Smart Home System

(MICROBOTS)

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Abstract

Smart Home System is automation and remote control of common Electrical appliances found in every household. In this Project we have focused on some of the most used and most common appliances that could be remotely accessed via just a tap on your smartphone or tablet.

The five mostly used household components we have automated in this project are Smart Lighting System, Smart Door Lock, Smart Irrigation System, Smart HVAC(Heating Ventilation and Air-Conditioning) and Smart Shower System. The Remote control of these appliances allows user a better and care free living standard.

All of these Devices consists of main and head device called Smart Hub controlling all of the other components such as cameras, light bulbs, heaters and e.t.c. This hub stores data recorded and added(preferences or passwords) on a local cloud by the user and process it. An Application which controls all is the epicentre of our Smart Home System. User can add and edit the data accordingly.

User is notified via the application for any warnings or unusual activities. Components consists of on-chip integrated sensors actuators and control processing units. All of the devices are designed for their best performance and finest that perfectly fits with your home interior. The system developed is eco-friendly made with 100% recyclable material.

System can be powered by Solar energy. The system developed is cost effective for a large group of peoples.

Motivation

Smart Home System came up from numerous reasons, but high level security, energy consumption, convenience and lap of luxury being the principal reasons that came up up. Smart Home System is upcoming next automation field and a concept to our future world.

Smart Home System is implementation of ideas that we have for our automated world. Sitting on your comfortable and warm sofa reading a book but suddenly wants to change the light of the room, Now you don't need move from your sofa just sit there and change it with just on click on your smartphone or just ask Google assistant/Alexa with just your voice. Suddenly you slept now that light may disturb you in your sleep but our smart device could switch it off. This vision is now reality.

Security is one of the necessities what we need nowadays for a piece of mind and power. Just having cameras in your home is not enough there is a need of 24/7 surveillance. We thought of a system that keep track what is going on and notifies us when there is something unusual.

Energy management is a huge factor for our motivation. Increase in population and electrical appliances whereas limitation of resources. We need to save what we have and use as less as we can. Smart Home Systems can monitor and control the amount of energy being used. The built-in advanced AI monitors this and controls. All smart home system devices regulates the energy usage on its own and provides a weekly usage graph.

Luxury is also a contributing factor for the motivation. After a chaotic day you want to just go to your comfy home with the desired temperature and calm moody lights and sleep fearlessly on your bed for a good start for a new day.with a ratio of quantities and units. For example, write "Temperature (K)", not "Temperature/K".

SUMMARY AND OUTLOOK:

THE SMART HOME SYSTEM PROJECT BY TEAM MICROBOTS COMPRISES OF VARIOUS SUB SYSTEMS WHICH CAN PROVIDE THE USER WITH MORE CONTROL AND AUTOMATION WITHIN THE HOME ENVIRONMENT. THE SYSTEM CONSISTS OF THE FOLLOWING VARIOUS SUB SYSTEMS:

- SMART LIGHTING SYSTEM
- SMART DOORLOCK SYSTEM
- SMART SHOWER SYSTEM
- SMART HVAC SYSTEM
- SMART IRRIGATION SYSTEM

EACH SUB SYSTEM IS RESPONSIBLE FOR DIFFERENT TASKS. SMART LIGHTING USES DIFFERENT SENSORS SUCH AS PIR, TEMPERATURE AND LIGHT SENSORS TO PROVIDE A MORE EFFICIENT AND AMBIENT LIGHTING EXPERIENCE TO THE USER. SMART DOORLOCK CONSISTS OF CAMERAS AND OTHER SECURITY FEATURES TO MAKE THE HOUSEHOLD A SAFER ENVIRONMENT. SMART SHOWER SYSTEM IMPROVES THE BATHING EXPERIENCE OF THE USER. IT USES A FLOW RATE SENSOR ALONG A TEMPERATURE SENSOR TO INCREASE ITS FUNCTIONALITY. THE SMART HVAC SYSTEM CONSISTS OF MULTIPLE SENSORS AND CONNECTS TO HVAC EQUIPMENT TO GIVE THE HOUSE A MORE BREATHABLE AND LIVELY ENVIRONMENT. THE SMART IRRIGATION SYSTEM TAKES CARE OF THE PLANTS AND GREENERY OUTSIDE THE LIVING SPACE TO MAKE THEM HEALTHIER AND REDUCES THE WASTAGE OF WATER WHILE DOING SO.

Smart Lighting (Abdullah Zafar)

Smart Lighting is an automated technology that focuses on convenience and energy saving.

Micro Bots have introduced some of the latest features as follows:

1. Light up the world with your presence/movement.
2. Ultimate power saver.
3. Bulb color change as per atmospheric temperature

   Warm (Red, Yellow or Orange) Cold (Blue,Green and indigo)

1.1 Light Up the World

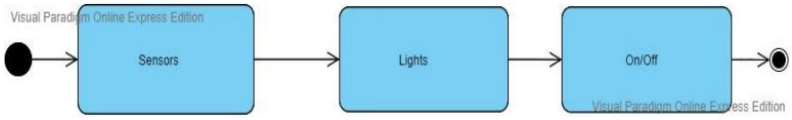
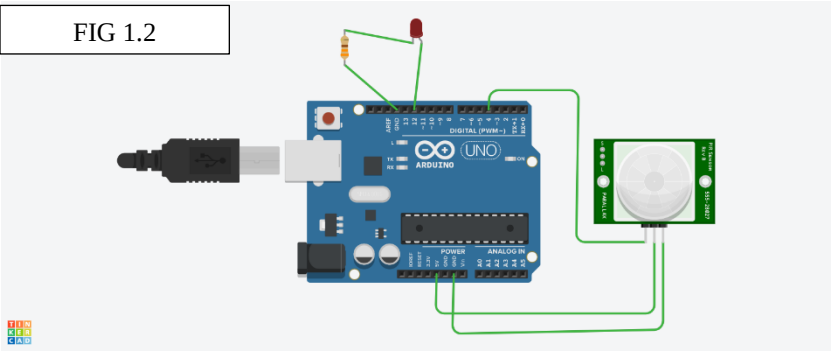


FIG 1.1

FIG 1.1 shows state machine diagram and it clearly illustrates on how the motion sensors would be used to serve the given purpose.

FIG 1.2 uses Arduino Uno, 3 Wires, led bulb and PIR Sensor. Furthermore, it demonstrates the circuit realization of the concept used. The led is in series with 330 Ohms resistor.

FIG 1.2



PIR Sensor

PIR Sensor are widely used to detect any kind of movement. PIR sensors are 3 pinned are may vary in the arrangement. The PIR sensor used in the illustration has Ground (Right Pin), Power (Middle Pin) and Signal (Left Pin). Digital Output is generated in form of high and low.

