

Automation of Home Essentials using IoT

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Abstract - As humans, we tend to leave the fans and lights ON while leaving the room which consumes a lot of electricity without our knowledge. To reduce electricity consumption and provide comfortability, an attempt is made to automate the home essentials using the IoT. IoT technology has a huge potential to take over the control of home appliances in the coming years. IoT technology will help control home appliances through a mobile device. By automating the home appliances, saving and tracking the usage of electricity would become easier. This paper aims at providing an insight into how IoT, Computer Vision, and commercial off-the-shelf circuit boards like Raspberry Pi and sensors could be interconnected and used to control the home appliances being away from home. Home security systems could also be integrated with the developed system to monitor and secure the house from a remote place.

Key Words: IoT, Raspberry Pi, Home appliances, sensors, mobile device.

1. INTRODUCTION

Home automation is an emerging sector that can control home appliances like lights, fans, air conditioners, water pumps, dishwashers, washing machines, heating systems, etc.,

By implementing the IoT to the home essentials, we can automate and control them through a mobile device. As it is connected through the internet, we can access devices from any part of the world. We can deploy various sensors to retrieve the data of the environment. Based on the data acquired, signals can be processed to do the appropriate actuation. Automation of home appliances helps us track and save electricity usage. Automation also keeps manual intervention out of the equation. Platforms like Ubidots provide IoT services. The signals can be sent through their dedicated APIs. The user can customize it according to their own needs. These platforms can be linked with a voice assistant like Google Assistant, Amazon Echo, and Apple Siri. Linking them both will enable voice commands to control the IoT implemented home appliances.

These IoT systems can also provide solutions to issues that are encountered in industry, commercial buildings, public places like railway stations, airports and malls, etc.,

To automate home appliances, conventional techniques use motion sensors. A motion sensor can detect and trigger signal any motion that happens in an environment. To reduce the false trigger, we have implemented the use of the camera to detect the human, to whom the automation is intended to work.

IoT can replace manual switches. IoT in Home automation can remove the usage of big control panels that spoils the aesthetics of the house. The household switches have the risk of giving a shock to the user due to leakage of electricity. There is a scope of IoT taking over the home electricals. IoT will play a major role in the interior design industry in the coming years. We found that identifying the presence of humans in the room is done mostly by motion sensors. What we need is the presence of humans to trigger the home appliances. A motion sensor can detect any motion that is present in the room. This false alarm can trigger an unwanted trigger of the actuation of the home appliances.

Many research papers were studied to understand the current methods used to implement home automation.

In [1] Akbar Satria et al. the framework used gave us a based foundation in the application of IoT on a mobile device.

In [2] Ali, U et al used the real-time control of the home appliances using the smartphone.

In [6] Bhagyalakshmi, P et al used Raspberry Pi for automating the home appliances. This system used built-in Wi-Fi of the Raspberry Pi for the implementation of the IoT.

In [11] Chonggang Wang et al provided the different architecture and protocols used in the IoT automation.

In [13] Delgado, AR et al applied remote-controlled home automation. It was found to be fast and secure but not mobile compatible.

In [14] El Shafee, et al used the Wi-Fi-based home automation system. A Wi-Fi-based home automation can work in a local network.

2. Methodology

In this paper, smart automation of the home is done by implementing IoT and Computer Vision.

A Raspberry Pi controller is used for the implementation as Raspberry Pi is compact and has sufficient machine learning capabilities for Computer Vision.

For human detection, a camera and IR sensor are used. Computer Vision processing calls for a large computational process. Using the Computer Vision continuously in real-time with the Raspberry Pi will take a hit on its performance and higher usage of the CPU. So, to reduce the usage of highly computational Computer Vision, we use the IR sensor to detect the motion first and use the camera to detect the presence of humans in the environment.

For detecting the presence of humans, we use the Haar Cascade frontal-face algorithm. This is an open-source algorithm and is easily available on the internet and easy to set up.

Ubidots platform which helps us communicate to the smart home through REST API is used. It allows us to read and write data to the resources available: data sources, variables, values, events, and insights.

Our data will be protected with two more replication, encrypted storage, and optional TLS/SSL data support. It is possible to customize permission groups to each module of the platform, making sure the right information is shown to the user.

Figure 1. below shows the architecture of the automation system.

