SCHOOL OF INFORMATION TECHNOLOGY & ENGINEERING
M.TECH (SOFTWARE ENGINEERING)
SWE 4002: CLOUD COMPUTING
FALL 2021-2022

FINAL REVIEW

TEAM Name： Team DCB

Team Member(s)

VAISHALI . S 18MIS0082 vaishali.s@vitstudent.ac.in 8870911968

Project Title : Damage Control For Buildings

1. Problem Statement

1.1 Background

The current approach in the design of climate resistant structures is based on damage prevention during low magnitude earthquakes, allowing some damage during moderate or intermediate tremors and on prevention of collapse during severe earthquakes. This concept seem more economical and more feasible than complete damage prevention in all cases. The concept is implemented by allowing for a design in which the structural members will experience post elastic excursions associated with permanent deformations, stiffness and strength deteriorations. A member experiencing such transformations can be defined as damaged. Indeed after a strong earthquake, many buildings experience various degrees of damage and some collapse. One of the most difficult tasks or the post earthquake inspection is to asses and quantify the seismic damage or estimate the seismic safety and further usability of the remaining building stock. A common factor however unifies these problem. The need for a reliable way to mitigate the hazards to life and property during and in the aftermath of an earthquake. Therefore a better understanding of various degrees of damage and control of such damage by proper design of structures with necessary sensors .

1.2 Problem Statement

Many elements must be addressed in the strength of high-rise buildings due to their fast expansion. It is the process of determining a weakness as a result of ageing, pressure, vibration, movement, raindrops, and temperature. In many areas, it is necessary to monitor high-rise structures and keep an eye on the concrete structure's condition. When the behavior of the structures is known, it is easier to interpret and monitor them. The state of the building may be read and monitored using sensors that sense and communicate data to the cloud, allowing them to be saved before they collapse

1.3Novelty

By providing early warning capabilities, minimizing the threats and maximizing the overall health of the building. The sensors is also used to improve the accuracy of the results which helps to predict the various parameters in monitoring the health of the building which is monitored through the cloud Internet of things (IOT) is effectively used in monitoring the health of the building.

2. Related works :

2.1 Literature Survey (10 per student , only from reputed TR - IF journals)

1. A Disaster Management Framework Using IOT Based Interconnected Devices Author : Kaljot Sharma, Darpan Anand, Munish Sabharwal,
Year : 2021

Description : As the IoT permits interconnections of different devices, the IoT- enabled disaster management system, for early-warning systems, is used by implementing information analytics and computational tools. We relate various open research issues for IoT disaster management programs in this survey. In disaster management, IoT devices are playing a very important and unique role and mitigate the effect of disaster. This paper presents IoT-based disaster management of different disasters and compares between some existing solutions for disasters presenting the role of IoT in disaster management. It shows implementation of some examples of IoT applications, such as, the early-warning system for fire detection and earthquake. It describes the whole application, IoT architecture, and focuses on the study of different disasters.

Strength: So security threats are very less in disaster management. Any malicious users do not obstruct the gathered data from either the multiple event sites to stable and shared systems

Weakness : Due to various factors, it is the need of possibility for selection of the data mining algorithm which will improve the performance of the IoT based on system.

2. Application of Low-Cost Sensors for Building Monitoring:

Author : Behnam Mobaraki , Fidel Lozano-Galant, Rocio Porras Soriano

Year : 2021

Description : his analysis allows to illustrate the potential uses of low-cost sensors in the building sector and addresses the scholars the preferred communication protocols and the most common microcontrollers for installation of low-cost monitoring systems. In addition, special attention is paid to describe different areas of the two mentioned fields of building monitoring and the most crucial parameters to be monitored in buildings. Finally, the deficiencies in line with limited number of studies carried out in various fields of building monitoring are overviewed and a series of parameters that ought to be studied in the future are proposed.

Strength : It represents the various sensors that are available most crucial parameters to be monitored in buildings

Weakness : Its basic and need to be serviced and monitoring requires a lot of people

3. Design and Implementation of a Smart IoT Based Building and Town Disaster Management System in Smart City Infrastructure

Author : Angmin Park, Soung Hoan Park › Lee Won Park , Sanguk Park

Year : 2018

Description : In this a small test-bed was designed and implemented for interlocking and interoperability test of the system between system devices. Most buildings are taller than two floors, so the proposed service is expected to reduce the risk of large damages and many casualties.

They implemented the system in a small test-bed and established an AR-based smart building disaster management service system board installed in a total of 10 system devices (electric leak detectors, temperature and humidity sensors, network cameras, multi gas and dust detectors, flame detectors, gas leak detectors, damper breaker, distribution board, and gas valve breaker). Additionally, they composed the Smart Building Model to simulate the AR-based system providing an evacuation guideline service to the occupants and rescuers by scanning the building structure using smart pads in case of a fire inside the building

Strength : This technique is best for large buildings in interoperability test of the system between system devices.

Weakness : Major effect on Small Building and cannot be operated within the building

4. Smart IoT Based Real-Time Remote System

Author Burak et al

Year : 2019

Description : It presented a framework where IoT can enhance public safety by crowd management through sensing services that are provided by smart phones equipped with various types of sensors. They proposed Trustworthy Sensing for Crowd Management for front- end access to the IoT. The situation-aware IoT service coordination using the event-driven service-oriented architecture (SOA) paradigm. They focused on the design of an event-driven, service-oriented IoT services coordination platform, and they proposed a reliable real- time data distribution model to support the effective dispatching sensory data between information providers and consumers. They proposed an IoT-based autonomous system for workers’ safety in construction sites with real-time alarming, monitoring, and positioning strategies.

Strength : The experiment results show that there are no package loss and package errors during transmission packages in both private and public networks

Weakness : There would be a large network problem as people using the internet are more in the crowd .

5. Sensing Technologies for Monitoring Intelligent Buildings

Author : Anuj Kumar , Senior Member, IEEE, Abhishek Singh, Student Member, IEEE, Ashok Kumar, Manoj Kumar Singh, Pinakeswar Mahanta,

Year : 2018

Description : A sustained research is given in improving the noise reduction and electromagnetic interference in the development of the sensor-actuator based applications. Still in most of the commercial buildings, occupant's comfort parameters are controlled manually thus the operation of devices consume more power. The existing commercial facilities have huge potential to improve energy efficiency and performance by integrating the appliances into building operations without compromising IEQ and thermal comfort. Currently, the real- time measurement and controlling of particulate matter is a crucial issue. The real-time fault and drift detection, fault isolation, communication of sensor condition to the sensor management level, reconfiguration of the sensor operation are a necessity for the realtime applications in the intelligent building. Hence, the implementation of the sensor actuator based applications in intelligent buildings is a necessity .

Strength : The sensor-actuator (S-A) role is enormous in an intelligent building. The monitoring and controlling of the building parameters mainly depends on the sensor characteristics and sensor integration capability

Weakness : The critical issues in real-time building health monitoring are selection of measuring parameters, sensors and installation of the sensor within the building,

6. Structural Health Monitoring: An IoT Sensor System for Structural Damage Indicator Evaluation

Author : Mirco Muttillo , Vincenzo Stornelli , Rocco Alaggio

Year : 2020

Description : In this paper an IoT monitoring system for structural health is presented. The IoT system, with application in Smart Buildings, allows for the measurement of the main parameters for evaluating the damage indicator. The system is based on the microcontroller and high-resolution digital accelerometer Furthermore, the use of an SD card and DMA, the system allows for the acquisition of a high number of samples and communicates through the structural device . The reliable results have been ensured with the high synchronization between the sensors and their high resolution. Instead, the problems of the traditional analog sensors used in the typical monitoring systems have been eliminated with the use of the digital accelerometers. the calculated damage indicators have been reported. However, the proposed monitoring system with a damage indicator approach will detect structural defects or damage after events such as earthquakes or landslides.

Therefore, the proposed monitoring system is cheaper than an analog solution.

Strength : The method, being based on a non-parametric test, does not require to explicitly know system parameters and is suitable for automatic data-driven damage detection monitoring of in-service structures

Weakness : Detecting data may be difficult. Damage detection is a problem that has been studied using various methods

7. AWS IOT (Security Issues in Information Security under AWS-IOT Platform)

Author : M. B. Saffrin Banu1 T. Kavya

Year : 2018

Description : The IoT showcase is developing quickly and as an outcome the consideration has moved from proposing single T components and conventions towards application stages so as to distinguish systems supporting the standard IoT suites of directions and conventions.

AWS IOT cloud doles out a private home catalog for each authentic client. Every private datum are put away scrambled utilizing symmetric key cryptography .
This investigation has secured a subset of business structures and stages for creating mechanical and purchaser based IoT applications . We featured on the safety efforts of every system as checking the different security highlights and resistance against assaults is a standout amongst the most vital contemporary issues confronting the Internet of Things.

Strength : The size of framework for both mass and focused on assaults is not too far off, with the standard reception of the Internet of Things (IOT).

Weakness : The approval procedure in AWS IOT is arrangement based. It can be connected by either mapping wrote standards and strategies to each testament or applying IAM arrangements.

8. AWS Cloud Infrastructure vs Traditional On-Premise

Author : Akshay Kushwaha

Year : 2020

Description : The major outcome of this research was to change the customer's perspective of AWS Cloud and give more information on why it should be preferred over on premise. This is important for start-ups and small/medium sized companies. As any other technology, AWS cloud has its own limitations. But recently AWS Cloud has started sharing their resources with open source communities so that the issues can be found and resolved quickly to provide more efficient user experience. But as provided in the research paper, AWS cloud has more significant advantages over traditional data centres. However, a hybrid cloud storage strategy can be adapted to provide better solutions to organization. If the customer still requires the its data on-premise but with AWS Tools and services, it is recommended to use AWS Outpost to manage those servers and create a hybrid environment. AWS Outpost can help run these servers efficiently and can help the customer to avoid unnecessary costs. This research paper can help start-ups, small/medium sized companies to choose a better environment for their infrastructure with the size of their budge.

Strength : The customer has complete control over the data, software and applications, also the customer decides the configurations, updates and any changes in the system.

Weakness : - On premise won't run as efficiently as AWS Cloud because the latter has more services to make the process more efficient.

9. Wireless Sensor Network Combined with Cloud Computing for Quality Monitoring

Author : Patricia Arroyo , José Luis Herrero, José Ignacio Suárez

Year : 2019

Description : A low-cost, low-power, low-size node has been developed for wireless sensor networks for air quality monitoring. These features make it possible to deploy a large number of nodes to create a ubiquitous sensor network. The use of a gateway enables the pre processing before sending the data, reducing its dimensionality and connecting the nodes directly to the cloud, where the data is stored, processed, and displayed. The aim of the network is the detection of air pollutants in large areas. Its efficiency has been verified by detecting and quantifying volatile organic compounds (BTEX). Pattern recognition techniques have been used for this purpose. The results indicate a proper performance of the system in both tasks, achieving success rates of discrimination and determination coefficients around in the quantification tasks (regression).

