

# A Comprehensive smart monitoring system for hospitals using Internet of Things (IoT)

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**Abstract** - Most of the time, due to negligence of hospital staff, excessive number of patients or inattentiveness of relatives it may happen that saline bottle is not monitored properly and it may lead to cause heart attack due to "AIR EMBOLISM". In a hospital, number of electrical equipment's (fan, lights) are more so energy consumption is more. Thus, it is important to use electricity as per the requirement. Maintenance of good air quality in hospital environment is very important because dust and pollutants in the air will cause breathing problems and skin irritation in patients. Thus, in this paper we have proposed a system which include combination of sensor technology and Internet of Things (IoT). Using this system, one can control switch of the fans, lights and monitor level of the saline bottle from distant position.

**Key Words:** IOT, ATMEGA Atmel 328PU, Load Cell, LDR, Temperature sensor (LM35), Light Dependent Resistor (LDR), Node MCU.

## 1. INTRODUCTION

In each association there is dependably data work area that gives data, commercial messages and numerous notices to their clients and staff. The issue is that it requires some staff that is committed to that reason and that must have up and coming data about the offers promotion and the association. Because of IoT we can see numerous keen gadgets around us. Numerous individuals hold the view that urban communities and the world itself will be overlaid with detecting and activation, numerous implanted in "things" making what is alluded to as a keen world. Comparative work has been as of now done by numerous individuals around the globe.

### 1.1 Basics of IoT

The Internet of Things (IoT) is the network of physical objects—devices, vehicles, buildings and other items embedded with electronics, software, sensors, and network connectivity—that enables these objects to collect and exchange data.

The Internet of Things brings both a beneficial and disruptive element. With the concept of "always-on", such technology will require a change in mindset when considering implementation of products and services related to IoT. Since IoT is more and more an element in the daily

lives of individuals and organizations, maintaining both privacy, security and business operations/opportunities will be more of a priority both today and in the future.

In closing, while, how we as security professionals work, support, and provide the security expertise for Higher Education business initiatives is crucial to success in the scope of IoT.

### 1.2 Problem Statement

In hospitals, electrical and medicinal gear's utilization over the top measure of power. The essential natural impact of vitality abuse is an expansion in measure of carbon impression. For instance, if the gadgets are continued running when redundant, the outcome is an expansion in electrical utilize. This section controls utilization of power.

One more imperative issue identified with healing facility is medical attendant or clinic staff need to continually screen the level of saline container. Along these lines, it might happen that because of the carelessness of the healing center staff or because of more number of patients and negligence of relatives, saline container may not screen legitimately which can prompt the demise of the patient. This can happen when saline jug is bolstered totally to the patient and when it isn't expelled then because of the weight distinction between the patient's blood stream and an unfilled saline container, can causes outward stream of blood into saline jug, air pockets will be shaped in blood veins hinders the blood stream and it prompts heart assault.

In a few hospitals neatness may not be looked after legitimately, intemperate tidy and poisons noticeable all around may cause contamination among patients and increment of breathing issues in asthma patients.

### 1.3 Objectives

1. To save power consumption by monitoring the switch of the electrical equipment automatically as per the requirement.
2. To avoid the death of patients due to "Air Embolism" by properly monitoring liquid level in the saline bottle.
3. To provide the data communication capabilities.
4. To monitor and to keep check on maintenance and hygiene protocol.
5. To reduce the work load of the hospital staff.

## 2. LITERATURE REVIEW

The authors in [1] “Smart Hospital based on Internet of Things”, *JOURNAL OF NETWORKS*, VOL. 7, NO. 10, OCTOBER 2012, propose an architecture and a scheme of smart hospital based on Internet of Things (IOT) in order to overcome the disadvantages of the present hospital information system, such as the fixed information point, inflexible networking mode and so on. The key technologies and construction of smart hospital is presented based on understanding of the connotation and architecture of smart hospital. This Experiment proves that deployment of smart hospital can effectively solve the prominent problems existing the diagnosis and treatment of hospital and it brings a positive and profound effect for the present diagnosis and treatment mode in hospital.

