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Charging Station for Electric Vehicles Using RF Module

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Abstract - The requirement for clean environment has promoted the development of green car technology such as electric vehicles which are cost effective too. The number of Electric Vehicles (EVs) on the roads are increasing so charging infrastructure is gaining an important role. There are several issues on the EV charging system and some of them are option for improving the operation and efficiency, understanding of the charging behaviours of existing EV users. Thus, in this paper, we have introduced RFID (radio frequency identification) technology which allows automatic identification of users. This technology uses electromagnetic waves to transmit and receive information of the users.

Key Words: RFID, Electric Vehicle, Micro Controller, Charging Station

1. INTRODUCTION

The Internet of Things, also called things-linked internet, it refers to a kind of network that adopts RFID (radio frequency identification), infrared sensor, and other sensing devices, to enable the linkage between any articles and the internet, to enable the exchange and communication of information, This paper aims to discuss the application of RFID technology in the battery charging stations, and analyse the technical advantages of RFID technology in the electric vehicle identification as well as the unified management of the battery charging compartment. These advantages enable RFID technology to provide better service for the electric vehicle industry, and support the effective management of the battery charging compartment. At present many regions have started forming charging station for electric vehicles but still have not completed a sophisticated layout planning system.

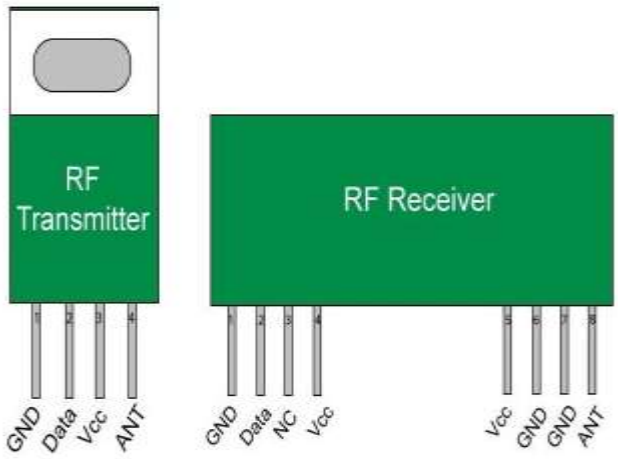
1.1 LITERATURE REVIEW

With the development of EVs, many studies have begun for layout and technology of public charging stations.
C. Panatarani et al. (2016) developed a charging station using microcontroller ATMEGA8535 and RFID as controller and identifier of the EV users, respectively. It has desired features for electric vehicle from renewable energy resources grid connected with solar panel. Halil et al. (2018) developed a wireless charging station for electric vehicle controlled by RFID tag. The charging was very easy because the power transfer method is wireless. N.KALYANI et al. (2014) have developed RFID based secured access system using 8051 microcontroller and is very commonly used in offices, institutes, homes, etc. by referring this paper we have understand the interfacing of RFID with 8051. Ching-Yen Chung et al. (2013) have proposed a mesh network RFID system for user identification and charging authorization for smart charging grid connection. It provides a cost-efficient solution to identify and authorize vehicles. WentaoJing et al. (2017) investigated the effect of the location of BEVs public charging facilities on a network with mixed conventional gasoline vehicles (GVs) and BEVs.

2. RF MODULE TECHNOLOGY

In generally, the wireless systems having two constraints: it must operate over a certain distance with a certain amount of information within a data rate which is transfer speed of RF module. The RF modules are very small in size and having a wide operating range of voltage. i.e. 3V to 12V.

Simply the RF modules are 433 MHz RF transmitter and receiver modules. The transmitter draws no power when transmitting logic zero it suppressing fully the carrier frequency so it consumes significantly low power in operation which is desirable. Instead of logic zero if logic one is sent, carrier is fully on to about 4.5mA with a 3volts power supply. The data is being sent serially from the Rf transmitter which is received by the tuned receiver. Transmitter and the receiver are interfaced to two microcontrollers for data transfer.

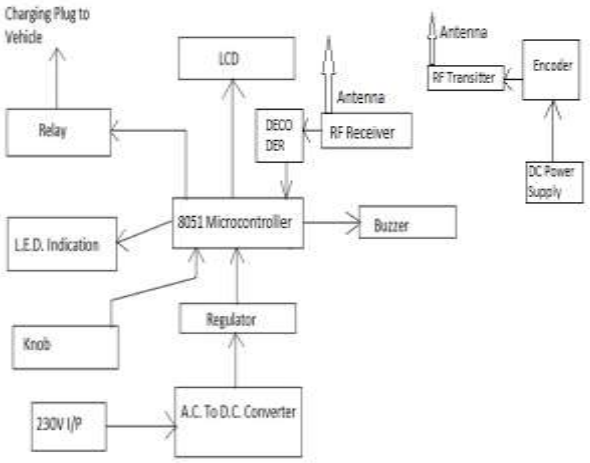


3. PROTOTYPE OF CHARGING STATION FOR ELECTRIC VEHICLE

Here In this we research paper we have proposed a prototype model which is cost effective and consists of RF module, 8051 micro-controller, Relays, etc. this is basic model for charging station for electric vehicle and If we want to implement this for large scale then we need to further add some features.