Strength : Best proposed approach for climatic control Low-cost air pollution wireless sensors are emerging in densely distributed networks that provide more spatial resolution.

Weakness : The results may change according to the pattern. The final stage in pattern recognition is the estimation of errors or performance of the trained model using validation techniques.

10. A Monitoring Scheme With IOT And Sensor Expertise

Author : Sayeda kausar Fatima

Year : 2019

Description : The aim of this paper is to build a system which monitors the pollution in an area and informs the authorities about the violation when the air pollutants exceeds the threshold value analyzed and stored in the comparison data set. The system also sends the location where this violation has occurred which helps the authorities for easy analysis. In this system sensors are implemented to detect the presence of undesired gases in the air of residential areas. The sensors provide continuous monitoring. Internet of Things technology is used to analyse the collected data for pollution. This system has low-cost, low power consumption, and easy to maintain.

Strength : When the pollution increases beyond the pre- determined threshold, then the gathered data can be sent to the higher authorities for which appropriate actions can be taken by them.

Weakness : The system implementation and hardware connections The analog signal from the sensors is converted to a digital signal where it is passed are not secured much.

11. Efficient and Secure Data Transmission Approach in Cloud-MANET-IoT Integrated Framework

Published year: 2020

Authors: Tanweer Alam

Description : This paper presents The secure data transmission among IoT nodes has been introduced in this research using a framework named Cloud-MANET-IoT Smart physical things can use ubiquitous computation to perform data transmission across physical devices. Pervasive computations are used in IPv6 to cover the proposed architecture as well as well as facilitating machine-to-machine communication. The authors looked at the security requirements as well as communication security issues across all connected devices in the cloud services. The proposed framework has been built, tested, and implemented.

Strength : The Cloud-MANET-IoT structure is an integrated model of Cloud computing and MANET technologies in the internet of things

Weakness : Applications must be deployed on every device

12. Cloud Based IoT Network Virtualization for Supporting Dynamic Connectivity among Connected Devices

Published year : 2019

Authors : Israr Ullah , Shakeel Ahmad , Faisal Mehmood and DoHyeun Kim

Description: This paper presents the concept of virtualized IoT network formation over the cloud environment among connected IoT devices . Recent development in various networking and cloud infrastructure technologies enabled us to explore the concept of IoT network virtualization. enables the rapid development of the functionalities of real devices in the form of a software package and its convenient deployment in the cloud environment. the results of this paper indicate that, when the network traffic grows beyond a certain threshold, gateway nodes then become the performance bottleneck. Utilization of multiple gateway nodes can significantly improve the network performance.Traffic jam can be prevented by dynamically modifying the data transmission rate of the sensors via virtualization server optimization.

Strength : a dynamic virtual network in the cloud environment among connected IoT devices.

Weakness : traffic grows beyond a certain threshold, gateway nodes then become the performance bottleneck

13. From Sensor to Cloud: An IoT Network of Radon Outdoor Probes to Monitor Active Volcanoes

Published year : 2020

Authors : Luca Terray , Laurent Royer , David Sarramia , Cyrille Achard , Etienne Bourdeau , Patrick Chardon , Alexandre Claude , Jérôme Fuchet , Pierre-Jean Gauthier , David Grimbichler , Jérémy Mezhoud , Francis Ogereau , Richard Vandaële and Vincent Breton

Description : This paper presents the implementation of a wireless network of outdoor air radon probes on the Mount Etna Volcano in Sicily .the LoRa network allows several months of autonomy with a global transmission rate close to 100% and a very short delay of transmission (90% of the data are transmitted and data lake and collection of data in hard climate conditions and The communicating nodes are flexible and can be interfaced to other sensors to measure temperature, position, humidity, deformation, tilt, etc. with the help of LoRaWAN technology.

Strength : LoRaWAN Technologies

Weakness : The energy supply needed for several months of autonomy. - The extreme conditions related to meteorology (very strong winds, heavy snowfalls, and extremely low temperatures) and, eventually, to volcanic activity (acidic plumes, damage due to ash, and bombs).

14. Energy Efficient and Reliable Transport of Data in Cloud-Based IoT

Published year : 2019

Authors : HALAH MOHAMMED AL-KADHIM AND HAMED S. AL-RAWESHIDY

Description : This paper present solutions to the problems like power efficiency and reliability and capacity limitations with the methods like.

1. optimization using a mixed integer linear programming (MILP).
2. standby routes selection scheme (SBRS).
3. a desired reliability level scheme (DRLS).
4. reliability-based sub-channel scheme (RBS).
5. reliability-based data compression scheme (RBDS).

By using that methods can significantly reduce energy consumption with an average power saving of 57% for SBRS and 60% for RBDS, compared to DRLS.

Strength : Optmization of models like MILP,RBDS,DRLS,SBRS.

Weakness : the network goes down owing to packet drop out due to capacity limitation

15. Enhancing Cloud-Based IoT Security Through Trustworthy Cloud Service: An Integration of Security and Reputation Approach

Published year : 2019

Authors : G LI , QIXU WANG , XIAO LAN , XINGSHU CHEN , NING ZHANG AND

Description : This paper present Some widely adopted trust assessment methods for evaluating the trustworthiness of cloud services have been proposed from different perspectives. The QoS-driven trust assessment method for cloud services is one of them. Ina compliance-based multi-dimensional trust evaluation system was proposed, which enabled CSCs to determine the trustworthiness of a CSP. This system helps CSC to choose a CSP from candidate CSPs that satisfy its desired QoS requirements. This framework has the ability to enhance the security of the cloud-based IoT context through trustworthy cloud services.

STRENGTH : STRAF framework has the ability to enhance the security of the cloud-based IoT context through trustworthy cloud services
WEAKNESS : Want to work on working prototype

16. Buildings and Road Bridges Structural Condition Monitoring Against Cracks and Vibration Using Embedded System

PUBLISHED YEAR : 2018

AUTHORS : Priyanka R S, Dr. Nataraj K R

DESCRIPTION : This paper present splits recognition flex sensor and vibration sensor for vibration identification and total framework ARMLPC2148 microcontroller it also used system when crack or vibration to notify message with the help of Global System for Mobile Communication (GSM) and Global Positioning System (GPS) The outputs from various sensors the output stored in Mobile base station database

Strength : A System is outlined with various sensors for estimating different parameters like vibration, break, bowing and fire identification and administration

Weakness : the reliability of system can decrease due to adopted areas

17. The Use of Chipless Sensors with RFID for Condition Monitoring

PUBLISHED YEAR : 2018

AUTHORS : H. Gokay Bilic, Tarik Buyukoztekin, Serhan Ozdemir

DESCRIPTION: This paper present Radio Frequency Identification (RFID) technology and components reader known as interrogator and the transponder known as tag. Chip less RFID is so useful in hard climate conditions and climate and to save energy efficiency. They will reform the identification market of low cost product tagging and sensing, especially for condition monitoring applications.

Strength : the chip less RFID sensors with focusing on critical materials for strain and temperature sensing

Weakness : it only survive a certain temperature and conditions

18. An Internet of Things System for Underground Mine Air Quality Pollutant Prediction Based on Azure Machine Learning

Published year : 2018

Authors : ByungWan Jo and Rana Muhammad Asad Khan

Description : This paper present Arduino-based sensor modules for environmental monitoring in UCM. Mine environment index (MEI).Use of AML platform for mine air quality prediction. Identification of the most influential pollutants present in the mine environment and modelling of mine air quality for an accurate prediction of MEI. The proposed ANN-PCA model is 14.8%, and approximately 3%, more accurate, compared to linear regression and ANN models, respectively. Azure Machine Learning enabled quick data processing with easy web service, based on an easy graphical user interface.

Strength : The calibration of the prepared SNs with regression constants was always greater than 95% for almost every parameter, which confirmed the reliability of system

Weakness : These limitations are the harsh environment of underground mines

19. A Lazy Approach to Access Control as a Service (ACaaS) for IoT

Published year : 2018

Authors : Tahir Ahmad , Umberto Morelli ,Silvio Ranise ,Nicola Zannone

Description : This paper present Access Control as a Service (ACaaS) . Architectural design of the smart lock system requirements of access control are, Expressibility, Administration ,Portability Extensibility, Latency, Reliability, Scalability. approach is translating from the high-level policy specification language used in the ACaaS tool to the proprietary specification language of the various CSPs. then it allows to reuse tools for
security analysis leveraging the access control mechanism available in the IoT platform for policy evaluation and enforcement

Strength : Major Cloud Service Providers (CSPs) have proposed platforms to support IoT by combining cloud and edge computing

Weakness : AWS IoT does not allow the specification of fine-grained access control policies

20. Hand Gesture Recognition using Flex Sensor and Machine Learning Algorithms.

Published year : 2018

Authors : Akash Kumar Panda, Rommel Chakravarty, Soumen Moulik

Description : This paper present a mechanism of hand gesture recognition using flex sensors and Arduino UNO and deep learning models include fast-gradient sign method (FGSM), basic iterative method (BIM) or momentum iterative method (MIM).the improve of accuracy 88.8%.

Strength : It will helps in healthcare and crime department.

Weakeness : Need to improve the results

21 Cloud platform wireless sensor network detection system based on data sharing

Author : Shuo Xiao Tianxu Li Bin Guo Zhenzhen Huang

Year : 2018

Description : Cloud computing is one of the more popular technologies nowadays, and at the same time, cloud computing also brings a lot of benefits for enterprises. Building a private cloud platform within the enterprise can facilitate enter- prise information management, save resources, and bring opportunities for the development of enterprises. The virtualization technology is used to provide different levels of services so that users can use the cloud service anywhere, including smart client, or login of cloud platform through the browser. It can also be integrated with other systems to form an application with its own characteristics.

Strength : The use of cloud platform can ensure that the data, after disaster, can quickly recover from the backup without affecting the user's use.

Weakness : According to the needs, use and pay method is used for allocation of computing, storage and bandwidth resources. The cloud is a huge pool of resources, which can be bought as required**22 Early Detection of Building Collapse using IoT**

Author : Niranjan.D.K , N.Rakesh

Year : 2020

Description : Early detection of the building collapse is based on the IoT platform where the system is a more reliable, effective and fast system which helps the residents of the area or the person who is living in any structure, where monitoring the structured data is effective. This helps them to take necessary action at the earlier stage so that they can safeguard themself. So, the person can take necessary action whenever by monitoring the data. The person can be stress-free on the structure because the person will get an alert if anything happens at the starting stage only. The proposed system is implemented in the Arduino board and monitored in the serial monitor.

Strength : The system is generated and simulated as per the details. This project can be implemented in any structural buildings. It can be placed to the pillar and the roof of the building.

