wireless. All the sensor information is displayed on web page which we can open with URL address. Here we created a webpage for monitoring and to control all the parameters from anywhere at any time through GPRS. If the sensor parameters like temperature, humidity, fire and water level values exceeds particular value then user can take action by operating the required device. With all these accelerometer has been used which is based on Micro Electro Mechanical System (MEMS) technology. In industrial automation it is very helpful to detect machinery faults. So the user can prevent total damages of machines by checking with minor changes.

The main board of automation section as shown in figure 1. As shown in figure 1 all the sensor values will be displayed on the mobile through GPRS from the controller through web page in data acquisition unit. Here everything will be done by automatic mode. All the parameters are controlled by automatic. For every parameter we are fixing particular value according to environment. When the value exceeds particular value then it takes action by selecting the device on to control the parameter. All these can be done by sending and receiving commands through GPRS from the controller to mobile and vice versa.

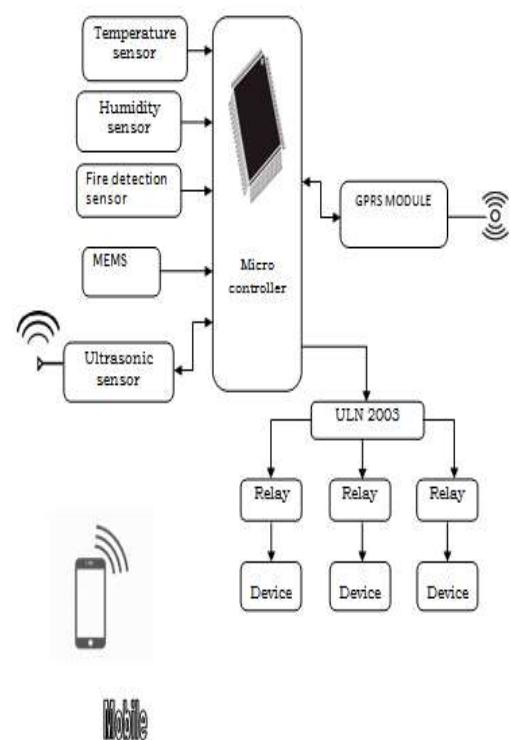


Figure 1. Block diagram of hardware

IV. HARDWARE IMPLEMENTATION

The controller LPC1768 has special and unique features which are used for industrial automation. The main features of arm cortex M3 processor are:

- It is Harvard bus architecture and it is a three stage pipeline with branch speculation.
- Configured nested vectored interrupt controller (NVIC).
- Wake up interrupt controller. It enables ultra low power stand by operation.
- Optional components for specific market requirements.
- Support for fault robust implementation via configured observation interface.
- Physical IP support.
- Greater performance efficiency with enhanced determinism.
- Wide choice of development tools with low cost solutions

A. SENSORS

In our project different sensors are used to monitor different parameters. LM35 series are precision integrated circuit temperature devices with an output voltage linearly proportional to centigrade and calibrated in Kelvin. It does not require any external calibration or trimming to provide typical accuracies with stability and reliability. This sensor has resistive type humidity measurement component.

Hence it is preferably used in most laboratories and industrial process to measure both temperature and humidity.

To measure liquid levels we have used HC-SR04 ultrasonic sensor which provides 2cm-400cm non contact measurement functions. The ultrasonic works on a principle which is similar to radar or sonar which evaluate attributes of a target by interpreting the echoes from radio or sound waves respectively.

MQ5 gas/smoke sensor can be used to detect combustible, flammable and toxic gasses. It makes an alert when it detects leakage of dangerous gasses in industries.

B. GPRS MODULE



Figure 2. GPRS MODULE

General Packet Radio Service (GPRS) modem is built with dual band sim900A works on frequencies 900/1800 MHz, the modem is coming with RS232 interface, which allows us to connect pc as well as microcontroller. The baud rate is configurable from 9600-115200 through AT commands and it has internal TCP/IP stack to enable you to connect with internet via GPRS. It is most suitable for data transfer application in Mobile to mobile interface. Hence GPRS is used to monitor the parameters in industrial automation.

V. RESULTS

Figure 3 shows entire hardware of the system which includes microcontroller, sensors, GPRS module and required devices. There are two sections in the system: One is at industrial monitoring board and the second section is mobile. All the parameter values are displayed on the monitoring board and these Values are updated in the webpage. By selecting automatic mode everything will be done by automatic. The parameters temperature, humidity, fire all these sensor values exceeds particular limit immediately the controller takes action by selecting particular device on .ultrasonic sensor is used to control water level depends on tank status the controller makes motor on/off. Accelerometer is another parameter which is used to detect machinery faults. The following figure

shows data acquisition unit in mobile phone. Hence the user can monitor all the parameters from anywhere in his mobile phone.



Figure 3. Complete Hardware of the Project



Figure 4. Data Acquisition Unit in Mobile Phone

VI. CONCLUSION

The industrial automation system has been experimentally proven to work satisfactorily by connecting sample appliances to it and the appliances were successfully controlled automatically. By the GPRS the user can successfully monitor the environment of total industrial plant from long distances. Thus proving portability and

wide compatibility, this proposed system will not only provide convenience to the common man but will be a boon for the elderly and disabled.

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