The authors in [2] “Smart Saline Level Indicator cum Controller”, *International Journal of Application or Innovation in Engineering & Management (IJAIEEM)*, Vol 4, Issue3, March 2015, developed a small box like arrangement which has a spring system. The spring is made to act as a weight sensor i.e. the weight of a filled bottle and an empty bottle is differentiated by the spring. When the saline drops down to a certain low level then an alarm is placed in the close vicinity of the nurse chamber to alert the nurse that the saline fed to the patient is over.

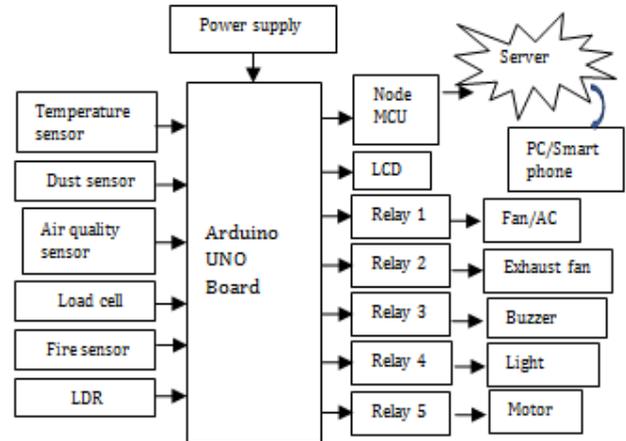
In this paper we have proposed a system which include combination of sensor technology and Internet of Things(IOT). Using this system, one can control switch of the electricity and monitor level of the saline bottle from distant position. This project is highly energy efficient as it uses Arduino board having microcontroller (ATmega Atmel 328PU) which having low power utilization. It also uses MQTT networking protocol which is a light weight protocol and helps in power saving. It is possible to control the switch from a webpage or from the mobile application.

## 3. WORKING METHODOLOGY

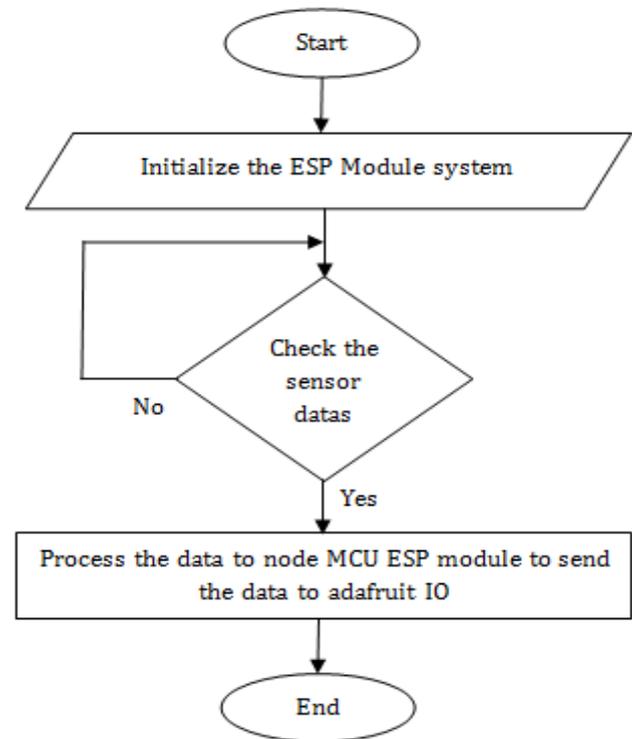
In this system sensors will sense the various condition of the surrounding and collects the data. Information acquired by the majority of the sensors will be transmitted by USB port, which is utilized for the information exchange to the Arduino circuit board. This information hence got is then distribute to the MQTT server.

At whatever point one needs to secure this information then that individual needs to buy in to the MQTT server. MQTT stage is utilized to control to the switch which will at last control electrical apparatuses.