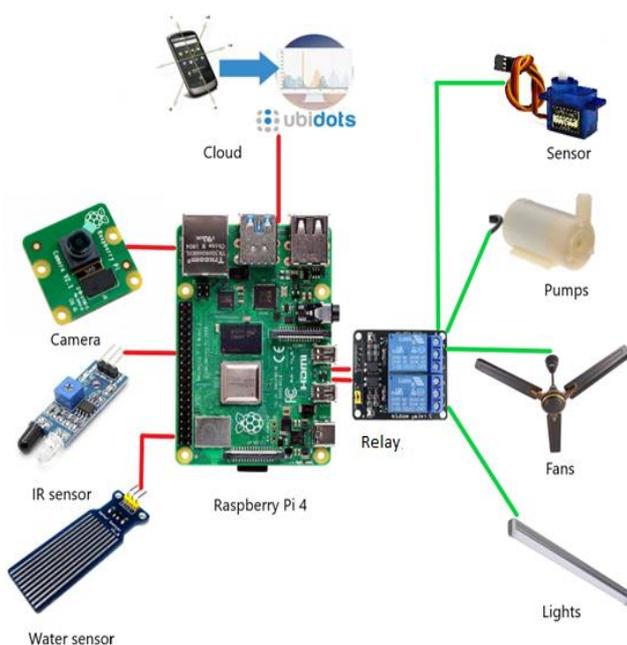


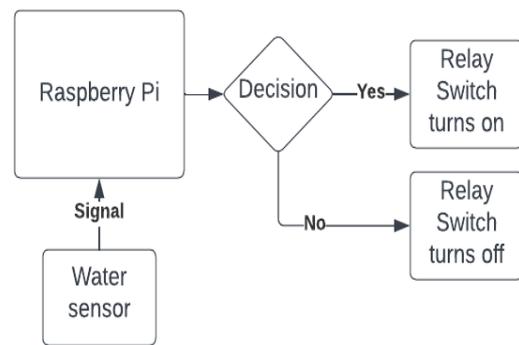
Fig 1: The architecture of the proposed system

3. INTEGRATION AND IMPLEMENTATION OF HUMAN DETECTION AND AUTOMATION

3.1 WATER PUMP ACTUATION

When the water is detected through the water sensor, the signal is sent to the Raspberry Pi. Raspberry Pi sends the output signal to the relay switch to turn on the motor pump. When the water sensor detects the absence of water on it, another signal is sent to the Raspberry Pi. Raspberry Pi receives it and sends a signal to the relay switch to turn off the motor pump.

Fig 2. Process flow diagram of water pump actuation



3.2 FAN AND LIGHT ACTUATION

The IR sensor detects the motion and sends the signal to the Raspberry Pi. Raspberry Pi receives the signal and turns on the camera. Using OpenCV the camera looks for the presence of a human face. When it detects the human presence it sends the signal to the Raspberry Pi. Raspberry Pi receives the signal and sends the signal to the relay switch to turn on the fan and light. When the IR sensor doesn't detect a motion or the camera doesn't detect any human presence, the relay switch is reversed to the off position, which turns off the fan and light.

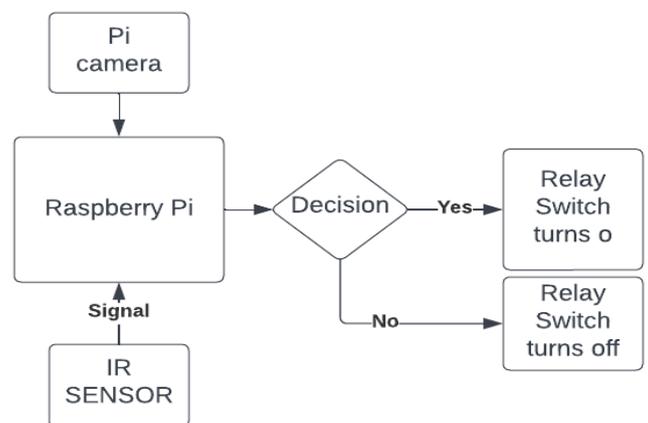


Fig 3. Process flow diagram of fan and light actuation

3.3 INTEGRATION AND IMPLEMENTATION OF UBIDOTS IOT PLATFORM

The Ubidots IoT platform is programmed to have 2 buttons for the fan and light, and the door and, an indicator light for the motor pump. When the respective buttons are pressed, through the Rest API, the Raspberry Pi receives the respective signal and sends the signal to the relay switches. The relay switches further receive the signal and turn on and off the fan and light and door respectively.

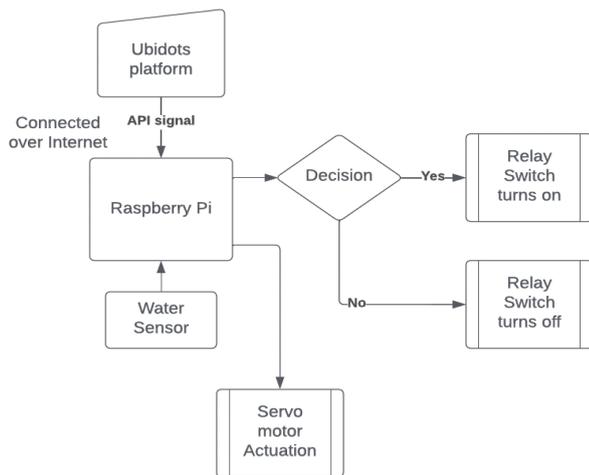


Fig 4. Process flow diagram for Ubidots IoT platform

4. CONCLUSIONS

Home automation may likewise enable key home capacities to be controlled remotely from any place on the planet utilizing a PC associated with the Internet. The integration and implementation of human detection and automation are done.

The integration of Ubidots IoT platform is done to control the home essentials over the internet through mobile phones or personal computers.

The functioning of the automation system was as per the expectations, even though we found some drawbacks in the functioning of the automation system.

We found that the speed of the execution of the Ubidots IoT platform is slow. There is significant latency in the actuation of the relay switch.

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