Partial code used in Light up the World (Detailed code is part of annex)

```
void loop(){
  val = digitalRead(sensor);   // sensor value

  switch(state)
{ case 0:

if (val == LOW) {           // no movement
    digitalWrite(led, LOW);   // light off
    delay(500);                // delay of 100 milliseconds
break;
}
 else if (val == HIGH) { state=1 ;

break;}

 case 1:

if (val == HIGH) {           // movement
    digitalWrite(led, HIGH);   // turn LED ON
    delay(2000);                // delay 2000 milliseconds
break;
}
 else if (val == LOW) { state=0 ;

break;}


 }
}
```

1.2 Ultimate power saver

This mode was introduced by Micro-bots to enable power saving and cost efficiency. Ultimate power saver depends on the natural light in the surroundings, lights go dim when the natural luminance is beyond the given threshold value and vice versa.

FIG 1.2.1

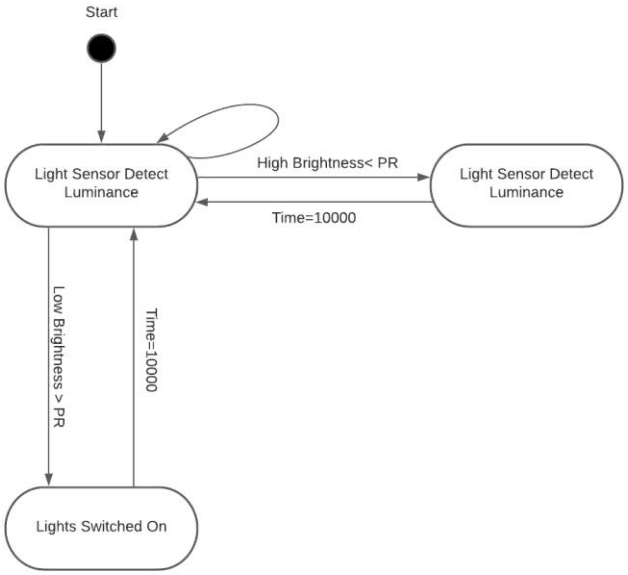


FIG 1.2.1 illustrates the state machine and explains the main concept behind Ultimate power saving mode. FIG 1.2.2 furthers the concept by using use case of the given scenario.

FIG 1.2.2

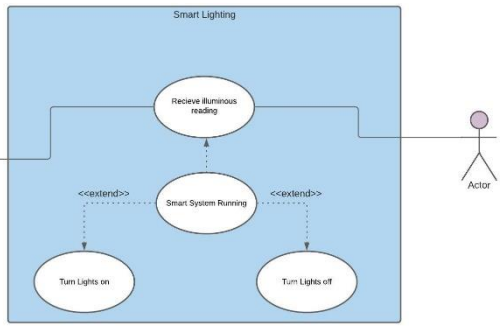
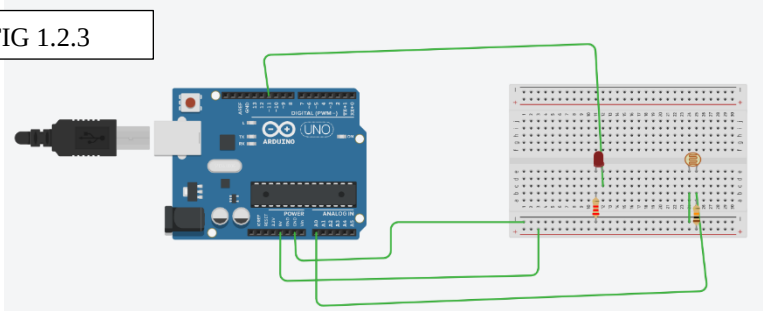


FIG 1.2.3 shows the circuit design of Ultimate power saving

FIG 1.2.3



Components used in FIG 1.2.3, 4 wires, Arduino, Led, Photo resistor, 2.2 K ohms and 10 k ohms resistors.

PHOTO RESISTOR

A photoresistor decreases its resistance with respect to receiving light on its surface . The resistance of the photo resistor and the light that falls on the surface are inversely proportional.

FIG 1.2.4

Equation below represents the resistance with respect to luminance.

Resistence $\propto$ 1/ luminance

Photo Resistor is to be placed outside the main building to ensure that it gets the most accurate reading. Cloud cover would mean that lesser natural light is available, hence would result in lights turning on.

PIR sensors works at a distance 10-12 m, they are to be placed in a good number as per the area of the house.

Both functions included ensure that the power is saved as much as possible and hence reducing the energy cost. Smart lighting does not only aim at convenience but also strives hard to ensure environmental friendliness.

FIG 1.2.5

Extracted from Pixabay(No copy rights)

The house model represented above can use the Ultimate power saving mode by placing a photo resistor on the top of the house connected to the smart light system and it will give the signal of the brightness level that is available.

PIR sensors are to be placed in a good number as compared to photo sensors. Reason being that the radius in which PIR sensors work are very limited; moreover, the sensor is obstructed by partitioning that is present in a normal house. A PIR sensor is required for every room that is present inside a building.

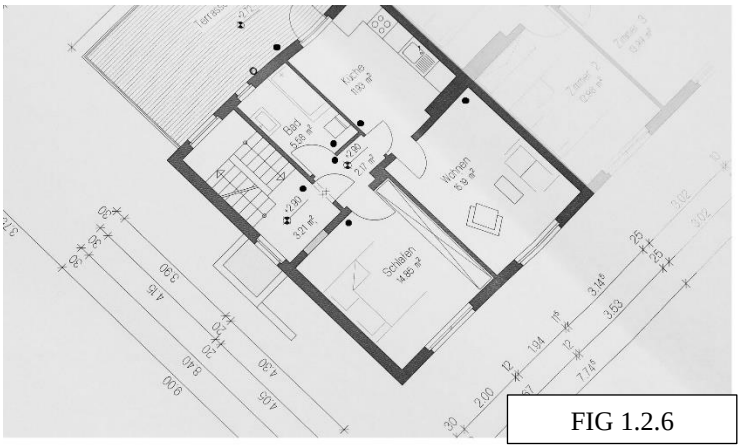


FIG 1.2.6

Black Circles present on the floor plan(FIG 1.2.6) shows the use of PIR sensors. A total of seven PIR sensors are used.

1.3 Bulb color change

Bulb color change enables its users to feel the atmospheric temperature in form of LED bulb color change. Conventionally, Warm used to be presented using colors such as Red, Yellow or Orange; and cold was represented as Blue, Green and indigo.

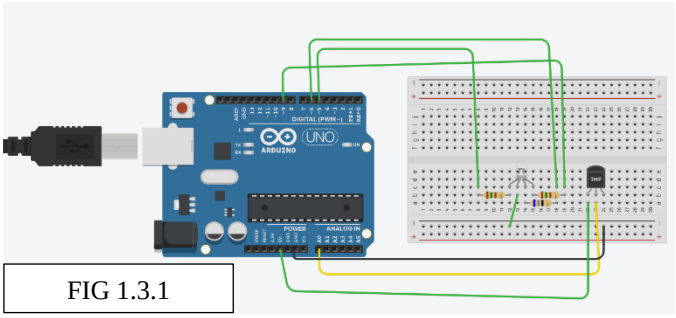


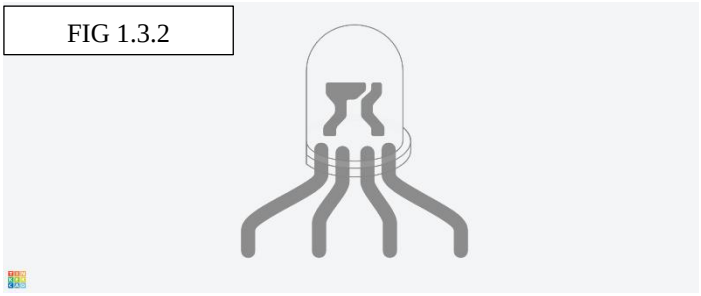
FIG 1.3.1

FIG 1.3.1 uses 3 resistors, wires, Arduino, LED and TMP 36

LED RGB

Light Emitting diode is a pack of three LED as one. Red, Green and Blue are the three LED used and different colors are generated by adjusting the brightness of these LED. PWM is used to achieve that function.

