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IoT: Smart Vehicle Management System for Effective Traffic Control and Collision Avoidance

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Abstract: ***This paper uses Internet of Things(IOT) as a medium to propose a solution to the problem of accident detection and collision avoidance using present day technologies and also upcoming technologies. It also aims to reduce the traffic at toll nakas by providing an online payment facility in order to reduce day-to-day traffic. Loss of life due to road accident is a major cause of concern for any country and most of the accident happens due to negligence of the driver or driver is under the influence of the alcohol. Automation of Vehicular Systems can help to minimize the road accidents to a great extent. Using technologies like Global Positioning System(GPS),Smartphones it is easier to avoid collisions with the leader vehicles and obstacles. A car fitted with a Wi-Fi Technology and integrated with a smartphone can easily find a vacant parking lots and it can switch to auto- drive mode whenever Required. An efficient fuel monitoring system can help to reduce the fuel theft and improve the performance of the vehicle. It will also be possible to detect the amount of alcohol a person is under when driving so that a car can automatically sense a danger if person has consumed more alcohol then the permissible limits and it will refuse to start unless someone who is not under the influence of the alcohol is at the driving wheel. This paper proposes an effective system for traffic control and avoidance of car collision bringing down accident rates by a considerable amount.***

Keywords: Internet of Things (IOT), RFID, Smart Phones, LADAR.

1. Introduction

In today's world everyone desire for a fast-paced life even without bothering for the human life. Nowadays due to easier EMI options people are able to afford luxury cars, bikes thus adding to the traffic day by day. Even manufactures have adopted various marketing strategies like how much mileage a vehicle gives to increase the sales. This not only adds to the traffic vows but also increases the risk of deaths due to accidents and vehicle collision. Due to heavy traffic on some roads even emergency vehicles couldn't arrive on time thus leading to more deaths due to road accidents. Internet of Things (IOT) can deal with this kind of emergencies by integrating the real time accident information with relay centres, using Wireless Technology (WiFi), smart chips, smart phones and RFIDs so that emergency services could be put to effect immediately without wasting time and nearby hospitals will be intimated within seconds of accidents so that they can prepare themselves in case a major operation is required.

IOT can also be used to deal with the problem of long waiting queue at toll nakas in order to manage traffic efficiently and a considerable amount of time will be saved if Online facility is provided at toll nakas making travel less hectic and comfortable.

IOT is also capable to deal with the fuel theft especially in case of corporate vehicles. By Making use of the latest and future technologies accidental deaths can be reduced to a great extent, time waiting period at toll nakas can be reduced and fuel usage can be monitored effectively. The rest of the paper is organized as follows – Background and Motivation, Problem Definition, Architecture of the Internet of Things, Application Scenarios, Proposed System, Conclusion and Reference. Proposed System presents our ideas that could be implemented in Future.

A. Background and Motivation [4]

There has been conception of smart, communicating objects even before the global computer network was launched forty-five years ago. As the Internet has grown to link all signs of intelligence (i.e., software) around the world, a number of other terms associated with the idea and practice of connecting everything to everything have made their appearance, including machine-to-machine (M2M), Radio Frequency Identification (RFID), context-aware computing, wearables, ubiquitous computing, and the Web of Things. In 1999, Kevin Ashton, a British technologist coined the term 'Internet of Things,' but the idea of devices connecting with each other hails from as far back as the creation of the internet itself. The dawn of the internet age kick started an era of growing and shrinking. The amount of information that could be created, stored, and shared grew exponentially with the ability to create and harvest from across the world– or, at least, from across the world wherever servers were at the time. Simultaneously, places and people that once seemed far away and beyond one's own scope could now be reached and interacted with on a more personal level.

