RF BASED HOME AUTOMATION SYSTEM

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Abstract - The project of automating house using RF technology with inclusion of microcontroller was created to automate the operation of traditional lighting mechanisms (switches on walls) in the home using an radio frequency controlled remote. This project calls for an RF remote that delivers ON/OFF signals to the receiver via a microcontroller (of the 8051 family) on the transmitter side. Receivers are attached to loads which can be toggled wirelessly by the operation of remote. Opto-isolators and triacs are used to connect the loads to the microcontroller. As a result, the technology provides an easy way to light up the house without having to make any physical moves. Houses are becoming smarter as technology progresses. Modern homes are gradually moving away from traditional switches and toward a centralised control system with RF-controlled switches. Currently, traditional wall switches are dispersed throughout the place or house, Creating intricacies for the user to get close enough for activating them. It becomes quite difficult for the old aged or disabled. With RF technology, a remote controlled home automationsystem gives a simpler option.

1.INTRODUCTION

The extension of a house to create an automation system is what home automation is all about. Because of its greater usefulness, the popularity of automation has exploded recently. Remote, smart phone, tablet, Wi- Fi, and Zigbee can all be utilised as controllers because of their versatility and simplicity. The main difficulty is the inability to control and access equipment from a remote place, which might result in energy waste. We are all aware of the critical necessity for energy conservation in every way imaginable. An android or a web application can be used to deliver instructions for these systems. These home automation systems enable users to communicate with a variety of electronic and electrical products, allowing them to better manage their operations. These qualities aid in the optimization and reduction of energy usage, as well as the system's low cost, which benefits the elderly and disabled. Our project mainly focusses to create and supply a secure automation of house that allows users to control loads or electric home equipment remotely, such as turning on/off lights, fans, air conditioning, televisions, and other household equipment.

1.1 LITERATURE SURVEY

Previously, the use of home automation was made. largely to cut labour costs Later, devices such as washing machines, water heaters, sewing machines, dishwashers, and textile dryers were designed to meet specific needs. The first general-purpose home automation network technology, which uses radio frequency for signal transmission, was invented in 1975. To operate the house appliances, we use a radio frequency remote control. The adoption of the wheel kicked off the automation system. By the time sailing

boats were introduced, the automation system had advanced significantly. The early 1900s saw rapid advancements in automation, culminating in the invention of electricity, which marked the beginning of home automation. During that time, we received the electronic lamps. Home automation became popular in the late 1990s all over the world. Apart from the remote control system, a worldwide system for mobiles and ZigBee were started at that time to operate that sector. Home automation has exploded in popularity in the twenty-first century, becoming a multibillion-dollar industry. Radio frequency remote control appliances were used to operate home automation utilising radio frequencies.

2.DEVELOPED HOME AUTOMATION SYSTEM USING MICROCONTROLLER AND RF TECHNOLOGY

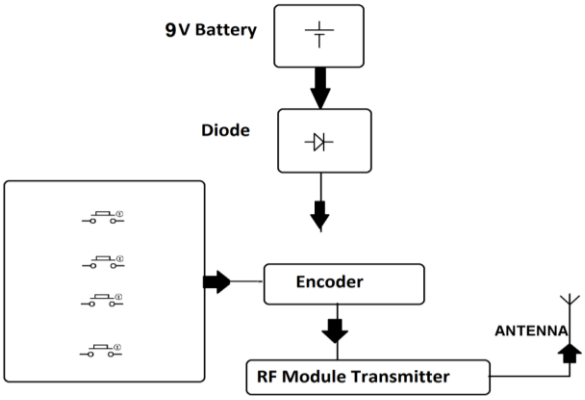
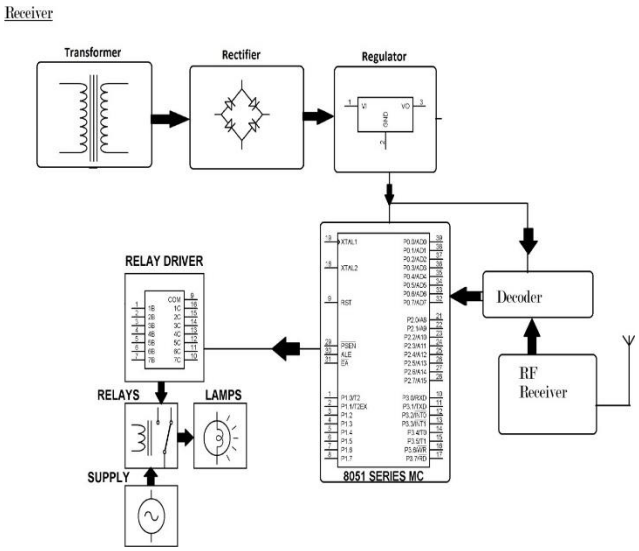


