Controlling Home Appliances by IR Remote Control using Arduino Uno

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Abstract: ***In today's world, the requirement of controlling appliances is necessary to reduce human effort and utilize a maximum of the technology and doing it everything smartly and efficiently. With the increase in population, consumption of energy is also increasing and there is a need to conserve energy in every possible way either outside or inside the surrounding atmosphere. This paper discusses an emerging idea whereby only a single device can control various home appliances such as switching ON and OFF of appliances or loads. A single remote control is used to control several appliances, achieving a simple low-cost home automation system. In the proposed scheme, a circuit has been built that meets the requirements to control the house appliances through a remote-control device, portable in all parts of the room, and controlling appliances such as TV, fans, bulbs, heaters, etc.***

Keywords: *Arduino Uno; TSOP1738; potentiometer RV1-10K; LCD; Relay; AC source; IR sensor; connecting wires.*

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1. Introduction

In the old as well as in the present days, especially in villages, people generally operate their electrical and electronic appliances such as fans, lighting bulbs, coolers, etc. manually through switches of regular switchboards. This manual operation is an inconvenient method especially for old people or physically handicapped elders as well as for the young youth when the frequent switching operation is required. This type of method can be replaced by introducing or by using home appliances that can be controlled by remote control.

This method can be easily handled and it requires less manpower. It is more sophisticated, safe to use, and is more secure. With the increasing advancement in technology the concept of IoT (Internet of Things) came into existence and with the use of this concept, we can control appliances in our home.

Arduino is used for controlling the whole process. IR remote is used for giving the signal to the IR sensor, and then the signal is fed into the Arduino. Arduino sends the related signal to relays that are responsible for switching ON or OFF of the home appliances (e.g., fans, TV, bulbs, etc.) through a relay driver.

2. Proposed Methodology

The Block diagram in figure 1 shows the whole process of the system. Here, the TSOP 1378 module acts as the IR Receiver sensor which can receive IR signals of 38 KHz. It operates on 5V and consumes around 5 mA for its operation. It is connected to the microcontroller or Arduino to analyze the IR signal which is received from the remote when pressing any button. Microcontroller or Arduino Uno is interfaced directly with the TSOP 1378 it accepts the input data given by the TSOP signal and performs the required functions necessary for controlling the relay outputs. A relay is used as a switching element. It consists of several sets of input terminals of single or multiple signals interfacing with the Arduino output pins. The relay output pin is connected with the loads or appliances which is needed to be controlled.

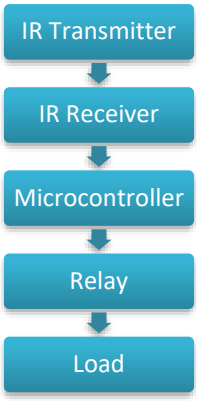

Figure 1: Block Diagram of Home appliances controlled by the IR remote using Arduino

3. System Design

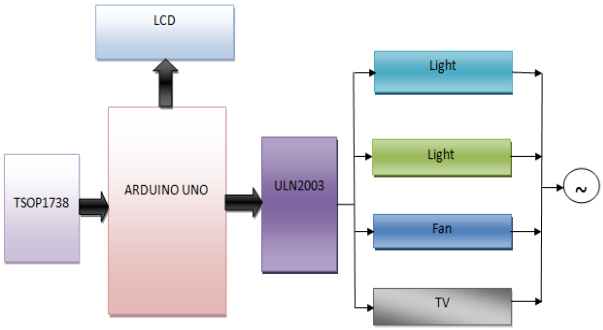

Figure 2: Circuit Design of Home appliances controlled by the IR remote using Arduino.

Signals or data which is sent by the remote at 38Khz is received by the Arduino for controlling the process from its input pins and the receiving data is analyzed, executed and output pins are connected to the relay so that it can perform the function of the appliances for switching action purposed required in the house. With every load or function performed by the appliances, the results will be shown in the Liquid crystal display (LCD) indicating which appliances are in operation.

3.1 Components Description

3.1.1 Arduino Uno (Uno R3)

The Arduino Uno R3 is a microcontroller board based on a removable, dual-inline-package (DIP) ATmega328 AVR microcontroller. It has 20 digital input/output pins (of which 6 can be used as PWM outputs and 6 can be used as analog inputs). Programs can be loaded onto it from the easy-to-use Arduino computer program. The Arduino has an extensive support community, which makes it a very easy way to get started working with embedded electronics. The R3 is the third, and latest, revision of the Arduino Uno.

Figure 3: Arduino Uno

3.1.2 TSOP1738

This IR sensor module consists of a PIN diode and a pre amplifier which are embedded into a single package. The output of TSOP is active low and it gives +5V in the off state. The **TSOP1738** module has an inbuilt control circuit for amplifying the coded pulses from the IR transmitter.

