Gokhale Education Society's

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Studies & Research, Nashik- 422005

Department of Computer Engineering

Subject: Embedded System and Internet of Things

Class : TE Computer

Division: A

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Semester: VI

Group Number:5

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Problem statement

Write the process and Design, IoT Application to access Home appliances remotely.

Purpose And Requirement Specification

- **Purpose:** A home automation system that allows controlling of the lights in a home remotely using a web application. mode, the system provides the option of manually and remotely switching on/off the light
- **Behavior** : The home automation system should have auto and manual modes. In auto mode, the system measures the light level in the room and switches on the light when it gets dark. In manual mode, the system provides the option of

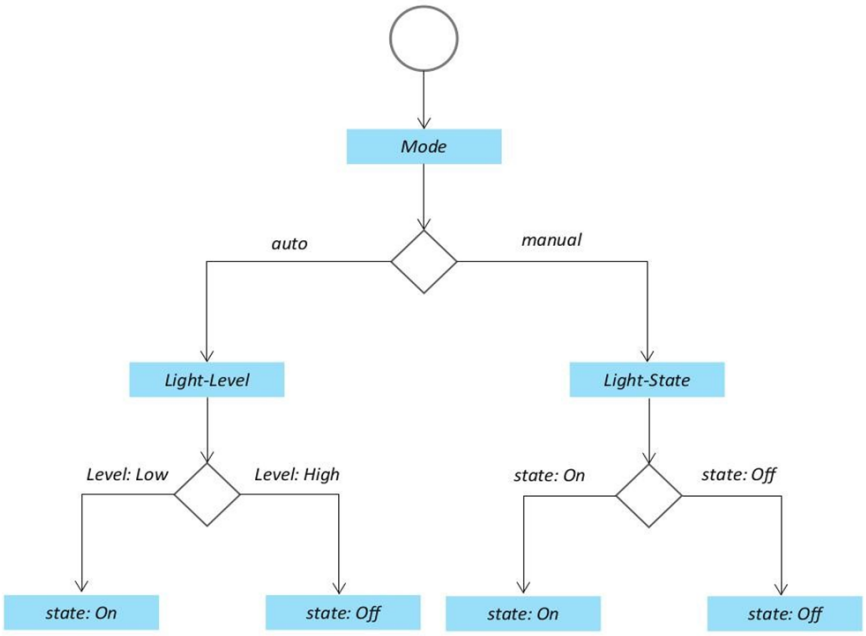
manually and remotely switching on/off the light.

- **System Management Requirement:** The system should provide remote monitoring and control functions.
- **Data Analysis Requirement:** System should perform local analysis of the data
- **Application Deployment Requirement:** The application should be deployed locally on the device, but should be accessible remotely
- **Security:** : The system should have basic user authentication capabilit

Process Specification

Automation framework which assesses the improvement of a Low-cost security framework utilizing Motion sensor and IOT.
The human development is distinguished utilizing the Motion sensors.
Every one of the items with a temperature above supreme zero discharge warm vitality as radiation.

- **Draw the use case:**



Domain Model Specification

The IoT based Home Automation will enable the user to use a Home Automation System based on Internet of Things (IoT).

The modern homes are automated through the internet and the home appliances are controlled.

Domain model provides an abstract representation of the concepts, objects and entities in the IoT domain, independent of any specific technology or platform

The entities, objects and concepts defined in the domain model include

Physical Entity: Physical Entity is a discrete and identifiable entity in the physical environment
(E.g. a room, a light, an appliance, a car, etc.).

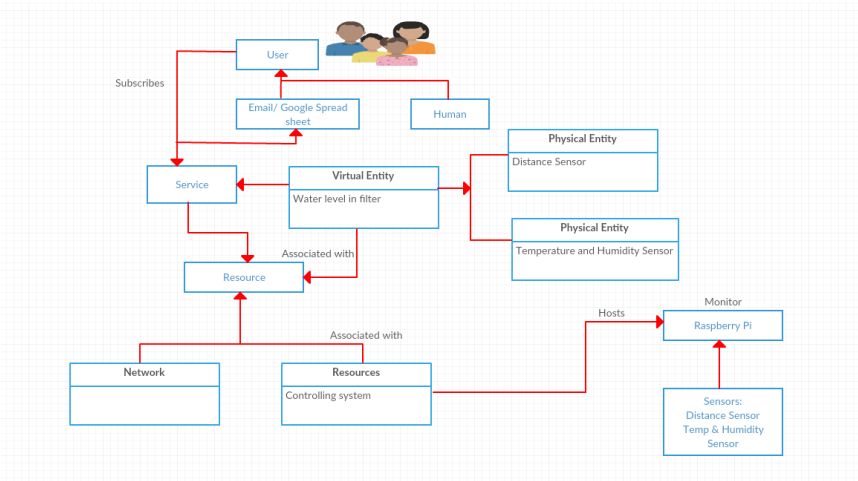
Virtual Entity: Virtual Entity is a representation of the Physical Entity in the digital world.

