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AN AUTOMATIC CAR ANTI-THEFT ALARM SYSTEM

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ABSTRACT
The theft of cars and other automobiles by criminals has become so frequent in our society as to be classified as alarming. Most of the thefts are organized by gangs of robbers but sometimes individuals engage in this activity. The result usually, however, is that the persons from whom the vehicles have been stolen are left to grieve as many of these vehicles are never recovered. This paper describes a simple alarm system that can be easily installed in all kinds of vehicles. The system described will effectively defeat intended car thieves.

KEYWORDS: vehicles, car theft, alarm, transducer, detector logic network

INTRODUCTION
Vehicles and especially private cars, in spite of their ubiquity, are treasured possessions of individuals and are jealously guarded not only to prevent them from being stolen but also to prevent unauthorized users from gaining entrance into them. The efforts that have been exerted by vehicle owners to deter thieves have generally met with little success. The recent trend has been towards the use of electronic methods to prevent or minimize the theft of cars. Some of these methods are not only expensive but too sophisticated for easy deployment by car users. The alarm system described here is effective and also simple to use and can be deployed in most vehicles without the attendant problems of space constraint.

SYSTEM BLOCK DIAGRAM
The block diagram of the alarm system is shown in Figure 1[1]. The whole system is powered by a 12-V car battery. The power switching device and the car ignition switch route this 12-V dc supply to the rest of the circuitry through the alarm switch. The alarm trigger network consists of a bank of switches that monitor the opening and closing of doors of the vehicle or any other appropriate points determined by the user. When any of these switches is triggered the detector logic network acts in conjunction with the delay and driver circuits to send an audible signal to the output transducer (usually a loudspeaker). The feedback logic network ensures that once the alarm is triggered it cannot be defeated by the criminal hastily closing the door of the car. The inhibitor network, together with the delay circuit, allows the owner of the vehicle to regain entrance into the car without triggering the alarm.

SCHEMATIC DIAGRAM
The block diagram depicted in Figure 1 can be realized with the schematic diagram shown in Figure 2. The alarm network is connected to the 12-V battery of the car through the power switch consisting of transistors Q5 and Q6. The circuit is powered automatically when the car ignition is switched off. This removes the problem of forgetfulness on the part of the driver. A delay time of a few seconds is provided to enable the driver to get out of the vehicle before the alarm circuit is powered.

This delay time is provided by the resistor R_d and capacitor C_d. The relay RLY is in the normally closed (NC) position. It is thus seen that while one input of the Nand gate G1 is at the high logic level the other is at the low logic level causing its output to be high. The switches that monitor the doors are S1, S2, S3 and S4 and none of them has been depressed yet. This means that Q2 is turned off and the input to Nand gate G2 through D5 is high. The output of G2 is therefore in the low state thereby ensuring that transistor Q3 is turned off and this causes RLY to be switched to the normally closed (NC) position. There is then no