Weakness : It can extended by adding few more sensor like moisture sensor for monitoring the wet walls or roof, adding more flex sensor so that it helps to calibrate

23 Easy and Secure Handling of Sensors and Actuators as Cloud-Based Service

Author : REYES SÁNCHEZ-HERRERA , MARCO A. MÁRQUEZ ,

Year : 2019

Description : This presents a set of tools to facilitate the adoption of Industry 4.0 across all sectors of the business world. Although many industries have already migrated their IT processes to the cloud, the OT component remains accessible only at local level. The tools presented in this paper, based on open hardware and free software platform, and implemented in EJS/EJSS, enable IT and OT to be integrated and accessed remotely. The integration of systems and devices running different protocols is achieved through Mod- bus TCP/IP within a single of level of the LAN.

Strength : The result is a secure, controlled, organized and collaborative access to physical systems, which are in this way available 24 hours.

Weakness : The solution and results addressed in this research are extrapolated to other sectors as the industry, service or household. Really, the application scope is not a problem, because the solution is completely general.

22 Early Detection of Building Collapse using IoT

Author : Niranjan.D.K , N.Rakesh

Year : 2020

Description : Early detection of the building collapse is based on the IoT platform where the system is a more reliable, effective and fast system which helps the residents of the area or the person who is living in any structure, where monitoring the structured data is effective. This helps them to take necessary action at the earlier stage so that they can safeguard themself. So, the person can take necessary action whenever by monitoring the data. The person can be stress-free on the structure because the person will get an alert if anything happens at the starting stage only. The proposed system is implemented in the Arduino board and monitored in the serial monitor.

Strength : The system is generated and simulated as per the details. This project can be implemented in any structural buildings. It can be placed to the pillar and the roof of the building.

Weakness : It can extended by adding few more sensor like moisture sensor for monitoring the wet walls or roof, adding more flex sensor so that it helps to calibrate

23 Easy and Secure Handling of Sensors and Actuators as Cloud-Based Service

Author : REYES SÁNCHEZ-HERRERA , MARCO A. MÁRQUEZ ,

Year : 2019

Description : This presents a set of tools to facilitate the adoption of Industry 4.0 across all sectors of the business world. Although many industries have already migrated their IT processes to the cloud, the OT component remains accessible only at local level. The tools presented in this paper, based on open hardware and free software platform, and implemented in EJS/EJSS, enable IT and OT to be integrated and accessed remotely. The integration of systems and devices running different protocols is achieved through Mod- bus TCP/IP within a single of level of the LAN.

Strength : The result is a secure, controlled, organized and collaborative access to physical systems, which are in this way available 24 hours.

Weakness : The solution and results addressed in this research are extrapolated to other sectors as the industry, service or household. Really, the application scope is not a problem, because the solution is completely general.

26 Ensuring Interoperable IoT Device-to-Cloud Communication between AWS and Azure Infrastructures

Author : S. I. Zhukov

Year : 2020

Description : It has been shown that there are significant differences between the two—AWS and Azure—infrastructures. In some respects, Amazon Web Services offers better functionality (e.g., flexible topic system) to the IoT device, whereas certain features of Microsoft Azure (e.g., direct methods) make it a preferable IoT infra- structure solution. Nevertheless, during the develo ment of the IoT device firmware with the goal of ensuring its portability, we have managed to make the most of the infrastructure-neutral code while localizing dependencies in several small functions in the inter- face module.

Strength : The proposed technical solutions can be reused for connection to other IoT infrastructures

Weakness: The authentication mechanism remains the same the upgrade header passes slightly different parameters as compared to AWS.

27 Implementation of Bridge Strength Detection and Accident Prevention System using Raspberry pi

Authors-Abhishek R. Sonar, Husain K. Bhaldar, Rohit S. Ranaware, Tanjim M. Sayyad

Year: 2020

Description : This paper is effectively experimented & implemented for bridge strength monitoring and alert system to avoid crisis scenarios. Which helps for easy monitoring of bridge parameters. Advanced sensors such as flex sensor, vibration sensor and IR sensor the data of these sensors are precise and accurate. The changes detected by the sensors are processed by Raspberry pi to get the obtain of the bridges. For communication they have used GSM communication system instead of wired communication to reach remote area access.

Strengths
Avoid accidents and life loss.
Improve disaster management capability.
Early damage detection.

Weakeness: structure's strength and serviceability. The changes detected by the sensors are processed by Raspberry pi to get the obtain of the bridges.

28 A Reliable Trust Computing Mechanism Based on Multisource Feedback and Fog Computing in Social Sensor Cloud

Authors: Junbin Liang , Min Zhang , and Victor C. M. Leung

Year: 2020

Description : Social sensor cloud (SSC) is combined with social network, wireless sensor network, cloud computing, and fog computing. The devices of fog computing can independently process and store data, and feedback more quickly in SSC. A fusion algorithm is designed to aggregate different types of feedback trust values, which overcoming the limitation of trust weights in artificial weighting and subjective weighting in traditional trust mechanisms.

Strengths
reliable trust computing mechanism (RTCM)
packet success rate, routing success
rate (interactive frequency), forwarding delay, data correctness rate

Weakness
message forgery,message tampering, reply attacks, hidden data attacks

29 Amazon, Google and Microsoft Solutions for IoT: Architectures and a Performance Comparison

Authors: paola pierleoni , roberto concetti , alberto belli , and lorenzo palma

Description: The growth in Cloud platforms with IoT world is increasing. The paper highlights the characteristics of each platform including Google cloud ,AWS ,Azure with mapping of services and reference architecture. Each platform provides a Cloud access point through which physical devices can connect in a secure and private way. After an authorized connection, devices can start to send their data to the Cloud and by checking through it the most used protocol is MQTT. By increasing the load in each scenario and keeping in mind the use of free tiers for each platform, we were also able to verify the limitations imposed by the providers. The final analysis was made on costs of the platforms according to different types of load and service usage, helping the readers to compare and make the choice.

Strengths

Analysis of different cloud platform and services and its usage for different loads and services

Weakness

cost of services makes users to use less of service and load
gain unauthorized access on user devices

Comparative statement

No.	Source by Author	Subject of Study (Type of Building)	Number of Stories	Types of Sensors Used	Measured Parameters
1	Demetriou	3-story building	3	_	Reduction in stiffness because of harmonic motion
2	Dong et al.	Van Nuys hotel and imperial country service building	_	_	Relationship between the severity of damage and damage index
3	Yanget al.	Steel frame building	20	-	Dynamic behavior due to seasonal frost
4	Autunes et al.	Adobe masonry structure	_	Optical fiber sensors	Natural frequency
5	Hisonet al.	Tufa wall	_	Magnetoelastic sensors	Elastic deformation and fracture alarm
6	Mahjoubiet al.	Shanghai tower	_	Triaxial accelerometer	To reduce the number of sensors
7	Sajedi and Liang	RC moment frame building	3	_	Prediction of damage location, existence, Severity
8	Soltaninejadet al.	Two adjacent building	_	_	Anticipate pounding
9	García-Macías and Ubertini	Sciri tower	_	Accelerometers	Levels of frequency and deformation
10	Sunet al. (2019)	Skyscraper building (Al Harma Tower)	86	_	To find the building deformation due to heavy dead load and seismic response
11	Chelliniet al.	Composite frame structure		Accelerometer sensors	Damage in beam-column joint
12	Morales-Valdezet al.	5-story building	5	MEMS Technologies based accelerometers	Predict damage by adopting a wave propagation algorithm
13	Pachón et al.	Heritage building (Monastery of San Jeronimo de Buenavista)	_	_	Dynamic behaviour like ambient vibration and model identification

14	Frigui et al.	Ophite tower	18	_	Damage severity
15	García-Macías and Umbertini	Consoli palace	–	various sensors types	Damage
16	Li et al.	Tall building (Ping an Finance Centre)	–	different sensors	Vertical deformation in the various structural element
17	Zhanget al.	108-story building	108	Accelerometers and tilt sensors	Monitor and damage prediction
18	Modenaet al.	Heritage structures, Spanish fortress, and tower (L'Aquila), Scrovengni chapel (Padova), the stone tomb of Cansignorio	–	–	static and dynamic response of the building
19	Aguilaret al.	Adobe church	_	Accelerometers	Damage post-earthquake
20	Coletta et al.	Sanctuary of Vicoforte	_	various sensors	Dynamic behaviour for all environmental degradation

2.3 Hardware Requirement :

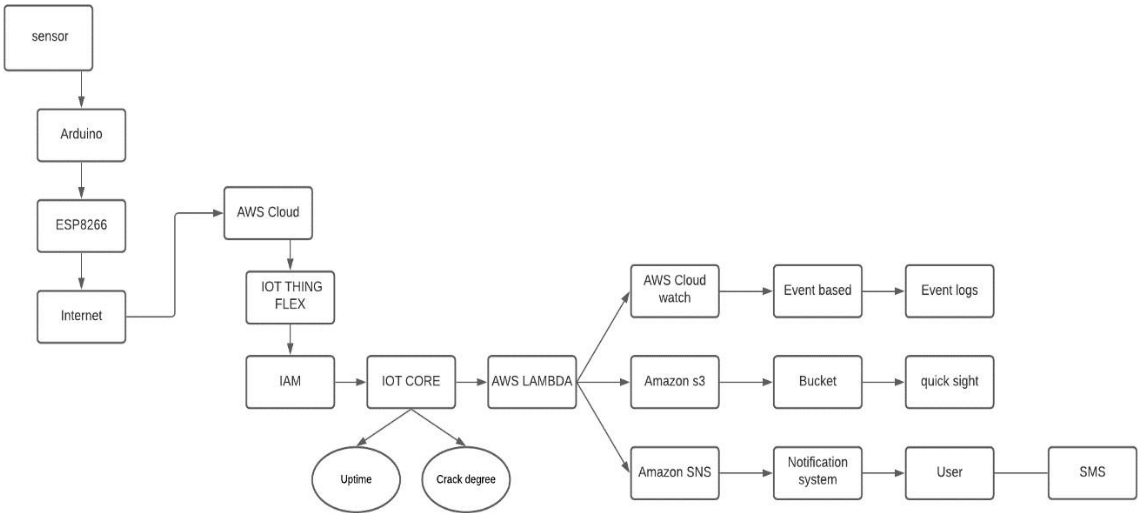
- ESP8266
- Flex sensor
- Wires
- Breadboard
- Resistor

