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LABORATORY EQUIPMENT LOAD CONTROL DESIGN AND DEVELOPMENT USING DTMF TECHNIQUE

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ABSTRACT

The noises or tones produced by a telephone when the digits are pressed are known as dual-tone multi-frequency (DTMF). The voice channel is used to send these tones. DTMF is a signaling system that is used to manage automated equipment and convey user intent, such as dialing a phone number. Every single key has two distinct tones with different frequencies. Previously, switches were used to control electrical appliances in laboratory equipment. Various technologies have been invented around the world to control both agriculture and household appliances. The technology used to remotely manage laboratory equipment and perform efficient operations in order to acquire the greatest results from their performance. The goal of this study is to control laboratory equipment, household appliances, and office equipment from a remote location. As a result, energy will be saved, electric bills will be reduced, and consumers will pay the Electricity Offices less money.

Keywords*: DTMF technology, Electricity saving, Relay, Microcontroller AT89S52, Inverter IC 7404.*

1. INTRODUCTION

An Embedded System is a collection of computer software and hardware, as well as mechanical and other components, that are all designed to perform a specific task. A microcontroller-based, software-driven, trustworthy, real-time control system that operates on a range of physical variables and in a variety of conditions is offered into a competitive and cost-conscious market. A simple project that uses DTMF technology to regulate various loads is the DTMF based Load Control System with 8051 Microcontroller (electrical appliances). The telecoms sector uses the Dual Tone Multi Frequency (DTMF) signaling technology (telephones to be specific). The operation of the DTMF-based Load Control System using an 8051 Microcontroller is totally based on DTMF Technology. When the phones button is pressed, a corresponding and distinctive tone is generated, which is known as DTMF Technology. This tone is made up of two distinct frequencies. Every key is associated with two frequencies, and when you press the key, a tone is produced that is an overlap of the two signals. A standard telephone keypad has 12 buttons: 0 to 9 number button and two (Hash # and Asterisk *). The keys are arranged in four rows and three columns. DTMF Technology also includes a fourth column consisting of the letters A, B, C, and D.

2. LITERATURE REVIEW

C.K. Gomathy et al. explored to allow mobile sensing applications, direct mobile communication between the driver's phone and the owner's phone is required. Direct connectivity between the driver's phone and the owner's phone is critical for increasing data collecting efficiency and sharing participative sensing data on a budget. They created a practical and optimal communication method for direct phone-to-phone data transmission to the driver's phone, enabling phone-to-phone conversation strategically. The DTMF technology accessible on mobile phones is used in this study to regulate vehicle activities. We use a variety of sensors in the car to feed us information about its operations. The sensors identify any anomalies in the vehicle's operation promptly and send a notice to the owner of the vehicle[1].

Manish Kumar Tiwari et al. analyzed a cell phone used to control a robot car using DTMF. The robot is operated by a smartphone that makes contact with the robot's mobile phone. If any button is pressed during a call, the opposite end of the line hears a tone corresponding to the button pressed. This tone is known as Dual-Tone Multiple-Frequency. With the assistance of the phone piled atop the robot, the robot detects this DTMF tone. With the help of a DTMF decoder, the microcontroller processes the received tone. The microcontroller subsequently transmits the message to a motor driver ICs, which turns on the motors, and our robot moves [2].

Mitesh S. Agrawal et al. proposed that with the technological innovations in electrical and mechanical, a new discipline of mechatronics has emerged. Mechatronics has enabled robots to become more intelligent and autonomous, minimizing human work. More AGV (automatically guided vehicle) (automatically guided vehicle) (automatically guided vehicle) (automatically guided vehicle) (automatically guided vehicle) (automatically guided

vehicle) (automatically guided vehicle) (automat In this project, they used the similar concept in ATVs (all-terrain vehicles), which allows our vehicle to determine its own path using artificial intelligence. The use of a microprocessor allowed the vehicle to determine its own direction. The ATV has been developed so that it may be controlled using a cell phone to include AGV characteristics[3].

