Remote Controlled Automatic Power Saver

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ABSTRACT
People often become unaware and forget to switch off lights, electric fans before leaving the room. This switched on electric loads cost several amount of power. A remote controlled method of power saving has been implemented by using the voltage driving the vibration motor of the mobile phone so that user can switch off the household loads by certain number of ring counts while giving missed call to a dedicated mobile phone even after they forget to switch off while leaving.

General Terms
Security, Remote Control, Power Saver

Keywords
Mobile phone, vibration motor, astable multivibrator, binary up-counter, decoder, electromagnetic relay

1. INTRODUCTION
Mobile phones have become integral part of our daily life since last two decades[1][2]. A vibration motor is included in a mobile set to indicate call or message service to the user[3]. Each good working handset contains a vibration motor attached to mobile's main circuit board so that whenever it gets voltage from circuit board it starts functioning[2]. The mobile vibration motor generates about 3.5 to 4.5 volt to start vibrating which is provided by mobile circuit board time to time whenever there is a phone call. This work aims at sensing the vibrations produced by a mobile, when it receives a call from another mobile, and using these vibrations as signals to switch multiple appliances working on 230V, 50Hz AC supply. The idea is applied with the help of counter and decoder circuits to count the number of rings or pulses from that missed call and switch off the particular appliance after certain number of counts through a relay circuit. This work can be considered as a step towards automation of homes and offices, also known as Smart Home Technologies.

The main goal of the system is on using the mobile phone vibration functionality to switch off/on the household loads. A missed call will be given to a mobile to produce vibration mode and count the number of rings or vibration produced by it and after predefined count number is reached, different electrical loads can be switched off.

The social significance and advantage of this idea lies in the need of automatic control of appliances, accessible from anywhere in the world and also to minimize the cost as much as possible.

2. BLOCK DIAGRAM

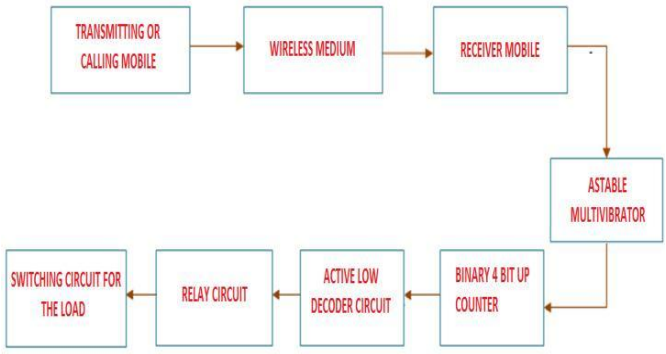

Fig 1: Block diagram of the work

A vibrating alert is a feature of mobile phone devices to notify the user of an incoming call connection. Each good working handset contains a vibration motor attached to the main circuit board of the handset so that whenever it gets voltage from circuit board it starts functioning. Vibration is produced by motor due to an uneven load attached to it. The mobile vibration motor requires about 3.5 to 4 volt (4.75 volt is achieved in the experiment) to start functioning which is provided by mobile circuit board whenever a call comes.

The vibration voltage received at the receiver handset is around 4.75 volt pulse from each ring produced at the receiving mobile. This voltage is fed to the power supply of an astable multivibrator designed through a NE 555 timer IC to generate appropriate clock pulse to be fed to drive the 4 bit binary up counter[4][5]. The resistance and the capacitance values are so chosen that the time period output of the astable multivibrator should be equal to one mobile ring period with equal time shared for on time and off time. This pulse is to be given to the counter so that the counter can count the number of rings to the receiving handset.

Fig 2: Snapshot of the handset being used in this work

3. 4 BIT BINARY COUNTER

IC 74HC193 is used to design the 4 bit binary synchronous up counter[6]. This IC provides preset and clear options with both up and down counter options. The circuit connections are shown in the figure 3.

