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To end this acknowledgement, we would like to thank all those who have helped us during the project development .

Abstract : In recent times the postulation of smart cities have gained grate popularity. Constant efforts are being made in the field of IoT in order to boost up the productivity and reliability of urban infrastructure. Problems such as, wastage of power, waste of time in management or scheduling of classrooms , and safety of classrooms are being addressed by IoT. In this paper, we present an IoT based smart classroom maintenance system. The proposed Smart classroom maintenance system consists of an on-site deployment of an IoT module that is used to monitor and signalize the state of availability of each single classroom. A mobile application is also provided that allows an end user to check the availability of classroom and slot accordingly ,power consumption by electronic gadgets being installed ,safety alerts ,and also the gadgets are programmed in such a way that they are adaptable to the environment . The paper also describes a high-level view of the system architecture. Towards the end, the paper discusses the working of the system in form of a use case that proves the correctness of the proposed model

Introduction

The idea of Internet of Things (IoT) established with things with identity communication devices. The devices could be traced, sensed, controlled or monitored using remote computers connected through Internet. IoT enlarges the usage of Internet providing the communication, and thus inter-network of the devices and physical objects, or ‘Things’. The two prominent words in IoT are “internet” and “things”. Internet means a vast intercontinental network of connected servers, computers, tablets and mobiles using the universally used protocols and connecting systems. Internet enables sending, receiving, or communicating of information. Thing in English has number of uses and meanings. Dictionary meaning of ‘Thing’ is a term used to reference to a physical object, an action or idea, situation or activity, in case when we do not wish to be precise. IoT, in general consists of inter-network of the devices and physical objects, number of objects can gather the data at remote locations and communicate to units managing, acquiring, organizing and analysing the data in the processes and services. It provides a vision where things (wearable, watch, alarm clock, home devices, surrounding objects with) become smart and behave alive through sensing, computing and communicating by embedded small devices which interconnect with objects or persons via connectivity. These factors gave rise to the union of both technologies thus leading to the formation of a new technology could be accessed, monitored and controlled from any location In simple terms IoT can be described in terms of an equation stating:

Physical Object + Controller, Sensor and Actuators + Internet = Internet of Things

In present day schools and colleges are finding an available of classroom is always difficult for teachers, management, and it tends to become harder with ever increasing number of students in an institution. This situation can be seen as an opportunity for smart

campus to undertake actions in order enhance the efficiency their classroom resources thus leading to reduction in searching times, congestion between allocation of classes and students losing their patience . Problems can be solved if the teachers can be informed in advance about the availability of classrooms . Recent advances in creating low-cost, low-power embedded systems are helping developers to build new applications for Internet of Things. Such systems require efficient sensors to be deployed in the classrooms for monitoring the occupancy as well as quick data processing units in order to gain practical insights from data collected over various sources The smart classroom management system that we propose is implemented using a mobile application . The system helps a user know the availability of classrooms, power consumption details ,emergency alerts on a real time basis.

Project Aim and Scope

Project Aim the aim of the project is to design and construct a Smart Management System of classroom that will enables us to monitor appliances automatically ,using a microcontroller , sensors ,and wifi based android application

Project objective

The objective of this project is to implement a low cost ,reliable and scalable smart management system of a classroom that can be used to monitor the appliances automatically using a microcontroller and sensors to achieve hardware simplicity ,low cost short messaging services, measure the power consumption and also automatically respond to the emergency situation

Project scope

This project work is complete on its own in remotely and automatically switching on and off of an electronic appliances by using sensors and send feedback message indicating the new present state of an electronic appliances ,the power consumption and also automatic response to the situation

Requirements

Hardware requirements

- Arduino UNO with Atmega 328P microcontroller
- LM317 DC-DC adjustable PSU module(2 pieces)
- MQ-2 gas sensor
- Flame sensor
- IR Infrared Obstacle Avoidance Sensor Module
- LED (red and green)
- Light dependent resistor (LDR)
- Wifi module ESP8266
- Digital LED strip
- Exhaust fan
- Micro DC 6-9V Submersible mini water pump

Software Requirement

- Arduino 1.8.10 compiler
- Android application

Description of Hardware Required

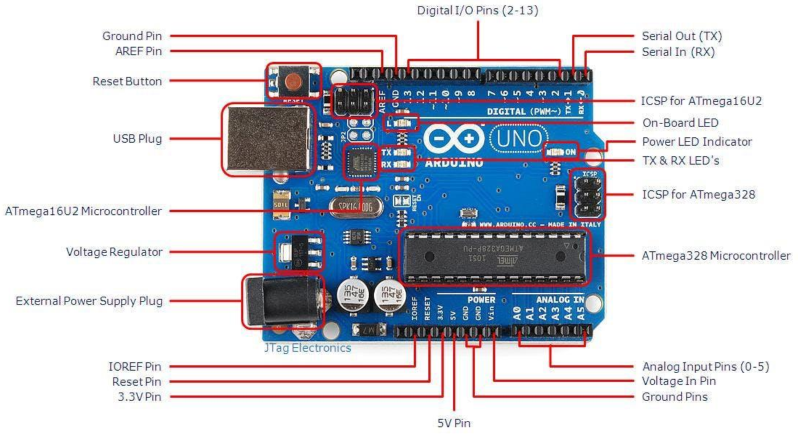
Arduino UNO

The Arduino UNO is a microcontroller board based on the ATmega328P. it has 14 digital input/output pins (of which 6 can be used as PWM outputs),6 analog inputs , a 16MHz crystal oscillator ,a USB connection ,a power jack ,an ICSP header and a reset button .it contains everything needed to support the microcontroller : simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or batter to get started .