Fig 3.1 Block diagram



Both of the RF modules are turned on to ensure that our project works properly. This prevents the receiver module receiving garbage data during partnering with the transmitter. Once the modules have been successfully linked, the LED connected to the receiver module VT pin will light up. The data out pins of the decoder will now always be logic high because there will be no button pressed in the transmitter circuit. Once the microcontroller is turned on, all of the loads attached to microcontroller pins are turned off because the receiver receives a steady logic high signal.

On the LCD, the status of the loads is presented. This transition will let the microcontroller recognise when a key or button is pressed, allowing it to turn on the appropriate load as described in the code or program. If the same button is pressed again, the load is turned off by the microcontroller. When any key in the transmitter part is pressed, this Encoder Chip reads 4-bit information. This 4-bit parallel information is transferred to serial data by the Encoder IC, which is subsequently sent to the RF Transmitter.

This serial data is sent over radio signals by the RF transmitter. The serial data is received by the RF receiver on the receiving side via RF communication. The serial information is received by the HT12D decoder Chip. The Decoder IC translates serial data to 4-bit parallel information and send it to the microcontroller. According to the button pressed, the microcontroller will toggle the loads.

3.COMPONENTS USED

RF TRANSMITTER AND RECEIVER

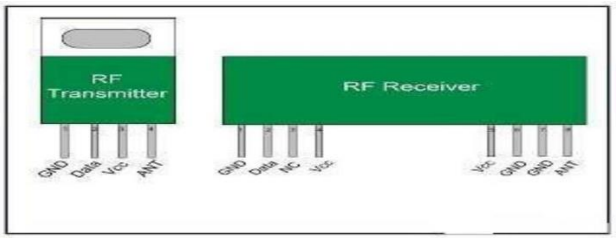


Fig 3.1 RF Transmitter and Receiver

For AM radio between 535 and 1605 kHz to computer LANs at 2.4 GHz, the term Radio Frequency has become synonym with wireless and high-frequency communications. RF, on the other hand, has defined frequencies ranging from a several kHz to around 1 GHz. This spectrum extends to 300 GHz if microwave frequencies are considered RF.

