SMART HOME AUTOMATION USING IoT AND KIVY APPLICATION

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Abstract— In the world of digitization, Internet of Things (IoT) is the most trending topic for Home Automation. Internet of Things (IoT) conceptualizes the idea of remotely connecting and monitoring real-world objects and control them. This paper mainly focuses on wirelessly controlling the devices. Devices get the capability of communicating with each other and take decision smartly. As all the devices begin to store data about our activities, they will begin to understand our lives. The paper describes the use of Google Cloud IoT Core and Raspberry Pi. Google Cloud IoT Core which is a fully managed service for securely connecting and managing IoT devices, from a few to millions. By storing the data on Google Spread Sheets we can control the home devices by using Kivy application developed for windows as well as Android platform.

Keywords—Internet of Things (IoT), Raspberry Pi, Google Cloud IoT Core, Google Spread Sheet, Kivy Application.

I. INTRODUCTION

In the world digitization, people are fond of automatic devices which are often referred to as smart devices. Since 2013 with the development of new technologies, the Internet of Things (IoT) has emerged to make smart devices smarter. In the 1990s almost every home consisted of electrical appliances like washing machine, television, heater, etc which were manually controlled making a smart home. With the help of the Internet of Things (IoT) all these manually controlled electrical and electronic devices can be controlled automatically. The main concept of IoT it creates a virtual connection between a hub or a network and electronic and electrical objects. This virtual connection helps to control, locate, and track down these connected devices. With the introduction of device-to-device connectivity, there was the development of smart sensor together with communication technologies such as Wi-Fi, Bluetooth etc. and they are supported by cloud computing technologies. IoT has become reality and its goal is to make devices more aware, interactive and efficient for a better and safer world.

A great example is Google's application of machine learning and IoT to its data centres last year. Data centres need to remain cool, they require vast amounts of energy for their cooling systems so that they will function efficiently (or you could just dunk them in the ocean). So the main goal of Google was to increase efficiency with machine learning. With 120 variables affecting the cooling system (for example. fans, windows, etc.), building a model with classic approaches would be a huge undertaking. Google implemented machine learning and cut its' overall energy consumption by 15%. By this Google saved hundreds of millions of dollars in the coming years [6].

Home automation systems are used to control appliances like lights, door locks, and air conditioning through a web interface or smartphone application. A lot of technologies are being developed around this concept, such as independent lightweight IoT networks and protocols for passing data[7].

IoT have 6 levels When you pair IoT with cloud computing it is called level 4.The data you get from IoT and the services you provide using this data lives on the cloud, and users and stakeholders can access this data from anywhere and from any device. Projects uses the internet enabled devices to transmit real-time data to a central server. It also uses algorithms to process this information and then take automated decisions regarding operation of end-device. Governments across the world have been planning a future where public utilities may be IoT-enabled in such a way that the resources consumed by them may be optimized in real-time

This project describes a real deployable prototype of home/room automation by using Raspberry Pi and Google Iot Core via phone from anywhere in the world or let it get controlled automatically.