The primary web fit machines don't appear like much today, however when they were initially made, Carnegie Mellon University software engineers and designers added to the first apparatus joined with the web in the mid 1980s. They fixed a Coca-Cola machine to send announcements and messages about the accessibility of a jar of Coke so a trek to the nibble range would not be futile. It wasn't until the late 1990s and mid 2000s that the idea of having a Network of

interconnected gadgets got to be prevalent and drew enthusiasm from companies and shoppers. Kevin Ashton drove the development at his Auto-ID Center at MIT with exploration into the field of radio-recurrence ID, or RFID. Currently, the most serious issue confronting the IoT is the absence of guidelines for correspondence. Without a "typical specialized technique," gadgets might have the capacity to converse with their own particular brands and extremely constrain the accommodation of joined machines. For instance, right now, resting screens just offer results to telephones for clients to examine themselves. Envision a future where dozing screens could offer results to specialists or ready clients of irregular or undesirable resting examples and propose fixes that could thus be incited by correspondence with an espresso machine (if caffeine is associated with harming the client) or indoor regulator (if temperature could be contrarily affecting resting propensities). To cure this circumstance, Intel, Cisco, GE, and IBM have meet up to shape the Industrial Internet Consortium, an aggregate not-for-profit with the objective of expanding between operability principles in gadgets joined with the Internet. Yonck, as a futurist, comprehends the present patterns of innovation and predicts where they are going.

*"As it develops, the future of IoT is to basically make our world more intelligent. Technology everywhere will **literally** have the ability to sense it's environment and respond to it. While this may not result in direct physical **action** on the particular device's part, it will be capable of relaying data to servers elsewhere that will potentially cause other devices to respond."*

B. Problem Definition

Road accidents have been a major issue for most of the countries. Studies shows that the number of deaths due to road accidents is increasing year by year making safety a major concern. Even though the safety norms is being practised and precautions are being taken to minimize the fatality rate there has been no major advancements in this regard. Internet of Things coupled with Smartphone technology, RFID, sensors and LADAR system aims to minimize the deaths that occur worldwide due to road accidents and to increase the life span and mortality rate of person. Proposed System is also capable to eliminate the long waiting queues at toll nakas by allowing the vehicle owners to register for online payment facility and eliminating the need for requiring tender exchange at toll nakacounter. It deals with the major issues of Traffic Congestion and Collision avoidance and suggest remedies to tackle the same.

C. Architecture of the Internet of Things

The Internet of Things needs an open structural engineering to augment interoperability among heterogeneous frameworks and disseminated assets including suppliers and purchasers of data and administrations, whether they be individuals, programming, brilliant articles or gadgets. Structural planning principles ought to comprise of all around characterized conceptual information models, interfaces and conventions, together with solid ties to impartial innovations, (for example, XML, web administrations and so on.) so as to backing the amplest conceivable mixed bag of working frameworks and programming dialects. Web of Things hubs may need to alterably and independently shape associate systems with different hubs, whether nearby or remote, and this ought to be bolstered through a decentralized, circulated way to deal with the structural planning, with backing for semantic hunt, disclosure and companion organizing. Envisioning the boundless volumes of information that may be produced, it is critical that the structural engineering additionally incorporates components for moving insight and capacities for separating, example acknowledgment, machine learning and choice making towards the very edges of the system to empower circulated and decentralized preparing of the data, either near to where information is created or remotely in the cloud. To make Internet of Things work needs range from

1) Internet
2) Sensors, RFID
3) Distributed architecture
4) Smart phones.
5) LIDAR or LADAR

Sensors: A sensor is a gadget that can quantify a physical quality and proselytes that physical amount into a signal that can be read by an instrument or an onlooker. In the thought of the Internet of Things, the capacity to identify changes in the physical status of things is likewise crucial for recording changes in the earth Sensors gather information from nature, for example, vibrations, temperature, and weight, among others, and convert them into information that can be processed and analyzed. This permits the Internet of Things to record any adjustments in nature or an item.

RFID: Radio Frequency Identification (RFID) is a system that transmits the information of an article or a man utilizing radio waves for recognizing or tracking the item or individual. It is finished by first appending a tag, known as the RFID tag, to the item or individual. This tag will then be read by the reader to focus its ID data. [13]It lives up to expectations much like a barcode, where a scanner examines the barcode and the data will be acquired from the it. Then again, barcode obliges an observable pathway with a specific end goal to be examined though RFID tags needn't bother with a viewable pathway to be read. This implies that RFID tags can be read regardless of the possibility that the tag is kept in a container or a compartment, or kept in a pocket. This is on the grounds that it uses radio waves. This is an enormous favorable position of RFID. Another point of interest of it is that there is a kind of RFID tag known as an inactive RFID label which does not oblige batteries to capacity.Its power supply comes from the radio energy transmitted by the reader. Other than that, many RFID tags can be read at once, not at all like the barcode where only 1 can be scanned at a time.

