Arduino Based Weather Monitoring System

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Abstract: **Weather is the state of the atmosphere, to the degree that it is hot or cold, wet or dry, calm or stormy, clear or cloudy. Most weather phenomena occur in the troposphere, just below the stratosphere. Weather generally refers to day-to-day temperature and precipitation activity, whereas climate is the term for the average atmospheric conditions over longer periods of time. When used without qualification, weather, is understood to mean the weather of earth. Monitoring the weather conditions manually is difficult. This paper present our work to develop an automated system which monitors the weather condition. The weather condition is driven by air pressure (temperature and moisture) differences between one place and another. These pressure and temperature differences can occur due to the sun angle at any particular spot. Through this system we can automatically collect the information about humidity and temperature. The details are stored in a database and according to current and previous data we can produce the results in graphical manner in the system.**

Keywords Climate control, Weather analysis, Temperature Moderation, Moisture Control, Humidity Control, Arduino.

1. INTRODUCTION

Weather forecasting is the application of science and technology to predict the state of the atmosphere for a given location. Human beings have attempted to predict the weather informally for millennium and formally since the nineteenth century. Weather forecasts are made by collecting quantitative data about the current state of the atmosphere on a given place and using scientific understanding of atmospheric processes to project how the atmosphere will evolve on that place. Weather is driven by air pressure (temperature and moisture) differences between one place and another. These pressure and temperature differences can occur due to the sun angle at any particular spot, which varies by latitude from the tropics. The atmosphere is a chaotic system, so small changes to one part of the system can grow to have large effects on the system as a whole. This makes it difficult to accurately predict weather more than a few days in advance, though weather forecasters are continually working to extend this limit through the scientific study of weather, meteorology. It is theoretically impossible to make useful day-today predictions more than about two weeks ahead, imposing an upper limit to potential for improved prediction skill. Once an all-human endeavour based mainly upon changes in barometric pressure, current weather conditions, and sky condition, weather forecasting now relies on computer-based models that take many atmospheric factors into account. Human input is still required to pick the best possible forecast model to base the forecast upon, which involves pattern recognition skills, tele-connections, knowledge of model performance, and knowledge of model biases.

2. Proposed System

There are a lot of high end systems available these days for round the clock weather monitoring. But these systems are implemented on a very large scale, for monitoring real time weather for a whole city or state. Implementing such system for a small area is not feasible, since they are not designed for it and the overhead for maintaining such systems for a small area is very high. Our proposed system makes use of 3 sensors to measure the weather/environment factors such as temperature, humidity, light intensity, dew point and heat index. The values read from the sensors are processed by the Arduino micro-controller and stored in a text file which can be processed upon to derive analysis. The readings are also displayed on an on board LCD for quick viewing. All these readings can be analyzed to get the weather characteristics of a particular area and record the weather pattern. These recorded parameters are essential and vary from places to places. All these requirements are fed into the database and these values are essentials and recorded over time. As mentioned before, the system is consisted of an LCD display that demonstrates the data provided by the sensors directly. DHT11 sensor that measures (T) and (H) locally based on Arduino code. Wind speed meter that generates power transferred to pin A1 of Arduino in order to specify wind speed value according to the wind speed realization formulas represented by Arduino code. LDR module that measures the light fallen over the photo resistor, in result (Day/Night) time period is reported and shown on the display. The whole connection scheme of the system is exposed in Fig.9, which resembles the entire components to create the proposed system. Each element in the system needed to be provided with 5V and GND from Arduino board. The modules that make up the weather monitoring system have been carefully and well thought of, to make sure that the sensors used are giving the most accurate reading and are compatible with the Arduino. The modules used for the weather monitoring system can be summarized as follows:

