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Article

IoT Based Smart Home Automation System

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I N F O

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A B S T R A C T

This paper describes a design concept of reliable and flexible smart home automation system based on Internet of Things (IoT). The idea of remotely monitoring and connecting real world object through the internet is termed as Internet of Things (IoT). The whole system can be controlled by sensors and mobile devices. The automatic systems are being favored due to energy efficiency, safety benefits and consumption of resources. The appliances can be communicated in an integral manner with the home environment. The main motive of this project is minimizing the use of electricity and reduction of human effort. Various aspects of technologies such as wireless networking, motion detection, embedded working process assimilates the IoT Based Smart Home Automation System (HAS).

Keywords: Internet of Things (IoT), Home Automation System (HAS), Embedded Process

Introduction

An internet connection gives all sorts of benefits. The internet is a part of life due to rapid increase in the number of users of internet. The main point is that involving things to the internet yields astonishing welfares. The Internet of Things (IoT) is a concept which defines, "Connecting things to the internet". It allows objects to be control and sense remotely across existing network infrastructure. It can create the connection between the physical world into computer based system, enabling them to send and receive data. IoT depends on host of technologies such as Application Program Interface (APIs). Without human interference IoT is able to communicate. Data retrieved from the sensors and perform appropriate activities which is analyzed by IoT, thereby saving human time. This project put forward the design of home automation by using Arduino. This project put forth the equipment, which enable user to control their home appliances using their cellular phone. It shows working and construction of the device wirelessly control the home appliances based on GSM networking. Initially an authenticated signal is send from the user cellular phone via GSM network to equipment. The signal or code consists of the information about the function or action to be taken place i.e. which appliances should be turned off or turned on. The receiver phone receives the message that is send from the users phone and then send it to the GSM modem which in turns send the output digital signal to the microcontroller. Then the microcontroller based on received signal, control the different relays and triggers the required appliances. Basically this project has three type of automations and i.e bulb automation, tank automation and door automation.

System Level Description

Arduino UNO

Arduino UNO is an open source. It is used in both hardware and software. The Arduino UNO R3 is a microcontroller board which is based on a removal, Dual In Line Package (DIP) ATmega328 AVR microcontroller. The internal circuitry of this microcontroller is designed with low current consumption feature. AT mega 328P is a very feature rich and advanced microcontroller. The pin configuration is as shown below.

GSM Module

GSM stands for Global System for Mobile Communication.

This module is a chip or a circuit that will be used to set up communication between a mobile device/ computing machine and a GSM system. It is a very cost effective product and it also provides wireless connectivity. Based on SIM card the phone works. So user can easily commanding or messaging. The use of this module in this project will be transferring the digital signal, from the user phone to the microcontroller. Based on received signal the microcontroller can control different relays and triggers the required appliances.

