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An IOT Based Low Cost Weather Monitoring System

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Abstract: Weather is a phenomenon that describes the present atmospheric conditions like temperature, wind direction, humidity etc. over a geographical location. Weather monitoring involves use of high configuration computer system that require high amount of power and expenditure for installation and maintenance. In the present work we have developed a low cost IoT based system to monitor weather conditions of a location. This system is limited in its geographical radius but its low cost reliable features make it possible to use such a series of systems instead of just one to monitor weather conditions over a large pheriphery.
Keywords: IoT, Weather Monitoring, Low cost weather monitoring

I. INTRODUCTION

Weather is a temporary atmospheric phenomenon over a place on earth. Aristotle around 230 BC, was among the first to document the weather observations. Satellite based imagery has made it possible for meteorologists and weather scientists to trail the changes of weather over a place to understand weather pattern. Very high definition satellite imagery has been instrumental in opening new and better imagery for accurate weather prediction. Internet of Things (IOT) is a combination of using sensors alongwith other similar objects, to perform computing operations and obtaining required results. IOT mainly comprises

II. IOT

IOT has been used in industries like farming, healthcare, home automation and have changed the range into a contract a smart city and also used to forecasting of weather. Weather prediction is very useful to various markets like power industries and farming transport department, and thus weather furcating is part of the economic growth [4]-[6]. Performance Investigation of a Closed Cycle Magneto-Hydrodynamics Power plant with Liquid Metal as Heat Source [7]. Integrated environmental management for sustained development [8], [9] Presents IPv6 neighbour discovery method including IoT devices' automatic lightweight address setting and enhanced RPL-based lightweight routing protocol in the IoT-based wireless inter-device communications environment. Results of an inverter with SPWM in [10] control strategy have better voltage control, and simulation results of system demonstrate that the PV system has the fast and efficient response under changing irradiance levels. An autonomic characteristic gives in [11] to IoT aiming at system feature and security information of IOT and uncertainty, prediction and fuzziness of its change. Focusing on self-assessment of the safety hazard, the self-assessment algorithm of IoT security risk based on a three dimensional average cloud was studied based on the dynamic fusion result of different security factors

With the advancement of Big Data technologies and deep learning techniques, weather forecasting and climate prediction can be done effectively and accurately.

III. IOT FOR WEATHER MONTIORING

A. Connections

The low cost weather monitoring system is powered by a Node MCU based ESP 8266 microcomputer. The connected light dependent resistor (LDR) is a=connected to the analogue connector pin. Another sensor, DHT-11 (digital temperature and humidity) is a digital temperature and humidity sensor. It makes use of a capacitive humidity sensor and a thermistor to measure the humidity level and temperature of surrounding air and sends a digital signal out on the digital-data pin. The LED bulb is connected to the digital pin 1 and a common ground is provided alongwith the DHT11 sensor. NodeMCU can be controlled from any internet enabled device such a smartphone or a PC. An onboard 2.4GHz wifi will enable wireless communication between the connected LED and the control web-socket browser.

Node MCU ESP 8266 microcontroller is powered through its micro USB C-type socket. The external power source from a battery bank of 15000mAh is used for this purpose.

B. Methodology

NodeMCU uses an Arduino IDE (Integrated Development Environment). IDE is the environment, in which codes are written, compiled and uploaded to the boards. An open-source platform is used by us to collect and store sensor data in the cloud. A Web 3.0 based web page is created to display the captured recordings on internet based web-browsers.

Switching of LED bulb is controlled through ESP. ESP is a wifi controlled module. Hence, the state of LED bulb can be changed from ON to OFF from any part of the world using wifi and an active internet connection.

On the Arduino IDE, we open Serial Monitor Window, and refresh the ESP. An IP address of the ESP is generated and is displayed on the serial monitor window. We enter the generated IP address on the web address bar of the browser. Thereby we change the state of the LED from the OFF to the ON state, by clicking on the respective icons. During the normal operation the switching ON and Switching OFF of the LED can be controlled through the wifi.

For blockchain based reporting about smart LED, we would create a feedback loop. This would be done using a LDR module. LDR module has two types of output, an analog and another digital. We would use digital output, because of its characteristic 0 and 1 as output values. In the presence of light, the output would be 1 and 0 otherwise. The output given by module would serve as an input for the Arduino UNO, microcomputer.

A real time weather prediction system presented in this paper has been developed around low cost IoT board and sensors. The temperature, light and humidity are the three important parameters that are monitored and uploaded on thingspeak cloud [9]. The system has been deployed in an indoor environment and values of the parameters have been recorded in Google spreadsheet. A Logistic regression model has been used in Jupyter notebook environment that is trained with prerecorded values of parameters and used to predict the weather parameters in real time environment. The result of the model is also compared with the other works available in literature and the proposed system is slightly better in terms of accuracy. Further, the system can be modified to be used at commercial level and have many applications in smart homes, buildings, sports, hospitals etc.