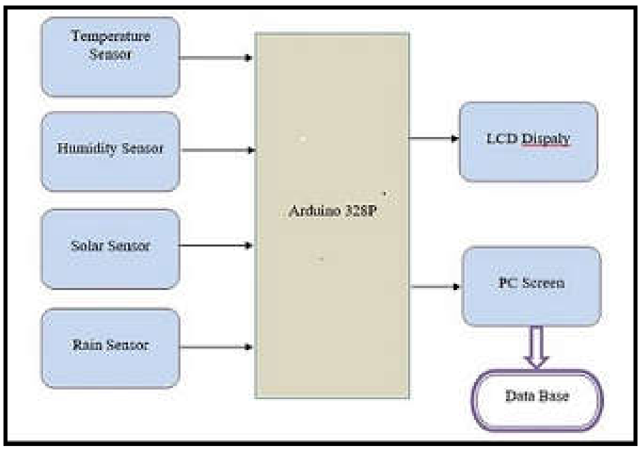

Fig 1. Proposed System

3. Temperature and Humidity Sensor (DHT11)

DHT11 digital temperature and humidity sensor is a composite Sensor contains a calibrated digital signal output of the temperature and humidity. Application of a dedicated digital modules collection technology and the temperature and humidity sensing technology, to ensure that the product has high reliability and excellent long-term stability. The sensor includes a resistive sense of wet components and an NTC temperature measurement devices, and connected with a high-performance 8-bit microcontroller.

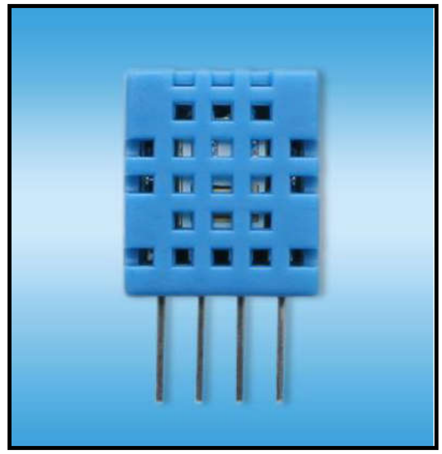

Fig 2. DHT11 Humidity Sensor

Model	DHT11
Power supply	3-5.5V DC
Output signal	digital signal via single-bus
Sensing element	Polymer resistor
Measuring range	humidity 20-90%RH; temperature 0-50 Celsius
Accuracy	humidity +-4%RH (Max +-5%RH); temperature +-2.0Celsius
Resolution or sensitivity	humidity 1%RH; temperature 0.1Celsius
Repeatability	humidity +-1%RH; temperature +-1Celsius
Humidity hysteresis	+-1%RH
Long-term Stability	+-0.5%RH/year
Sensing period	Average: 2s
Interchangeability	fully interchangeable
Dimensions	size 12*15.5*5.5mm

Table 1.Humidity Sensor Parameters

4. Arduino

Arduino is an open source tool for making computers that can sense and control more of the physical world than your desktop computer. It's an open-source physical computing platform based on a simple micro-controller board, and a development environment for writing software for the board. Arduino can be used to develop interactive objects, taking inputs from a variety of switches or sensors, and controlling a variety of lights, motors, and other physical outputs. Arduino projects can be stand-alone, or they can communicate with software running on your computer (e.g. Flash, Processing, MaxMSP). The boards can be assembled by hand or purchased pre-assembled; the open-source IDE can be downloaded for free.

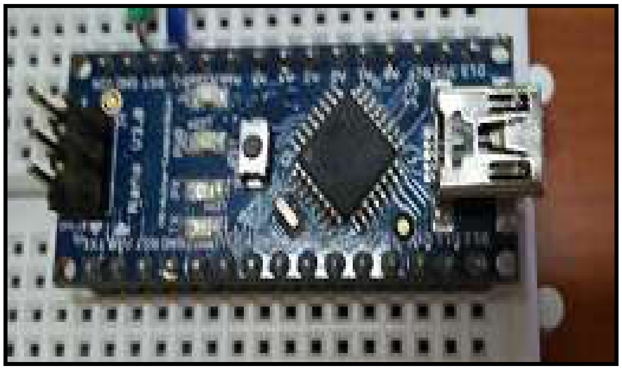

Fig 3. Arduino Microcontroller

5. Light Dependent Resistor

An LDR is a component that has a (variable) resistance that changes with the light intensity that falls upon it. This allows them to be used in light sensing circuits. A light-dependent resistor (LDR) is a light-controlled variable resistor. The resistance of this decreases with increasing incident light intensity; in other words, it exhibits photo-conductivity. An LDR can be applied in light-sensitive