FIG 1.3.2



TMP 36

A temperature sensor that provides a voltage output that is linearly proportional to the temperature. TMP 36 comes with 3 pins, Power(Left most), V out(Middle) and GND (Right most).

FIG 1.3.3

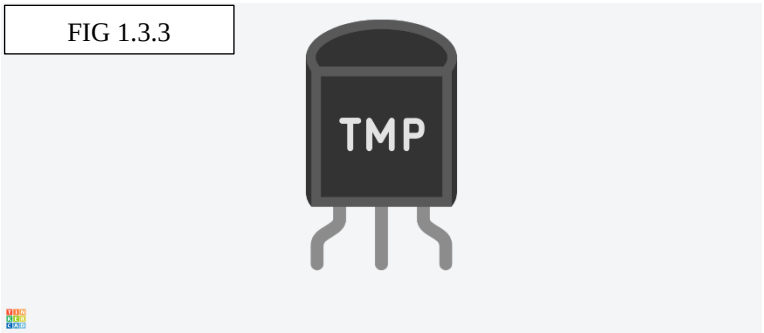


FIG 1.3.4

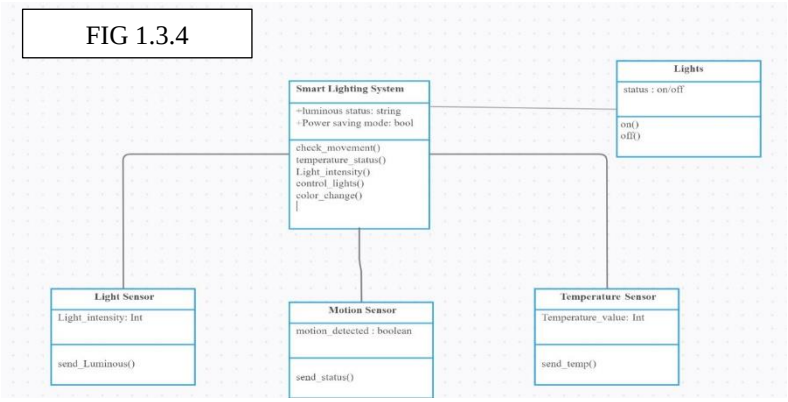


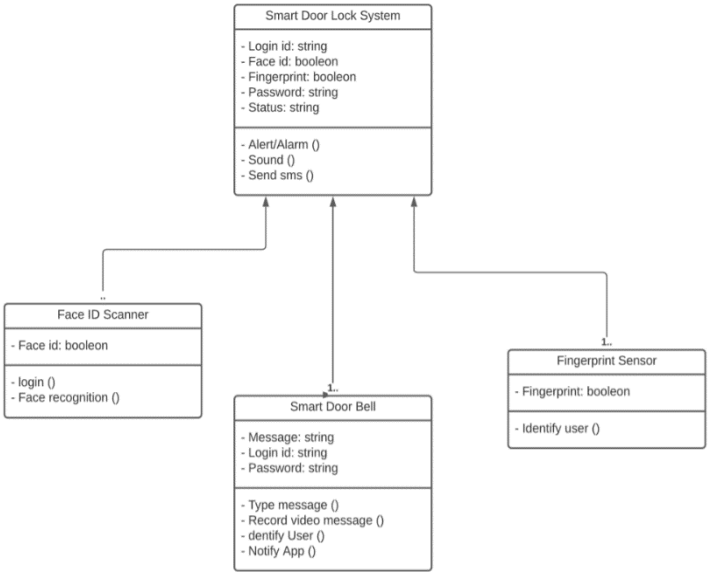
FIG 1.3.4 is Class diagram representing the entire Smart Lighting system and it is mapped to C++ in FIG 1.3.5

FIG 1.3.5

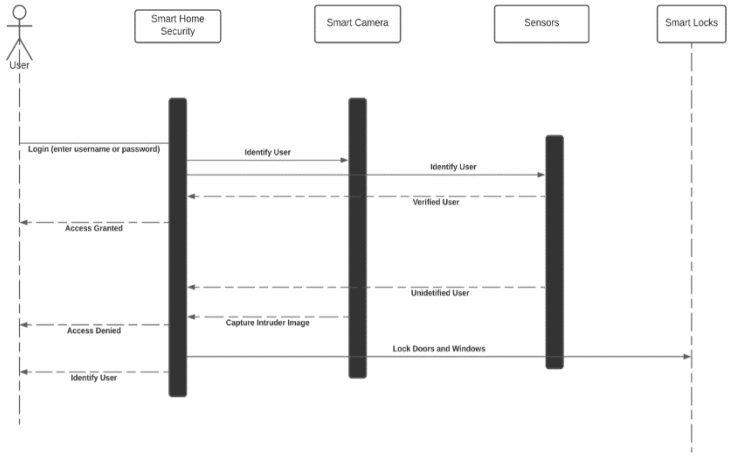
```
#include<iostream>
using namespace std;

class Smart  Lighting System {
public:
    string luminous status;
    boolean power saving mode;
private:

void check_movement();

void temperature_status();

void Light_intensity();

void control_lights();

void color_changes();
};

class Temperature Sensor {                  //temp sensor
public:
    Int Temperature_value;
private:

void send_temp();
};

class Motion Sensor {                       //motion sensor
public:

void send_status();
private:
    boolean motion_detected;
};

class Lights {                              //Lights Control
public:
    onoroff status;
private:

void on();

void off();
};

class Light Sensors {                       //Light Sensor
public:
    Int Light_intensity;

private:

void send_Luminous();
};

#endif
```

Smart Door Lock System.
(Mustafa Touqir)

