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Research Article

APPLICATION BASED INTEGRATED WEATHER MONITORING AND CONTROLLING HOME APPLIANCES SYSTEM

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A R T I C L E I N F O

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A B S T R A C T

The Internet of things (IOT) become very popular these day as it is repetitively evolving in the various filed of technologies like smart homes, smart irrigation, smart cities , smart management etc. The technology behind the Internet of Things is to connect various things to the internet which is a very advanced and efficient solution to connect the entire world things with in a network. The present work aims to regulate the home appliances like A.C. through android application by monitoring the local area weather. The introduction of internet of things provides a way to monitor the weather of a local area and controlling the home appliances from any remote area. The dynamically change in the weather parameter is monitored through pair of sensors like temperature, gas, rain, humidity and ATMEGA 16 microcontroller. The data from the sensors are collected by the microcontroller which can be seen on LCD screen and the data from the microcontroller is send to the cloud server through WIFI module. If the calculated or assume values of sensors exceeds then a message from GSM carrying sensors readings is sent to the registered mobile number with this information, user can control the inside weather condition by simply sending the signal to the relay using android application. In this work, monitoring the weather and controlling the home appliances using anAVR (16 bit micro-controller) and Android mobile app has been discussed. It has many advantages as compared to other systems in terms of its small size, on-device display, low cost and portable.

INTRODUCTION

Current improvements in technology mainly focus on controlling and monitoring of different activities. These are gradually evolving to reach the customer needs. Most of this technology is focused on efficient monitoring and controlling different activities and continuously influencing the various aspect of daily life. The internet is being used as common source and numerous devices are connected to make the life very easy. It provides quick result for several problems and it is able connect to those remote area where impossible to reach physically. The Internet of things has become very attractive in the modern telecommunication world. This is referring as "a world- wide network of interconnected objects uniquely addressable, based on standard communication protocols". The main objective of Internet of thing is mutual interaction of different things or object, which manage and control physical object around us in a more intelligent and meaningful manner and also improves the quality of life in an effective manner including safety, security cost etc. The Internet if things inspired by the success of near filed communication(NFC), Radio Frequency Identification(RFID) and technologies related to Sensor Network(SN) that permits to integrate the message and information system in the surroundings. Therefore, a smart object is defined as embedded system involving physical device. The device that processes the data related to sensor and provides communication to internet wirelessly. Hence, a vision can be built through smart object for IOT. It provides various solutions that are capable of making contribution in different applications file while improving the life quality. It also plays an important role in environmental monitoring, security, smart capitals, healthcare, smart business/inventory.

Presented work is an automated instrument or system that measures and records the change in the environment parameters i.e. temperature, CO gas level, humidity, and rain. The measured parameter is stored in the data log or can be transmitted to a cloud server via communication link and accordingly controls the inside room temperature using android application. By embedded intelligence into the environment and home makes the home and environment collaborating with other objectives, this one of the application that this smart system targets.

The main aim of this work is to design and effective monitoring and controlling system which monitors and control system remotely using internet, stored that data in to

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the cloud which can be access from anywhere and control the home temperature according through android application from any remote area.

Related Work

There is several techniques which had been put forward by researchers for measuring the environment parameter in real time. The use of microcontrollers and sensors has been common in those. The following section represents the researches done in Weather monitoring system.

Prediction Based System: Authors [1] showed a cooperative predictive system which calculates the weather using numerical weather prediction model system. They used the data mining technique based on the historical weather record for Precipitation Forecasting. This model is based on HIRLAM and ALADIN where HIRLAM is operational High resolution limited area model which is considerably designed for short range weather whereas ALADIN model deals with the method of compatibility with the Global Model. In this paper [2], authors enlighten a new real-time application by referring a Cloud cast which provide short term weather forecasting according to the location. The Cloud cast is based on now casting algorithm and execution of this algorithm is supported by a new architecture. This architecture consist of two component (i) Meteorological command and control (MC&C)[5] which controls thescanning of radar and instances of cloud(ii) Now casting Algorithm[6][7] which are used to forecast weather for short term.

Wireless Network and Mobile Based System: Authors proposed a system to design and implementing a mesoscale weather monitoring system using mobile intelligence [3]. They predicted the weather by calculating the past weather information and determined the user position with the help of GPS sensor present in the mobile device. In this paper, K NEAREST NEIGHBOR (KNN) was used and extrapolation rule [4] for prediction was reported.

GSM Based System: In thestudies [8, 9], a model was purposed to measure the ongoing environment change activitieswhich included temperature, humidity and dew point temperature using sensors. The conversion of analog to digital and signal which were further manipulated to display on a LCD screen.

