Home Automation System with Smart Garden

IoT Project

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Problem Statement

A web application has been created to control the home appliances such as lights, AC and fans. Along with that we incorporated a functionality of the Smart Garden, wherein based on the moisture present in the soil, we turn on the sprinkler.

BENEFITS OF HOME AUTOMATION SYSTEM:

- Energy efficient
- Hands-free convenience
- Enhanced security

Architecture

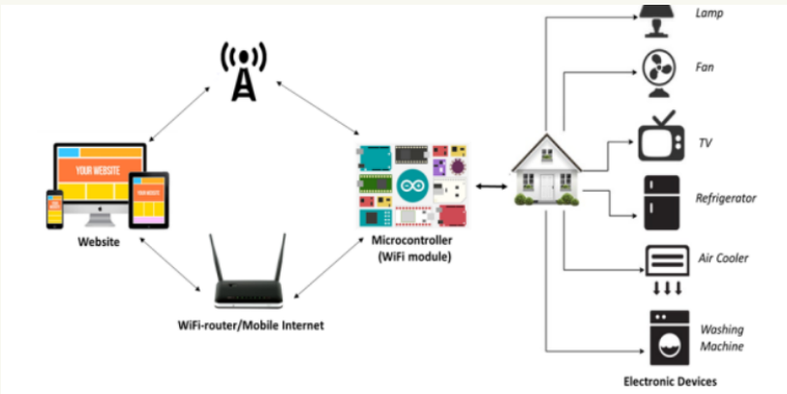

Fig. 1. System Architecture.

The block diagram of the system is shown in Fig. 1. In this system, a website has been designed. Initially, the user accesses that website from where he or she will send a command over the Internet. Firstly, python codes will be executed. After that we can show a change in the Firebase database through the website. When a button is toggled from the website, a change can be seen in the Firebase. So, according to the command sent by the user the electronic devices can be operated. The users can control the devices using the website. Also the same status which is displayed in the Firebase is shown on the front-end part i.e. our website.

Currently we are unable to find a micro-controller and physical sensors, so we tried to integrate the functions of the micro-controller and sensor data in the python code itself.

Implementation

DATASET:

- We will be using the firebase real-time database for data storage.
- For motion detection, we will be using video streaming from a mobile phone. For video streaming, we downloaded an app from the google play store, named IP Webcam.
- For moisture detection, we used a CSV file that has soil masses and their corresponding sensors reading. Then we used that CSV file to calculate volumetric water content for corresponding soil masses. After that, we used volumetric water content and corresponding sensor reading to train the linear regression model. After training the linear regression model, we saved the parameters in a separate CSV file.
- For smart AC we generated random temperature values.

CODE:

- All the functionalities of the system has been implemented in Python language.
- For motion detection, we used video streaming from a mobile phone and then detected motion based on the first frame of video. Then we calculated the start and end of motion. If the difference between start and end time is more than 6 seconds then we will send a signal to the firebase real-time database that turns on lights or fans. If it's evening time we will send turn on the lights and for morning and afternoon time we will not consider lights. We also considered the case of winter when we don't want to turn on fans.
- The CSV we got after training the linear regression model, was used to predict soil moisture. We generated three random values of sensor readings. And then took the average of it, let's call it x'. For making prediction we used the hypothesis ax+b where x = 1/x'. If the moisture predicted is less than 0.15 g/ml, then we will send a signal to the firebase realtime database that turns on the sprinkler.
- After generating the random AC temperature we checked some conditions and then decided the calculated appropriate AC temperature. If temperature >= 31 Celsius then the appropriate AC temperature will be 27 Celsius, if the temperature is <= 24 Celcius then AC should not be turned ON or must be turned OFF if it's already ON. Other than that appropriate temperature is calculated using the following equation: 27 - (measured_temp - 27). Then we will send the calculated appropriate temperature to the firebase real-time database.

Results

For lights and fans:

- If a motion is detected for more than 6 seconds, lights and fans will be turned on.

For AC:

- If temperature>=31 Celsius then the appropriate AC temperature will be 27 Celsius, if the temperature is<=24 Celcius then AC should not be turned ON or must be turned OFF if it's already ON. Other than that appropriate temperature is calculated using the following equation: 27-(measured_temp-27).

For sprinkler:

- The sprinkler is turned on when the moisture level is below 0.15