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IoT Based Vehicle Mounted Weight Sensors

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Abstract*: The as most of the goods trucks in the developing nation are overloaded with goods, and this needs to be controlled via smart way. This can be achieved using the Smart Sensors and Internet of Things (IoT), as these are the emerging technologies. In these paper we propose the weight mounted sensors can dynamical give an accurate inputs about weight variation, the advantage of this system is that any extra goods or loads cannot be added while movement of the trucks, if any extra goods are been added then it can be alerted nonstop to the government agencies on the real-time or the weight on the trucks can be monitored by the central government organization. This paper will provide an integration of smart sensors and the Internet of Things (IoT) and Block Chain integration together on one platform, we propose in this paper using the block chain technology to encrypt the real-time data to the government database and this data is securely transferred or encapsulated in the block chain as block, these data cannot be modified by the cyber attacker.

Keywords: Internet of Thing (IoT), IoT Weight Sensors, IoT Transportation System, Block Chain, Sensors, Cloud Computing service.

I. INTRODUCTION

The transportation of the goods through the land, air, or water there is tremendous changes of transportation mode, as there are many smart highways roads are being constructed over the world from past decades, to have a smooth flow of the vehicles. A common issue in the developing nation is the overload of the transportation trucks, which has steered to a growing number of fatal accidents and slower movement of the vehicles, which cause major traffic jam over the highway roads [1]. The Trucks are illegally overloaded, after been weigh in the weigh station, so we are coming up with a smart Internet of Things (IoT) weighs vehicle-mounted sensor, so that any illegally overloaded in between while traveling can be detected and traced on the real-time basis's, if any illegally overloaded beyond the threshold load as per the government laws, it can be captured and informed via real-time data transmission to the government central organization about the status of the load increase on the vehicle. In this paper, we are moving out from our traditional static weighing mechanisms to an automated real-time Internet of Things (IoT) weighing mechanism.

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The main drawback of this system is expensive and verytruck owner cannot afford the Internet of Things (IoT), based weigh instrument, if this concept is adopted and manufactured in the larger scale then this drawback can be eliminated.

II. PROBLEM STATEMENT

The existing system, the goods, and load of trucks transportation import and export process is carried out by means of manual paperwork regarding the vehicle information and the load weight on the trucks, are gathered through manual paperwork in the overall goods transportation, as paperwork will delay the process and also increase the waiting time period of the trucks in the national highways, which cause the delay in the transport of the goods to the destination [2].

Fig. 1. Traffic jam in front of a traditional toll plaza and weigh bridge center.

In the traditional system, the accuracy of weighbridge systems is usually not accurate and the goods on the trucks are usually measured wrongly and usually, truck owner's end up paying more money than expected actual amount, and this error can be minimized by dynamic Internet of Things (IoT) weigh system [3], the other disadvantage of these manual weigh bridge are manipulation of the weigh bridge and computer system manipulation by the operator, the operator of the weighbridge captures can manipulate and generate a fake bills [4], and the manual weighbridge process of weigh of vehicle in the toll gate will cause more traffic[5], and this issues can be resolved via automation of the weighbridge by Internet of Things (IoT) dynamic weigh system.

Fig. 2. Over Loaded goods trucks exceeding the load threshold values, set by the government organization [6]

III. PROPOSED METHOD

The system design involves setting up of hardware components and installation of required packages as mentioned below.

The Internet of Things refers to a collection of physical objects (or) set of entities that individual entity is allocated internet address for internet connectivity, and the communication that happens amongst these objects and other devices were internet is enabled and computer or mobile systems. The Internet of Things (IoT) has provided a remarkable break over to shape supervisory of the larger organization or industrial machinery systems and the even the tiny of devices and other applications and a larger set of Industrial Internet of Things (IIoT) applications have been developed and deployed in recent days [7], for example the remote smart home monitoring environment can assistance in the remote monitoring of the smart home device and controlling of the device, and the other usage of Internet of Things (IoT) application as shown in the figure 3.

