Smart Residence with Enhanced Security using Internet of Things

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Abstract: The proposal is to create Smart Home using Internet of Things that saves energy and make human life better. Internet of Things is an interconnection of Programmable and electronic gadgets that enables us to control them without physical contact by sending and receiving data. Raspberry Pi acts as the controller that is connected to Source power supply in such a way that it controls power to various electronic appliances at home. Raspberry Pi is a visiting card sized, cost efficient and reliable electronic device with 64 bit quad core processor and a Raspbian distribution of Linux as its default operating system. Raspberry Pi can be controlled by maximum of four mobile devices with necessary application via Internet and Bluetooth. Raspberry Pi must be connected via wireless mode to detect Wi-Fi and Bluetooth signals. If none of the four devices are reachable via Bluetooth, all the power ports must be disabled except t he port providing electricity to the refrigerator. Air Conditioners can be switched on through a command from any of the four mobile devices when Bluetooth connection is unavailable. Once the data signal is received from the mobile device, Air Conditioner and the Raspberry Pi's timer must be switched on. Once the timer reaches 30 minutes and if none of the device is connected to Raspberry Pi via Bluetooth, then the Air Conditioner must be switched off automatically so that power is conserved, if the person is unable to return. Even water can be conserved by switching off the electric motors automatically. When the tank is full, the concern sensor intimates the Raspberry Pi that the tank is filled. Fire sensor can also be attached to the Raspberry Pi so that it generates a high interrupt signal to Raspberry Pi that in turn alerts all the connected mobile devices in time of emergency. This can help people to take precautions to avoid fire accidents when the residents are unavailable. Similar mechanisms can also be implemented to avoid thefts at home. When the residents are unavailable, it generates an interrupt signal from the actuator located on the door to the Raspberry Pi which in turn alerts the residents. The same alert can even be intimated to the neighbor so that they can take immediate physical action.

Keywords: Smart home, IoT home, Automation of home, Pi in home, control of home applicants via mobile, theft detection in home.

I. INTRODUCTION

With all the advanced technologies in hands we are living in the world that is already smart, to take it to next level, the dreams of true smart homes must be fulfilled. Smart homes provide convenience, contentment, security, power efficiency to its inhabitance. The quality of life can be increased by adding intelligence to home environment. Homes are getting digitalized in the recent years due to high thriftiness and advancements in technology. Modern development in Applied Science, have led to notarization and upgrading the functions of Internet of Things and sensors. With the advancement in Internet of Things, we move a step closer to make our dreams turn into reality. Smart Home signifies upcoming evolution that takes vast leap in its pace to modernize the present homes.

II. RELATED WORKS

Home automation has been so beneficial for science fiction writing for many years, but has only flattered practical since the early 20th Century ensuing the widespread introduction of energy into the home, and the rapid advancement of IT.

Home Automation is automation of the home-based, housework or household action. Home automation may comprise centralized control of lighting, HVAC, appliances, security locks of gates and doors and other systems, to provide better-quality suitability, comfort and energy efficiency. Home automation for the ageing and disabled can provide increased quality of life for persons who might then require caregivers or institutional care. Bluetooth based home automation systems using Android Smart phones are physically connected to a Bluetooth sub- controller which is then accessed and controlled by the Smart phone using built-in Bluetooth connectivity. However, due to limited range of operation (maximum up to 100 m) the system is unable to cope with mobility and can only be controlled within the vicinity.

III.NEED

The already proposed system provides access to devices only via Bluetooth which deprives the advancement in technology. To overcome the range complexity, Internet of Things is added to the existing

system (Bluetooth). This provides control facilities to the users outside the range space of Bluetooth. The connected home devices will coordinate energy usage, consumer convenience and consistently anticipate the needs of the people who dwell in their homes.

IV. SMART HOME TECHNOLOGY

A. Smart Home Network
The network can be classified into two types:
1) Wiring Systems.
2) Wireless System.
Here, we deal with wireless systems that include two main elements: Sender and Receiver. Wi-Fi, Bluetooth, Radio Frequency, Infrared are some of the wireless communication systems. Internet of Things is one of the examples which are reliable and affordable method for instant remote control of appliances providing a solution for home automation.
B. Smart Home Controller
Smart Home controlling devices are used for managing the systems by sending data or signal to control the actuators. Web browsers, Smart phones, Applications, Short Message Service (SMS) are some of the examples of controllers.