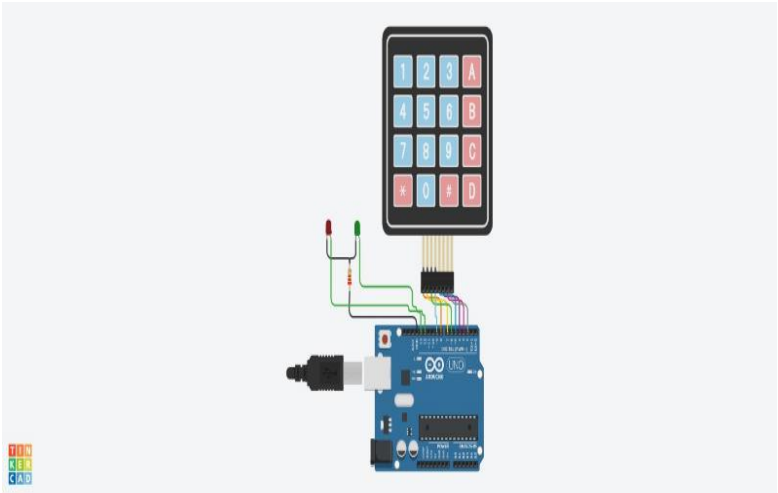
In recent years there has been increase in household thefts. To prevent these incidents we came up with the idea of a smart door lock system that is controllable with a help of a smartphone.




```
#include<iostream.>
Using namespace std;
Private
class smartdoor lock {
void string loginid();
void string password();
void bool faceid();
void bool fingerprint();
void string status();
private
 int get login id ( ) {
    return loginid;
}
int get password( ) {
    return password;
}
int get faceid ( ) {
    return faceid;
}
 int get fingerprint ( ) {
    return fingerprint;
}
int get status ( ) {
    return status;
}
}
```

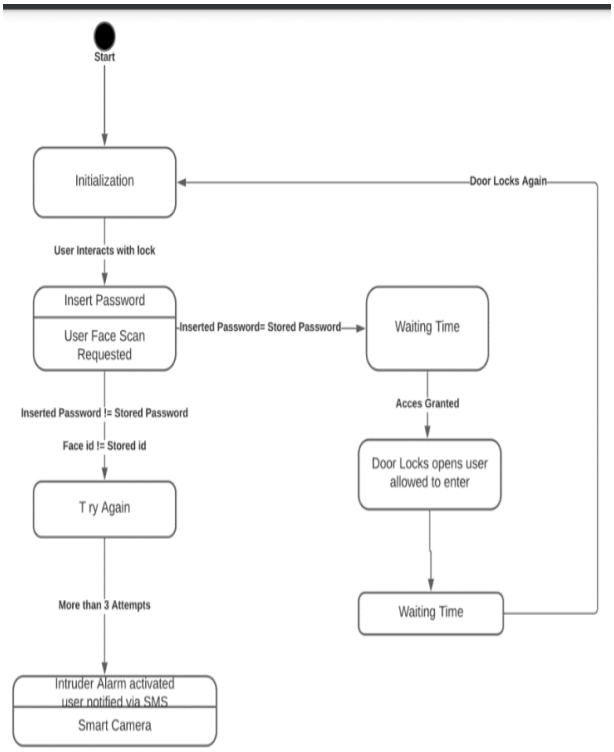


The Smart Door Lock System consists of an integrated doorbell with an in-built fingerprint sensor and face-id scanner with our best and enhanced face recognition feature. All of the door's and window's locks are connected to the doorbell. The System also interacts with the installed security cameras to recognize any intruder or unusual activities. The System notifies the user via the app or SMS (Short Message Service).



Door Bell Password Keypad Schematic.

To unlock the Door the user must enter the password which is the first step in the verification. A digital keypad appears on the screen where user can input Password The user has three attempts. If the Password entered is correct the user will then have verify his/her identity. If the Password enter is false the user has a total of three tries. If the user fails to enter the correct password within three attempts, a notification is forwarded to the owner or the main user. If there is a forced attempt after the three failed attempts, a SOS message is also delivered to a nearby Police station.



State machine representation.

Fingerprint and Face-ID Sensor.

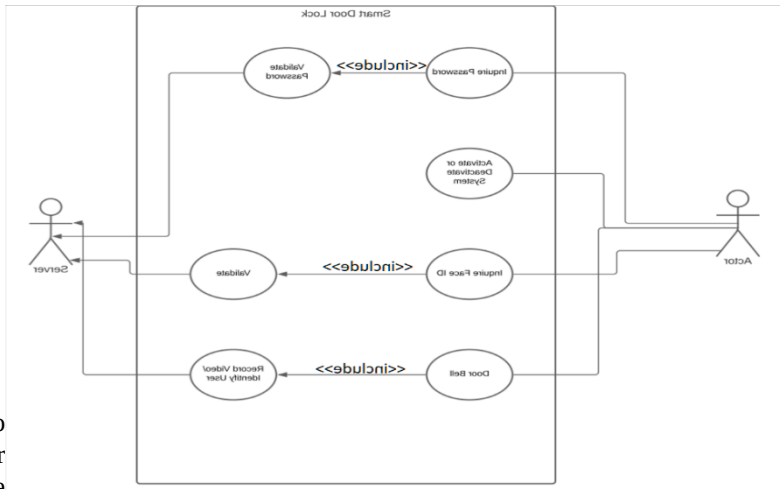
This is a second level verification after a correct Password to verify the User. This identifies which user has attempted or which user is trying to access. If a user is blocked or the password is known to someone which is not a household member. This will ensure that one who is a household member set foot in the house.

The embedded Fingerprint sensor is a high resolution sensor with a superior design to capture most of the angles for a quick and prime results.

The Face-ID consists of camera, sensors and our high end dot projection technology controlled with AI. Which scans quickly and cannot be easily tricked by our 3D dot projection technology.

Smart Door Lock Application.

Smart Door Lock is remotely accessible from anywhere via application. You can deactivate or activate the Door Lock in case of emergency remotely via application. You will get updates via the application of what is happening at your door. You can access recorded videos of the ones who accessed your door and those who attempted to enter your fortress. you can add new users and remove or block users only via application. Application can also be used to unlock the door, application uses smartphone built-in Face ID or fingerprint scanner to identify the user. Pin can also be changed via the application.
This application can also be installed on your PC, Tablet or your smartphone.



Data Privacy.

Your data is only accessible by you only not by us. The data is stored in a local network and can only be accessed locally. To prevent data breaches we have added many security features to prevent hacking.

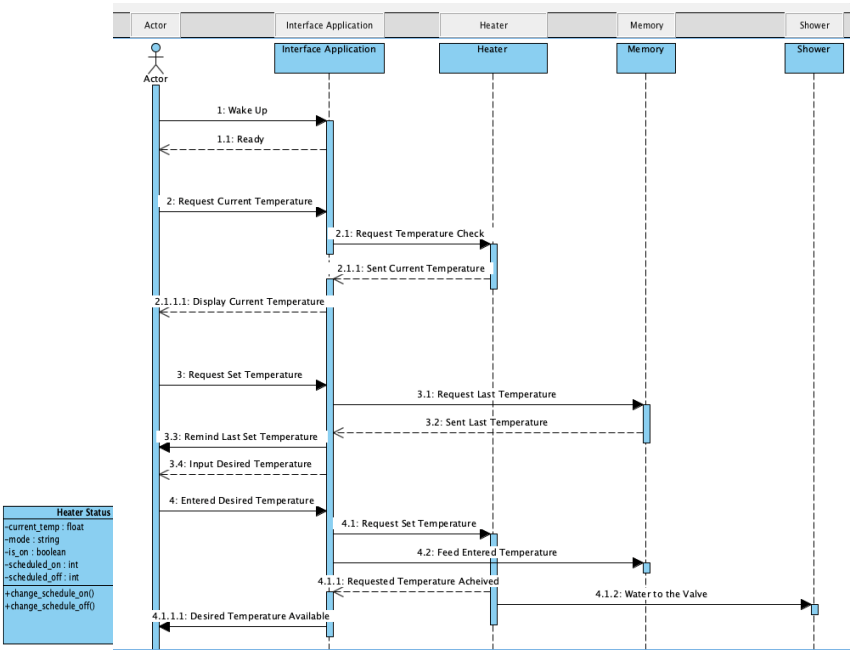
Addtional Features may be updated later

One of the additional features is that it can record a message from a visitor for you or play a recorded video message to the visitor. The HD camera can record a video message in 1080p. This smart device can receive a parcel, package or a mail on your behalf and notify you.

