SMS Alert for Room Light Smart Monitoring System using Z – Score Analysis

Rishabh Dwivedi[1], Prasanna Mohan Dhande[2], Shubham Kiran Patil[3], Prof. R. A. Agrawal[4]

[1,2,3]*UG Students, Department of Computer Science and Engineering, Hindi Seva Mandal's, Shri Sant Gadge Baba College of Engineering and Technology, Bhusawal – 425203, District – Jalgaon, Maharashtra, India*
[4]*Assistant Professor, Department of Computer Science and Engineering, Hindi Seva Mandal's, Shri Sant Gadge Baba College of Engineering and Technology, Bhusawal – 425203, District – Jalgaon, Maharashtra, India*

---***---

Abstract - *The driving force of wiring this paper is to monitor any smart home room light using Z - Score Analysis Machine Learning Algorithm. The benefit of using Z-Score is that it partitions data into meaningful, useful categories. It is also used as an initial point for the purpose of security and management of critical objects. In this paper we discuss some very basic of Z - Score and Monitoring Sensors, techniques. Monitoring technique to come up with sensors, here we use Z-Score calculation tool. The outcomes are examined on the datasets which are Light Dependent Resistor, IOT Module and 10k ohm Resistor. We analysed all data points with Z – Score Analysis Machine Learning Algorithm and the results which are shown is the successful working of set up and IOT Module. This algorithm has a feature of detecting sudden changes in data set using machine learning. It takes small amount of sample data sets of normal points and learns using them.*

*Key Words***:** Monitoring System, Circuit, Z-Score Analysis, Monitoring, Light Detecting Sensors Resistor, IOT module.

1. INTRODUCTION

In the future all electrical appliances reception will be connected to intelligent networks, PCs, telephones, stereos, refrigerators, and even laundry machines. Heaters and air conditioners, antecedently controlled by a distant, fixed, manual thermostat, will currently be managed by associate intelligent controller with remote and mobile apps with same Wi-Fi affiliation to them access capabilities. In previous few years, the employment of residential air-con[1] has become widespread because of increasing living standards and expectations for comfort. The management and observance of indoor part conditions represent a very important task with the aim of guaranteeing appropriate operating and living areas for folks. However, blanket air quality observance, which incorporates observance humidness, temperature, O2, CO2, and flying mud particle density, isn't simply monitored and controlled. Recent progress in wireless technologies has junction rectifier to a re-innovation in home automation that makes it doable to changes environmental controls in rooms[4][5]. one in every of the popular examples is that the utilization of wireless detector networks (WSN), that is currently employed in several areas, like care, home automation[7], and intelligent transportation systems. In specific, there square measure a

lot of opportunities to create wireless observance. Taking this prospective into consideration, we decide to move with the ongoing technological advancements to develop a smart and a comfortable future.

2. Literature Review

- ➤ F. Calvino, M. La Gennusa[2], describes the algorithm because of its efficiency and superior performance. However, the performance of Z-Score algorithm depends heavily on the selection of initial points. This paper proposes an extension to the original Z-Score algorithm enabling it to solve classification problems.

- ➤ Z. Lin and S. DengFirst[1], describes the monitoring concept is employed to adapt the Z-Score analysis to be used as a classification technique. Then, to improve the performance of algorithm, a new scheme to select the initial variables is proposed. The proposed models are tested on given monitoring system.

- ➤ Han, H. Lee, and K. R. Park[6], "Remote-controllable and energy-efficient room architecture based on ZigBee communication They have used the Z-Score technique for withdrawing important information from the Room dataset using RapidMiner tool because it is solid and complete package with flexible.

3. Methodology

K-Nearest Neighbour Algorithm: In every instance the input consists of the KNN coaching model within the characteristic space. In k-NN regression, the KNN algorithmic rule is employed for calculating continuous variables. One such algorithm uses a weighted average of the KNN, weighted by the opposite of their distance. This algorithmic rule works as:
    I. Compute the Euclidian distance from the question example to the labelled examples.
    II. Order the label sample by increasing area.