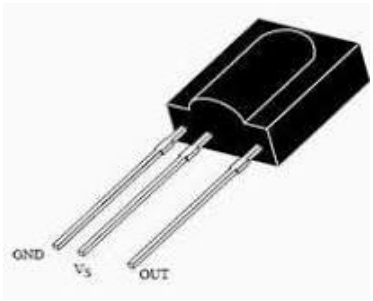

Figure 4: TSOP1738

3.1.3 IR Sensor

An infrared sensor is an electronic device that emits to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detect motion. The IR transmitter sends an infrared signal which, in the case of a reflecting surface (e.g., white colour), bounces off in some directions including in the direction of the IR receiver which captures the signal detecting the IR sensor object.

Figure 5: IR Sensor

3.1.4 ULN2003

The ULN2003 module is a high voltage and high current Darlington array IC. These ICs are used when driving a wide range of loads and are used as relay drivers, display drivers, line drivers, etc. ULN2003is also commonly used while driving Stepper Motors.ULN2003 operates on 5V and TTL (Transistor-Transistor Logic) and CMOS (Complementary Metal Oxide Semi-Conductor). Its pin configuration is designed so that the input pins are on the left side of the IC whereas the output pins of it are on the right side in front of the corresponding input pin.

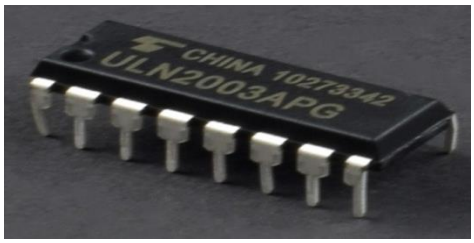

Figure 6: ULN2003

3.1.5 Relay 5V

The relay module is a separate hardware device used for remote device switching. With it, you can remotely control devices over a network or the Internet. It works on the principle of an electromagnetic attraction. When the circuit of the relay senses the fault current, it energizes the electromagnetic field which produces the temporary magnetic field. The current flows through the coil produces the magnetic field around it.

Figure 6: Relay 5V

4. Working Explanation

Here, the IR remote act as the transmitter and the 1738 module works as a receiver which is of 38 KHz frequency. When a button is pressed from the IR remote which uses 38 KHz of carrier modulating frequency, it sends a signal which is in the form of an encoded pulse. The generated pulses sent by the remote control are received by the TSOP 1738 which is connected to the Arduino and is read by the Arduino. It decodes the received train of pulses into hexadecimal code value and compares that decoded value with the predefined hex value of the pressed button. If there is a match occurs, then Arduino performs relative operations and the corresponding result is displayed on 16*2 LCD with the appropriate command. For testing and experiment purposes in this project, we have used three bulbs that represent fan, light, and TV.

An IR receiving breakout detect the IR signal and decodes it as HEX code, then it displays it on the serial monitor to read what the remote control sends. When any button on the remote control is pressed, the serial monitor shows the hexadecimal code of that button. Every button on the remote control has a corresponding hexadecimal code. On pressing any button, it shows the HEX code on the serial monitor, as well as the IR transmitter and receiver module. Keeping the IR LED on the remote control close and opposite to the IR detector shows better signal reception.

5. System Implementation and Analysis

An IR receiving breakout detects the IR signal and decodes it as decimal code, then displays it on the serial monitor to read what the remote control sends.

5.1 Results

Table 1: Decimal code shown in the serial monitor

KEY 1	551520375
KEY 2	551504055
KEY 3	551536695
KEY 4	551512215
KEY 5	551528535

Table 2: When key is pressed from the IR remote and its loads response

Keys	Appliances	Fans (Bulbs)	TV (Bulbs)	Bulbs
1	ALL	ON	ON	ON
2	FAN	ON	OFF	OFF
3	TV	OFF	ON	OFF
4	BULBS	OFF	OFF	ON

6. Conclusion and Future Recommendation

In this paper, controlling of home appliances by IR remote using Arduino board controller for home appliance (fan, TV, bulb) is successfully demonstrated. This system is cheap, reliable, and

easy to install. It also has scopes to enhance several devices by appropriate circuits, as the cost involved is moderate and more efficient. Hence, remote monitoring can put our minds at ease while we're away from the house. With remote dashboards, lights and lamps can be turned ON and OFF, and automated blinds can be raised and lowered.

In today's world, every system has been upgraded to an automatic or smart system. Then why not an automatic home appliance controlling from the IR remote? It can operate in domestic as well as in industrial applications. This work can also be upgraded to a smart home automation system including some sensors like light sensors, temperature sensors, and safety sensors, etc, and automatically adjust the different parameters in the room.

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