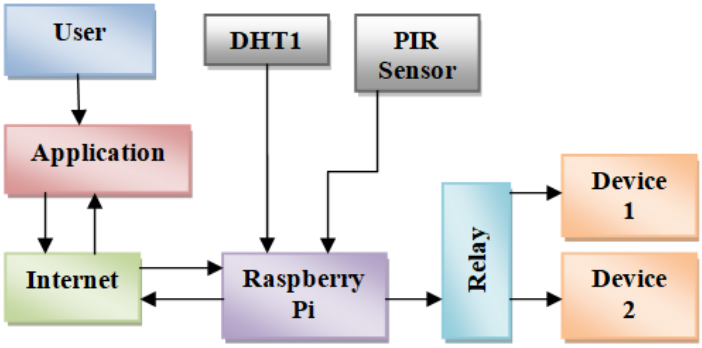

Figure 1: Flow Diagram

II. LITERATURE SURVEY

There have been many prototypes developed for Home Automation. R. K. Kodali presented 'IoT based smart security and home automation system 'that focused on developing a smart wireless home security system which sends alerts to the owner by using the Internet in case of any trespass and raises an alarm optionally. The same project can also be utilized for home automation by making use of the same set of sensors. The advantage of this system over other existing systems is that the alerts and the status sent by the WiFi connected microcontroller managed system on the user's mobile phone irrespective of whether user's mobile phone is connected to the internet. They have used a Microcontroller Launchpad board which onboard Wi-Fi shield making use of which all the electrical appliances inside the home can be controlled and managed[1]

S. Dey from New York developed a prototype of home automation using smartphone and computer. IoT devices control and monitor all the electronic, electrical and mechanical systems used in various types of buildings. These devices connected to the cloud server are controlled by a single administrator which facilitate a number of users to which a number of sensor and control nodes are connected. The administrator can access and control all the nodes connected to each user but a single user can control only the nodes to which the user itself is connected. They have used the Internet of Things (IoT), which allows the user to remotely control all the functions and features of appliances using the internet connection by using a Mobile phone or computer. The system designed is economical and can be expanded as it allows connection and controlling a number of different devices[2]

M. Al-Kuwari developed a complete design of an IoT based sensing and monitoring system for smart home automation. His proposed design uses the EmonCMS platform for collecting and visualizing monitored data and remote controlling of home appliances and devices. His selected platform is very flexible and user-friendly. Sensing of different variables in the house is conducted using the NodeMCU-ESP8266 microcontroller board, which allows real-time data sensing, processing and uploading/downloading to/from the EmonCMS cloud server.[3]

Ranjan Praful developed a home automation system with the ability to be controlled from a central host PC, the internet, and also remotely accessed via a pocket PC with a windows mobile based application.[4]

III. DESIGN AND IMPLEMENTATION

Project is divided into 3 modules:

A. End User(Phone)

B. Raspberry Pi End (Home appliances)

C. Server/Cloud (via which both parts can communicate).

3.1 End User(Phone)

The language used is Python, Kivy framework for UI design and build. The interface for the user end is made using python's Kivy framework. User can control appliances manually using the mobile/desktop application in manual mode or can let them get controlled automatically in automatic mode. Basically, there are three Google spreadsheets named as "mode", "client" and "status".

I)Mode Sheet: This sheet will contain on which mode user wants to operate the appliances of home. The description of different modes used is as follows:

1. Mode-0 (Automatic Mode): User will tell raspberry pi to control the home as per data from sensors.
2. Mode-1 (Manual Mode): User will control according to his/her customized needs.

II) Client Sheet: If in manual mode then the client will click on particular lights/fans icon to make them on/off as per his/her choice, the information of which appliances need to be controlled will set into "Client" sheet on the cloud. Client (User who is using the app) will have the power to modify this sheet only. Now Raspberry Pi will fetch this "Client" sheet and can read, whether to on or off the appliances

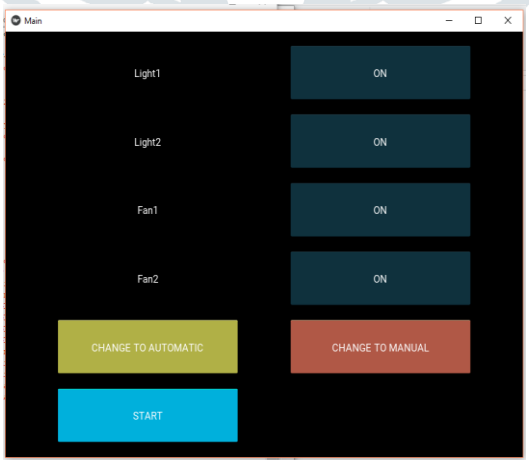

Figure 2: glimpses of our user end

III) Status Sheet: If in Automatic mode then User at-least should get to know what is the status of appliances at home. Which devices are on and which are off. Hence Raspberry Pi end will update values/status in "status" sheet and user end will access that sheet and in the application, it will show the status accordingly. Raspberry Pi receives data from sensors like temperature sensor, PIR sensor. As per the data received by the sensor,

the algorithm will find out which devices should be in which state, without human interaction. i.e. Appliances will get controlled automatically.

