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A PATH FOR HORIZING YOUR INNOVATIVE WORK

WIRELESS WEATHER MONITORING SYSTEM USING GSM

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Abstract: Monitoring of environmental factors is very important over the last few decades. In an industry during certain hazards is will be very difficult to monitor the parameter through wires and analog devices such as transducers. To overcome this problem we use wireless device to monitor the parameters so that we can take certain steps even in worst case. Few years back the use of wireless device was very less, but due the rapid development is technology now-a-days we use maximum of our data transfer through wireless like Wi-Fi, Bluetooth, WI-Max, etc. The fundamental aim of this project is to develop a wireless weather monitoring system using GSM which enables to monitor the weather parameter in an industry or anywhere by using GSM technology and display the parameter on PC'S screen. The system contains two parts. One is transmitter node and another one is receiver part and both can be any number. Contains two parts. One is transmitter node and another one is receiver part and both can be any number. The transmitter part consists of whether sensors, microcontroller and GSM and the receiver part consist of a PC interfaced with GSM through PC serial port. In this project we deal with monitoring the weather related parameters through wireless GSM modules. Here we monitor temperature, wind speed, wind direction and humidity with the help of respective sensors. The data from the sensors are collected by the micro controller and transmitted to the receiver section through wireless medium. All the parameters are viewed by the pc using program in the receiver side.

Keywords: Wireless sensors, GSM, Microcontroller, PC, Environmental Monitoring, Data Acquisition.

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INTRODUCTION

Natural disasters are becoming more severe. One important Reason is the results of global warming around the world Causing many of the disasters. To carefully protect people in these areas, we need a monitoring system. In many events such as landslides and water flooding, they can be warned by a raised alarm within in a specified period. The surveillance system's equipment is a tool used to measure parameters such as sample temperature, air pressure, moisture, vibration, wind speed ,wind direction, rainfall etc. These parameters will vary depending on the requirement of the surveillance system. Monitoring system, the equipment used for detection is the heart of the work. The monitor system devices are installed in different places. Sometimes it is not easy to install equipment in some areas for many reasons such as lack of access to power or unable to connect to signal wiring. In addition, tools used for measurements are very expensive. To resolve this problem, a wireless sensor network can be implemented to help in data communications. The advantages of using a wireless network are: using less energy, no need for hardwiring, and high transmission distance.

REVIEW OF WEATHER MONITORING TECHNIQUES

A. Weather monitoring by satellite The weather satellite is a type of satellite that is primarily used to monitor the weather and climate of the earth. Satellites can be polar orbiting, covering the entire Earth asynchronously, or geostationary, covering over the same spoton the equator. The first weather satellite, Vanguard 2, was launched on February 17, 1959. It was designed to measure cloud cover and resistance, but a poor axis of rotation kept it from collecting a notable amount of useful data. Meteorological satellites see more than clouds and cloud systems. City lights, fires, effects of pollution, auroras, sand and dust storms, snow cover, ice mapping, boundaries of ocean currents, energy flows, etc., and other types of environmental information are collected using weather satellites. Weather satellite images helped in monitoring the volcanic ash cloud from Mount St. Helens and activity from other volcanoes such as Mount Etna. Smoke from fires in the western United States such as Colorado and Utah have also been monitored. Other environmental satellites can detect changes in the Earth's vegetation, sea state, ocean color, and ice fields. For example, the 2002 Prestige oil spill off the northwest coast of Spain was watched carefully by the European ENVISAT, which, though not a weather satellite, flies an instrument (ASAR) which can see changes in the sea surface. The first weather satellite to be considered a success was TIROS-1, launched by NASA on April 1, 1960. TIROS

Operated for 78 days and proved to be much more successful than Vanguard 2. TIROS paved the way for the Nimbus Program, whose technology and findings are the heritage of most of the Earth-observing satellites NASA and NOAA have launched since then.

