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COST EFFECTIVE AUTOMATIC WEATHER STATION-A REVIEW

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ABSTRACT

There are several solutions for monitoring the weather. They collect data and send it by wires to a central station. Many other low cost Weather systems are also available in which the design of a tiny and low cost Wireless Weather Station to measure accurate temperature, relative humidity, light intensity and atmospheric pressure. These direct climatic variables and others indirectly attainable, like the dew-point, wind chill, etc., are readable through base station but such systems does not deals with wind speed and wind direction. The proposed system consists of monitoring the weather without man power or human interaction. The fundamental concept is to provide a highly enabled monitoring environment which focuses on the giving various sensing analysis about the environment. The wireless weather monitoring system basically requires few basic modules such as solar panel, GSM module, display module, sensors and controller module. It captures the physical phenomenon such as temperature, wind, humidity that can be monitored in environment. In this project, ARM-7 controller plays a major role. To communicate with real world we need GSM system. GSM is the most popular standard for mobile phones in the world. Power for the proposed system is supplied through solar power panel so proposed system is ecofriendly.

Keywords: ARM7, GSM module, Sensors, Solar pannel, Weather station

I. INTRODUCTION

Normally, a weather forecasting merely tells people the weather conditions within a certain city or district, and within a certain period of time. However, the forecasting sometimes cannot be predicted precisely, especially in some particular cases. For example, strong wind during winter would make the actual feel temperature much lower than what it is.

In this 21st century, weather monitoring holds great importance and have uses in several areas ranging from keeping track of agricultural field weather conditions to industrial conditions monitoring. Weather monitoring would help in keeping track of different climatic behavior's including temperature, humidity, rain, wind speed and wind direction. Weather Monitoring System can be either wired or wireless one. In case of wireless communication, the connectivity will be more convenient and user friendly and weather monitoring would not require physical presence of the person at the location. Wireless communication is the transfer of information

over a distance without the use of wires. The distances involved may be short (a few meters as in television remote control) or long (thousands or millions of kilometers for radio communications).GSM technology is the cheapest and the most convenient technology now being used for wireless communication. The wireless weather monitoring system basically requires few basic modules such as solar panel, GSM module, display module, sensors and controller module.

The aim of the project is weather monitoring without man power or human interaction. The fundamental concept is to provide a highly enabled weather monitoring system which focuses on giving different kinds of analysis about the sensed environment. It captures the physical phenomenon such as temperature, wind, humidity that can be monitored. The data that is sensed from various places is transmitted to the central Global System for Mobile (GSM) node or coordinator node which will send the data to the personal computer through gateway. A server is connected to the database, which has minimum and maximum threshold value of temperature, humidity, rain, wind speed, wind direction.

II. LITERATURE REVIEW

Adnan Shaoutet al. [1] present an embedded design of a low cost weather station. Three weather parameters; wind speed, wind directions and temperature are measured. The measured parameters are used to measure the wind chill temperature and dressing index through calculation and a build-in intelligent system. Only basic type sensors were used so that the cost of this design is reduced. A small scale neural network was planted into the microcontroller for the post-processing. Taking the three measured data as inputs, the system gave out the dressing index as an output. All of the data were displayed on the LCD and also sent to computer from the serial port.

This paper represents a design of a small-scale embedded intelligent weather station which can deliver real time weather conditions of surrounding environment. Three basic factors; wind speed; wind direction and temperature and two post processed elements; real feel temperature and dressing index would be shown on LCD and also could be sent to serial port of a personal computer. The whole system was built using free scale Dragonl2-Plus2 board from HCS12 microcontroller family with MC9S12DG256 inside which uses 5V power supply. The wind speed and wind direction sensors were designed, tested and built in this paper which can get power supply from the board easily. These sensors cost much lower than the products on the market with respect to both the cost and power supply aspects. Most of the existing wind speed and wind direction sensors in the market are medium or large scale with external power supply, obviously not suitable for a small-scale embedded system with limited power supply. Besides the basic weather parameters, the built-in intelligent system can process these data further. A small-scale 978-1-4799-5241-0114/$3100 ©20 14 IEEE neural network was implemented in the system to calculate the dressing index according to the real time temperature, wind speed and wind direction.

R. Lajaraet al.[2]in the paper “Ultra Low Power Wireless Weather Station” proposed a design of a tiny and low cost Wireless Weather Station to measure accurate temperature, relative humidity, light intensity and atmospheric pressure. These direct climatic variables and others indirectly attainable, like the dew-point, wind chill are readable through a web page. The chosen sensors are factory calibrated and have a digital interface. The Weather Sensor Nodes are able to achieve ultra-low power consumption, allowing a single super capacitor

to power them for 52 days. A really small and autonomous wireless node transmits accurate information about several parameters of weather. These are temperature, relative humidity, atmospheric pressure and light intensity. A constantly powered base station collects the data and retransmits them through cable to a host computer. The host stores the data and creates several files which can be acceded through a web server.