Humayun Rashid et al. analyzed that the automatic control system for robotics is becoming increasingly popular due to its incredible reliability and, in particular, its ability to optimize time and performance. The implementation of a room cleaning robot is discussed in this paper, which was created using the Arduino Uno platform and can be controlled by a cell phone from any distance using DTMF technology. It's a self-contained electrical device with a waste and dust collection mechanism. A vacuum cleaner is indeed an efficient device for cleaning the house, but it must be controlled manually by anyone. The primary goal of creating a DTMF-driven room cleaner robot is to create an autonomous cleaning system that can be controlled remotely using a cell phone. The robot was developed on a microcontroller architecture and used DTMF technology to build remote control capabilities. The robot used two effective, innovative pathways following cleaning methods and an updated vacuum system with the appropriate filter and air suction system [4].

MM Abdullah et al. examined that one of the issues farmers confront in the agricultural industry is that water used for watering schedules is often squandered. Water wastage could occur due to an ineffective irrigation system, resulting in excessive moisture in the soil and crop damage. The load management system in agricultural sectors is critical, particularly for irrigation systems, since it can affect the operations' efficiency and production. To work efficiently and produce profitable results, many new technologies have been used in the agricultural sector, such as irrigation systems, temperature and humidity sensing systems, and many more systems. To solve the inefficiency of manual irrigation, the desired load control system employing Dual-Tone Multiple Frequency (DTMF) will be designed for the irrigation system. Using DTMF to operate the irrigation system will save time and provide a wide control range. The coding for this control system is developed in C++ using the Arduino IDE program. The code will then be compiled to ensure error-free before being uploaded to the Arduino Uno board. The code will then be uploaded to the computer via USB by linking the Arduino Uno board to the PC. After that, Proteus 8 and Fritzing software will be used to model the architectural layout plan of this control system. The manufacturing of the hardware begins after the circuit simulation is successful. The first piece of hardware for this load control system is to link the mobile phone to a DTMF decoder through a 3.5mm connector. The Arduino Uno board will then be connected to the DTMF decoder. The Arduino Uno's output port was linked to the four-channel 12V relay. Finally, this irrigation management system operates when the user sends a signal through a cell phone, which is received by another cell phone connected to the DTMF decoder [5].

3. MODELLING OF A SYSTEM

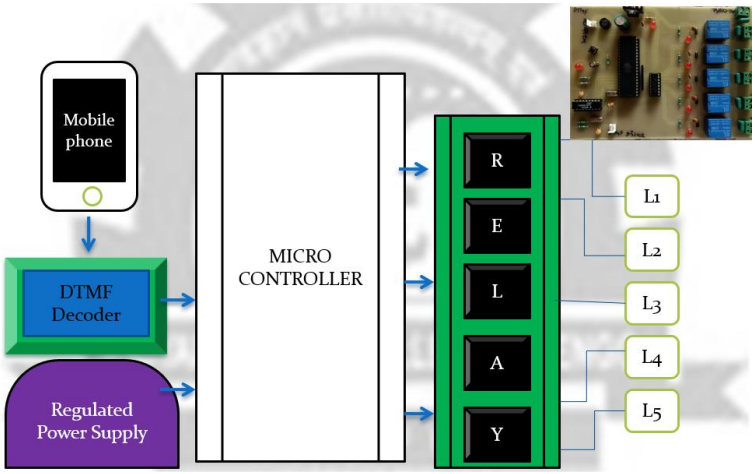

Fig.1: Block Diagram

The project employs a DTMF decoder, the MT8870/HT9170, which uses a 3.57 MHz crystal to provide the required frequency for analyzing the audio data tones at pin 2 to form a four-bit BCD code at pins 11 to 14. This BCD data is routed through HEX CMOS inverters (74LSO4), whose outputs are pulled high and linked to port-3 pins 10 to 14 as a buffer between the MC and the DTMF IC. The DTMF decoder IC, MT8870, receives tone commands from the telephone line after the call is established. When button 1 is pressed, the output at pins 11-14 develops 0001, which is reversed and supplied towards the microcontroller input pins. The result created for digit 2 is 0010, so for the other digits. According to the DTMF table on the datasheet, when the MC program is run, it generates a specific output for each number, which is then fed to the ULN2003, which operates the relays, which subsequently turn on or off the associated load.