Radar Based System*:* In the system basedon Radar like [10, 11], the authors presented a simple technique to synchronize both of the information sources to strategically arrange the climate radar.

Microcontroller Based System: In this paper[12], a model was designed with monitors and control weather system with the ability to perform data acquisition on temperature, gas, accelerometerand humidity sensors.The data of these sensorswere sent to the ADC port of ARM9 and upload the data uninterruptedly on excel sheet using LAB VIEW.

Zigbee Based System: They designedthe networking of sensor and monitoringof weather system using wireless zigbee without the human interference [14, 15]. This was designed to keeps track on temperature, humidity, pressure, wind flow and direction, rainfall amount and displaying those readings in a real time.

Network of Wireless Sensor Based System: A technique of Wireless Sensor Networks (WSNs) [13] was proposed in which various sensors are used for transmitting, processing and computing. The sensed data was sentto the base station continuously and the received data is than processed and managed accordingly in real time. The proposed structure [16] utilized the virtual sensors for different climate which uses WSN as a base. Checking of the climate was obtained through different sensors and provided SAAS and Interpersonal organization an edge over the others for the selection of light when the system was consider as ID3. It gave the validation of the cloud using secure shell. Similarly in paper [17], authors gave GIST on WSN by Internet of bothers based on plan of PARASENSE. They made an arrangement for continuously sending the applications and conveying it.

***Wireless Sensor Based System Using Mems*:** The sensors in the proposed model [18] consisted of a PT RTD, capacitive humidity sensors, a piezo-resistive pressure sensor and anemometer which used a bulk-micromachining technology for integration. The signals sensed by the system were then transmitted and received between the Octopus-A nodes with the help of WSN Technology, after receiving the signals were amplified and converted in to digital form through ADC, which then were processed and showed on output screen.

Ardunio Based System: Author [19, 20] enlightened a framework which naturally gathered the data of humidity and temperature using temperature and humidity sensors.

Table 1 Weather Monitoring System with different Techniques

Serial No.	Category	Technique	Refreence	Problem
1	Communication and technique based	Wireless sensor with MEMS	[18]	Time consuming process. Costly fabrication process. Less secure. Increase in complexity
2	Communication based	GSM based system	[8][9]	Call locales range max up to 35km. Same bandwidth causing interference during transmission because of heat beat transmission.
3	Communication based	Radar based system	[10] [11]	Time radar takes 2 sec to trigger. Wide pillar spread.
4	Processor and technique based	Microcontroller	[12]	32 bit RSC processor with ARM,JAVA,SIM Each stage take one clock cycle
5	Communication and technique based	Wireless network and mobile based	[3] [4]	Wireless sensors are expensive. Required more wiring to install a sensor with wire. Costly.
6	Communication based	Zigbee based system	[14] [15]	Short range Less complex High cost Less information speed
7	Communication based	WSN system	[13] [16] [17]	Lower speed. Sensor designed to perform a specific task cant be the alternative to the ones not suitable for other task. Less secure.
8	Processor and technique based	Prediction based system	[2] [5] [6] [7] [1]	Wrong prediction due to change in climate. Difficult to address correct climate prediction.

The gathered data from the sensors are first converted in to digital form through ADC and putaway in data base. With help of previous information, authors provided the output in graphical way.

Satellite Based System: The gathered information was gradually used as a part of combination with routine meteorological views in the brief study and established climate gauge to deliberated data [21]. The main purpose of CanSat [22] was to outline, create and dispatch of a genuine satellite. The assembles of Cansatwere transmitted and used to monitor the change in climate of a given location in an economical way. In this study authors stated that the climate and atmosphere of the surrounding can be monitored/ observed through a screen panel, continuously with the help of the sensors through the climate satellite

Below table define the weather system in to different techniques and category with their problems.

Proposed Model

The design of smart system Embedded with sensors used for monitoring the temperature, humidity, Rain, CO levels in the atmosphere and controlling the home appliances accordingly to make the environment and home intelligent with the objects through wireless communication.

The architecture of model is discussed in four stages with the function of each individual module developed for monitoring as shown in Fig. 1. The system is divided into few steps. 1st stage is environment, 2nd stage is sensor device, data acquisition and decision making 3rd stage, intelligent environment is 4th stage.

The first stage provides the information about the parameters which are used to monitor the environment condition. Second stage deal with the sensors and their characteristics suitable for measuring the weather.