Smart Shower System(Rohail Usman)

INTRODUCTION

MAKING THE SMART SHOWER EASY TO USE AND TARGETING AUDIENCE OF EVERY CLASS, OUR SYSTEM IS AFFORDABLE AND SIMULTANEOUSLY APPEALING ASWELL.



SIMILAR TO MANY SWITCH BUTTONS IN HOUSES, OUR WALL-MOUNTED INTERFACE APPLICATION HOLDS A SLEEK DESIGN.

THE INTERACTION BETWEEN THE SHOWER AND THE PERSON IS ASSISTED BY THE SYSTEM VIA A SELECTION OF WATER TEMPERATURE AND ITS SPEED MAKING IT HASSLE FREE

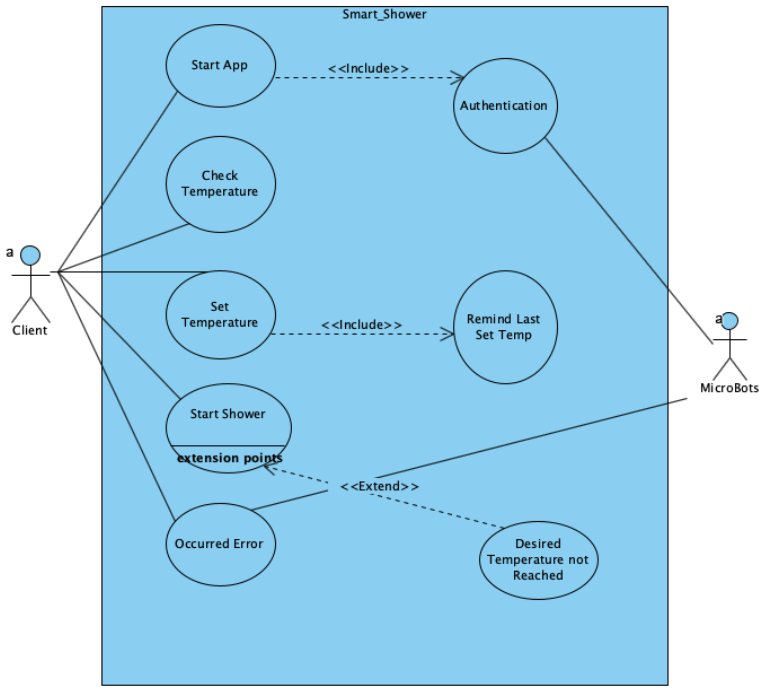
HIGH RESPONSIVENESS TIME OF THE SYSTEM REDUCES THE WAITING TIME FOR PERSON TO USE THE SHOWER.

Above mentioned Class diagram demonstrates on how the functions of the smart shower system are realized.

The use case diagram illustrates on how the system interacts with the customer.

The sequence diagram gives a good representation of the entire system

Temperature Sensor:



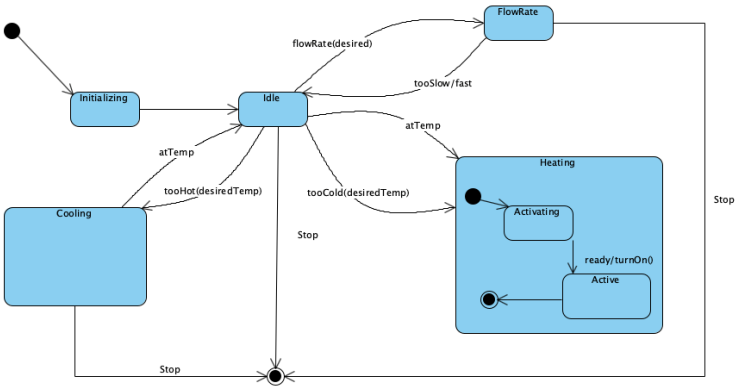
The TMP36 temperature sensor being used in this design is relatively easy to test as an individual component. To test the component, a digital multimeter, small laboratory power supply, and a breadboard will be used. Since the voltage drop across the transistor in the sensor in linear with temperature change, the formula,

Temperature in •C = [(Vout in mV)-500]/10

will give the temperature measured by the sensor by simply measuring the voltage across two pins.

Flow Rate Sensor

The water pump used on the test bed will be a non-variable speed pump and have a set throughput. Using the diameter of the flow rate sensor, the throughput of the pump, and a calculator, we can determine the expected maximum flow rate.



Perspectives

1.Water conservation due to high reaction time.

2.Hassle free temperature selection and flow rate to maximum precision.

3.Auto reminder for last selected temperature.

4.Cost effective, easy installation and excellent after sale service.

5.Installation requires only a single day.

Heating Ventilation and Air-Conditioning System(Syed Muhammad Saim)

The objective of this topic is to realize the smart heating, ventilation and air-conditioning using IoT. At the start comes the description of the topic followed by various UML diagrams and eventually, the realization part using Arduino Uno (*Abstract***)**

Keywords—component, formatting, style, styling, insert (*key words****)***

Introduction

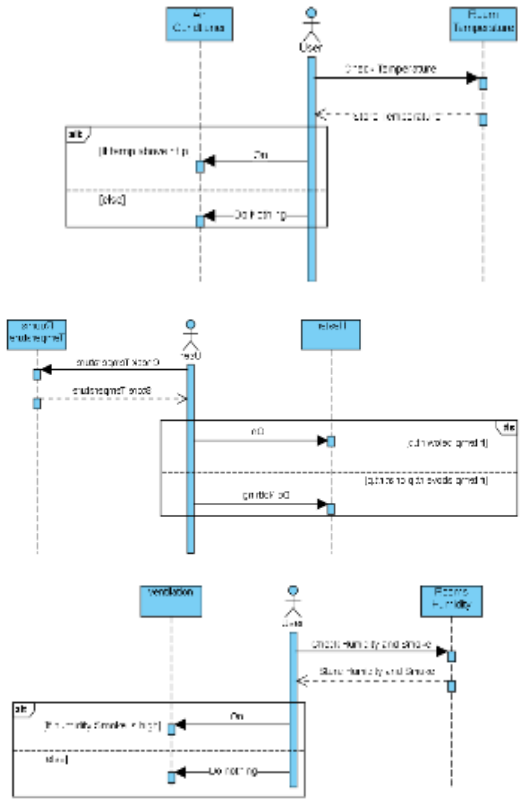
Heating, ventilation and air-conditioning is a basic component of a house. As the world is moving towards automation then how can we neglect this essential component with which we, intentionally or unintentionally, interact on daily basis. It does not only further ease our comfort in controlling theses components of house but advantageous in many other ways. For example, high use of energy consumption can be controlled as there is a smart assistant who is continuously monitoring the above mentioned scenario. As a result, there will be a drastic decrease in electricity bills. Moreover, excessive use of heating, ventilation and air-conditioning can also affect the atmosphere by increasing the amount of greenhouse gas resulting in global warming.

