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HOME AUTOMATION SYSTEMS - A STUDY

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ABSTRACT

With the rise in energy consumption and population, it is more important than ever to preserve energy in every manner feasible. One of the main causes of energy waste is the inability to access and operate equipment from afar. Users provide directions to these systems via a web or Android application. Wi-Fi, Bluetooth, and ZigBee are just some of the connection options available to this system. Existing systems have a variety of control devices and settings. For a wide range of applications, such systems have already been discovered in several locations. This document provides an overview of all of these systems.

Keywords: Energy Conservation, Raspberry Pi, Portability, Physically Challenged, Electrical and Electronic Devices, Home Automation.

1. INTRODUCTION

In this sense, an electronic and electrical environment is any setting that has equipment such as fans, television sets, air conditioners, motors, heaters, lighting systems, and so on. A remotely accessible environment is one in which each appliance can be accessed and managed from a distance using the software as an interface, such as an Android app or a Web app. Such remotely accessible devices are currently on the market, but they come with a variety of disadvantages. The goal of this study is to conduct a survey of all existing similar systems and compare the features provided.

2. METHODOLOGIES

Bluetooth Based Home Automation

Figure 1 shows a system that uses a mobile phone and Bluetooth technologies. Bluetooth technology is safe and inexpensive. It makes use of a Bluetooth Arduino board. The user interface on the mobile phone is provided via interactive python software. The Bluetooth board's I/O ports and relays are utilized to interface with the devices that need to be controlled. Bluetooth is password locked to guarantee that the system is safe and that intruders do not take advantage of it. Bluetooth has a range of 10 to 100 meters, a bandwidth of 2.4 GHz, and a throughput of 3 Mbps. The phone's python app is portable. It's also a quick and inexpensive system. The circuitry has a diagnostic machine and that can identify faults. After each signal toggle, a feedback mechanism will indicate the state of the devices. The biggest disadvantage of Bluetooth is that discovering and accessing objects in its proximity takes a long time. It does not include any energy-saving suggestions. Real-time access is not possible. It is impossible to gain access to the devices from anywhere. Within the Bluetooth range, access is restricted.

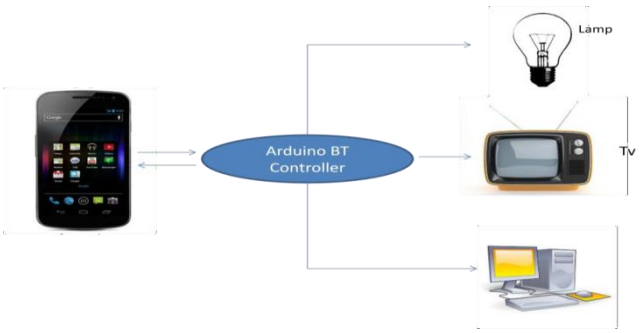

Figure 1. Block Diagram of Home Automation

Home appliances are controlled via Bluetooth technology. The client is a PC with a Bluetooth module, sensor circuit, and pulse width modulation circuit linked via USB. The circuit is controlled by sensors and actuators. It will be able to receive various commands over Bluetooth thanks to the Bluetooth module that is linked to it. Bluetooth devices can quickly scan and detect other Bluetooth devices. It may also be feasible to determine whether or not gadgets are operational. A temperature sensor and an illumination sensor are also included in the system, which may switch on lights when the outside light is dim. This technology also has the disadvantage of having a Bluetooth range of only about 10 meters. This system has the benefit of being able to be installed on top of an existing system. This system also has a low-cost component.

Phone-Based Home Automation

Some technologies are considered enabling systems that may be utilized to provide a standard foundation for home automation. It provides a smart home system with features such as a system controller, house-wide wiring, and a

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common interface. This will allow the existing system to be used for home automation.

Describes a hardware-based remote controller for Powerpoint control. The purpose of this remote controller is to regulate the power delivered to devices located at a distance. The commands are sent via the phone line by the system. The controller is a hardware-based logic system. It saves money by eliminating the need for microcontrollers. It controls the power supply via a DTMF transceiver that is connected to a solid-state relay. Infrared signals and AC power line carrier technologies might possibly be used in an experimental setting.