HT-12E IC ENCODER AND HT-12D IC DECODER

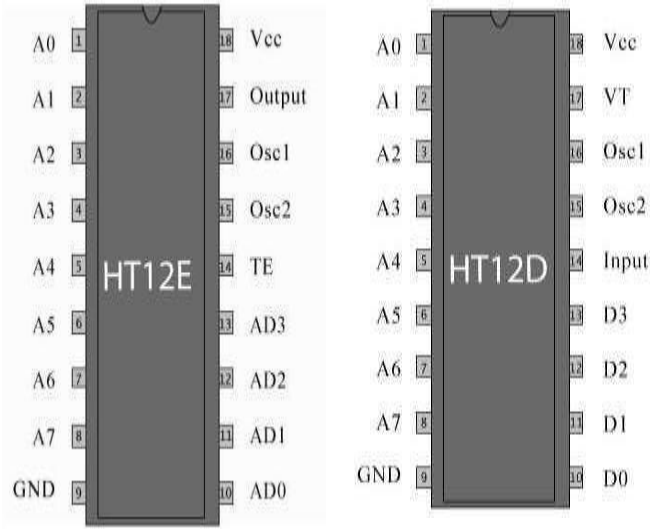


Fig 3.2 Encoder and Decoder

Only the HT12E and HT12D ICs can be used together. An encoder and decoder pair is made up of these two ICs. They're 12-bit encoders and decoders, which means they could send and receive 12-bit data. Your encoder IC, on the other hand, should not connect with another decoder IC, therefore an Encoder and Decoder Integrated circuit pair would share an 8-bit data address. That's why, of the 12-bits, 8 will be employed for setting the address, and the other 4 will be utilised to transfer data. We can make 16 different combinations using 4-bit data (24 = 16). RF or IR pairs are frequent applications for these ICs. If you're working on a project that requires sending 4-bit data from one end to the other by wire or wifi, this Integrated circuit pair is ideal. The Encoder integrated circuit of encoder that is used in conjunction with an radio frequency transmitter to convert n-bit data into serial form for transmitting data. The Decoder integrated circuit employed for decoding that is used in conjunction with an RF receiver to convert obtained serial data to parallel data.

MICROCONTOLLER

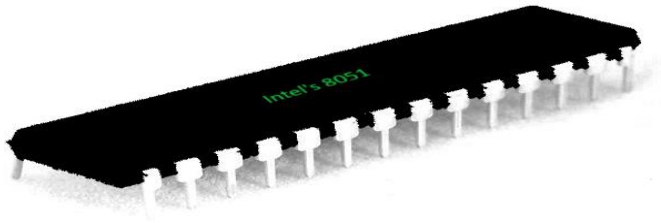


Fig 3.3 Microcontroller

A microcontroller is a small computer on a single metal-oxide-semiconductor (MOS) integrated circuit (IC) chip. A microcontroller contains one or more CPUs (processor cores) along with memory and programmable input/output peripherals.

Microcontrollers can take inputs from the device they controlling and retain control by sending the device signals to different parts of the device.

RELAY

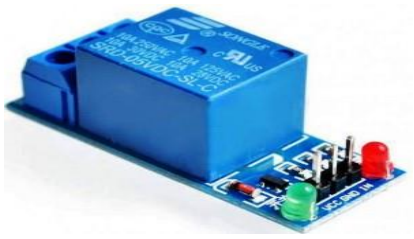


Fig 3.4 Relay

Our circuit operates at 5V and we need something to control 220V AC load, this is where a relay comes handy. This relay when triggered with 5V will toggle an electromechanical switch; this electromechanical switch is capable of candling 220V AC up to 10A current. Hence, our AC load can be connected to the terminals of the relay.

We can also build this circuit without using a relay module. In that case you would have to use an additional transistor like BC547 and drive it using a current limiting resistor to its base.

MAX32 IC

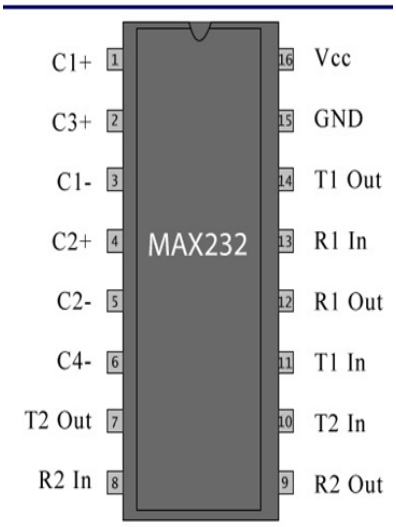


Fig 3.5 MAX32 IC

The MAX232 is an integrated circuit that converts signals from an RS-232 serial port to signals suitable for use in TTL compatible digital logic circuits. The MAX232 is a dual driver/receiver and typically converts the RX, TX, CTS and RTS signals.