Nowadays, there are various smart devices have been built for heating, ventilation and air-conditioning system and companies are still in the quest of making the system smarter and more reliable. Among such smart devices includes Carrier Cor Wi-fi Thermostat, Ecobee, Emerson Sensi Wi-fi Thermostat, Nest Learning Thermostat, etc. These devices also allow you to make your own schedules and routines of heating, cooling and ventilation These devices might help to make your HVAC system smart but still there are not as much efficient until now. There is still need many more upgradations.

Under following headings, I have explained a basic pattern related to the smart system of heating, ventilation, and air-conditioning system. The idea can easily be understood using the UML diagrams where the diagrams are mostly self-explanatory. Furthermore, the explaining with help diagrams is also important so that the code could be created and can be understood in a professional way.

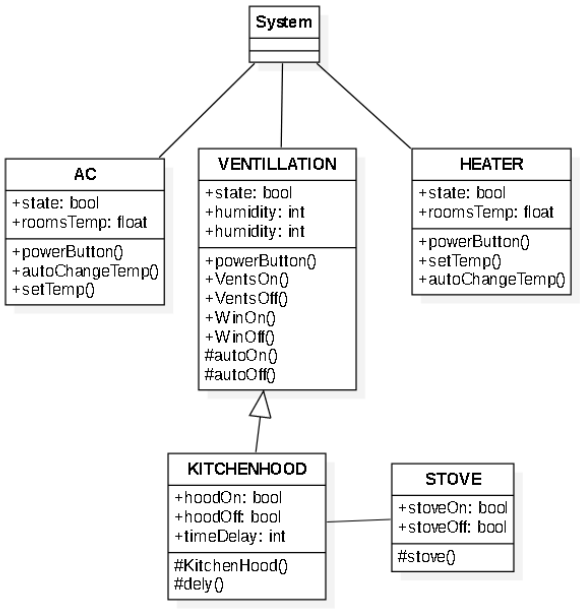
I. Realization with UML Diagrams

A. Sequence Diagrams

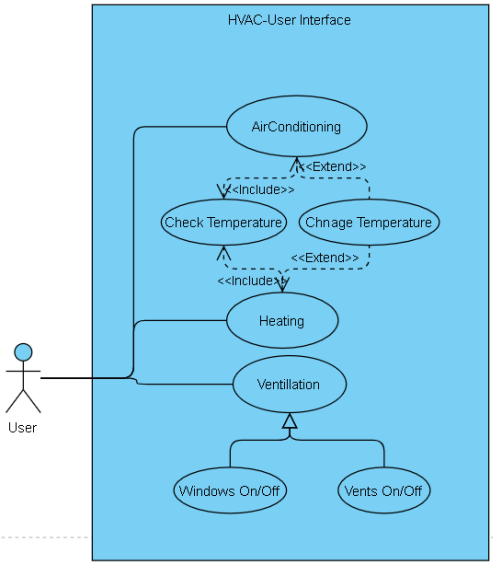


This sequence diagrams in which scenario is represented individually. It shows that first users interact with the device which tells the temperature or room humidity and then user will do accordingly. For example, if the temperature is high air-conditioner will turn on and if the temperature is low heater will turn on. In case of humidity, if humidity is not at the normal percentage or there is no fresh air, vents will turn on.

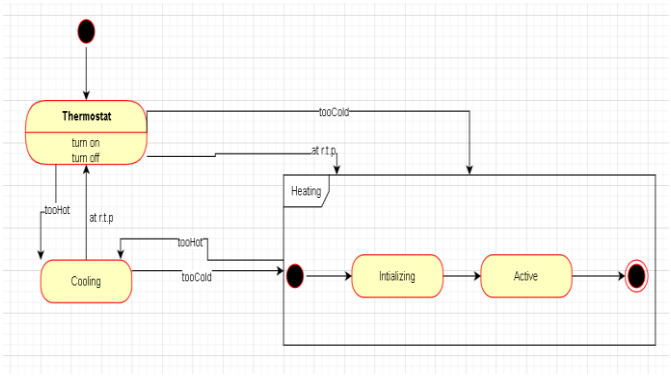
B. Class Diagram



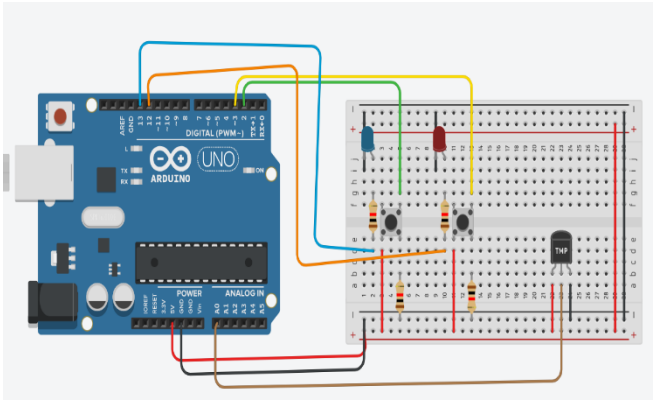
C. Use Case Diagram



D. State Machine Diagram



II. Realization with Arduino Uno



This is the realization of two of the three scenarios of smart heating, ventilation and air conditioning system in which only heating and air conditioning scenarios are realized. In this, the temperature sensor (TMP36) is used to detect the temperature of the surroundings which gives us the analog values. If the temperature is lower that the r.t.p (room temperature and pressure) red light is turned on automatically which depicts the heating and if the temperature is higher than the r.t.p then blue light will on which depicts the cooling. The question could be raised that why there is a need of buttons when everything is happening automatically. So, the reason of buttons is to control heating and cooling manually where necessary. It provides an extra function of manual as well.

REFERENCES.

[a.] Michael R. Miller, ”My Smart Home For Seniors”, June 2017, ISBN: 9780134752792, Publisher: Que.

SMART IRRIGATION SYSTEM (DAWAR ZAMAN)

The smart irrigation system is made to provide an automated solution for homes requiring irrigation for their gardens/ backyards. It composed of two sensors and an actuator connected to a microcontroller which controls the output of the actuator based on different input values of the sensors.

