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SENDING SMS OR CALL WITH PIC MICROCONTROLLER

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Abstract. Reading and recording values of several physical quantities such as temperature, humidity and pressure and sending SMS or call to the user at unwanted values of these quantities prevent financial losses and losses of life occurring in several industrial companies. For instance, stable or mobile cold storages, laboratories, data processing rooms, nuclear power plants, electric motors, car engines, industrial boilers and furnace, health and food sector, libraries and museums are the places that should be managed by monitoring and controlling temperature values. Accordingly, a PIC microcontroller-controlled measuring, recording and early warning system is developed in this study. Warning is sent by GPRS modem. When unwanted measurement value is occurred, PIC microcontroller gives the appropriate logic signal that activates modem. Recording operation can be done at 12 bit resolution with intended time period. However, recording capacity is limited by PIC's EEPROM. If required, recording capacity can be increased with AT24C512 EEPROM. In this paper, developed system's set up and operation are discussed in detail.

1. Introduction

Data communication for the purpose of measuring and controlling over long distances can be done via landlines, internet or mobile networks. Mobil measurement device that is placed at a measuring point can be controlled with the GSM network. In addition, mobile measurement device can send measurement information to the user or send SMS when unwanted measurement values are taken via a GPRS modem connected to the measurement device [1-3]. In recent years, monitoring of the parameters of the localized heating system [1], control of remote data collection and transmission system [2-4], data acquisition and monitoring systems for water supply pipe network [5], automatic

monitoring system for water quality control [6-8], management and control of traffic [9,10], operation of mine monitoring and control system [11],control of wireless image transmission system [12], radon monitoring system control [13], wireless home security systems control [14], control of fire alarm systems [15], tornado detection and warning system control [16], control of geologic hazard warning system [17-20] are the studies that used mobile phone or GPRS modem. In this study, a PIC microcontroller-controlled measuring, recording and early warning system is developed.

At this system the warning is provided through GPRS modem. When unwanted measurement value is occurred, PIC microcontroller gives the appropriate logic signal that activates modem. Also, necessary calculations for the measurement are being performed by PIC microcontroller. AT (Attention Telephone) commands that are developed as standard for modem and mobile phones are used for communication of PIC microcontroller with GPRS modem. "AT commands" is one of the standards that is developed for mobile phones by ETSI (European Telecommunication Institute). Recording operation can be done at 12 bit resolution to PIC's EEPROM with intended time period. If PIC's EEPROM memory is not enough for recording, it will be done to AT24C512 EEPROM. If the necessary sensor is determined and changed, this system can be used in several areas such as security systems at home and offices, device control, industry, getting information about machine situation, temperature and humidity control, agriculture, getting information about weather condition, obtaining information about the status of the silos, controlling of irrigation systems, patient monitoring at health sector. In this paper, the developed system's set-up and operation are discussed for controlling temperature and humidity.

2. Material and Method

Within the scope of this study, firstly the measurement system that controls temperature and humidity is developed. SHT11 is used as temperature and humidity sensor. SHT11 includes a 14 bit analog digital converter and a serial communication unit. The result of detection is transmitted to the microcontroller as digital data with two cables from serial port. Temperature value is transmitted at 14 bit resolution and relative humidity value is transmitted at 12 bit resolution to the microcontroller. Temperature measurement with error of ± 0.5 °C and relative humidity measurement with error of ± % 3.5 can be done between -40 °C and +128 °C. In this study, measurement, record and early warning system, which is developed within the scope of temperature and humidity control, consists of two main parts; measurement and decision unit and sending call or SMS unit. Measurement and decision unit stops working of an external electronic device such as a refrigerator if the value of temperature is out of selected temperature values. Sending SMS or call unit sends SMS or call to the user if the ambient temperature reaches unwanted values such as long-term power cuts.

Circuit diagram of measurement and decision unit developed in the scope of this study is given at Figure 1.