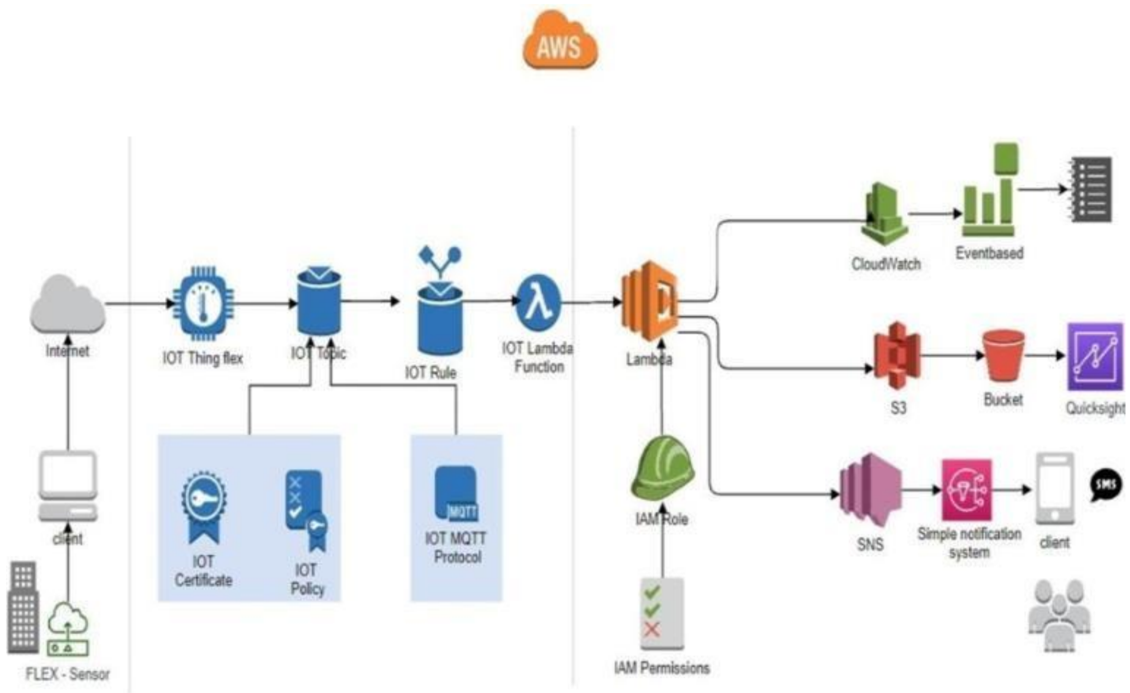
2.4 Software Requirements

Arduino 1.8.16

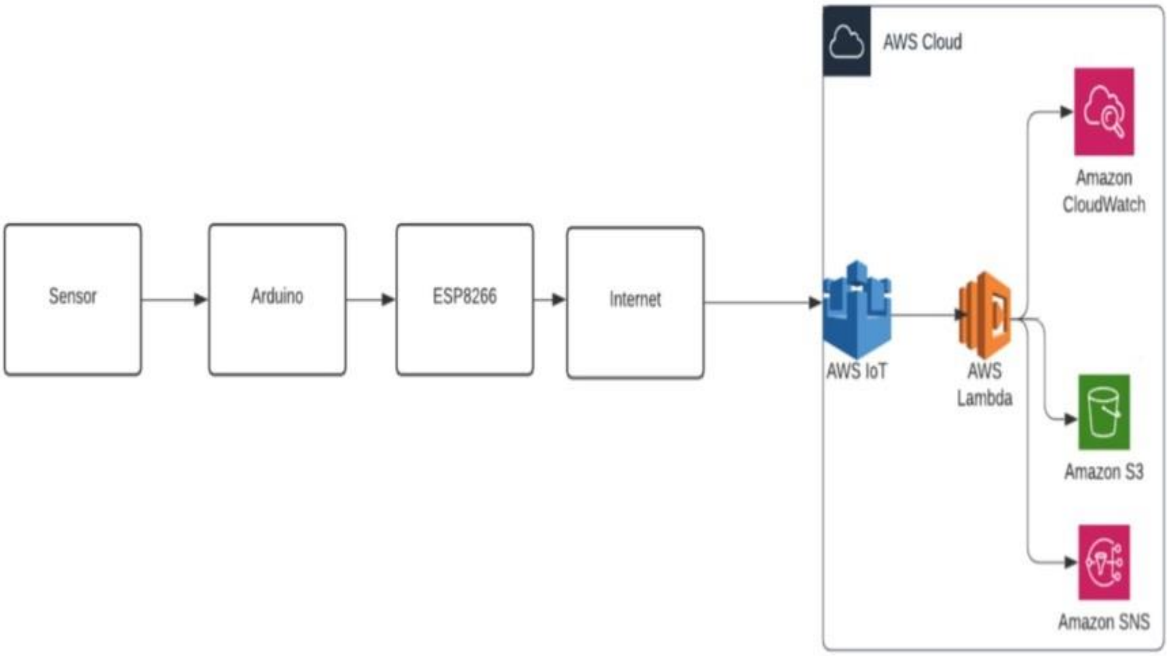
3. System Design

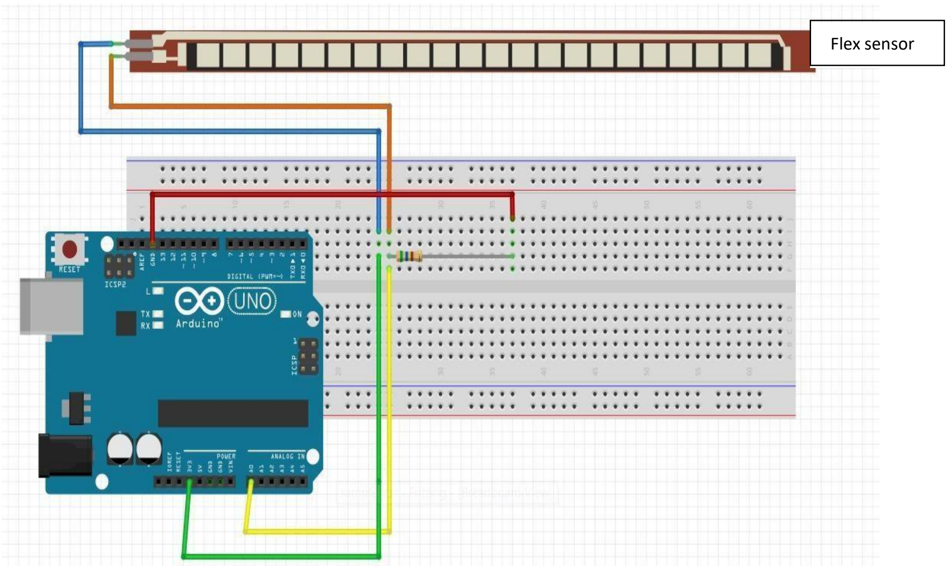
3.1 High level Design





3.2 Low level design





	AWS
Device management	IOT device management
	Console
	Command line interface
Data communication Protocols	MQTT 3.11 HTTP(S)
Rules	Rules Engine (SQL -like rules)
Cold storage	AWS S3
Integrations	AWS LAMBDA
	AWS SNS
Languages	Python
	C ++
Security	X.509 certificate
	AWS IAM

4. System Implementation

4.1 Code :

```
#include <ESP8266WiFi.h>
#include <PubSubClient.h>
extern "C" {
#include "libb64/cdecode.h"
}const char* ssid;
const char* password;
const int FLEX_PIN = A0;
const float VCC = 3.29; // Nodemcu Voltage
const float R_DIV = 56000.0; // R2 (external resi value)
const float STRAIGHT_RESISTANCE = 26500.0; // resi when straight
const float BEND_RESISTANCE = 70000.0; // resi at 90 deg


// Find this awsEndpoint in the AWS Console: Manage - Things, choose your thing
// choose Interact, its the HTTPS Rest endpoint
const char* awsEndpoint =;

// For the two certificate strings below paste in the text of your AWS
// device certificate and private key, comment out the BEGIN and END
// lines, add a quote character at the start of each line and a quote
// and backslash at the end of each line:

// xxxxxxxxxx-certificate.pem.crt
const String certificatePemCrt =;

// xxxxxxxxxx-private.pem.key
const String privatePemKey =;

const String caPemCrt = ;


WiFiClientSecure WiFiClient;

void msgReceived(char* topic, byte* payload, unsigned int len); //function prototype

PubSubClient pubSubClient(awsEndpoint, 8883, msgReceived, WiFiClient);

X509List *rootCert;
X509List *clientCert;
PrivateKey *clientKey;
```

```
void setup() {
  Serial.begin(115200); Serial.println();
  pinMode(FLEX_PIN, INPUT);
  Serial.println("ESP8266 AWS IoT Example");
  Serial.print("Connecting to "); Serial.print(ssid);
  WiFi.begin(ssid, password);
  WiFi.waitForConnectResult();
  Serial.print(", WiFi connected, IP address: "); Serial.println(WiFi.localIP());
 // get current time, otherwise certificates are flagged as expired
  setCurrentTime();

  uint8_t binaryCert[certificatePemCrt.length() * 3 / 4];
  int len = b64decode(certificatePemCrt, binaryCert);
  clientCert = new BearSSL::X509List(binaryCert, len);

  uint8_t binaryPrivate[privatePemKey.length() * 3 / 4];
  len = b64decode(privatePemKey, binaryPrivate);
  clientKey = new BearSSL::PrivateKey(binaryPrivate, len);

  WiFiClient.setClientRSACert(clientCert, clientKey);

  uint8_t binaryCA[caPemCrt.length() * 3 / 4];
  len = b64decode(caPemCrt, binaryCA);
  rootCert = new BearSSL::X509List(binaryCA, len);

  WiFiClient.setTrustAnchors(rootCert);
}

unsigned long lastPublish;
int msgCount;

void loop() {

  pubSubCheckConnect();

  //Add a JSON package of fake data to deliver to AWS IoT
  //Uses snprintf but other viable options are: sprintf, strcpy, strncpy, or
  //Use the ArduinoJson library for Efficient JSON serialization
  //If you need to increase buffer size, then you need to change MQTT_MAX_PACKET_SIZE in
PubSubClient.h

   // Read the ADC, and calculate voltage and resistance from it
  int flexADC = analogRead(FLEX_PIN);
  float flexV = flexADC * VCC / 1023.0;//felxADC=Vout
  float flexR = R_DIV * (VCC / flexV - 1.0);
```

```
// Serial.println("Resistance: " + String(flexR) + " ohms");//

 // Use the calculated resistance to estimate the sensor's
 // bend angle:
 //float angle = map(flexR, STRAIGHT_RESISTANCE, BEND_RESISTANCE,
 //                  0, 90.0);
 char fakeData[128];
 sprintf(fakeData,  "{\"uptime\":%lu,\"crackdegree\":%.2f}", millis() / 1000, flexR);

 if (millis() - lastPublish > 10000) {
    pubSubClient.publish("outTopic", fakeData);
    Serial.print("Published: "); Serial.println(fakeData);
    lastPublish = millis();
 }
}
void msgReceived(char* topic, byte* payload, unsigned int length) {
 Serial.print("Message received on "); Serial.print(topic); Serial.print(": ");
 for (int i = 0; i < length; i++) {
   Serial.print((char)payload[i]);
 }
 Serial.println();
}
void pubSubCheckConnect() {
 if ( ! pubSubClient.connected()) {
   Serial.print("PubSubClient connecting to: "); Serial.print(awsEndpoint);
   while ( ! pubSubClient.connected()) {
     Serial.print(".");
     pubSubClient.connect("ESPthing");
   }
   Serial.println(" connected");
   pubSubClient.subscribe("inTopic");
 }
 pubSubClient.loop();
}
int b64decode(String b64Text, uint8_t* output) {
 base64_decodestate s;
 base64_init_decodestate(&s);
 int cnt = base64_decode_block(b64Text.c_str(), b64Text.length(), (char*)output, &s);
 return cnt;
}
void setCurrentTime() {
 configTime(3 * 3600, 0, "pool.ntp.org", "time.nist.gov");

 Serial.print("Waiting for NTP time sync: ");
 time_t now = time(nullptr);
 while (now < 8 * 3600 * 2) {
   delay(500);
```

```
    Serial.print(".");
    now = time(nullptr);
  }
  Serial.println("");
  struct tm timeinfo;
  gmtime_r(&now, &timeinfo);
  Serial.print("Current time: "); Serial.print(asctime(&timeinfo));
}
```

