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Implementation of home automation and security system using PIR sensors

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ABSTRACT

This paper focuses on the concept of home automation using the Internet of Things. This allows the person to operate certain functions and operations of these devices connected in the IOT network even when they aren't at home. This system utilizes sensors which can detect various values that it's designated to and be controlled by the user. Likewise, the temperature sensor utilized will help the user get the control of the room temperatures and be able to control the AC according to their needs. These devices are controlled by using microcontrollers, sensors, RF Encoders, and Decoders and can be monitored using mobile, Laptop or PC. There are various kinds of sensors which can be used to make the devices work without human intervention. With the increased number of devices, security needs to be taken care of and hence the PIR (Passive Infrared) sensors proposed detects any sort of movement that occurs at home to increase the concept of security. Any anomaly movements which may be there in the house which can be easily detected using LED and LCD setups. This can send a request to a wi-fi system and hence the user can easily control all the appliances from anywhere. The main information is obtained from data obtained in the cloud.

Keywords— *PIR sensors, Wi-Fi module, RF Encoder, Decoder, Big data*

1. INTRODUCTION

Internet of Things is a collection of things connected to form a network and the data is analysed and collected in the cloud. The request is sent to the cloud after which they are processed, and the desired result is obtained. Vignesh Govindaraj [2] explains a smart system to control home using sensors utilizing mobile application and wireless communication that stores the data received by the sensors into the cloud. This is very useful to obtain data and conclude the values in a graph. There was no backup of values because the coverage of internet using GSM was not efficient. The smart home system [1] uses IOTSHS which will give an access point from which the devices can be connected using a laptop or mobile. A smart home system is made using wi-fi routers and ssh connections. The devices can be connected and then a security system will be induced in the proposed system model. This system will automatically detect the movement and then will give notifications to users to the user about the malicious use of devices present in the house. The system configuration is designed and fabricated in such a manner so that the users can establish a secure connection with every device with unique IP address and then the connection is made with the specific router which will be responsible for controlling all the devices present at home. According to the authors in [3] they have equipped special equipment to reduce the privacy issues related to IOT. Such methodology and equipment have been used to connect all the devices and then work with them using routers and wi-fi devices.

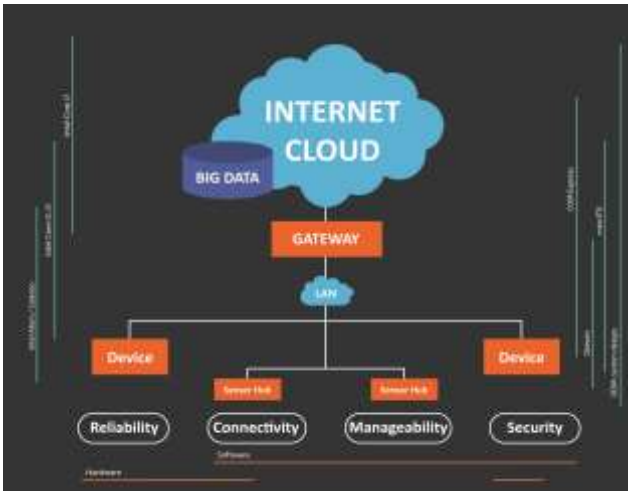

Fig. 1: IOT using big data and cloud

From the figure 1, we can say that the internet of things can be done using cloud management system. The devices are connected using IOT gateway which has enough strength, reliability, and ability to give output from the cloud. The data

can be managed and hence the security can also be ensured using IOT platforms. The data can be in private, public or hybrid clouds and then they can be processed and then the specific output for the given input data can be obtained.

2. SYSTEM ARCHITECTURE

2.1 Security system

The security system is very important to be present in an IOT system configuration. The use of sensors can be done and hence security system can come to play in the automated home. This system can be very reliable and useful for users to ensure the security of their home. The encoders and decoders of the RF circuit can be used for implementing the security system and using microcontroller AT89S52. LED bulbs and LCD panels are used to alert the user or the neighbouring people about any malicious or intruder in the home. This system is very useful in making the user aware of the burglary or any movement inside the house.