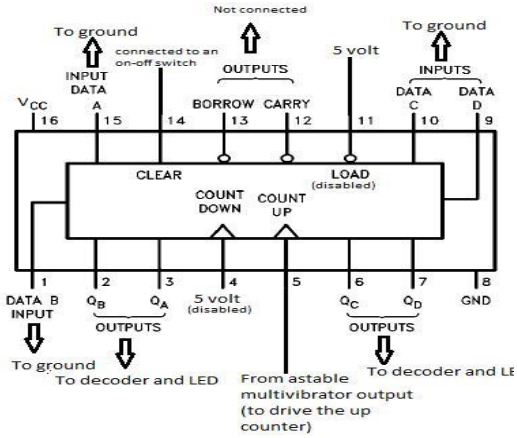

Fig 3: 4 bit binary up counter circuit connections

The necessary up counting is achieved by providing the clock pulses from the astable multivibrator outputs to the "count up" pin. The count is increased after every clock pulses, or after every ring in the rising edges of the clock. Count down operation is disabled by giving the high voltage to "count down" pin. The parallel loading is also disabled by giving high voltage to "load" pin. The clearing of the flip-flop outputs is necessary after each operation. So "clear" pin is connected through a switch.

The 4 bit counter outputs are fed to the LED and also to a decoder to generate 16 distinct outputs from the 16 combinations (though in one single call, only 12 times the rings occur)[7]. For example, if user wants to switch off an electric load after 4 rings, he will ring the receiver handset for at least 4 times. The decoder will generate a low pulse after 4 ring pulses and the relay circuit enables which will ensure switching off the load.

4. DECODER ARRANGEMENT

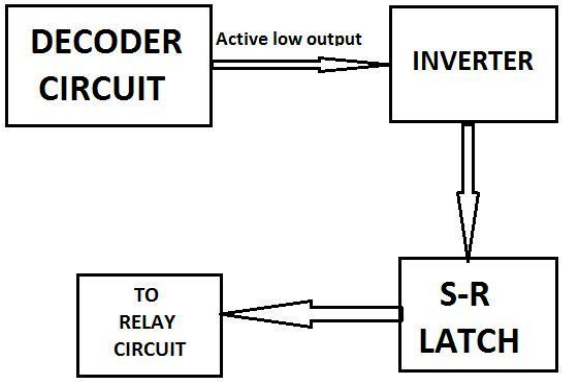

Fig 4: Block diagram of post decoder circuits

The decoder is fed from the counter outputs. The selected active low outputs from the decoder are fed to an inverter to get active high output. The selection of output is up to the user as user will decide which combination or how many rings will be able to switch off the load selected. In this process we can connect 12 possible loads for each of the 12 rings to be switched off by the predetermined value. The decoder connections are shown in the figure 5.

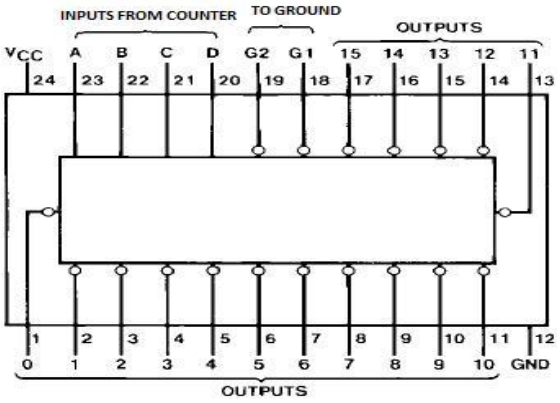

Fig 5: Necessary circuit connections for decoder circuit

Decoder 74LS154 is used as a 4 to 16 active low decoder[8]. Pin "G1" and "G2" are kept low for normal operations.

5. SR LATCH ARRANGEMENT

SR latch IC is used to latch the output after predecided combination is received. This is done to ensure that the electrical loads remain switched off even after user exceeds the predecided number of rings. As the outputs get latched, the inputs will no longer be able to affect the current state of the outputs any more ensuring proper and permanent switching off of the electrical loads.

