HOW STUFF WORKS

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AIM: To explore the components and functioning of a ***Car Locking System*** comprising of:

1. A Remote
2. A Control Box
3. An Actuator

REMOTE:

A remote is the primary component of a car locking system. It may be having only one way communication, i.e., sending of signals from the remote to the control box placed in the car or a two way communication system in which the control box in the car can also send back the signals to the remote. Further, one can have a manual remote or a remote that has an LCD display.

The two types of remotes that we are going to use are:-

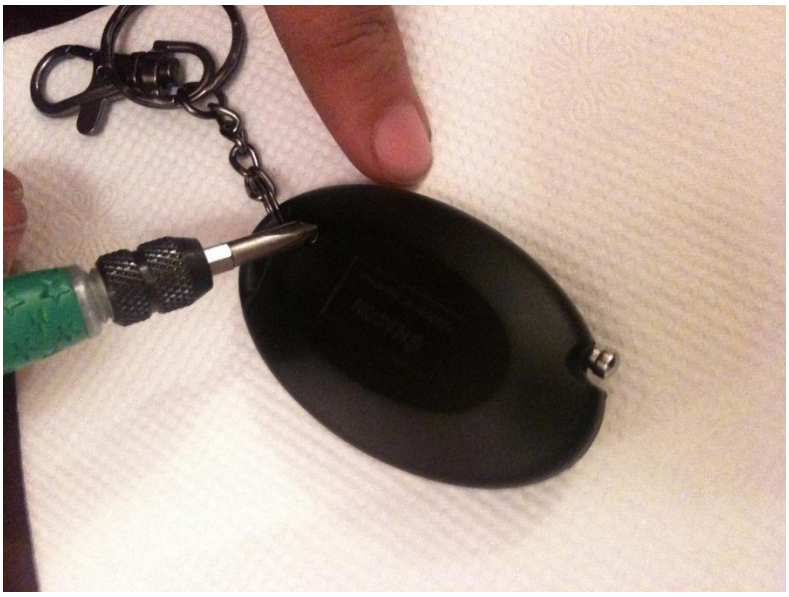
TX-08(one way remote without LCD display)

The one way communication car remote also called as TX-08 remote is used in car locking systems. It is one of the most common and basic design used in the car locking system industry.

As one can clearly see on the shell of the remote there are three buttons, a LED light and a switch. The buttons clearly indicate their functions of lock, unlock and silent lock. Further on prolonged pressing of the lock button

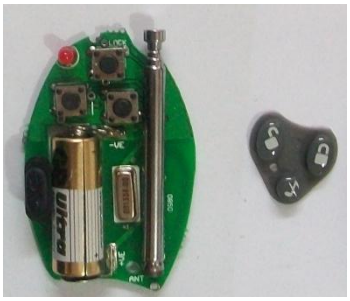
the car gets bypassed, that is, the car would no more respond to an attempt of theft and therefore it will not ring the alarm. The lock button has another option of search, the bypass option is valid only for a period of 30 seconds or as programmed by the operator but after this period of time prolonged pressing of the lock button on the remote would give the search option in which the siren starts to ring till the time the lock button is pressed upon. The switch on the remote is responsible for switching off and switching on of the remote that is, simply powering it on or off.

Now moving on to opening the remote, one can open the remote by loosening the screw at the back of the remote.