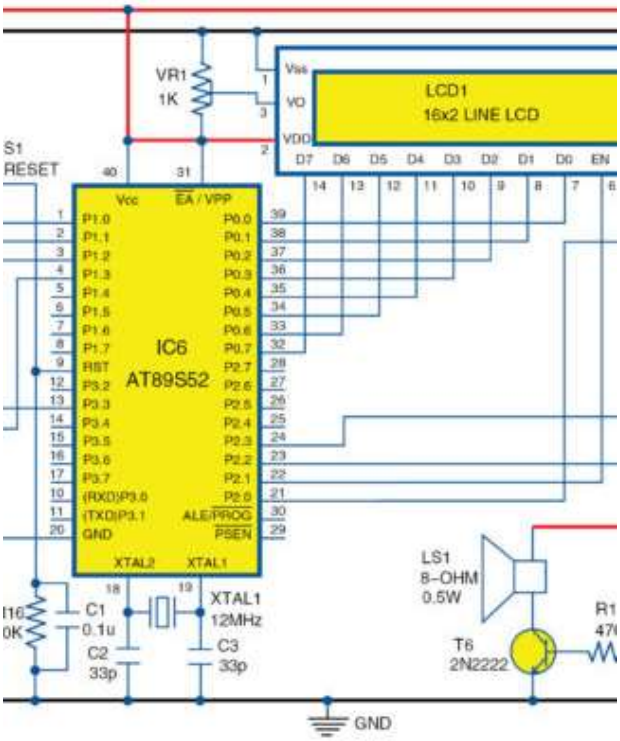

Fig. 2: Circuit diagram for the security system

Figure 2 shows the circuit diagram for implementing the security system using PIR motion sensors. The sensor is interfaced with AT89S52 and then with RF Encoder and Decoder circuit. The signals for infrared rays are taken as input in the encoder circuit, the signals are then processed, and its corresponding output is obtained from the decoder circuit. LCD and LED panels are used for getting an output in the form of the light system from which neighbors can also be alarmed. Basic notifications are sent to the user about the motion that is taken place inside the house. The pins which are present helps in identifying the given input and then accordingly give the output.

2.2 Mechanism involved

The wi-fi module is fitted in the home and then using mobile the IP address of each system is taken into account. Each system will have a separate IP address. The wi-fi module becomes very useful for connecting the systems with the mobile or laptop. This enables the house to be automated and get into easy control. To consider the fact on the security of homes we use PIR sensors which can detect motion very easily. The PIR sensors detect the IR (Infrared Ray) from the object it detects and produces a digital output. Thus, the user gets ensured about the security of his home. These sensors will take in infrared radiations from any object and then it will send to the RF Encoder. This encoder encodes the signals that get detected by the microcontroller which is already in the existing configuration system of the home automation. The encoded signals from the RF encoder will be sent to the RF Decoder which will decode the signals and send the signals through the wi-fi module to the mobile or whichever device the user is possessing with them.

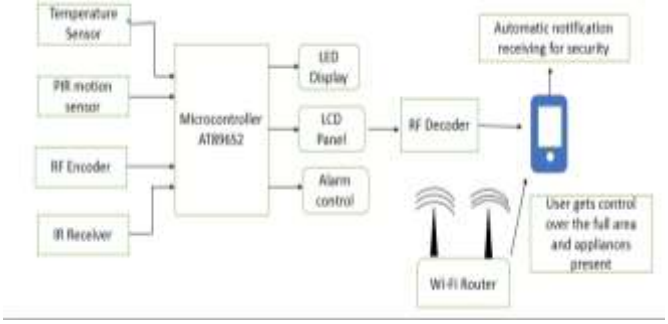

Fig. 3: System architecture

Figure 3 depicts the representation of the relay used in home automation and how the PIR sensors have been used to detect the motion of any moving object. The wi-fi routers can be used to detect the IP addresses of each device that can be accessed and are provided access to the mobile or laptop. This is very useful for the user as they can get access to the system as well as get notified about any sort of malicious activities inside the house. Hence this promotes home security which is what we intended to propose.

2.3 Sensors used

Mainly the sensors to detect the temperature are fitted in the air-conditioners and normal sensing sensors are fitted in the other appliances which can be controlled by the user through the wi-fi module. These sensors are configured with their own IP address so that when they are connected, they can give the output according to their inputs. The motion sensors which have been implemented are the PIR motion sensors. These sensors can easily detect any motion and give the user notification about any anomaly conditions happening in the house. These Passive Infrared sensors (PIR) can be used to take infrared radiations as input and then give output. The kinds of sensors used in this system are temperature sensors, IR receiver sensor, a motion sensor (PIR) and a secured access point for controlling all the devices. The temperature sensor will be useful to detect the rise and fall in temperatures. The radio frequency (RF) Encoder and Decoder can be used as appliances to take input signals and then they are processed and then sent to the RF Decoder to decode the signals and then give the output in the form of notifications. The various kinds of sensors used in home automation are water level monitoring sensors, automatic smoke detecting sensors, thermostat sensors, the excess light detecting sensors used in homes which can detect the specific amount of light that it can produce sensing the rate of heat the light produces. These sensors can sense the surrounding temperatures or the amount of smoke that may be there inside the home. These are the advantages of having sensors inside the home. Sensors have specific IP addresses which are configured with the phone and then they can be controlled using the phone. Along with these sensors, the highest level of anything can be easily detected and hence this becomes very useful for the user. The PIR sensor is also used to detect infrared radiations and hence can detect any anomaly conditions which can occur inside the house.