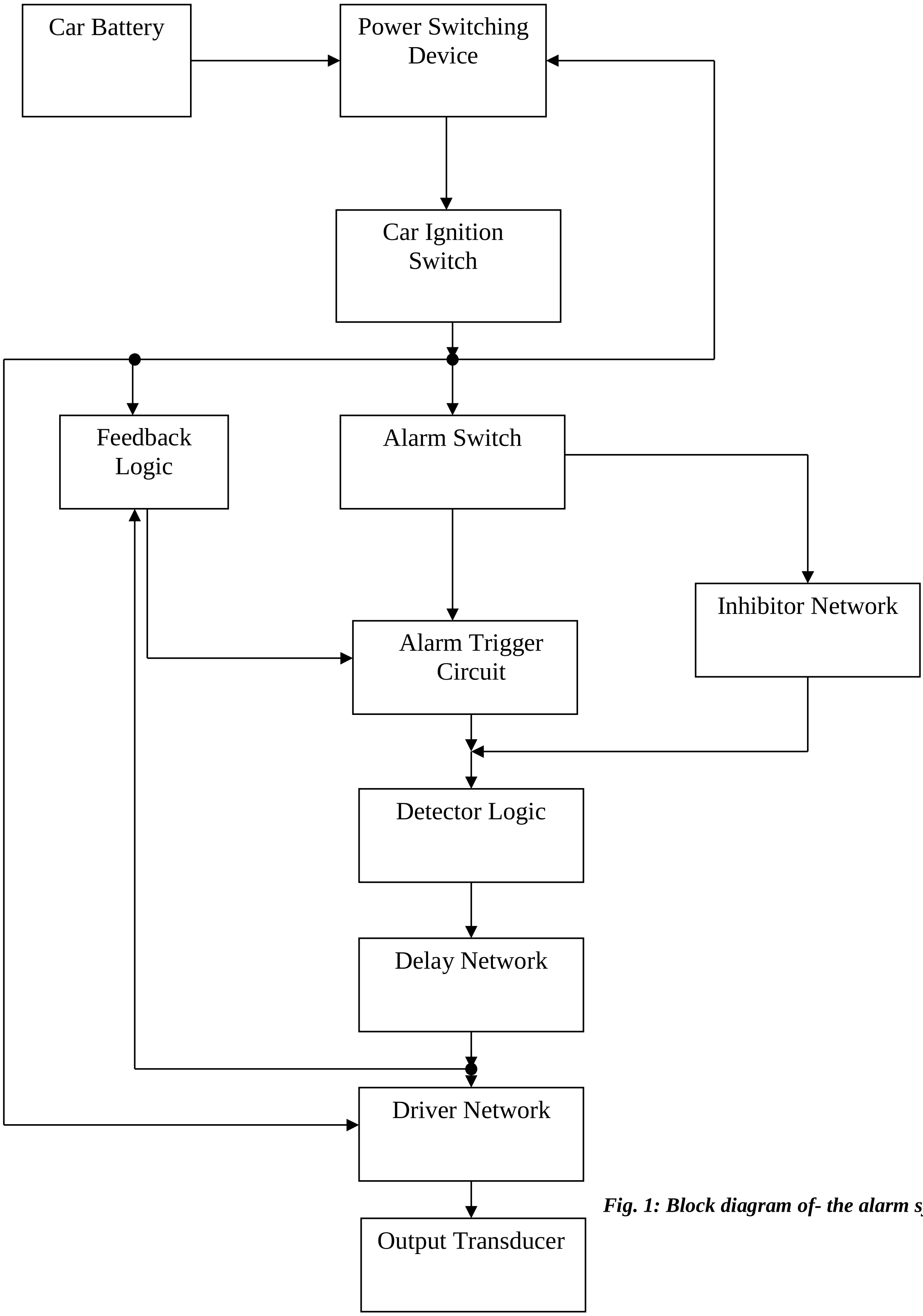

Fig. 1: Block diagram of- the alarm system

output from IC2 which is a 555 timer configured as an astable multivibrator. The alarm is off and produces no audible signal.

Consider now that any of the switches S1, S2, S3, and S4 (or a combination) is depressed. This causes Q2 to turn on. Momentarily the inputs of G1 are high and low giving its output as high. Gate G2 has a low input through D5 and a high input from the output of G1. The output of G2 is therefore high. This turns Q3 on causing RLY to be switched to the normally opened (NO) position. However, any subsequent change in the position of RLY and even in any of Switches S1, S2, S3 and S4 will not affect the output of G2. The importance of this feature is that once a vehicle door has been opened and the alarm triggered, the alarm will continue to be operational even if the door is immediately closed afterwards.

The integrated circuit IC1 is wired as a monostable [2] and the switch S5 is used as a re-entry switch by the owner of the vehicle. The action of S5 causes the monostable to go to the unstable state for a fixed length of time determined by R7 and C1 thus keeping Q3 from switching on. The owner of the vehicle can gain entrance into the car during this time without triggering the alarm.

SYSTEM ANALYSIS AND DESIGN

The relay RLY is a 12-V type. The transistors Q1-Q6 are all used as switches. A typical bipolar junction transistor switch is depicted in Figure 3.

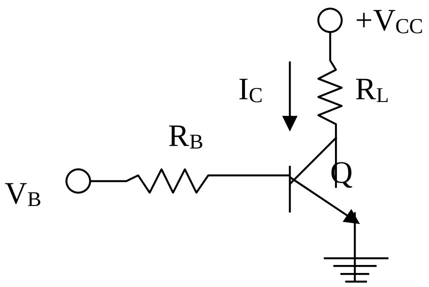

Fig 3: A BJT switch

The load to be switched (R_L) is connected to the collector of the transistor while the signal (V_B) that turns the transistor on is connected to the base. When the transistor is switched on the load current is given approximately by

$$I_c = \frac{V_{CC}}{R_L} \qquad (1)$$

The base current is expressed as

$$I_B = \frac{V_B - V_{BE}}{R_B} \qquad (2)$$

The condition for the BJT to be switched on is that [3]

$$\beta_F I_B > I_C \qquad (3)$$

where β_F is the dc current gain of the transistor.

The resistor R_B is obtained from equations (1) and (2) and the inequality (3) to be

$$R_B < \frac{\beta_F (V_B - V_{BE}) R_L}{V_{CC}} \text{-----------------} \quad (4)$$

The time duration for the monostable (IC_1) is given by [3], [4]

$$T = 1.1 R_7 C_1 \text{----------------------} \quad (5)$$

Equation (5) determines the re-entry time for the owner of the vehicle before the alarm triggers. An appropriate value can be chosen by the designer.