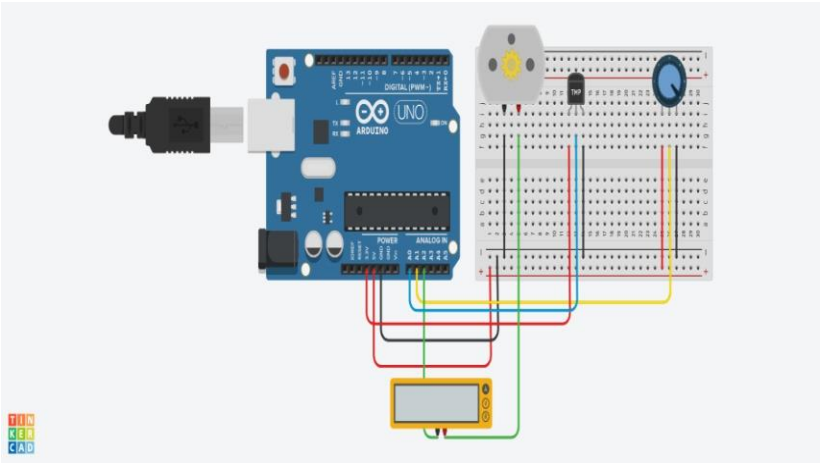
Components Used for the Project:

- Arduino Uno R3
- Breadboard
- Single core wires
- Potentiometer (for simulating moisture sensor)
- TMP36

Detail:
Arduino Uno R3:
The Arduino Uno R3 is the main component of the system which is controlling the system.
Breadboard:
Breadboard provides a stable medium for linking different components in the circuit.
Single core wires:
Wires are used for providing connection between Arduino and breadboard along with other components.
Potentiometer:
Potentiometer is used for simulating a Soil moisture sensor.
TMP36:
TMP36 is a temperature sensor.

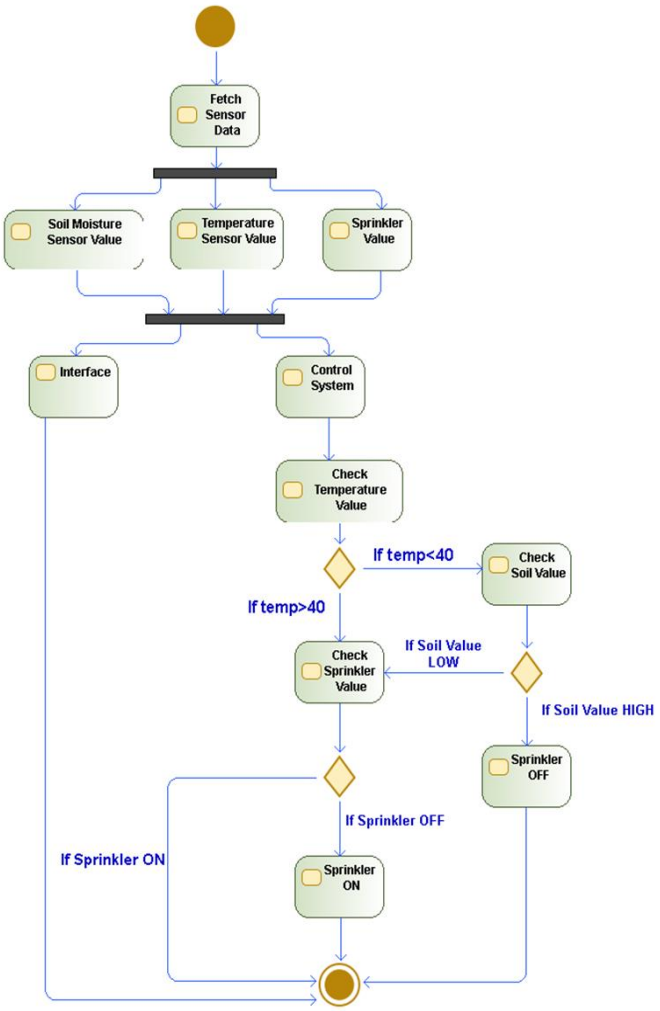
Working Principle:
The smart irrigation system works based on the following logic:

Temperature	Soil Moisture	Sprinkler
LOW	LOW	ON
HIGH	LOW	ON
LOW	HIGH	OFF
HIGH	HIGH	ON

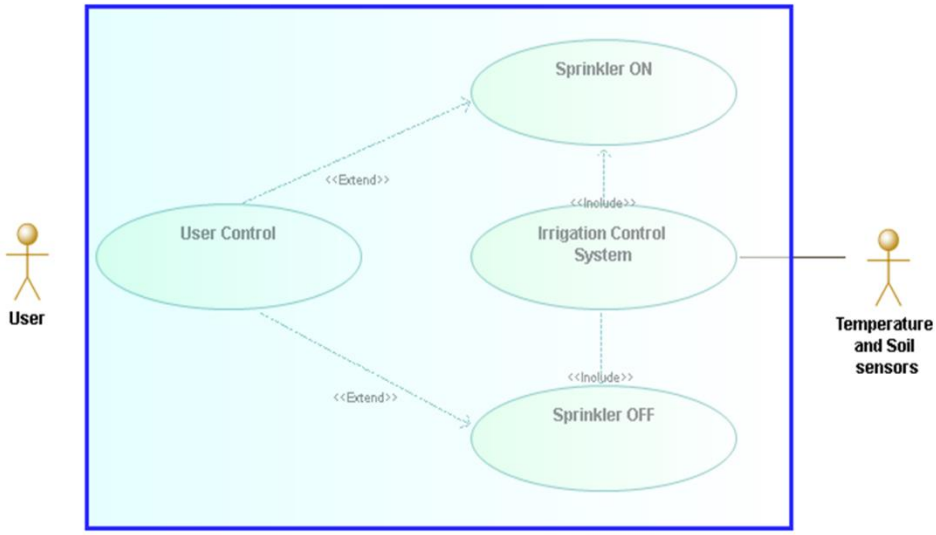


The sensors that are used in the Smart irrigation system give the system an analog value, The system then converts this analog value to a digital (ON/OFF) value using a threshold value for switching between the states. The output is sent to the sprinkler and it turns the sprinkler ON or OFF based on the above shown truth table.