Fig. 4: Sensors present in smart home

Figure 4 shows the user control over the whole house and that the can control all the appliances. The security sensors would be present outside the compound of the house to detect any anomaly movements and hence the user can have full control over the home. This system is very useful for those who cannot do movements from one place to another and have some disabilities. This system is also very useful for the old people who are unable to walk from one place to another, but they can control all the appliances from the phone. The motion sensor can detect any movement inside or outside the house using the infrared radiations which may be detected while entering the house.

3. CIRCUIT AND WORKING

There are five circuits. Of these, four transmitter circuits are like each other. The transmitter circuit will just transmit signals to the sensors present inside the home. The two diodes D1 and D2 connection transmit enables (TE) pin with an AD8 pin so that both pins get input from the sensor at the same time. LED (Light Emitting Diode) system is connected to the collector output so that it blinks when the PIR sensor takes input and gives respective output. Address pins A0 through A7 are connected to the data output. The whole circuit is given a power through 6V battery connected across CON1.

When the PIR sensor PS1 detects motion, the output of it goes high. T1 conducts and LED blinks. Pins AD8 and TE are pulled low together through diodes D1 and D2. As pin AD8 is pulled low, data bits are transmitted as 1110. Similarly, in other such circuits, when motion is detected, the respective data pin is pulled low, so different data is transmitted. Hence when the PIR sensor detects any sort of motion, there is a different bit pattern of D0 which is transmitted through D3. From the receiver side, this pattern is used to identify where the motion is detected.

Table 1: Different data bits

Sensor	PIR sensor output connected to a pin of HT12E	Transmitted data bits (D3 D2 D1 D0)
Front sensor	AD8(10)	1 1 1 0
Back sensor	AD9(11)	1 1 0 1
Left sensor	AD10(12)	1 0 1 1
Right sensor	AD11(13)	0 1 1 1

Table 1 shows the probable values that the PIR sensor can give while giving the input of infrared radiations. All the values are obtained from the respective pins fitted in the circuit. The receiver unit also is built using 434MHz Rx module, RF decoder chip HT12D (IC5), AT89S52 and multivibrators. The serial data output obtained from 434 RF Rx module is then given to the data input pin 14 of HT12D decoder. Address pins A0 through A7 of HT12D are connected to ground to set same address 00 as an encoder. The Valid Transmission (VT) pin is connected with LED5 which blinks to indicate data receival. The same VT output is inverted using T5 and given VT output is inverted using T5 and given to external interrupt pin EX1 (pin 13) of AT89S52. Data output pins D8 through D11 are connected to port pins P1.0 through P1.3, respectively. LCD data pins D0 through D7 are connected to port P0 of IC6. Control pins RS ad EN are connected to port pins P2.0 and P2.1 of IC6, respectively. Pin R/W is connected to ground to enable LCD to write. Pre-set VR1 is connected to pin 3 to vary LCD brightness. Backlight LED pins 15 and 16 are connected to +5V via R23 and ground, respectively, to turn on LCD backlight. There are two multivibrator circuits. Both are built using IC NE555 and configured on a stable mode. Reset pin 4 of both multivibrators are controlled by MCU port pins P2.2 and P2.3. The 12 MHz crystal is connected to crystal pins 18 and 19 of IC6 along with two 33pF capacitors (C2 and C3). This circuitry has a clock signal for the MCU for its internal operations. Capacitor C1 is connected parallel with resistor R16 and push button S1 is connected to RST pin 9 to provide the manual reset to the MCU. When any sensor detects motion. Data is transmitted through RF Tx. This is received and demodulated by RF Rx module. This data is sent to RF decoder HT12D (IC5), which detects valid address indicated through the blinking of LED. Then, the decoder latches the data pins D8 through D11 of IC5. When a valid address is received, the VT pin of IC5 goes up high and the MCU gets an interrupt signal. The MCU immediately decides to send and display the message "intruder detected from the xxxx side" on LCD. This is sent in the form of a notification system to the user in his phone from where he can understand or come to know about the movement.