The dual-tone multi-frequency (DTMF) used in telephone lines is employed in a home automation system. Figure 2 depicts a system that employs ordinary public-switched telephone lines. The system is made up of three parts. The DTMF receiver and ring detector are the first. The IO interface unit is the second component. The third component is the computer, which performs online tasks. When the phone rings, the PC recognizes it and authenticates the user. After that, the user will be able to operate the devices using the keypad tones as needed. A stepper motor control example is shown. This approach offers the benefits of security and worldwide uniformity. This is due to the fact that all DTMF tones are the same over the world. However, it has the downside of having a restriction on the number of appliances due to the number of keys in the keypad. Ordinarily, a phone has just 12 keys.

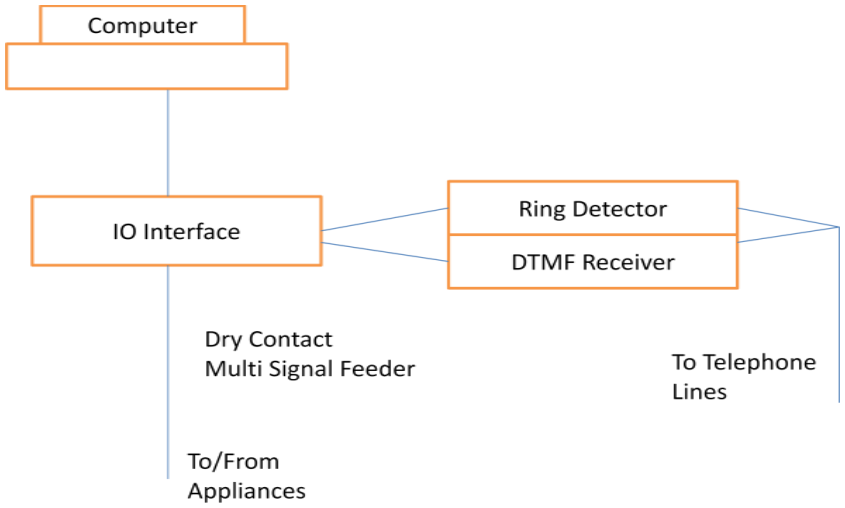

Figure 2. Smart Control System to control Appliancesremotely by phone

ZigBee Based Home Automation

For home automation, the ZigBee wireless communication technology can be used. For this, the system makes use of a PIC microcontroller and voice recognition software shown in figure 3. A microphone is used to record the vocal orders. They are processed after being matched to a voice database. The orders are then sent to the receiver via ZigBee by the PIC microcontroller. The command can be processed by another PIC microcontroller in the receiving device. Relays are used to control the various appliances. The disadvantage of this technology is that ZigBee is a low-range communication channel. As a result, remote access from afar is restricted. In addition, the speech recognition module may become cumbersome. The addition of a smoke detector to this system makes it much more useful. It sends a message to the user's built-in cellphone number when it detects smoke.

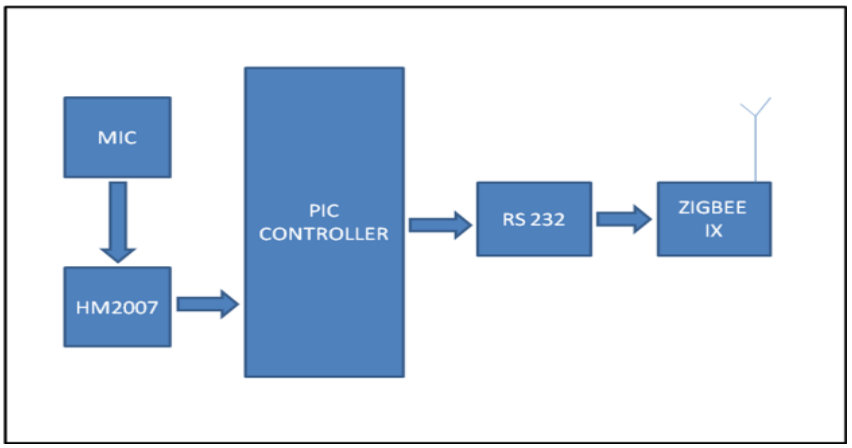

Figure 3. Block Diagram of Transmission

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Unit Wireless Control Systems