Device: provides a medium for interactions between Physical Entities and Virtual Entities. Devices are either attached to Physical Entities or placed near Physical Entities.

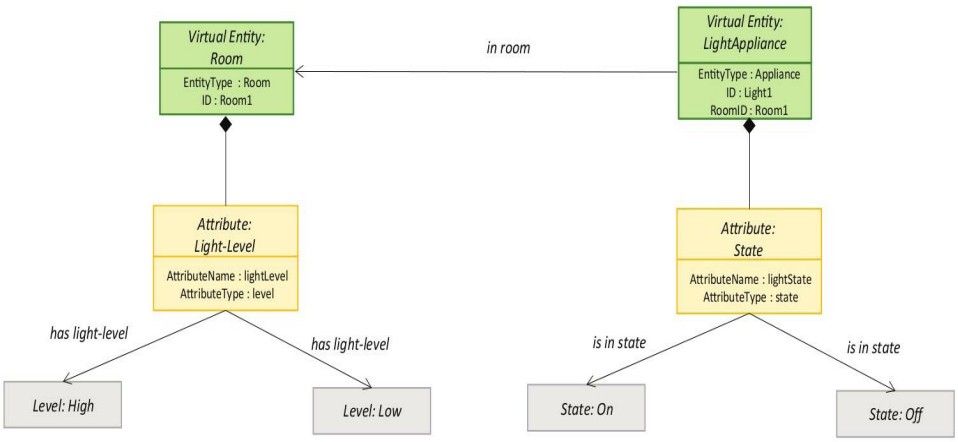
Resource: Resources are software components which can be either “on-device" or "network-resources". On-device resources are hosted on the device and include software components that either provide information on or enable actuation

upon the Physical Entity to which the device is attached.

Service: Services provide an interface for interacting with the Physical Entity. Services access the resources hosted on the device or the network resources to obtain information about the Physical Entity or perform actuation upon the Physical Entity



Information Model Specification



The connection to the internet allows the end user, resident, to communicate with the smart home to get current information and remotely activates tasks.
To demonstrate the benefits of the advanced smart homes, we use RSA, a robust asymmetric cryptography algorithm, which generates a public and private key and encrypt/decrypts messages.

Service Specification

Service specifications define the services in the IoT system, service types, service inputs/output, service endpoints, service schedules, service preconditions and service effects.
Service types-Mode service, State Service, Controller Service

Mode Service-Set mode to auto or manual or retrieves the current mode.
State Service-Set the light appliances state to on/off or retrieves the current light state.
Controller Service-In auto mode, controller service monitors light level and switches the light on/off and updates the status in the status database.
In manual mode, the controller service the retrieves the current state from the database and switches the light on/off.