4. HARDWARE COMPONENTS OF THE PROPOSED SYSTEM

a) MICROCONTROLLER AT89S52

The AT89S52 is a high-performance, low-power CMOS 8-bit microcontroller having 8K bytes of configurable Flash memory. It is a sophisticated microcontroller that integrates a configurable eight - bit Processor with programmable flash to provide a cost-effective and highly flexible solution to a variety of advanced embedded systems. The programme memory could be reprogrammed using a non-volatile memory programmer thanks to the on-chip Flash.

Fig.2: MICROCONTROLLER AT89S52

b) TRANSFORMER (230-12V AC)

Transformers transform alternating current (AC) through one voltage to the other with minimal power loss. Step-up transformers boost voltage, whereas step-down transformers lower it. A step-down transformer is used in most power supplies to lower an extremely high voltage to a relatively low voltage. The primary coil is the input coil, while the secondary coil is the output coil. The two coils are joined with an alternating magnetic field formed inside the smooth core of the transformer, rather than via an electrical connection. The core is represented mostly by two lines in the center of the circuit symbol. Transformers waste extremely little energy; therefore, the output is nearly equivalent to the input. It's worth noting that even as voltage is reduced, current is increased.

Fig 3: Transformer

c) Voltag Regulator 7805

The three-terminal positive regulators of the LM78XX/LM78XXA family are accessible in the TO-220/D-PAK package with a series of fixed output voltages, making them appropriate for different applications. Thermal shutdown, internal current control limiting, and safe working area protection are all used to make each kind virtually indestructible. They can provide around 1A output current if appropriate heat sinking is given. Although these devices are often developed as constant voltage regulators, they can use them in conjunction with external elements to achieve variable voltages and currents.

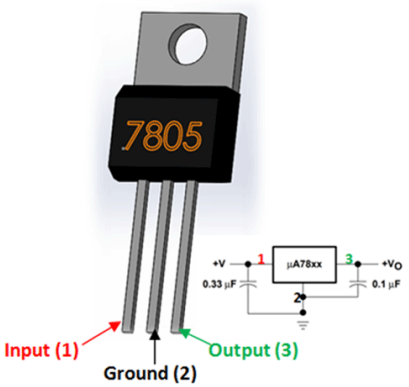

Fig 4: Voltage Regulator 7805

d) Relays

A relay is indeed a switch that is controlled by electricity. Usually, relays need an electromagnet to operate a switching mechanism mechanically, but alternative means are sometimes used. Relays are used to control a circuit with a low-power signal (with perfect electrical isolation between the controlled and supervisory circuits) or to control multiple circuits with only one signal.

Fig 4: Relays

e) Capacitors

A capacitor, also known as a condenser, is an electrical component that consists of two conductors separated by an insulator. An electric field exists in the dielectric when the conductors have a voltage potential difference. This field energy will be stored while also exerting a mechanical force between the plates. The effect is strongest between conductors that are wide, flat, parallel, and closely spaced.

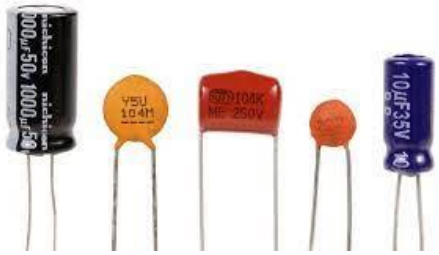

Fig 6: Capacitors

f) Resistors

A resistor is a two-terminal electrical device that opposes an electric current by creating a potential difference between its terminals proportional to the current, as Ohm's law states: V = IR. Like blended and printed circuits, resistors can be used in integrated circuits. Resistors must be usually big enough not just to burn when dissipating their power; hence their position and size are essential to equipment designers.