The drivers provide RS-232 voltage level outputs (approx. ± 7.5 V) from a single + 5 V supply via on-chip charge pumps and external capacitors. This makes it useful for implementing RS-232 in devices that otherwise do not need any voltages outside the 0 V to + 5 V range, as power supply design does not need to be made more complicated just for driving the RS-232 in this case. The receivers reduce RS-232 inputs (which may be as high as ± 25 V), to standard 5 V TTL levels. These receivers have a typical threshold of 1.3 V, and a typical hysteresis of 0.5 V.

The later MAX232A is backwards compatible with the original MAX232 but may operate at higher baud rates and can use smaller external capacitors (0.1 μF) in place of the 1.0 μF capacitors used with the original device. The newer MAX3232 is also backwards compatible, but operates at a broader voltage range, from 3 to 5.5V.

LCD (LIQUID CRYSTAL DISPLAY)

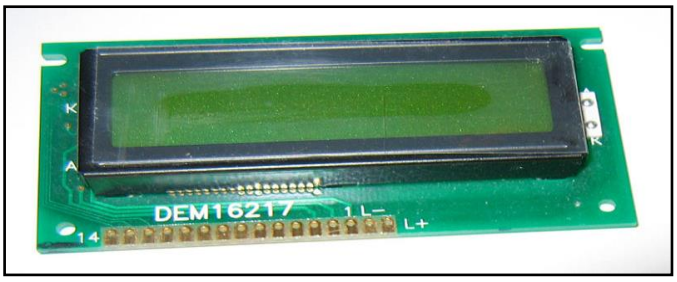


Fig 3.6 LCD

Frequently, an 8051 program must interact with the outside world using input and output devices that communicate directly with a human being. One of the most common devices attached to an 8051 is an LCD display. Some of the most common LCDs connected to the 8051 are 16x2 and 20x2 displays. This means 16 characters per line by 2 lines and 20 characters per line by 2 lines, respectively.

Fortunately, a very popular standard exists which allows us to communicate with the vast majority of LCDs regardless of their manufacturer. The standard is referred to as HD44780U, which refers to the controller chip which receives data from an external source (in this case, the 8051) and communicates directly with the LCD.

RESULTS

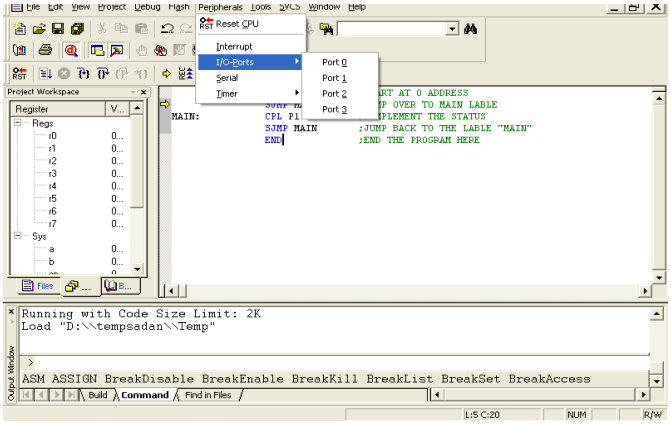
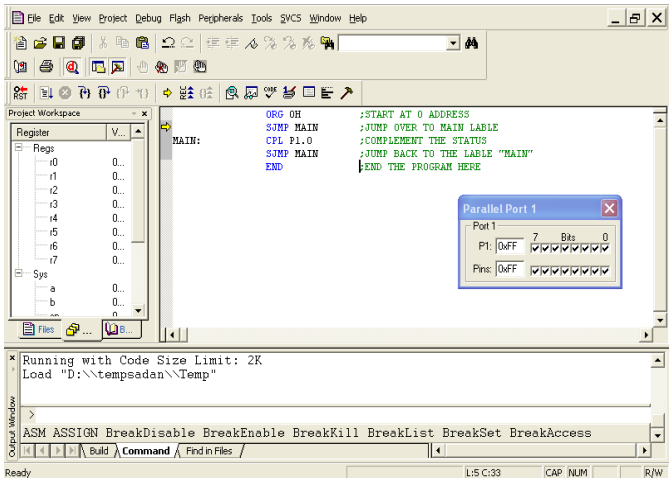


