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ARTICLE

TOWARDS THE MODERNIZATION OF SMART TRAFFIC LIGHTNING USING IOT

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ABSTRACT

In the present scenario of smart city, explicitly in the modern and market zones, the traffic situation is much clogged more often especially at the pinnacle time of business hours. Because of expanding development of populace and vehicles in smart and metropolitan urban areas individuals are confronting a ton of issue at the significant traffic purposes of the business towns. It causes delays as well as it adds to ecological contamination just as different well-being perils because of contamination brought about by vehicle speeding. To avoid such extreme issues numerous brilliant urban networks are connect presently executing keen traffic control structures that chip away at the benchmarks of traffic computerization with counteractive action of the recently referenced issues. In this paper, we have contemplated and thought about the conventional and the sharp traffic control framework, their different favorable circumstances and impediments. We likewise did some examination into different urban communities worldwide where the sharp traffic control framework has been embraced and their prosperity proportions. Moreover, we investigated the urban areas in India where this idea is a generally new one with more accentuation and contextual investigation on the smart traffic control framework received in Bhubaneshwar, the parts utilized, the deformities in it and based on this paper, we mean to amend the imperfections in this rush hour gridlock control framework.

KEY WORDS
IoT, Smart-cities, Censors, ATSC System

INTRODUCTION

The conceptualization of Smart City varies from city to city and country to country, depending on the level of development, willingness to change and reform, resources and aspirations of the city residents. In the imagination of any city dweller in India, the picture of a smart city contains a wish list of infrastructure and services that describes their level of aspiration. The urban planners aim at developing the entire urban eco-system, which is represented by the four pillars of comprehensive development-institutional, physical, social and economic infrastructure. The core infrastructure elements in a Smart City would include: sufficient water supply, guaranteed power supply, sanitation, including strong waste administration, effective urban versatility and open transport, reasonable lodging, particularly for poor people, vigorous IT availability and digitalization, great governance, particularly e-Governance and native cooperation, feasible condition, well-being and security of residents, especially ladies, kids and the old, and wellbeing and training. As needs be, the motivation behind the Smart City Mission is to drive economic growth and improve the personal satisfaction of individuals by empowering neighborhood and tackling innovation that prompts smart results.

INTERNET OF THINGS

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Evolution of IoT

IOT is a network of devices, buildings, vehicles and other physical objects embedded with sensors that transmit the valuable data between a company and the consumer. The purpose of all this communication between the two is to provide consumers smarter products and services, a better customer experience, and for businesses a competitive edge and ability to build revenue. The evolution of IOT took place since 1999 to till date. The evolution of an IoT has been shown in Fig 1.

ARCHITECTURE OF IOT

With the use of IoT, things in the physical world (i.e. the IoT devices or objects) interact with the virtual world (cloud services, platforms and various applications) through a communication network which enables exchange and sharing of information with each other. So, an IoT system comprises of the physical world, virtual world and a communication network and these three are most importantly the basic blocks of an IoT system.

Things - With Internet of things, any item that has a special personality in the physical world or in the realm of data which can be coordinated in correspondence is called 'Thing'. The Things can be of two kinds' physical things and virtual things. The physical things are commonly the IoT devices and the virtual things can be the cloud administration arrangements like programming applications, APIs and application arrangements that trade and procedure information in their own position. The most well- known case of physical things can be a temperature sensor. A temperature sensor is associated with a correspondence organize through a controller and after that it is utilized for gathering and sharing the dynamic data about the ongoing temperature of the earth.

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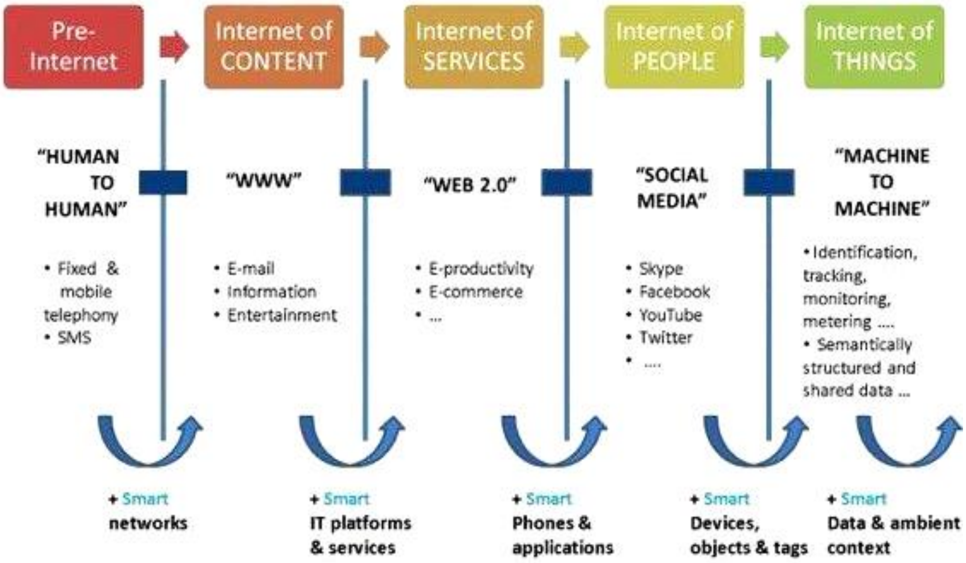

Fig. 1: Evolution of IoT

The physical world - The physical world in an IoT framework is an accumulation of physical things or devices. These physical things or devices are worked around controllers or processors with of include IOT sheets. These devices are fit for detecting, gathering, putting away, sharing and handling data and are likewise fit for working at least one actuators to affect in reality.

The virtual world - The virtual world in IoT alludes to the gathering of virtual things. These virtual things are by and large Internet, cloud or versatile applications, APIs or application stages. The virtual things additionally assume a noteworthy job in information logging, information mining and investigation in an IOT framework.

Communication system: The correspondence organizes a connection that permits communication between the physical world and the virtual world.