Fig 1. Example of weather monitoring by satellite

B. Weather monitoring by radar

Radar is used to take large scale weather imagery. Radar images allow meteorologists to see up-to-the-minute weather

Observations of weather formations like cloud systems, storm cells and hurricanes. Radar imagery is particularly useful in times of emergency weather conditions as it provides live coverage of the weather, enabling more accurate warning systems to be put in place. Meteorologists use radar to monitor precipitation. It has become the primary tool for short-term weather forecasting and watching for severe weather such as thunderstorms, tornadoes, winter storms, precipitation types, etc. Geologists use specialized ground-penetrating radars to map the composition of Earth's crust**.**

Fig 2. Example of weather monitoring by radar

C. Weather monitoring by microcontroller

Computers play an integral role in modern weather monitoring, enabling more accurate readings and record keeping. Computers are usually used in conjunction with weather software and externally introduced weather readings from satellites, radar readings or from computerized weather instruments like modern anemometers

Fig 3 example of weather monitoring by microcontroller

and thermometers. According to Windmill, computers are used to display, analyze, record and also predict weather patterns. Computers using weather monitoring software and devices are also often linked to control mechanisms, so that, for instance, when the temperature reaches a minimum level, the computer switches on the heating in a house.

D. Wireless GSM based weather monitoring system

In an industry during certain hazards is will be very difficult to monitor the parameter through wires and analog devices such as transducers. To overcome this problem we use wireless device to monitor the parameters so that we can take certain steps even in worst case. Few years back the use of wireless device was very less, but due the rapid development in technology, now-a-days, we use maximum of our data transfer through wireless like Wi-Fi, Bluetooth, Wi-Max, etc. A wireless weather monitoring system which enables to monitor the weather parameter in an industry or anywhere can also be designed by using GSM technology. The parameters can be displayed on the PC's screen.

III SYSTEM ARCHITECTURE

The modules included in the system architecture are as

Follows,

1. Microcontroller

2. GSM on transmitter side.

3. GSM on receiver sides

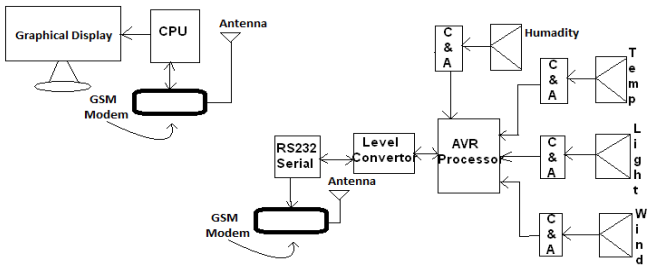

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Fig. 4 Block diagram for transmitter and receiver.

1. Microcontroller

A microcontroller is a processor with built in memory and RAM and you can use it to control your projects. So it saves you building a circuit that has separate external RAM, ROM and peripheral chips.

2 *GSM modules*

GSM is short for Global System for Mobile communication system GSM modem is a specialized type of modem which accepts a SIM card, and operates over a subscription to a mobile operator, just like a mobile phone. From the transmitter side transmit the signal using the GSM transmitter. On the other hand, the transmitted signal is received using the GSM receiver. Data are sent out periodically to the nodal agency though automated GSM modem as SMS with detail. In case of

Measured parameter value is above threshold value automated

Warnings SMS can also be send to mobile and on pc data acquisition.

3 SIM 300 GSM MODULES

A GSM modem is a specialized type of modem which accepts a SIM card, and operates over a subscription to a mobile operator, just like a mobile phone. From the mobile operator perspective, a GSM modem looks just like a mobile phone. These GSM modems are most frequently used to provide mobile internet connectivity, many of them can also be used for sending and receiving SMS and MMS messages. We have used SIM300 GSM module. It is an Advanced Low cost modem for wireless GSM communications which includes sending and receiving text messages

Fig 5. SIMCOM 300 GSM modem

A. Specifications:

- Tri-Band GSM/GPRS 900/1800/1900 MHz
- Supply voltage range is 3.4V to 4.5V
- Low power consumption
- Operating temperature is -20°C to +60°C
- Serial interface and debug interface
- LCD interface
- Keypad interface
- Antenna connector and antenna pad

B. 4 RS232

Serial Cable provided has following pins connected with RS232 level (+12V / -12V) output. Pin 2 is RS232 level TX output Pin 3 is RS232 level RX input. Pin 5 is Ground Serial Cable connections for RS232 interfacing (Provided with Product)To use with a PC serial port, use a serial cable of male-female type with pins 2,3,5 connected to 2,3,5 straight(no cross over cable).Below is pin out of 3 Core serial cable provided with Product.

