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Smart Real-time Monitoring System (SRMS) for Solid Waste Management based on IoT and Wireless Sensor Nodes

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***Abstract:** In this paper, we discuss the design of an IoT based mart monitoring system which intends to identify the key elements of the waste disposal problem in the residential or environment sensitive areas and to deliver the real time prompts based on the information analysis and processing without the human intervention. We present an improved IoT based mart real-time monitoring system by the suitable integration of the traditional methodology with the latest technologies such as the Internet of Things (IoT) and the Wireless Sensor Networks (WSN).We discuss only the design and the application aspects here leaving the Testing and the Instrumentation aspects to be discussed later.*
***Keywords:** Solid Waste Management, Illegal waste disposal, Internet of Things (IoT), Sensors, Raspberry Pi, Python Script, Wireless Sensor Networks (WSN).*

I. INTRODUCTION

Solid Waste Management is the backbone of the Clean India Movement and deserves secure and effective measures of monitoring the solid waste disposal in the residential, rural and environment sensitive areas. Monitoring needs not only in terms of legislative norms but also in the protection of the Environment and the rural people staying in the vicinity of the illegal waste disposal sites. Monitor systems which are being used now are not smart enough to provide real time notification at a reasonable time after sensing the problem.

A suitable integration of the traditional methodology with latest technologies such as Internet of Things (IoT) and Wireless Sensor Networks (WSN) can lead to an improved real-time monitoring system. Keeping this in our mind we present the design, testing and analysis of an IoT based Real-Time Monitoring device which is capable of analysing the information captured and to transmit it to the user in time. This device can be controlled and monitored from remote location and it can be implemented in environment sensitive fields, rivers, residential and potential illegal waste disposal sites for monitoring purpose.

In this paper, we discuss the methods to design an IoT based mart monitoring system which intends to identify the key elements of the waste disposal problem in the residential or environment sensitive areas and to deliver the real time prompts based on the information analysis and processing without the human intervention. In this device, sensors and suitable electronic devices like Rapberry, Sensor, Ultrasonic Ranging Device, Web/CCTV Camera and Ultrasonic Sound Repellers are integrated using Python scripts and works on the Linux based Raspbian Operating System.

Over the past years information and communication technologies have been introduced in environmental sciences, Engineering and management, improving pollution control and sustainable development. However the integration of these technologies is not yet used for real-time monitoring purposes. The significant challenge facing the real-time monitoring is the interaction between the components of the real-time monitoring devices and to provide them artificial intelligence to control other electronic devices such as cameras and sound repellers. For example, a basic CCTV camera installed in an illegal waste disposal site cannot be of use until the recorded media is accessed and it also cannot process the information to give prompt signals or actions.

In the implementation and adoption of information and communication technologies, the cost is also a major factor. It is not easy to achieve exchange of information among the devices and upgrading their functionality while keeping their cost to a reasonable level [1]. So, it is the design of the monitoring systems, which must be responsible for integrating and analysing the information and issue prompts to the user with real time information.

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This lack of data analysing and information transmission are addressed by the integration of Internet of Things (IoT) with the currently available monitoring devices to achieve the efficiency and productivity. While the Solid waste management involves a lot of other threats, this research is limited to the design and analysis of a smart real-time monitoring device, considering the damages to the environment by illegal waste disposal as an applicable area. We address the challenge of integrating Internet of Things with electronic monitoring systems to improve the efficiency.

Kevin Ashton in 1999 proposed ”Internet of Things” to refer inter-connected devices [2]. It’s a major tech revolution in information and communication technology with updated infrastructure and networks where all the connected devices are able to identify and communicate with each other [3]. According to Gartner [4], in near future, about 25 Billion identifiable devices are expected to be a part of this computable net-work. Thus, Environment Science is a vast area to integrate Internet of Things with distributed autonomous electronic sensors to monitor environmental information and to analyse the captured data and pass the useful information to the remote developer.

Juan Felipe Corso Arias introduced the concept of the “Wireless Sensor Network (WSN)” as a distributed collection of small devices, called sensors, which are capable of local processing and wireless communication [5]. While the implementations of the wireless communication technologies are necessary, to transmit the information generated by the sensors and to control them, the design and integration of the system is an important aspect as pointed out by Malik Tubaishat [6].

For developing an intelligent security device based on IoT, M2M framework, sensor network and database management are the foundations. The fields like data analytics and pattern matching also influences security devices. Distribution of resource, delegate control of devices and balance of loads to improve efficiency of resource devices are using, is achieved by integration of hardware resources into clusters using vitalization technology.

Data collection is also a major part in security devices. Here, data i.e. sensory information using various sensors. Information generated from sensors are transmitted to server or IoT based M2M platform over network so that it can be accessible through remote location for further processing and monitoring. IoT framework is used in order to easily view, handle and interact with data and information. Within the system, developer can register their sensors, create streams of data, process them and can even search with a query language, allowing a developer to use APIs for data streaming and triggering operations.