IoT has a basic four tier architecture and following are the layers as denoted in Fig 2:

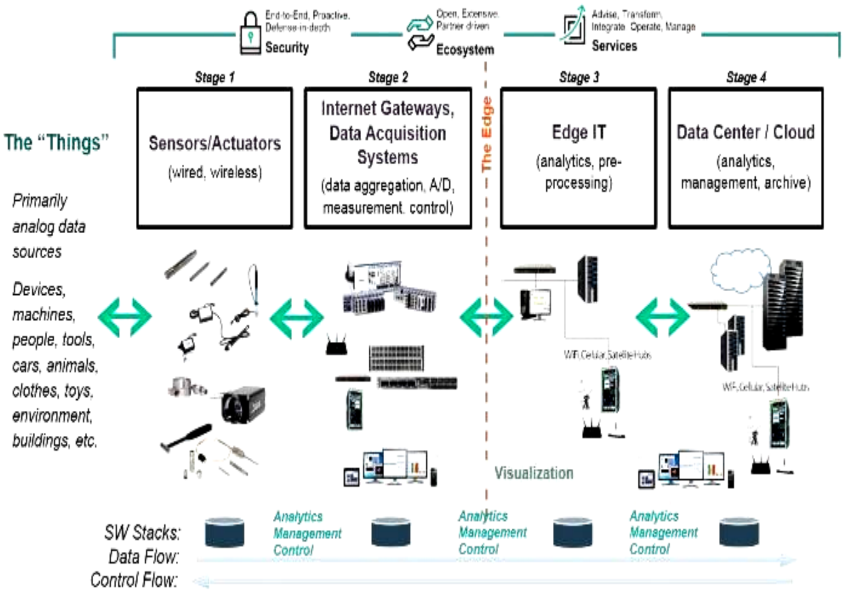

Fig. 2: Four Stages of IoT Architecture

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Advantages of IoT

- Communication: IOT empowers the correspondence between devices which is additionally prominently known as Machine-to-Machine (M2M) correspondence. Along these, the physical devices can remain associated and subsequently the all-out straightforwardness is accessible with a less wasteful aspects and improved quality.
- Automation and control: Because of physical articles getting associated and controlled carefully and midway with remote framework, there is a tremendous measure of robotization and control in the operations. Without human impedance, the machines can speak with one another which prompts a quicker and convenient yield.
- Information: It is clear whether there will be more data then it will enable us to detail better choices. Regardless of whether it is a minor choice as having to recognize what to purchase at the supermarket or if your organization has enough devices and supplies, information is power and more learning is better.
- Monitor: The IoT enables you to computerize and control the assignments that are done every day, keeping away from human impedance. Machine-to-machine correspondence keeps up straightforwardness in the procedures. It additionally prompts a consistency in the errands. It can likewise keep up the nature of administration. We can likewise make vital move if there should arise an occurrence of crises.
- Time: The machine-to-machine connection gives better effectiveness; consequently, exact outcomes can be acquired rapidly. This outcome in sparing profitable time. Rather than rehashing similar assignments consistently, it empowers individuals to do other imaginative employments.
- Money: The greatest preferred standpoint of IOT is setting aside extra cash. IOT on a very basic level ends up being an exceptionally supportive to individuals in their everyday schedules by influencing the machines to impart to one another in a powerful way subsequently sparing and moderating vitality and cost. Enabling the information to be conveyed and shared among devices and afterward making an interpretation of it into our required way, it makes our frameworks effective.
- Better Quality of Life: All the applications of this technology emphasize on increased comfort, convenience, and better management, thereby improving the quality of life.

Drawbacks to IoT

- Security: With the majority of this IoT information being transmitted, the danger of losing protection increments. For instance, how very much encoded will the information be kept and transmitted with? Do you need your neighbors or managers to know what meds that you are taking or your money related circumstance?
- Compatibility: As devices from various makers will be interconnected, the issue of similarity in labelling and checking manifests. Although this disadvantage may drop off if all the manufacturers agree to a common standard, even after that, technical issues will persist. Today, we have Bluetooth-enabled devices and compatibility problems exist even in this technology! Compatibility issues may result in people buying appliances from a certain manufacturer, leading to its monopoly in the market.
- Complexity: The IOT is a different and complex system. Any disappointment or bugs in the product or equipment will have genuine outcomes. Indeed, even power disappointment can cause a ton of burden.
- Lesser work of modest staff: The incompetent specialists and partners may finish up losing their positions in the impact of robotization of every day exercises. This can prompt joblessness issues in the general public. This is an issue with the appearance of any innovation and can be overwhelmed with training. With every day exercises getting computerized, normally, there will be less necessities of HR, principally, laborers and less taught staff. This may make Joblessness issue in the general public.
- Technology assumes responsibility forever: Our lives will be progressively constrained by innovation, and will be reliant on it. The more youthful age is as of now dependent on innovation for each seemingly insignificant detail. We need to choose the amount of our everyday lives willing to automate and be constrained by innovation.

APPLICATIONS OF IoT IN SMARTCITIES

Smart car parking system: Traffic congestion caused by vehicle is an alarming problem at a global scale and it has been growing at a large scale. Car parking is a major issue these days and has contributed immensely with increasing vehicle size in the luxurious segments and confined parking spaces in the urban cities. Searching for a parking space has become a routine task and often is a frustrating activity for many people in cities around world. With IOT based smart parking system, users will automatically find a free parking space in a particular geographic area and that too at a minimal cost [4]. IOT based smart parking system involves using low-cost sensors, real-time data collection, and mobile-phone-enabled automated payment systems that will allow people to reserve parking spaces in advance or very accurately predict where they will likely find a parking spot. It also enables cities to carefully manage their parking space. Smart car parking has solved one of the biggest problems in urban areas for finding empty parking spaces and controlling illegal parking spaces and controlling illegal parking. As for example we have shown an IoT based smart parking system in below Fig 3.