The UNO differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip .instead ,it features the Atmega8U2 programmed as a USB-to- serial converter

- Some technical specification of Arduino UNO are :
  1. Microcontroller ATmega38P
  2. Operating voltage 5V
  3. Input voltage (recommended) 7-12V
  4. Input voltage (limits) 6-20V
  5. Digital I/O Pins 14
  6. Analog input Pins 6
  7. DC current per I/O Pin 40mA
  8. DC current for 3.3V Pin 50mA
  9. Flash memory 32KB of which 0.5 KB used by bootloader
  10. SRAM 2 KB
  11. EEPROM 1KB
  12. Clock speed 16MHz

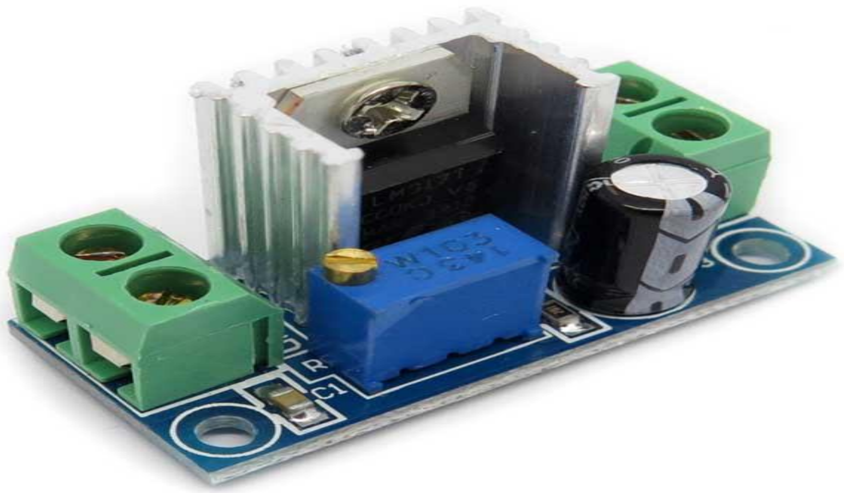
Circuit Diagram



LM317 DC-DC adjustable PSU module

- It is capable of providing excess current of 1.5A, hence it is conceptually considered as operational amplifier with an output voltage ranging from 1.2V to 37V.
- The LM317 voltage regulator circuit internally consists of thermal overload protection and short circuit current limiting constant with temperature.
- It is available in two packages as 3-Lead Transistor Package and surface mount D2PAK-3.
- Stocking of many fixed voltages can be eliminated.

Circuit Diagram



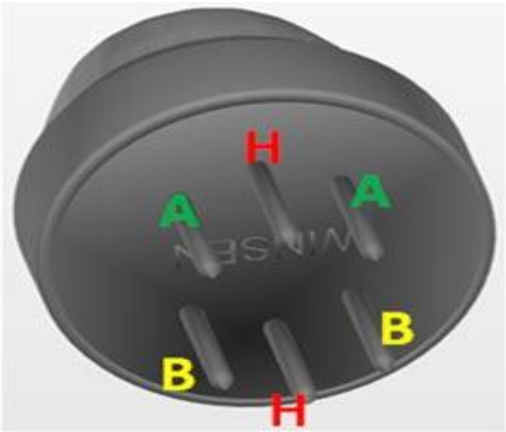
MQ-2 gas sensor

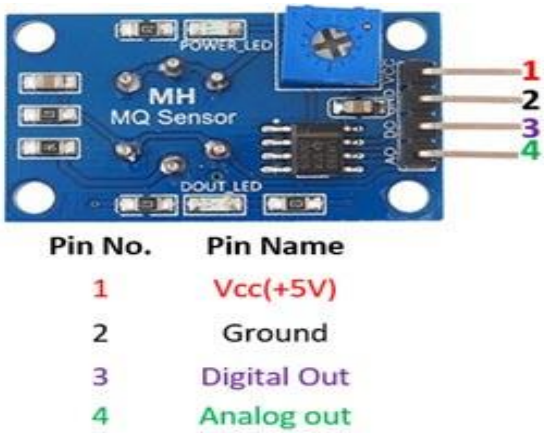
The Grove - Gas Sensor(MQ2) module is useful for gas leakage detection (in home and industry). It can detect combustible gas and smoke. The output voltage from the Gas sensor increases when the concentration of gas. Sensitivity can be adjusted by rotating the potentiometer. Please note that the best preheat time for the sensor is 24 hours and above.This is an Analog output sensor. It needs to be connected to any one Analog socket in Grove Base Shield. It is possible to connect the Grove module to Arduino directly by using jumper wires

- Operating Voltage is +5V
- Can be used to Measure or detect LPG, Alcohol, Propane, Hydrogen, CO and even methane
- Analog output voltage: 0V to 5V
- Digital Output Voltage: 0V or 5V (TTL Logic)

- Preheat duration 20 seconds
- Can be used as a Digital or analog sensor
- The Sensitivity of Digital pin can be varied using the potentiometer

Circuit Diagram





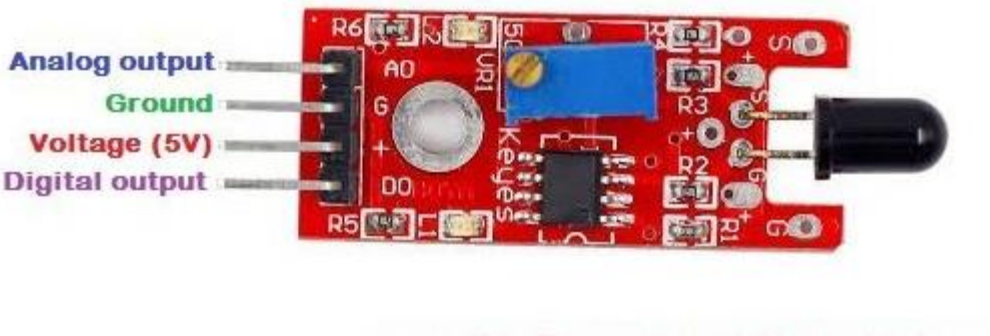
Flame sensor

The flame sensor can detect flame and infrared light sources with wavelengths ranging from 760 nm to 1100 nm. It uses the LM393 comparator chip, which gives a clean, stable digital output signal and driving ability of 15 mA.

