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IT-05

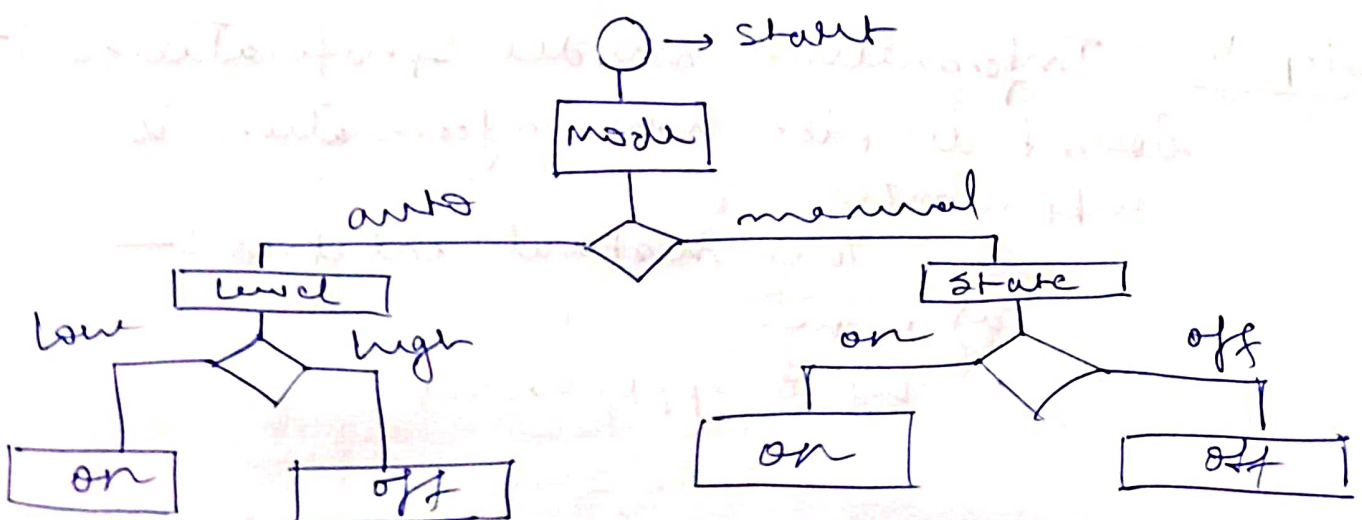
## IoT Assignment - 03

Q1) Describe in detail about the various steps involved in home automation system with diagram.

Ans1) Step-1: Purpose and requirement specification :-

- Purpose: allow remote control of light in room.
- Behaviour: 2 modes - auto & manual
- System management requirement: provide remote monitoring & control
- Data analysis requirement: local analysis of data
- Security requirement: basic user authentication
- Application deployment requirement: deployed locally on device, should be accessible remotely.

Step-2: Process specification :-



### Step-3: Domain model Specification :-

- i> Physical entity :
  - a) room
  - b) light appliances
- ii> Virtual entity :
  - a) room
  - b) light appliances
- iii> Devices : provides a medium of interaction between physical & virtual entities. They are also used to gather information about physical entities.
- iv> Resources : Software component either on device or network. In home automation we require the operating system.
- v> Services : Entity for interacting with physical entity
  - a) Service to set mode to auto or manual
  - b) Service to set light appliance state to on/off or retrieve the current state
  - c) Controller service that runs as native on device.

### Step-4 : Information model Specification :-

Doesn't describe how information is represented.