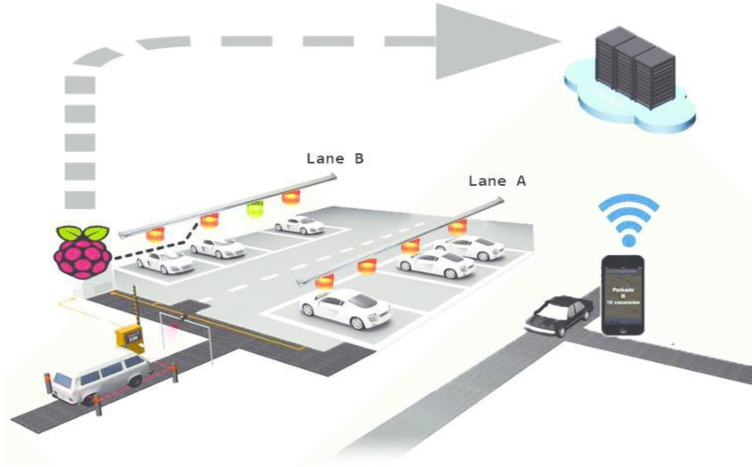

Fig. 3: IoT based Smart Parking system

Waste management- (smart bin): Sensor Based Waste Collection Bins are used to identify the status of waste bins if they are empty or completely filled so as to customize the waste collection schedule accordingly and also to make it cost effective. Real time waste management system with the use of smart dustbins enables to check the fill level of dustbins whether the dustbins are completely full or not, through this system the information of all smart dustbins can be accessed from anywhere across the globe and anytime by the concerned person [3]. It will also inform the status of each and every dustbin in real time so that the concerned authority can send the garbage collection vehicle only when the dustbin is full. It has been represented in Fig 4 below.
Benefits:

- It will stop the overflowing of dustbins along roadsides and localities as smart dustbins are managed at real time.
- The filling and cleaning time of smart bins will also be reduced thus making empty and clean dustbins available to the common people.
- It also aims at creating a clean and green environment.
- By using the route algorithm it will smartly find the shortest route thus it will reduce the number of vehicles used for garbage collection.
- It will send optimized routes directly to drivers.
- It will reduce the fuel Consumption.
- Less amount of fuel will be consumed by vehicles thus it will help in saving a large amount of money as well.
- It will stop overflowing of dustbins along roadsides and localities.

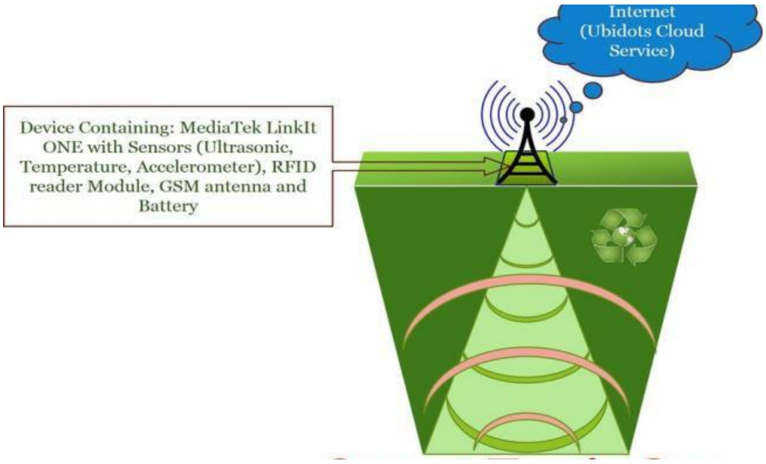

Fig. 4: IoT based Smart Dustbin

Smart water quality checking framework: Guaranteeing the security of water has turned into a testing undertaking because of the unnecessary wellsprings of poisons a large portion of which are brought about by human exercises. The primary driver for water quality issues is the over-abuse and over utilization of common assets. The quick development of industrialization, urbanization and more prominent accentuation on rural development joined with the most recent headways and mechanical improvement, rural composts and non- authorization of laws have added to water contamination to an expansive extent. The issue is at times disturbed because of the unpredictable circulation of precipitation. The Keen Water Quality Observing Framework which is IOT based will screen the nature of water continuously [3]. This framework comprises of certain sensors which measure the water quality parameter, for example, pH, turbidity, risky Gas, broke up oxygen, water level, and so on. It is planned and oversaw utilizing a Remote Sensor System (WSN) that screens the water quality with the assistance of data detected by the sensors submerged in water, in -order to keep the water asset inside a standard that is depicted for household use and to almost certainly take essential activities to re-establish and improve the soundness of the debased water asset. It has been represented in Fig 5 below.

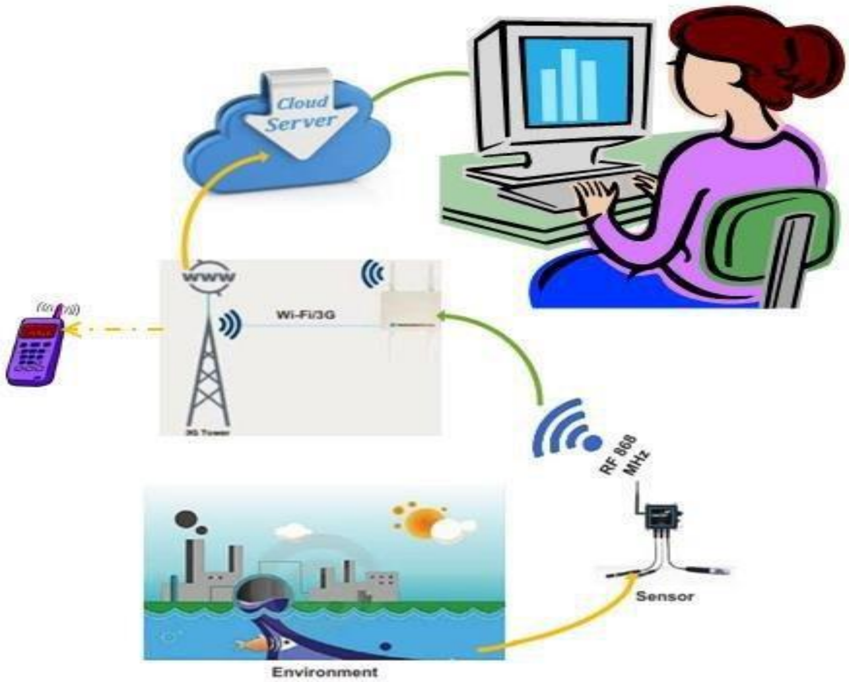

Fig. 5: Schematic diagram of the Smart Water quality monitoring system

Smart air quality checking frameworks: The air quality in Delhi, as indicated by a WHO review of 1600 world urban areas, is the most exceedingly bad of any significant city on the planet. Air contamination in India is assessed to slaughter 1.5 million individuals consistently; it is the fifth biggest executioner in India. India has the world's most astounding demise rate from unending respiratory illnesses and asthma, as indicated by the WHO [2]. Significant poisons causing respiratory sicknesses are:

I. Fine particles delivered by the consuming of non-renewable energy sources like coal, oil, and so forth.
II. Noxious gases like sulfur dioxide, nitrogen oxides, carbon monoxide-CO, compound vapors, and so forth.
III. Ground-level ozone (a receptive type of oxygen and an essential part of urban exhaust cloud) .
IV. Volatile Natural Mixes having a high vapor weight at standard room temperature, formaldehyde-HCHO gas being significant segment.

Air quality Checking gives crude information comprising of estimations of gases and convergences of contaminations, which would then be able to be examined and deciphered. IOT Based Air Contamination Observing System screens the Air Quality over a Internet server utilizing Internet and it will trigger a caution when the air quality goes down past a specific dimension, implies when there are unreasonable measure of hurtful gases present noticeable all around like CO2, smoke, liquor, benzene, NH3, NOx and LPG. The framework will demonstrate the air quality in PPM on the LCD screen and just as on site page with the goal that it tends to be observed in all respects effectively. Temperature and Humidity(moisture)can additionally be identified and observed in the framework. It has been represented in Fig 6 below.

Fig. 6: IoT based Air Quality monitoring system

Smart traffic control system: Traffic light control frameworks are broadly used to screen and control the stream of vehicles crosswise over different intersections of a few streets. Their point is to acknowledge smooth movement of cars in the transportation courses. Be that as it may, the synchronization of various traffic lights frameworks at adjoining intersections is a confounded issue. Likewise, the common impedance between nearby traffic light frameworks, uniqueness of autos streams with time, different instances of mishaps, the entry of crisis vehicles, and the person on foot intersections are not actualized in the current traffic framework which prompts automobile overload and blockage. The ordinary traffic framework should be moved up to understand the extreme traffic blockage, ease transportation issues, diminish traffic volume and holding up time, limit generally travel time and advance vehicles wellbeing. IOT based traffic the executive's frameworks for smart urban communities serves to effortlessly arrange with emergency vehicle driver to locate the flag status and pick the way where traffic stream can be progressively controlled and petty criminal offenses are been distinguished by on location traffic officers through halfway checked and controlled through Internet. A robotized miniaturized scale controller based traffic control framework utilizing sensors alongside live Internet updates can be a useful advance in enhancing the traffic stream design in occupied convergences. Keen Traffic The board is where halfway controlled traffic signs and sensors direct the stream of traffic through the city.

TRADITIONAL TRAFFIC CONTROL SYSTEM

One of the serious issues looked in any metro city is traffic clog. Stalling out between substantial traffic is a migraine for every single individual driving the vehicle and even to the traffic police in controlling the traffic. One of the most established methods for taking care of traffic was having a traffic policeman conveyed at every intersection who physically controls the inflow of traffic through hand flagging. Anyway this was very bulky and afterward came the requirement for an alternate kind of control – utilizing Traffic signals, which is developed by Garret Morgan and J.P.Knight. Customary Traffic light controllers utilized a fixed foreordained calendar for traffic inflow for every bearing in the intersection. The controller was an electro mechanical controller which comprises of mechanical frameworks worked electrically. It comprises of three noteworthy parts-a dial clock, a solenoid and a cam get together. An engine and an apparatus gathering works the dial clock which thusly are dependable to empower or de-invigorate a solenoid which thusly works a cam get together which are capable to give current to each flag sign. The dial clock is utilized to give redundancy of fixed span interims. The issue with this conventional methodology is that it will in general be wasteful. Indeed, even arrangements that offer need to open and crisis transportation will in general miss the mark. This principally happens on the grounds that one key blemish stays with these frameworks that the control is brought together. It has been represented in Fig 7 below.

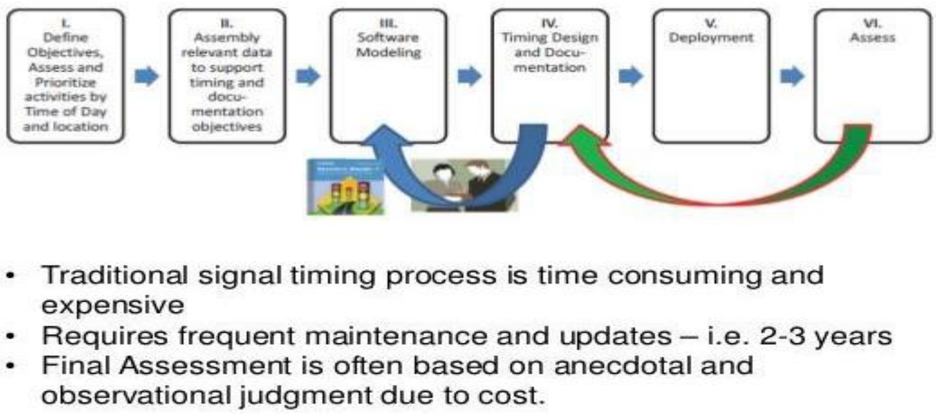

Fig. 7: Traditional signal timing process

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Working of traditional traffic lights

A traffic control system in general consists of traffic light heads, controllers and detectors.

Block diagram: It has been represented in Fig 8 below.

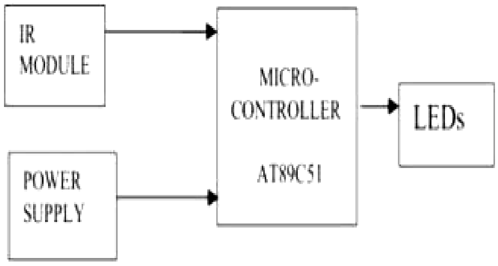

Fig. 8: Block Diagram of Traffic System

Function of signal controller: A controller is a device or group of devices that serves to govern in some predetermined manner the performance of an electric device. A controller might include a manual or automatic means for starting and stopping the motor, selecting forward or reverse rotation, selecting and regulating the speed, regulating or limiting the torque, and protecting against overloads and faults. Type of controllers used is:

Centralized signal controllers: These controllers use microchips and LSI particularly for traffic control in various leveled structure for improved unwavering quality.

