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Weather Monitoring using AWS Cloud Computing

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ABSTRACT

The system proposed is an advanced solution for weather monitoring that uses AWS IoT to make its real time data easily accessible over a very wide range. The system deals with monitoring weather and climate changes like temperature, humidity, pressure, altitude using sensors and Raspberry pi as a controller. These sensors data will be stored in the AWS Dynamo DB. The data uploaded to the Cloud can easily be accessible from anywhere in the world. The data gathered in the Cloud can also be used for future references. The project even consists of a MQTT(Message Queuing Telemetry Transport Protocol) protocol that sends Messages/emails as an effective alert system to warn people about sudden and drastic weather changes. Due to the compact design and fewer moving parts this design requires less maintenance. The components in this project don't consume much power. Compared to other devices that are available in the market the Smart weather monitoring system is cheaper and cost effective. This project can be of great use to weather stations, aviation and marine industries and even the agricultural industry.

Keywords: *Internet of things; Raspberry pi; Sensors.*

1.0 Introduction

Internet has become an unavoidable piece of urban life. Utilizing Internet was a serious deal twenty years prior yet today even a youngster can utilize cell phones and workstations no problem at all. Prominence of 3G, 4G innovations, their moderate rates and simplicity of their utilization at last have brought about huge number of Internet clients today. As Internet is utilized for collaboration with different clients, through different stages, for example, Facebook, twitter, sends and so forth, we run over the idea called Internet of Things. The term itself is simple There are various methods by which different electronic instruments can speak with one another. This can be utilized for test of utilizations. In the long run ideal usage of such framework which can speak with one another can be utilized to make a proficient, blunder free framework because of human associations. There are restrictions to the degree up to which a man can take a shot at the other hand with appropriate support and treatment of machines, there is hypothetically no restriction on the efficiency of a

machine. The standard of internet of things can be applied in medicinal services, industry, training etc. There is a space for an improvement when continuous information observing is concerned. We are anticipating give the fundamental data of different parts of a specific city like its climate, traffic and the degree of contamination. No single stage gives us the data about these things on a solitary snap. Moreover, time is a vital part of urban way of life. This paper will give a model which will give ongoing traffic situation in various pieces of a city so as to stay away from your boisterous excursion likewise with the assistance of sensors and raspberry pi , constant information will be gotten and shown on AWS cloud and alexa will be the voice assistant. These qualities will be continuous estimations of genuine climate conditions which you can't jump on internet.

2.0 Literature Review

2.1 Cloud Computing

Cloud computing is a term used to describe both a platform and type of application. A cloud

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computing platform dynamically provisions, configures, reconfigures servers as needed. Servers in the cloud can be physical machines or virtual machines. It is an alternative to having local servers handle applications. The end users of a cloud computing network usually have no idea where the servers are physically located—they just spin up their application and start working. Advanced clouds typically include other computing resources such as storage area networks (SANs), network equipment, firewall and other security devices. Cloud computing also describes applications that are extended to be accessible through the Internet. These cloud applications use large data centers and powerful servers that host Web applications and Web services. Anyone with a suitable Internet connection and a standard browser can access a cloud application.

2.2 Amazon web services(AWS)

Amazon Web Services (AWS)[1] is the market leader in IaaS (Infrastructure-as-a-Service) and PaaS (Platform-as-a-Service) for cloud ecosystems, which can be combined to create a scalable cloud application without worrying about delays related to infrastructure provisioning (compute, storage, and network) and management. With AWS you can select the specific solutions you need, and only pay for exactly what you use, resulting in lower capital expenditure and faster time to value without sacrificing application performance or user experience.

Amazon offers a whole universe of products and services for building or expanding your cloud environment. New and existing companies can build their digital infrastructure partially or entirely in the cloud with AWS, making the on-premise data centre a thing of the past. The AWS cloud ensures infrastructure reliability, compliance with security standards, and the ability to instantly grow or shrink your infrastructure to meet your needs and maximize your budget, all without upfront investment in equipment. Here's a look at some of the services Amazon offers for making IT design and management simple with AWS.