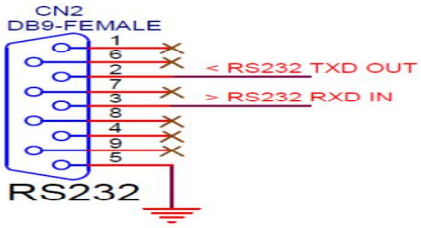

Fig 6 RS 232 pin configuration

IV HARDWARE DESIGN

The ATMEGA series provides a family of micro controllers which are cost effective, flexible and suitable for a wide variety of applications. ATMEGA are popular with both industrial developers and hobbyists alike due to their low cost, wide availability, large user base, and extensive collection of

Application notes, availability of low cost or free development tools, and serial programming (and re-programming with flash memory) capability.

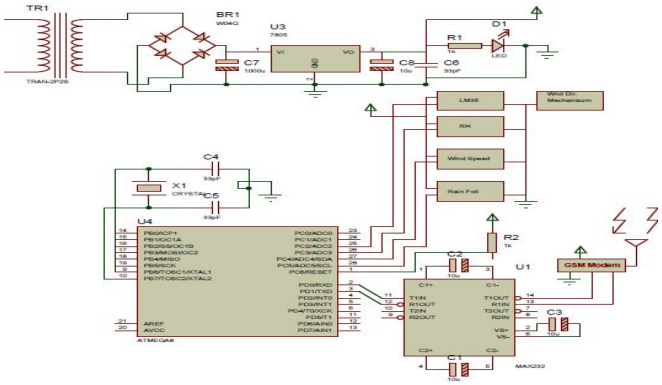

Fig 7: Transmitter Circuit Schematic

Equipment Required

- RS232 – USB connector
- Humidity sensor – HIH-4030/31
- Ambient Light sensor – TEMT6000

- Temperature sensor – LM35A
- AVR, ATMEGA 16 Microcontrollers
- Wind speed & direction sensor (Reed switch)
- Discrete components like resistors, capacitors,
- Data logging system PC
- Mechanical arrangement for wind speed, wind direction and rain fall.
- GSM MODEM(SIM 300 Series)
- Max 232

Humidity Sensor (HIH-4031):

It needs a 5v dc supply. The output is an analog signal that varies in linearly with humidity.

RH = (Vout - 0.958) / 0.0307

Ambient Light Sensor (TEMT6000):

The supply voltage can be from 3.3v or 5v. In our case we used 5v dc supply. The output is an analog voltage that

Ranges from 0v to 5v based on the brightness (luminance).

Temperature Sensor (LM 35A)

It is also an analog sensor that gives an output between 0v and 5v with a linearity of 10mv per Kelvin change in temperature.

Anemometer & rain gauge (p/n 80422)

They are based on a reed switch, which is activated by the magnetic field produced during the motion of a sensor. The Cup-type anemometer measures wind speed by closing the reed switch contact. A wind speed of 1.492 MPH causes the Switch to close once per second. The rain gauge is a self-emptying tipping bucket type. Each 0.2794 mm of rain causes one momentary contact closure that can be recorded with a digital counter or microcontroller interrupt input. The gauge's switch is connected to the two Centre conductors of the RJ11-terminated cable.

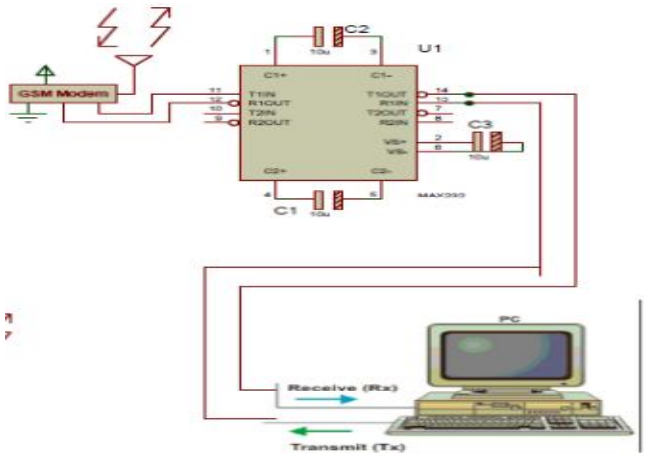

Fig 8: Transmitter Circuit Schematic

GSM module 2

The modem can either be connected to PC serial port directly using RS232We can receive the output of all parameter on the PC and also designing the pages to display the output using software.