Just as dealing with the different sensor controls, the chip additionally gain proficiency with the split controls, show changeovers and remotely controlled cycles, split controls. This forestalls flag control interruption by guaranteeing that the capacity is proceeded regardless of whether there is a break in the rush hour gridlock control focus circuits. This framework is intended to proceed with safe flag task even in case of breakdown where the microchips helpless to incite the traffic flag control LSI. It has been represented in Fig 9 below.

Multistage signal controllers: With an inherent widespread timetable, this device can adaptably program flag designs for some random schedule vacancy on weekdays, Saturdays and Sundays.

Push-button signal controllers: These controllers initiate green signs for people on foot wishing to cross fundamental streets all walkers need to do is to press the catch given at the street crossing point. Ordinarily the lights on the fundamental streets are set to green, enabling vehicles to pass.

Fig. 9: Signal controllers

Function of traffic light heads

Traffic lights, also known as traffic signals, traffic lamps, traffic semaphore, signal lights, stop lights, robots (in South Africa and most of Africa), and traffic control signals (in technical field), are signaling devices positioned at road intersections, pedestrian crossings, and other locations to control the flows of traffic. Traffic lights alternate the right of way accorded to users by displaying lights or LEDS of a standard color (red, amber (yellow), and green) following a universal color code. In the typical sequence of color phases:

- The green light enables traffic to continue toward the path meant, in the event that it is sheltered to do as such and there is room on the opposite side of the crossing point.
- The amber (yellow) light cautions that the flag is going to change to red. In various nations – among them the Unified Kingdom – a stage amid which red and yellow are shown together demonstrates that the flag is going to change to green. Activities required by drivers on a yellow light change, with certain wards expecting drivers to stop in the event that it is sheltered to do as such, and others enabling drivers to experience the crossing point if safe to do as such.

- A blazing golden sign is a notice flag. In the Unified Kingdoms, a blazing golden light is utilized just at pelican intersections, instead of the consolidated red– golden flag, and shows that drivers may pass if no walkers are on the intersection.
- The red flag restricts any traffic from continuing.
- A flashing red sign is treated as a stop sign.

Function of detectors:

Any traffic-responsive control system depends on its ability to sense traffic for local intersection control and / or system-wide adjustment of timing plans. A system accomplishes this by using one or more of the following detector types:

Pavement invasive detectors

- Inductive circle: It is the most widely recognized indicator innovation. It comprises of at least one turns of protected circle wire twisted in a shallow space sawed in the asphalt. Circle locators come in various sizes and shapes, and different arrangements can be utilized relying upon the zone to be recognized, the sorts of vehicles to be distinguished, and the goal, (for example, line identification, vehicle tallying, or speed estimations).
- (Such as queue detection, vehicle counting, or speed measurements).
- Magnetometer: It measures changes in both the horizontal and vertical components of the earth's magnetic field. Early magnetometers could only detect the vertical component, which made them unable to operate near the equator, where magnetic field lines are horizontal. Newer two-axis fluxgate magnetometers overcome this limitation. Magnetometers are useful on bridge decks and viaducts, where the steel support structure interferes with loop detectors, and loops can weaken the existing structure. Magnetometers are also useful for temporary installations in construction zones.
- Magnetic: It consists of a coil of wire with a highly permeable core. Measures the moving faster than a certain minimum speed, and therefore cannot be used as a presence detector. Useful where pavement cannot be cut, or where deteriorated pavement or frost activity break inductive loop wires.

Non-pavement invasive detectors

- Microwave Radar: It transmits microwave energy toward the roadway. CW (Continuous Wave) Doppler radar can only detect flow and speed. FMCW (Frequency Modulated Continuous Wave) radar can also act as presence detector. Certain bridges with large steel structures can cause problems with radar based systems.
- Active infrared: It transmits infrared energy from detector and detects the waves that are reflected back.
- Passive infrared: It does not transmit any energy; detects energy from vehicles, roadway and other objects, as well as energy from the sun that is reflected by vehicles, roadway, and other objects.
- Ultrasonic: It transmits ultrasonic sound energy waves, and measures the distance that the reflected wave travels. Can detect vehicle count, presence, and lane occupancy.
- Acoustic: It measure vehicle passage, presence, and speed by passively detecting acoustic energy or audible sounds produced by vehicular traffic.
- Video image processor: Video cameras detect traffic, and the images are digitized, processed and converted into traffic data. Can replace several loop detectors, and measure traffic over a limited area, rather than just a single point. The typical usage of Induction Loop Traffic Sensors has been shown in Fig 10.

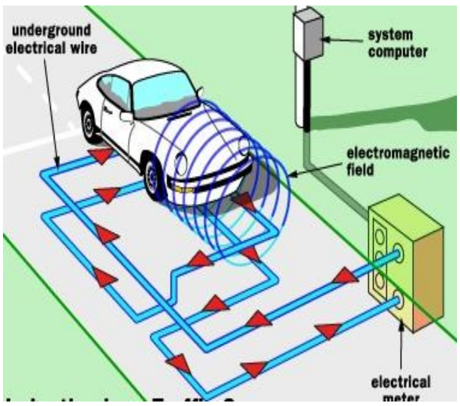

Fig. 10: Induction loop traffic sensors.