2.3 Amazon Alexa

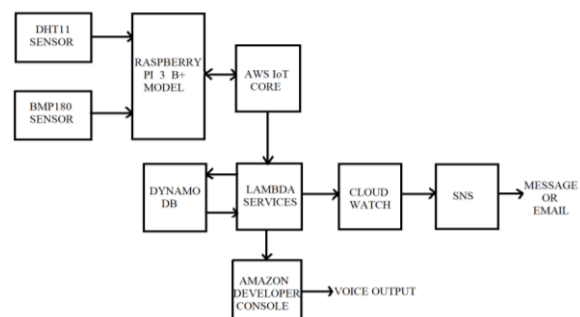
You may have heard of Amazon Echo, the voice-enabled speaker from Amazon that allows you to get things done, by using your voice. The brain behind Echo and other Amazon voice-enabled

devices like Echo Show, Echo Dot, and Amazon Tap is Alexa — the cloud-based service that handles all the speech recognition, machine learning, and Natural Language Understanding for all Alexa-enabled devices. Alexa provides a set of built-in capabilities, referred to as skills, that define how you can interact with the device. For example, Alexa's built-in skills include playing music, reading the news, getting a weather forecast, and querying Wikipedia. So, you could say things like: Alexa, play Music, Alexa, what's the weather in India. In addition to these built-in skills, you can program custom skills by using the Alexa Skills Kit (ASK). An Alexa user can then access these new abilities by asking Alexa questions or making requests.

3.0 Proposed System

In the proposed work, an advanced method of weather monitoring that uses the Amazon web services to monitor and store the values of the various parameters like temperature, humidity, pressure etc. Our proposed system makes use of 2 sensors to measure the weather factors. The sensors are connected to the Raspberry Pi and the values from the Raspberry Pi are obtained in the AWS IoT and they are passed to the Dynamo DB through the Lambda services. The values are passed into Cloud Watch. If there is an increase in the factors of the weather more than the given condition, an email or a message will be sent to the respective mobiles or mails. The figure 1, shows the block diagram of the proposed system.

Figure 1: Block Diagram of Proposed System



3.1 DHT11 sensor

It is used to measure the humidity and temperature. It is very popular for electronics hobbyists because it is very cheap but still providing great performance. The DHT11 temperature range is

from 0 to 50 degrees Celsius with +-2 degrees accuracy. The DHT11 humidity range is from 20 to 80% with 5% accuracy.

Figure 2: DHT 11 Sensor



3.2 BMP180 sensor

It is one of sensor of BMP XXX series. They are all designed to measure pressure and as well as altitude. BMP180 is a high precision sensor designed for consumer applications. The range is from 20 to 80% with 5% accuracy. Pressure range: 300 to 1100hPa. High relative accuracy of ± 0.12 hPa.

Figure 3: BMP 180 Sensor



3.3 Raspberry pi 3 B+ model

The Raspberry Pi is a low cost, credit-card sized computer that plugs into a computer monitor or TV, and uses a standard keyboard and mouse. It is a capable little device that enables people of all ages to explore computing, and to learn how to program in languages like Scratch and Python.

3.4 AWS IoT core

AWS IoT provides secure, bi-directional communication between Internet-connected devices such as sensors, actuators, embedded micro-controllers, or smart appliances and the AWS Cloud. This enables you to collect telemetry data from multiple devices, and store and analyze the data. You

can also create applications that enable your users to control these devices from their phones or tablets.

How AWS IoT Works:

AWS IoT enables Internet-connected devices to connect to the AWS Cloud and lets applications in the cloud interact with Internet-connected devices. Common IoT applications either collect and process telemetry from devices or enable users to control a device remotely.