5 . Results and discussion :

5.1 Implementation results :

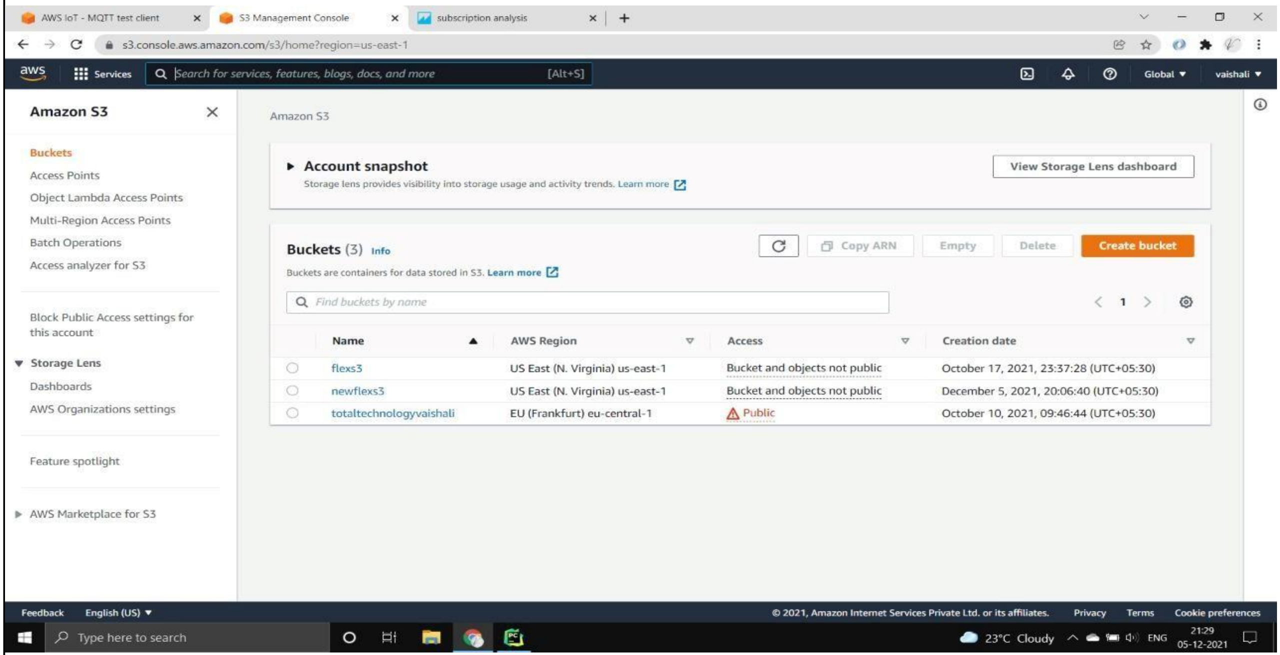


Figure 1 – S3 Bucket

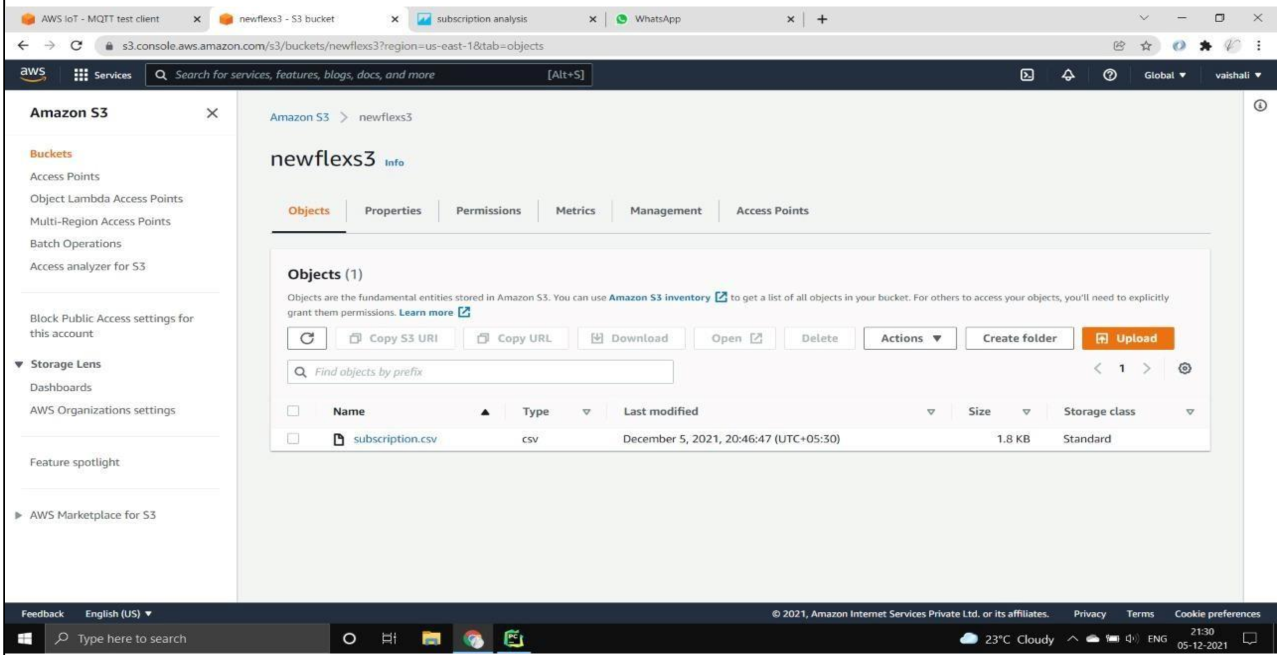


Figure 2 – S3 Object

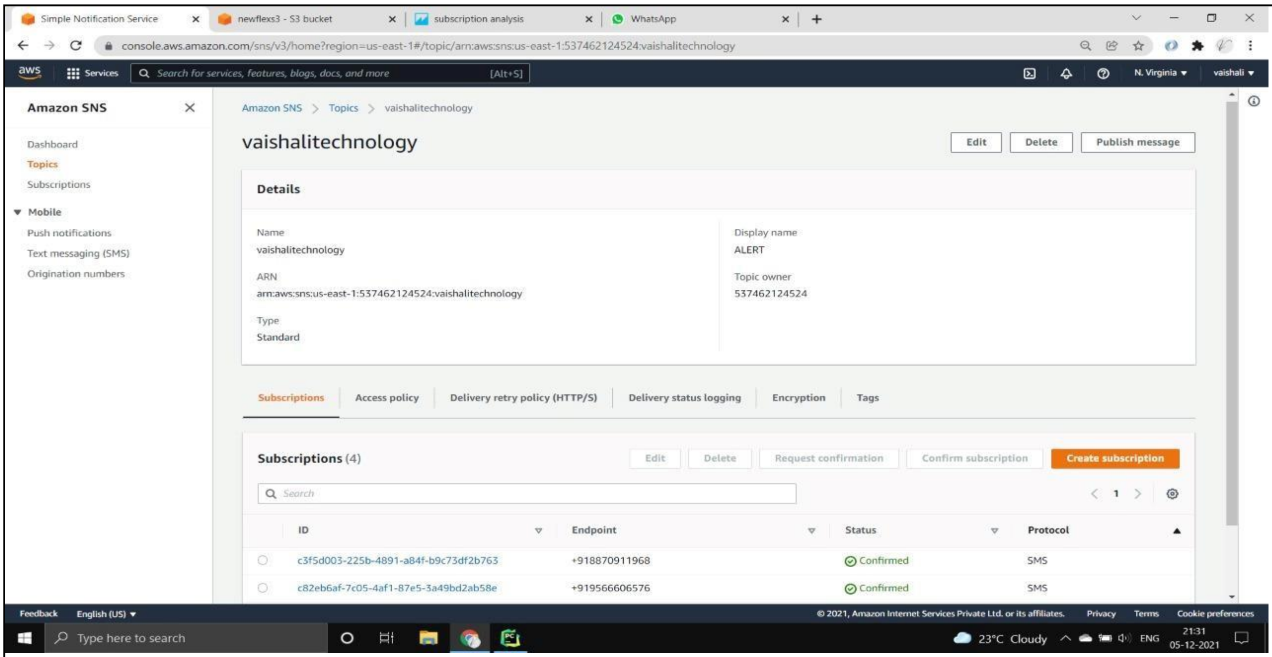


Figure 3 - SNS

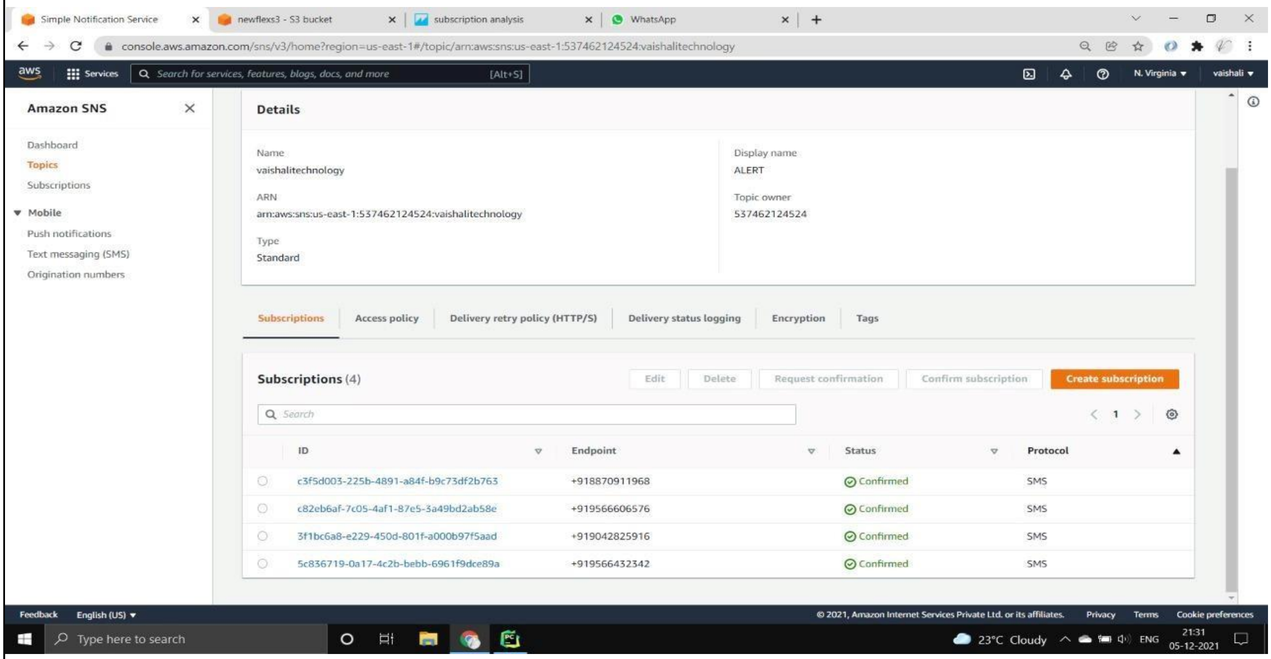


Figure 4 – SNS Subscription

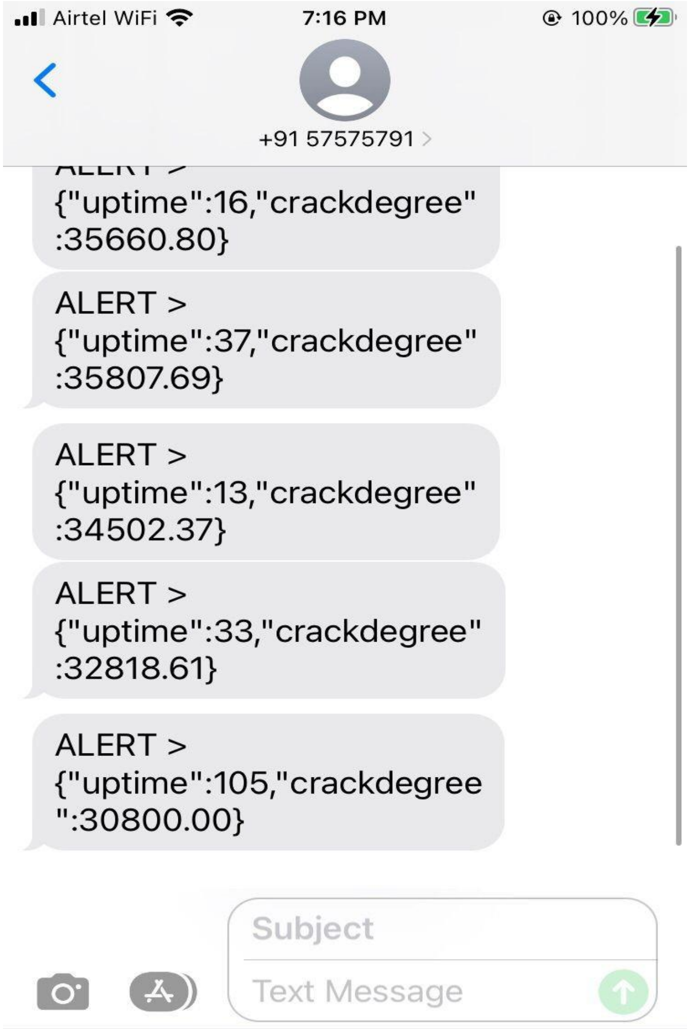


Figure 5 – SNS SMS

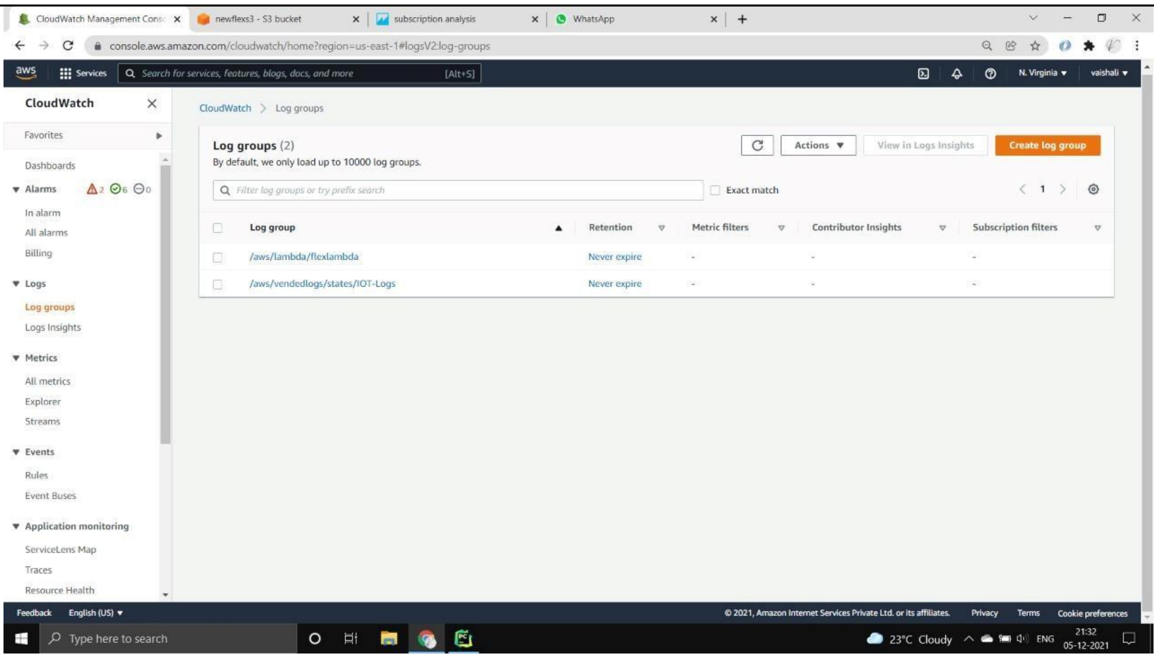


Figure 6 - Cloudwatch

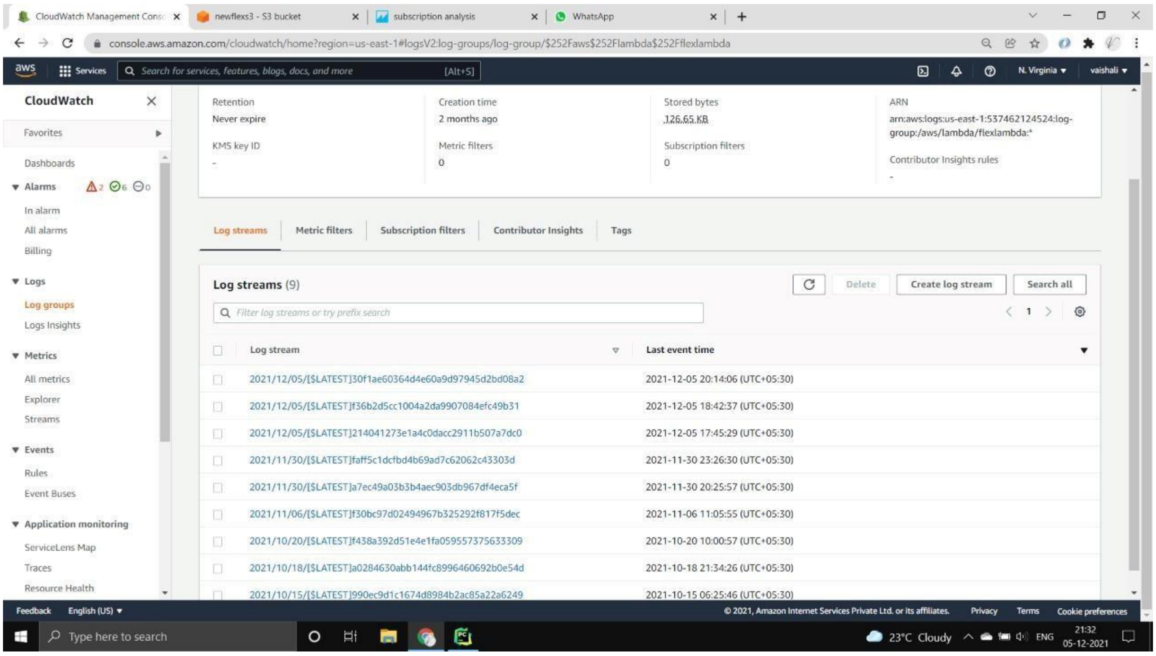


Figure 7 – Cloudwatch Log Group

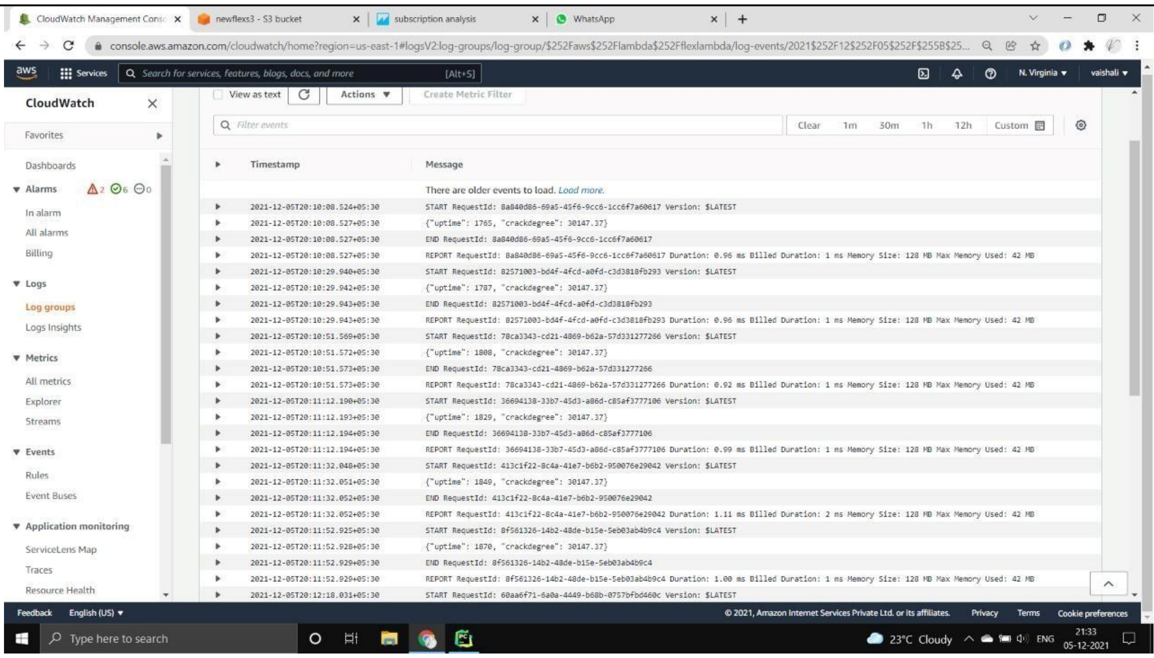


Figure 8 – Cloudwatch Logs

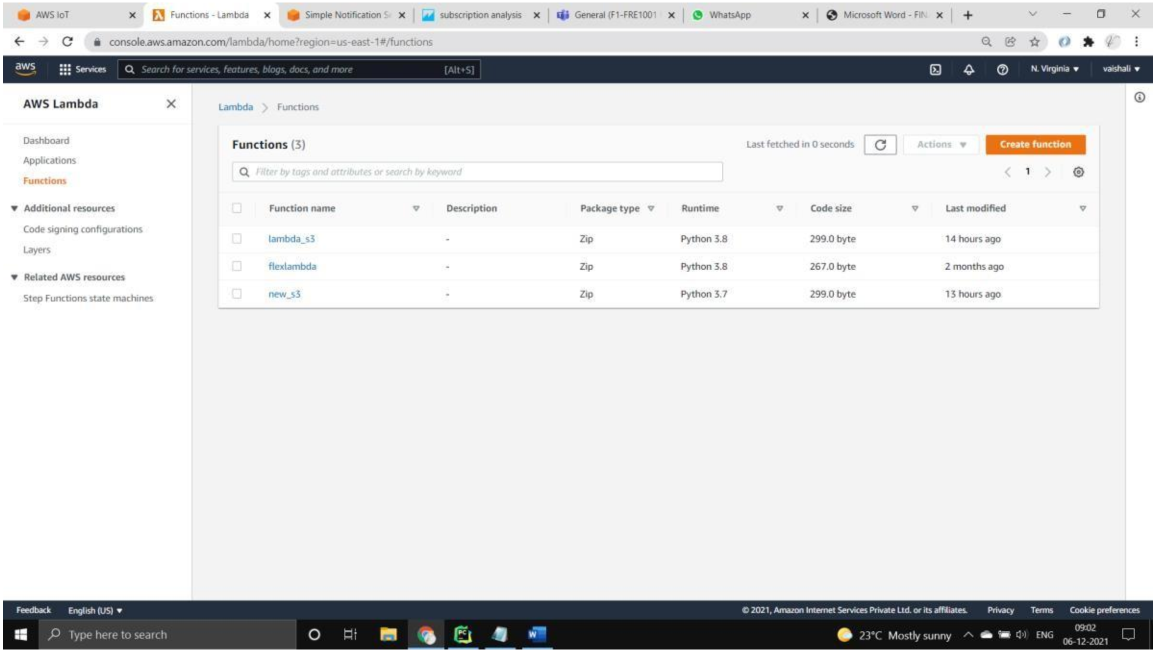


Figure 9 – Lambda

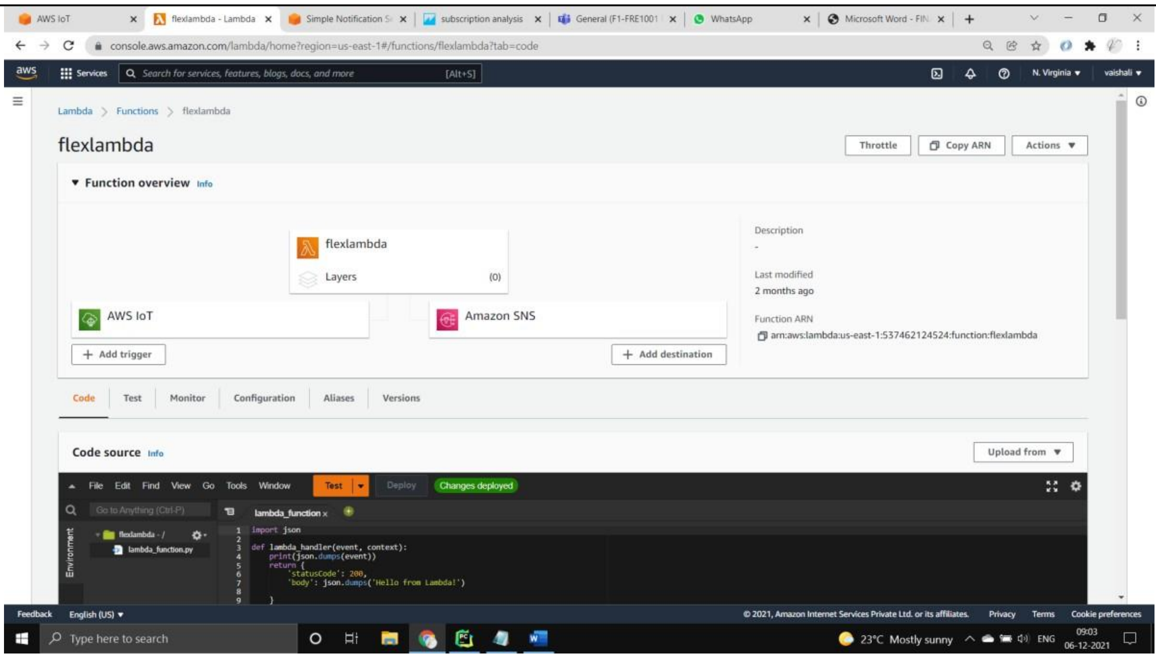


Figure 10 – Lambda to SNS

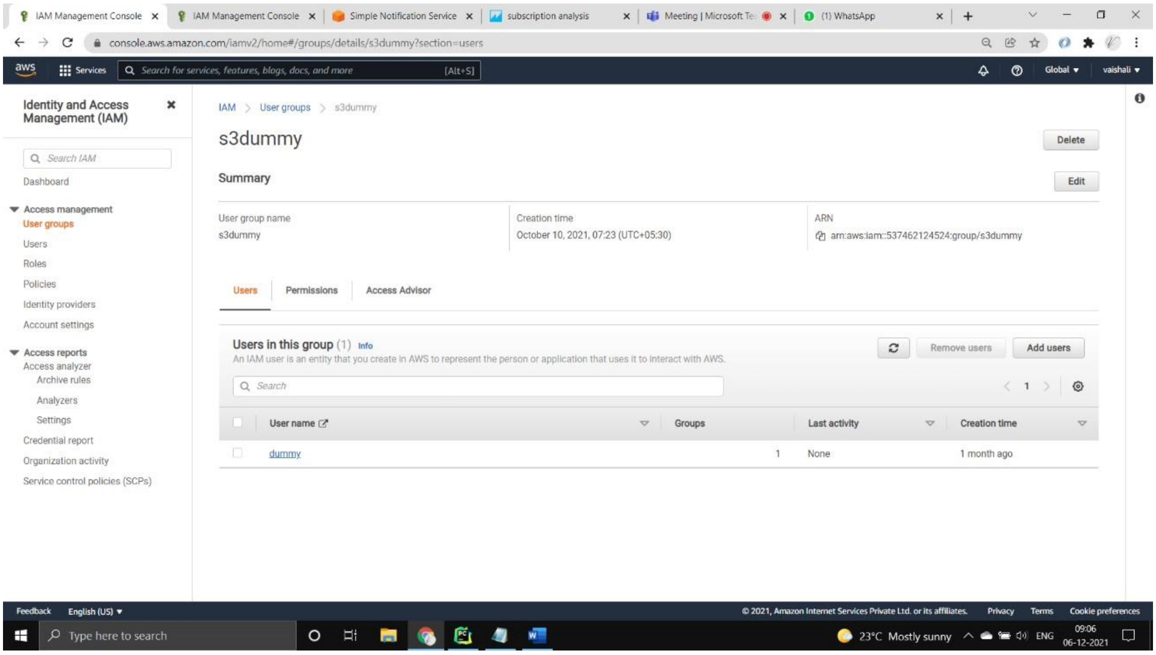


Figure11 – IAM

5.2 Graphs :

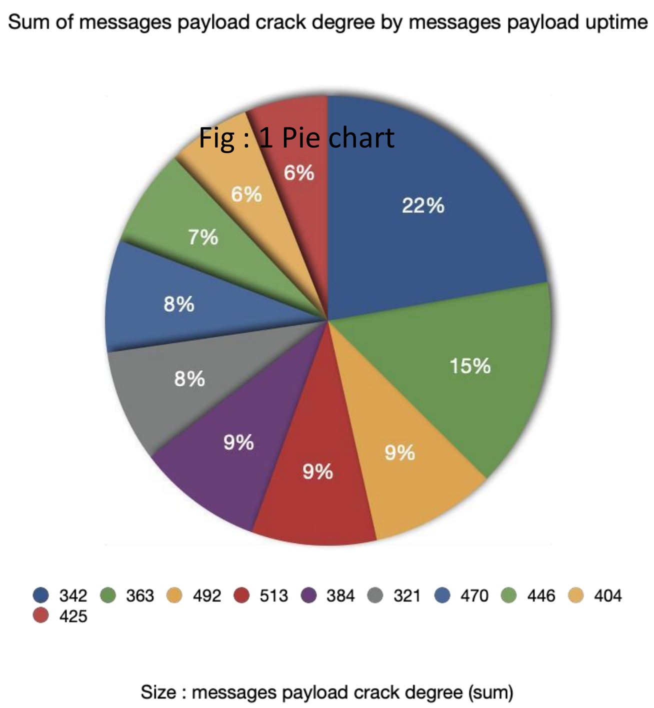


Figure 12 - Pie chart

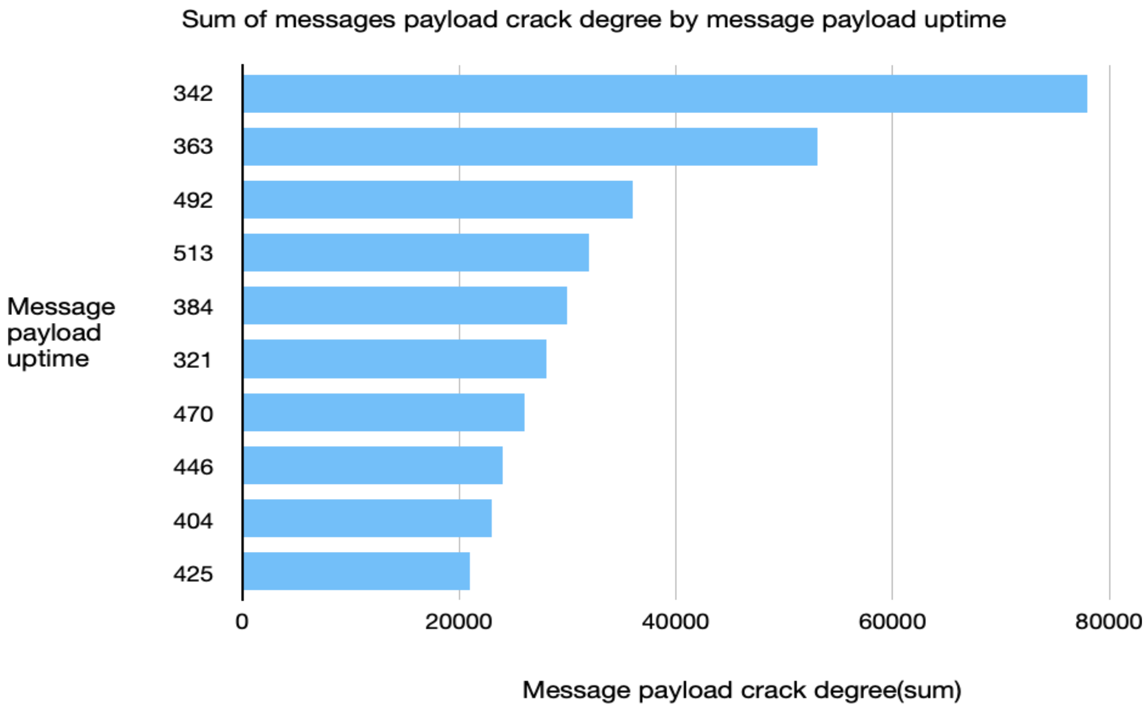


Figure 13 - Bar graph

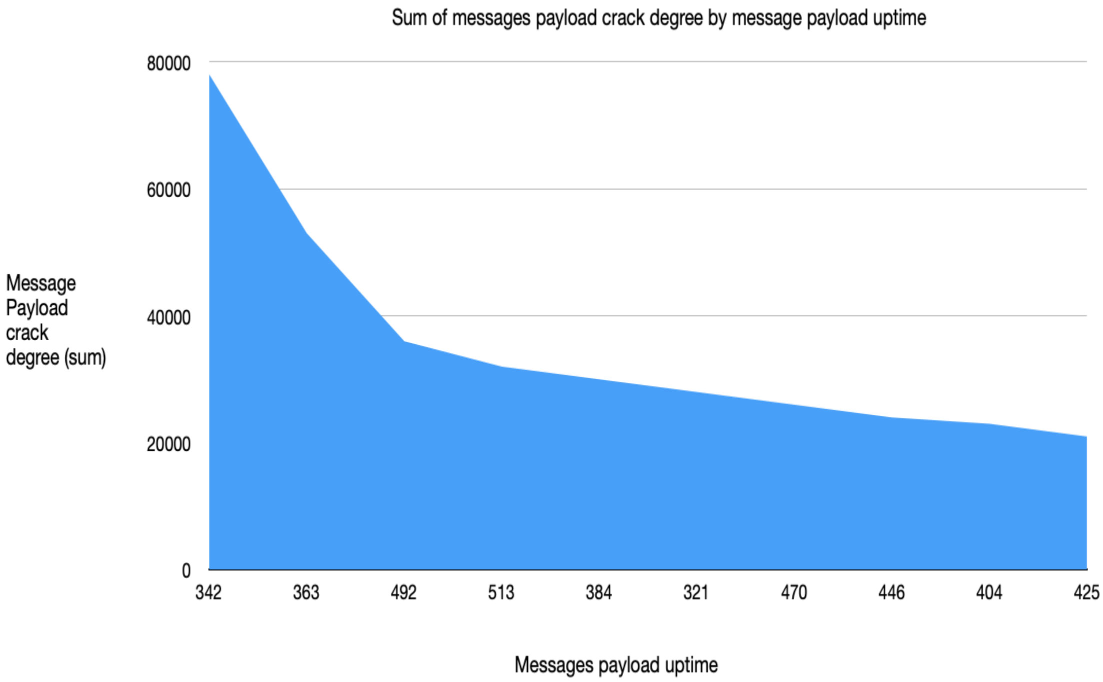


Figure 13 - Area graph

5.4 Metrics :

- Crack degree
- Uptime

5.5 Discussions :

A critical analysis of methodologies adopted to monitor buildings using various sensors was performed. As the graphs above indicates the cloud data that has been analysed and with the flex sensor that retrieves data and showcase the emergency condition of the building and AWS cloud is used to store the data and helps in identifying the risk factors. As in future IOT plays an important role in safety control for large monuments or buildings

Conclusion :

The considerable number of analyses and reviews evaluated in this project disclosed in what way the IoT could definitely end up serving as a powerful system for enhancing damage management in residential, commercial and other buildings.

Both predictive and adaptive approached might be required to optimise energy efficiencies. Predictive methods are crucial to get a greater accurate profile of representative energy consumption, while adaptive methods are entailed for edge situations wherein the estimated energy pattern is imprecise within a given boundary.