IOT Level Specification

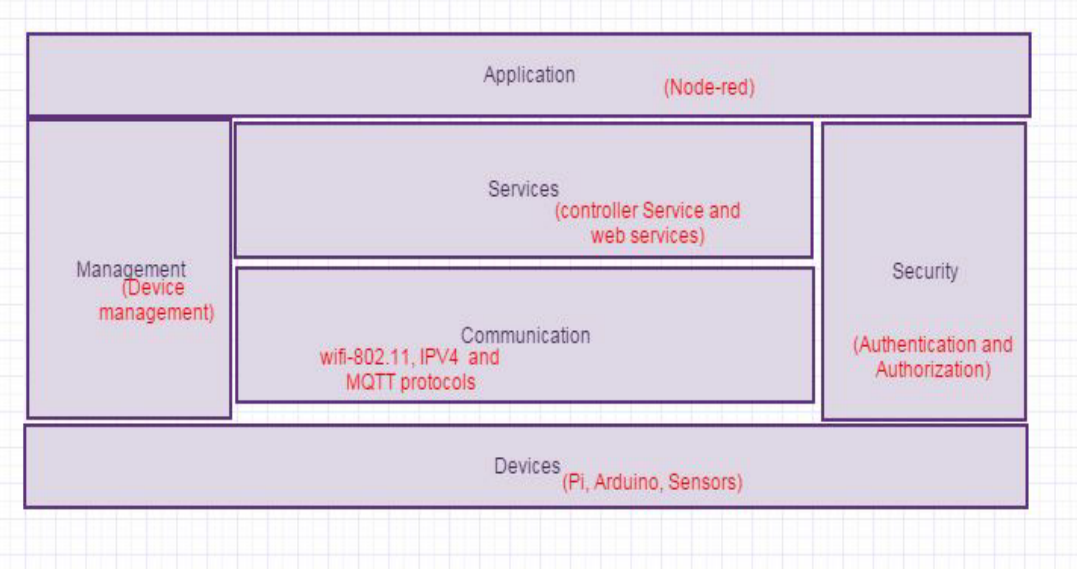
IoT Levels and Deployment Templates an IoT system comprises the following components: Device, Resource, Controller Service, Database, Web service, Analysis Component and Application.
Device: An **IoT** device allows identification, remote sensing, and remote monitoring capabilities.
Resource: Software components on the IoT device for –
Accessing, processing and storing sensor information.
Controlling actuators connected to the device.

Enabling network access for the device.
Controller Service: Controller service is a native service that runs on the device and interacts with the web services.
Database: Database can be either local or in the cloud and stores the data generated by the IoT device.
Web Service: Web services serve as a link between the IoT device, application, and database and analysis component.
Analysis Component: Analysis Component is responsible for analysing the IoT data and generating results in a form that is easy for the user to understand.
Application: IoT applications provide an interface that the users can use to control and monitor various aspects of the IoT system. • Applications also allow users to view the system status and the processed data.

Functional View Specification

The Functional View (FV) defines the functions of the IoT systems grouped into various Functional Groups (FGs). Each Functional Group either provides

Functionalities for interacting with instances of concepts defined in the Domain Model or provides information related to these concepts.
The IOT Functional Model identifies groups of functionalities, of which most are grounded in key concepts of the IoT Domain Model.
The functional view defines the functions of the IOT systems grouped into various functional groups (FGs).
A number of these Functionality Groups (FG) build on each other, following the relations identified in the IoT Domain Model.
E.g. information about Virtual Entities or descriptions of IoT Services.



Devices: In my “home intrusion detection system” the computing

devices I am going to use
are Raspberry Pi and Arduino. And the sensors that I am going to use to implement my system are PIR motion sensor, Laser pointer and the light dependent resistor.

Communication: The communication block handles the communication for the IOT system. The communication protocols allow devices to exchange data over network.

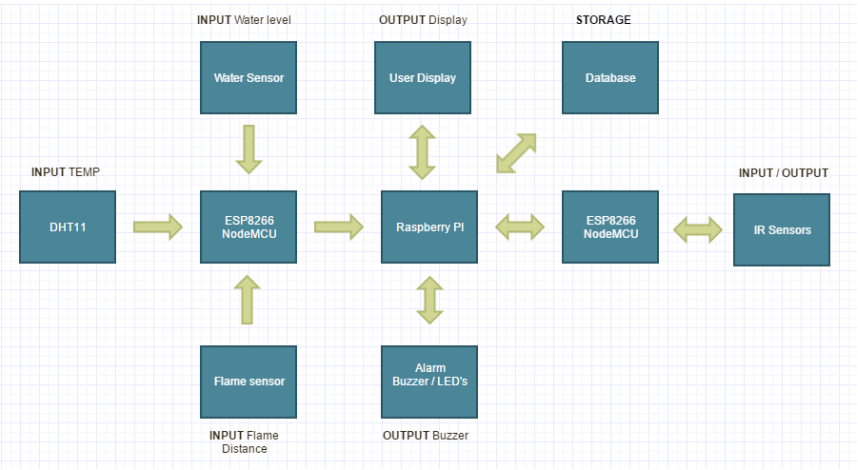
Services: The service functional group includes various services involved in the IoT system such as services for device monitoring, device control services and data publishing services.

Application: The application functional group provides an interface to the users to control and monitor various aspects of the IOT system.