The description as well as working of this project is discussed in this section.

3.1 BLOCK DIAGRAM



The working model of charging station for electric vehicle contains transmitter with encoder, receiver with decoder, micro-controller, power supply circuit, set of relays. Here Users who wants to charge their vehicle carries the transmitter and, in the transmitter, there are different push buttons. According to for how long the battery needs to be charged the users will operate the transmitter. This transmitter contains encoder which encode the data and this data will be transmitted by transmitting antenna.

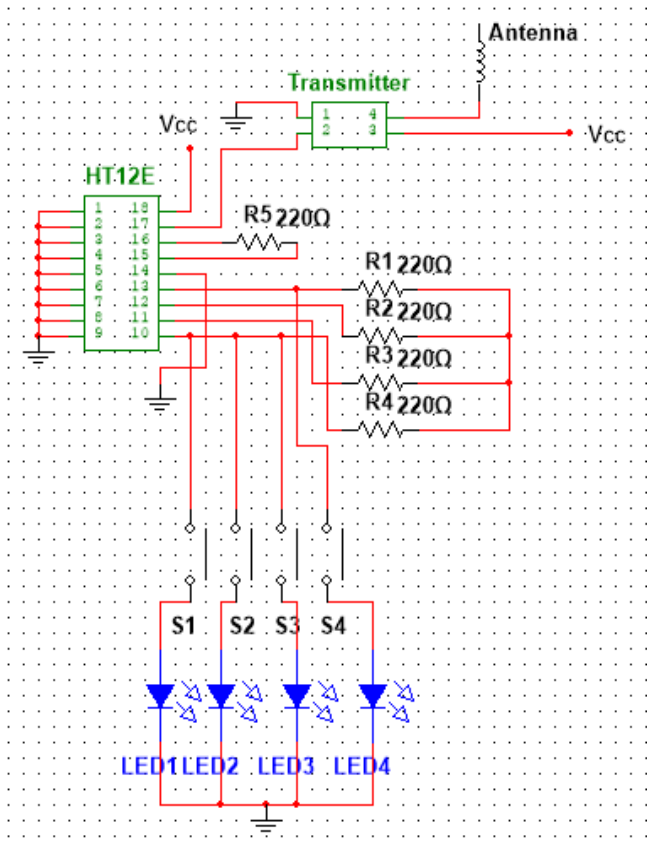
Now, at charging station side there will be a receiver. The receiving antenna receives the data transmitted by transmitting antenna. This receiving antenna is connected to the decoder so this data goes to the decoder. After decoding of data it's further given to the micro-controller.
This both transmitter and receiver work on radio frequency(433Mhz).

The 8051 micro-controller controls the relay switching accordingly. For example, push button 2 was operated by user and after that this data transmitted and received by RF module. Here we have programmed micro controller in a such way that for different push buttons the relay will make connections charger to the electric vehicle for different amount of time and after that relay will break the connection.

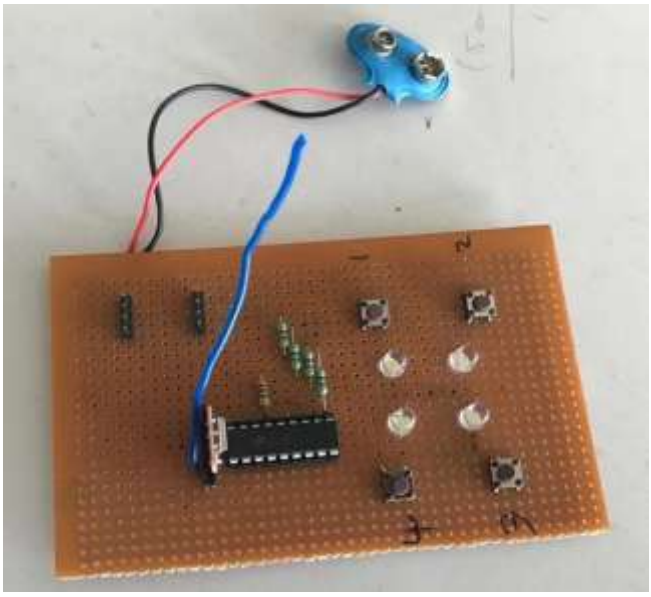
3.2 WORKING OF PROTOTYPE

I. TRANSMITTER

SCHEMATIC DIAGRAM:



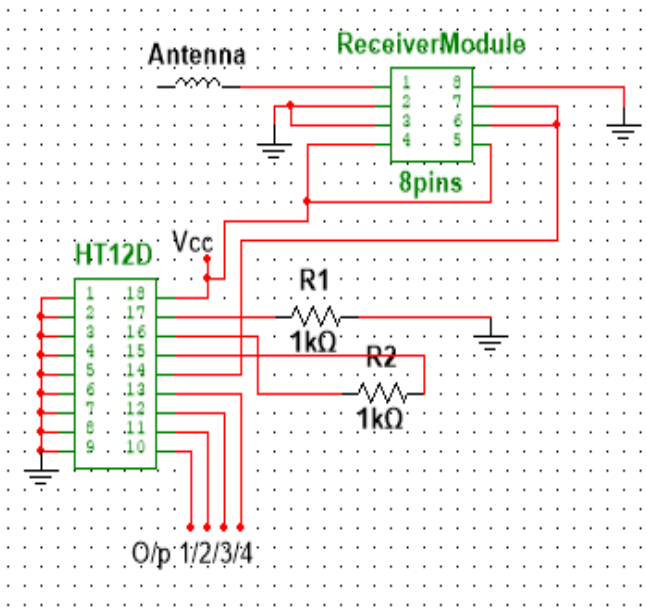
ACTUAL HARDWARE MODEL:



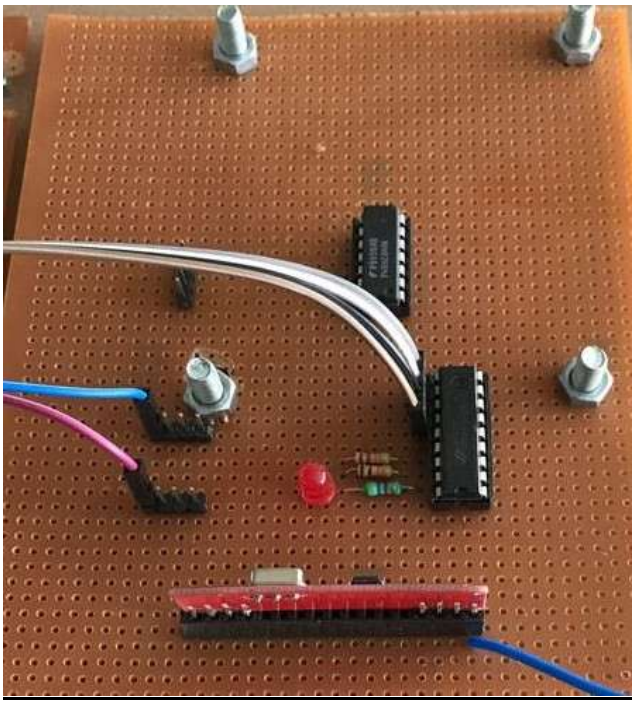
In transmitter circuit we have used HT12E to encode the data for easy transmission. Here we have grounded all the 8 address pins for coupling it with HT12D. At 4 data pins we have 4 push buttons with a led indication. So, when we operate any push button at data pins this will simply convert into serial data and this can be easily transmitted by RF transmitter. All the resistors are used for limiting the excessive currents.

II. RECEIVER

SCHEMATIC DIAGRAM:



ACTUAL HARDWARE MODEL:



In receiver circuit we have used HT12D to decode the received encoded data. Here we have all the 8 address pins for coupling it with HT12E. We have given this output pins to the micro-controller through Not gate because the output from HT12D will be low (0). Data received from is given to 14th pin. This receiver will encode the data which can be given to micro-controller.

III. MICRO CONTROLLER

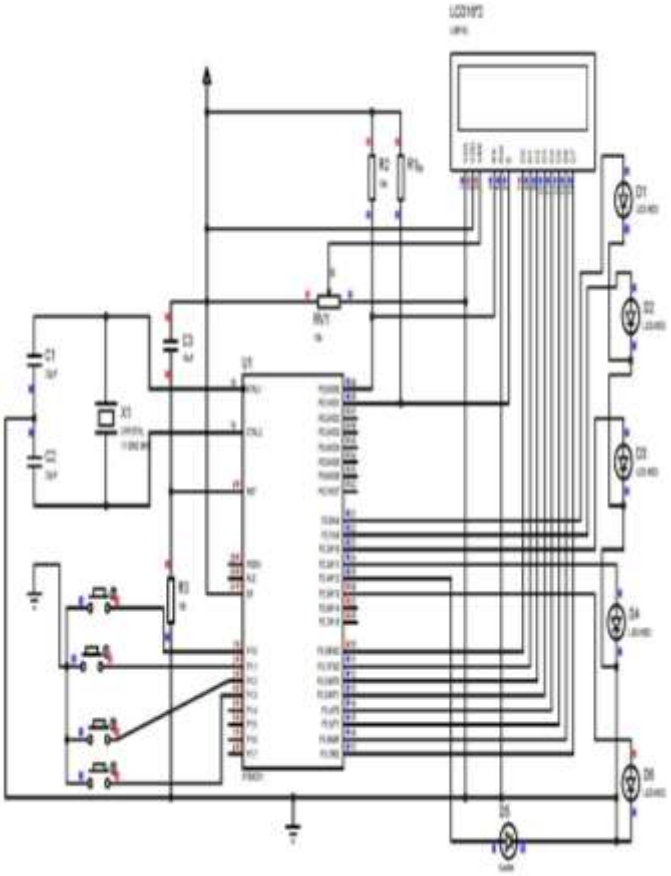
Here in this circuit we have connected Port-1 with output pins from receiver circuit, Port-2 is connected with relay circuit, Port-3 is connected with LCD (16*2), other connections are common for 8051 micro-controller.

