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Smart City with Internet of Things

Revathi Lavanya Baggam
Computer Science Engineering
CVR College of Engineering
Hyderabad. India

Abstract: People living in localities much near to highway suffer to air pollution[9] than the people residing far a away from highways. In this paper, an idea is proposed of installing air purifiers to street lights which will get switched on /off automatically depending on the levels of some gases present in the atmosphere. At the same time the street lights too will switched on /off depending on the sunlight. Thus by reducing human intervention in monitoring these systems at the same reducing the wastage of power when they go unnoticed. Since its human tendency to forget or it's the irresponsibility which keeps the street light on even during day time. Since vehicles usage has increased to a great extent, the gases emitted by vehicles i.e. carbon monoxide, nitrogen oxides, sulphur dioxide, hydro carbons and many toxic gases content in the atmosphere has increased to a larger extent [12[13] . Thus by leading to a situation by reducing the fresh air levels in the atmosphere and causing the people to suffer with lung and breathing problems. Internet of Things (IoT) which played a major role in bringing out many smart systems [3][5][7] is also behind this proposed idea.

Keywords: sensor system integration; service functions and management; sensor; Wi-Fi; MQTT; cloud; Raspberry Pi;

I. INTRODUCTION

The Internet of things (stylised Internet of Things or IoT) is the internetworking of physical devices, vehicles (also referred to as "connected devices" and "smart devices"), buildings and other items—embedded with electronics, software, sensors, actuators, and network connectivity that enable these objects to collect and exchange data[1][2][3][11][14][15][16]. In 2013 the Global Standards Initiative on Internet of Things (IoT-GSI) defined the IoT as "the infrastructure of the information society." (A. Laya, V. I. Bratu, and J. Markendahl et al, 2013) The IoT allows objects to be sensed and/or controlled remotely across existing network infrastructure (H. Schaffers, N. Komninos, M. Pallot, B. Trousse, M. Nilsson, and A. Oliveira et al,2011) creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit. When IoT is augmented with sensors[11] and actuators, the technology becomes an instance of the more general class of cyber-physical systems, which also encompasses technologies such as smart grids, smart health ,smart homes, intelligent transportation and smart cities[3][5][14][15][16]. Each thing is uniquely identifiable through its embedded computing system but is able to interoperate within the existing Internet infrastructure.

However, such a heterogeneous field of application makes the identification of solutions capable of satisfying the requirements of all possible application scenarios a formidable challenge. This difficulty has led to the proliferation of different and, sometimes, incompatible proposals for the practical realization of IoT systems [3][5][7][14][15][16]. Therefore, from a system perspective, the realization of an IoT network, together with the required backend network ser-vices and devices, still lacks an established best practice because of its novelty and complexity. In addition to the technical difficulties, the adoption of the IoT paradigm is also hindered by the lack of a clear and widely accepted business model that can attract investments to promote the deployment of these technologies.

Day to day the number of vehicle users count is tremendously increasing where as people commuting by cycles have reduced to a greater extent. In order to meet the timelines human being has opted to travel more on private transport than by public transport. But at the same time human being is unaware of after side effects with too much usage of private transport which is emitting poisonous gases into the atmosphere. Gases like carbon monoxide, sulfur dioxide, nitrogen oxides, hydro carbons and many other toxic gases which are being released by the motor vehicles into the atmosphere are resulting in the reduction of fresh air in the environment [12][13] . This is the main cause of people suffering from lung diseases and breathing problems. Traffic police keeping his/her life at stalk by breathing these poisonous gases standing long hours in the midst of the roads controlling the traffic. Its high time motor vehicle manufacturers to build a vehicle which emits less amount or less poisonous gases[4]. At the same the government should start taking strict action against the vehicle owners who are neglecting the vehicles from getting pollution check done. Even the motor vehicle manufacturers should come forward with latest vehicles which run by other than petrol or diesel and are much more efficient in performance. Long back the release of electric vehicles has released into market but people could not accept the same. At least the people should be educated by the concerned authorities that electric vehicles should be used when commuting for shorter distances. Government should also work out on some interesting concepts by attracting the people to board the public transport. Concepts like car pooling or vehicle pooling

should be adopted by the people with much ease so that the number of vehicles usage on road per day will reduce to some extent. Here the end sufferers are the people. In order to have a peace and safe life style, smart air purifiers [3][9][14][15][16] should be installed to the street lights. It not only the motor vehicle but they are many agents that are causing air pollution like biomass burning, industrial emissions, residential heating and cooking. The second smart system proposed is the smart street light system. In many parts of the country street lights are not working on solar panels, this is resulting in lot of wastage of electric power since people tend to forget or feel irresponsible to turn off the lights during day time.