Smartphones: A modern smartphone is equipped with up to 10 sensors, able to capture anything from location to the device orientation to light conditions. Collectively, these sensors produce a huge amount of data, both in unstructured form (picture or videos) as well as structured, such as GPS or acceleration data. With the rise of the wearables, such as Android Wear or the Apple Watch your smart phone increasingly plays and additional role. This new role can be

considered as the 'brain' of your Body Area Network (BAN), given the storage and communication capabilities of the smart phone. Last but not least with technologies such as Near Field Communications (NFC), more and more smart phones can function not only as sensors but as actuators, that is, trigger actions (such as payments) or control other things, including TVs or cars.

LIDAR or LADAR: Lidar (likewise composed LIDAR, LiDAR or LADAR) is a remote detecting innovation that measures remove by lighting up an objective with a laser and breaking down the reflected light. Lidar is prominently utilized as an innovation to make high- determination maps with applications in geomatics, archaeology, geography, geology, geomorphology, seismology, ranger service, remote detecting, climatic material science, airborne laser swath mapping (ALSM), laser altimetry, and shape mapping.Lidar utilizes bright, noticeable, or close infrared light to picture objects. It can focus on an extensive variety of materials, including non-metallic articles, rocks, downpour, substance mixes, mist concentrates, mists and even single moleculesA tight laser-shaft can outline highlights with high resolutions of up to 30 cm/px. This lidar may be utilized to output structures, rock developments, and so forth., to deliver a 3D model. The lidar can point its laser bar in a wide range: its head turns evenly; a mirror tilts vertically. The laser bar is utilized to quantify the separation to the first question on its way.

D. Application Scenarios

1) Home and Offices [5]

a) Trackers

You can without much of a stretch find your keys with the assistance of Bluetooth and a sensor appended to the keychain of your key. What happens is, the sensor reacts to the Bluetooth use of your PDA and transmit beeps relying upon the region. This tracker could used to track any item extending from keys to records gave the sensor is appended to the article.

i. Smart Locks: Smart Lock and comparative items are locks that can be opened and shut utilizing a smartphone or a smart home hub. The lock is controlled with a smartphone utilizing a Bluetooth connection instead of an Internet connection . At the point when your phone is sufficiently close to join with the lock, a simple tap of a button in the app will lock or unlock your door. You can likewise give "virtual keys" to friends and family, permitting them to open your entryway with their phones indefinitely or for a set time of time.

ii. Smart Light Bulbs: Smart Light Bulbs takes the switch from the wall and puts it on your phone. A perfect highlight to make certain, with the ability to dim and change colors,all from the solace of your sofa. Keeping in mind these LED bulbs likewise incorporate these functionalities, by inserting sensors and microcontrollers, and also Bluetooth, Zigbee and iBeacon equipment, specifically into the hub. If the rain clouds part and the room suddenly brighten, the bulb's ambient light sensor picks up the change and automatically dims to appropriate levels according to the new amount of light. Thus light control, voltage control is possible on the tip of your fingers on your smartphone.Also the lights can be able to auto off by detecting temperature expand or diminish. So in the event that you have neglected to switch off the lights and you are out on an excursion, brilliant bulbs spare you a gigantic bill.