- Device gateway : It Enables devices to securely and efficiently communicate with AWS IoT.
- Rules engine : The rules engine evaluates inbound messages published into AWS IoT.
- Rule actions : It transforms and delivers them to another thing or a cloud endpoints such as lambda functions and dynamoDB etc.

3.5 AWS Lambda

AWS Lambda lets you run code without provisioning or managing servers. You pay only for the compute time you consume - there is no charge when your code is not running. With Lambda, you can run code for virtually any type of application or backend service- all with zero administration. Just upload your code and Lambda takes care of everything required to run and scale your code with high availability. You can set up your code to automatically trigger from other AWS services or call it directly from any web or mobile app.

3.6 Dynamo DB

Amazon DynamoDB[3] is a fully managed NoSQL database service in AWS. It works with document and key-value storage models, and its high availability and flexibility make it perfect for gaming, mobile apps, and more. Spin up databases with ease and save on compute expenses with DynamoDB.

3.7 Cloud watch

Amazon CloudWatch is a monitoring and management service that provides data and actionable insights for AWS and on-premises applications and infrastructure resources. With CloudWatch, you can collect and access all your performance and operational data in form of logs and metrics from a single platform. This allows you to overcome the challenge of monitoring individual systems and applications in silos (server, network, database, etc.).

3.8 SNS service

Simple Notification Service (SNS) is a highly available, durable, secure, fully managed messaging service that enables you to decouple micro services, distributed systems and server less applications. Amazon SNS provides topics for high throughput, push based, many-to-many messaging.

3.9 Amazon developer console

The first thing we will do is create the interaction model, also called the Voice User Interface (VUI) for our skill. We will do that using the Alexa Developer Console. If you don't have an Amazon Developer Account, Signup [2] for a free account.

- 1 Sign in to your Amazon Developer Account.
- 2 Mouse over Your Alexa Consoles in the top navigation bar.
- 3 In the dropdown menu, click on Skills.

Create Skill :

To start building a skill, click on the Create Skill button in the top right corner. This will bring you to the "Create a new Alexa Skill" wizard. We will walk through this wizard step by step.

Step 1: Skill Information

Follow the steps below to complete the Skill Information:

- 1 Skill Name — The name of the skill as the Alexa skills store will display it. Name your skill TESTEVENTS and click on Next
- 2 Skill Model — While there are a few different models, including Flash Briefing, Smart Home, and Video, we will focus on the Custom Interaction Model in this course. Select the Custom Skill Model and click Create skill.

Step 2: Skill Builder

Once the skill is created, you will be taken to the Skill Builder.

- 1 Interaction Model — In the menu to the left, under Interaction Model, click on Invocation.
- 2 Skill Invocation Name — This is the name that users will say to launch the skill. As a general rule, you want the invocation name to be easy to pronounce, not too long, and at least two words. Here are some guidelines for choosing an invocation name. Because TEST EVENTS is invalid, set the invocation name to TESTEVENTS— (Amazon Alexa doesn't allow one-word invocation names).
- 3 Click on Save Model.

Create the Interaction Model

you came up with unique utterances that map to your skill's "Welcome". Some of your utterances may include "hello", "hiAlexa", "Good Morning", and "Good Afternoon". It's time to put your planning to use by building your first interaction model. If you are not there already, go to the Build tab of the Skill Builder Dashboard. Create the and add sample utterances and connect the lambda functions.