The following are the topics which will be covered, section II: Smart Systems Concept and Services section III: Smart Systems Architecture, section IV: Advantages of Smart Air Purifier System and section V: Conclusion[3][5][7][9][14][15][16].

II. SMART SYSTEMS CONCEPT AND SERVICES

Smart Air Purifier System is an application that helps in purifying the polluted air in the atmosphere by turning the same into fresh air.

Smart Air Purifier System – The air pollution rate in the atmosphere is tremendously increasing due to drastic increase of vehicles by humans. People now days are showing much interest to travel on private transport rather than public transport in order to meet their timelines and targets. Due to the increase in usage of vehicles in the city[6] , poisonous gases ration in the atmosphere too kept on raising drastically as these vehicles are emitting gases like carbon monoxide , sulfur dioxide , hydro carbons , nitrogen oxides and many other toxic gases. This smart air purifier system will work as an agent in reducing the content of these harmful gases in the atmosphere and thus by generating fresh air[3][5][7][8][9][14][15][16]. This smart air purifier senses the various gases in the atmosphere along with the percentage content they are present in the environment. Once the value of any gas crosses the limit it send a alert message to the concerned authority of the area and to the people in the locality with the percentage values of each gas present in the atmosphere. At the same time the air purifier automatically turns on and purifies the air in the locality, thus by helping the people of the locality get fresh air to breathe. The message that is sent by the smart air purifier system help the people of the locality get educate about the quality of air that is present in the atmosphere and alarms them about the safety precautions that they should take in reducing the same. So this smart system [6] keeps turns on and off depending on the gases level in the atmosphere. As and when the gases level in atmosphere reach to normal limit the smart air purifier system turn off. But every time it turns on it sends the message of gases level values present in the atmosphere. May be this may help the people to put a stop to the activities like burning waste and would encourage them to choose for vehicle pooling.

The below figure explains briefly about the percentage of each gas being emitted by each sector, which is resulting in air pollution.

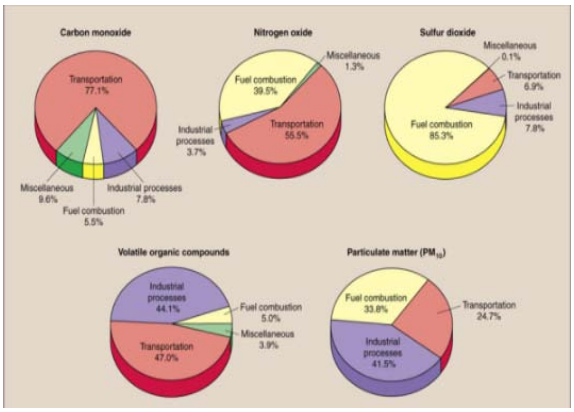

Figure 1: Gases being emitted by each sector

The drastic increase of pollution in many major cities of India can be explained much clearly from the below figure.

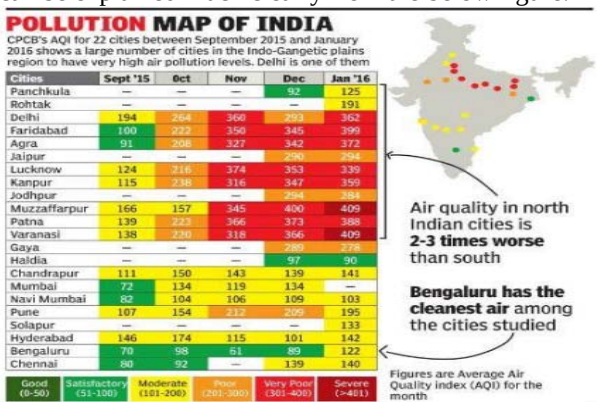

Figure 2: Increase of pollution rate of Major cities in India.

Some of the major causes for the increase in the pollution in many major cities could be due to increase of usage of vehicles, emergence of many industries and increase of irresponsibility by the human being.

Smart Street Light: In the recent trends people have come across street lights with solar panels which use the energy from sun and thus help in emitting the light instead of using the electric energy. This facility is present in only some areas of the country. Smart Street Light [9][10] system would have a sensor [11] inbuilt within it which can detect the day light strength. Depending on the strength of the day light the street light gets switched automatically on / off. This helps in reducing the human effort as its needs no human intervention. At the same time saves lot of electrical power, since at many places people tend to forget or feel irresponsible to switch off the turned lights during day time. Also there are many instances where people lose their lives by touching eclectic items during rains, so this smart system[3][5][14][15][16] helps in reducing the death toll rates.