This flame detector that can be used in fire alarms and other fire detecting devices.

- LM393 comparator chip
- Detection Range: 760 nm to 1100 nm
- Operating Voltage: 3.3 V to 5 V
- Maximum Output Current: 15 mA
- Digital Outputs: 0 and 1
- Detection Angle: about 60 degrees
- Adjustable sensitivity via potentiometer
- LED lights indicators: power (red) and digital switching output (green)
- Fixed bolt holes for easy installation
- PCB Size: 32 x 14 mm

Circuit Diagram



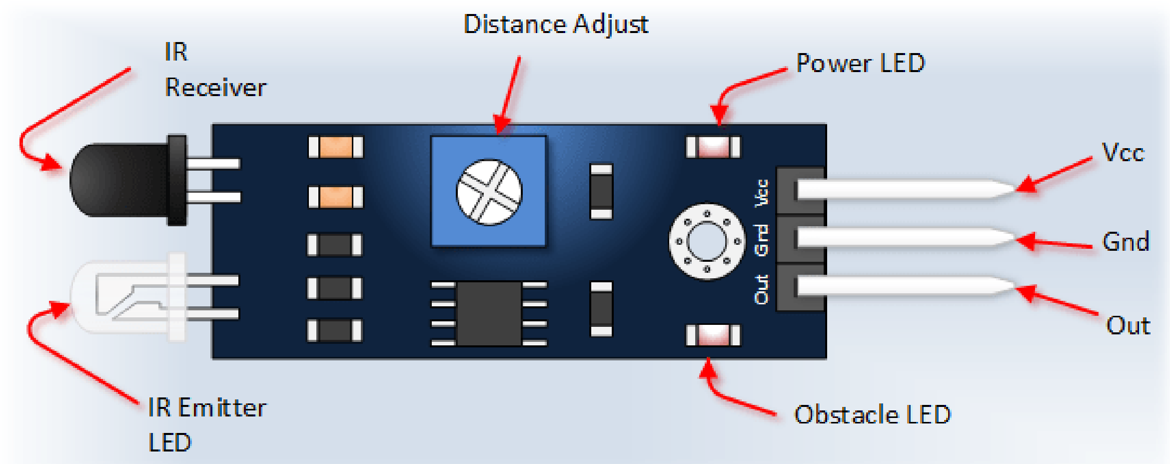
IR Infrared Obstacle Avoidance Sensor Module

IR Infrared Obstacle Avoidance Sensor Module has a pair of infrared transmitting and receiving tubes. When the transmitted light waves are reflected back, the reflected IR waves will be received by the receiver tube. The onboard comparator circuitry does the processing and the green indicator LED comes to life.

The module features a 3 wire interface with Vcc, GND and an OUTPUT pin on its tail. It works fine with 3.3 to 5V levels. Upon hindrance/reflectance, the output pin gives out a digital signal (a low-level signal). The onboard preset helps to fine tune the range of operation, effective distance range is 2cm to 80cm.

1. Easy to assemble and use
2. Onboard detection indication
3. Effective distance range of 2cm to 80cm
4. A preset knob to fine-tune distance range
5. There is an obstacle, the green indicator light on the circuit board.

Circuit Diagram



Light dependent resistor (LDR)

A ***Light Dependent Resistor*** (LDR) or a photo resistor is a device whose resistivity is a function of the incident electromagnetic radiation. Hence, they are light sensitive devices. They are also called as photo conductors, photo conductive cells or simply photocells. They are made up of semiconductor materials having high resistance. There are many different symbols used to indicate a **LDR**, one of the most commonly used symbol is shown in the figure below. The arrow indicates light falling on it.