For a cost efficient system free from maintenance and geographic constraints and to access affordable services, extended ”as-a-Service” framework in cloud computing can be integrated with IoT to deliver financially economical IT resources [8]. In IoT and Cloud Era, sensing, actuation, data generation, storage, and computation has extended the cloud services ahead of SaaS, IaaS, and PaaS. Thing-as-a-Service is introduced in order to develop a cloud of Things, where different kinds of resources as sensors can be integrated based on the tailored thing-like schema.[9].

II. MAIN RESULTS

In this Paper, we aim to design an intelligent security system capable of analyzing data and transmitting the information to a remote location. Usual IP based CCTV cameras require connectivity for monitoring from remote location and have no ability to notify developer by analyzing data. In our device, we use basic sensors and electronic devices and the sensory information is analyzed using Raspberry pi to activate the electronic devices.

The systems components are Rapberry Pi 2 Model B+, PIR Sensor, Ultrasonic Ranging Device, CCTV/Web Camera and Ultrasonic Sound Repeller and the Platform and Language Used are PTC Thing Worx’s IoT platform for M2M, Python and Linux based Raspbian Operating system. ThingWorx is a internet of thing based platform provided by PTC-LLC to provide machine to machine services and internet of thing based applications.

A. The Design of the System

System architecture has 4 levels of interfaces for data collection, analysis and transmission::

1) Perception layer: Layer which is used to differentiate the different type of sensors used in device.
2) Network layer: Layer used for process and transmit the information over network.
3) Application layer: This layer is responsible for various practical application based on the need.
4) Middle-Ware layer: Extra layer between the Network and Application layers which is a data analyzing system and can take actions based on information and provide dedicated services among the connected devices.

The system circuit contains the sensors, heat sensor, camera, PIR sensor; Ultrasonic ranging device and Ultrasonic sound based repeller, to be activated by server based upon data analysis. Rapberry Pi can be used to provide connectivity to I/O devices and web camera may be connected to the USB port of Raspberry pi, which is accessible via IP address of the server over network.

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B. Data Analysis and Transmission

After installing and activating the device, python scripts may be used to identify motion of human beings or vehicles using heat sensor which provides discrete values. Considering these discrete values as flag signal, URD sensor may be activated to calculate the distance of intruder triggering webcam daemon to capture the area. Ultrasonic ranging device and web camera are dependent on the values generated by the PIR sensor.

The analyzed data and information are stored in SQL database along with ThingWorx's IoT platform. An SMS application programming interface can deliver analyzed information to the developer including IP address of the server to access webcam. After data processing, on application interface, a website's link is sent to the developer along with timestamp and information and based upon the distance calculated by ultrasonic ranging device, repeller will be activated.

After the collection of the data, further processing and transmission of the data to ThingWorx IoT platform's server is done using Python scripts and APIs.

The values transmitted by the monitoring system to the database may be stored in an SQL database in some suitable format. After configuring the prototype, API template is to provide webcam access link within the body of developer notification. The efficiency of the system depends on various factors like connectivity, data transmission, notification and the PIR and heat sensors.

C. Conclusion And Further Works

'Internet of Things' is used in connecting devices and collecting information. After collecting and analyzing the data, algorithm is designed and implemented by Python scripts to provide accuracy in notifying developer and activation of repeller. We are trying to implement this system as a monitoring device in possible illegal waste disposal sites especially residential and rural areas, rivers and paddy fields.

Further research is going on in two directions: Firstly, we are testing and developing such monitoring systems practically in our local areas and on the way to patent it. Secondly, we are exploring the means to incorporate more information about intruders and the surroundings and to incorporate the Machine Learning techniques like pattern recognition to identify more details of the intruders and to send the information to Municipal or Police authorities on time.

REFERENCES

[1] Alexandros Kaloxylos, J Wolfert, Tim Verwaart, Carlos Maestre Terol, Christopher Brewster, Robbert Robbemond and Harald Sundmaker. ''The Use of Future Internet Technologies in the Agriculture and Food Sectors: Integrating the Supply Chain'' in 6th International Conference on Information and Communication Technologies in Agriculture, Food and Environment. pp. 51-60

[2] D. Singh, G. Tripathi, A.J. Jara, ''A survey of Internet-of Things: Future Vision, Architecture, Challenges and Services in Internet of Things" (WF-IoT), 2014

[3] Fan Tong Ke., ''Smart Agriculture Based on Cloud Computing and IOT'', Journal of Convergence Information Technology(JCIT) Volume 8, Number 2, Jan 2013.

[4] M.U. Farooq, Muhammad Waseem, Anjum Khairi, Sadia Mazhar., ''A Critical Analysis on the Security Concerns of Internet of Things (IoT)'', International Journal of Computer Applications (0975 8887) Volume 111 - No. 7, February 2015.

[5] Gartner Inc., http://www.gartner.com/newsroom/id/2905717.

