Dual Tone Multi-Frequency Control Based Solar Car – A Case Study

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Abstract – **Vehicles used for travelling longer distance is in paramount to the world. But least is used to travel at shorter distance. People either prefer to walk or cycle to reach their nearest destination in which it involves a much load of man power. In order to overcome this an electric tri-wheeler is introduced in which the vehicle is used for smaller distance travel to reach the nearest desired place with shorter time period and less man power. It is mainly focused on electrical working for the transportation which overcomes the fuel usage of vehicle which runs in demand in present days. The electrically driven motor from the battery makes the shaft of the rear wheels rotate and also a steering system is provided at the front wheel adopted from a conventional bi-cycle. The movement of the vehicle is controlled by a controller and a throttle twist in which a braking system is also used. Thus through these ways the transportation is made in easy and simpler ways for the better usage of vehicle in shorter distance.**

1. INTRODUCTION

Renewable energy plays a major role in today's energy demands and also in the future. Non- renewable resources would expend in the coming years. So vehicles which run on fossil fuels may have no purpose in the future. Solar powered cars will be one the major production units in the automobile industry [8], [9]. Even though this idea is not feasible in physical existence, with continued research, cars which run on solar power may eventually become a practical solution in the future. Since no fossil fuel is used, these solar cars appear to be ecologically friendly [1]. Compared to other cars that use fossil fuels, the solar cars are economical.
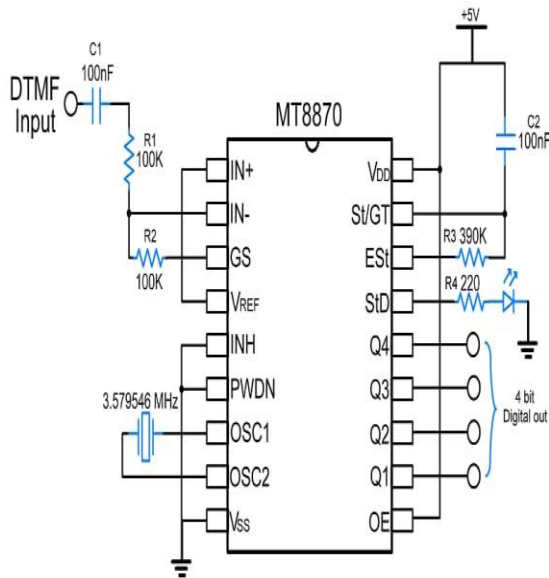
2. LITERATURE SURVEY

Solar Energy is now-a-days considered to be a source of energy which is implemented in various day to day applications, with the aid of this technology it is intended to make solar powered car. When sunlight falls on the solar panel the solar energy is converted into electrical energy and stored in the battery [1] .The motor drives the wheel of the vehicle which is powered by Battery. The vehicle which has been proposed uses a belt pulley mechanism in which the shaft of the motor is connected through the belt pulley system. The power supplied to the batteries is from the solar panels which are giving a total output of 400W and they are used for charging the batteries. The battery used here is lead acid battery of 48V

rating which gets charged through the four12V batteries [5].The motor rating is the same as the Battery rating of 48V. The batteries are connected to a charge controller which will ensure healthy life of the batteries by preventing it from over charging and over discharging. A microcontroller inside the charge controller is programmed to detect the voltage at the battery terminal or the panel terminals accordingly to determine what charging current the battery needs to be supplied[2] .Dual Tone Multi Frequency (DTMF) is used to detect which key is to be pressed in the mobile phone. By pressing any of the keys in the mobile phone a unique tone is generated which basically consist of two further frequencies, the one is of the higher range and the one is of the lower range [4] .DTMF decoder is used here to train the commands for the robot. DTMF decoder consists of 4 output pins D0-D3.Whenever a command is given, the binary value of the address is given to the output pins D0-D3.
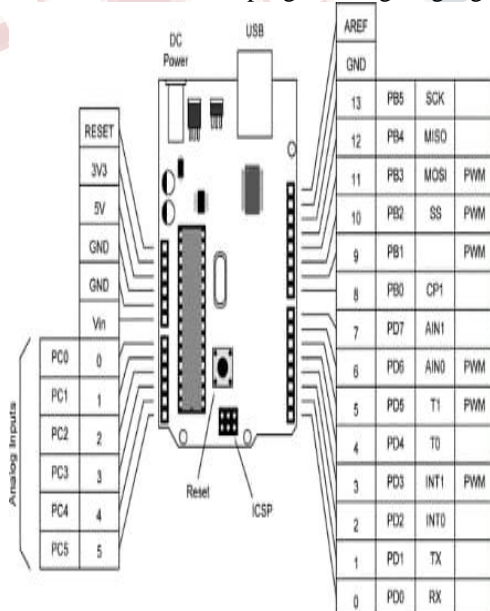
3. FUNCTIONS OF COMPONENTS

3.1 DTMF DECODER
Dual tone multi-frequency decoder is a signalling system for recognising the keys or the buttons pressed in a keypad [6].It uses eight frequency signals which are transmitted in a pair to produce the sixteen numbers with the symbols and letters. In DTMF, when any key pressed on the phone, it generates two tones of specific frequencies. The first frequency is high frequency and the second one is a low frequency code.

3.2 SOLAR PANEL

Photovoltaic solar panels absorb sunlight and convert it into electricity . Photovoltaic modules constitute the photovoltaic array of a photovoltaic system that generates and supplies solar electricity for many applications. The majority of modules contain crystalline silicon cells or thin film cells. In the future concentrator solar cells can achieve an efficiency of about 45% to 50%.

