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INTERNET OF THINGS FOR BUILDING SMART HOME SYSTEM

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ABSTRACT

Internet of Things (IoT) is an emerging technology that is making our world smarter. The idea of connected world cannot be imagined without IoT. In IoT enabled Smart Home environment various things such as lighting, home appliances, computers, security camera etc. all are connected to the internet and allowing user to monitor and control things regardless of time and location constraints. This paper describes Frugal Labs IoT Platform (FLIP) for building IoT enabled smart home and its application and introduces FLIP architecture and proposed system.

Keywords: Iot Platform Architecture; Smart Home; FLIP; Machine To Machine Communication.

I. INTRODUCTION

A smart home also referred to as a connected home with environment for living that has highly advanced automatic systems. A Smart home looks "intelligent" because its daily activities are monitored by a device. A smart home is a place that has highly advanced automatic systems for controlling and monitoring lighting and temperature, home appliances, security systems and many other functions. IoT plays an important role in building smart home. Through IoT almost every object of our daily life in a home can be connected to the internet. Internet of things allow monitoring and controlling all of these connected objects regardless of time and location.

II. METHODOLOGY

FLIP ARCHITECTURE

FLIP developed by Frugal Labs Bangalore, India is an open source IoT platform aimed for developers, Hobbyists, and anyone interested to learn and work on IoT to transform their idea to "Proof of Concept". FLIP is complete IoT platform and not just collection of devices and sensors or cloud services for building IoT infrastructure. FLIP architecture represented in fig. 1 [7].

Figure 1 - FLIP ARCHITECTURE

The FLIP architecture has four distinct layer device, gateway, cloud, and app & SDK.

A. Device Layer

Device layer consists of controller, communication module, sensors and actuators. In this layer FLIP base board is used as controller. FLIP base board is based on Arduino Nano. For smart home application this layer also uses FLIP smart home shield. The smart home shield stacked over based to extend functionality of the base board.

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Smart home shield has temperature & humidity, light intensity (LDR) sensors attached to it and also allows to connect other sensors such as PIR and various gas and air quality sensors, sound sensors and many more. Smart home shield also has Alternating current (AC) relay which can be used to control anything up to 7 amps of current and 250 volts AC current. It enables to connect home appliances, home lighting etc. The FLIP smart home shield is displayed in fig. 2 [6].

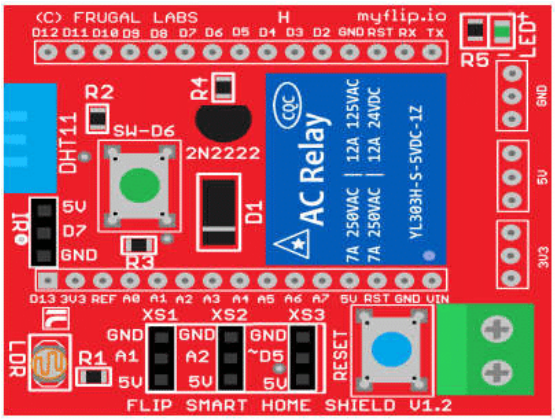

Figure 2 - FLIP-SMART-HOME-SHEILD

For connectivity at device layer FLIP board uses Wi-fi/Bluetooth module. Both modules can be connected to FLIP base board directly via 6-pin interface. Wi-Fi module, shown in fig.3 [5], directly connect FLIP device to the Internet and Bluetooth module, shown in Fig.4, [4], connects FLIP device to Internet via gateway layer in the architecture.