Integration takes the information chunks along exploitation totally different databases. Transformation uses homogenize and average the information and deduction helps in decreasing the quantity of knowledge keeping similar analytical results.
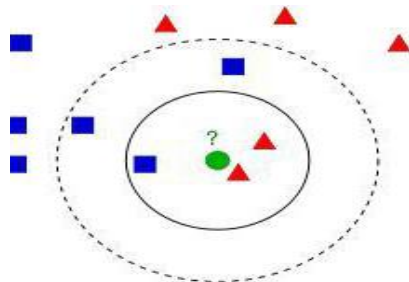
Fig –1: Impact of k value on k-NN algorithm

Example of advice
- Comments on the K-means -> Strength: comparatively efficient: O(tkn), wherever n is # objects k is # clusters, and it is repetitions. Normally, k,t → n.
- Comparing: PAM→ O(k(n-k)2), CLARA->O(ks2 + k(n-k))
- Comment: typically terminates at a neighbourhood optimum. the worldwide optimum might be found exploitation techniques such as: settled tempering and generic algorithmic rule
- Applicable only mean is outlined, then what concerning categorical data?
- Necessitate specifying value of 'k' (the quantity of clusters) priorly well before itself.
- Unable to handle clangourous information and outliers

Not appropriate to get clusters with non-convex shapes.

3.1. K-Medoids Clustering Method

- Find representative objects, known as medoids, in clusters
- PAM (Partitioning Around Medoids, 1987) starts from associate initial set of medoids and iteratively replaces one in every of the medoids by one of the non-medoids if it improves the whole distance of the ensuing clump[3].
- PAM works effectively for tiny information sets, however doesn't scale well for big datasets.
- CLARA (Kaufmann & Rousseeuw, 1990)
- CLARANS (Ng & dynasty, 1994): irregular sampling.
- Focusing + spacial system (Ester et al., 1995).

3.2. Data Pre-Processing

Data pre-processing [2] may be a data processing technique that involves remodelling data into a lucid format. typically, the information is disorganized, changeable, has missing values, and lack in bound behaviour or trends that offers several errors. Therefore, it must be clean, integrated, transformed, and thus reduced disinfecting fills within the missing values and removes discord. Integration take the information cubes or chunks along exploitation multiple databases. Transformation uses standardization and aggregates the information and Reduction helps in

decreasing the quantity of knowledge keeping similar analytical results

METHOD OF clump

Hard clump

These strategies of clump are supported the classical pure mathematics, and need that associate object either will or doesn't belong to a cluster [1]. It suggests that partitioning the information into specified range of reciprocally exclusive subsets. That is, every document belongs to precisely one cluster, it solely assigns a worth of one or zero.

Density-Based

This is supported property and density functions. In density-based clump, clusters are configured as areas of upper density than the rest of the information set. Objects in these distributed areas that are needed to separate clusters - are typically thought of to be discord and border points. the foremost fashionable density based mostly clump technique is DBSCAN.

Fuzzy clump

Fuzzy clump additionally known as soft clump. Enable the objects to belong to many clusters at the coinciding, with totally different degrees of participations. it's additional natural than onerous clump as a result of objects on the boundaries between many categories don't seem to be forced to totally belong {to one|to at least one|to one} of the categories and however rather are allotted membership degrees between zero and 1 indicating their partial membership

3.3. Methods of Clustering

Hard clustering

These methods of clustering are based on the classical set theory, and require that an object either does or does not belong to a cluster [1]. It means dividing the data into certain specified number of mutually exclusive subsets. That is, each document belongs to exactly one cluster, it only assigns a value of 1 or 0.

Density-Based

This is based on connectivity and density functions. In density-based clustering, clusters are interpreted as regions of higher density than the rest of the data set. Objects in these scanty regions that are essential to filter out clusters - are usually observed to be noise and border points. The most popular density-based clustering method is DBSCAN.

Fuzzy Clustering

Fuzzy[2] clustering also called soft clustering. Allow the objects to be included in to some clusters all together, with different degrees of associateship. It is more natural than hard clustering because objects on the boundaries between several classes are not forced to fully belong to one of the classes and but rather are allocated membership degrees between 0 and 1 denoting their partial membership.

4. Implementation

Firstly, we need to connect our hardware setup.

Hardware Required:

- Bolt IoT Module
- LDR Sensor (Light Dependent Resistor)
- 10k ohm Resistor
- Micro USB Cable

The resistance of an LDR changes conflictingly with light, i.e., the resistance declines as the magnitude of light falling on the LDR rises.

Connecting the LDR circuit to the Bolt:

Step 1: Insert one lead of the LDR in the Module's 3v3 Pin. and insert other lead of the LDR in the A0 pin.

Step 2: Insert one leg of the 10k Ohm resistor into the GND pin and insert the other leg of the resistor also into the A0 pin.

Warning!! Make sure that at no point do the 3.3V (5V) and GND pins or wires coming out of them touch each other. If you short power to Ground without a resistor even coincidentally, the current drawn might be high enough to destroy the Bolt module.