3.3 MOTOR

500 RPM 12V DC Geared Motor is a DC geared motor. It has steel gears and pinions to ensure longer life and better wearing away properties. The output shaft rotates in a plastic bushing and the whole assembly is covered with a plastic ring. Gearbox is sealed and lubricated with lithium grease and require no maintenance. 500 RPM 12V DC geared motors for robotics applications. Shaft is provided to mount on chassis for easy connection to wheel.

3.2. ARDUINO

Arduino is an open-source electronics platform based on hardware and software. Arduino boards are able to read inputs and do anything we wish to do. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. It is an open source platform, which supports products for IoT applications and Embedded systems [10].It is inexpensive compared to other microcontroller platforms. The language can be expanded through C++ libraries and can make the leap from Arduino to the AVR C programming language [10].
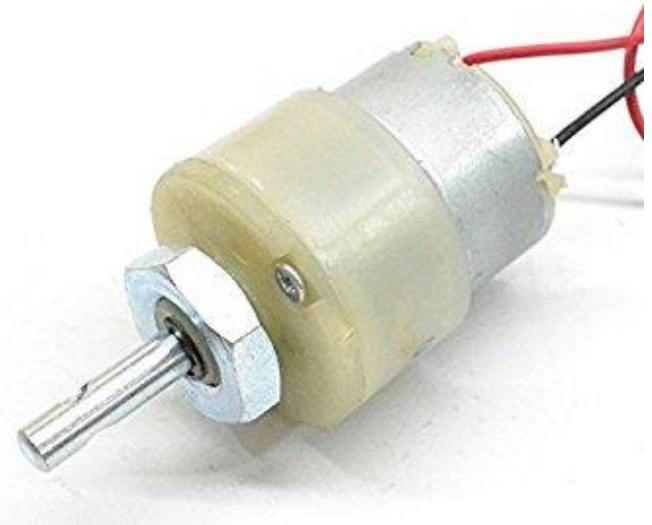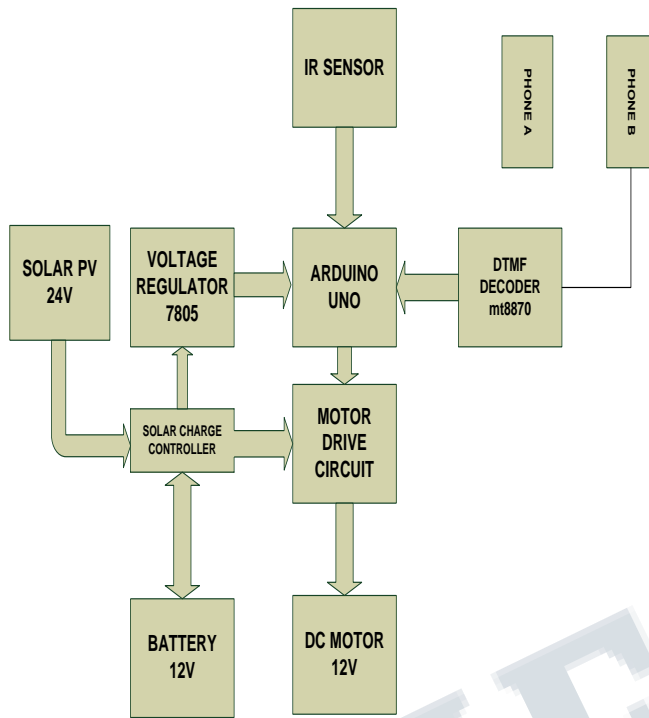

4. WORKING OF DTMF BASED SOLAR CAR

This solar car consists of two mobile phones each at both sending and receiving ends. Phone A act as transmitter and phone B as receiver. The phone B is connected to DTMF decoder using audio jack. The phone A act as a DTMF generator with tone depending on the key which is pressed by the user in mobile phone[3]. The phone B attached to the DTMF decoder is kept in auto answer mode. When the phone A makes a call, the phone B receives it automatically. The data from phone A is transmitted to DTMF decoder through phone B. The received tone is processed by the Arduino with the help of DTMF decoder. DTMF decoder decodes the received tone and gives binary equivalent of it to the Arduino[3],[6]. The Arduino process the data and the output of the Arduino is given to the motor driver circuit. The motor drive circuit is connected to DC motor.

When the driver circuit gets input from the Arduino the DC motor runs by the driver circuit. For sensing any obstacles, the IR sensors are used. When any obstacle is sensed the car will turn to the opposite direction automatically. The car is powered by battery and solar PV. The PV and battery are connected to solar charge controller. The solar charge controller is used for load sharing. When the PV is disconnected or low voltage is detected due to cloud formation the Charge controller will directly feed the supply from battery. When the PV produces required power the battery will be charged and

at the same time supply is given to the load. At night time the battery is the only source of supply to the car.

Command	Address	DTMF module output (D0-D3)
Forward	02	0010
Backward	08	1000
Left	04	0100
Right	06	0110
Stop	05	0101

a) When key 2 is pressed robot moves FORWARD direction.
b) When key 4 is pressed robot moves LEFT direction.
c) When key 6 is pressed robot moves RIGHT direction.
d) When key 8 is pressed robot moves BACKWARD direction.

When key 5 is pressed robot STOPS. [7]

5. APPLICATIONS

Solar powered cars don't utilise fossil fuel so they replace normal cars.
It is wireless so it can be operated anywhere.
It can be used in Surveillance system.
It can be used in military operations.

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