IC HEF4043B is used for latching purpose[9]. The IC circuit diagram is shown in the figure 6. It is a quad R/S latch with 3-state outputs with a common output enable input (OE). Each latch has an active HIGH set input (1S to 4S), an active HIGH reset input (1R to 4R) and an active HIGH 3-state output (1Q to 4Q).

When OE is HIGH, the latch output (nQ, n varies from 1 to 4) is determined by the nR and nS inputs as shown in Table I. When OE is LOW, the latch outputs are in the high impedance OFF-state (Z). OE does not affect the state of the latch.

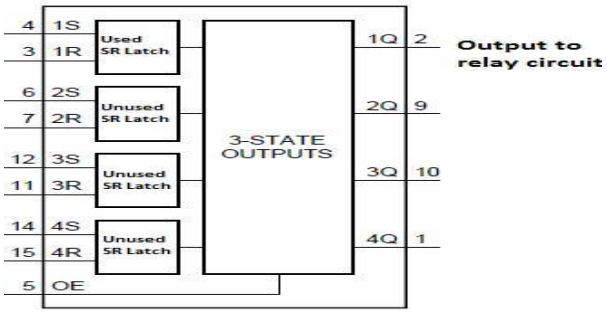

Fig 6: Necessary circuit connections for SR-Latch circuit

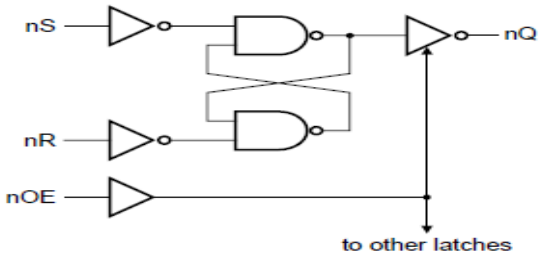

Fig 7: Logic diagram of a single latch[9]

Table 1. Truth Table for SR Latch[9]

Inputs			Outputs
OE	**nS**	**nR**	**nQ**
L	X	X	Z
H	L	H	L
H	H	X	H
H	L	L	Latched

The SR Latch of pin 3, 4 has been used. The inverted outputs from the decoder is given to the 'S' input whereas the reset 'R' input is kept low. OE input is kept high. So, the output will never reach to high impedance state. When an active high input comes to the 'S' input, the output become high and become latched when it gets low. In this process the desired high state can be retained even if user exceeds the desired number of ring counts.

A current amplification arrangement has been done after the SR latch output by an npn transistor BC 547 connected in common emitter mode. BC 547 has a current amplification gain in the range of 100 - 800. This amplified current is applied to drive the relay.

6. ELECTROMAGNETIC RELAY CONNECTION

A single pole double throw electromagnetic relay has been used for the work. When the relay is energized by the high voltage from the SR latch IC, the 'common' and the 'normally open' terminals get connected and the already connected terminals between 'common' and 'normally connected' terminals get broken. A high voltage source to drive an electrical load is connected through the 'common' and 'normally connected' terminals. So when relay gets energized, this connection is broken and thus the load gets switched off.

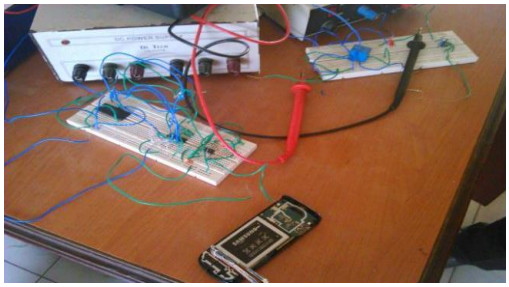

Fig 8: Snapshot of the entire work

7. POSSIBLE APPLICATIONS

1. This system can be easily used in the daily home automation system.
2. This system can be implemented to switch on our air-conditioners hours before we reach our homes from office, so that we enter into cool rooms.
3. Another application can be to turn on/off refrigerators without going near them.
4. The major application of the system is attributed to turn on/off lights and fans wirelessly, without even touching their switches and from anywhere in the world.
5. This system can be helpful to trigger an alarm wirelessly from any distance away, in case of burglary.

8. ACKNOWLEDGMENTS

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