KETTERING UNIVERSITY

CE-480 COMPUTER NETWORKS

FINAL PROJECT

DOMESTIC ALARM SYSTEM

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DECEMBER - 2015

INTRODUCTION

This report presents an implementation of a domestic alarm system using IoT technologies. The idea is to create a system in which the owners of the residence can operate and check the status of their residence from anywhere in the world through the internet.

In this way, this solution was implemented in two modules: residential module and mobile module. The residential module consists of a Raspberry Pi. And the mobile module can be implemented in laptops or smartphones. Both connected to the internet.

The system makes use of Web Services, and a leading provider is Amazon. Thus I made use of the IoT and S3 service that this company provides.

DOMESTIC ALARM SYSTEM

My solution was developed in two modules. The first one is the mobile module, which can be implemented in any device that executes JavaScript code. Ie, can be implemented on computers, tablets or smartphones.

The second module is in fact the one that implements the system functions, it was written in JavaScript language and runs through NodeJS platform, which is a technology that enables the development and execution of Javascript code in hardware, since once this language was used only in Web applications.

Important to highlight that the use of NodeJS allows us to change the hardware without changing our system behavior, because the NodeJS is a multiplatform technology and independent of any operating system. But, one disadvantage of using this platform is that it runs slower compared to solutions implemented in C or other compiled language.

For this solution, JavaScript language is executed on the Raspberry Pi. The hardware we can be seen below:

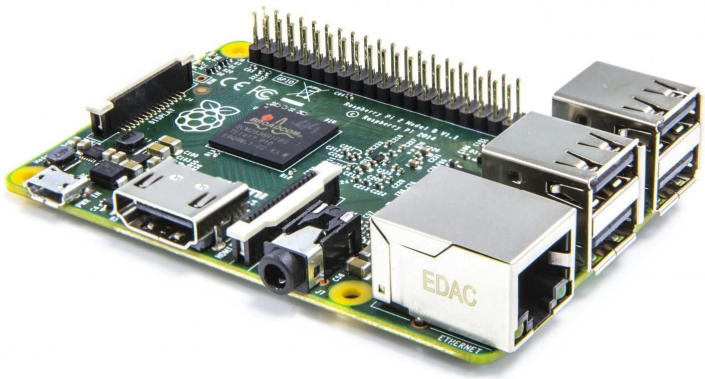

Fig 1. Hardware Raspberry Pi.

We know that this hardware provides mobility and a satisfactory performance for the implementation of monitoring and control applications. Another important point is that it runs on a Linux distribution, which is Open Source and highly customizable, so it allows excellent control by the programmer. However, a disadvantage is that the use can be more complicated for less experienced programmers with this operating system.

So, the alarm system works by detecting and controlling the residence through the Raspberry Pi, ie, this module will read the presence sensors placed in several rooms of the residence.

By a mobile application, the owner can enable, disable or view the status of the alarm system. When the alarm detects any intruder, it communicates the owner of the residence by sending a message with the information of which room was invaded.

The communication of messages between modules is accomplished through the MQTT protocol, this protocol is not new, it has already been used for some time in telemetry applications. But with the increased use of IoT applications, it was found that this protocol would be a good option, because it enables the applications to traffic information with low overhead and in a very convenient way.

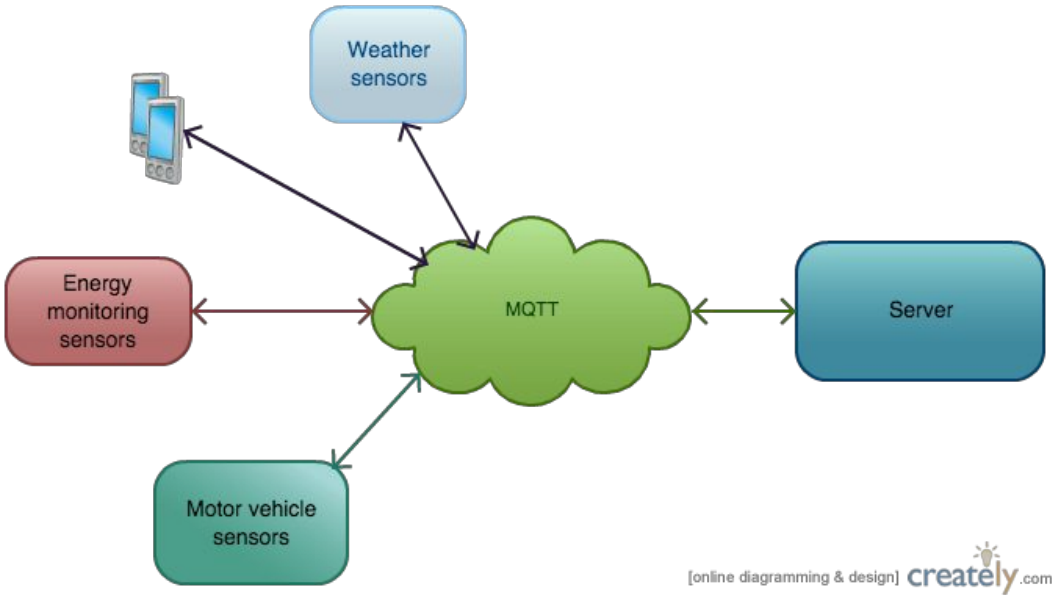

Fig 2. MQTT Protocol.