Thus, we are constructively measuring the voltage across the 10k Ohm Resistor and the final circuit should look like the image below:
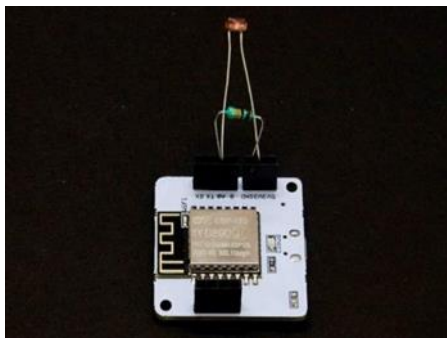

Fig -2: Final Set up of IoT Device

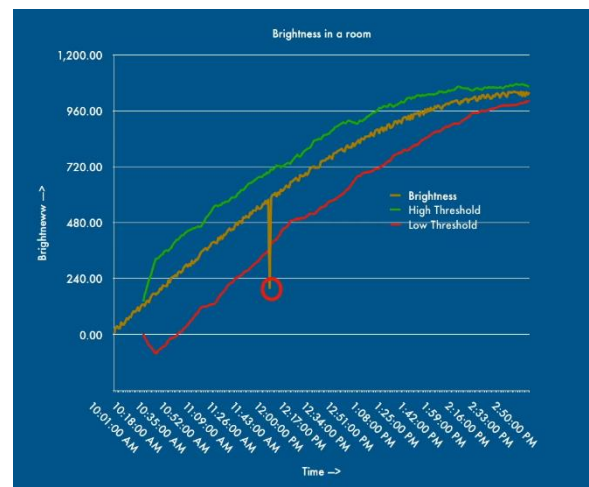### 4.1 Implementation Algorithm

This is a security alert system. So, we would like to urge notified once there's some activity in our observance surroundings. Choose your observance place or actual object that has to be secured. Place your module on the subject of your object of observation or within your observation area. From {this purpose|now|this time} onward we'll say observation point for our observance area or object. Light Dependent resistance that connected on to the module has to be facing the observation purpose. Since this can be main half that is perceptive information. When everything is ready in situ like BoltIoT module is connected to the Wi-Fi and Power[18]. For power you'll use power bank in order that

you'll place module anyplace even once there's no electrical affiliation. This detection method is extremely straightforward. once somebody can enter the purpose of observation. He/she can solid a shadow or an interference in lightweight once it's daytime. once it's nighttime, someone can acquire purpose of observation with {a lightweight|alight-weight|a lightweight} supply (Supposing all lights are transitioned within the area or if it's within a locker then positively there's no light) it'll create modification in light. All of those lightweight changes are becoming determined by lightweight dependent resistance. lightweight dependent resistance can modification the voltage and another resistance that is fitted across A0 pin and GND can facilitate United States in measure information. This information is sent to the cloud exploitation BoltIoT module. On the cloud wherever the info goes. Here Z-Score machine learning formula are accustomed confirm abrupt changes in information set. In the final step if it detected that there's anomaly within the information set. Then the formula can use Twilio web site API to send associate degree SMS to variety of security professional United Nations agency created this setup for observation.

You can observe the anomaly graph below.

The yellow line is that the actual information purposes of sunshine of point of observation. border and line are the High Threshold and Low Threshold severally. currently observe the red circle. this time represents abrupt in lightweight density. Screenshot of the execution is shown below. This is however it collects 1st ten sample information points in order that it will learn the pattern and create a high threshold and lower threshold exploitation this. When it goes higher than the brink or lower threshold. This triggers SMS alert that is shipped to the safety professional United Nations agency created the setup. You can observe the SMS that is received once there's an abrupt modification in intensity.

You can observe the anomaly graph below.

Graph -1: Data set on a Graph

The yellow line is the actual data points of light of point of observation. Green line and Red line are the High Threshold and Low Threshold respectively.

Now observe the red circle. This point represents sudden in light density.

Screenshot of the execution is shown below.

Fig -3: Algorithm's Output

This is how it collects first 10 sample data points so that it can learn the pattern and make a high threshold and lower threshold using this.

When it goes above the threshold or lower threshold. This triggers SMS alert which is sent to the security expert who made the setup.