Wireless communication systems may be created by connecting stand-alone appliances at home or in the office and merging them to establish a cooperative network. The system is integrated using a mix of technologies such as Wi-Fi and Bluetooth. Figures 4 and 5 show how such a system is set up. The Universal Plug and Play feature is utilized to offer the user a transparent network of devices. The Open Service Gateway Interface is used by the system (OSGi). Different networking technologies are used to link the appliances. Web browsers and pocket PCs are used in the user application layer.It's also possible to utilize it to operate appliances. Device detection and connectivity are among the advanced features available. The system is entirely built on the Linux operating system. Intelligent control modules can be added to the system as well. Knowledge capturing and pattern recognition are capabilities of these control modules. For interoperability, the universal plug-and-play system employs a number of standard protocols. The system's interoperability is its most significant benefit. The dynamic discovery of the service is another benefit. It is a central console and an application Commands delivered by speech. Also capable of service sharing.

An Arduino board is used in conjunction with Wi-Fi communication technologies in the suggested system. It also features a second automated mode with temperature and light sensors that can be programd to manage the appliances based on the conditions. An Android smartphone is used in the system.

These servers act as a server while communicating with a home PC. The Arduino board is controlled by the PC, which is linked to it. MATLAB was used to create the user interface. Through the Internet, a mobile phone may interact with a computer. Wi-Fi is used to connect to the internet. The system, however, does not yet support this expansion. Remote access by phone is a benefit of the system. The disadvantage is that the computer must always be turned on. In addition, internet connection is reliant on Wi-Fi, which is unreliable and scarce.