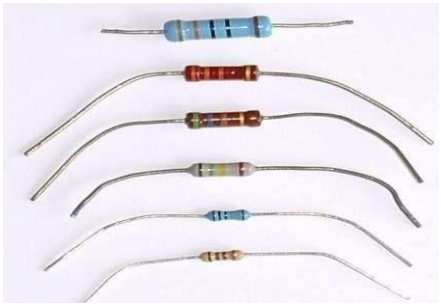

Fig 7: Resistors

g) Diodes

To convert AC to DC, diodes are employed. They can be used as half-wave or full-wave rectifiers. When employing any type of diode, three things must be kept in mind.

I. Forward current capacity maximum

II. Maximum capacity for reverse voltage

III. Forward voltage capacity maximum

Fig 8: Diodes

5. WORKING OF THE PROJECT

The project employs a DTMF decoder, the MT8870/HT9170, which employs a 3.57 MHz crystal to provide the required frequency for analyzing the input audio tones at pin 2 to form a four-bit BCD code at pins 11 to 14. HEX CMOS inverters are used to convert the BCD data (74LSO4), whose output is pushed high and linked to port-3 pins 10 to 14 as a buffer between both the DTMF IC and the MC. The DTMF decoder IC, MT8870, receives tone commands from the telephone line after the call is established. When button 1 is pressed, the output at pin 11-14 becomes 0001, which is reversed and transmitted to the microcontroller input ports. The result created in this manner for digit 2 is 0010, and so on for the other digits. According to the DTMF table on the data sheet, when the MC programmed is run, it generates unique output for each number, which is then fed to the ULN2003, which operates the relays, which then turn on or off the relevant load.