Operational View Specification

Operation view is very important to address how actual system can be realized by selecting technologies and making them communicate and operate in a comprehensive way.
The data is used to check if the required temperature is being

maintained or not. The temperature Sensors (DHT11) are used to collect the data.
The operational view specifications for home intrusion detection system are as follows:



Devices: The computing devices I am going to use are Raspberry Pi and Arduino
Communication Protocols: Link layer 802.11, network layer-IPV4, application layer MQTT. I have mentioned all these protocols in the above figure.
Services: Controller service that is hosted on my device runs as a native service.
Application: Node-red web application.
Security: Authentication and authorization.
Management: Raspberry Pi device management.

The mapping of operational view and functional view specifications are shown in the above figure in the functional view block where I have mentioned the operations in red.

Device and Component Integration

In this step we have to integrate the devices and components. The devices and components used in my home intrusion detection system are raspberry Pi, arduino, PIR sensor, laser pointer, light dependent resistor, web cam and a buzzer.

Smart home has three components: hardware, software and communication protocols.

Having the right hardware enables the ability to develop your IoT prototype iteratively and respond to technology pivots with ease.

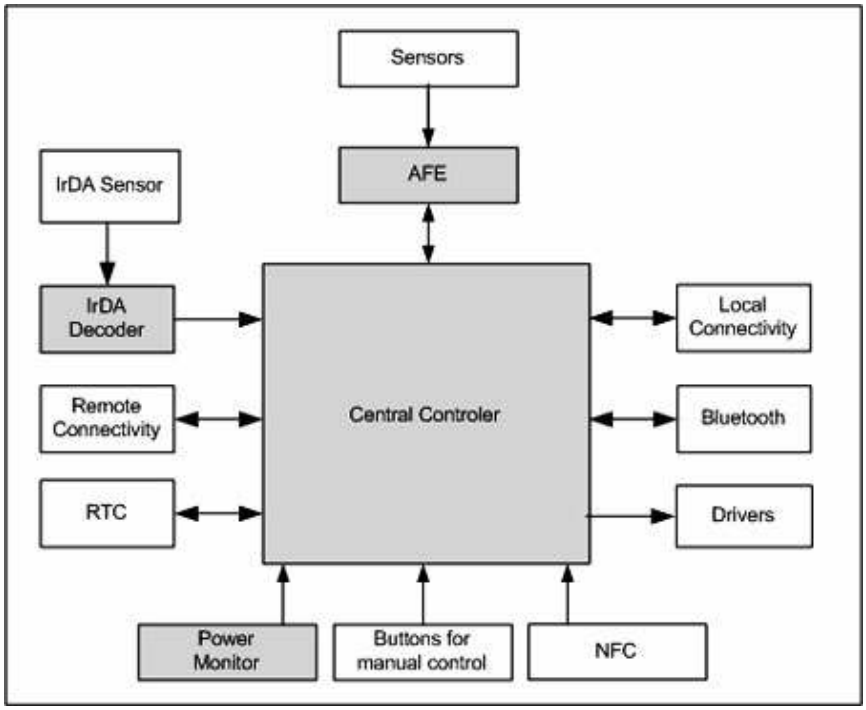
A protocol selected with the right testing and careful consideration helps your avoiding performance bottlenecks that otherwise would restrict the technology and device integration capabilities with sensors and IoT

gateways.

The major components can be broken into:

- IoT Sensors
- IoT Gateways
- IoT Protocols
- IoT Firmware
- IoT Cloud and Databases
- IoT Middleware (if required)

IoT sensors involved in home automation are in thousands, and there are hundreds of home automation gateways as well. Most of the firmware is either written in C, Python, Node.Js, or any other programming language.



Application development

Development of IoT (Internet of Things) home automation components that store, analyse, and process streaming data from devices and applications using IoT cloud-based services, as well as integrate home automation platforms with Bluetooth hardware for auto-discovery to reconcile and validate smart devices. The most common applications of home automation are lighting control, HVAC, outdoor lawn irrigation, kitchen appliances, and security systems.

Rebuilding consumer expectations, home automation has been projected to target wide array applications for the new digital consumer.
Some of the areas where consumers can expect to see home automation led IoT-enabled connectivity are:

- Lighting control
- HVAC
- Lawn/Gardening management
- Smart Home Appliances
- Improved Home safety and security
- Home air quality and water quality monitoring
- Natural Language-based voice assistants
- Better Infotainment delivery
- AI-driven digital experiences
- Smart Switches

Application development