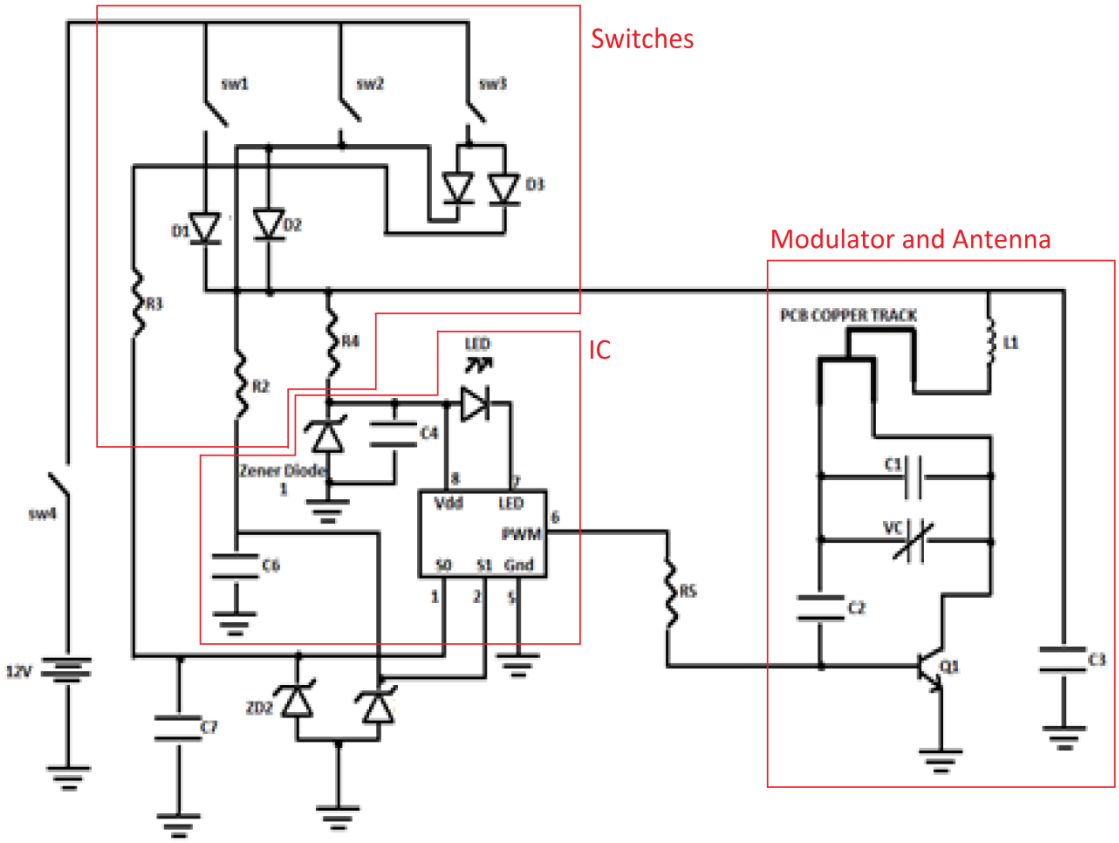
As one opens it, he sees a 12 volt battery, an eight pin IC along with some soldered connections.

As we invert the remote chip we see the 3 buttons, the LED, the power on switch, the antenna and last but not the least the modulator. There is also a rubber pad which gets attached on top of the buttons on the chip.



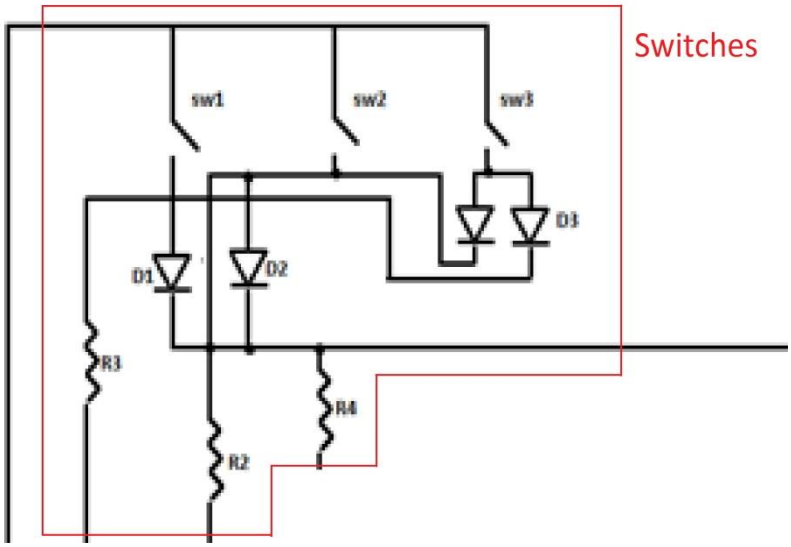
Circuit diagram

The circuit of the TX-08 remote can be clearly divide into three parts the buttons, the IC and the modulator.



The Buttons

The buttons are actually switches which on one side are connected to the 12 volt battery and on the other side to their respective diodes.