The block chain, can also be called as the circulated database which maintains millions of growing blocks which holds the transactions of the users and it's also termed as the distributed ledger technology. The block chain is a chain of one or multiple blocks, where each block contains data values. In this research paper, the data contents, which are stored inside the blocks, are trucks plate number, driver information, address of the owner information all these data are masked sent over to the government central monitoring trucks department (or) to vendors. Each block has current timestamp value which holds the current time when the block was created, current hash value these comprises of a 256-bit hash values and the preceding hash value holds a 256-bit hash values of the preceding block. But for the first block, it does not holds any prior block hash value content. It just acts as a default block to make a chain the block. The hash value is produced on one occasion a block is created newly and any additional alteration to the block will cause the hash values to modification [8].

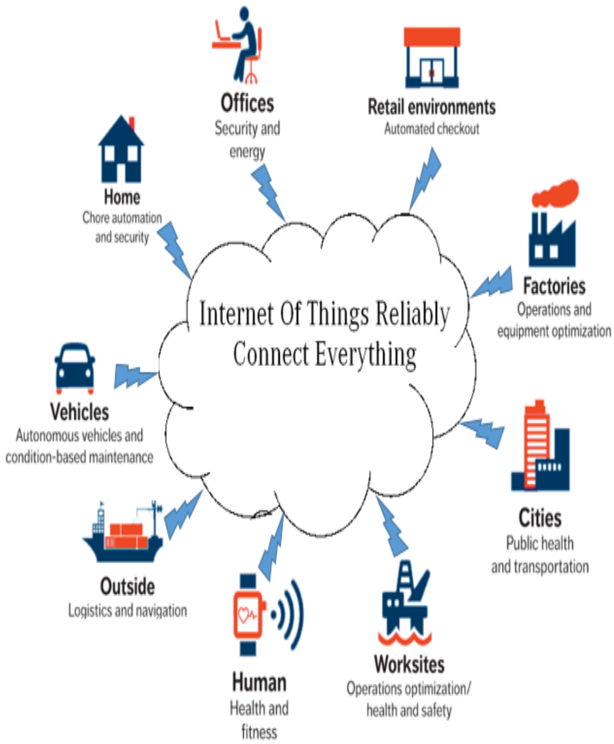

Fig. 3. A Schematic View of the Block Chain Structure.

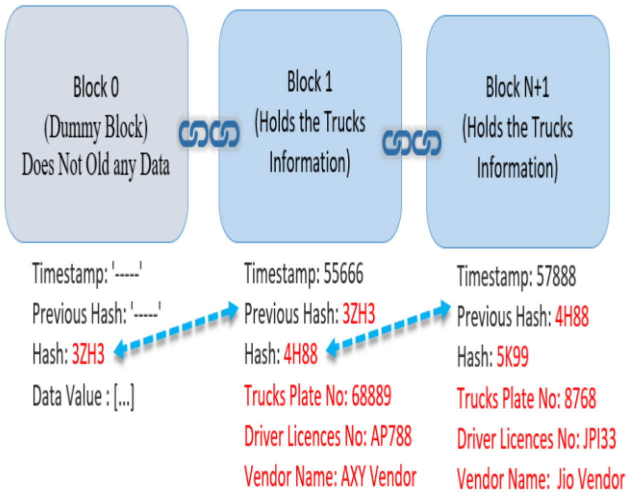

Fig. 4. A Schematic View of the Block Chain Structure.

A. Architecture of IOT Mounted Scale.

The weighbridge is directly mounted on the backside of the truck with the Internet of Things (IoT) [9] weigh sensors, as shown in the figure 3 [10]. The data can be displayed in real-time on the truck-mounted Internet of Things (IoT) [10] scale indicator, the weight of the product values are transferred via block to the government organization, if any hackers or operator try to manipulate the block data values, then the hash values of the block will be changed, then it's easily predicted that weight value of the block data is changed by operator or hackers while transferring the data over the network. The other advantages of the Internet of Things (IoT) [11]

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Mounted weighbridge and Scale indicator is that it provides a real-time data and if any operator try to overload the truck while traveling, the same information can be traceable by the government organization, the real-time data is captured for every one hour duration or while traveling on the way, if the truck driver try's to overload with the extra goods on the truck, then an immediately a notification message is sent over the mobile to the truck owner or the government organization that truck threshold values is over loaded above the threshold values, and this data is encapsulated into the blocks, each block contains the one hour weighbridge data, the blocks contains the timestamp and the hash value based on the current timestamp when the data is captured, initial a dummy block is generated which is called genesis block, and from block one, the actual data are stored.