PROBLEMS FACED BY TRADITIONAL TRAFFIC CONTROL SYSTEM

These limitations hinder the ultimate usefulness of traffic control systems. They become limited in terms of effectiveness and versatility. While this is a problem in any setting, it becomes worst in a city experiencing rapid growth. These traffic control systems will be unable to effectively direct traffic. Multiple redundant systems may employ conflicting control schemes, which in turn further diminish the effectiveness of these systems. The main problems with most traffic direction solutions are that they:

- Increase in rear- end collisions: When it comes to accidents, traffic signals are sort of a mixed bag. Traffic signals can reduce certain type of car accidents, most commonly broadside collisions. One of the primary disadvantages of traffic signals are that they lead to an increase in rear-ends collisions. Rear-end collisions occur more frequently when a driver abruptly stops at a yellow or red light, causing a distracted driver behind him to ram into the rear of his car. Rear-end collisions aren't typically as severe as broadside collisions, so this trade-off can be seen as worth it. However, in an intersection where broadside accidents are not a concern, installing traffic lights can mean an automatic increase in accidents at the intersection. Traffic engineers do a risk-benefit analysis as part of determining whether to install a traffic light.

- Excessive delays: While they do help manage the flow of traffic, one of the other disadvantages of traffic signals is that they can cause traffic delay. Waiting for a traffic light to turn or waiting for a car in a turn lane to safely cross an intersection can result in long wait periods. Excessive delays can translate to wasted fuel, air pollution and costs to motorists.

- Aggressive driving: Partially as a result of excessive delay and partially as a result of unwarranted or improperly functioning traffic signals, drivers can get impatient and aggressive when driving. When that happens, more red lights may be run, more traffic laws are broken and drivers may veer off onto neighborhood streets. Aggressive driving can mean increased accidents, congestion, and air and noise pollution. These are some of the many disadvantages of not following traffic rules.

- Cost of traffic signals: One of the other disadvantages of traffic signals is the cost, especially when a less expensive stop sign will do. The cost of installing and maintaining a traffic signal varies, depending on the state. In Missouri, it costs between $100,000 and $150,000 to install and about $4,000 a year to maintain a traffic signal. It costs the taxpayer $250,000 and $500,000 to purchase and install a signal and about $8,000 a year to maintain. A basic stop sign, on the other hand, can average around $400 to manufacture and install. Maintenance costs of a stop sign are significantly lower than a signal, since there is no electrical system to maintain. Traffic engineers consider the advantages and disadvantages of traffic signals when determining whether to install them. Once they are installed, signals are monitored and adjusted on an ongoing basis to make sure they are as beneficial as possible.

SMART TRAFFIC CONTROL SYSTEM

Keeping these challenges of traditional traffic lights in mind, the concept of intelligent traffic control system was introduced. Objective of this project is to provide traffic and transit management services to the traffic police in support of improving congestion and reducing delays in the cities. This traffic system will improve travel time reliability by progressively moving vehicles through intersections.

BASIC MODEL OF A SMART TRAFFIC CONTROL SYSTEM

The traffic control framework planned in programmed mode and manual mode. In programmed mode relying on sensors yield the choice is taken. However, in manual mode we can have control on traffic; this is finished by approved individual in control room. The Raspberry Pi is utilized in framework takes controls on all. IR sensors are utilized to distinguish the thickness of traffic. What's more, to recognize the section of rescue vehicle and lost cars RFID is utilized. Camera utilized in framework takes still pics of traffic. By observing this image, approved individual in control room will take choice in manual method of activity.

Raspberry Pi: UK was first to create Raspberry Pi. It is a progression of little single board PC. There are three ages in Raspberry Pi for example Raspberry Pi 1, 2 and 3. In this age we can likewise discover diverse models like model A, B. The fundamental Raspberry Pi did not have Wi-Fi and Bluetooth in it, later it was included. Raspberry Pi 3 is utilized in our proposed framework. It has Broadcom SOC and GPU. CPU's speed is 700M Hz – 1.2G Hz.

RAM has 256MB – 1GB memory. SD card store OS in it. There are 4 USB slots. For camera to interface it has CSI. USB cable is used to power the raspberry pi. Raspberry Pi also have video or audio jack. And it has 40 GPIO pins. For monitor connection it has HDMI port.

RFID: RFID is a technology in which data will be transferred without any external connection of components. In RFID we have RFID Reader and RFID tag [5][6]. A unique number is allotted for every tag. The RFID tags are of two types:

- Active
- Passive

In traffic lights, passive RFID tags are used. The RFID system contains of a passive tag, an RFID reader, a micro- controller, a GPRS module, a high speed server with a database system and a user module. It has been represented in Fig 11 below.

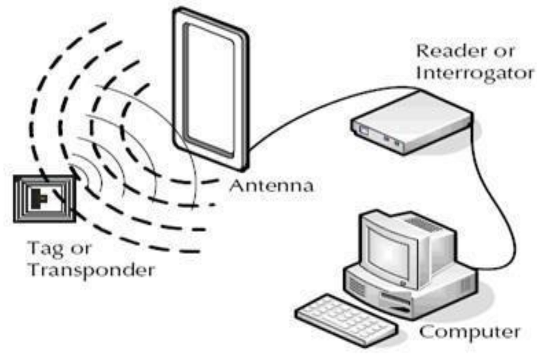

Fig. 11: RFID

IR sensor: An IR sensor contains a transmitter and a receiver. The transmitter emits the IR rays which strike the object, if present in front of the sensor. These rays will be reflected and thus sensed by the IR receiver. This will help in confirming the presence of an object and how far it is [7]. It has been represented in Fig 12 below.

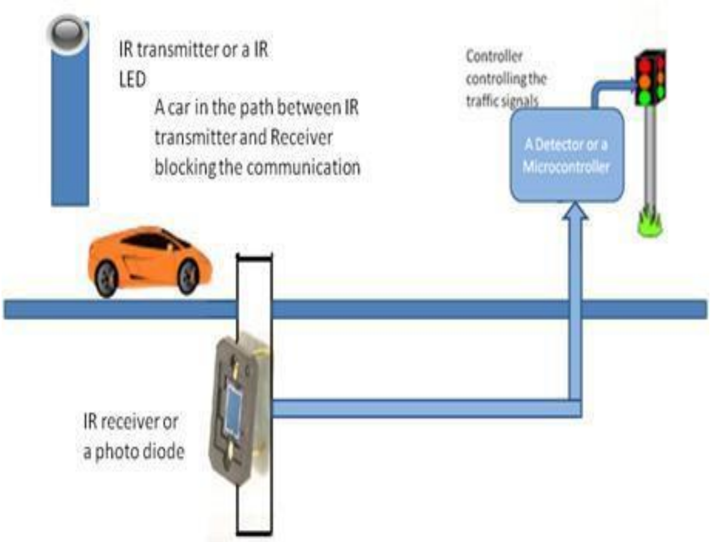

Fig. 12: IR Sensor

Pi camera: A Pi camera takes high definition pictures and videos. It has a flat cable which is used for connected to CSI port of the Raspberry Pi. The camera is a 5 Mega-Pixel which is generally used for surveillance purposes.