MirceaPopa et al. [3] developed "Embedded Weather Station with Remote Wireless Control". Weather monitoring is of great importance in many domains such as: agriculture, military, entertainment etc. There are several solutions for monitoring the weather. The classical solution present in static weather stations. Another solution is based on wireless sensor networks (WSNs). The third solution uses low dimensions weather stations. This paper presents a weather station made of temperature, humidity, pressure and luminosity sensors, embedded in a microcontroller based board. The station is remotely controlled by the user through SMS commands. The remote control can be implemented through wires, on Internet, or wirelessly by using different communication technologies. The system uses the SEN-08311 USB Weather Board, which includes the temperature and humidity sensor, pressure sensor and the TEMT6000 luminosity sensor.The software is written in the Python language. It is divided in three parts: I) the main program for initializations, establishing the connection to the GSM network, receiving the data from the WSB Weather Board and processing the sensed values so that the user commands can be achieved, II) the SIM library: the functions set the PIN value, prepares the SIM card, verifies the strength of the signal for using the GSM network, III) the SMS library: the functions are responsible with sending, receiving and erasing, after being processed, the messages.

OndrejKrejcar[4] developed "Low Cost Weather Station with Remote Control". Proposed work describes use a PC to control home weather station and visualization measuring data via applications written in programming language C# with communications via USB or RS232. Weather station is capable of measure temperature up to five temperature sensors DS18B20, wind speed via measuring turbine with optical encoder, the intensity of illumination via light sensitive element and finally is able to detect an approaching thunderstorm by measuring atmospheric charge. The station also disposing eight galvanic separation switch outputs, whose function in the supplied software set to customer requirements.

ArpitaGhoshet al. [5] proposed a model which acts as a weather station and a rain detector and is solely solar powered. The model is designed in such a way that it can be used remotely and the readings are displayed on a user friendly LCD display and are displayed as digital numeric values. The weather station includes a remote station for monitoring the weather powered by a solar panel, and a base station to display data. The remote station includes sensors to measure temperature, relative humidity, rain and solar radiation level. The goal in system design is optimizing cost and power. The main intention of the proposed model was to make a weather station which is powered by renewable sources of energy. Hence we built a solar powered weather station which can capture the various environmental factors and send the reading back to the LCD for monitoring.

III. BLOCK DIAGRAM AND DESCRIPTION

The scope of cost effective automatic weather station design, that can measure the real time wind speed, wind direction, temperature, humidity and rain detection and gives that information on the LCD and also can be sent through the serial port to personal computer. Power for the proposed system is supplied through solar power panel so proposed system is ecofriendly.

To accomplish above scope the implementation of the scheme can be achieved in three stages.

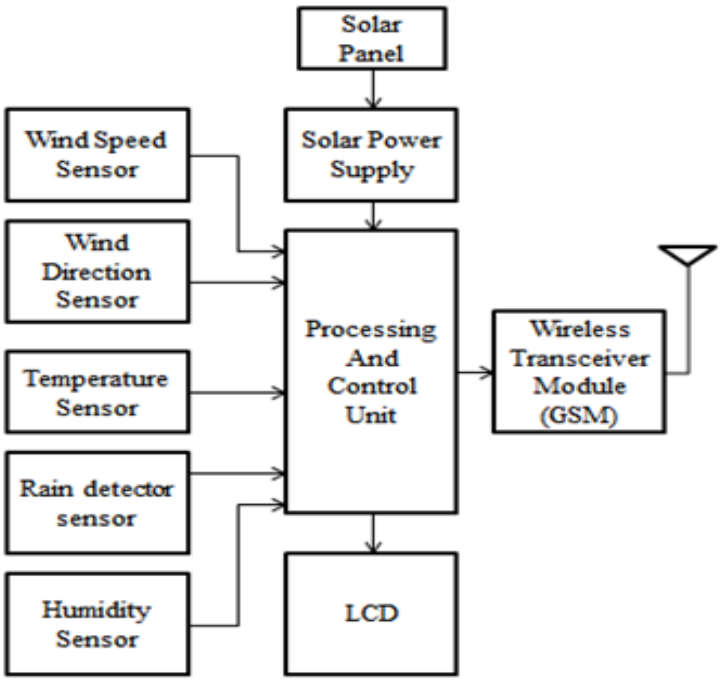

Fig 1 Block Diagram of Transmitter Side

Stage 1: This stage contains design of sensor nodes which are responsible for collection of environmental parameters and sending the collected data. Solar panel will be used to Power microcontroller, five sensors, GSM transceiver module and the LCD.

Stage 2: The ARM will directly read port data from wind speed sensor and reads ADC data from the wind speed sensor, wind direction sensor, rain detector sensor, humidity sensor and temperate sensor. ARM processes data that it receives from the ADC with interrupt service routine (ISR) and then it save to the global location and display it on LCD.

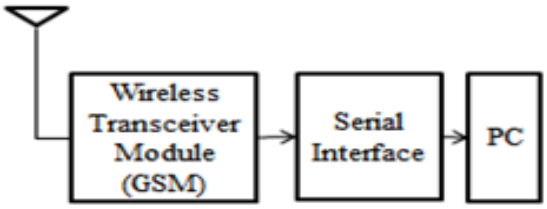

Fig 2 Block Diagram of Receiver Side

Stage 3: Data stored on memory unit will be transmitted to the central GSM node which will send the data to the personal computer through gateway. Personal computer is connected to database, which will have minimum and maximum value of temperature, rain, humidity, wind speed and wind direction. Power for the proposed system is supplied through solar power panel so proposed system is ecofriendly.

IV. CONCLUSION AND COMPARISON

Most of the low-cost embedded weather stations available in the market and reviewed in literature review do not have the function to measure wind speed and wind direction. This paper presents a cost effective automatic

weather station design that can measure the real time wind speed, wind direction along with temperature, humidity and rain detection. Power for the proposed system is supplied through solar power panel resulting an ecofriendly system.

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