III. SMART SYSTEM ARCHITECTURE

Smart Air Purifier System: The below figure Fig.3 depicts the architecture of the Smart Air Purifier System[3][5][7][8][9]. The system gets automatically turns on as and when the sensor detects the gases content in the atmosphere has reached a limit. Also the system send a message to the concerned authority of the locality and to the people residing in the nearby locality with the values of the gases in the atmosphere so that the people can take precautionary measures to reduce the air from getting polluted in their locality. The sensor should send data to

the cloud using MQTT over Wi-Fi through Raspberry Pi [11] by using the logic present in the python script through Ethernet medium [12][13] . The data present in the cloud can be shared through Amazon AWS IoT using Dynamo DB .This data is further sent to various devices using Android .The message will be sent each every time when the system gets turned on. As soon the gases in the atmosphere reach a safe limit then the smart system will be turned off automatically.

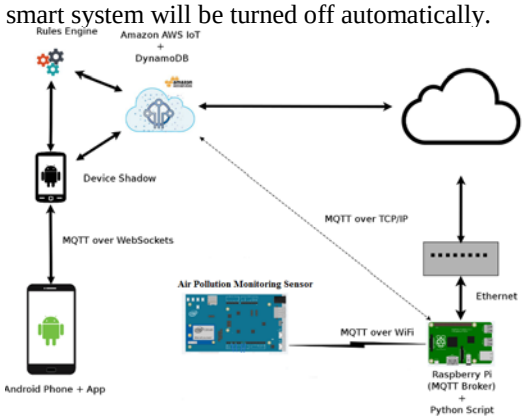

Figure 3:Smart Air Purifier System Architecture

Smart Street Light System: In order to reduce the wastage of electric power , this smart system has been proposed which helps the street light in turning on and off automatically depending on the strength of day light. A message will be sent to the concerned authority with a text including the unique identification number of the street light status whether it is turned on or not. This message would help the authority personnel to keep track of the street lights which are not functioning through the unique identification number as the message includes the street light status. The below figure tells about the architecture of the smart street light system.

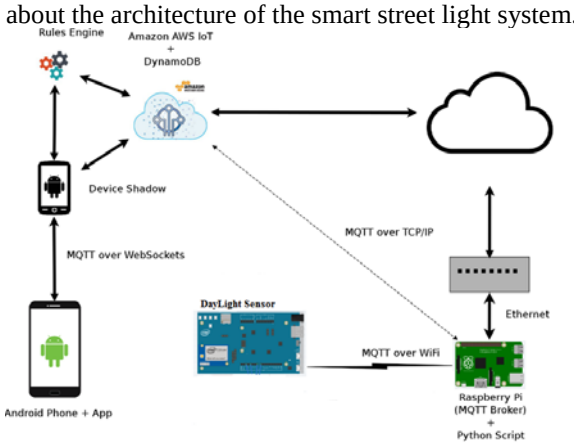

Figure 4: Smart Street Light System

The sensor should send data to the cloud using MQTT over Wi-Fi through Raspberry Pi by using the logic present in the python script through Ethernet medium. The data present in the cloud can be shared through Amazon AWS IoT using Dynamo DB [12][13][14][15][16] .This data is further sent to various devices using Android.

IV. ADVANTAGES OF SMART SYSTEM

Smart Air Purifier System: This latest IoT app would definitely result in many advantages like:

1. With the increase in the air pollution rate, people are suffering from lung diseases and breathing problems. But this system helps in reducing the lung problem cases.
2. Reduction of human effort, since this system needs no human intervention.
3. It helps in educating the people of the respective locality with the message being sent about the gases level in the respective locality. This in turn encourages the people to take precautionary measures by the reducing the scenarios of burning of wastage and helps then to maintain their locality pollution free.
4. It is mostly advantageous to the traffic department, where the police stands for hours together in managing the traffic and breathing the poisonous gases released by the vehicles.

Smart Street Light System: This latest IoT app would definitely result in many advantages like:

1. Reduction of human effort, since this system needs no human intervention.
2. Reduction of electric power wastage.
3. This helps in reducing the death toll rates in situations where people need to operate the street light manually especially during rains.

V. CONCLUSION

These smart applications would definitely lend a helping hand to the society by reducing air pollution problems and wastage of electric power issues. The Internet of Things which emerged in this latest advanced technology is definitely making surroundings manage in a smart way. In present scenario of managing both work and life one will always opt for leading a smart life with smart devices which are making the surrounding smarter. The idea present in the paper which was drafted needs to be implemented which would be the future scope of this paper.

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