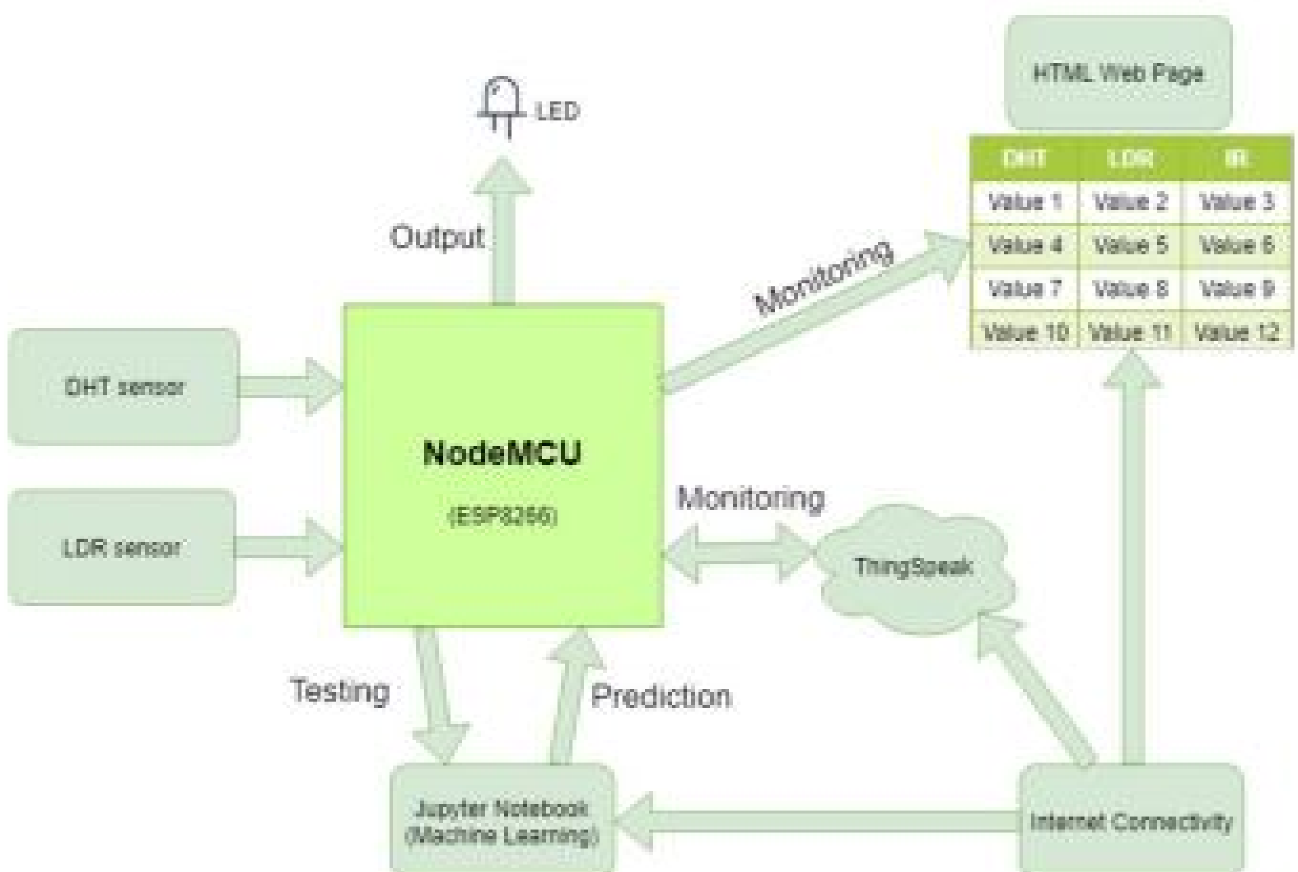

Fig. 1 Experimental model set-up

TABLE I
COMPARISON WITH OTHERS

	Comparitive		
	Bhatkandel et. al. [8]	Radhika et. al. [1]	Experimental values
Algorithms	Decision Tree	ANN	Regression logical
Accuracy	84%	80%	83.57%
Parameters used	Min- Max Temperature, Humidity and Wind Speed	Min- Max Temperature, Rainfall, Cloud Conditions and Wind Stream	Density, Humidity, Temperature, Intensity of light