iii. Smartenergy administration gadgets: Along with a developing consciousness of sparing vitality in workplaces, more endeavors are expected to decrease vitality utilization and enhance the vitality sparing execution of multifunction gadgets. Routinely, when a multifunction gadget recuperated from sleep mode, the whole gadget must be fueled up to empower a client to utilize all capacities. Client interfaces (UI) give vitality input to purchasers. They- additionally alluded to as direct feedback, give more essential data restricted preparing to inhabitants, such real time as well as memorable information on vitality utilization (in kWh, $/hr, watts/hr, and so on.). In contrast, UI's with processed data, also referred to as indirect feedback, have the potential give users a better sense of the personal significance of raw usage data and how to act upon that information Examples of processed information include: energy consumption by end use, circuit, or device historical comparisons / trends; personalized; targeted recommendations, and goal setting. Energy output can also be controlled depending upon the statistics on the UI. Every house/Office can have a dedicated workbench that allows the owner to change the settings of the linked attachments/objects. This is likewise feasible for recognizing gas utilization, warmth levels in the region, spillages, and water utilization and so on

2) Vehicles

i. Fuel Monitoring System:
A Fuel Monitoring System for fleet management will not only exclude fuel theft and ensure company vehicles are used it will also have additional benefits like appropriately refining fuel consumption rates vehicle operating time monitoring improving fleet profitability.

ii. Traffic Detection and Accident Avoidance:
Tracks all dynamic cell phones on the streets anonymously, through an association at the principle switches of the cell system, to give the best movement data accessible today for urban communities and nations, for all thruway, materials and applicable surface avenues. We can likewise get the continuous data with respect to the toll naka and we can pick paying it online as opposed to sitting tight in the line for turn.

iii. Parking Sensors
Parking Sensors will be joined with Wifi so that a Car can get to continuous data about accessible parking areas with the assistance of a cell phone and it could be consequently headed to the parking garage and its proprietor can with help of a smartphone can call it to which ever area he at present is in.

3) Health

Using appropriate sensors one can monitor's cancerous cells, disease detection, sending heartbeat details to doctor on time so that your health does not deteriorate beyond a point. Track your body's weariness, vitality levels, tear of a muscle , hamstring damage and can likewise recognize mind tumors .It could likewise screen the radiation levels transmitted by adjacent devices so that danger of wellbeing related infections can be minimized to a degree. It could likewise study body structure, immunity and resistant power, allergies, glucose levels.

E. Proposed System

The system deals with 2 aspects in Vehicle Management. Collision Avoidance [7][8][9]

Almost 1.3 million individuals bite the dust in street crashes every year, overall 3,287 passings a day.Road car accidents rank as the 9th driving reason for death and record for 2.2% of all passings globally.Road accidents are the main reason for death among youngsters ages 15-29, and the second driving reason for death worldwide among youngsters ages 5-14.Each year about 400,000 individuals under 25 pass on the world's streets, by and large more than 1,000 a day. More than 90% of all street fatalities happen in low and center salary nations, which have not as much as 50% of the world's vehicles. Street accidents cost USD $518 billion comprehensively, costing individual nations from 1-2% of their yearly GDP.Road accidents cost low and center wage nations USD $65 billion every year, surpassing the aggregate sum got in formative assistance.Unless move is made, street activity wounds are anticipated to turn into the fifth driving reason for death by 2030.[1]

Mechanized fender bender recognition can spare lives by diminishing the time needed for data to achieve crisis responders. Late improvements in mm-wave RADAR examining will make this a promising innovation soon for impact shirking, particularly when nature is darkened with smoke, tidy, and climate .LAser Detection And Ranging(LADAR) or LIght Detection And Ranging(LIDAR) uses laser light to identify the separation to questions like a RADAR framework.

Self Sufficient vehicles use lidar for deterrent location and evasion to explore securely through situations. Expense guide or point cloud yields from the lidar sensor give the essential information to robot programming figure out where potential obstructions exist in the earth and where the robot is in connection to those potential snags. Samples of organizations that deliver lidar sensors ordinarily utilized as a part of apply autonomy or vehicle computerization are Sick and Hokuyo.Examples of hindrance identification and evasion items that influence lidar sensors are the Autonomous Solution, Inc. Estimate 3D Laser System and Velodyne HDL-64E.[11]

Cell phones have made it conceivable to coordinate the in-manufactured vehicle sensors with remote portable sensor to send continuous data by method for Bigdata and Hadoop Technology. These days cell phones produces are giving a plenty of sensors effortlessly accordingly expanding the effectiveness with which mishap spots can be recognized and checked for loss of human lives and ongoing data will be accessible to the closest crisis focuses so they can set themselves up completely and can get to the circumstance better with the assistance of the data send by the cell phones. Late advances in cell phone advancements are making it conceivable to distinguish auto collisions in a more versatile and financially savvy way than ordinary in-vehicle arrangements.