When the astable multivibrator (IC2) is turned on its frequency is given by [3], [4], [5]

$$f = \frac{1}{(R_{16} + 2R_{17}) C_3 In2} \text{-----------------} \quad (6)$$

A suitable audio frequency of 1 kHz was used to test the performance.

CONCLUSION

The alarm system that has been described in this work was constructed and tested. The performance with regards to the sensitivity of the circuit was found to be satisfactory. The project can easily be modified for use in homes, supermarkets, banks and other environments where many entrances need to be monitored.

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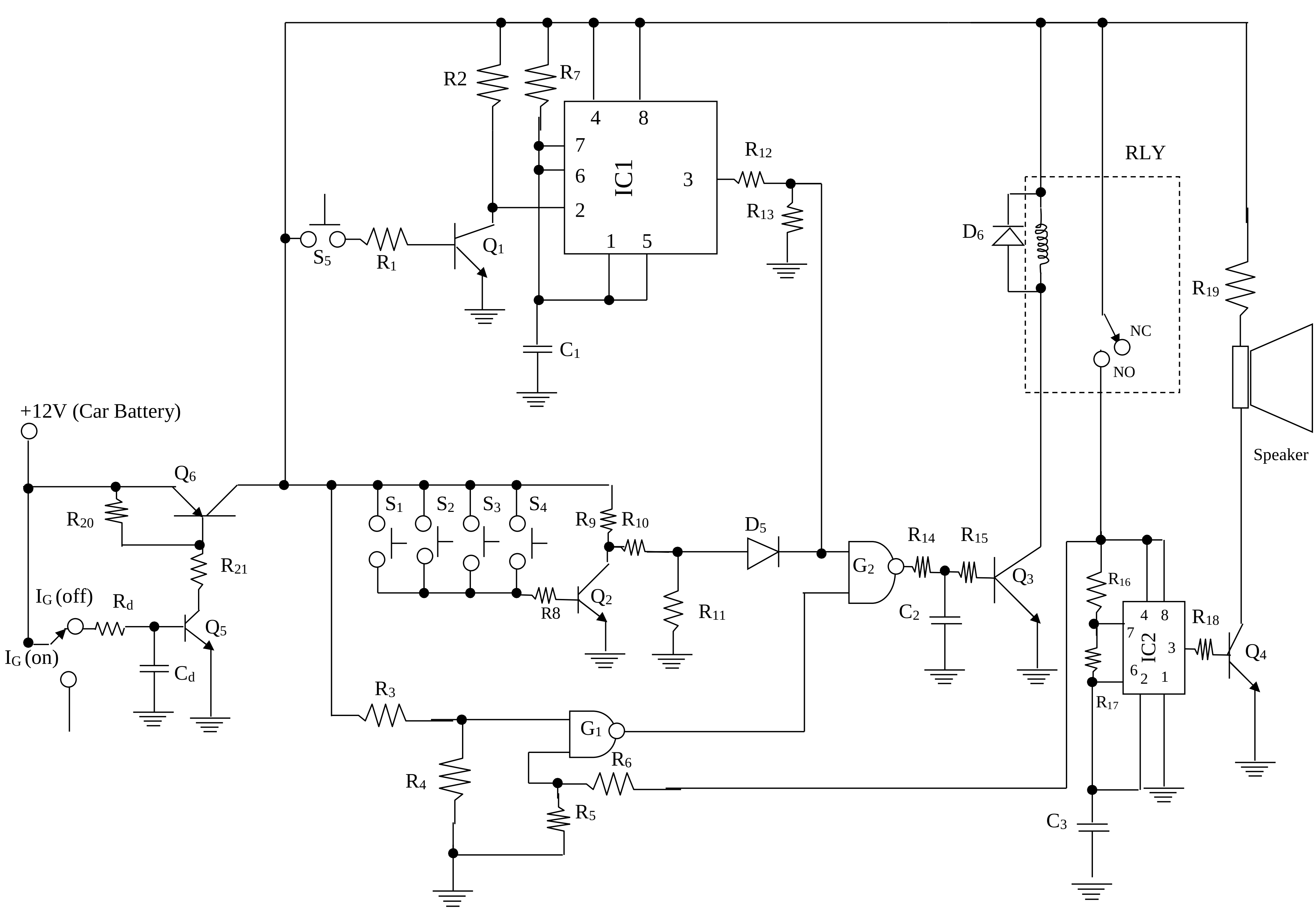

FIG 2: Schematic Diagram of the Alarm System