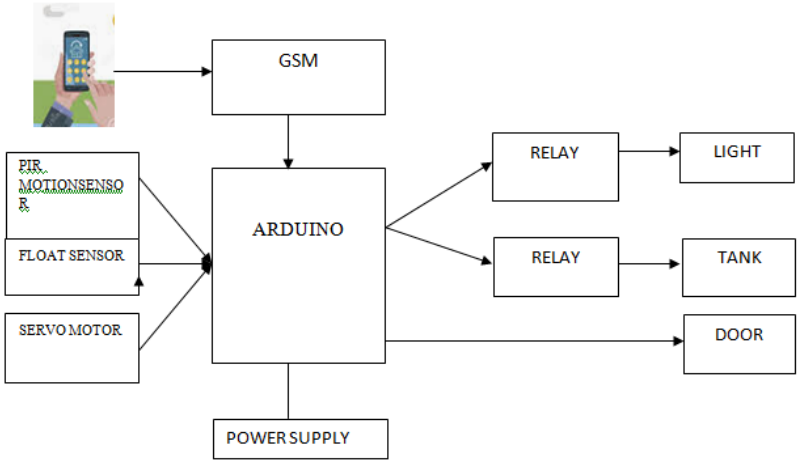

Figure 1.Block diagram of Home Automation System

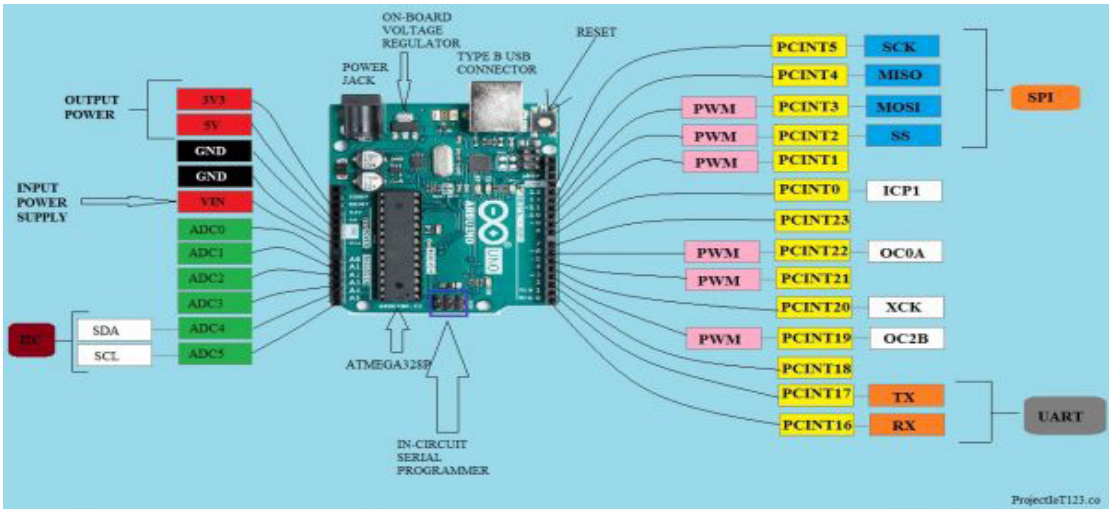

Figure 2.Pin Configuration

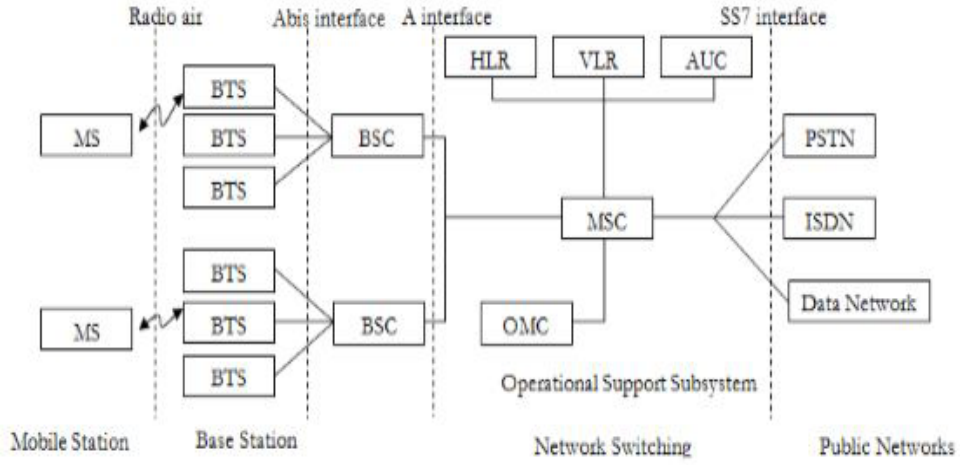

Figure 3.GSM Architecture

Pir Motion Sensor

PIR sensor referred as “Passive Infrared” or “IR motion” sensors. PIR sensors permit to sense motion. They are used to detect whether a human has moved in or out of the sensor’s range. It covers distance of about 120° and 7 meters. Input voltage varying 4V to 12V.

Float Sensor

To make a circuit closed circuit, float sensor use magnetic reed switch. Risen water level makes magnetic fields for reed switch.

