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Wireless Sensor Network (WSN) Implementation in IOT Based Smart City

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Abstract: *as the IoT (Internet of Things) has made the man machine interface a very sophisticated thing. Due to this a large number of devices got connected to the internet. The proposed system forms the network (Wireless Sensor Network or also termed as WSN) of such devices(Sensors) which collectively sends the real time weather parameters (Temperature, Humidity, Light Intensity and Depth of water level present in Dam) of particular location to the local Web server created using Arduino platform. The system also provides the certain kind of Security. Hence system can only be accessed and monitored by authorized persons.)*

Key Words: IoT, WSN, Arduino, Web Server.

1. INTRODUCTION

The IoT is trending concept getting popular across the globe. Due to IoT the man machine communication became too much easy. A lot of research is going in this section. In the conventional system the various weather parameters were measured by conventional methods but getting real time data was not possible. The proposed system collects the weather parameters such as temperature, humidity, external light intensity and water level present in dam of particular location. The whole city has network of such sensors which will collect data and simultaneously send it to the web server.

Present innovations in technology mainly focus on controlling and monitoring of different activities. These are increasingly emerging to reach the human needs. Most of this technology is focused on efficient monitoring and controlling different activities. An efficient environmental monitoring system is required to monitor and assess the conditions in case of exceeding the prescribed level of parameters. When the objects like environment equipped with sensor devices, microcontroller and various software applications becomes a self-protecting and self-monitoring environment and it is also called as smart environment. The effects due to the environmental changes on animals, plants and human beings can be monitored and controlled by smart environmental monitoring system. By using Intelligent Network of Sensors and IoT across the city makes the environment interactive with other objectives, this is one of the application that smart environment targets. Human needs demands different types of monitoring systems these are depends on the type of data gathered by the sensor devices. Event Detection based and Spatial Process Estimation are the two categories to which applications are classified. Initially the sensor devices are deployed in environment to detect the parameters (e.g., Temperature, Humidity, Environmental Light Intensity etc.) while the data acquisition, computation and controlling action. Sensor devices are placed at different locations to collect the data to predict the behavior of a particular area of interest. The main aim of this paper is to design and implement an efficient monitoring system through which the required parameters are monitored remotely using internet. The solution provides an intelligent remote monitoring for a particular area of interest. In this paper we also present a trending results of collected or sensed data with respect to the normal or specified ranges of particular parameters. The embedded system is an integration of sensor devices, wireless communication which enables the user to remotely access the various parameters. The whole sensor data will be which will be transferred to the server will be secured by certain algorithms.

2. Methodology

For the implementation of the proposed system we have used the Arduino Mega 2560 development board which has ATmega2560. To measure the temperature and humidity we have used the DHT11 sensor which is combined module which provides temperature as well as humidity present in environment. The DHT11 provides digital values of temperature and humidity and these values are sent to the local webserver local webserver created using arduino and Ethernet shield. The environmental light intensity is detected by the Light Dependent Resistor (LDR) sensor. This sensor is used along with 10k resistor in voltage division configuration. The light intensity is converted into the percent value by doing certain mathematical calculations and simultaneously sent to the local webserver. The water level present in dam is then measured by ultrasonic sensor HC SR-04 and it is also sent in real time to the local webserver. Ethernet Shield used is W5100 by Wiznet. The Ethernet shield is connected to arduino board by Serial Peripheral Interface (SPI) protocol. The Ethernet shield then sends data to router (Digisol DG HR-3400). The Ethernet shield and router are connected through TCP/IP protocol. The router assigns IP address to Ethernet shield. The data can be accessible on secured website through internet service provider (ISP). The whole data is secured through MD5 encryption technique developed using php. The following is the block diagram of the proposed system:

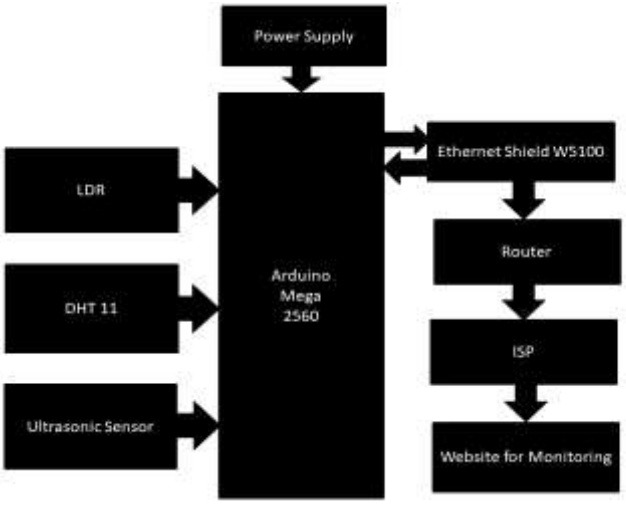

Fig- 1: Block Diagram of the proposed system

3. HADWARE DESIGN

The hardware of the system is enclosed in perfect ABS Plastic enclosure. The hardware setup of the system is shown below:

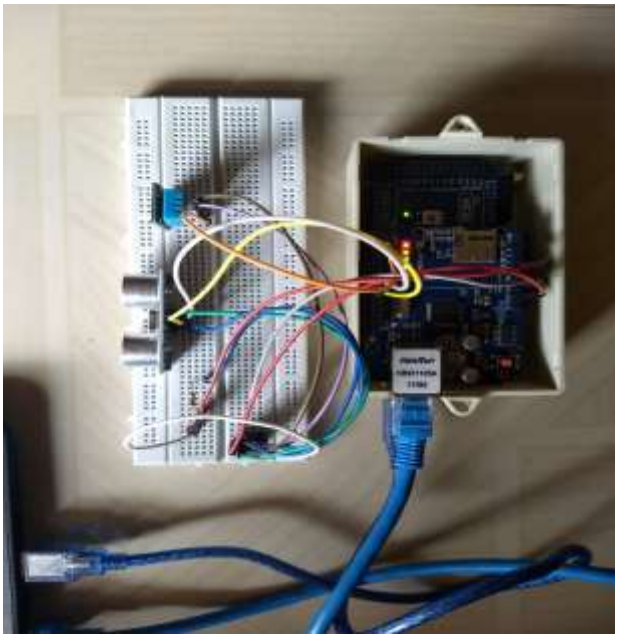

Fig- 2: Hardware Setup

The testing hardware setup is made with the help of breadboard. All the sensors i.e. LDR, DHT11 and HC SR-04 are interfaced with Arduino Mega 2560. The whole setup is shown in next image Fig-3.

Fig- 3: System Setup with Network Interface

4. SOFTWARE INTERFACE

The software tool used to write down the code for the proposed system is Arduino IDE. Basically this is the compiler. The code written in this compiler is dumped into the hardware through USB interface present on arduino board. The GUI (Graphic User Interface) of the arduino IDE is shown in below figure Fig- 4:

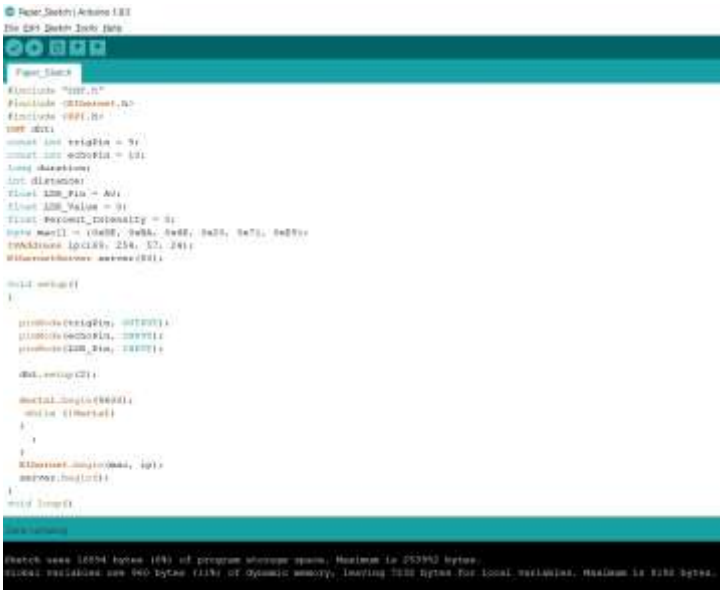

Fig-4: GUI of Arduino IDE

5. Experimentation and Results:

5.1: Formula Used:

For the conversion of analog values received from LDR sensor into the percent value, we used following formula:

LDR_Value = analogRead(LDR_Pin);

Percent_Intensity = ((LDR_Value - 30.00) / 993) * 100;

Percent_Intensity = 100 - Percent_Intensity;

The formula is developed by subtracting the minimum value that is 30.00 (we got this from observation) from LDR_value (variable giving real time analog value of Light Intensity) and then we divided this value by (1023-30=993) as we have 10 bit ADC present in arduino. Then we multiplied this value by 100 to convert into percent. As we were getting the reverse values we used complementary function to get correct values. We got accurate values of temperature and humidity using DHT library. Following Figure Fig-5 is GUI of serial monitor showing all the sensor readings sent through serial port at baud rate of 9600:

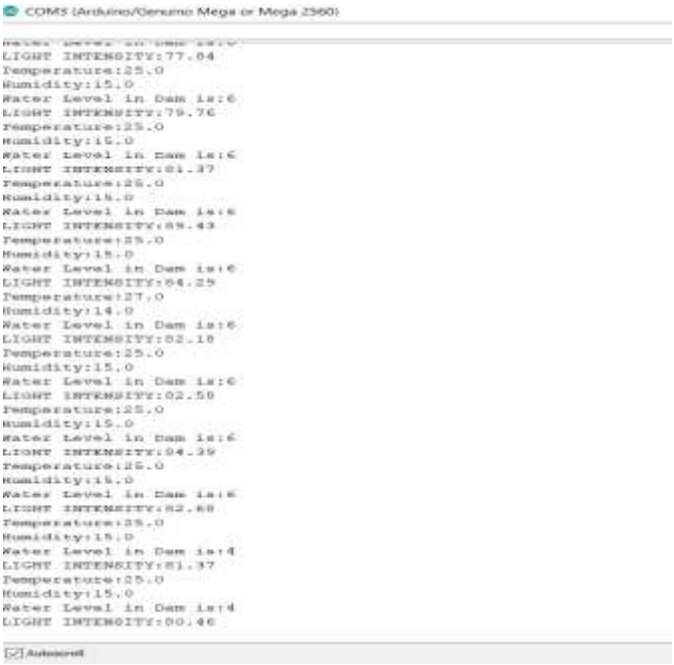

Fig-5: Serial Monitor Output Window

5.2. GRAPHS OBTAINED

The graph of Light Intensity on Serial Plotter is shown in Chart-1:

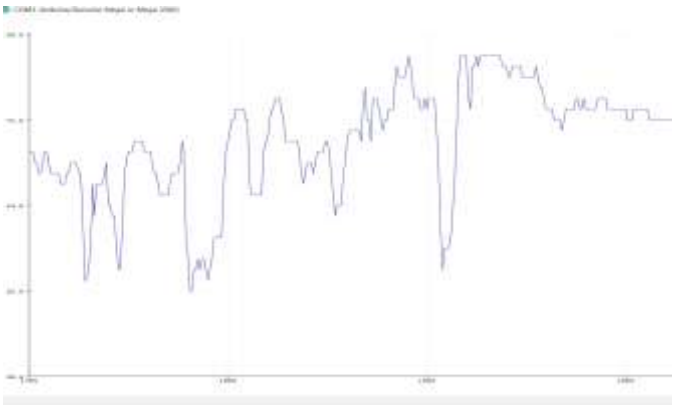

Chart-1: Light Intensity Graph of LDR

The graph of temperature and humidity is also plotted using serial plotter. It is shown in Chart-2:

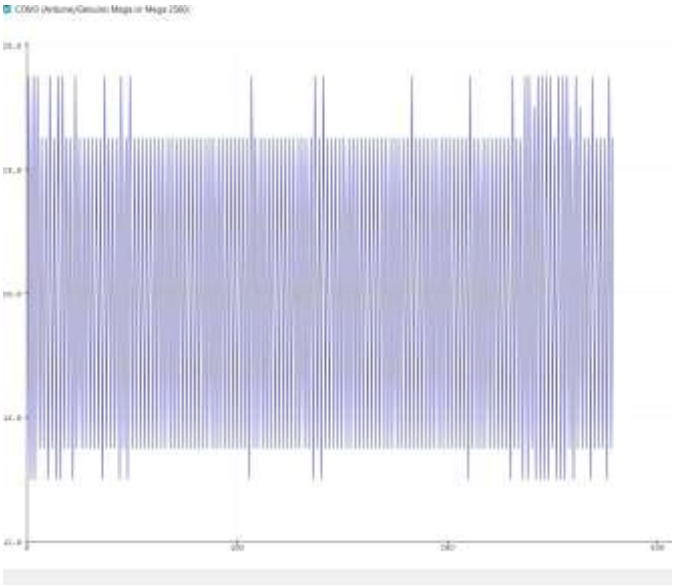

Chart-2: Temperature-Humidity Graph

The final output is shown on the local webserver created using the arduino Ethernet shield. Here we allocated the IP address 169.254.57.24 to the Ethernet shield. When we enter this IP address into the web browser we get all the sensor data on webpage created using basic HTML. The final output is shown in the Fig-6:

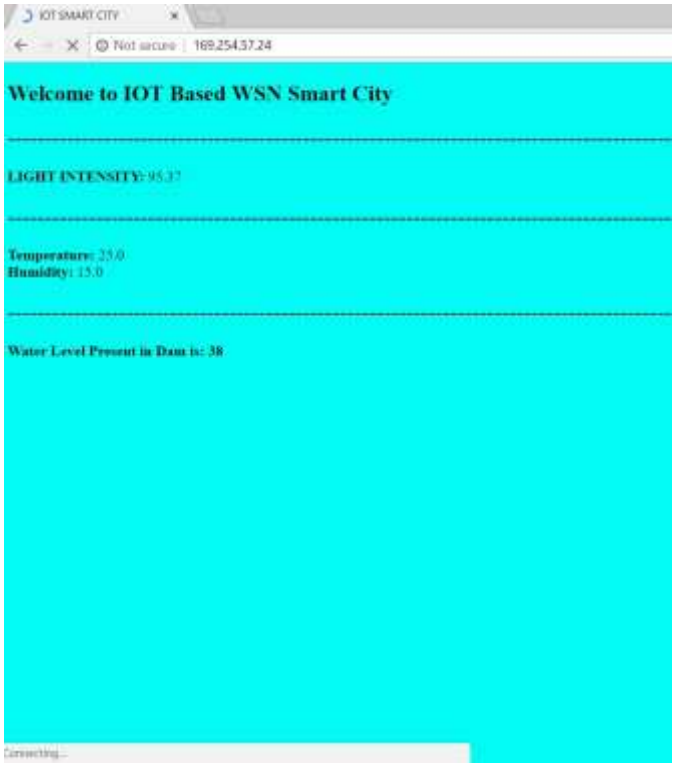

Fig-6: Arduino Local Webserver

6. CONCLUSION

Hence we have developed the proposed system which takes readings from various sensors like LDR, DHT11 and Ultrasonic Sensor HC SR-04 which real time information of the parameters Environmental Light Intensity, Temperature, humidity and water lever present in dam of smart city. We also putted these real time readings onto the arduino webserver created using HTML. The whole interface is secured through hash tag of MD5 encryption technique developed using PHP.

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