Fig 4.1 Code running successfully



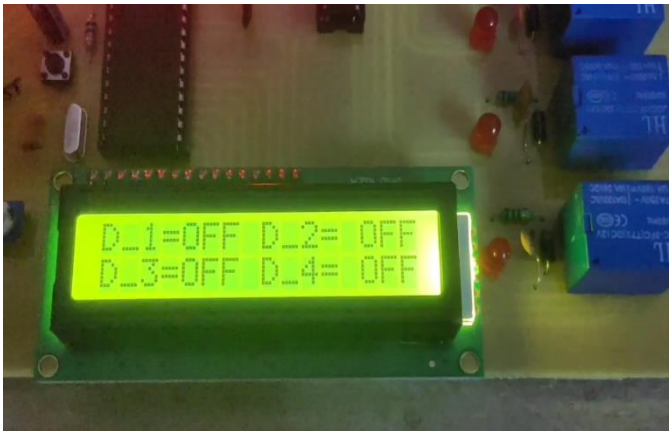


Fig 4.2 Load Status (off)

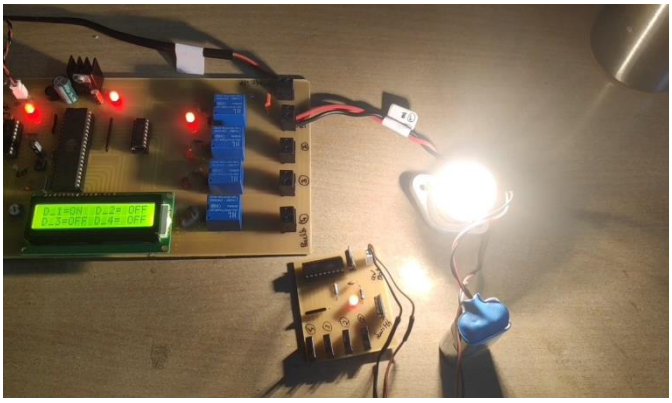


Fig 4.3 Load Status(on)

CONCLUSION

Homes are becoming smarter as technology advances. This project is developing an RF automation system. The system is intelligent, cost-effective, and energy-efficient. The automation system is the main approach utilised in this smart home systems for controlling and developing an acceptable construction to our system for fulfilling ambition of building a smart home. These homes can get intelligent without any manual effort thanks to the application of the four essential characteristics of an automation system. By regulating temperature and illumination, power supply, lighting, and temperature control systems help to maintain a sustainable condition. The security system aids in providing a safe atmosphere for the house's occupants. It could also save customers money on energy by using a smart control design.

FUTURE SCOPE

A Remote Control transmitter is used to transfer signals to a receiver. After receiving the signals from the Transmitter the receiver controls the system by turning on-off some different home appliances (as example, lights, heater, oven etc.). The home automation system which are available in the market are of high price, having lots of circuits and connections, but our model has low cost, easily affordable which uses minimum circuits. ϖ Hence this is a basic model, so depending on the requirement, this model can be upgraded.

This project can be useful for the people who want to use unconventional way to use switches and that can help to reduce exceeding use of energy and power, such as electricity. So overall it could be a beneficiary project for the practical, busy and urban life. However, this project can be upgraded by using GSM modern, which can control home appliances by sending an SMS. Benefits of using this technology is there will not be any range limitation compared to RF technology. The cost of the project is also not that high and it is also take less time to consume.

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