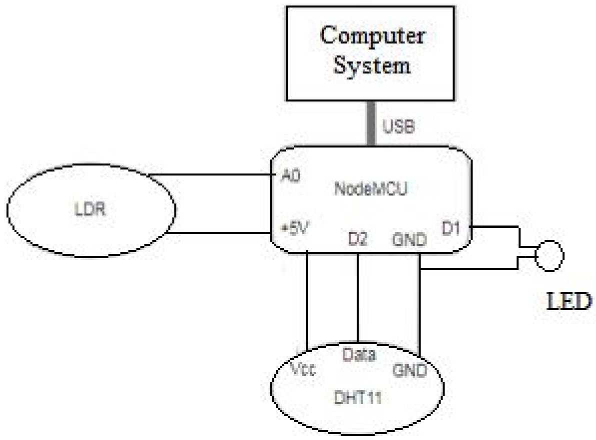

Fig. 2 Block diagram of proposed model

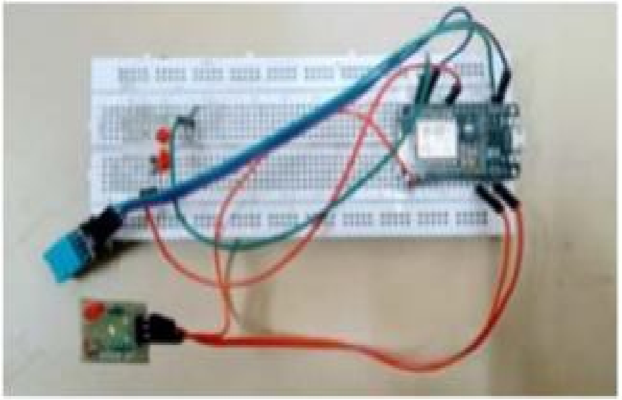

Fig. 3 Experimental set-up

IV. CONCLUSIONS

In this work we have worked to develop, deploy and test an IoT based low-cost system to monitor weather conditions. On an industrial level, IIOT or Industrial Internet of Things can be used on the similar lines to develop a low cost weather monitoring solution. Future work will focus on designing and end-to-end low cost, reliable weather monitoring system that can be used as a swarm at geographical locations highly susceptible to even minor changes in weather conditions.

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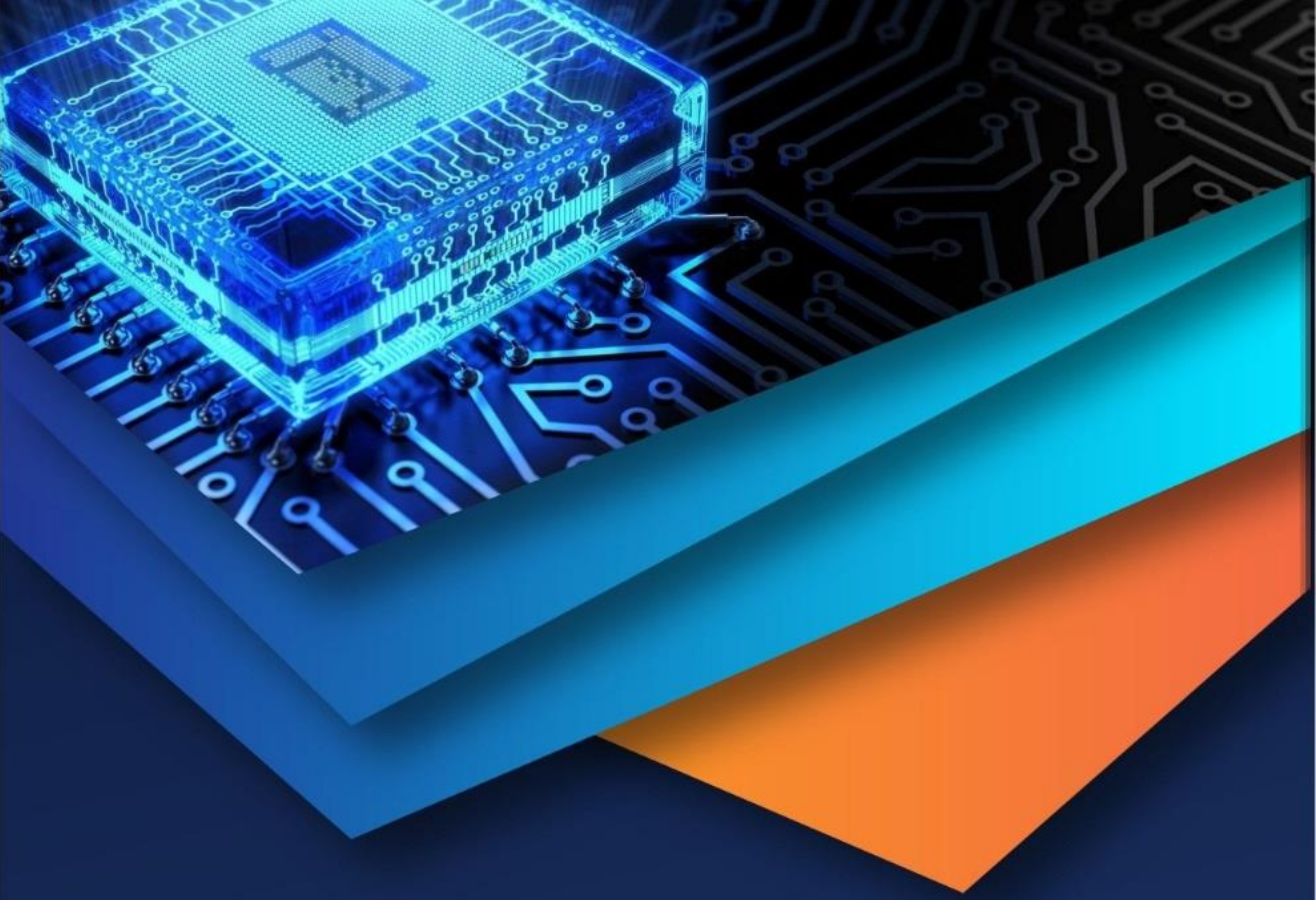

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