The good news is that a number of established communications protocols remain applicable for Building IoT systems (for example, Bluetooth, LoRaWAN (Long-Range long-power Wide Area Network), Wi-Fi, ZigBee or Z-Wave). More recent models have explored tiered architectures so clusters of sensors can use lower bandwidth and lower power to communicate among each other, but connectivity to central gateways would be of a higher bandwidth, from where high bandwidth solutions transmit information to applications in the cloud. As this architecture especially Building IoTs find into wide-area solutions such as for Smart Cities.

References :

1. Kamruzzaman M, Sarkar NI, Gutierrez J, Ray SK. A study of IoT-based post-disaster management. In2017 international conference on information networking (ICOIN) 2017 Jan 11 (pp. 406-410). IEEE.
2. Mobaraki B, Lozano-Galant F, Soriano RP, Castilla Pascual FJ. Application of Low-Cost Sensors for Building Monitoring: A Systematic Literature Review. Buildings. 2021 Aug;11(8):336.
3. Park S, Park SH, Park LW, Park S, Lee S, Lee T, Lee SH, Jang H, Kim SM, Chang H, Park S. Design and implementation of a smart IoT based building and town disaster management system in smart city infrastructure. Applied Sciences. 2018 Nov;8(11):2239.
4. Chowdury MS, Emran TB, Ghosh S, Pathak A, Alam MM, Absar N, Andersson K, Hossain MS. IoT based real-time river water quality monitoring system. Procedia Computer Science. 2019 Jan 1;155:161-8.
5. Kumar A, Singh A, Kumar A, Singh MK, Mahanta P, Mukhopadhyay SC. Sensing technologies for monitoring intelligent buildings: A review. IEEE Sensors Journal. 2018 Apr 23;18(12):4847-60.
6. Muttillo M, Stornelli V, Alaggio R, Paolucci R, Di Battista L, de Rubeis T, Ferri G. Structural health monitoring: An iot sensor system for structural damage indicator evaluation. Sensors. 2020 Jan;20(17):4908.
