**SMART CITIES – PROJECT DESCRIPTION**

*Introduction*

Smart cities is a notion of utilizing the information and communication existing in urban areas with the sole purpose of better resource usage and lesser harmful actions to the environment. Further, it transforms traditional network systems into digitization benefitting the inhabitants and business. To construct an infrastructure for smart city, various sensors, actuators, technologies are needed along with the existing network. The most widely used implementation is internet of things which refers to a system of numerous components each having its own unique identifier and ability to transfer data over the internet without human interaction.

Smartness can be established in any sector of the urban area; be it an office, school, transport areas, library etc. Our idea is centralized to a library with a focus on energy consumption, security, safety and comfort of its occupants. Energy wreckage can be reduced effectively by handling the lighting system, HVAC and other electronic components dynamically. Security is obtained by the alarming system in case of unexpected and malicious entry into the environment under consideration. Sensors and actuators are combined to provide the desired outcome here.

System architecture

We present the architecture of our implementation in this section. As we know the architecture is split into four different layers. Here we explain the four distinct layers wrt to our idea.

The physical layer contains the hardware part of our system which includes the sensors and actuators. The sensors and actuators used are mentioned in the next section. They provide necessary information to the higher layers.

From the sensor information, filtering is done to eliminate errors along with storing data which can be static or dynamic data meaning storing all the historical and current information about the surrounding, system configuration, capacity of the system. For instance with the motion detector, this layer does minimal computation of detecting the presence or absence of any movement in the area. This is the analysis in the sensing side; in the actuation part, this layers sees to that the action intended is performed as expected. This is the ubiquitous layer.

Our reasoning layer has tasks as follows. For automatic light control, the layer must decide whether the latter must be turned on or not; the intensity of the light has to adjusted or left untouched. HVAC system is turned on or off considering the input from the sensors and data from the repository providing the historical information on occupants on the particular day, which can be used to control it without any external control required. The temperature to be adjusted in the room is decided based on the sensor information and weather forecast . once all the computations are done, input is provided to the physical layer devices via the ubiquitous layer.

Requirement specifications

As mentioned earlier, sensors and actuators play a major role in building a smart city. The sensors that will be used here are : Motion sensor, Light sensor, Temperature sensor. The actuators in our system are: Electric relay for high voltage, high current drivers, Plugwise set to control the electrical appliances in the environment.

Our system is implemented to control the lighting, HVAC system with the data from sensors along with static data stored and dynamic data obtained dynamically; here in our case we are using online services. In addition, safety is established by burglar alarm system in case of intruders and notifying this data to the responsible. Further we discuss each and every sensing and actions in a detailed way.

Firstly, the automatic lighting control in our context refers to turning on and off the lights depending on the presence of subjects in the environment. We need sensors to detect this presence which can be achieved using the motion detector. PIR is used for this purpose, a sensor that is sensitive to person’s skin temperature through emitted black body radiation in the mid frequency range in contrast to the background objects at room temperature. A light sensor is used to adjust the brightness in the room depending on the amount of the light available in the surrounding. Energy gets saved in these scenarios.

Next is energy consumption reduction in HVAC system. The latter is turned off and on using the previous data stored in the repository and the presence of the users. Motion detector senses the availability of pupil; this data is stored in the repository as and when it is obtained for future test cases. From this data, a map can be plotted to decide the days of maximum, minimum and optimal occupancy. In this way, energy is conserved. Another sensing- action dual that is performed is temperature control which is again done by sensing the surrounding temperature using the temperature sensor along with weather forecast to modify the temperature beforehand to provide comfort to the pupil.

Lastly is the alarming system in case of any suspicious entry into the environment in unexpected times. Motion detectors are used in this case. Once these suspicious movements are detected, a notification is sent to the responsible alerting the situation.

By this implementation, we intend to bring energy efficiency in the library with security, comfort and safety to the personnel thus fulfilling the purpose of a smart city to an extent utilizing the internet of things technology.