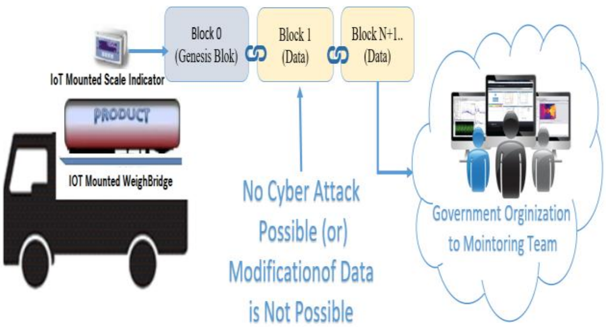


Fig. 5. Proposed Block Diagram Architecture model of the IOT Mounted Scale Indicator.

B. Algorithm.

Once the data values are stored into the cloud the data values are further masked using the masking function, as the pseudo code for masking generating algorithm is mentioned in the figure 6, the block chain masking function, is generated using the random string function, where the data which needs to be masked is inserted into a block. The mask function generates random string values or numerical values.

```
INPUT: MASKING BLOCK CHAIN FUCNTION(Vehicle Information Details)
Variable Vehicle  Processing Data = Vehicle Information Details
Variable Text Arrary Length = Input Data.Split("").lenght_Data_Value
For(Variable i =0; i < Text Array Length; i++)
{
Maksed Data Block += Processing Data.ChartAT(Math.floor(math.radomn()*Text Array Length));
}
OUTPUT: Mask(Maksed Data Block)
```

Fig. 6. Pseudo code for masking\ random generating algorithm

C. Flow Chart of the Project

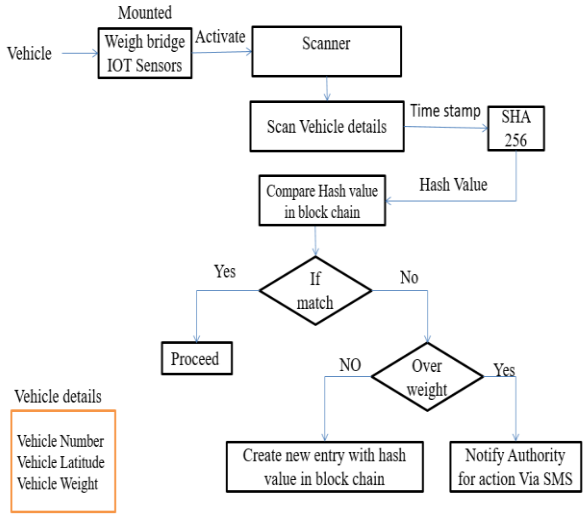


Fig. 7. Data Flow Diagram for the IOT Mounted Scale Indicator.

The figure 7, explains detail flow of the IoT weigh bridge, if the weigh bridge within government threshold values of 1 Kg as we are defined these values, if it exceeds 1 Kg values on the IoT weigh bridge then an SMS message notification is send to the government organization.

IV. RESULTS ANALYSIS

When the truck is carrying the load on the IoT mounted weighbridge, the sensors captures the values and the data values these values are stored into the cloud computing for further processing of these data values and analyses purpose. As shown in the figure 8 and 13. As it is a prototype product, some small objects are placed on the IoT mounted weighing sensors to weigh the value of these objects. In the case of the truck-1 object weights around 0.56 grams as and in case of the truck-2 object weights around 0.70 grams, which is within the limit of the government organization threshold values of 1 KG weighing values. If the values are exceeded above 1 KG, then the SMS message is sent to the mobile handset device, these values are stored into the cloud server database, the output values results are shown in the figure 9 and 14.