Detector circuits, and light- and dark-activated switching circuits. An LDR is made of a high resistance semiconductor. In the dark, an LDR can have a resistance as high as a few mega ohms (MΩ), while in the light, an LDR can have a resistance as low as a few hundred ohms. If incident light on an LDR exceeds a certain frequency, photons absorbed by the semiconductor give bound electrons enough energy to jump into the conduction band. The resulting free electrons (and their whole partners) conduct electricity, thereby lowering resistance. The resistance range and sensitivity of an LDR can substantially differ among dissimilar devices.

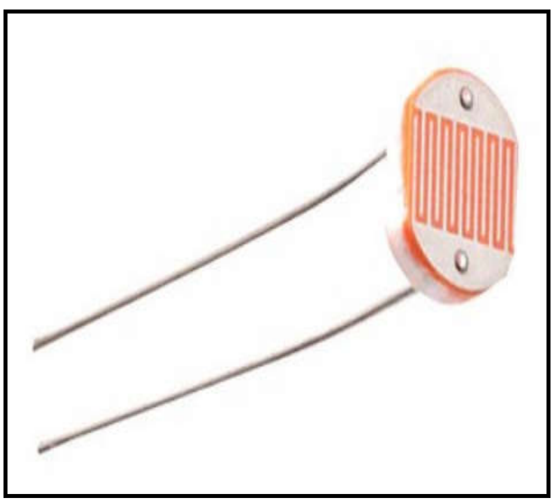

Fig 4. Light Dependent Resistor

Parameter	Conditions	Min	Typ	Max	Unit
Cell resistance	1000 LUX 10 LUX	- -	400 9	- -	Ohm K Ohm
Dark Resistance	-	-	1	-	M Ohm
Dark Capacitance	-	-	3.5	-	pF
Rise Time	1000 LUX 10 LUX	- -	2.8 18	- -	ms ms
Fall Time	1000 LUX 10 LUX	- -	48 120	- -	ms ms
Voltage AC/DC Peak		-	-	320	V max
Current		-	-	75	mA max
Power Dissipation				100	mW max
Operating Temperature		-60	-	+75	Deg. C

Table 3: Electrical Characteristics

6. Rain Sensor

The rain sensor module is an easy tool for rain detection. It can be used as a switch when raindrop falls through the raining board and also for measuring rainfall intensity. The module features, a rain board and the control board that is separate for more convenience, power indicator LED and an adjustable sensitivity though a potentiometer. The analog output is used in detection of drops in the amount of rainfall. Connected to 5V power supply, the LED will turn on when induction board has no rain drop, and DO output is high. When dropping a little amount water, DO output is low, the switch indicator will turn on. Brush off the water droplets, and when restored to the initial state, outputs high level.

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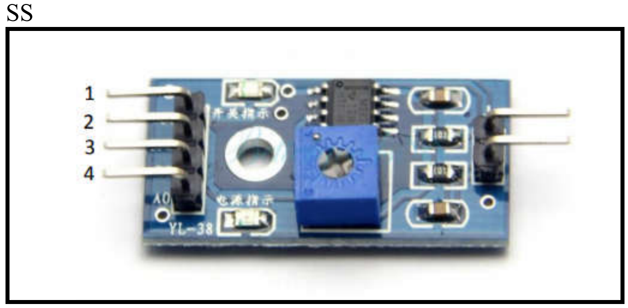

Fig 5 Rain Sensor

An application in professional satellite communications antennas is to trigger a rain blower on the aperture of the antenna feed, to remove water droplets from the Mylar (heat resistant plastic film) cover that keeps pressurized and dry air inside the wave-guides.