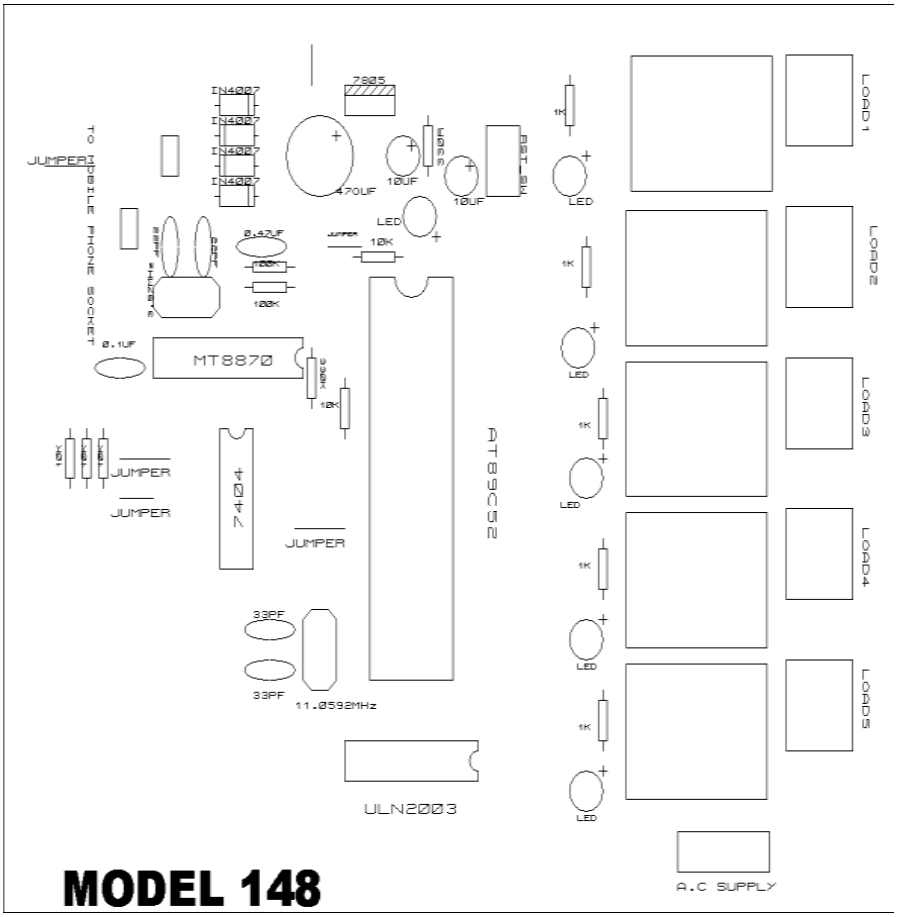

Fig.7: Layout Diagram

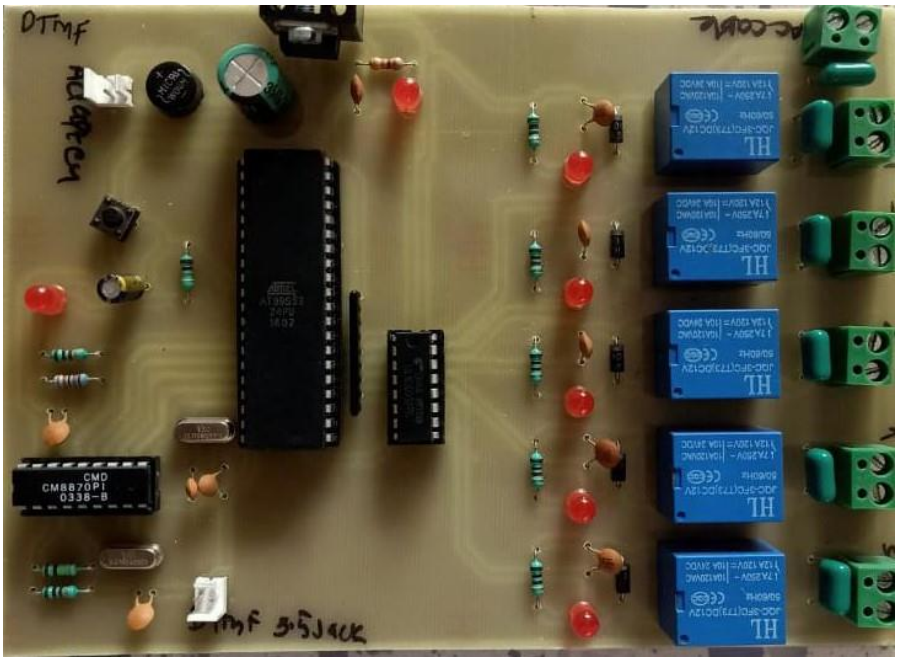

Fig 8: Hardware of the project

6. RESULT

Dual-Tone Multi-Frequency Tones (DTMF) are very much in telecommunications signals that are sent over voice frequencies. DTMF tones, often known as Touch Tones, are extensively utilized over telephone lines. While spinning, rotary phones disrupt electrical connections, and the ensuing electrical pulses were processed as commands (such as "call this number"). Humans have needed a mechanical and repeatable way to communicate with telegraph and telephony systems for almost as long as they have existed. Signaling systems have emerged to fulfil that role, both in terms of routing and dialing calls, as well as engaging with phone systems once they've been connected.

7. CONCLUSION

As a result of this effort, we have concluded that home security is now a top priority that cannot be overlooked. So, with this project, we can quickly achieve home security by automatically controlling home appliances; if a person forgets to turn off any devices and moves to another location without turning off the appliances, the person can turn off the home appliances from that location without returning home. As a result, even while busy at work, we can keep an eye on our household appliances.

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