3.2 Raspberry Pi End (Home Appliances)

Raspberry is connected to the home appliance through a relay module. Raspberry Pi reads the data from Google spreadsheet and accordingly controls the devices like lights, fan, refrigerator, etc

3.3 Server/Cloud (via which both parts can communicate)

In this Project, we have used the Google cloud (gspreadsheet) database for the same. To use the Google sheet database for the project you first need to create a project on the Google developer console and get the credentials for using Google Sheets API.

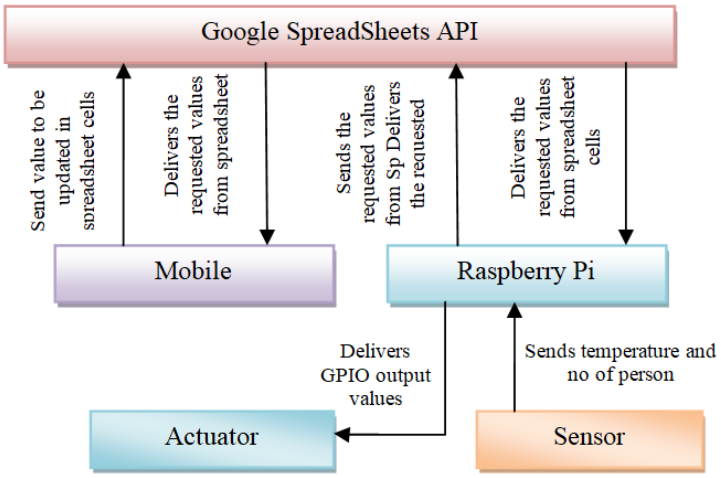

Figure 3:Data Flow Diagram

IV. FLOWCHART

Basically, our proposed system works in two different modes. Whenever the application is started, the method firstly verifies the credentials and send data to Google Spreadsheets accordingly. When the mode is 1, it disables automatic mode and updates the status of concerned appliances in client sheet. When the mode is 0, it updates the status of concerned appliances in the status sheet.(Figure 4)

V. RESULTS

5.1 MODE SHEET IN MANUAL MODE

In the figure 5, we can see that selected mode is Manual Mode as Mode=1.

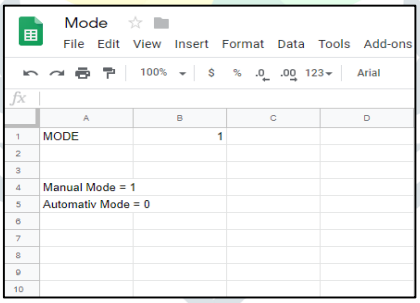

Figure 5: Updated Mode Sheet

5.2 Client Sheet in Manual Mode

From the figure 6, it is seen that Light 2 and Fan 2 are ON; Light 1 and Fan 1 are OFF.