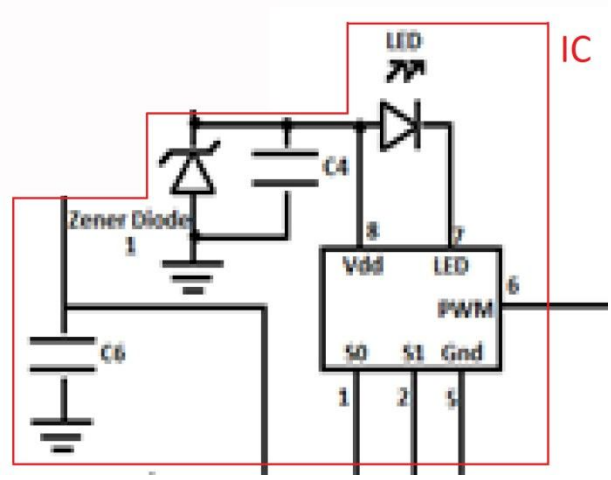


The lock button is connected to diode 1 which in turn leads it to the zener diode and the led via the resistor R4.The unlock button has its own diode which again has the same connection as lock button to the LED. The switch three can be used for two purposes either as an auto start option (by pressing the button the car starts by itself) or the silent lock. This particular feature is programmed in the post factory manufacturing. In the remote we are using the third button (switch) plays the role of silent lock. The third switch has two diodes

because we would send two inputs to the IC from this switch.

The IC:

The IC number is HCS200. The IC has 8 pins; the first two pins are responsible for the inputs coming from the switches. The 5th pin is for grounding, the 6th pin is responsible for the output which is taken as the input by the modulator. The 7th pin corresponds to the LED, while the 8th pin is responsible for the VDD of the LED. The 3rd and 4th pins are used during post factory manufacturing to program the IC.



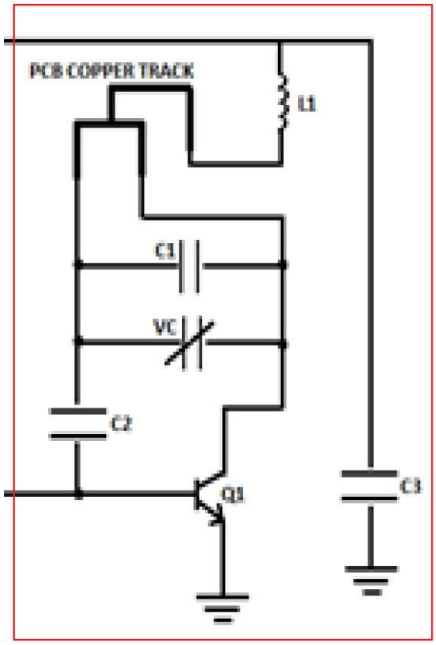
The 1st pin or the S0 of the IC is connected to SW1 via R3, the 2nd pin or S1 is connected to SW2 while SW3 is

connected both to S0 and S1. Whenever the user presses the lock button, a signal is sent to S0 in the IC which then accordingly gives the output for the VDD and LED, i.e., the 7^{th} and 8^{th} pin of the IC along with the PWM output or 6^{th} pin of the IC which leads to the modulator. Similarly, for SW2 or the unlock button the signal is sent to the IC in the 2^{nd} pin or S1 which accordingly gives the output in the 6^{th}, 7^{th} and 8^{th} pin representing PWM, LED and VDD resp. as for the SW3 or the silent lock button, the signals are sent both to S0 and S1 and correspondingly the outputs are given in PWM, LED and VDD pins.

The Modulator and Antenna:

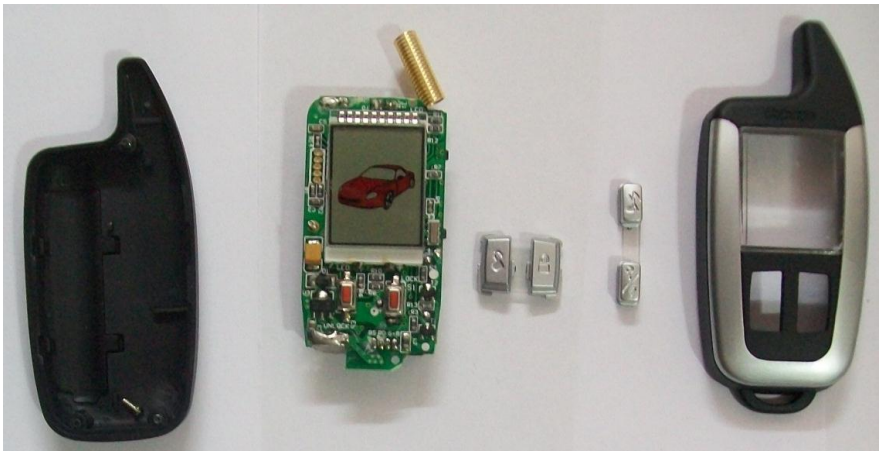
The modulator is responsible for creating carrier wave and messenger wave which is then sent via the PSB copper track (antenna) to the control box. Within the modulator the carrier wave is generated by the capacitor C1 and the messenger wave is generated by capacitor C2. The overall wave is finally transmitted using the antenna that is nothing but the PSB copper track itself.