Brilliant GPS Dialer

A Smart GPS or programmed mischance responder unit is an electronic gadget that can naturally associate with the closest satellite station recipient giving the data about the area of mishap through GPS(Global Positioning System) .It will consequently contact the close-by crisis focus furthermore the close-by police headquarters will be informed.A Short Message Service (SMS) will be sent containing the vehicle enlistment number and GPS area, to the powers or even the protection operators. This life-sparing framework which can be put operating at a profit box of a vehicle to report occurrences and accordingly decrease the time expected to transfer mishap area data to the significant powers. [12]

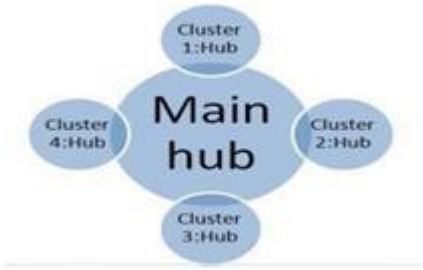
Time Reduction at toll naka

Vehicles can abstain from holding up time at toll nakas by paying the said sum by utilizing online installment administrations and there would be a devoted path for the vehicles who have effectively paid the toll sum. A GPS gadget will continually overhaul the area of the adjacent toll nakas which will pull continuous data from the servers applying enormous information and Hadoop innovation to transfer data back to the GPS framework. Installment System at toll naka will be redesigned on auspicious premise and will likewise keep up a tally of the no of vehicles entering and leaving the toll naka. Each vehicle's enlistment number, vehicle sort and driver subtle elements will be said online so that toll naka can ascertain the accurate sum and there will be no issue of giving back the trade. .

2. Measuring traffic using IOT [2] [3]

Radio frequency identification (RFID) technology is viewed as a key enabler of the Internet of Things. RFID tagged entities have a unique digital identity and play an important role in connecting the physical world with the digital one into a hybrid space. Monitoring environmental parameters like carbon dioxide emissions in the specified area helps us to understand the amount of traffic. Areas can be grouped into a cluster and later connect to many such similar clusters forming a network. Every vehicle will have a sensor that calculates the smoke area in the vicinity.

Clusters and hubs:

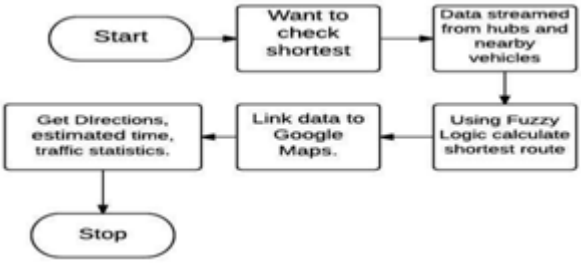


This data travels to a main hub of the cluster and a final amount of emissions is estimated. These hubs can be attached to traffic lights that not only store data but also have the provision to notify police stations and hospitals in case of an accident or a calamity. It can do so by judging the amount of pollution (air), honking of the horns (sound pollution) and a dedicated hotline for travelers that can be a feature in their smart phones as an app. The app can have latest updates of all clusters with an option to choose different routes as well. If the value is beyond a threshold value, a trigger sets off notifying approaching cars to slow down and suggest an alternate route.