LED lights: The LED lights are used as traffic lights. These are diodes and when the p-n junction is forward biased, it emits lights in the form of photon. This gives us different colors and the color is determined by the gaps in the energy band.

TECHNOLOGIES USED IN SMART TRAFFIC CONTROL SYSTEM

RFID labels: The traffic executive's frameworks that are created utilizing the RFID framework is equipped for giving critical traffic related data which would help in lessening the movement time for workers. It tends to be helpful for different purposes like following stolen autos, vehicles that avoid traffic flags or tickets, tolls and so forth. This innovation encourages the framework to gather required information and determined the normal speed of vehicles on the streets of the city. The procured information, for example the normal speed determined at different intersections is then transmitted to the focal calculation server which at that point computes the time taken by a vehicle to go in a specific street [8]. Accordingly, the server makes a guide of briefest time ways of the entire city. This information would then be able to be gotten to by clients through an interface module put in their vehicles.

Sensors and smaller scale controllers: Utilizing IR sensors alongside miniaturized scale controllers and Drove's, a model of a traffic control framework can be made which can demonstrate worth for constant utilization of controlling traffic signals dependent on the thickness of the traffic. A 4-side intersection is viewed as where the traffic stream on each side is just a single way [9]. There are 3 parts of the framework:

- Display Unit: Comprises of 3 Drove's: Red, Golden and Green on each side of the intersection making an aggregate of 12 LED's.
- Detector Unit: Comprises of a course of action of photodiode and IR Drove at every intersection which identifies the nearness of vehicle by recognizing an adjustment in opposition.
- Controller Unit: Comprises of a smaller scale controller which gets the IR sensor yield and appropriately controls the gleaming of LED's.

Actuator nodes: A WSAN (Wireless Sensor and Actuator Node) is a group of sensors that gather information about the environment and actuators around them such as motors that interact with them. The communication between the elements is wireless [10]; the interactions are either autonomous or controlled by humans. WSAN's are built of approximately thousands of nodes where each node is connected to one or more sensors with sensor hubs as well as individual actuators or actors. These are used in locations like traffic control system or scientific development, where exact measurement and control of an environment is necessary.

VANET: VANET (Vehicular ad hoc networks) are created using the principles of MANET's (Mobile ad hoc Networks). It is a creation for vehicle to vehicle (V2V) data exchange. These vehicles to vehicle or vehicle to roadside communications architectures that co-exist in VANET's can help in providing road safety, navigation and other road-side services. VANET's are an important part of the ITS (Intelligent Traffic System) framework and are sometimes referred as Intelligent Transportation Networks [11].

COMPARISON OF TRADITIONAL/CONVENTIONAL TRAFFIC CONTROL SYSTEM TO SMART TRAFFIC CONTROL SYSTEM.

The comparison of traditional traffic control system with the IoT based smart traffic lightning system has been shown in below Table 1.

Table 1: COMPARISON OF TRADITIONAL/CONVENTIONAL TRAFFIC CONTROL SYSTEM TO SMART TRAFFIC CONTROL SYSTEM.

S.NO	PARAMETERS	TRADITIONAL/CONVENTIONAL TRAFFI C CONTROL SYSTEM	SMART TRAFFIC CONTROL SYSTEM
1.	Excessive Time Delay	It uses a fixed time delay for different traffic directions and follows a particular cycle while switching between signals. As a result, this creates unwanted congestion during the peak hours and loss of man-hours. Also here, the junction timings are fixed so the vehicles have to wait at road crossing even though there is little or no traffic at all[12].	It uses Microcontroller interfaced with sensors which helps in changing the signal timing automatically based on the traffic density at the junction. This also helps in avoiding unnecessary waiting time at the junction.
2.	Traffic congesti on	It creates unnecessary traffic jam. Also there are problems like Ambulance getting caught up by red traffic signal and wasting valuable time.	It reduces the traffic congestion. It is controlled by algorithm and it not only takes into consideration all complex road intersections in a city but also adds type of vehicles leading to accurate predictions of traffic flow.

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3.	Aggressive driving	As a result of excessive delay and improper functioning of traffic lights drivers can get impatient and aggressive while driving which may lead to accidents, congestion, air and noise pollution.	This won't be the scenario here as it will improve travel time reliability by progressively moving vehicles through intersections. It will also provide city planners with accurate predictions of pollution and emission levels as well as estimation of best fuel efficiency for various types of vehicles in the city.
4.	Gathering Traffic data	Conventional systems cannot gather traffic data. It cannot measure the number and type of vehicles using a particular road.	Smart traffic control systems can effectively gather traffic data. It can measure the number and type of vehicles using a particular road or visiting a particular part of the city, also monitor peak traffic times, journey[13][14], length and other data.
5.	Cost of Traffic signals	The cost of installing and maintaining the traditional traffic signals was much more cheaper because of the lack of smart devices starting from $100,000 and will go on up depending upon quality of the material.	The cost of installing and maintaining the latest traffic signals is costlier than the traditional system because of the additions such as RFID labels, sensors and small scale controllers and actuator nodes starting from $250,000 and increasing depending on the quality of the material[15][16].

REAL LIFE EXAMPLE OF SMART TRAFFIC LIGHT CONTROL SYSTEM IN BHUBANESWAR

In India, the concept of intelligent traffic control is still fairly new. It has been implemented and Bhubaneswar with varying degrees of success, while it is still in the process of implemented in Delhi. Here we will discuss the smart traffic control system adopted in Bhubaneswar, its working, its components, the advantages it has, the drawbacks and the methods in which we can try to overcome these drawbacks.