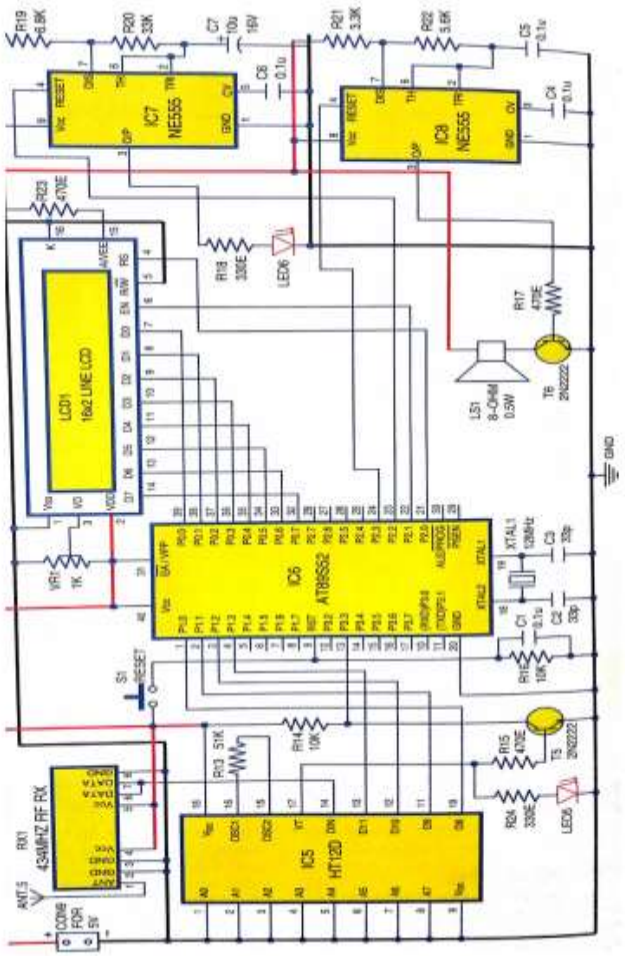

Fig. 5: Picture of the MCU-based central receiver circuit

When the sensor PS1 or any sort of sensor detects any motion, the output stays high for a few seconds due to the slower response. Along with that the siren sounds and the LED6 remains to flash for the same interval. The message depicted on the LCD1 shows the side where motion is sensed. After sensor output becomes stable (low), both the siren and LED6 turns off. It also enables the multivibrator (IC7) that flashes LED6 has a flashing rate of 2Hz. Component values for R19, R20, and C7 are chosen in a way that output frequency is around 1KHz.

4. FUTURE SCOPE

Home automation isn't a new industry it has been used previously and still getting better, but many persons are still facing problems regarding an automated home. Still, many people are not acquainted with the new techniques in home automation so then a friendly home automated system which can be useful and good for the people can be made. Also, for old people, they may have some difficulties in understanding the use of mobiles, tablets or laptops for an automated home. As per some new discussions IOT can emerge as a domination field by the year 2020. Much better technology can be used in the security systems used in home automation. Maybe some new technologies have been released for security, but it should be made in such a manner such that it can be used by common people too, not only by those who have good knowledge about computers. A new face detection system for system authentication which can be able to detect people even if there are a few changes in the face, but they are the same people who used to get access to the system before. Maybe they may consume a large amount of energy so in future they can be made or manufactured using waste products.

5. CONCLUSION

Thus, we conclude that the existing system has been proposed using the security sensors and online notification system which will tell the user what is going on in the house and hence also allowing the user to know about the full structure of the house. Also, this will helpful for the user to detect anomaly when he or she will not be staying in the house. The security system is required in all homes and hence that is going to be very friendly for the user. The others present in the neighbourhood would also get informed about the condition at home, when there may be any server problem for sending a message, the neighbours can at least give a call to the user and hence the user gets updated with the condition of the house. The use of circuits in the system is very useful and cost effective too. These circuits will do the desired work automatically without any user intervention. Security is the main requirement for users. As soon as the user will get to know about the security of home then he or she can take respective measures of how to reduce the anomaly conditions. Many other means are also there to secure homes like face detection and many others. Therefore, the system used here is useful and hence cost effective for the users.

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