Once the data values of the Truck 1 and Truck 2 details are stored into the cloud-computing server, these values are extracted and transferred in the form of the masked blocks the output results values are shown in the figure 10 and 13. Each block contains the one hour weighbridge data, the blocks contains the timestamp and the hash value based on the current timestamp when the data is captured, initial a dummy block is generated which is called genesis block, from the second block onward the actual vehicle information's are stored into the blocks.

If the values of government allocated weighbridge threshold values exceeds, then a SMS short message notification will be sent to the government organization to the dedicated mobile sim card number, stating that for Truck 1 the weighbridge threshold values exceeds as shown in the figure 11.

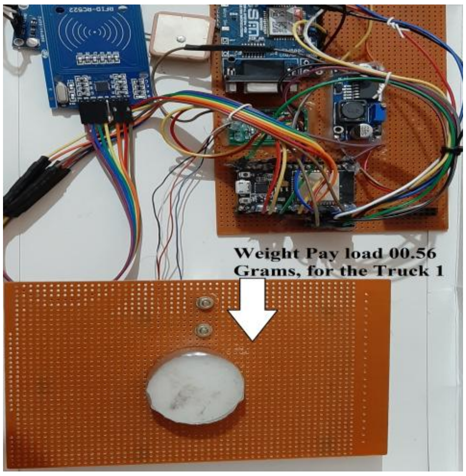


Fig. 8.The glimpse of the weight pay load for the Truck 1.

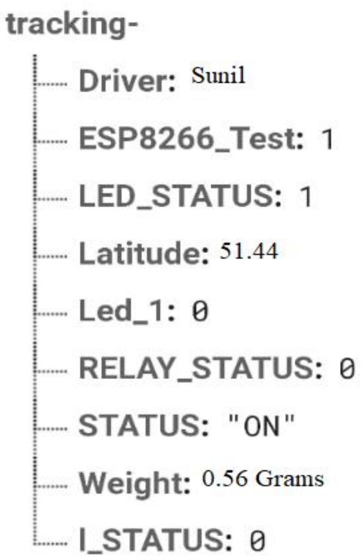
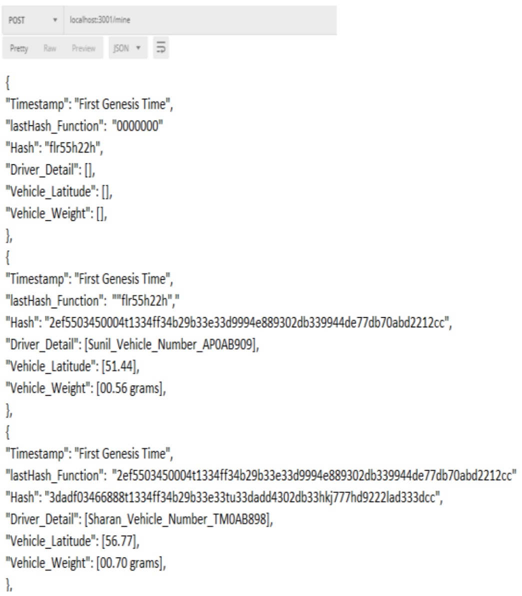


Fig. 9.The sample weight payload for the Truck 1 values captured in the could computing service.




```
{
"Timestamp": "First Genesis Time",
"lastHash_Function": "0000000"
"Hash": "flr55h22h",
"Driver_Detail": [],
"Vehicle_Latitude": [],
"Vehicle_Weight": [],
},
{
"Timestamp": "First Genesis Time",
"lastHash_Function": ""flr55h22h","
"Hash": "2ef5503450004t1334ff34b29b33e33d9994e889302db339944de77db70abd2212cc",
"Driver_Detail": [Sunil_Vehicle_Number_AP0AB909],
"Vehicle_Latitude": [51.44],
"Vehicle_Weight": [00.56 grams],
},
{
"Timestamp": "First Genesis Time",
"lastHash_Function": "2ef5503450004t1334ff34b29b33e33d9994e889302db339944de77db70abd2212cc"
"Hash": "3dadf03466888t1334ff34b29b33e33tu33dadd4302db33hkj777hd9222lad333dcc",
"Driver_Detail": [Sharan_Vehicle_Number_TM0AB898],
"Vehicle_Latitude": [56.77],
"Vehicle_Weight": [00.70 grams],
},
```


Fig. 10. The masked block data values of node 1(peer) glimpse.