7. Banerjee AD, Jiang BH. A Blockchain-based IoT Platform Integrated with Cloud Services. InProceedings of the International Conference on Parallel and Distributed Processing Techniques and Applications (PDPTA). The Steering committee of the World Congress in Computer Science, computer Engineering and Applied Computing (Worldcomp) 2019.
8. Rajamohan S, Settlage RE. Informing the on/off-prem cloud discussion in higher education. InPractice and Experience in Advanced Research Computing 2020 Jul 26 (pp. 64-71).
9. Patil MS, Vidyavathi BM. WIRELESS SENSOR NETWORKS-DATA ANALYSIS AND EXPLORATION. Journal of Critical Reviews. 2020;7(19):9426-36.
10. Kausar Fatima S, Gauhar Fatima S, Abdul Sattar S, Sheela DK. A Monitoring Scheme With IoT and Sensor Expertise. International Journal of Advanced Research in Engineering and Technology. 2019;10(2):271-7.
11. Alam T. Efficient and secure data transmission approach in cloud-MANET-IoT integrated framework. Tanweer Alam. Efficient and Secure Data Transmission Approach in Cloud-MANET-IoT Integrated Framework. Journal of Telecommunication, Electronic and Computer Engineering. 2020 Mar 30;12(1).
12. Ullah I, Ahmad S, Mehmood F, Kim D. Cloud based IoT network virtualization for supporting dynamic connectivity among connected devices. Electronics. 2019 Jul;8(7):742.
13. Terray L, Royer L, Sarramia D, Achard C, Bourdeau E, Chardon P, Claude A, Fuchet J, Gauthier PJ, Grimbichler D, Mezhoud J. From sensor to cloud: An IoT network of radon outdoor probes to monitor active volcanoes. Sensors. 2020 Jan;20(10):2755.
14. Al-Kadhim HM, Al-Raweshidy HS. Energy efficient and reliable transport of data in cloud-based IoT. IEEE Access. 2019 May 16;7:64641-50.

15. Li X, Wang Q, Lan X, Chen X, Zhang N, Chen D. Enhancing cloud-based IoT security through trustworthy cloud service: An integration of security and reputation approach. IEEE Access. 2019 Jan 3;7:9368-83.
16. Priyanka RS, Nataraj KR. Buildings and Road Bridges Structural Condition Monitoring Against Cracks and Vibration Using Embedded System.