Two virtual entities :-

- a) Room
- b) Light appliances

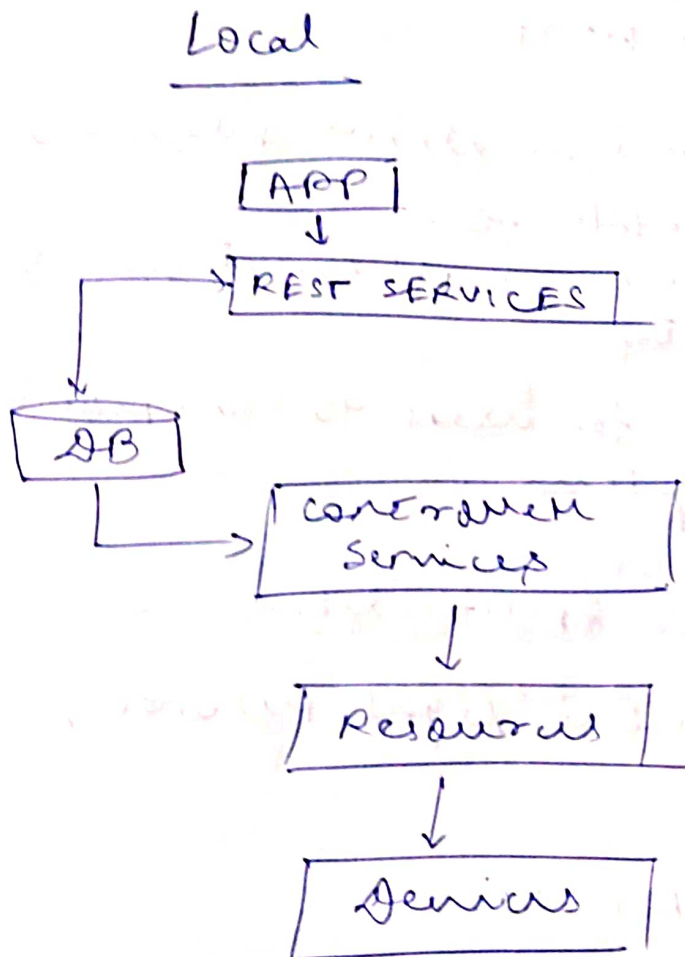
### Step-5: Service Specification :-

- Defines services in IOT system.
- For each state & attribute we define a service which either changed the state or attribute value of current attribute
- Mode Service changes the mode to auto or manual & returns the state.

### Step-6:-

#### IOT level specification :-

- Home automation falls in level 1 IOT systems :-



cloud



monitoring node  
perform analysis / status data



## Step-7: Functional view specification :-

- Includes multiple functional groups :-

- (a) Device : controls devices for monitoring & control → single board mini computer, light sensor & relay switch
- (b) Communication :
- Handles communication for IOT devices.
  - Includes communication protocols.
- Link layer : 802.11  
Network layer : IPv4 / IPv6  
Transport layer : TCP  
Application layer : HTTP
- (c) Management : all functionalities required to manage IOT systems.
- (d) Security : authentication, authorization & data security
- (e) Application : interface for users to control & monitor the system.

## Step-8 : Operational view specification :-

- (a) Devices : computing devices, light resistor, relay switch
- (b) Communication : REST API
- (c) Comm. protocols : Link layer 802.11  
Network layer : IPv4 / V6  
Transport layer : TCP  
Application layer : HTTP
- (d) Services : Controller service : native on device  
mode service : REST-full web service  
State service : same as mode service

(e) Application :-

web : django

Database : MySQL

(f) Security :-

Authentication : web app database

Authorization : Django app database

(g) Management :-

Application : Django app

Database : MySQL database

Device : Raspberry pi device mgmt.

Step-9 : Device & component integration :-

- Raspberry pi mini computer
- LDR sensor
- Relay switch actuator

Step-10 : Application development :-

- Control for modes (auto/manual)
- Only one mode can be active at a time.
- In auto mode, controls are switched off and app is sensor driven, in manual mode, app reflects the current state & it is input driven.

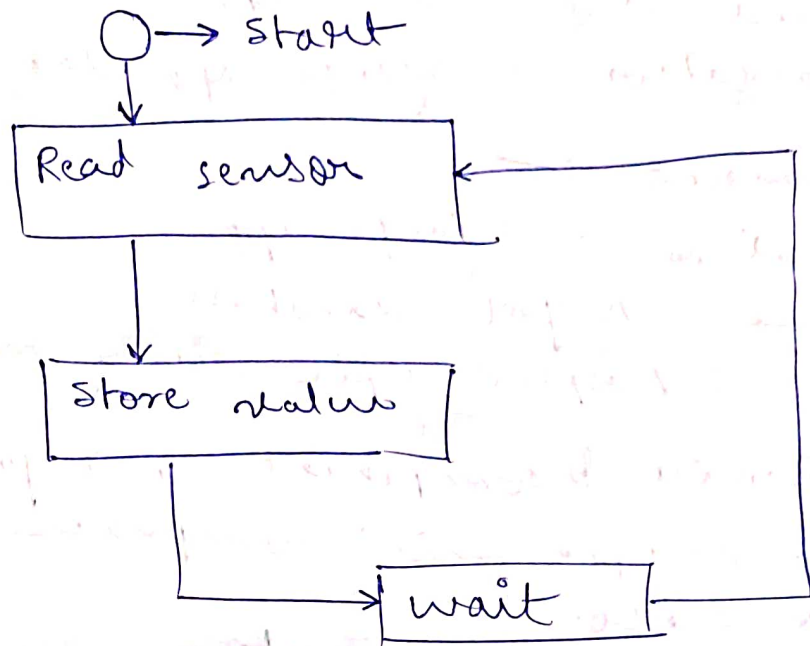
Q2) Describe in detail about the various steps involved in weather monitoring system with diagram.

Ans2) Step-1 : Purpose & requirement Specification :-

- gather data of surroundings

## Step-2: Process Specification :-

Sensor reads data after a set interval and data is stored.