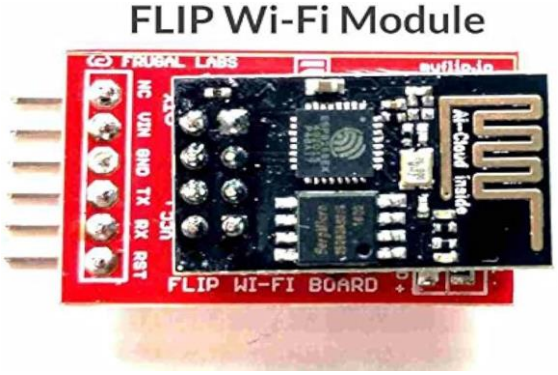

Figure 3 - WIFI MODULE

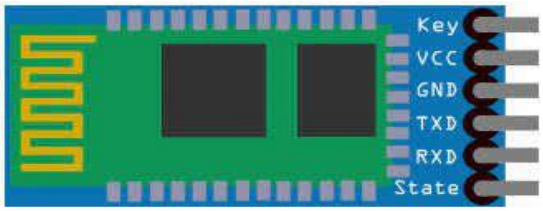

Figure 4 - BLUETOOTH-MODULE

B. Gateway Layer

Gateway layer consists of local processing unit which is based on Linux operating system. FLIP architecture uses Raspberry PI 3 [5] as gateway device. Gateway device has Bluetooth connectivity which allows other devices to connect to it. In architecture all the devices are connected to gateway and gateway is connected to the Internet. Gateway is connected to Internet through Ethernet or Wi-Fi.

C. Cloud Layer

Cloud layer consists of broken and the database Broken connects to all the devices and database stores the data coming from the devices. The cloud layer has three main structures MQTT broken named Mosquito, Mongo DB database for backend processing.

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D. App & SDK Layer

The top layer is App & SDK layer. The app consists of web app and dashboard and is used for data visualization using widgets and graphs. Using dashboard devices can be monitored and controlled. SDK ha rule engine based on python.

III. MODELING AND ANALYSIS

PROPOSED SYSTEM

The proposed system discussed in the study is based on FLIP. The proposed system has four main application modules smart lighting, smart appliances, intrusion detection, and smoke gas detection. In the proposed smart home system FLIP device is connected to sensors, light-air conditioner, camera, windows and door system, and various application. The FLIP device is connected to the Internet via Gateway. The proposed smart home system is capable of performing various functions such as monitoring environment for air quality and security purpose, controlling home appliances, locks, doors and windows from remote location, gathering alerts and notifications at present conditions. Following C language firmware code, uploaded on one of the FLIP devices, publishes temperature and humidity and light intensity data and also turning light on/off remotely. The following code segments from proposed smart home system sends temperature, humidity, and light intensity data to server and also allows user to control electric switch remotely.

```
#include <FlipSmartHome.h>
#include <FlipMqtt.h>
FlipSmartHome fsh;
FlipMqtt m;
char* temp_topic ="Home/temp";
char* hum_topic ="Home/hum";
char* ldr_topic =" Home/light";
char* switch_topic="Home/switch";
char* ssid="ssid";
char* pwd="password";
int temp, hum, ldr;
char* s=NULL;
void setup()
{
m.mqttSub(switch_topic);
m.mqttBegin(ssid,pwd);
fsh.relayOff();
}
void loop()
{
s=m.GetSubValue(switch_topic);
if (strcmp(s,"1")==0){
fsh.relayOn();}
else{
fsh.relayOff();}
temp = fsh.readTempC();
m.mqttPub(temp_topic,temp);
hum = fsh.readHum();
m.mqttPub(hum_topic,hum);
```

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```
ldr = fsh.readLdr();
m.mqttPub(ldr_topic,ldr);
}
```

The proposed system visualize data using widgets and graphs in web app and also provides widgets to set alert conditions and controlling devices such as opening/closing doors and windows, turning on/off lights and other equipment.

Currently the proposed system performs functions as described in this section but it is not limited. Any new functionality to the system can be easily added thus making system extensible.

IV. RESULT AND DISCUSSION

The proposed system is very helpful in monitoring and controlling smart home environment. Using this system air quality can be continuously monitored in home and alerts can be sent to user about health risks if any. Proposed system also improves security. This system also ensures better utilization of energy and resources through smart lighting, smart appliances and smart air-conditioning system. Figure displays email notification received at user's registered email account as the higher light intensity detected in room and as a result room lights were automatically turned off by the system.

V. CONCLUSION

With the rapid development of Internet and communication technologies today's homes also have strong computation and communication abilities. IoT based smart home is emerging as an important part of smart and intelligent cities which are being proposed and developed around the world. The smart home plays an important role in development of society. The aim of this paper is architecture and proposed system of FLIP.

VI. REFERENCES

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