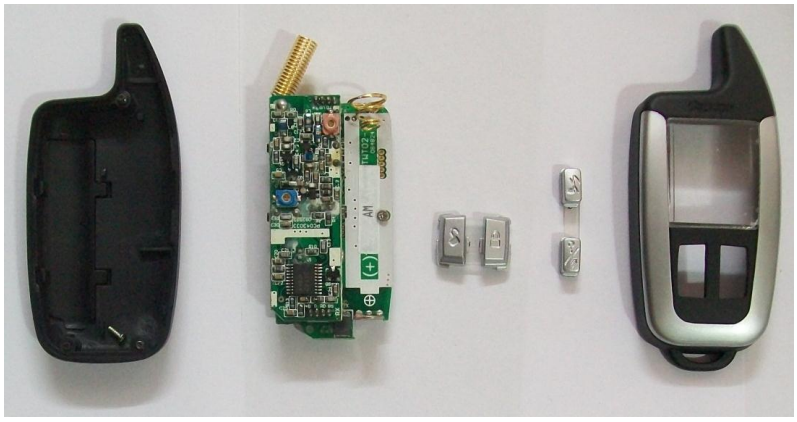
Modulator and Antenna



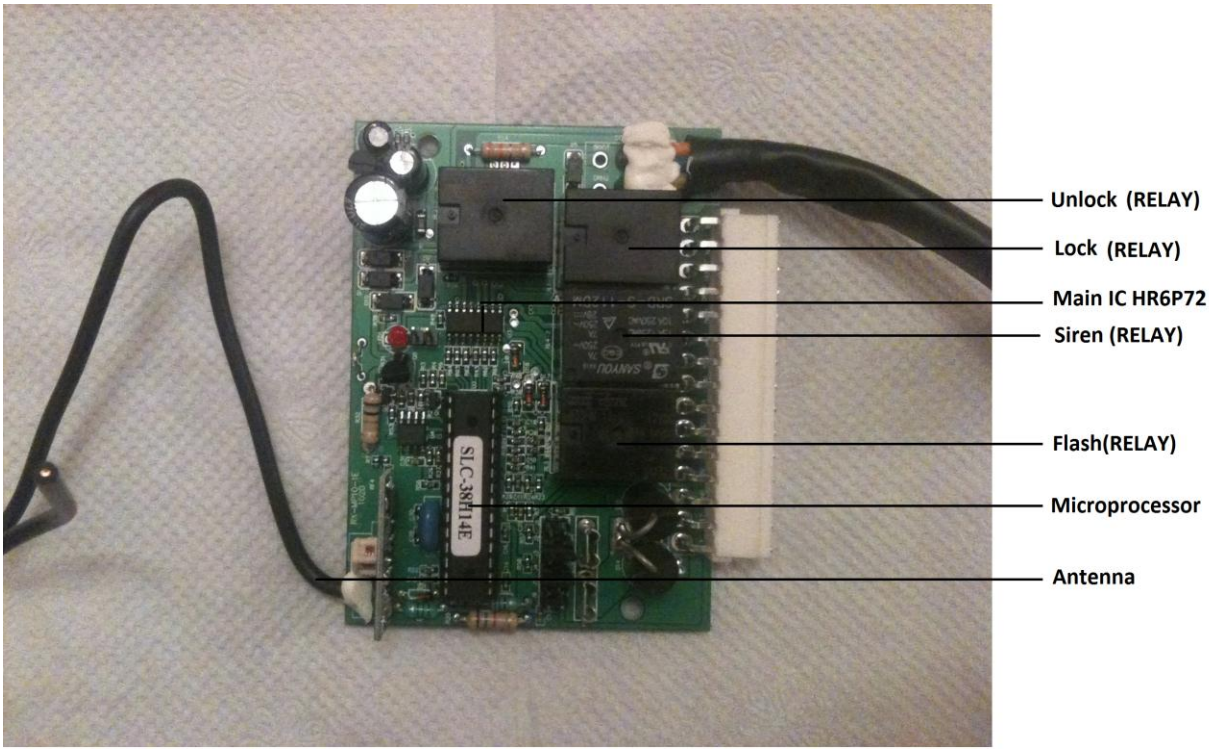
FMTX (two way communication remote with LCD display)

This particular type of remote has two chips, one for receiving the signals and displaying the output on the LCD and the other for sending the signal to the control box.