Servo Motor

A Servo Motor is a small device that has an output shaft. By sending coded signal this shaft can be positioned to specific angular positions.

Working Description

The implementation of Home Automation System using IoT project can be modeled using various components. The whole system is an embedded system. This project is based on three applications. So the working part is divided into three parts i.e bulb automation, door automation and tank automation.

The bulb automation can be controlled by mobile through GSM. The GSM module is connected to the Arduino. When we send SMS to the GSM module via mobile. The GSM module receives that SMS and sends it to Arduino. The module can only understand the ‘AT’command and respond. The command which is given through SMS by mobile is like relay1on#, relay2on#. In our project the bulb is connected to relay 1 so the sms is relay1on#. Then the arduino reads this sms (relay1on#) and extract main command from the receive string and store veriable. Arduino compare the string with predefined string. After matching, Arduino send the signal to relay via relay driver for turning ON/OFF the bulb according to requirement of user. This can be done from any location.

In the tank automation, a float level sensor is used in the tank which can monitor the level of water. This sensor can sense the rising and falling of water. When we fit the sensor in an empty tank the switch position is at bottom but as water starts filling up switch position rises up which generates magnetic field for the reed switch. So simply, when water level goes down sensor break the circuit and series led connected will turned off, while when level goes up sensor make the circuit and series led connected will turned on.

The Door Automation System using Arduino, PIR Sensor and servo. When the PIR Sensor detects any motion of a person, its Data OUT Pin will become HIGH. This pin is connected to the Arduino, it will detect this HIGH Signal and understands that there is person approaching the door. Arduino then immediately activates the SERVO Motor Driver module to open the door. After 2 to 5 seconds the Arduino will once again activate the Motor Drive to close the door.

Observation and Result

From the above the circuit connection, some observations are taken which is prove the working process of the system. For light automation there are some particular message which is used for transferring the message signal to the microcontroller. In door automation, there is some specific distance which is detected by the motion detector PIR sensor. In tank automation, the level of tank is necessary which is detected by float sensor. According to the level, the motor is on/off automatically by relay.