C. V SYSTEM MODEL

Our wireless weather monitoring System is an automated version of manually measuring temperature and other parameter and sending the information to a distant database wirelessly via sms. Our system has got almost all things automated so that we get an advantage of this concept ie the real time direct measurement of the parameters (here temperature) just one sample through GSM. Maintaining backup of sent data is easy and can be done within a few seconds. This model uses a LM35, GSM module (SIM300), LCD JHD 162A and a ATMEGA-32 microcontroller (AVR trainer Board). The GSM module is connected to PC/Notebook through RS232 cable .Windows has a built in serial monitoring software called HyperTerminal to read the messages sent by modem. The system model is shown in Figure4 which says about the connectivity of all mentioned devices. The PC used in this project can be detached when we use the design for commercial purpose. PC is attached to ATMEGA32 to simultaneously display the measured temperature and other parameter through which we can experimentally check whether the data that is being sent is correct.

Fig 9: System Model

Working of system model

The LM 35 is the temperature sensor connected to PA0 port of the ATMEGA32 microcontroller device. The output voltage sensor is obtained in mill volts and is converted to digital value. The GSM modem and PC are connected to microcontroller. The temperature can be monitored directly which is simultaneously displayed on the PC and a message is sent to the mobile by using GSM technique at the same instance.

D. Sample process for temperature monitoring

- Analog output from the LM35 is fed to Atmega32 at pin number 40.
- Initialize the ADC and the converted value is stored in ADCH.
- PC is interfaced with GSM module using RS232 cable to display the output temperature.
- SIM300 is connected through TTL interface with microcontroller, it requires 2 data pins(PD0-Tx & PD1-Rx)
- AT commands are used to send and receive SMS.

E.

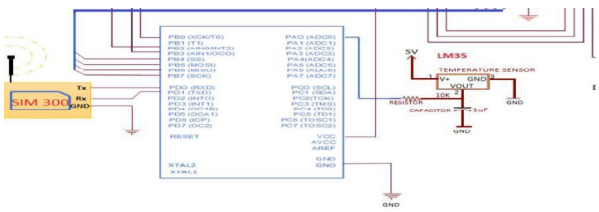

Fig: 10 interfacing of LM 35 with controller(sample for temperature)

Algorithm for ADC conversion with flowchart:

- Algorithm for ADC conversion with flowchart
- The output of LM35 linearly varies with temperature.
- The output is in 10MilliVolts per degree centigrade.
- The ADC gives an output in the range of 0-1023 value.
- Each step is of size 5MilliVolts.
- If ADC value is X then analog voltage value is X*5mVolts.
- Final TEMPERATURE=(X*5)/10 degree centigrade

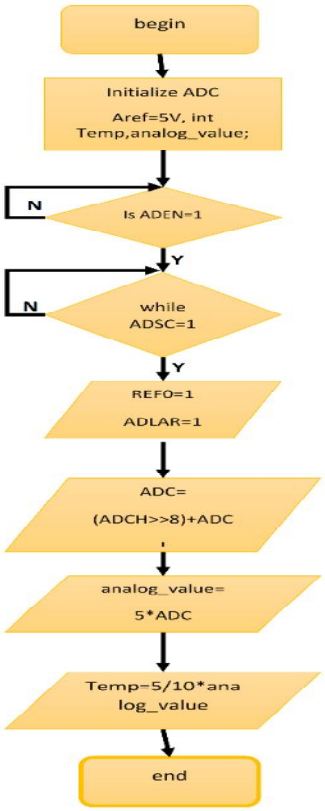

Fig 11: Flowchart for ADC conversion

VI IMPLEMENTATION AND RESULTS

The proposed system is tested and achieved good results. Fig shows the actual photographs of the proposed system.

