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Secure way of Data Transmission in Road Surface Monitoring System Using Internet of Things

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Abstract: ***In recent past Internet of Things (IoT) has been focused on recent research in various concerns. It is a very large network where it connects all smart objects together into the single network. It extends its usage into real-time applications like smart cities, smart house, and smart transportation. It is integrated to fog computing, to enable the services to every edge node in the network. Fog computing is enhanced prototype of the cloud computing, which provides the data storage to the devices at the edge nodes. Fog/Edge computing is distributed infrastructure, where the application of data is logically distributed between the data source and cloud. In recent years, greater attention has been given by many countries to monitor the Road Surface Condition; many solutions have been proposed to reduce the accident and traffic flow, which make use of mobile sensing and even vehicle sensing system. In this paper, we propose the model, Data transmission protocol for road surface monitoring system were designed to achieve the all security aspects in an efficient manner. Unique Id's were provided for each vehicle during the data exchange in the network. This helps to increases the efficiency of data transmission between nodes in a secure manner, reduces the time complexity and ensures the privacy of user data (location), as well as anonymity.***

Keywords : Internet of Things(IoT), Fog Computing, smart transportation, cloud computing, Road surface condition.

I. INTRODUCTION

In recent years, the usage of the internet has increased rapidly. It provides the anywhere, anytime connectivity with anyone, which makes the human's life easier. Every real-time objects/ things are connected to the internet to make the work easier. IoT is playing the major role in the various domains as well as the individual user by scheduling the day - to- day works. In many organizations, IoT is used to take the decision quickly at the critical situation, and also it reduces the human works. In addition to that IoT has deployed into houses, where home appliances/devices are controlled remotely and monitored. There are many types home automation systems which provide the various services, such as remote controlling appliances, voice alert, and theft alert as it is very useful for physically disabled persons. Population increases the ownership of vehicles increases exponentially. Due to enormous growth in vehicles usage, traffic management and road safety are the major challenges in many countries. Monitoring the road surface quality is a major indicator to avoid the accidents, such as slipperiness, potholes and bumps are parameters of road surfaces qualities. In worldwide, many governments spend millions of dollars to maintain the surface of the road, they have separate patrol crews to examine the surface of the road with the motive of identifying the potholes, bumps and rectify them periodically to avoid the accidents, and this process is not efficient and requires many manual resources. By using the advanced technologies, the road anomalies can be easily maintained. In many countries, smart transportation infrastructure has been constructed, which is used for traffic management and also to ensure the road safety. IoT uses the nodes and sensors to communicate between the vehicles, the main issues in IoT are security aspects, where data transmission between the node/device are not in a secure manner.

II. RELATED WORK AND METHODLOGIES

They are many proposed model in recent years based on the road surface monitoring system, to avoid the accidents and ensure the travelers' safety, this paper is focused on major methods used to detect the irregularities of road surface as follows, [2] the author proposes the model to monitor the road surface using the image processing technology. The proposed model uses the simple bicycle, to capture the image and process the data. It consists of two core modules: laser light module, where it emits grid laser light and camera module, it captures and alerts the cyclist if the road surface is bad. The surface of the road is detected by using the template matching method, (i.e) The template image of a good road surface is created and it is compared with an obtained image (captured by the camera) periodically. Yazan A. Alqudah & Belal H. Sababha [4], used a gyro rotation information, which is obtained from the sensors to detect the variation on the road. This model conducts the drive test, which has round-trip path with approximate 3.7 km's.