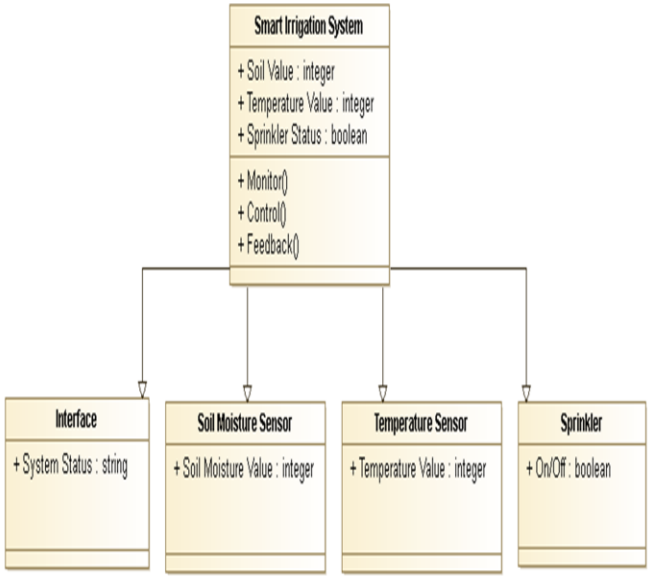
UML DIAGRAMS



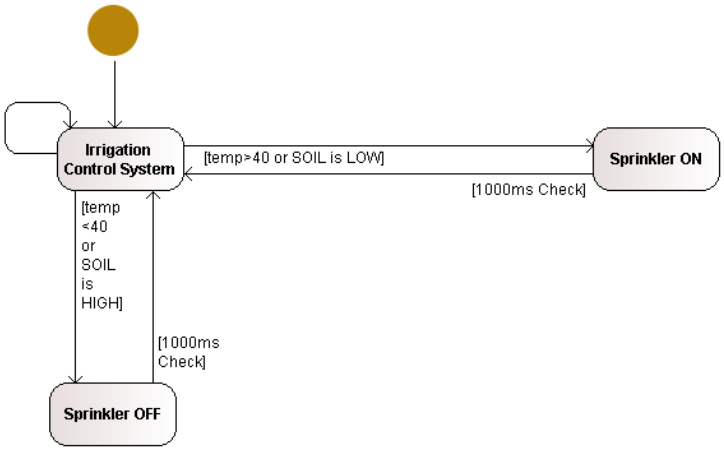
The illustration above represents the activity diagram of the irrigation system. It clearly shows the relation between the sensors and the actuators. Soil Value and Temperature play a vital role on the working of the sprinkles.



The user has the control to turn the sprinklers on and off. That is why extend function is used in the given USECASE. Spinkler On and OFF



In conclusion the smart irrigation system conserves water while maintaining the health of the plants. Smart irrigation can reduce water consumption and therefore reduce water bill and be more cost saving to the user along with taking care of the garden and using continuous sensor data to keep the plants nourished and healthy.



The source code is mentioned in good detail in the appendix:

https://www.tinkercad.com/things/9WR2RNCDCMM-epic-habbi-gaaris/editel?sharecode=3iTMs62x3EoVgn4Fe_bSlyPQ-TAD-GGbeia09zJp-Cw

Following is a state machine diagram for the irrigation system. It shows the guard condition that causes the current state to change. There are 2 states present, Sprinkler ON and Sprinkler OFF. Kindly consult the truth table above for better understanding and the effects of those conditions. The entire system runs in a loop.

APPENDIX

Smart Lighting(Abdullah Zafar) Source Code

```
int led = 12;
int sensor = 4;
int state = LOW;
int val = 0;
void setup() {
  pinMode(led, OUTPUT);
  pinMode(sensor, INPUT);
  Serial.begin(9600);
}
void loop(){
val = digitalRead(sensor);
  switch(state)
{ case 0:
if (val == LOW) {
    digitalWrite(led, LOW);
    delay(500);
break;
}
 else if (val == HIGH) { state=1 ;
 break;}
 case 1:
if (val == HIGH) {
    digitalWrite(led, HIGH);
    delay(2000);
break;
} else if (val == LOW) { state=0 ;
 break;}
 }
}
```

```
int PR = 0;
int smartlight = 2;

int state = 0;
int Lowbrightness = 500 ; //represents night
int Highbrightness = 600; //represents day

void setup()
{

pinMode(PR, INPUT);
pinMode(smartlight, OUTPUT);

}

void loop (){
smartlights();
}

void setup() {

Serial.begin(9600);
pinMode(smartlight,OUTPUT);

}

Smartlights(){
Int STATE 0;
int LDR = analogREAD(PR);

switch(State){
case 0:
if(PR< Lowbrightness){
      digitalWrite(smartlight, HIGH);
break; }

else{
state = 1 ; break;
 }
case 1:
if(PR>Highbrightness){digitalWrite(smartlight,LOW);
break;
}
}
}
```

Smart Door Lock (Mustafa Touqir) source code

```
#include <Keypad.h>
char* password = "6199";
int state = 0;
const byte ROWS = 4;
const byte COLS = 4;
char keys[ROWS][COLS] = {
  {'1','2','3','A'},
   {'4','5','6','B'},
    {'7','8','9','C'},
     {'*','0','#','D'}
};
byte rowPins[ROWS] = { 8, 7, 6, 9 };
byte colPins[COLS] = { 5, 4, 3, 2 };
Keypad keypad = Keypad( makeKeymap(keys), rowPins, colPins, ROWS, COLS );
int Redlight = 12;  //RED=LOCKED STATUS OF THE DOOR
int Greenlight = 13;  //GREEN=UNLOCKED STATUS OF THE DOOR
void setup()
{pinMode(Redlight, OUTPUT);
pinMode(Greenlight, OUTPUT);
LockedState(true);}
void loop(){
char key = keypad.getKey();
if (key == '*' || key == '#') {
LockedState(true);}
if (key == password[state])  {
state ++;}
if (state == 4) //CHANGE NUMBER OF DIGITS FOR THE PASSWORD
{LockedState(false);}
delay(150);}
void LockedState(int locked){
if(locked){digitalWrite(Redlight, HIGH);
digitalWrite(Greenlight, LOW);

}
else  {
digitalWrite(Redlight, LOW);
digitalWrite(Greenlight, HIGH);
}
}
```

Smart Irrigation System(Dawar Zaman) Source Code

```
double spr=A2;
double temp=A0;
double soil=A1;
double temp_value;
double spr_value;
double soil_value;
int state = 0;

void setup(){
pinMode(spr, OUTPUT);
pinMode(temp, INPUT);
pinMode(soil, INPUT);
}

void loop(){

switch(state) {

case 0:
temp_value = analogRead(temp);
spr_value = map(temp_value, 0, 1023, 0, 255);
analogWrite(spr, spr_value);
state = 1;

case 1:
soil_value = analogRead(soil);
spr_value = map(soil_value, 0, 1023, 0, 255);
analogWrite(spr, spr_value);
state = 0;

}
}
```

AFFIDAVIT

We (Abdullah Zafar, Mustafa Touqir, Dawar Zaman, Rohail Usman, Syed Muhammad Saim) herewith declare that we have composed the present paper and work ourself and without use of any other than the cited sources and aids. Sentences or parts of sentences quoted literally are marked as such; other references with regard to the statement and scope are indicated by full details of the publications concerned. The paper and work in the same or similar form has not been submitted to any examination body and has not been published. This paper was not yet, even in part, used in another examination or as a course performance.

Picture sources

https://pixabay.com/photos/building-plan-floor-plan-354233/
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https://pixabay.com/illustrations/finger-fingerprint-security-digital-2081169/
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https://pixabay.com/vectors/shield-security-protection-sure-1086703/

GIT OVERVIEW

https://github.com/MicroEle3/micEle3

Team contribution

1.Abdullah Zafar (Smart Lighting System)

20% work load (3HR/Week)

GIT COMMITS: 15 commits in 3 repositories

2.Dawar Zaman (Irrigation System)

20% work load (3HR/Week)

GIT COMMITS: 16 commits in 3 repositories

3.Mustafa Touqir(Smart Door lock)

20% work load (3HR/Week)

4.Syed Muhammad Saim(HVAC smart system)

20% work load (3HR/Week)

5.Rohail Usman

20% work load (3HR/Week)

Kindly note that Dawar Zaman being the group leader happened to commit most of our collective work in the GitHub repository. Members of the group used to send Dawar Zaman their files which were later committed by him in the repository.