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Smart Hospitals Using Internet of Things (IoT)

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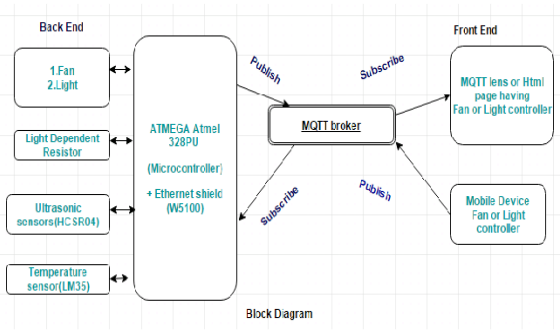
Abstract: **- This presentation about smart hospitals using IoT. Most of the time, due to the negligence of hospital staff, an excessive number of patients or inactiveness of relatives it may cause heart attack due to "AIR EMBOLISM". In a hospital, a number of electrical equipments (fan, lights) are more so usage of energy is also more. Thus, it is important to use electricity as per the requirement. Thus, in this paper, we have proposed a system which includes the combination of sensor technology and IOT. Using this system one can control switch of the electricity and monitor level of the saline bottle from distant position.**

***Key Words*- Internet of things, Atmel 328pu, ultrasonic sensor (HC-SR04), Temperature sensor (LM35), light dependent resistor (LDR), MQTT protocol.**

I. INTRODUCTION

The project is based on the IOT by which we can solve the problems related to hospitals. In a hospital, there is excessive use of electricity used by light, fans and various medical appliances. One of the biggest causes of excessive energy use in hospitals comes from amount of electrical equipments, lightning, and electronics and how to often it is left on when there is no use of it. The primary environmental effect of energy overuse is an increase in carbon footprint, but there are simple changes we can make to avoid this. For example, if the devices are kept running when they are not in use, the result is an increasing electrical use and consequently a bump in the amount of green house gases that enter the atmosphere. This module helps to control consumption of electricity. One more important problem related to hospital is nurse or hospital staff need to constantly monitored the level of saline bottle. So it may happen that due to the negligence of the staff or due more number of patients and inactiveness, saline bottle may not monitored properly which can lead to the death of the patient this can happen when saline bottle is fed completely to the patient and when it is not removed then due to pressure difference between patient's blood flow and empty saline bottle. In this system using IOT one can control switch of the electricity and continuously monitored the level of saline bottle.



Block Diagram

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In the below block diagram, there are three parts which as follows

II. BLOCK DIAGRAM

1. Back end which includes fan, light, ultrasonic sensor etc.
2. Arduio mega (ATMEGA Atmel328pu) +Ethernet shield (W5100)
3. MQTT broker as a cloud server
4. Front end which includes HTML page or mobile device which includes switch controller for fan and light.

In this system ultrasonic sensor, light dependant on resistor and temperature sensor is interfaced with Arduino mega board. This board is connected to MQTT server via Ethernet cable. This will provide connectivity to the server to transmit data on the internet

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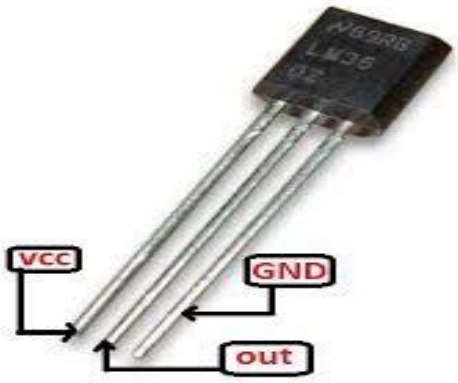
III. WORKING METHADOLOGY