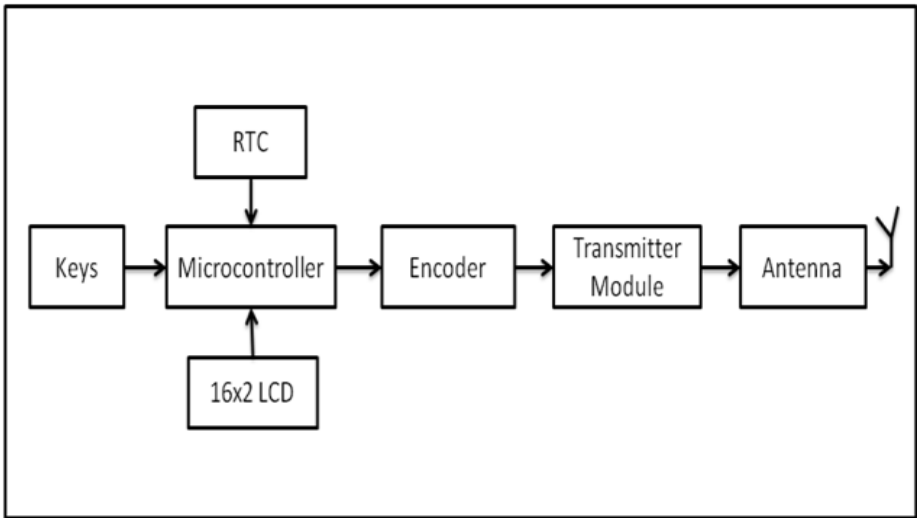

Figure 4. Block Diagram of Transmitter Section

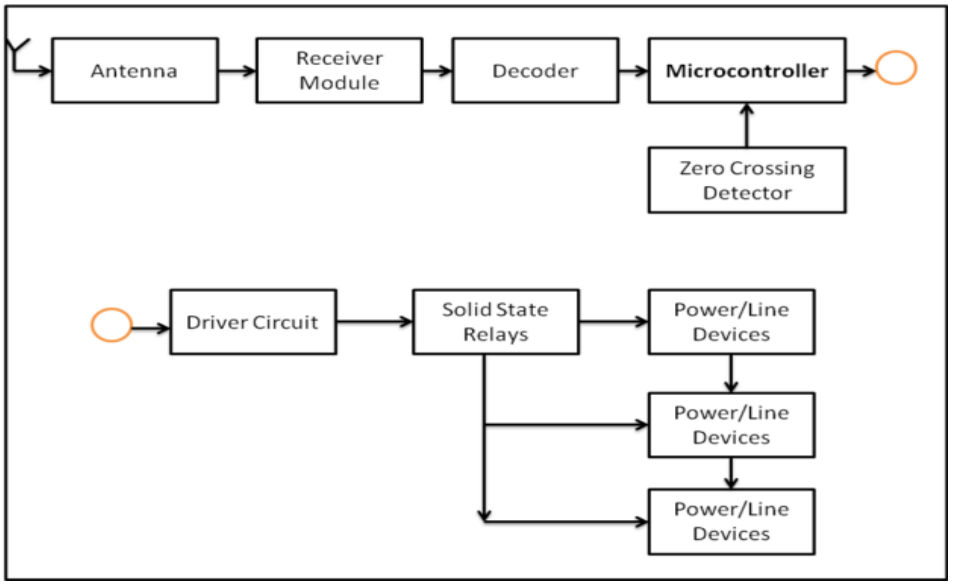

Figure 5. Block Diagram of a receiver Section

Mixed Type

GSM, Bluetooth, and ZigBee technologies are used to accomplish home automation. An Android application is used to interact with the user. This program converts a user's speech into a series of written commands. These orders are delivered to a different phone at home through SMS. This then sends the orders to a PIC controller over Bluetooth. This is referred to as a remote unit. The orders will then be sent to a ZigBee transmitter by this remote device. This sends the directives to the main controller through ZigBee. The controller decodes the orders and executes the necessary actions. It also uses ZigBee to communicate back status information. This system is functional and may be accessed remotely. However, because of the many controls and technologies used, the system might become costly. Furthermore, the SMS system might be unreliable.

A review of the many technologies that can be used in home automation is carried out. It discusses how contemporary networking protocols may be used to enable home automation in particular. It recommends that Internet Protocol (IP) be used to standardize home automation systems (IP). UPnP is a plug-and-play protocol that extends plug-and-play features. The report suggests that GSM networks be used as a backup, with a web-based application serving as the primary user interface. Wi-Fi and X-10 protocols are examples of technologies that may be used to assure home connectivity network. It also underlines the importance of a decent user interface.

The mechanism in action GSM and ZigBee are combined in an alternative home automation system. It sends orders from the faraway phone to the home phone through SMS. The system can employ GSM to deliver SMS alerts or automated calls to the user in the event of suspicious conduct. The user can take the necessary action by responding. The hardware is created with the help of Sony Ericsson T290i mobile phone set, ZigBee EM357 module, Atmega128 MCU (microcontroller unit). Both the ZigBee and GSM networks will be handled by the MCU. The sensors use the ZigBee technology to connect with the MCU. The complete system may be written in the C programming language. The household appliances are controlled by the relay. Due to the presence of the ZigBee network, the relays are segregated from the control section. The system's inexpensive cost and ease of usage are its main advantages. It also comes with home security, which is a nice bonus. It is not, however, a real-time system.

There are a variety of non-traditional home automation systems accessible. A system that combines GSM and an FPGA (Field Programmable Gate Array). This is owing to the FPGA's versatility, which may be configured. To meet the demands of the customers. In comparison to a microcontroller, it is also less costly. This aids in lowering the cost of such systems. A GSM modem is connected to the FPGA. To communicate with the gadgets, the modem is utilized. The FPGA makes judgments about how devices are controlled. The interface between the GSM modem and the FPGA is accomplished via a UART. One of the benefits of such a system is that it may be utilized in real-time. They provide security since they are hardwired and so cannot be hacked. They can also add or remove features based on the needs of the user.

3. CONCLUSION

This article highlights the qualities that an ideal system for home automation with remote access should have based on all of the systems studied and their benefits and limitations. An ideal system would be accessible to a user in real-time from anywhere on the planet. A GSM network has been identified as a potential possibility. To give an internet connection, however, the GSM data channel must be employed. The Internet is the only way to assure that access is available at all times. This will result in a uniform Internet protocol-based access mechanism for household appliances. A web application with a mobile application should be used as the user interface. In order for individuals of all types to have access to the system. It's also important for such a system to be simple to set up. Only then can economically feasible automated houses be possible. The design of the user interface for these apps should be carefully considered. The system's plug-and-play capabilities will be an extra plus. The ease with which a new gadget may be added to an automated home will be critical in moving the systems ahead commercially.

Home automation technologies have the potential to make houses increasingly smarter in the future. Sensors like motion sensors, light sensors, and temperature sensors can be integrated into homes to allow automatic device switching based on circumstances. More energy may be saved by confirming that the house is occupied before turning on gadgets, monitoring the brightness, and turning off lights when not in use. The technology may be tightly connected with home security solutions to provide homeowners more control and protection. The next stage would be to expand this technology to automate large-scale environments like offices or factories.

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