[6] Malik Tubaishat, Sanjaykumar Madria, 'Sensor networks: An Overview', IEEE Potentials, 5/2003

[7] Juan Felipe Corso Arias., Yeison Julian Camargo Barajas., Juan Leonardo Ramirez Lopez., 'Wireless Sensor System According to the Concept of Internet of Things', International Journal of Advanced Computer Science and Information Technology, Volume 3.3, 2014, ISSN: 2296-1739

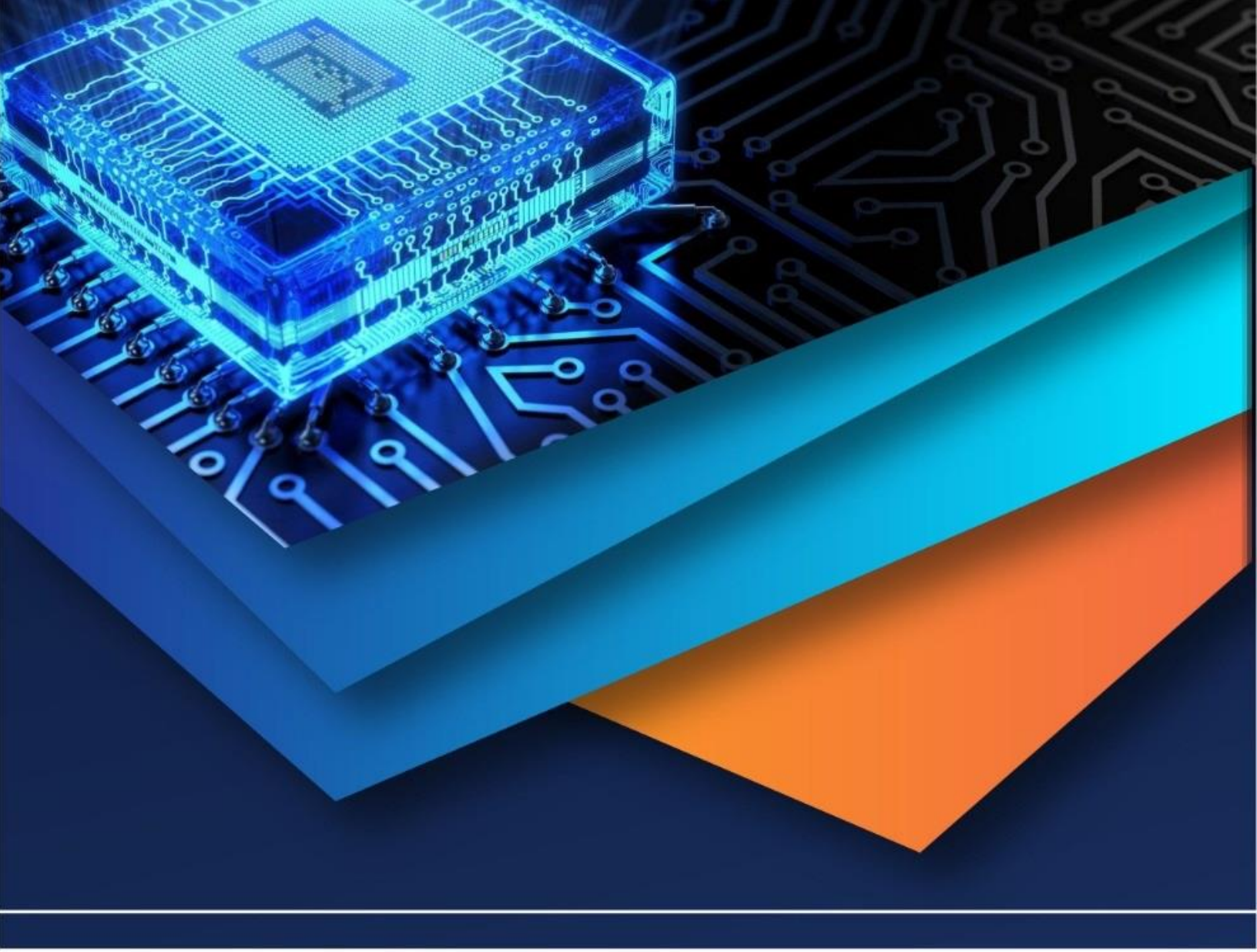
[8] Sugam Sharma, USTim, Shashi Gadia, Johnny Wong, ''Growing Cloud Density and as-a-Service Modality and OTH-Cloud Classification in IoT Era', (www.public.iastate.edu/ sugamsha/articles/ OTH-Cloud/in/IoT.pdf) 2015

[9] Sugam Sharma. 'Evolution of as-a-Service Erain Cloud', Cornell University Library. (arxiv.org/ftp/arxiv/papers/1507/1507.00939.pdf), 2015.

[10] M.U. Farooq, Muhammad Waseem, Anjum Khairi, Sadia Mazhar., 'A Critical Analysis on the Security Concerns of Internet of Things (IoT)', International Journal of Computer Applications (0975 8887) Volume 111- No. 7, February 2015.

[11] Rafiullah Khan, Sarmad Ullah Khan, R. Zaheer, S. Khan, ''Future Internet: The Internet of Things Architecture, Possible Applications and Key Challenges, in 10th International Conference on Frontiers of Information Technology (FIT 2012), 2012, pp. 257-260

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