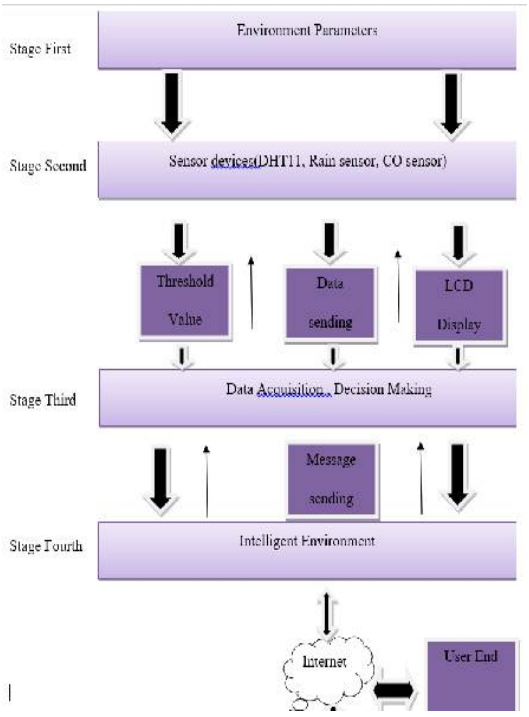

Figure 1 System Stages

Third stage gives details about the data acquisition which basically converts the physical form of data in to a form that can be readable by the device and process the data through computer device and also includes the decision making. It specifies which parameter would represent the data condition. Fourth stage is the intelligent environment stage which identifies the change in the weather condition and if the sensors value crosses its threshold value a message is send through GSM module accordingly on a register mobile number giving an alert regarding the room temperature condition with respect to the outside weather. Accordingly user can control its inside temperature through android developed application from any remote location.

System Architecture

Based on the proposed model, a suitable model has been introduced in this paper that consists of different sensors WIFI and GSM device and their functionality is shown in Fig. 3 .In this model we used ATMEGA16 bit microcontroller with Wi-Fi module and sensors which are embedded together on system board for sensing and storing the data and 16*2 LCD for continuous monitoring of the sensing data. ATMEGA 16 microcontroller consists of 32 I/O pins which are divided in to four 8 bit ports assigned as PORTA, PORTB, PORT C and PORT D. The PORTA of ATMEGA 16 is the only 8bit port where all the work or connections related to ADC takes palace, whereas Wi-Fi module is at PD0 and PD1of microcontroller connects the sensors to. Sensors are connected to ATMEGA 16 for monitoring. Sensors like Gas and Rain drop sensors gives output in analog form so they are connected to A0 and A1 where ADC converts the related sensor reading to its digital value, whereas DTH11 and LCD are connected to the PC0 and PB0-PB7 of microcontroller respectively. The evaluated value from the sensors is then send and store in cloud server THINK SPEAK channel which update its data in every 40 seconds

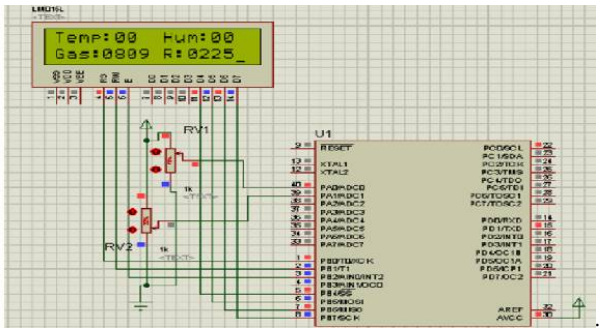

Figure 2 Circuit Diagram

The updated data is in a real time and can be access by the user from any remote area. If the data readings provided by the sensors crosses its threshold value then a message carrying all the information about weather data is been sent to the registered mobile number through GSM Module connected to the PD5 of PORTD of 16 bit microcontroller. Hence with respect to the change in weather condition the user sends signal from its android cell phone from any remote location using android application to switch on or switch off the A.C according to its requirement. The switch on/ off of A.C is done with the help of a relay embedded on a board connected to the PD4 of PORTD of the 16 bit microcontroller.