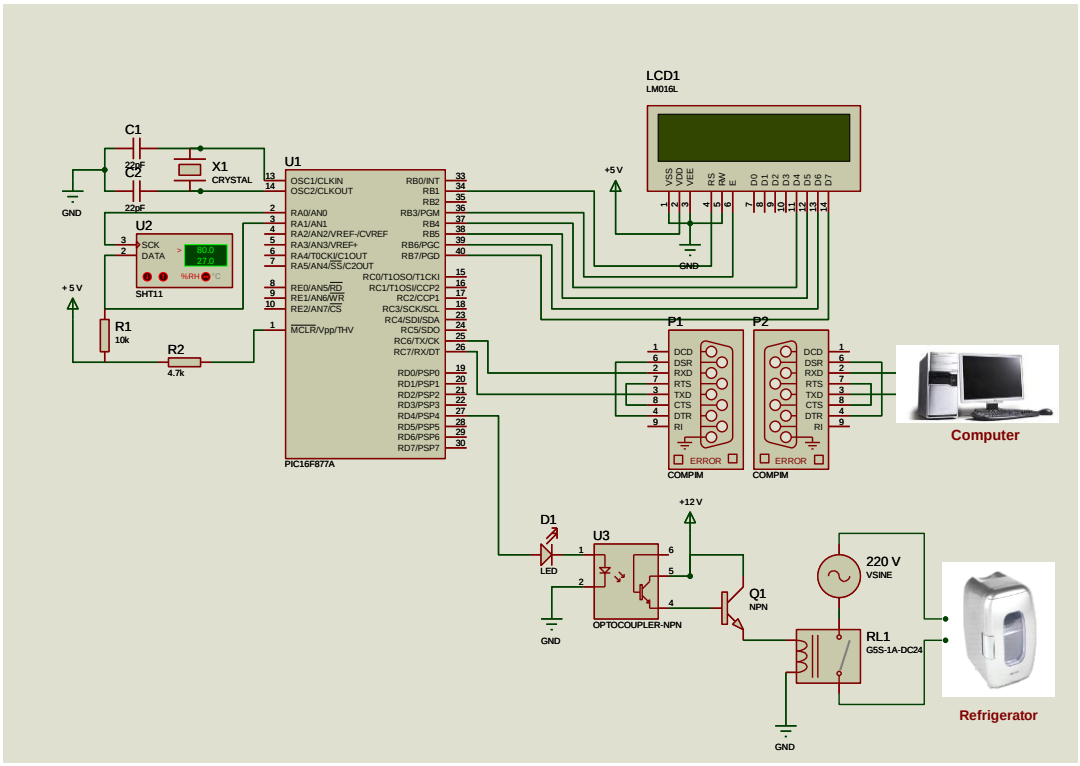

Fig.1. Circuit diagram of measurement and decision unit

As it is seen in Figure 1, measurement and decision unit gives appropriate triggers to get digital output from SHT11 temperature and humidity sensor and after that, the unit gets digital data output of SHT11. In addition, this unit processes digital data, converts it to the temperature-humidity value and records values into the EEPROM. Subsequently, the unit converts data to 8 bit that can read at LCD and can get from PC's serial port. Also, out of the boundaries of temperature and humidity that will be determined by the user, the unit converts microcontroller's D4 pin to logic 1, then optoisolator is triggered and magnetic relay is closed so that energy input is provided to the device controlled. It does not matter which type of device is controlled. Because, the magnetic relay that controls energy input resists to 7A alternative current at 220 V. Almost all devices that we use in our daily life does not work with such a high current. Software of microcontroller situated in developed measurement and decision unit is written with PIC Basic Pro programming language. D3 pin changes from logic 1 to logic 0, if the ambient temperature is over the temperature value that is determined by user at the software, so SMS or call sending unit is activated.

Circuit diagram of SMS or call sending unit developed in this study is given at Figure 2.

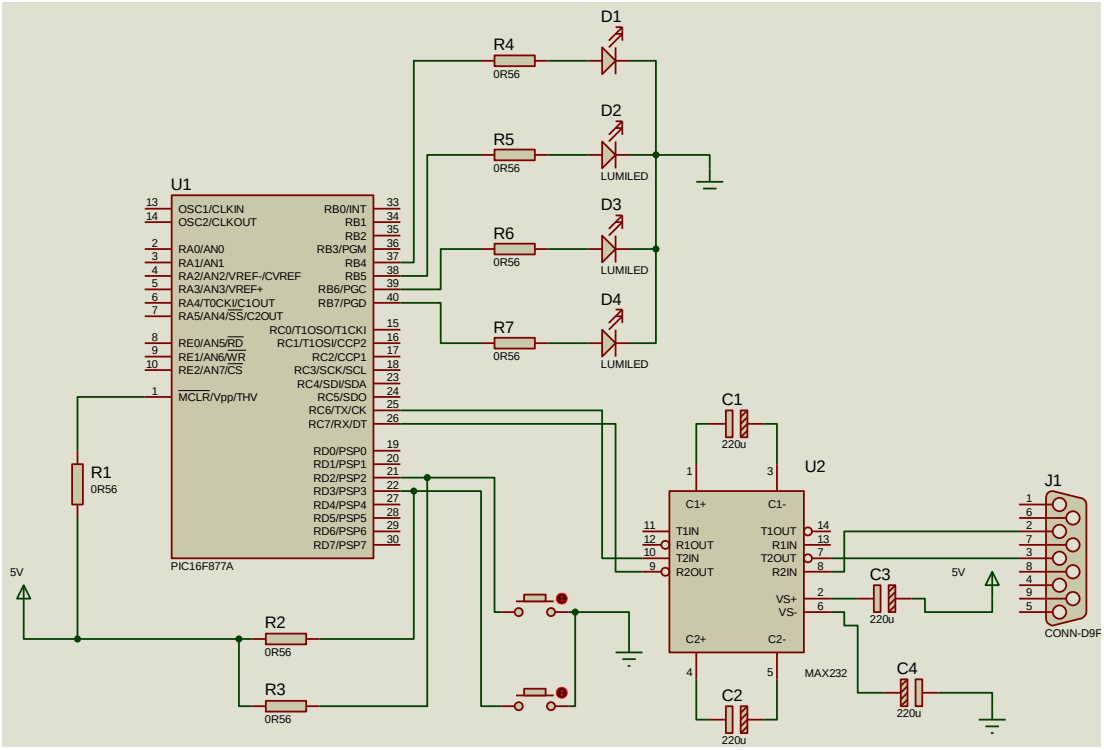

Fig.2. Circuit diagram of SMS or call sending unit

As it is seen in Figure 2, this unit is triggered with logic 0 signal that comes from measurement and decision unit or user button to PIC microcontroller's D1 pin. If PIC's D2 pin is triggered, SMS sending command will be sent, if D3 pin is triggered, sending call command will be sent from serial port.