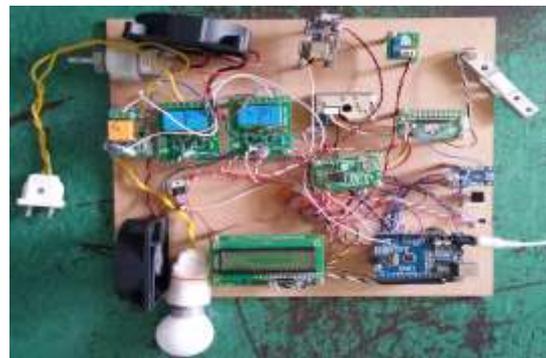
### 3.1 Block Diagram



### 3.2 System Flow



### 3.3 Experimental Setup





**5. Air quality sensor:**



**Fig - 5:** Air quality sensor

MQ135 receives SnO<sub>2</sub> as its gas touchy material on the grounds that SnO<sub>2</sub> has low electrical conductivity in the spotless air. Along these lines, when encompassed by dirtied air, the electrical conductivity of MQ135 will increment with the expansion of toxins, and the change in electrical conductivity can be changed over to relating yield flag. MQ135 has a high affectability to Ammonia, sulfide, benzene vapor, smoke and other unsafe gas. It can distinguish different unsafe gases, settling on it a financially savvy decision appropriate for numerous applications.

**6. Fire sensor:**



**Fig - 6:** Fire sensor

The fire sensor is used as a simple and compact device for protection against fire. The module makes utilization of IR sensor and comparator to detect fire up to range of 1-2 meters depending on the fire density.

**7. Load cell:**

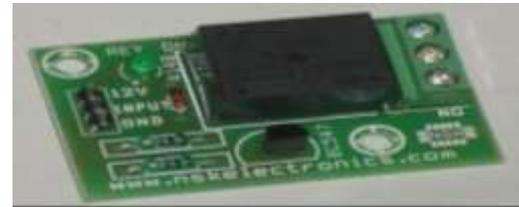


**Fig - 7:** Load cell

Strain gauge load cells are the most common in industry. These load cells are particularly stiff, have very good resonance values, and tend to have long life cycles in application. Strain gauge load cells work on the principle that the strain gauge (a planar resistor) deforms when the material of the load cells deforms appropriately. Deformation of the strain gauge changes its electrical resistance, by an amount that is proportional to the strain.

The change in resistance of the strain gauge provides an electrical value change that is calibrated to the load placed on the load cell.

**8. Relay:**



**Fig - 8:** Relay

Most of the high end industrial application devices have relays for their effective working. Relays are simple switches which are operated both electrically and mechanically. Relays consist of a n electromagnet and also a set of contacts. The switching mechanism is carried out with the help of the electromagnet. There are also other operating principles for its working. But they differ according to their applications.

**9. Node MCU:**



**Fig - 9:** Node MCU

The Node MCU is an open-source firmware and development kit that helps you to Prototype your IOT product within a few Lua script lines. Advanced API for hardware IO, which can dramatically reduce the redundant work for configuring and manipulating hardware. Code like Arduino, but interactively in Lua script.

**4. ADVANTAGES**

1. Decreased cost.
2. The patterns of heart rate pulse digestive systems and blood pressure can be monitored and diagnosed for anomalies.
3. The hospitals can be contacted in times of emergencies.
4. This system will be useful to senior citizens and disabled people who live independently.
5. We can monitor the emission from factories and vehicles to minimize air pollution.
6. The detection of fire is also possible with this technology.
7. This technology is more efficient and it also saves time and money.
8. Improved outcomes of treatments.
9. lights can be automatically switched off in presence of light and switched on in absence of light.

## 5. APPLICATION

1. Remote control appliances in home: Switching on and off remotely appliances to avoid accidents and save energy.
2. Smart Lightning: Intelligent and weather adaptive lighting in street lights.
3. Explosive and Hazardous Gases: Detection of gas leakages and levels in hospital environments, surroundings of chemical factories and inside mines.

## 6. CONCLUSION

Smart hospital has been successfully designed using IoT. This project is highly energy efficient as it uses Arduino board having AT mega chip Atmel 328PU microcontroller chip, which has low power utilization. It also uses MQTT networking standards. This protocol is a light weight protocol and helps in power saving. It is possible to control the electrical appliances from a webpage or from the mobile application. It is user friendly system. Maintenance of this system is not costly.

## REFERENCES

- [1] Lei Yu, Yang Lu, Xiao Juan Zhu, "Smart Hospital based on Internet of Things", JOURNAL OF NETWORKS, VOL. 7, NO. 10, OCTOBER 2012, Page No.1-8.
- [2] Manoj Kumar Swain, Santosh Kumar Mallick, Rati Ranjan Sabat, "Smart Saline Level Indicator cum Controller", International Journal of Application or Innovation in Engineering & Management (IJAIEEM), Volume 4, Issue 3, March 2015 Page No.1 and 3.