CONTROL BOX:



The control box is placed in the car and is responsible for converting the wave signals into electric signals which are then sent to the actuator. Within the control box there is an antenna which catches the signals and sends them to the demodulator. Here in the demodulator the carrier wave is separated from the messenger wave and the latter is sent to the microprocessor. In the microprocessor the signal is decoded and the output of the microprocessor is connected to the input of the HR6P72 IC in the control box. The

HR6P72 is the main IC in the control box that is connected to the relays.
The RELAYS are responsible for sending different output signals to different parts such as the actuator and the siren.

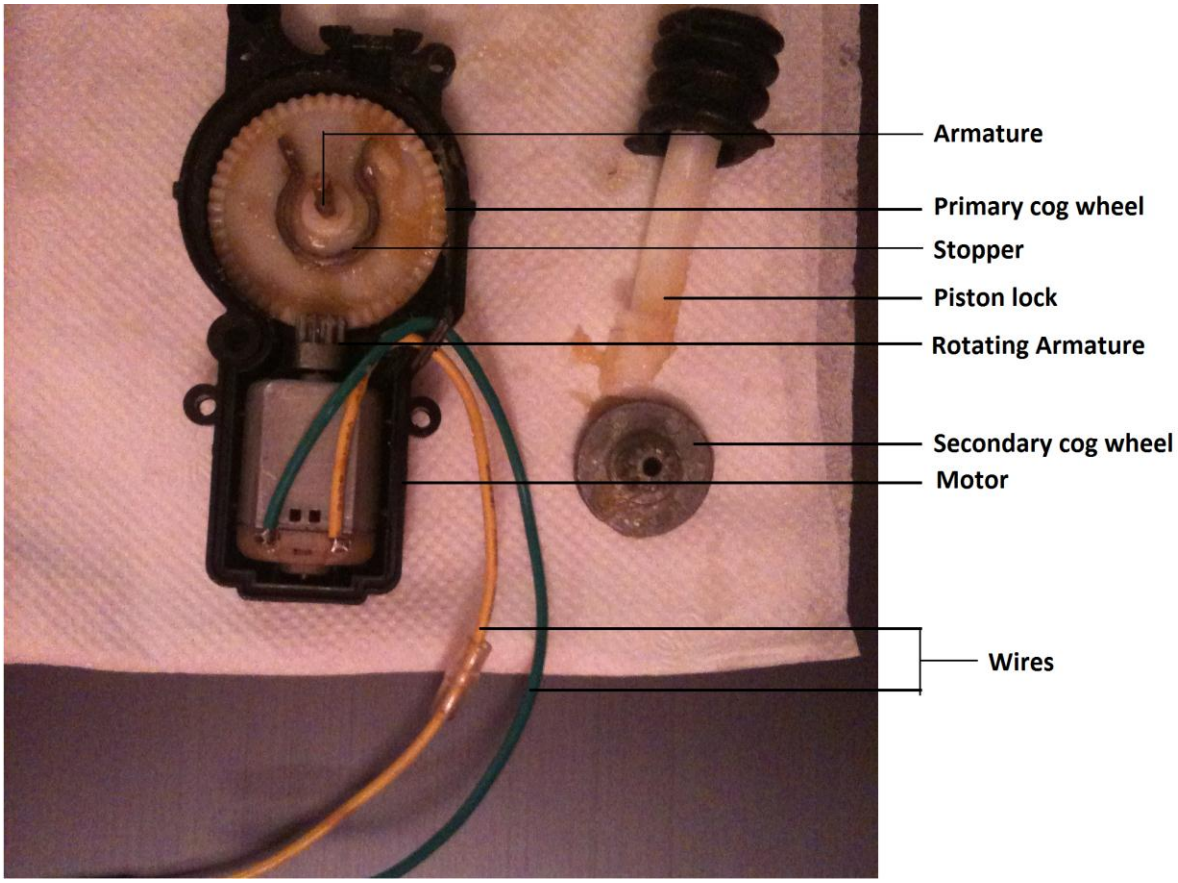
ACTUATOR:

It is the mechanical part of the car-locking system and it is connected to the control box with wires.

The master actuator(Drivers seat) has 4 wires(Extra two used to connect other slave actuators) while the rest three have 2 wires. These 2 wires(Positive and Negative) control the functioning of the actuator directly. If these wires are interchanged the functionality of the actuator is reversed i.e. it ‘unlocks’ when we press ‘lock’ and vice-versa.