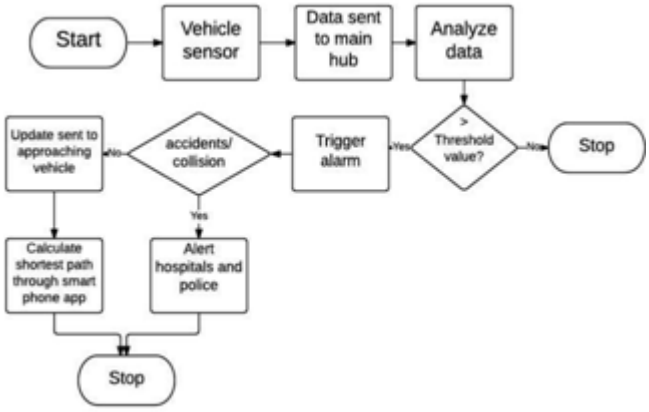
This is helpful in the case of ambulances, fire brigades as they get a notification/sound –light alarm via they RFID transmitter/receiver indicating traffic. The proposed system will from there calculate an alternate route by using soft computing methodologies like neural networks and fuzzy logic.

The data can be gathered from the hubs available at every cluster as well as every vehicle in the vicinity to calculate a shorter, faster route. By means of Big Data processing technologies the Proposed System can reach the most accurate and up-to-date picture describing real-time situation on the roads. Big data processing and high accuracy probabilistic analysis technologies open many new business opportunities in the field of freight and public transportation. Real-time public traffic analysis allows to deliver the optimal amount of transport for a given number of passengers during the peak hours and to avoid empty transport movement on the roads. This lets not only saving money, but improving passengers' comfort level. It makes transportation and logistics more efficient, leads to much better life quality on the roads due to excluding human factor as well.

Path: Passenger end- getting the shortest route.



Path: System detects traffic on the basis of pollution in the vicinity.



3. Conclusions

Taking everything into account, the Internet of Things is closer to being executed than the normal individual would think. A large portion of the vital mechanical advances required for it have as of now been made, and a few producers and organizations have as of now started actualizing a little scale rendition of it. A dynamic methodology has been proposed in this paper to handle the issue of Vehicle crash and location by utilizing the innovations of Internet of Things in most effective way and to minimize the mischance and human misfortunes all things considered. This paper additionally gives brief knowledge into the innovations that can be put to use to decrease holding up time at toll naka to avert movement blockage and to give the activity control room with the latest data about the movement development.

References

[1] http://asirt.org/
[2] An Internet of Things-based Distributed Intelligent System with Self-Optimization for Controlling Traffic-Light Intersections. Cristina Elena Turcu*, Vasile **Gheorghiță Găitan*,** Corneliu Octavian Turcu****Ştefancel Mare University of Suceava**, Computers, Electronics and Automation Department,Suceava,Romaniacristina@eed.usv.ro, gaitan@eed.usv.ro,cturcu@eed.usv.ro;978-1-4673-1810- 5/12/$31.00 ©2012 IEEE.
[3] Smart traffic light in terms of the Cognitive road traffic management system (CTMS) based on the Internet of Things.VolodymyrMiz, PhD student at Kharkov National University of Radioelectronicsmizvladimir@gmail.com. Vladimir HahanovDSc, professor atKharkov National University of Radioelectronicshahanov@kture.kharkov.ua.
[4] Internet of things. IEEE [Online]. Available: http://iot.ieee.org/
[5] http://postscapes.com/internet-of-things-examples/
[6] Pedestrian Detection and Tracking using in-vehicle Lidar for Automotive Application Takashi Ogawa, Hiroshi Sakai, Yasuhiro Suzuki, Kiyokazu Takagi, Katsuhiro Morikawa, DENSO CORPORATION
[7] V2V Wireless Communication Protocol for Rear-End Collision Avoidance on Highways Fei Ye, Matthew Adams, Sumit Roy {fye, mar22,sroy}@u.washington.edu Department of

Electrical Engineering, University of Washington, Seattle, WA
[8] On-Road Vehicle Detection: A Review Zehang Sun, Member, IEEE, George Bebis, Member, IEEE, and Ronald Miller
[9] Collision Avoidance for Vehicle-Following Systems Stefan K. Gehrig and Fridtjof J. Stein
[10] Monitoring Road Accidents using Sensors and providing Medical FacilitiesNeeti Bisht1, Pragya Siddhi2, Hema Kashyap3
[11] http://en.wikipedia.org/wiki/Lidar
12]http://link.springer.com/chapter/10.1007%2F978-3