Above system will work as follows
In the above system sensor will acquire the data from the surrounding i.e., temperature sensor will constantly modify monitor the temperature of patients room, ultrasonic sensor will monitor the level of saline bottle and LDR will monitor the illumination of a light on it in terms of resistance value.
Data acquire by all of these sensors will be transmitted by USB which is used for data transfer to AM board. This data is then publish to the MQTT server via Ethernet.
Whenever one wants to acquired this data then that person has to subscribe to the MQTT server and then hospital staff, they can monitor the data received. MQTT platform is used to control to the switch which will ultimately control electrical appliances. Whenever temperature of the patients room increase above predefined level, it will send the data to the page and then from the webpage or from the mobile device. In case of saline bottle, level of the saline bottle continuously sends on to the server so that hospital staffs need not to go to each and every patient's room to monitor it. As soon as the level of liquid in a saline bottle falls below predefined value then nurse can go to the patient's room and change that bottle.

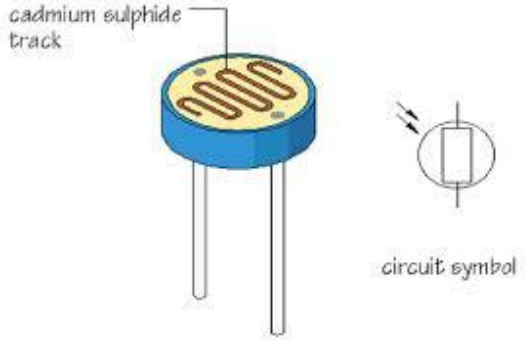
IV. COMPONENTS REQUIRED

A. Temperature sensor (LM35);



The LM35 –series devices are precision integrated –circuit temperature sensors, with an output voltage linearly proportional to the Centigrade temperature. The LM35 has an advantage over linear temperature sensors calibrated in Kelvin, as the user is not required to subtract a large constant voltage from the output to obtain convenient centigrade scaling. The features of the LM35 make it suitable for many general temperature sensing applications.

B.LDR (Light Dependant Resistor)



LDR sensor has two cadmium sulphite photoconductive cells (cds) with spectral response to that one of the human eye. The cell resistance will fall with the increasing light intensity. Its applications include smoke detection, automatic lightning control system, and batch counting and burglar alarm systems. Light dependent resistors have property to store the lightning conditions in which they have been stored. Light storage reduces equilibrium time to reach steady state resistance values.

C. Ultrasonic sensor (HC-SR04)

It includes ultrasonic transmitters, receiver and control circuit. It provides 2-400cm non contact measurement function. Ranging accuracy may reach 3mm.
The basic working principle of ultrasonic sensor is as follows:
a) Using ten trigger for at least 10us high level signal.
b) The module automatically sends eight 40 kHz and detect whether there is a pulse signal back.
c) If the signal back, through high level, time of high output 10 duration is time from sending ultrasonic to returning.
Test distance = (high level time * velocity of sound [340/s]/2)

E. ATmega Atmel 328pu

The ATmega Atmel 328pu is a low-power CMOS 8bit microcontroller based on the AVR enchanced RISC architecture. By executing powerful instructions in a single clock cycle ATmega Atmel 328pu achieves throughputs approaching 1MIPS per MHz allowing the system designer to optimize power consumption versus processing speed. Power saving is the major important factor. It is easy to do coding for the arduino board as various libraries are available to use in the code.

D.MQTT PROTOCOL

In this system use of MQTT protocol has been used because it has advantages over http protocol. This protocol gives faster response output. It has lower battery and bandwidth

consumption. It works efficiently enterprise level applications which include transfer data to server or to mobile application. It assures data transmission and efficient distribution. It is suitable for constrained environment than http. It is light weights publishes and subscribe protocol and runs on IP. It is open standard protocol.

V. RULES AND CONCLUSION

In this project, smart hospital using IOT has been successfully designed. This project is highly energy efficient as it uses arduino board having microcontroller (ATmega Atmel328pu) which having low power utilization. It also uses MQTT networking protocol and helps in power saving. We do not need to manually turn ON or OFF the switch of the light. It is possible to control the switch from a webpage or mobile application. This system is a time consuming. It will save patient from the risk of "AIR EMBOLISM". It is user friendly system. Maintenance of this project is not costly.

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