Project: Smart Home System in Stateflow

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I. Introduction

IoT or the Internet of Things is a concept of inter-networking where several physical devices such as buildings and vehicles are embedded with a range of electronics, sensors, software, etc. The network connectivity between these objects enables them to collect and exchange data for mutual benefits. The Internet of Things enables several elements working under it to control and gather information remotely across the established network. The project aims at creating a smart IoT based housing system that controls a number of devices and monitors certain specific conditions. The data monitored by the system are humidity, temperature, water levels, and several movements in the house. any changes in these parameters are informed to the user. Additionally, the project also demonstrates its functioning in the cases of power outage through a battery backup. The use of camera and different sensors are highlighted in the project. Finally, the case where the Internet fails is also accounted for by adding a provision to run the system through a mobile hotspot. The entire model is implemented using Stateflow.

II. Model

A. Problem Statement

The project attempts to design a smart home system that monitors temperature, humidity, water levels along with movement in the house to ensure that it remains safe and secure for the user, while providing vital information. The system also provides opportunity to control various functions with the house. For this purpose, certain system guidelines are defined. The system boundary displayed in Fig 1 shows the parameters that lie within the system, and those that lie outside it. Elements inside the system boundary can be easily managed and maintained. Inside the system boundary, there is a provision for a server, which basically manages the flow of data inside the smart home system. The control circuit describes the elements that control the power, for example from the main power circuit or through a battery in case of an outage. The element of communication describes the methods of transmission that are used by the devices within the system. This includes the provision of running through the Internet or mobile hotspot. The sensor shares information about the devices being used in the system for monitoring various parameters. Finally, the code part sheds light on the programming languages used to implement functionalities, logic and control scenarios in the system.

B. Design

The system constraints included ensuring that the smart home still functions under scenarios where there is no electrical power available. The system should be therefore, able to identify such situations and switch to battery mode. A similar situation must be adopted for Internet connectivity constraints, when there is no wifi available, the system functions via a mobile hotspot. Furthermore, attempts have been made to reduce the timelag or latency between messages sent by the devices in the smart home system and the time user receives it. The amount of data sent from the system to the user must also be low in size to avoid data costs. The system relies on sensor inputs, local variables and output variables. The detailed design of the system includes two parts- the first is sensor functionality where the sensors sense from the environment and notify the user, the second is minor functional requirements that includes some minor features for the remaining parts of the project. Fig 2 demonstrates the complete design of the system.

C. Sensors

Fig 3 shows a clear picture of the main sensors used in the project along with the provision for power management. Separate divisions between sensor elements have been created to show that they run in parallel since we want the system to measure all the parameters of the smart house and inform the user. These do not have a priority over one another. However, the power element does have priority over the others, since the entire basis of the smart house system lies on it. The priority is also defined so that in case of a power outage, the system can take over and switch to battery, and vice versa when the power is back.

D. Network Manager and User Request Handler

The final parts of the system include two managers- the first for handling requests from the user to get data from the sensors, and the second a network manager that helps perform the switch from the wifi to mobile hotspot in case on interruptions in the wifi Internet connection.