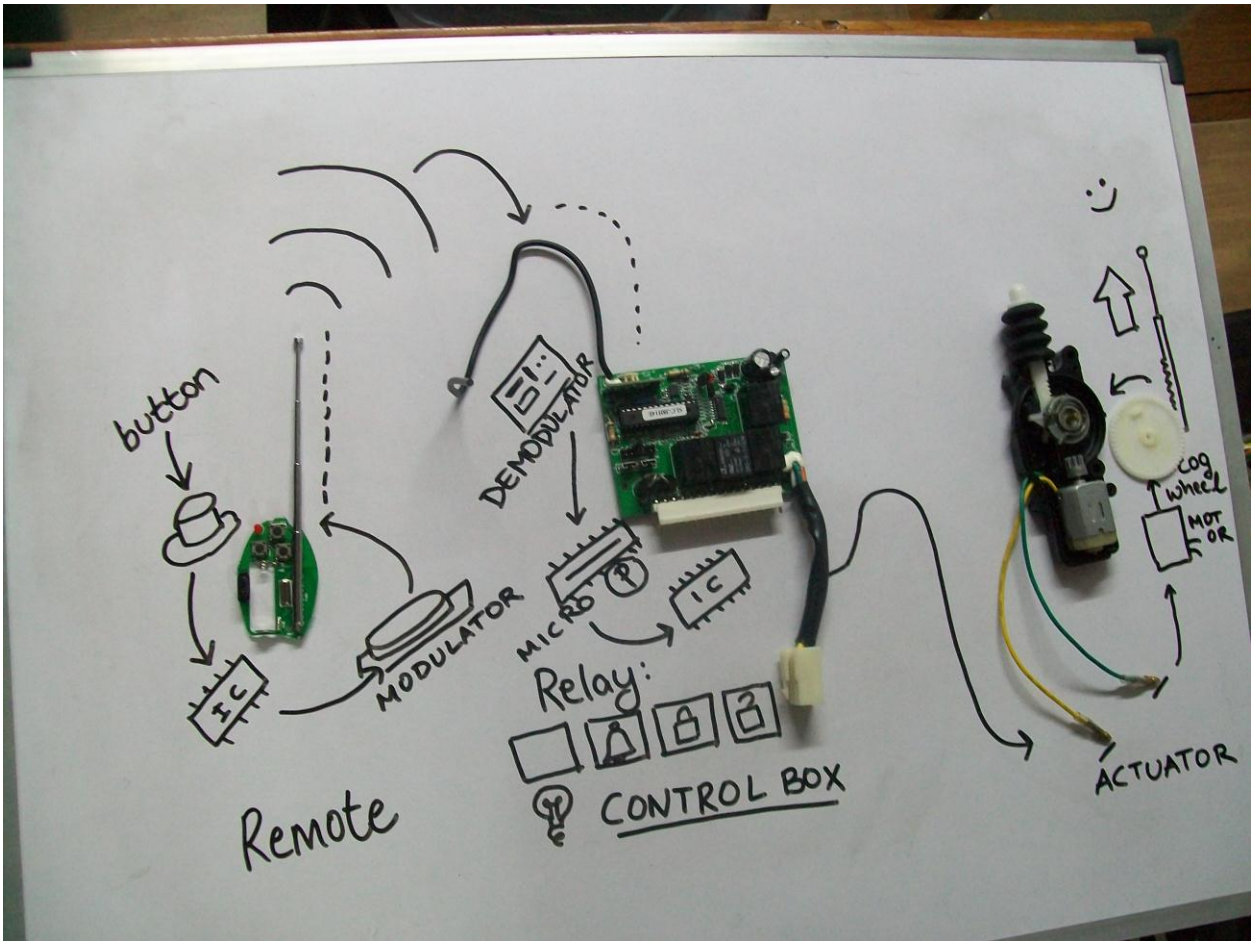
There are 2 types of actuators namely Repairable(The one we have opened) and Irreparable(Can’t be opened).

Functioning of Repairable Actuator:



It consists of a **motor** and an arrangement of **cog wheels** (gears) that control the movement of the **lock piston**. Also there is a **stopper** which controls the extent of movement of the piston by mechanically stopping the motor after a fixed rotation. The motor is connected (via 2 wires) to the control-box which has a basic function to decide the direction of motor rotation.

SUMMARY:



https://www.dropbox.com/s/kmso0hcvker3vlf/How%20Stuff%20Works.mp4

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