4.0 Result Analysis

Figure 4: Hardware Results

```

publish.py
1 import paho.mqtt.client as mqtt
2 import ssl
3 import Adafruit_BMP.BMP085 as BMP085
4 import Adafruit_DHT
5 from time import sleep
6 import json

Shell
temp=31.0* Humidity=62.0%
Altitude = 0.50 m
Sealevel Pressure = 101317.00 Pa
Temp=31.0* Humidity=62.0%
Altitude = 1.33 m
Sealevel Pressure = 101312.00 Pa

```

Figure 5: AWS IoT Results

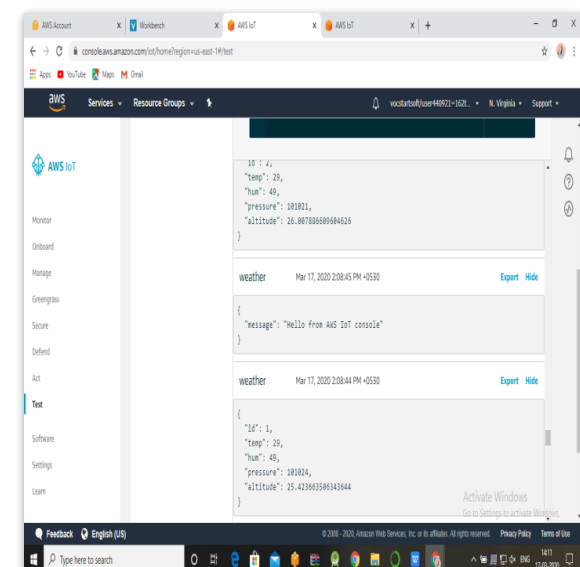


Figure 6: Cloud Watch Results

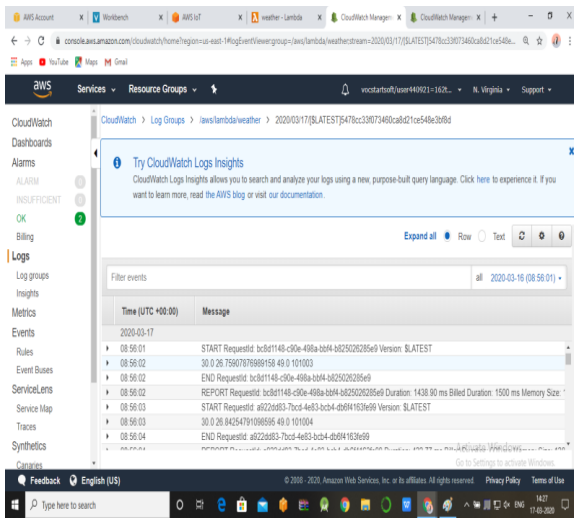
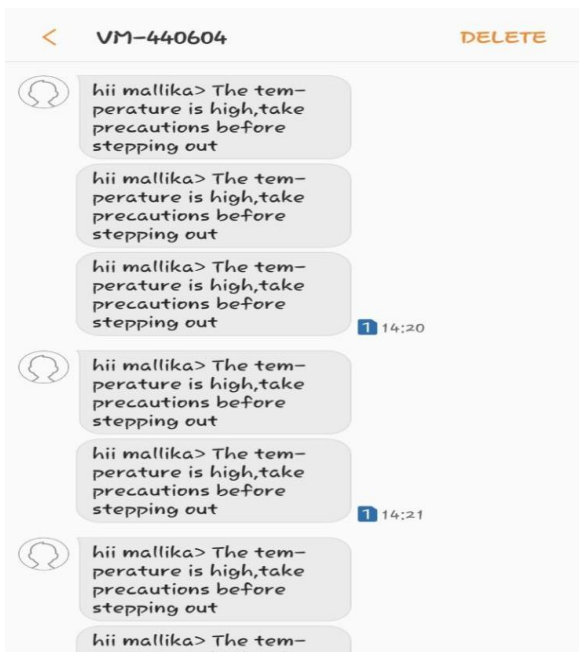


Figure 7: SNS Results



5.0 Conclusions

Finally, we conclude that we can monitor the weather from anywhere in the world by using proposed system and the data is stored in the dynamo DB. So that we can save the previous values. So, it will be useful for future predictions at the weather forecasting stations etc. Using the AWS Services we can easily update the values into the cloud. we can also obtain the parameters of the weather by giving the voice as the input.

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