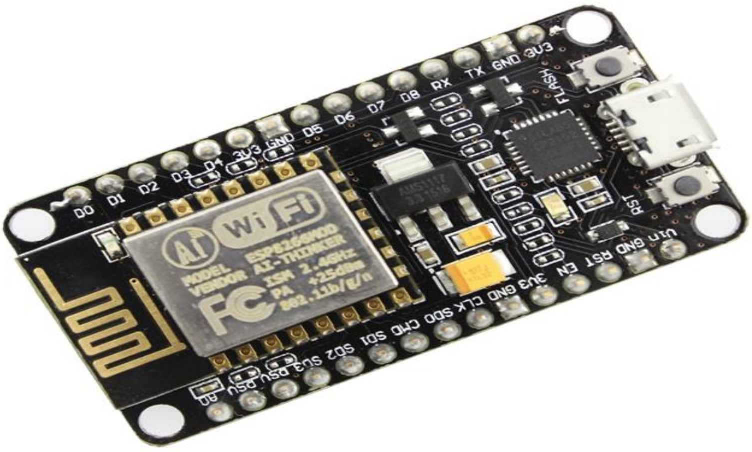
Circuit Diagram

Wifi module ESP8266

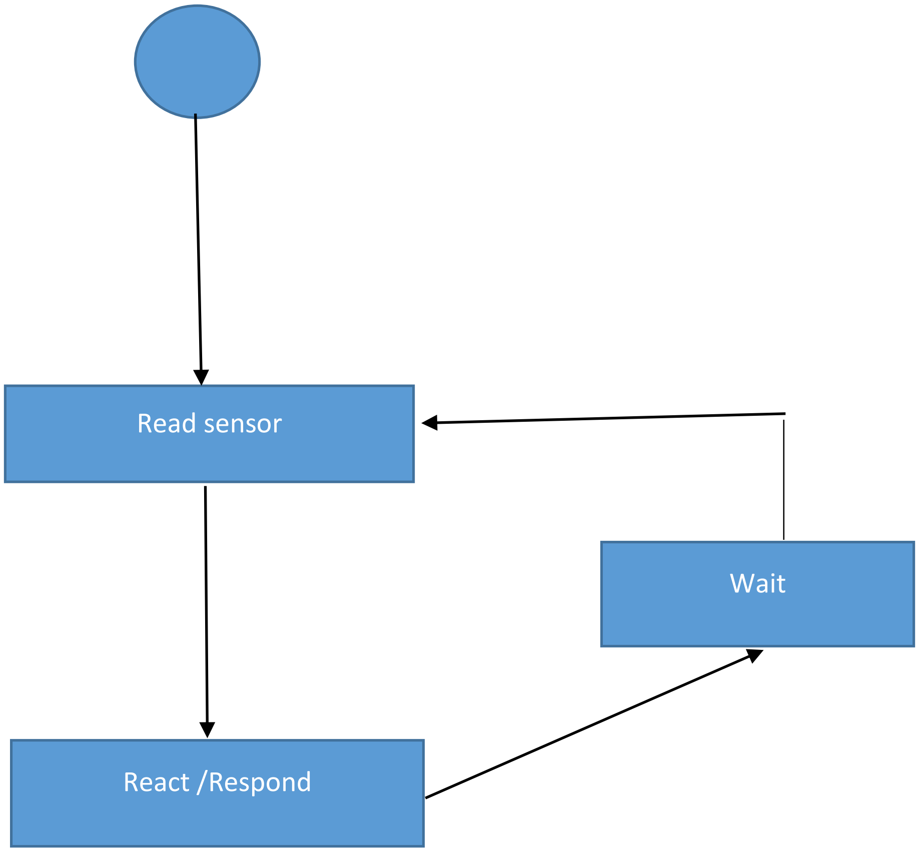
ESP8266 is a wifi SOC (system on a chip) produced by Express if Systems . It is an highly integrated chip designed to provide full internet connectivity in a small package

- Processor: L106 32-bit RISC microprocessor core based on the Ten silica Xtensa Diamond Standard 106Micro running at 80 MHz
- Memory:
  - 32 KiB instruction RAM
  - 32 KiB instruction cache RAM
  - 80 KiB user-data RAM
  - 16 KiB ETS system-data RAM
- External QSPI fl0ash: up to 16 MiB is supported (512 KiB to 4 MiB typically included)
- IEEE 802.11 b/g/n Wi-Fi
  - Integrated TR switch, balun, LNA, power amplifier and matching network
  - WEP or WPA/WPA2 authentication, or open networks
- 16 GPIO pins
- SPI
- I²C (software implementation)
- I²S interfaces with DMA (sharing pins with GPIO)
- UART on dedicated pins, plus a transmit-only UART can be enabled on GPIO2
- 10-bit ADC (successive approximation ADC)