They have repeated the test several times to ensure consistency. The dashboard of the vehicle is mounted with mobile phones, are used to collect the gyro rotation data and also have GPS, a speed of vehicles as log files. The phone with gyro rotation information is readings of a road surface, which can't be visualized and get the information easily. To get the information author uses the gyro rotation data as variability, which indicates the potholes, bumps on the road surfaces. The authors proposed the model to identify the irregularities of the road by using the smartphones [3], and they have highlighted the major 4 advantages over other existing systems. a) novel energy efficient, accelerometer analytics in phone b) communication of data between phones and backend has been reduced, c) multi-user fusion method to authentic the road maps, d) privacy of user data during the data sharing. The model consists of three modules: Extractor, Classifier, Fusion modules. User's smartphone capture the accelerometer sensed data continuously and these data were extracted by extractor module. In classifier module, scores were generated for each identifier in road surface and stored in backend server along with location using RESTful interface. At the backend, fusion module runs to aggregate readings depends on locations and store the aggregated scored along with a location. The mobile application now decides based on feature indicated by the score. If it exists (score) the answer will be yes and it is plotted on the map as obstacle and alerts the drivers in the way. The security is a major concern in IoT. The author focused on security by preserving the privacy of user's data during the transmission between the devices and cloud server [5]. The model has a separate control center, sensors, RSU as fog node and cloud server. The CC is used to generate the partial private key for registered users in order to avoid the escrow problem. Mobile sensors are embedded into vehicles to detect the surface of the road, the RSU (fog node) is an extension of cloud services, were able to react and make decisions. The sensed data from the vehicles are sent to RSU for immediate processing. At last the processed data is sent to cloud server, which has historical information about the data that is sent by RSU. The RSU is used to reduce the processing in a cloud server. This model uses Certificate Aggregate SignCryption (CLASC) scheme, where they have separate control center to ensure the data transmission in a secure manner. This KGC will generate the partial private key and send to the corresponding user in a secure manner. The user key is generated by taking user identity as input and return the secret value and corresponding public key, by this user will generate their own public key and shares in a cloud. Signcryption is done to each user's data. "n" set of user data signcryption has been aggregated by a separate algorithm and return the ciphertext. At the receiver, an aggregated chipper text has been verified. In the end, the ciphertext has been converted to original message by using aggregated unsigncrypt. A security issue has become the major concern in this field, due to enomours usage of IoT devices in day-to-day life. In previous section, we have seen that quality of road surface are detected using the sensors in the vehicles. These data's are transmitted between the nodes to identify the quality of road and to deliver the same to users. During the transmission, these data's can be fabricated by hackers/intruders. They can intrude the network and modify the data that passes through a channel; they even control the whole transmission channel and monitor the transaction of data between the nodes. They can also remove some packets from data, or even replace the original data. Moreover, the nodes in the network will become a malicious node and the whole network will be the same. Then, the receiver will get the forged report from server and whole system would be crashed. One of the major challenges is to ensure that, data generated by the sensors are transmitted between the node/device are in secure manner. This can done by, Data integrity: all message origination should be protected. Authentication: the sensor node and edge node should authenticate each other to ensure the originality of data. Anonymity: During authentication process, the sensor node information should be hidden from the receiver.

III. PROPOSED MODEL

In this section, we proposed the method that can implemented in real time application with less computation cost and in secure manner.

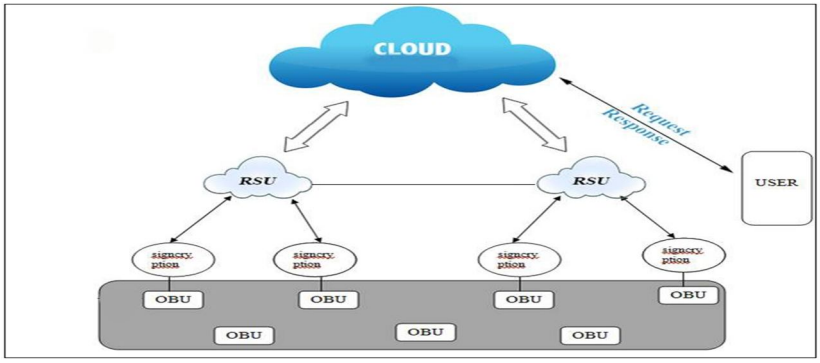

Fig. 1 System Architecture

OBU- On Board Unit; RSU – Road Surface Unit. Each RSU has their own unique id. RSU will generate their own key pair and signature for encryption & decryption. OBU (Onboard Unit) will enter to the network by providing the username & OBU license number. Once the OBU enter to the network OBU needs to provide the Source. Each OBU in the network has their unique id, by providing that OBU generate their own key pair & Signature. Onboard Unit (OBU) will generate the signature. OBU select the Destination and generate a path and monitor all the required parameter in the path monitoring parameters. Once the OBU Reach the Destination, OBU sends the sensed information and forwards the information to the region RSU. Before Sending any information to the RSU or Fog Node OBU need to encrypt the information to protect the OBU Privacy. OBU will encrypt the information and the signature on the content by giving the RSU name. RSU will receive the information and reverse the process and decrypt the information. For node (RSU) will receive the information from the region. The received information is in the encrypted format, Fog node needs to decrypt the information, by using OBU public key. The Decrypted information from RSU will be forward to the Cloud Admin. Cloud Admin will store the received information from the region fog node and whenever any mobile user request for any path Admin will process the request and provide the corresponding path. Configure the application to the server by providing appropriate IP address in the application, users have they own login credentials and they can search any path by providing the source and destination. Admin will receive the path request, process the request and provide the appropriate result to the mobile user

VI. CONCLUSION

IoT is emerging technology, where many countries have started to deploy the IoT devices in their cities to maintain the traffic, monitor the public transportation, monitor the public safety, and check the quality of road etc., In this paper, we discussed the major methods that are used for monitoring the road surface condition, and also represents the comprehensive analysis among those methods to find the efficiency and to ensure the privacy of users data. At the end of the analysis, we suggested the method that can be deployed as a real-time system in the efficiency and secure manner.

