International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 07 | July 2020 www.irjet.net p-ISSN: 2395-0072

IoT Based Hospital Monitoring System

Ujjwal Srivastava[1], Shubham Kumar[2]

[1]Ujjwal Srivastava, Galgotias University, Uttar Pradesh, India
[2]Shubham Kumar, Galgotias University, Uttar Pradesh, India

Abstract - *The Internet of Things (IoT) and Cloud computing, combined, are the prime focus in today's research and development work nearly in all fields of study. It is so because of the promising results they are delivering in the areas they are applied to. In this work, I have focused on one such field i.e. medical field and mainly on hospital management through IoT. In recent times there has been a significant increase in emergencies involving basic operations in the hospital. Such situations pose a great threat to all present in the hospital. To overcome such a situation, I propose a design of a hospital management system based on technologies of IoT and cloud computing, aiming to record and analyze the situation in real-time and provide a timely response which is both effective and efficient.*

Key Words*: Cloud Computing, *IoT, Hospital Operation

1. INTRODUCTION

IoT is a promising field that is revolutionizing society by integrating the advances in wireless networking. IoT is a network of physical devices that are embedded with electronics, software, sensors, actuators, and connectivity which enable these things to connect, collect, and exchange data.

Now, if we store the collected data in some cloud servers and make it available to others for analysis and other applications then in this way, we are implementing cloud computing as well. Cloud computing is nothing but a shared pool of configurable computing resources that can be rapidly provisioned with minimal management effort, often over the internet. In today's context, IoT is incomplete without the cloud, because the cloud is the one which enables the sensed data to be processed further, at various centers. It also makes decision making more efficient.

1. RISK MANAGEMENT

Initially, risk management was used only in those industries which were performance and reliability critical, for example, aerospace, aviation, refinery, etc. But as time passes these techniques were started being utilized by other sectors as well as healthcare organizations, for administrating their daily clinical work. In the past few years, we have increased our dependency on advanced equipment and information system. In the meantime, risks in non-clinical daily running and maintaining of hospitals, including logistics and ward, has received less attention from the concerned authorities. Due to this negligence, people have suffered severe consequences as well. For instance, a large number of child death occurred at the state-run BRD Medical College hospital in Gorakhpur city of Uttar Pradesh, India in August 2017. The reason for those deaths was that the hospital's piped oxygen supply ran out.

In hospital operations, the risk is involved in many parts of human work and equipment running. The present-day scenario is that most of the basic hospital operations are manually monitored and emergencies are handled as per the experience of the working staff. Due to this manual procedure, there is very high uncertainty of timely detection and resolution of any emergency. The incident discussed above is also a case of one such untimely detection of an emergency. There is a dire need to come up with solutions for such emergencies. IoT and cloud- based hospital management system will contribute towards solving this problem.

2. IOT INFRASTRUCTURE

As per the model proposed in this paper, the infrastructure consists of four layers namely the data collection layer, the transmission layer, the processing layer, and the application layer.

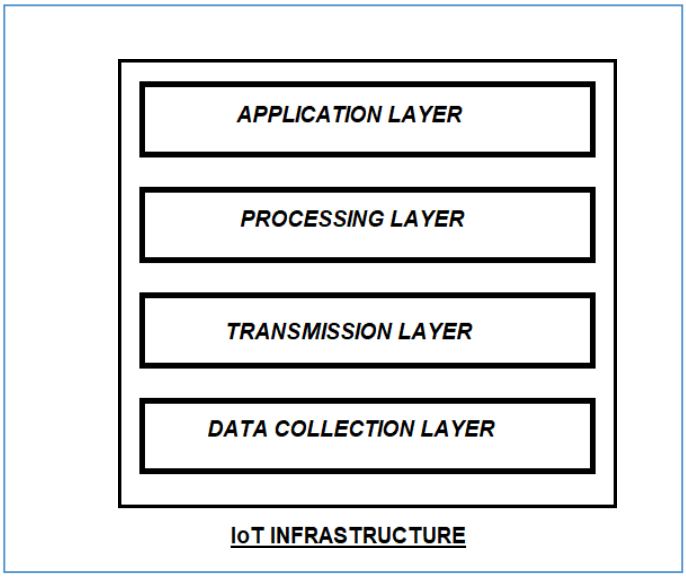

Fig -1: Layers of Infrastructure

2.1. Data Collection Layer

This layer mainly consists of a large number of cameras and sensors deployed throughout the hospital to monitor the situation of specific areas and record the current status of equipment running in the hospital.