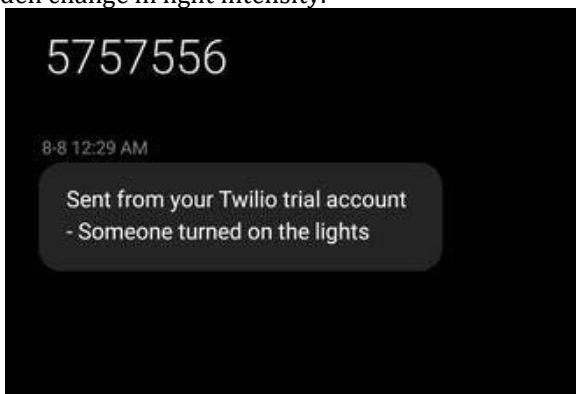You can observe the SMS which is received when there is a sudden change in light intensity.

Fig -4: SMS Recieved

5. Application

New Born: -

Take examine the load of newborn babies. Suppose that the mean weight of newborns is seven.5 pounds and also the customary error is one. 25 pounds. Say you're inquisitive about adjust likelihood that a newborn weigh but half-dozen pounds. however, does one do that?

Mean = 7.5 lbs.

Standard Deviation = one.25 lbs.

The first calculate the z-score. To work out the z-score, take the distinction between half-dozen and seven.5 to reach -1.5. after you divide -1.5 by the quality error of one.25, you finally end up with a z-score of -1.2.

Probability that a newborn weighs < half-dozen lbs
→ z-score = (6 - seven.5) / (1.25) = -1.20

What if you're inquisitive about peeking the likelihood that a newborn may weight over ten pounds? you'll calculate the z-score abundant an equivalent means you probably did with the previous calculation: likelihood that a newborn: -

weighs > ten lbs z-score = (10 - seven.5) / (1.25) = 2.00

A Content-Based counsel works by the information that we have a tendency to take from the user, either expressly (rating) or implicitly (clicking on a link).

By the information we have a tendency to produce a user profile, that is then wont to hints to the user, because the user provides a lot of input or take a lot of actions on the advice, the engine becomes a lot of correct.

IQ Scores: -

We once more use IQ scores, with a mean of a hundred and a regular error of fifteen, to calculate some possibilities. for instance, suppose that your IQ is a hundred and twenty. you would possibly spectacle however this score compares to alternative individuals' IQ scores. it's currently a comparatively simple procedure. we have a tendency to 1st acquaint what's known as the conversion formula. we are going to convert to z scores from IQ scores. we all know the way to decide possibilities for z scores, therefore if we all know the z score for a selected IQ score, we are able to additionally calculate a likelihood for that IQ score.

To convert score to a z score from associate IQ, we have a tendency to use the formula

$$Z = (x-mean) / (standard\ deviation)$$

In this formula, the "x" price is that the IQ score of possession (in this case 120), the mean is going to be a hundred, and also the customary error is going to be fifteen.

Let's calculate the z score for IQ of a hundred and twenty

Z = (120-100) / (15) = (20) / (15) = one.333

6. Usefulness

Usefulness for this project it can be used when there is requirement for immediate alert with SMS. This monitoring system can be modified for other purposes as well. Like for example in a factory where there are vaccines of which temperature needs to be monitored[11]. Our project will

work same, when the temperature rises above threshold suddenly it will generate an SMS.

It can be used for security purposes in many places. In bank lockers, corporate offices or in individual homes.

7. CONCLUSIONS

Z-Score analysis is helpful to solve the required calculation and to perform the practical work. Room light monitoring work effectively in such condition where it useful to create the good and safe environment and also useful to decrease the crime rate. Crime is characterized which change over time and increase continuously. The changing of crime give rise to the problems of understanding the crime behaviour, crime predicting, precise detection, and handling large volumes of data obtained from various sources. Research interests have tried to solve these issues. In the crime investigation procedures, input data is very essential to use in training process and testing process. The training process is used to accomplish the monitoring model and the testing process is used to validate the algorithm. The issues of crime pattern are concerning with finding and predicting the hidden crime. The proposed methodology provides security for the data during outsourcing. Monitoring and sensors are made on the crime information. While classifying the crime data, Sensor[9] content is added for the purpose of defence[15]. The sensor content is used for verifying the classification data. Based on Z-score and classification, the data can be classified and kept secured manner.

8. Future Scope

IOT in upcoming years grows drastically. As the machine learning and Artificial Intelligence can be implemented in the IOT projects. This makes the IOT futuristic as it includes the automation in different sectors. This calculates the averages or may be able to be said standard errors so; it can be used in standard error calculating all examples. Where the used method of Altman's z-score which gives scope for financial firm's health predictions. In further studies for this topic can be bankruptcy, Ohlson O score, t-score, Springate S-score model.