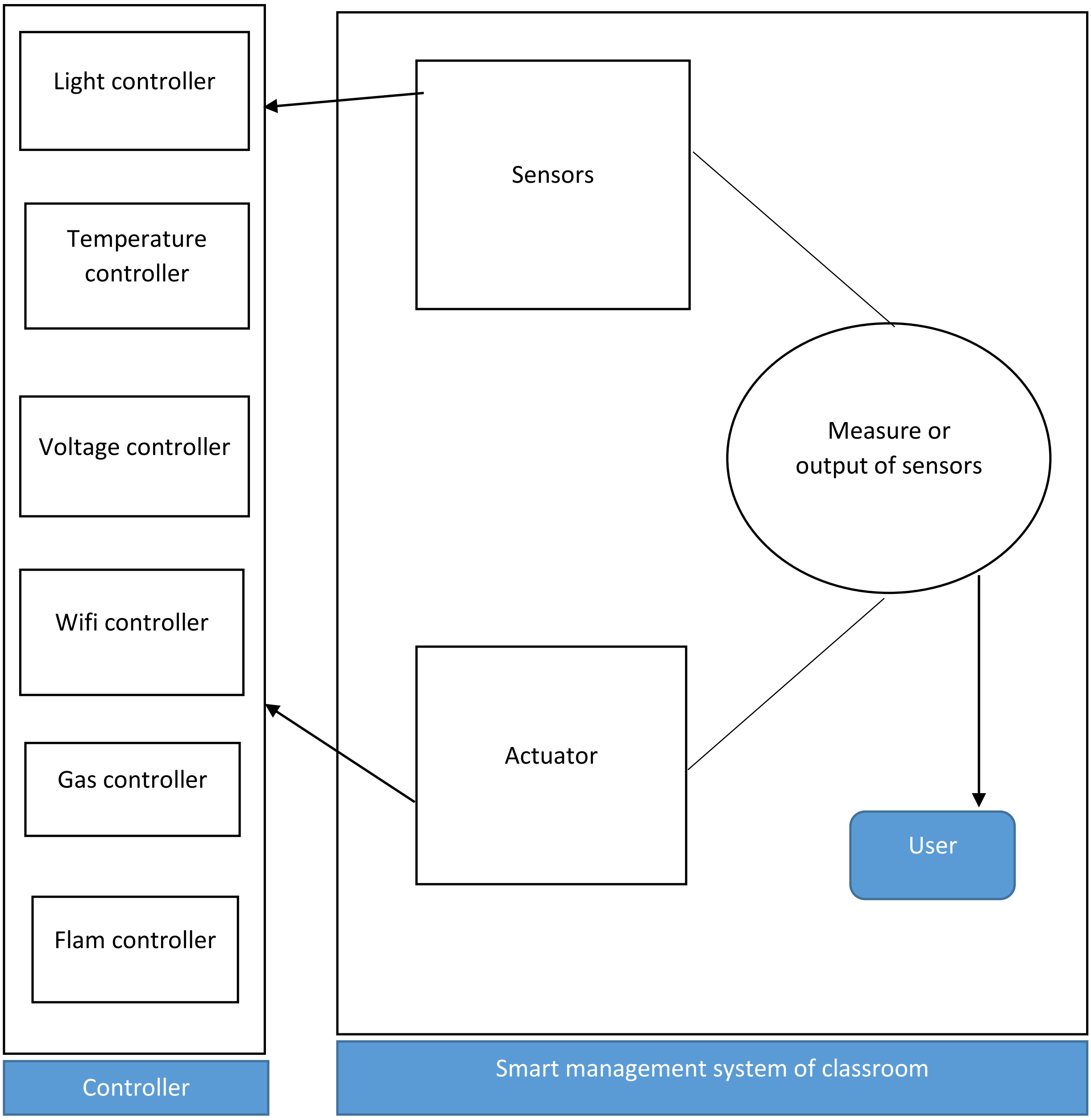
Circuit Diagram



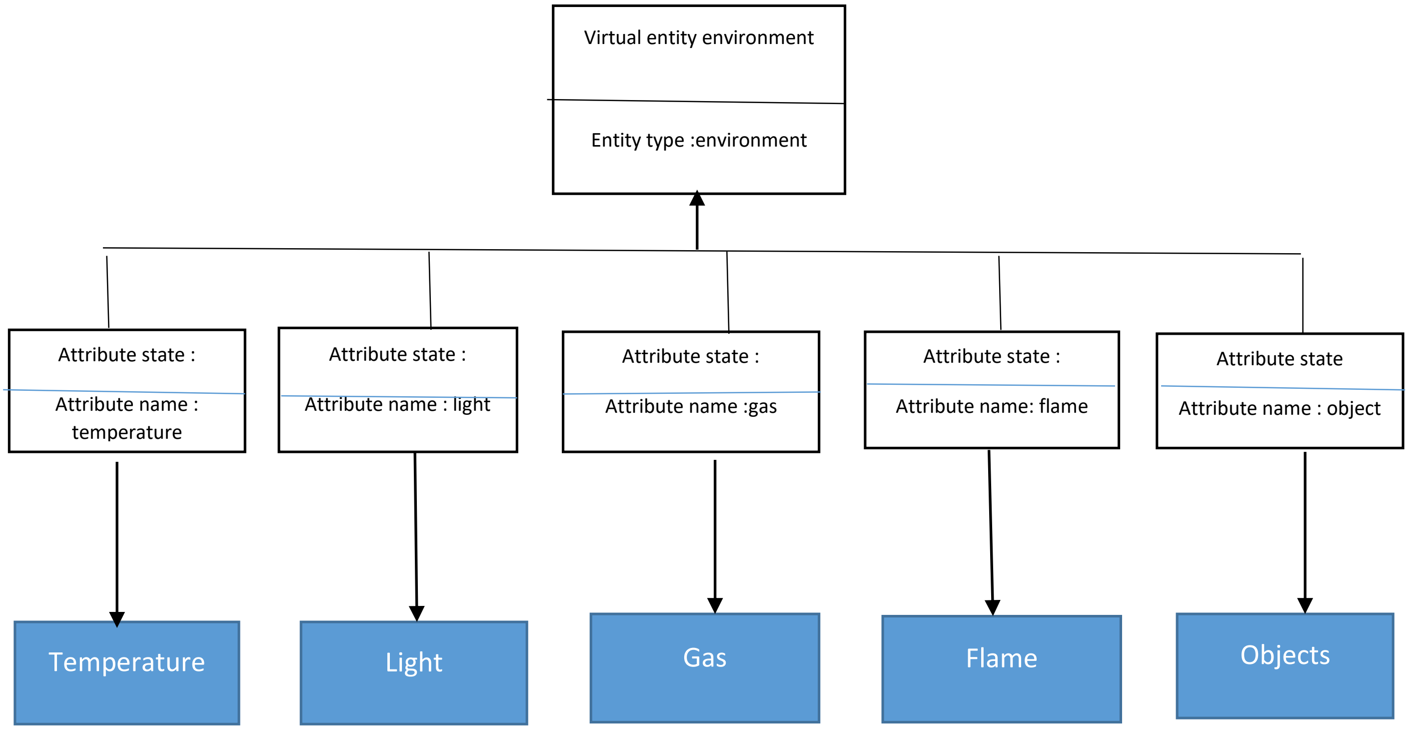
Process model specification



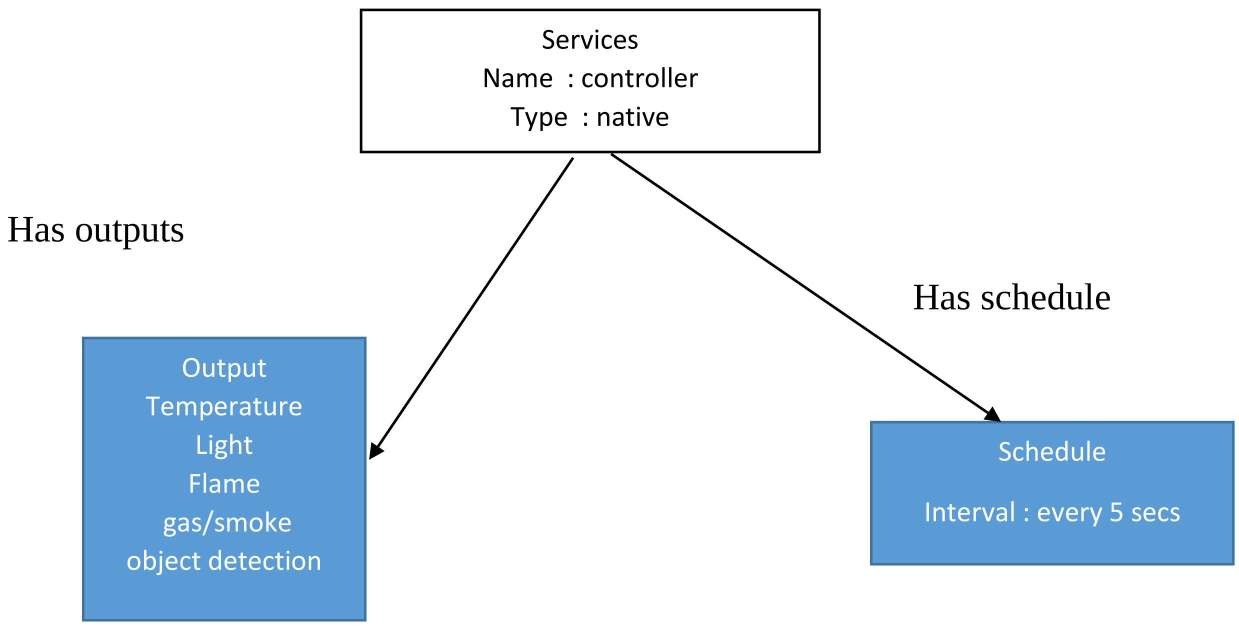