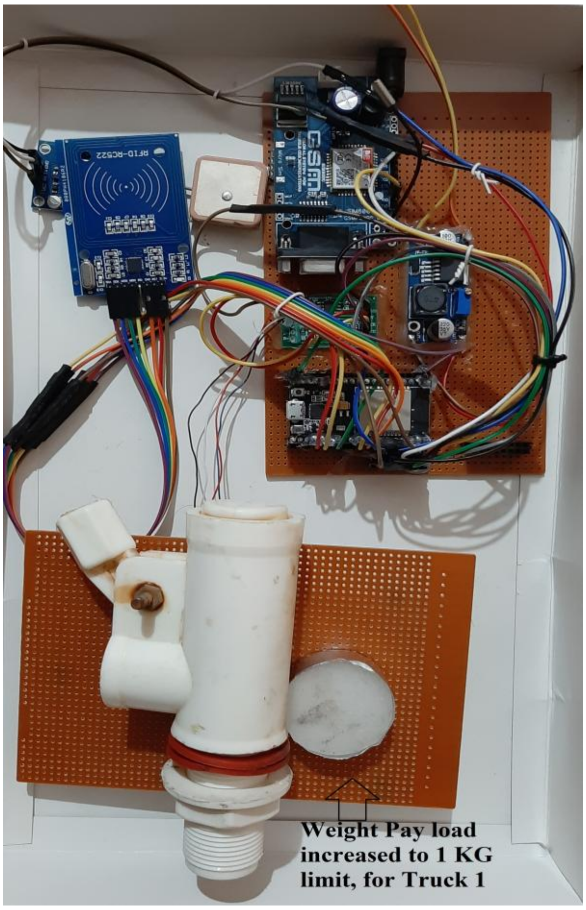


Fig. 11. The glimpse of the weight payload increased for the Truck 1 above 1 KG threshold values.

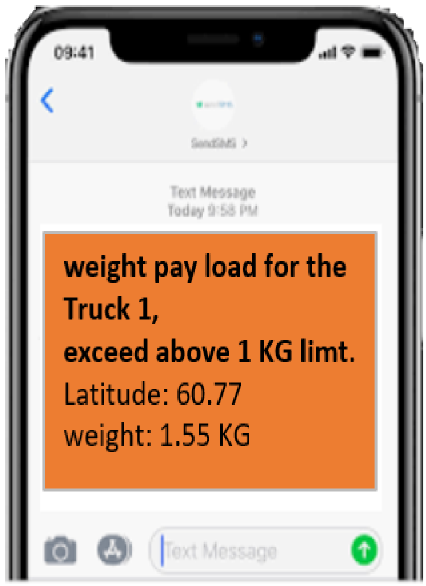


Fig. 12. The glimpse SMS notification to the Mobile, stating that weighbridge threshold values exceeds greater than 1 KG.