REFERENCES

[1]   Z. Lin and S. Deng, "The outdoor air ventilation rate in highrise residences employing room air conditioners," Building and Environment, vol. 38, no. 12, pp. 1389–1399, 2003.

[2]   F. Calvino, M. La Gennusa, G. Rizzo, and G. Scaccianoce, "The control of indoor thermal comfort conditions: introducing a fuzzy adaptive controller," Energy and Buildings, vol. 36, no. 2, pp. 97–102, 2004.

[3]   W. Y. Chung and J. W. Lim, "Patterning of thin tin oxide film with nano-size particle for two-dimensional micro-gas sensor array," Current Applied Physics, vol. 3, no. 5, pp. 413–416, 2003.

[4]   D. Kolokotsa, K. Niachou, V. Geros, K. Kalaitzakis, G. S. Stavrakakis, and M. Santamouris, "Implementation of an integrated indoor environment and energy management system," Energy and Buildings, vol. 37, no. 1, pp. 93–99, 2005.

[5]   W. Y. Chung and S. J. Oh, "Remote monitoring system with wireless sensors module for room environment," Sensors and Actuators B, vol. 113, no. 1, pp. 64–70, 2006.

[6]   K. T. Le, "Designing a ZigBee-ready IEEE 802.15.4-compliant radio transceiver," pp. 42–50, 2004, http://defenseelectronicsmag.com/site-files/defenseelectronicsmag.com/files/archive/rfdesign.com/.

[7]   C. Suh and Y. B. Ko, "Design and implementation of intelligent home control systems based on active sensor networks," IEEE Transactions on Consumer Electronics, vol. 54, no. 3, pp. 1177– 1184, 2008.

[8]   J. Han, H. Lee, and K. R. Park, "Remote-controllable and energy-saving room architecture based on ZigBee communication," IEEE Transactions on Consumer Electronics, vol. 55, no. 1, pp. 264–268, 2009.

[9]   K. S. Kim, J. G. Lee, S. S. Ahn, and J. Lee, A Study on USN MultiModal Sensor Fusion Technique for Intelligent Air Conversions Digital Home Appliances, MITA, 2010.

[10] K. S.Kim, J.Z. Song, C. Zhang, T. S. Yun, and S. K. Noh,AStudyon Home Indoor Environment System JCICT & the 1st YellowInternational Journal of Distributed Sensor Networks 7Sea International Conference on Ubiquitous Computing (YESICUC),2011.

[11] J. Zhang, G. Song, H. Wang, and T. Meng, "Design of a wireless sensor network-based monitoring system for home automation," in Proceedings of the International Conference on Future Computer Sciences and Application (ICFCSA '11), pp. 57–60, Hong Kong, China, June 2011.

[12] H. Xianzhe, "Room temperature and humidity monitoring and energy-saving system," in Proceedings of the 6th International Conference on Computer Science and Education (ICCSE '11), pp.537–540, Singapore, August 2011.

[13] M. M. Rahman, M. I. Abdullah, and M. S. Hossain, "Level based path selection technique in large WSN for hierarchical architecture," International Journal of Advanced Science and Technology, vol. 32, pp. 33–44, 2011.

[14] D. Gupta and A. K. Sharma, "On performance evaluation of WSN routing protocols for MICA and MICAz using different radio models," International Journal of Energy, Information and Communications, vol. 2, no. 4, pp. 181–194, 2011.

[15] S. Hwang and D. Yu, "Remote monitoring and controlling system based on ZigBee networks," International Journal of Software Engineering and Its Applications, vol. 6, no. 3, pp. 35–42, 2012.

[16] J. Yap and Y. H. Noh, "A ZigBee-based home control system using OSGi management platform," International Journal of Smart Home, vol. 6, no. 4, pp. 15–28, 2012.

[17] H. Zhang and Y. Liu, "Study and design of adaptive environment control system for mobile base stations," in Proceedings of the International Conference on Control Engineering and Communication Technology (ICCECT '12), pp. 426–429, Liaoning, China, December 2012.

[18] T. Lkhagvatseren and F. Hruska, "Path loss aspects of a wireless communication system for sensors," International Journal of Computers and Communications, vol. 5, no. 1, 2011.

[19] Fig -1 Impact of k value on k-NN algorithm https://www.mdpi.com/symmetry/symmetry-13-00826/article_deploy/html/images/symmetry-13-00826-g008-550.jpg