Domain model specification



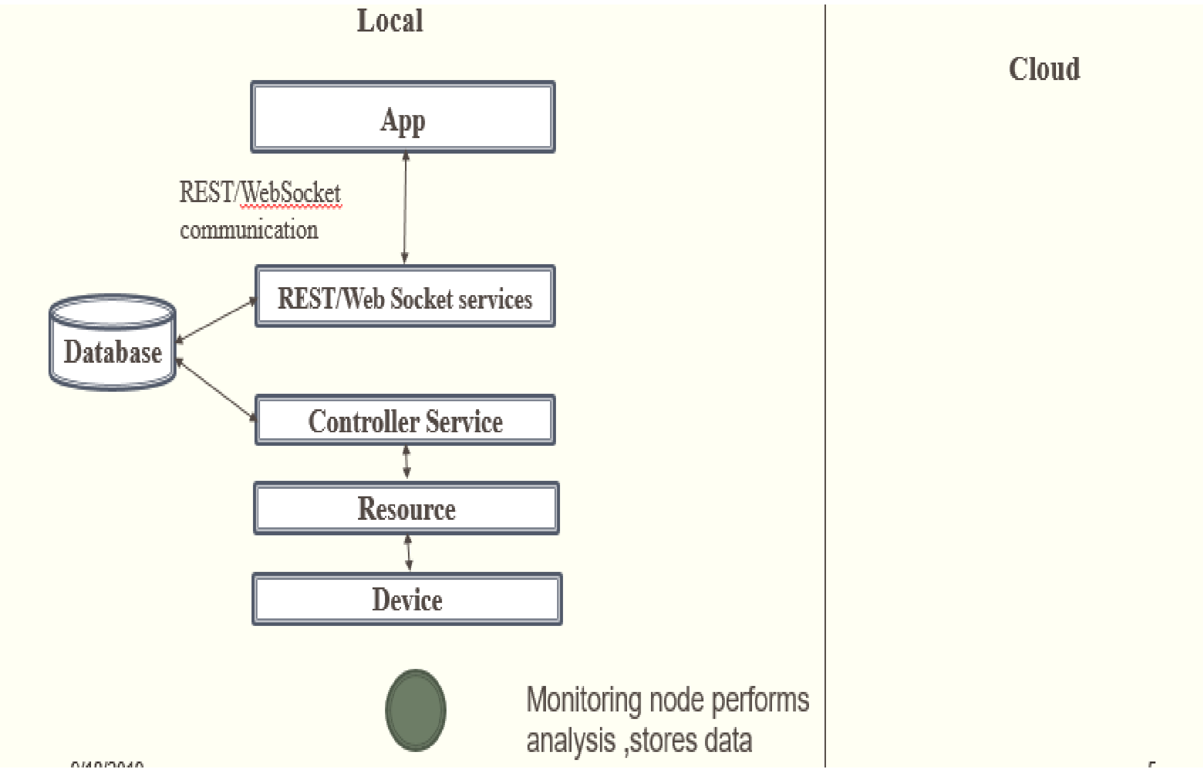
Information model specification



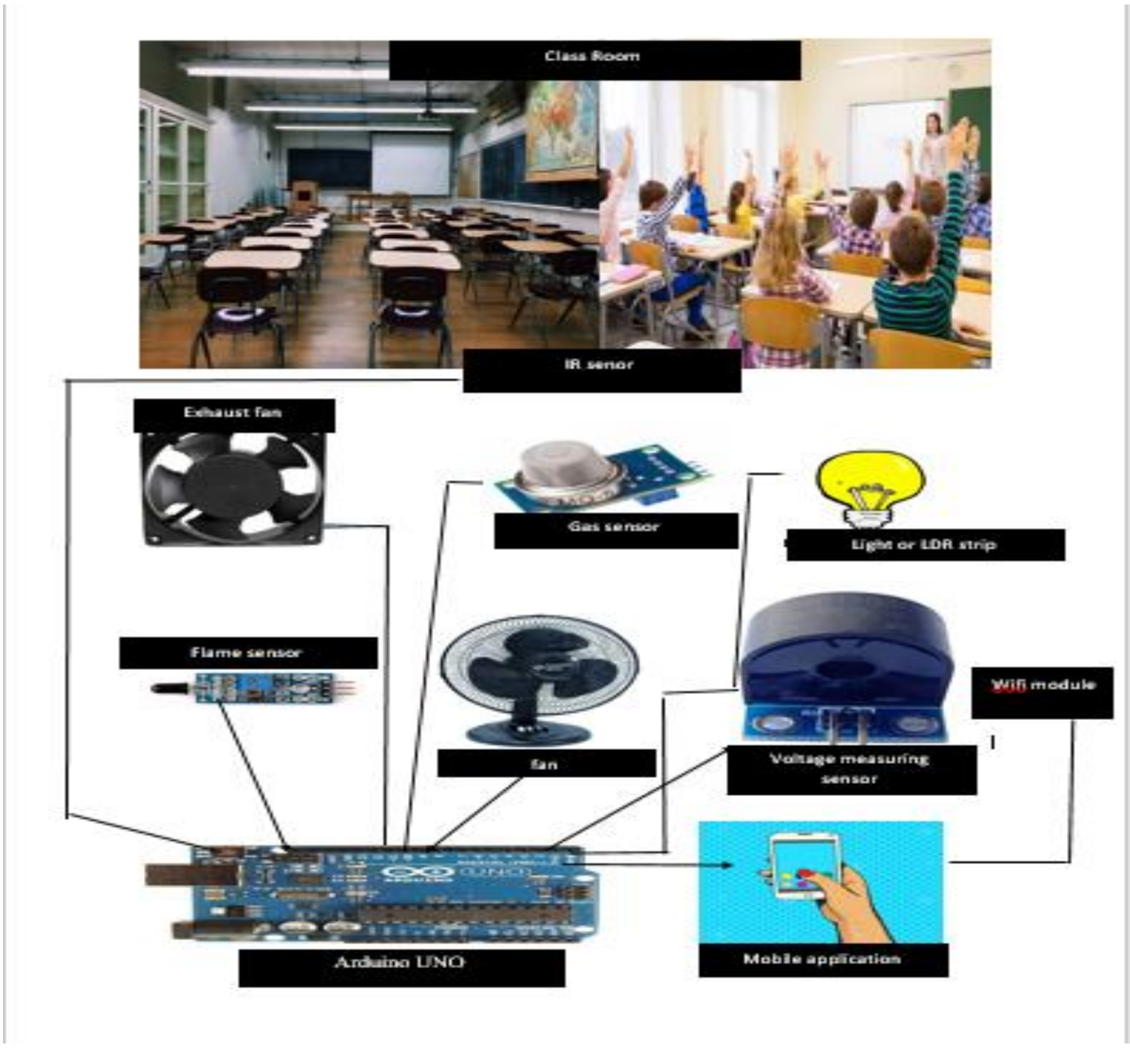
Controller service specification