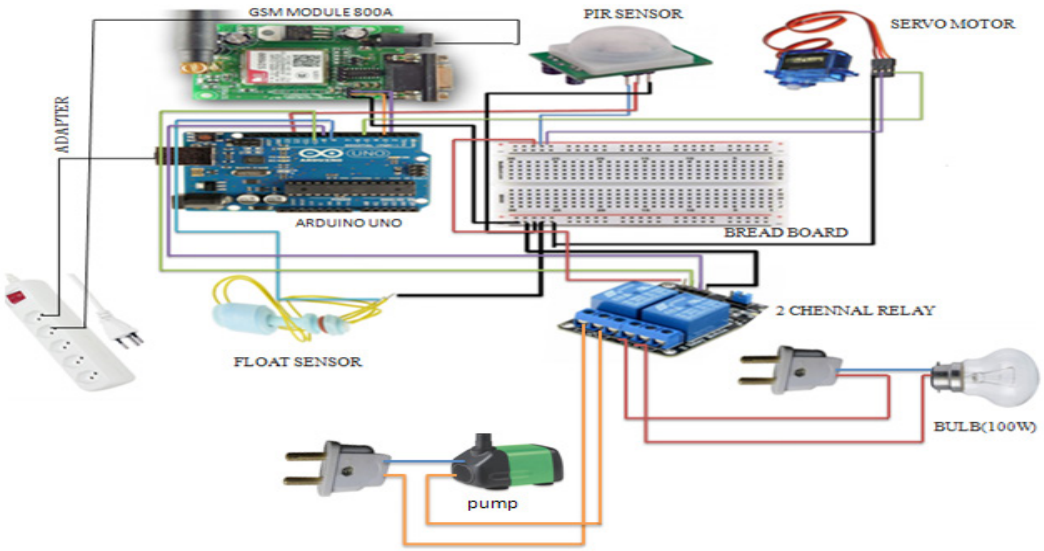

Figure 4.Circuit modeling

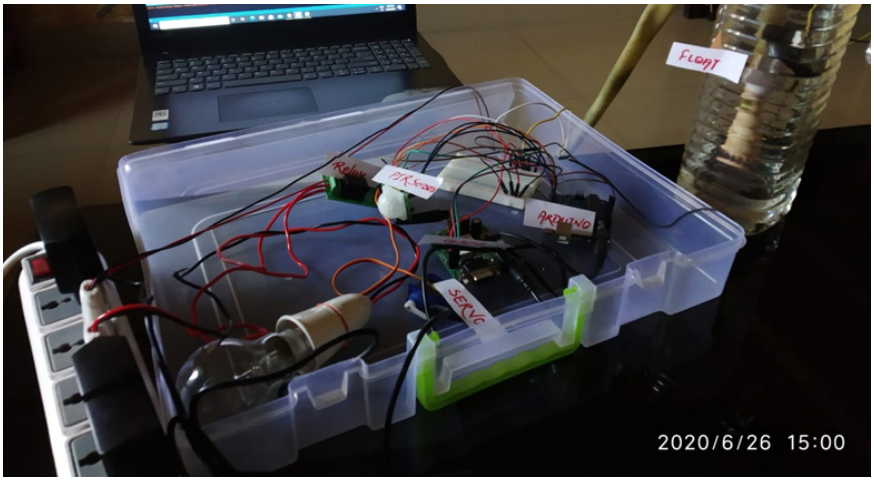

Figure 5.Hardware Implementation

Table 1.Messagesfor Light Automation

S. No.	Message	Operation
1.	relay1on#	Light ON
2.	relay1off#	Light OFF

Table 2.Distance Ranging by Pir Sensor of Door Automation

S. No.	Distance (In Meter)	Operation
1.	7	OPEN
2.	3	CLOSE
3.	5	OPEN
4.	9	OPEN
5.	12	OPEN
6.	6	OPEN
7.	4	CLOSE
8.	13	CLOSE
9.	10	OPEN
10.	2	CLOSE

Table 3.Switching of Tank Automation

S. No.	Level in Tank	Relay 2	Pump
1.	UP	OFF	OFF
2.	DOWN	ON	ON

Conclusion

The arduino UNO is the main unit. The microcontroller is programmed, according to the program the whole system is working. The GSM module is configured to access message signal. The command receives by a GSM module is executed by program. The main benefit of an automated lighting control system is the user's ability to manage an entire network of lights with one controller. Automatic doors not only offer convenience to users but also various benefits such as hygiene, security and energy saving. Without the use of hands the automatic doors can be opened and convenient to everyone even with baggage in both hands. The automatic water level control devices are proficient of controlling the functions of the motor and help to reduce the utilization of electricity. There by power and wastage of water can be reduced considerably. It also protects the motor from running dry and thus ensures durability.

Consumption of Electricity

The energy that we use, a water level controller is ideal at saving electricity. Usually, regulating water levels and consumes electricity. Though, with automatic controllers, the electricity usage is incomplete as well as less water needed to control supply by the use of relay which is connected with arduino board. The user can switch on/off using as well as regulate the flow of voltage to appliances. For instance- if the user is forget to switch off the bulb then the user can easily off the bulb or any appliances, in that way the electricity consume.

Automatic

Another notable advantage is that they regulate on their own. Manual operations are totally eliminate, the frustrations of manual monitoring water tanks, lights and doors are minimized. Water levels are maintained at the appropriate levels thanks to the automatic operations of these devices.

Economical and Environment Contribution

The system can ensure that using of necessary resource in that way we are sustaining the resource. The Home Automation System saves time and effort performing home activities. For properly managing energy in that way, we can reduce energy consumption, which helps us to save money.

Future Scope

Home automation has extensive scope. The system can be

expanded to various other features which could include security of home like capturing the photo of a person moving around the house. This will reduce the data storage then using CCTV camera which records all the time and store it. The system can be built in the initial stage so it can be expand for energy monitoring or weather station monitoring. The system will also include some advance feature in future.

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