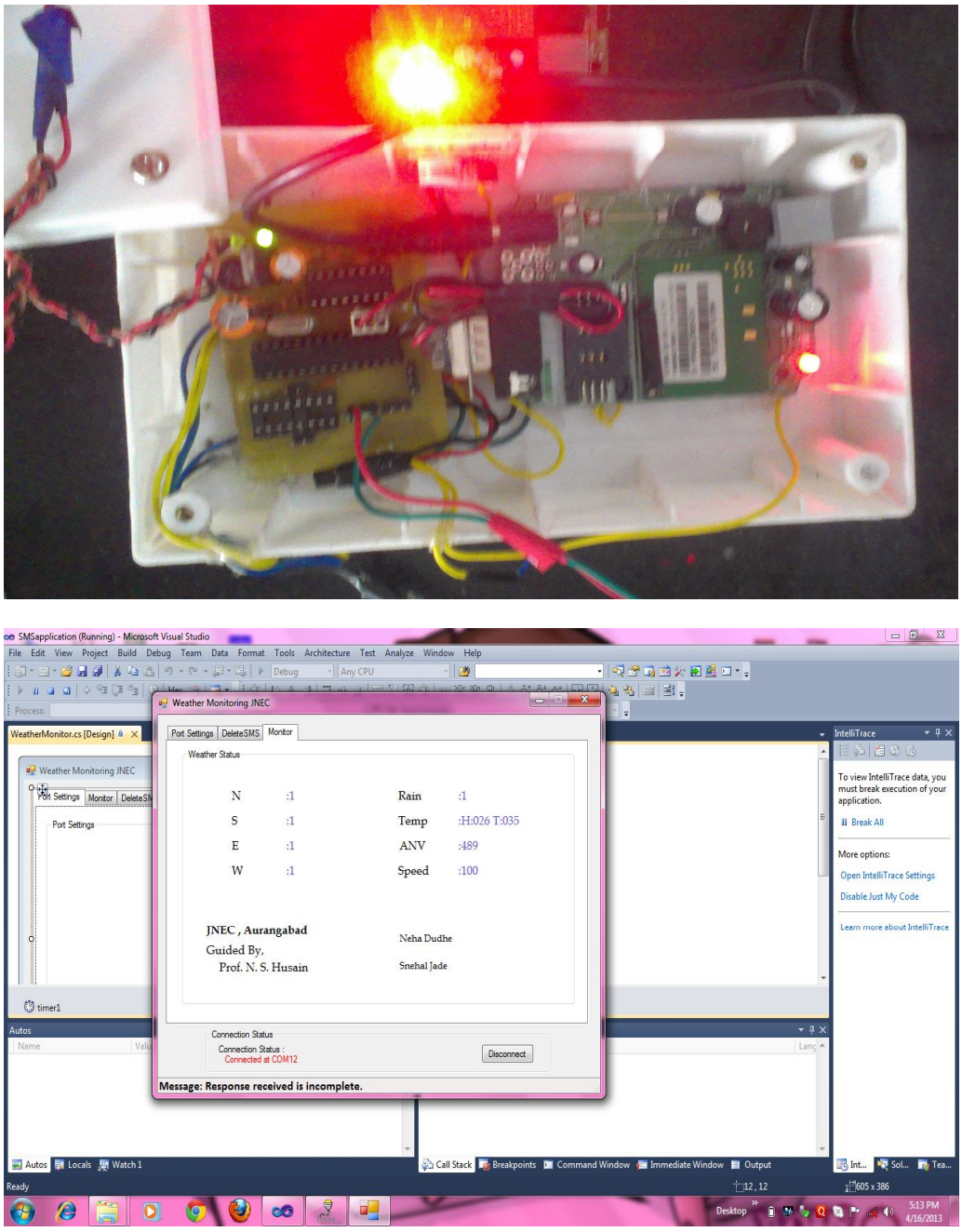

Fig: output on PC display

VII CONCLUSION

In the present work wireless weather monitoring system is designed to continuously monitor the parameter and display the reading on PC also send the output on mobile. The project deals with designing a simple and low cost weather monitoring system using different sensor, GSM SIM300 and ATMEGA-32 microcontroller unit to monitor weather conditions of the desired location and transmit it to a cell phone at distant location through SMS. And on PC.The designed product module is designed for monitoring other different type of environmental and climatic behaviour of a location, which also can be cost effective.

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