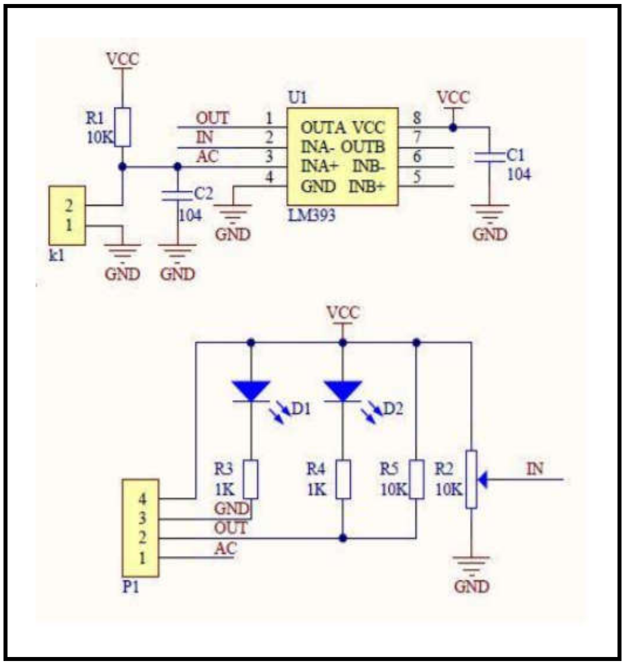

Fig 6. Schematic Diagram of Rain Sensor

7. Conclusions

The paper demonstrates a simple and low cost system design to measure climate components in perfect competence. The availability of such system is extremely preferred particularly, with the establishments, companies that depend considerably on taking decisions based on inputs variations; consequently, weather prediction processes will be taken into considerations. In addition, the system is considered perfect for controlling the sites based on the change in weather conditions. The system works as a supervisor controller, which govern places depending on the fluctuations of the weather or other conditions via feedback operation principles. Hereby, we conclude that the proposed system can be separated in to two different parts. The first part is excessively helpful for the companies and other organizations that are put in charge to plane and manage their works based on weather situations; such as, Transportation systems, Airways, and the Agriculture as a high priority. These projects can be 1used in Agriculture and helpful to farmer on uneven climate change. Houses, Markets.

8. Future Scope

As a future scope we can add solar panel and adding more sensors such as Barometric Sensor, Anemometer (To measure wind speed and the wind direction). We can make this SMS based and getting updates on day to day basis.

8. Refrences

1. N. Sabharwal, R. Kumar, A. Thakur, J. Sharma "A Low Cost Zigbee Based Automatic Wireless Weather Station With Gui And Web Hosting Facility" ICRTEDC, Vol. 1, Spl. Issue 2, May, 2014.

2. N. Gahlot, V. Gundkal, S. Kothimbire, A. Thite, Zigbee based weather monitoring system. The International Journal of Engineering And Science (IJES), Volume 4, Issue 4, PP.61-66, 2015.

3. D. V. Sose, A. D. Sayyad, “Weather Monitoring Station: A Review” Int. Journal of Engineering Research and Application, ISSN: 2248-9622, Vol. 6, Issue 6, (Part -1) June 2016, pp.55-60.

4. F. Hahn, M. Pablo, J. Reyes “Solar Driven Wind Speed Monitoring System Using Wireless or Wired Sensors” SciRes, Energy and Power Engineering, Vol 6, PP.213-221, 2014.

5. A. Katyal, R. Yadav, M. Pandey, " Wireless Arduino Based Weather Station" International Journal of Advanced Research in Computer and Communication Engineering Vol. 5, Issue 4, April, 2016.

6. Zheng tong. Y, Wenfeng. Z, “The research of environmental pollution examination system based on the Cloud Computing”, International Conference on Communication Software and Networks, pp.514-516, 2011.

7. Montgomery. K, Chiang. K, “A New Paradigm for Integrated Environmental Monitoring”, ACM International Conference Proceeding Series, 2010.

8. Kurschl. W, Beer W, “Combining cloud computing and wireless sensor networks”, International Conference on Information Integration and Web-based Applications and Services, pp.512-518, 2009.

9. Wei. Q, Jin. N, Lou X, Ma. R, Xu. J, “Software design for water environment remote monitoring system based on mobile devices”, Applied Mechanics and Materials, pp. 2027-2032, 2011.