When GPRS modem that is compatible with serial port associates with this unit, SMS or call is sent to the concerned person via GSM operator. Temperature and humidity values that are recorded at EEPROM and PC with 8 bit resolution can be evaluated at PC. If the value is gone over the limit, SMS can be sent with GPRS modem associated to PC's serial port. In short, SMS or call can be sent to the user with PC without SMS or call sending unit.

The interface of Visual Basic program developed for sending SMS via PC can be seen at Figure 3. If there is a user near measurement system who controls PC, except this program with using Hyper Terminal that is under "accessories SMS or call can be sent.

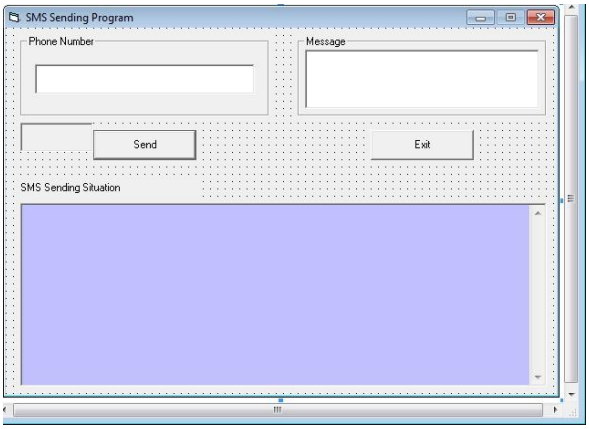

Figure 3. The interface of Visual Basic program developed for sending SMS via PC

Photos of measurement, record and early warning system developed for temperature and humidity control is given at Figure 4.

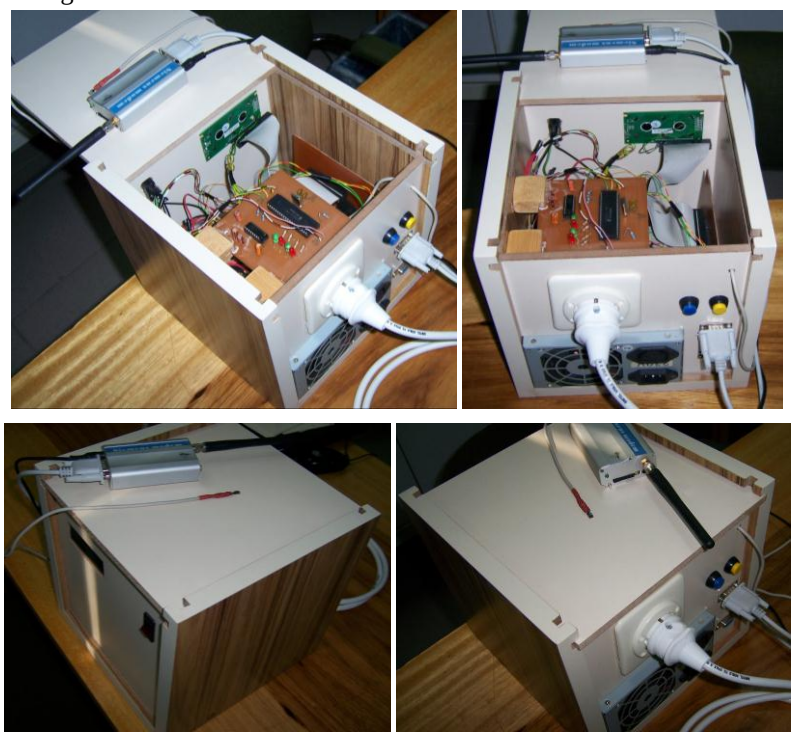

Figure 4. Measurement, record and early warning system developed for temperature and humidity control

3. Discussion and Conclusion

As it can be seen from the literature, there are many measurement and control systems for different purposes. As long as the sensor is correctly chosen, measurement and control systems can be developed for different purposes. But, it is important that developed measurement, record and early warning system has important features such as low and stable power consumption, low cost, ease of use, changeable sampling time, measurement precision, recording capacity, not be effected from electromagnetic interference and having low noise.

The measurement, record and early warning system developed within our study is designed with the aim of storing the vaccines safely at 4-6^{0}C, especially for the ones which are stored at the refrigerators of family health centers. Also, the system records monthly temperature change values as a list. However, the use of data loggers which are suitable for this aim is limited because of data loggers' high price and memory problems at long term records. In addition to this, the system's ability to send SMS or a call when the upper temperature limit (set by the doctor) is over prevents financial loss that will be caused by the disruption of the vaccines.

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