## step-3 : Domain model Specification :-

- a) Physical entity : temperature, pressure, humidity and light
- b) virtual entity : temperature, pressure, humidity and light
- c) Resource : Operating system
- d) Service : controller service, need to cloud

## Step-4 : Information model Specification :-

- Environment entity has 5 attributes :-
  - i) Temperature
  - ii) Pressure
  - iii) Humidity
  - iv) Light
  - v) Wind



### Step-5 : Service Specification :—

- Controller service calls REST API to store data in cloud.
- Sensors read data once every 15 seconds
- PaaS model used for cloud operations

### Step-6 : IOT Level Specification :—

→ Falls in level 6

### Step-7 : Functional view specification :—

- (a) Device
- (b) Communication
- (c) Service
- (d) Management
- (e) Security
- (f) Application

### Step-8 : Operational view Specification :—

- (a) Device : Raspberry pi
- (b) Communication : REST API
- (c) Communication protocols :
  - ↳ Link layer : 802.11
  - Network layer : IPv4/v6
  - Transport layer : TCP
  - Application : HTTP
- (d) Services : Controller service :—
  - Runs on service / Python
  - As a native service

### Step-9 : Device & component integration

### Step-10 : Application development

Q3) Differentiate b/w a physical & virtual entity.

Ans 3)

Physical entity

It is a discrete & identifiable entity in the physical world.

Ex - Room, light appliances

Virtual entity

(i) It is a representation of the physical entity in a digital world

(ii) Ex - one for the room to monitor & one for the app to be controlled

Q4) What is an IOT device?

Ans 4) An IOT device provides an interface b/w the physical & the virtual entity.

- Gathers information about physical entity
- Performs actuation upon physical entity
- Used to identify physical entity

Q5) What is the purpose of information model?

Ans 5) Information model defines the structure of all information in the IOT system, for example, attributes of virtual entities, relations, etc. Information model does not describe the specifics of how the information is stored or represented.



Q6) What are the various service types in both the applications?

Ans 6) Various services in the home automation system: —

- i) Mode service: Sets the mode to auto or manual and returns the current state.
- ii) State service: Sets the light appliance state to on/off and returns the current light state.
- iii) Controller service: In auto mode, the controller service monitors the light level & switches the light on/off & updates the status in the status database. In the manual mode, the controller service returns the data i.e. the current state & switches the light on/off.

• Various services in the weather monitoring system: —

- i) Controller service: Runs as a native service on the device. It monitors pressure, temperature, humidity, light and wind once every 15 seconds.
- ii) Xively REST API service: Controller service calls this PaaS to store these datapoints in the cloud.

Q7) What is the need for a controller service?

Ans 7) Controller service is a native service that runs on the device & interacts with the web services. Controller service sends data from the device to the web service & receives commands from the application (via web services) for controlling the device.

Q8) Explain the various applications in home automation system, explain each example in brief.

Ans) Various applications in home automation system :-

~~(i) Smart automation :-~~

(i) Smart lighting: These are energy saving mechanisms which sense human movement and surroundings & control the lighting accordingly. The device can be controlled remotely either manually or in auto mode.

(ii) Smart appliances: Management of various appliances can be cumbersome hence smart appliances provide status information to the users remotely. A controller is used to manage scheduling & interaction of the devices.

(iii) Intrusion detection: These systems use security cameras & sensors to detect intrusions and raise alerts. Alerts can also include a short video clip sent as an e-mail attachment.



(iv) Smoke / gas detectors : used to detect smoke which is an early sign of fire. Advanced systems can even identify the source of smoke & activate sprinklers accordingly.

Qii) Explain various applications in environment systems, explain each example in brief.

Ans) Various applications in environment systems : —

(i) Weather monitoring : These systems can collect data from a number of sensors attached and send the data to cloud based storage solutions, where they can be further analyzed by cloud based applications to produce alerts for users.

(ii) Air pollution monitoring : These systems can measure harmful emissions of a gas by factories & automobiles using gaseous sensors.

(iii) Noise pollution monitoring : These systems help in generation of noise maps. These maps can be used to improve city design.

(iv) Forest fire detection : IOT systems use various monitoring nodes ~~to replace~~ spread across the forest to generate early warning of forest fires.



(v) River floods detection : early warnings can be generated by monitoring water flow rate & water levels. Data from a number of nodes is aggregated & analyzed to generate early warnings.

Qiii) Explain the various applications in smart city designs. Explain each example in brief.

Ans) Various applications in smart city systems :-

(i) Smart parking : These systems track empty parking spaces & send data to the back-end app. The data is aggregated over a local device & sent over to the internet.

(ii) Smart lighting : allows the lighting to be dynamically controlled and adaptive to the ambient conditions. These can be controlled remotely to set lighting schedules & lighting intensity.

(iii) Smart roads : roads equipped with sensors can provide early estimates & information about travel time & poor driving conditions. It can also broadcast information about traffic.

(iv) Structural health monitoring : sensors are used to measure vibrations in a building or a bridge. The data is sent to cloud where it is analyzed & the health of a structure is predicted.