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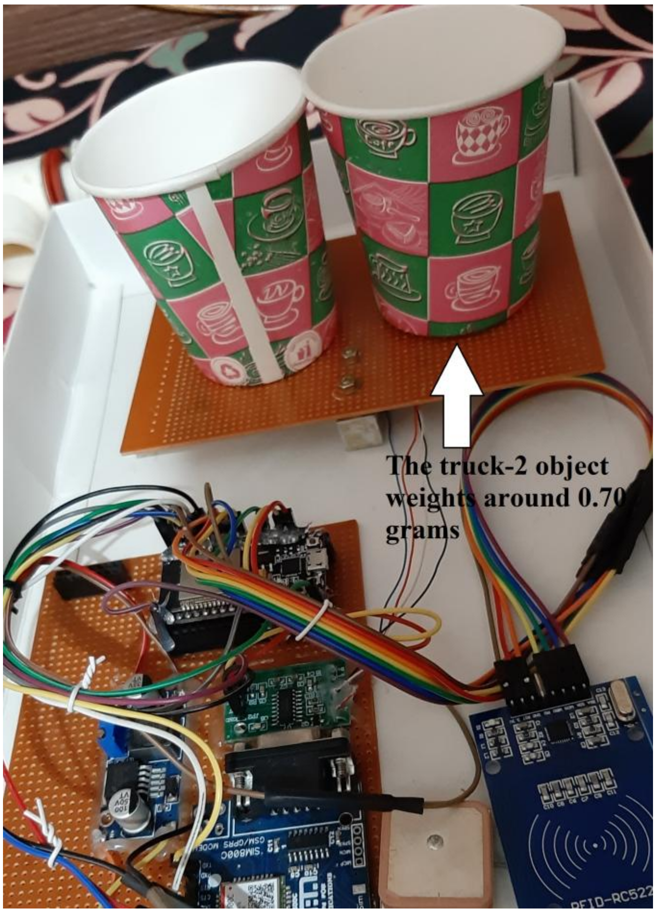


Fig. 13. The glimpse of the weight pay load for the Truck 2.

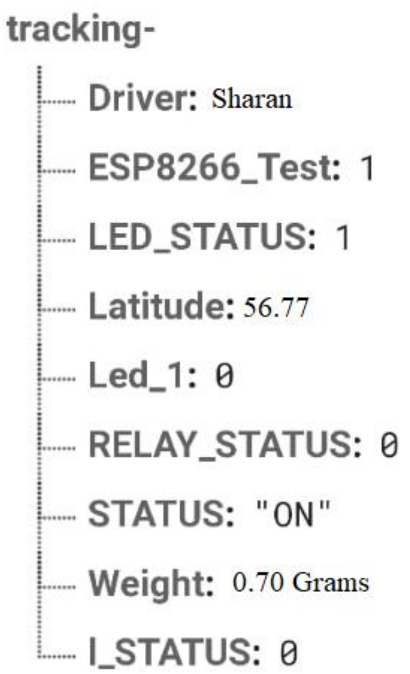
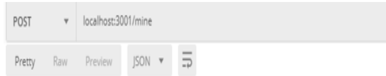


Fig. 14.The sample weight payload for the Truck 2 values captured in the could computing service.




```
{
"Timestamp": "First Genesis Time",
"lastHash_Function": "0000000"
"Hash": "flr55h22h",
"Driver_Detail": [],
"Vehicle_Latitude": [],
"Vehicle_Weight": [],
},
{
"Timestamp": "First Genesis Time",
"lastHash_Function": ""flr55h22h","
"Hash": "2ef5503450004t1334ff34b29b33e33d9994e889302db339944de77db70abd2212cc",
"Driver_Detail": [Sunil_Vehicle_Number_AP0AB909],
"Vehicle_Latitude": [51.44],
"Vehicle_Weight": [00.56 grams],
},
{
"Timestamp": "First Genesis Time",
"lastHash_Function": "2ef5503450004t1334ff34b29b33e33d9994e889302db339944de77db70abd2212cc"
"Hash": "3dadf03466888t1334ff34b29b33e33tu33dadd4302db33hkj777hd9222lad333dcc",
"Driver_Detail": [Sharan_Vehicle_Number_TM0AB898],
"Vehicle_Latitude": [56.77],
"Vehicle_Weight": [00.70 grams],
},
```


Fig. 15. The masked block data values of node 1(peer) glimpse.

V. CONCLUSION

As there is a tremendous growth of Internet of Things (IoT) high-end sensors, all the data are collected accurately and transferred over the target system using the block chain application concepts; these make the data more secure while transferring from source to target location. As most of the devices are getting connected via the internet, as it's connected to the internet the real-time data can be published thought out the world, the amount of the data generated by the Internet of Things (IoT) devices can further be analyzed for future business benefits, in these paper future work needs to be carried out on the analyses of the data generated via Internet of Things (IoT) devices and further improvement of the sensors for the better performance and accuracy of the system. We hope that this paper could act as a source for further research work or enhancement to find feasible solutions to these open problems.

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