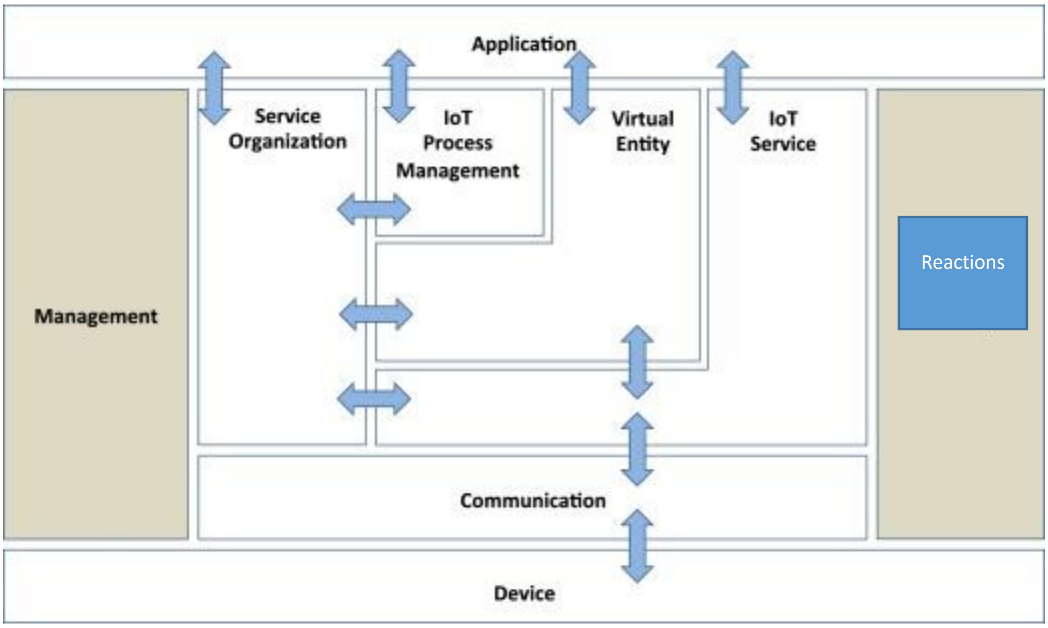
Deployment model specification



Design and components integration



Function model :



Gantt chart :

Application development:

Code :

```
#define LDR          A1
#define Fire_Sensor  7
#define Gas_Sensor   6
#define Pump         2
#define Fan         10
#define IR_Sensor    8
#define LED         11
#define Class_Fan    12
#define RLed1        4
#define GLed2        5

int Fcount = 0,Lcount = 0,Gcount = 0,FIcount = 0;

void setup()
{
  pinMode(LDR, INPUT);
  pinMode(Fire_Sensor, INPUT);
  pinMode(Gas_Sensor, INPUT);
  pinMode(IR_Sensor, INPUT);
  pinMode(Pump, OUTPUT);
  pinMode(Fan, OUTPUT);
  pinMode(RLed1, OUTPUT);
  pinMode(GLed2, OUTPUT);
  pinMode(LED, OUTPUT);
  pinMode(Class_Fan, OUTPUT);
  Serial.begin(115200);
  WIFI();
  Serial.write("AT+CIPSEND=0,15\r\n"); // MULTIPLE MODE SELECTION
  delay(50);
  Serial.write("SMART CLASSROOM");
  delay(50);
  Serial.write("\n\r\r"); // MULTIPLE MODE SELECTION
  delay(1000);
  digitalWrite(RLed1,LOW);
  digitalWrite(GLed2,LOW);
```

```
}
void WIFI(void)
{
   String BUFF, buff_1;
   char ch;
   Serial.print('A');
   delay(10);
   Serial.print('T');
   delay(10);
   Serial.print('E');
   delay(10);
   Serial.print('0');
   delay(10);
   Serial.print("\r\n");
   Serial.print("1");
   Serial.print(Serial.readString());
   delay(50);
   Serial.write("AT\r\n");
   Serial.print("2");
   Serial.print(Serial.readString());
   delay(50);
   Serial.write("AT+CWMODE=2\r\n");
   Serial.print("3");
   Serial.print(Serial.readString());
   delay(50);
   Serial.write("AT+CIPMUX=1\r\n");
   Serial.print("8");
   Serial.print(Serial.readString());
   delay(50);
   Serial.write("AT+CIPSERVER=1,80\r\n");
   Serial.print("9");
   Serial.print(Serial.readString());
   delay(50);
   Serial.write("AT+CIFSR\r\n");
   Serial.print("10");
   Serial.print(Serial.readString());
   delay(50);

}
```

```
void Fire_Monitor()
{
   if(digitalRead(Fire_Sensor)==LOW)
{
 //   FIcount=1;
      do
{

Serial.write("AT+CIPSEND=0,13\r\n"); // MULTIPLE MODE
SELECTION
delay(50);
Serial.write("FIRE DETECTED");
FIcount=0;
}while(FIcount);
digitalWrite(Pump, HIGH);
  }
   else
   {
 digitalWrite(Pump, LOW);
 FIcount = 0;
   }
}

void Gas_Monitor()
{
   if(digitalRead(Gas_Sensor)==LOW)
   {
 Gcount++;
//      if(Gcount == 1)
//      {
        Serial.write("AT+CIPSEND=0,12\r\n"); // MULTIPLE MODE
SELECTION
        delay(50);
        Serial.write("Gas DETECTED");
//      }
      digitalWrite(Fan, HIGH);
```

```
    }
    else
    {
     digitalWrite(Fan, LOW);
     Gcount = 0;
    }
}

void IRSensor_Monitor()
{

    if(digitalRead(IR_Sensor)==LOW)
    {
      digitalWrite(GLed2,HIGH);
      delay(1000);
       digitalWrite(GLed2,LOW);
       delay(1000);
     if(!Fcount)
     {
       Serial.write("AT+CIPSEND=0,9\r\n"); // MULTIPLE MODE
SELECTION
       delay(50);
       Serial.write("Fan is ON");
       Fcount++;
       Serial.write("AT+CIPSEND=0,9\r\n"); // MULTIPLE MODE
SELECTION
       delay(50);
       Serial.write("Lights ON");
       Lcount++;
      }

     digitalWrite(Class_Fan, HIGH);

    // delay(1000);

     if(analogRead(LDR)>=300)
     {
       digitalWrite(LED, LOW);
       Fcount =0;
```

```
      }

      else
      {

          digitalWrite(LED, HIGH);
//          Serial.write("AT+CIPSEND=0,9\r\n"); // MULTIPLE MODE
SELECTION
//          delay(50);
//          Serial.write("Lights ON");
//          Lcount++;
        }
      }
    else
    {
      digitalWrite(Class_Fan, LOW);
      digitalWrite(RLed1, HIGH);
      delay(500);
       digitalWrite(RLed1,LOW);
      digitalWrite(LED, LOW);
      Fcount = 0;
      Lcount = 0;
    }


}

void loop()
{
   IRSensor_Monitor();
   Gas_Monitor();
   Fire_Monitor();
//Serial.println(digitalRead(Fire_Sensor));
//delay(500);

}
```

Testing

Limitations of the project :

- High Complexity
- Chances of failure is high , due to improper working of sensors
- Fluctuate for environment conditions
- Less accuracy

Conclusion

The concept of Smart Camps have always been a dream for youth. Since the past couple of years large advancements have been made in making smart campus a reality. The growth of Internet of Things and Cloud technologies have give rise to new possibilities in terms of smart campus. Smart classroom facilities and congestion management systems have always been at the core of constructing smart campus. In this paper, we address the issue of classroom and present an IoT based Cloud integrated smart classroom maintenance system. The system that we propose provides real time information regarding availability of classroom in a campus. Users from remote locations could control by using our mobile application. The efforts made in this paper are indented to improve the facilities and thereby aiming to enhance the quality of education.

Future enhancement :

- Data base connection (cloud connection)
- Analysis of power consumption
- Call immediately to a in-charge person when disaster occurs