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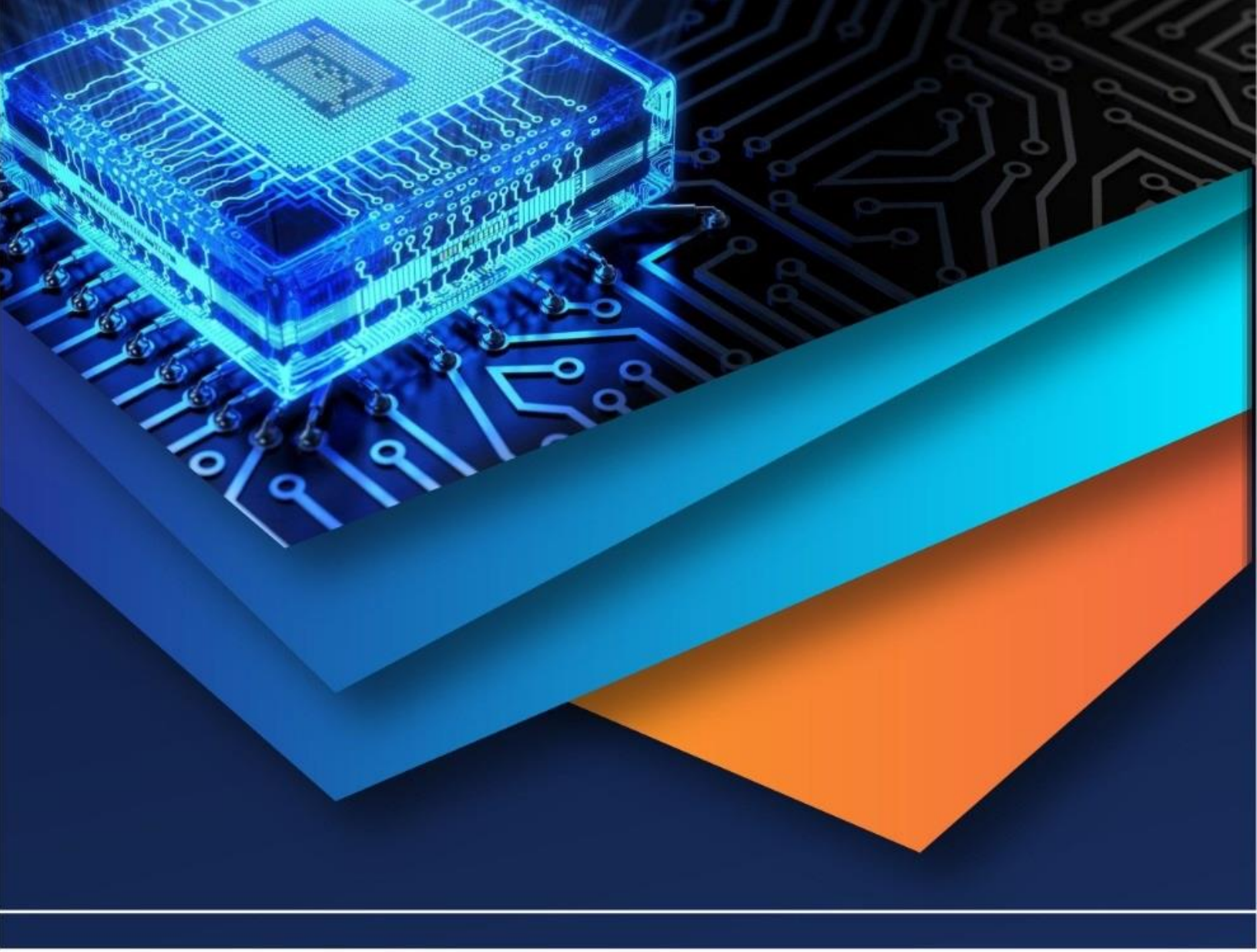

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