This protocol works through a central called Broker, this central receives and forwards messages to the other devices. That is, each device must at first to subscribe. Once subscribed, they can send messages to and receive them from other devices.

In our case, the two modules are connected by this Broker, thus allowing the exchange of messages between them. In addition, this protocol allows multiple devices to be interconnected, for our case if another resident of the the house wants to have this application on their mobile phone, they can do so instantly.

Therefore, as this protocol requires an external service, we needed to find a provider. There are several companies that provide this, and one of the most famous is Amazon, which provides several other services, and allows free use for non-commercial purposes.

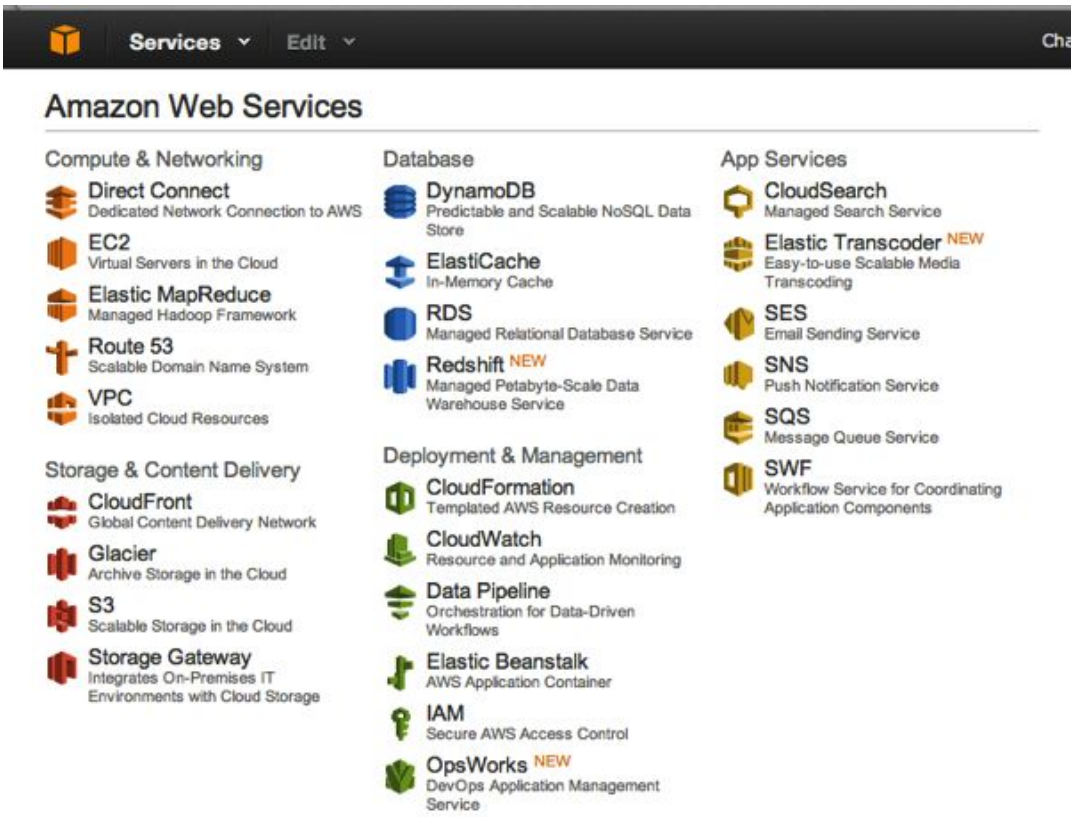

Fig 3. Amazon's Services

The integration with Amazon's services was made through an API that the company itself provides. They have API for development in C, Arduino and other languages. For the implementation of this project I was decided by the NodeJS API.

We know that API libraries are the interface between technologies, for our case, this API provided methods and classes for access to the various services that Amazon offers.

Using the IoT MQTT WebService provided by Amazon and using the API with NodeJS, it was possible to implement our exchange messages solution for domestic alarm system.

However, another desired feature for this system was the monitoring of the home door. That is, when the owner of the residence was not home and got a new one and pressed the doorbell, the system would photograph this person and send to the owner's mobile device. In order to let him know that a person had been in his residence.

To make this application works, using the MQTT protocol is not enough, since we encounter difficulties because of the size of the message that can be sent. In this sense we chose another service provided by Amazon.

The S3 storage service provides an effective solution for the implementation of our project, since it allows the photographed image to be saved in the cloud. And this service can also be implemented via Amazon's API.

With that, our application can operate properly, since the control monitoring of the alarm system is done by the WebService IoT. The storage of images are made by WebService S3.

Thus, it was possible to evaluate these two services offered by Amazon. And both worked as expected.

CONCLUSION

This project provide a better understanding of this emerging technology called IoT. That is, Internet of Things is just starting its development and in the future we will hear much about it.

Moreover, I could study the functioning of the hardware Raspberry Pi with NodeJS, which is a new programming language that has emerged and has been widely used today.

Another very important topic that has been verified with this work was the use of WebServices, that is, we use an API to integrate these services into our application.

Therefore, all of these topics covered are extremely important to us students who will be entering the job market soon.