Appendix A
Project Model and Other Figures

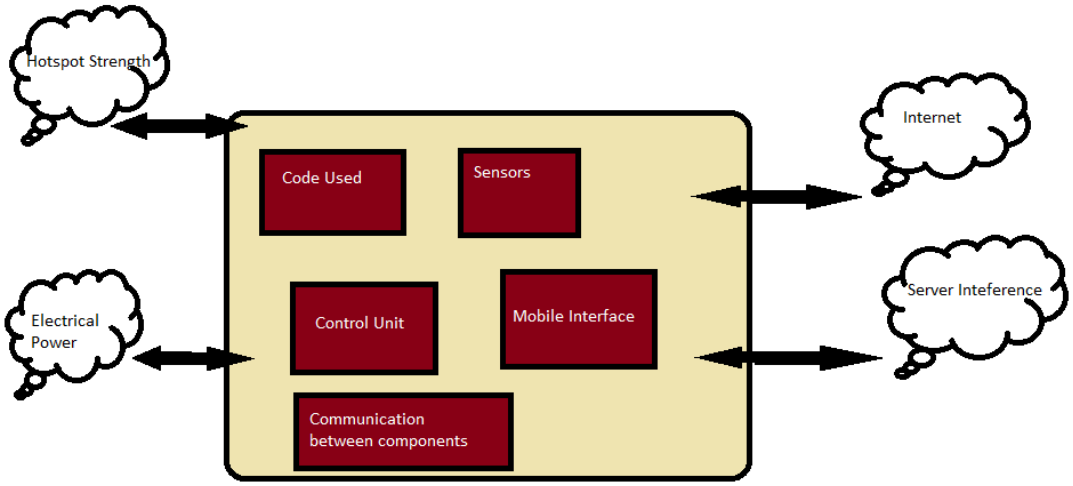

Fig. 1. System Boundary for Smart Home

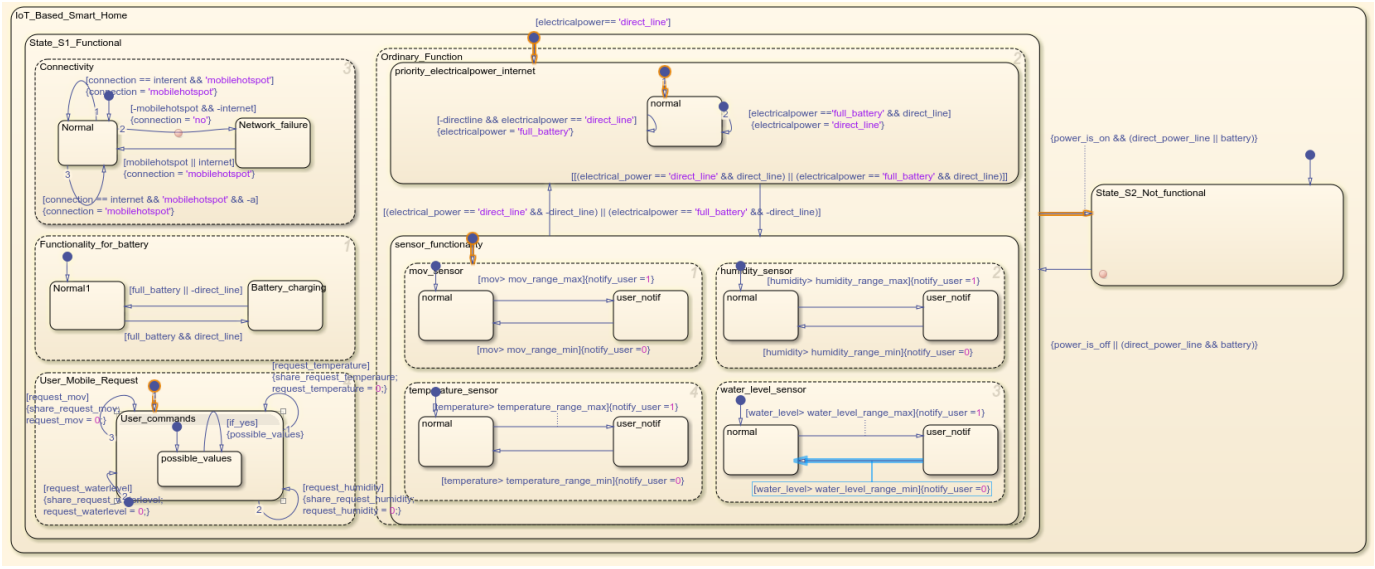

Fig. 2. The complete model for IoT based smart home

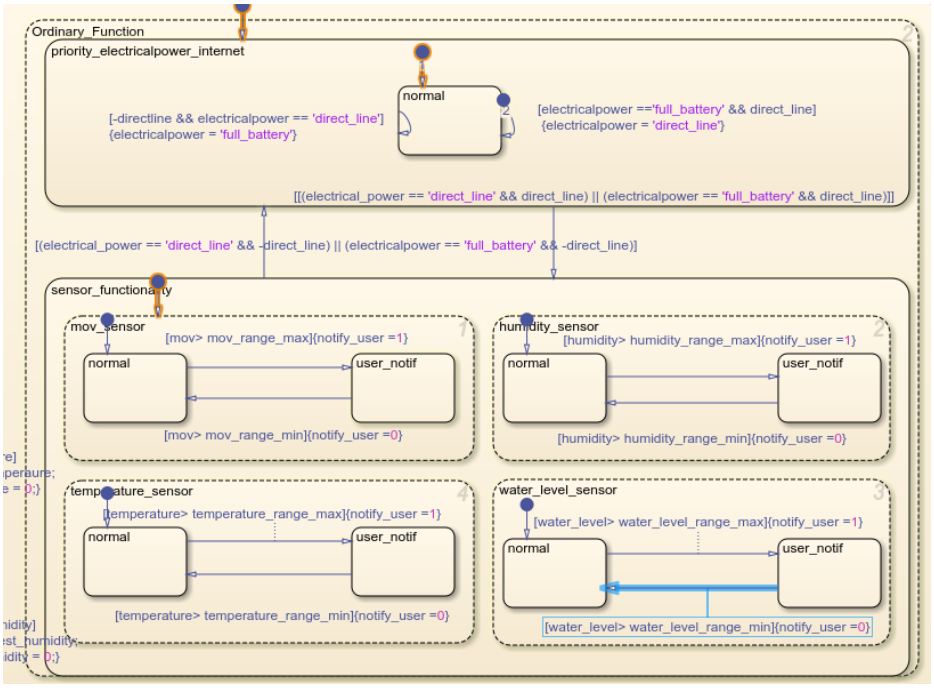

Fig. 3. Sensor design and Electrical power functionality

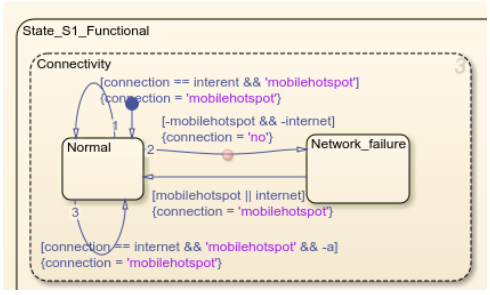

Fig. 4. Network functionality for normal and failure modes

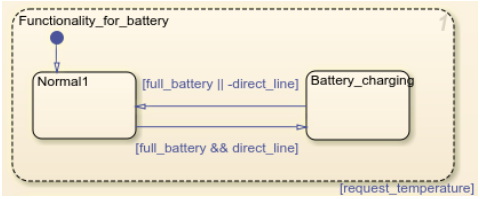

Fig. 5. Switching to battery charging mode functionality

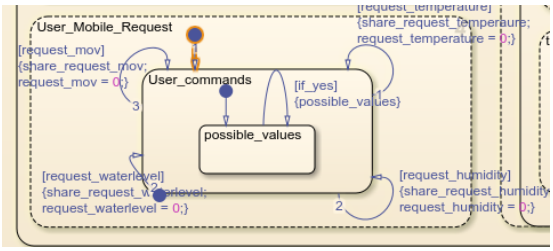

Fig. 6. User sensor output request functionality