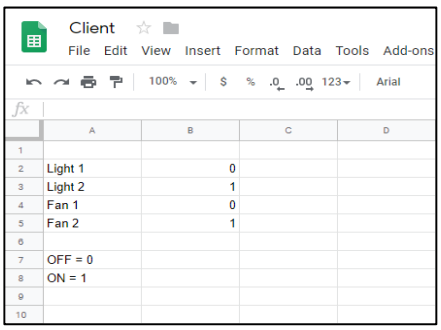

Figure 6: Updated Client Sheet

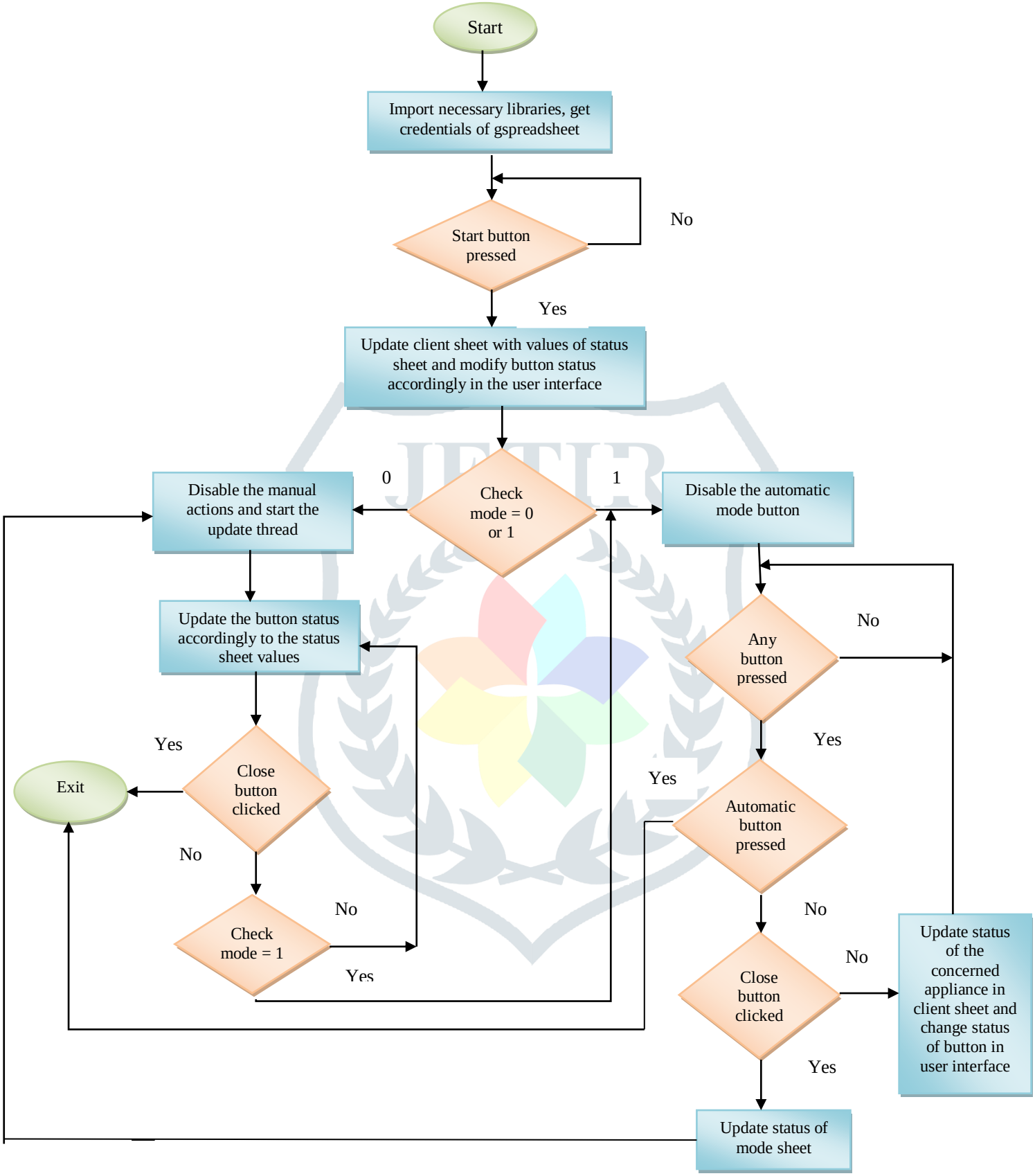

Figure 6: Updated Client Sheet

5.3 Status Sheet in Automatic Mode

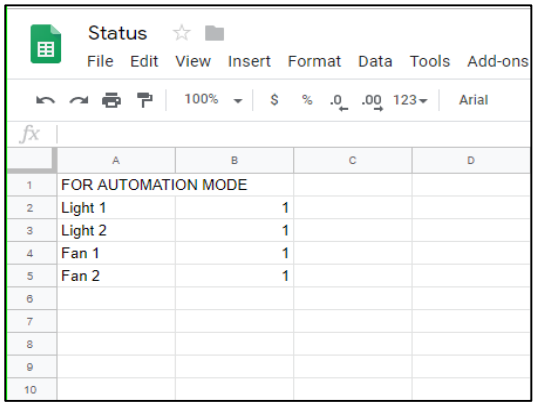

Figure 7: Updated Status Sheet

From the Figure 7, we can see our proposed system is in
" Automatic Mode " and all the Lights and Fans are ON by fetching data from connected sensors.

5.4 Output in Manual Mode

In the following figure, it is shown that only Light2 is ON.

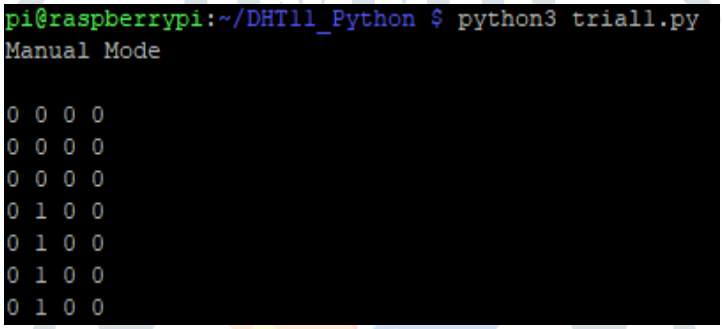

Figure 8: Output of Manual Mode on Terminal

5.5 Output in Automatic Mode

In the following figure, the temperature data is fetched and accordingly the lights and fans are turned ON and OFF.

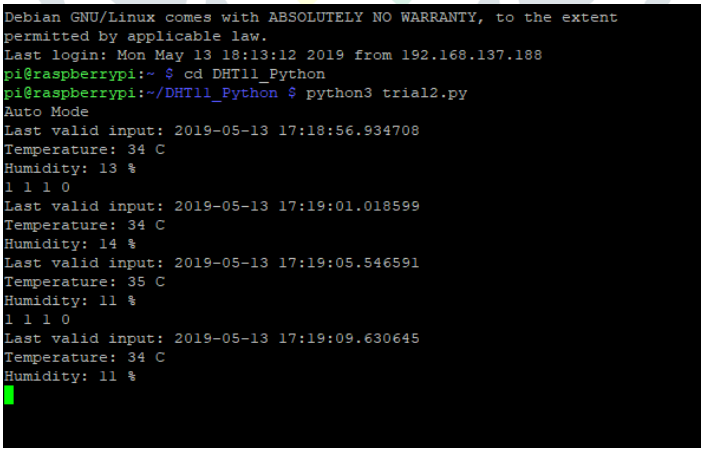

Figure 9: Output of Automatic Mode on Terminal

5.6 Time Analysis

Table 1 : Time Measurement of device turning ON and OFF

	Manual Mode	Automatic Mode
Turn ON	1850 ms	1320 ms
Turn OFF	1460 ms	1270 ms

The table describes the time taken by the proposed method to Turn ON/ Turn OFF any appliances in automatic or manual mode. From the table it is very clear that time taken to turn ON any appliance in automatic mode is less as compare to manual mode.

CONCLUSION

In this project, the focus was on implementing the module for Smart Home Automation. The working model we design has its focal point on home automation providing 100% efficiency. The model has its roots on an IoT platform so that it can be controlled remotely. This method can be used for commercial applications like in hotels, large industrial firms etc. The model is quite economical. The developed system so far, accomplishes the proposal method and purpose, giving the user the ability to remotely control the home appliances from anywhere in the world.

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