In recent times, Bhubaneshwar has emerged as one of the fast-growing, important trading and a commercial hub in the state of Odisha and Eastern India. This fact-paced development in the city has put adverse pressure on the ease of commuting in the city. Traffic Management has been identified as an important key for enhancing mobility of citizens in the city. For enhancing the efficiency of the signalized intersections, the city has given a proposal to have a coordinated traffic signal control system. This led to the installation of Adaptive Traffic Signal Control System at signalized intersections in the city. Thus, Bhubaneshwar has recently procured the requisite technology of traffic engineering named the Composite Signal Control Strategy (CoSiCoSt) developed by C-DAC (Centre for Development of Advanced Computing) which is a research and development organization under the Department of Electronics and Information Technology, Government of India. CoSiCoSt technology is an advanced control system which is capable of synchronizing traffic signals according to the real time traffic conditions. The system gets its input from the sensors embedded in the roads and the synchronize the group of traffic signals accordingly. This type of signaling system runs on solar power and it is being planned to be upgraded with automatic number plate recognition, variable message signs and surveillance cameras for real-time emergency and incident management system. The system shall be integrated with other smart city modules in the Central Command Centre and provide real-time decision support. The Adaptive Traffic Signal Control System is a part of the Intelligent City Operations and Management Centre which falls under the Pan City Proposal. The key outputs/outcomes implementation for pilot intersection is currently underway. The Adaptive Traffic Signal Control System is being planned to be installed at 58 traffic signals, 14 pelican crossings and blinkers at five locations in the city. The project is leading to the distribution of green phase (traffic signal) time equitably and faster response to traffic conditions and emergencies. The system also predicts traffic volumes and accordingly adjusts signal timings. The project will also travel time reliability, reduce congestion and related Green House Gas (GHG) emissions. The project is funded through Smart City Funds with a finance of 14.7 crores. The agency which is implementing the project is Bhubaneshwar Smart City Limited (BSCL).

CONCLUSION

In this paper we have seen that the IOT is having a vast amount of applications where it can be used. An example include usage in Smart cities, Healthcare and in other modern infrastructure has changed the things in a drastic manner. By studying in detail, we have compared the traffic signal system of traditional manner with the smart traffic-based mechanism based on IoT. Being a traditional system, we found that it was having various drawbacks such as it was unable to gather the real time data traffic light, time delay of red/green/yellow lights was fixed ir-respective of any amount of traffic in either of the 4 sides of road. As a result of the excessive delay in lights the drivers also become impatient due to more waiting hence all these things may lead to traffic jam as well as an accident. So, for avoiding all these things in the traditional lightning system a new mechanism called as the smart traffic lightning mechanism was proposed which uses the concept of IoT and the various components such as the Sensors, RFID signals and other devices. Although costing gets increased in later system but the time delay has been adjusted among the road side having more/less amount of traffic. The delay will get reduce if traffic is higher than expected and vice versa. In India, the concept of intelligent traffic control is still fairly new. It has been implemented and Bhubaneswar with varying degrees of success, while it is still in the process of implemented in Delhi. Here we will discuss the smart traffic control system adopted in Bhubaneswar, its working, its components, the advantages it has, the drawbacks and the methods in which we can try to overcome these drawbacks.

CONFLICT OF INTEREST
There is no conflict of interest.

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REFERENCES

[1] Ghazal B, et al. [2016] Smart traffic light control system. 2016 third international conference on electrical, electronics, computer engineering and their applications (EECEA). IEEE, doi: 10.1109/EECEA.2016.7470780

[2] Tapashetti A, et al. [2016] IoT-enabled air quality monitoring device: A low cost smart health solution, 2016 IEEE Global Humanitarian Technology Conference (GHTC). doi: 10.1109/GHTC.2016.7857352

[3] Geetha S, Gouthami S. [2016] Internet of things enabled real time water quality monitoring system. Smart Water 2.1 doi: 10.1186/s40713-017-0005-y

[4] Prasad AV. Et al [2017] Exploring the Convergence of Big Data and the Internet of Things. IGI Global.

[5] Andrea Z, et al. [2014] Internet of things for smart cities. IEEE Internet of Things journal 1 (1): 22-32.

[6] Luigi A, et al. [2010] The internet of things: A survey. Computer networks 54(15): 2787-2805.

[7] Schaffers H, et al. [2011] Smart cities and the future internet: Towards cooperation frameworks for open innovation, The Future Internet Lect. Notes Comput Sci. 6656:431- 446.

[8] Mischa D, et al. [2011] Smart cities: An action plan. Proc. Barcelona Smart Cities Congress, Barcelona, Spain.

[9] Patan R, et al. [2016] Real-time smart traffic management system for smart cities by using Internet of Things and big data. 2016 international conference on emerging technological trends (ICETT). IEEE, 2016.

[10] Chao KH, Chen PY. [2014] An intelligent traffic flow control system based on radio frequency identification and wireless sensor networks. International journal of distributed sensor networks 10 (5): 694545.

[11] Hasan MM, et al. [2014] Smart traffic control system with application of image processing techniques." 2014 International Conference on Informatics, Electronics & Vision (ICIEV). IEEE, 2014.

[12] Arasteh H, et al. [2016] Iot-based smart cities: a survey. 2016 IEEE 16th International Conference on Environment and Electrical Engineering (EEEIC). IEEE, 2016.

[13] Cheng B, et al. [2015] Building a big data platform for smart cities: Experience and lessons from Santander. 2015 IEEE International Congress on Big Data. IEEE.

[14] Choosri N, et al. [2015] IoT-RFID testbed for supporting traffic light control. International Journal of Information and Electronics Engineering 5.2: 102.

[15] Volodymyr M, Hahanov V. [2014] Smart traffic light in terms of the cognitive road traffic management system (CTMS) based on the Internet of Things." Proceedings of IEEE East-West Design & Test Symposium (EWDTS 2014). IEEE, 2014.

[16] https://timesofindia.indiatimes.com/city/bhubaneswar/adaptive-traffic-signal-system-inaugurated-in-bhubaneswar/articleshow/64921486.cms