The onsite cameras capture the scene and using artificial intelligence tools we can pick out that behavior- out of all the patients coming and going, some patients buying medicines from the medical store, etc. - as a potential safety risk. For example, if someone is smoking in the hospital premises or someone is going in a restricted area, then it can be easily identified and an alarm can be put up.

The sensors installed at various places will be used for various purposes like checking the noise level in corridors, recording the status of gas tube networks, building structure, and neighboring space. All these will be done using a corresponding sensing device. Apart from automatic sensing, if there are some manual inspections required then that needs to be collected by specific staff members transferred to the system database for analysis.

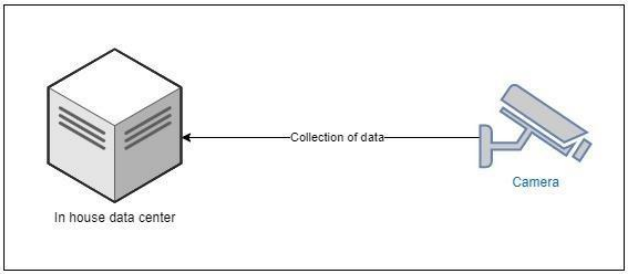

Fig -2: Data Collection Layer

2.2. Transmission Layer

The data collected through cameras and sensors need to be transferred for analysis. Here comes the role of cloud servers which will store the data in raw as well as processed form and made it available to the various analyzers as per their request. This data can also be made available to external departments like fire safety agency (in case the hospital is on fire and require immediate fire extinguishing support) and many others.

Fig -3: Transmission Layer

2.3. Processing Layer

This layer analyzes the data recorded through front end devices (cameras and sensors) and searches for any unexpected behavior.

The data collected will be heterogeneous, so while processing the data it will be converted into a format that matches the requirements of the database.

The real-time storage maintains the processed data and serves as a basic database for decision making support.

Fig -4: Data Processing in Cloud

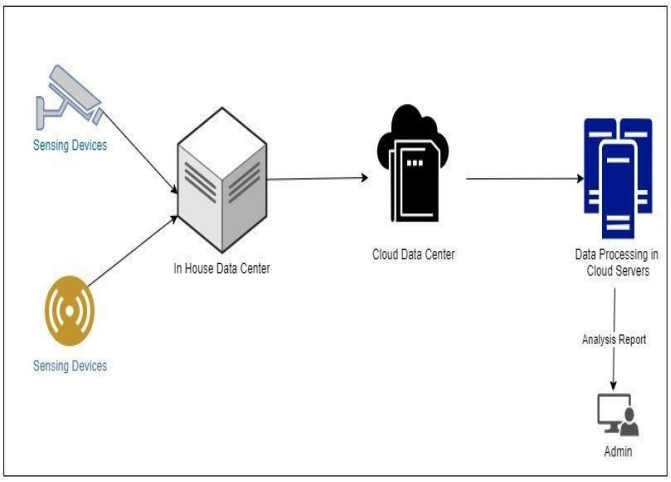

Fig -5: Data Processing

2.4. Application Layer

This layer provides the functions and applications through various user interfaces, which includes:

Safety Information Management: authorized users can increase or decrease risk indexes as the situation demands.

Risk Monitoring: as per the given risk indexes, risk factors can be easily monitored.

Assessment and alarming: current state of risk factors will be assessed dynamically and in case an alarm is needed, it will be immediately dispatched.

3. USE CASE

Consider a fire incident, which took place in the hospital, to understand the working of the proposed system. The sensors installed in the hospital detect the smoke, and the current environmental parameter readings are recorded and send to in house datacenter and further to the cloud datacenter. The cameras broadcast the visual scene to the central control room immediately.

In the meantime, the analyzing system will analyze the data and try to find out the best possible way to overcome the situation. Alerts will be generated to vacate the nearby areas and the fire control authority will be informed automatically, following a sequence of operations in which police and local authorities which even includes nearby chemist shops will also be informed. Also, nearby hospitals will be put on standby.

4. CONCLUSIONS

The hospital management system proposed in this paper aims to construct one comprehensive system, which monitors all the functioning of a hospital and give an appropriate response in case of some emergency. Currently, only critical functioning systems are closely monitored in hospitals, but the proposed system covers nearly all the functioning.

The proposed work will promote the ability of hospitals in risk detection, analysis, and decision making based on the integration of IoT and cloud.

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