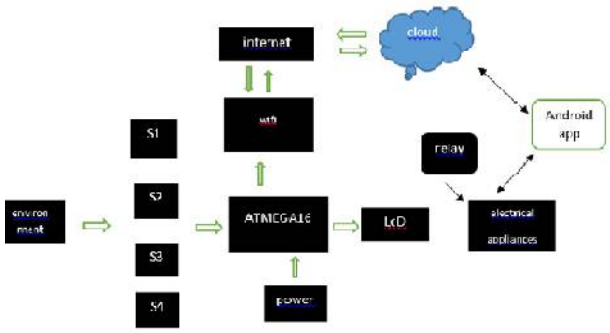

Figure 3 System Block Diagram

METHODOLOGY

The overall process for implementing is shown in Flow Chart in Fig. 4 and described step by step as follows:

1. Firstly working on the microcontroller programming to interface the different sensors with ATMEGA16 and display all the current environmental values on the display (LCD).
2. After LCD and sensors interfacing, the Wifi (ESP2866) module will be interface to connect the monitoring device to the internet so it can access the server for reading and writing data on to it.
3. Interfacing Relay module with the monitoring device to actuate the cooling device like A.C. (Air conditioner)
4. After present interval of time the data will be updated on the database created on the cloud server (Thingspeak.com) say for example (every 30 seconds all sensors reading will be updated on the server).
5. Android application development will be done to access the server data from anywhere in the world using internet.
6. Command can be issued from the app to the device to switch on or off the A.C as per required.

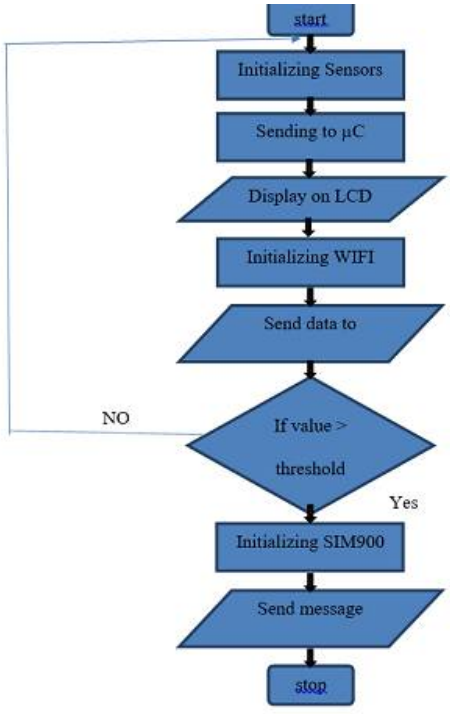

Figure 4 Flow Chart

RESULT AND DISCUSSION

After collecting the data from the different sensors, it sends to the MCU (microcontroller unit), the data is stored in EPROME chip which is simultaneously displayed on the LCD shown in Fig.5. Microcontroller store the data from the different sensors after converting it in to digital form through ADC (in case of CO and rain sensor) , before sending it to cloud server, the LCD flashes “Writing” on the screen which indicated that the data is being sent to the server. After every 40 seconds it resets both the reading of the sensors and LCD. The MCU manipulates the ADSCR register to enable ADC features. The ADEN, ADSC and ADIF bits are set to 1 so that microcontroller continuously takes the analog data and converted it in to digital form. The data from the ADC is stored in ADCH and ADCL registers from which user can mathematically calculate the value of respective sensors.

The model is programmed to display the sensors data on LCD display which provide user the real time display of weather condition of a local area and store that data to the cloud server with the help of WIFI which can be accessible from any remote area. Microcontroller continuously monitors the sensors reading and update the sever values in every 40 seconds. If the value crosses its threshold value then a message from GSM is send to the Mobile phone regarding weather data. According to the change in weather user can adjust or control its room temperature by switching on/ off its AC being not at home from any remote area simply by sending signal 1 or 0 to the relay through android application. Below given the list of figures which shows output from sensors.

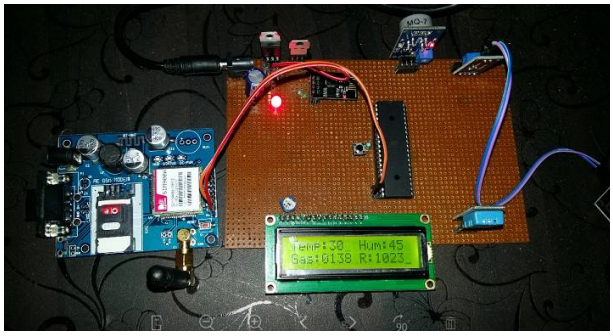

Figure 4 Hardware Connections

Figure 5 Sensors readings

CONCLUSION

This paper presents a prototype smart weather monitoring and controlling home appliances using IOT. Different sensors are integrated to 16bit microcontroller board with relay and Wi-Fi for monitoring change in weather and controlling temperature accordingly from any remote location in a real scenario. This wireless monitoring system allow user to reduce human power and also allow user to see accurate changes in it. Presented work uses IOT frame work and use cloud computing infrastructure for controlling and managing the remote devices and also store sensor data.

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