V. PROBLEM OF CURRENT SYSTEM

In the current system, incase if the user forgets to switch off the home and electronic applicants while leaving the home, power will be wasted to a greater extent. Similarly if the resident of the home wants the air conditioner to be switched on prior to his or her arrival, in the current system, he must set the timer. But in most of the day to day cases it is impossible to estimate the returning time. If the user sets the timer and is unable to return within the stipulated time, then power is wasted.
Many households use electric motor to fill water tank. Overflow of tank occurs if the time taken by the tank to be filled is not known. As a result, enormous amount of water is wasted.
In case of fire, the residents must be called or manually informed by the neighbors about the prevailing situation. Similarly, if the house is under theft when the residents are out, they will be able to know only when they return and the chances of recovery of the goods are very less.

Even if they are recovered, it will be recovered with significant damage or after very long time.
In the event of event of any medical issues, the resident must manually contact hospital or ambulance service. The concern hospital must send the ambulance to receive the person who is in need. It takes a more time to reach the destination, due to traffic, mainly in metropolitan areas.

VI. OUR SOLUTION TO THIS PROBLEM

The main power source must be connected to the Raspberry Pi, in such a way that it controls the power supply of all the home appliances. Raspberry Pi device must be configured in such a way that it receives and sends data to all the required mobile devices of the residents both via Internet and Bluetooth. Raspberry Pi must be connected to continuous Wi-Fi supply. The Raspberry Pi must be programmed in such a way that it detects the Bluetooth signal of all the registered mobile devices.

A. Power saving Mechanism
In case if none of the Bluetooth signals are available i.e. if none of the residents are home, all the ports connecting the power supply to the various appliances must be disconnected except the port providing power to the refrigerator. Similarly, if the resident fails to manually switch off the appliances consuming power, the proposed system can be used to turn them off, thus saving power.

B. Remote Control Mechanism
In today`s generation, people want the room temperature to be cool especially those who live in the Metropolitan cities of hot regions. This can be made possible by using Internet of Things. When the resident is yet to reach home, he/she can send the necessary command to Raspberry Pi to switch on the Air Conditioner, the Raspberry Pi in turn must enable the port connecting to AC, and the timer in Pi must be enabled. If the Pi's timer reaches 30 minutes, and none of the Bluetooth signal is available, then port must be disconnected. This is done with the intention to avoid huge wastage of power in case if the resident is not able to reach home in time due to various reasons.

C. Automation by sensor
In the busy schedule of the current life, most of the people don't have enough patience to continuously

wait to check the filling status of water tank. So, many let water motor to run continuously even after the water tank is filled, this causes wastage of both power and water resource. This can be avoided by connecting level sensor to the water tank that sends an interrupt signal to the Raspberry Pi by turning its state to 1. As a result, Raspberry Pi disconnects the power supply to the water motor. By this mechanism, the resident doesn't have to check the status of the water tank continuously. The water motor automatically gets turned off when the tank is full.

D. Emergency control mechanism

A fire sensor is attached to the Raspberry Pi. In the event of uncertain calamities, say, the house catches fire; the fire detector attached along with a pi must detect the smoke or fire and must send a high level interrupt to the Raspberry Pi. The Raspberry Pi in turn must give a high beep alert to all the registered mobile devices indicating an emergency and the power supply must be terminated from the main source such that the electricity passes nowhere in the home. In for fire control station with exact location stating that, immediate action must be automatically passed to the local action is required.