17. Bilic HG, Buyukoztekin T, Ozdemir S. The use of chipless sensors with rfid for condition monitoring. In2018 International Conference on Artificial Intelligence and Data Processing (IDAP) 2018 Sep 28 (pp. 1-4). IEEE.
18. Jo B, Khan RM. An internet of things system for underground mine air quality pollutant prediction based on azure machine learning. Sensors. 2018 Apr;18(4):930.
19. Ahmad T, Morelli U, Ranise S, Zannone N. A lazy approach to access control as a service (ACaaS) for IoT: an AWS case study. InProceedings of the 23nd ACM on Symposium on Access Control Models and Technologies 2018 Jun 7 (pp. 235-246).
20. Panda AK, Chakravarty R, Moulik S. Hand Gesture Recognition using Flex Sensor and Machine Learning Algorithms. In2020 IEEE-EMBS Conference on Biomedical Engineering and Sciences (IECBES) 2021 Mar 1 (pp. 449-453). IEEE.
21. Xiao S, Li T, Guo B, Huang Z. Cloud platform wireless sensor network detection system based on data sharing. Cluster Computing. 2019 Nov;22(6):14157-68.
22. Niranjan DK, Rakesh N. Early Detection of Building Collapse using IoT. In2020 Second International Conference on Inventive Research in Computing Applications (ICIRCA) 2020 Jul 15 (pp. 842-847). IEEE.
23. Sánchez-Herrera R, Márquez MA, Andújar JM. Easy and secure handling of sensors and actuators as cloud-based service. IEEE Access. 2020 Jan 10;8:10433-42.
24. Zhukov SI. Ensuring Interoperable IoT Device-to-Cloud Communication between AWS and Azure Infrastructures. Programming and Computer Software. 2021 Jul;47(4):240-8.
25. Sonar AR, Bhaldar HK, Ranaware RS, Sayyad TM. Implementation of Bridge Strength Detection and Accident Prevention System using Raspberry pi.
26. Liang J, Zhang M, Leung VC. A reliable trust computing mechanism based on multisource feedback and fog computing in social sensor cloud. IEEE Internet of Things Journal. 2020 Mar 16;7(6):5481-90.
27. Pierleoni P, Concetti R, Belli A, Palma L. Amazon, Google and Microsoft solutions for IoT: architectures and a performance comparison. IEEE access. 2019 Dec 23;8:5455-70.