E .Restricting Trespassers entry

In recent years, security is becoming an issue. At any time, when the residents are out, the possibility for trespassing is high. To prevent this, an actuator is attached to the door and it is connected to the Raspberry Pi. If someone tries to open the door and when none of the Bluetooth signal of the registered mobile devices is available, a high interrupt must be passed to the Raspberry Pi, and the Pi must alert the registered mobile devices which in turn alert the residents regarding the situation. The same alert can ever be given to the registered neighbor`s number, as they can take immediate physical action. As soon as any one of the residents or the neighbor confirms the situation, the information must be immediately sent to the local police station with exact location. Even if anyone of the residents marks it as safe, the interrupt must be called off and the same must also be intimated to other residents as well as the neighbor.

F. Medical Emergency

In the current scenario, at most of the time people are forced to live alone in their home. In case of any medical emergency, he needs to contact any medical agency manually. Even if the person manages to contact any medical agency for help it takes time for them to overcome this issue. In order to avoid that, a voice detector must be attached in mobile or any electronic device in such a way it detects the word "Help me help me". It automatically signals nearby ambulance and gets its attention.

VII. IMPLEMENTATION

The proposed system can be implemented by connecting all the required devices with Raspberry Pi. This implementation requires a programmed Raspberry Pi, a smart phone for all the residents with necessary mobile application to interact with an Internet of Things device, a level sensor, an actuator and a fire cum smoke sensor.

i) Raspberry Pi
Raspberry Pi is a visiting card sized, cost efficient and reliable electronic device with 64 bit quad core processor and a Raspbian distribution of Linux as its default operating system.

ii) Smart Phone
A mobile phone is a device that has features similar to that of a computer, typically having a touchscreen interface, Internet access, and an operating system capable of running various applications.

iii) Level Sensor
A level sensor is used to detect the level of water. It is used in tanks and dams.

iv) Actuator
An actuator is a component of a machine that is responsible for moving or controlling a machine or a system. An actuator requires a control signal and a source of energy. The control signal is relatively low energy and may be electric voltage or current, pneumatic or hydraulic pressure, or even human power.

v) Fire cum Smoke sensor
A smoke detector is a device that senses smoke, typically as an indicator of fire. Smoke can be detected by two methods:

1) Optical method (photoelectric),
2) Physical method (ionization). Detectors may use either, or both, methods.

The Raspberry Pi must be connected with a device to detect Bluetooth and Internet signal. It must be connected and programmed in such a way that it controls the power

supply. Raspberry Pi can be preferably programmed in Python programming language, which is the most efficient one. TCP and UDP networking algorithms are used for sending and receiving data. Mobile applications must be created in such a way that it interacts with Raspberry Pi efficiently both via Bluetooth and mobile data. Mobile application can be most preferably programmed in Java, an object oriented programming language.

VIII. SMART HOME CHALLENGES

A. Security
Certain security concerns are associated with smart homes that prevent hackers from accessing the network system.

B. Adaptation to New Environment
The capability to adapt many innovations such as security systems and sensors by the inhabitants plays a major role in the development of smart home.

C. High Cost of Intelligence
Though the properties of smart homes have higher price tag, it makes human life convenient. The cost is high because of the new relative technology.

IX. FUTURE ENHANCEMENT

SMART LOCKS: A chip can be integrated with the door lock that is connected to the Raspberry Pi. When the door is locked from outside, that is when no one is currently at home, the chip sends an interrupt signal to Raspberry Pi which in turn switches off all the home appliances it is connected to, except for the refrigerator.

This can be enhanced in future by creating a cost efficient device that can keep in track of the mobile of the residents using mobile phone signals directly. When it is unreachable they can use mobile internet. When this system becomes familiar, mobile devices can be created in such a way that it recognizes voice of the user to interact with Internet of Things to switch on and off all home appliances.

The same system can also be implemented to create smart area projects with required advancements, like, switching on and off of street lights when there is no sunlight, switching on and off of public water motors. Sending message to the nearest police station with exact location when there is heavy traffic or any other special attention is required in any certain place. Similar mechanisms can also be used in Fire detection.

X. CONCLUSION

Saving of power and water resources is the major social responsibility of this proposed system. Convenience, flexibility, increased energy efficiency and security are the benefits. Future development of this proposed project will have global influence and can further modernize the fast growing society. The entire system can be made cost efficient with the increasing growth of technology.

XI. ACKNOWLEDGEMENT

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