Now If user has operated push button 1, then it will be transmitted by encoder and RF transmitter, then at the charging station side RF receiver receives the signal after decoding using decoder this signal goes to micro-controller through NOT gate. That will lead to pin 1.0 high. According to program if P1.0 goes high then relay connected P2.0 will make connection the charger with connected battery with relay-1 for 60 seconds i.e. 1 minute, as well as LED and Buzzer connected to P2.5 will be on.

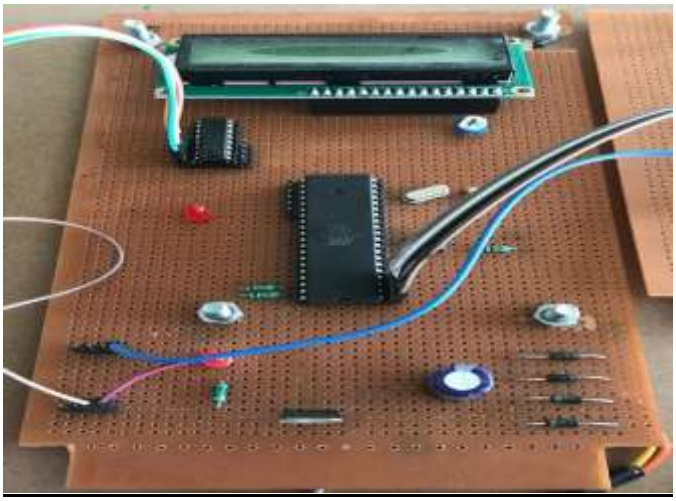
Accordingly, if user operate push button 2,3 and 4 then Relay-2 will start for 120 seconds (2 minutes), Relay-3 will start for 180 seconds (3 minutes) and Relay-4 will

start for 300 seconds (5 minutes) respectively. Output from micro-controller is given to the relay by amplifying using LN2003 Darlington's transistor pair so that it can drive the relay.

SCHEMATIC DIAGRAM:

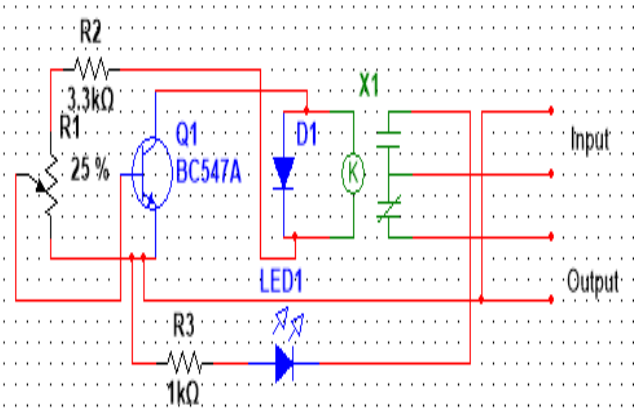


ACTUAL HARDWARE MODEL:

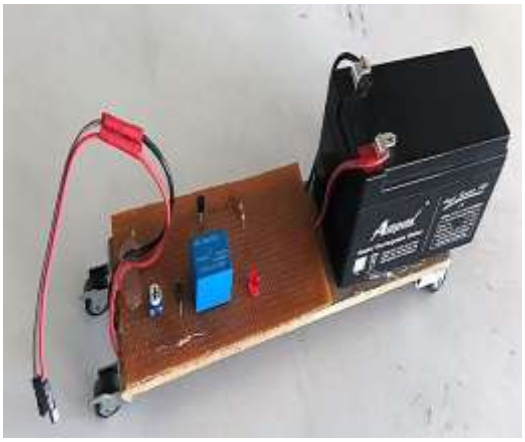


IV. AUTO CUT-OFF

SCHEMATIC DIAGRAM:



ACTUAL PHOTO:



This circuit needs to be connected between your existing charger and battery. Normally the relay is off and the charging is On but when battery voltage increases to the selected voltage the relay energized by the transistor which now disconnect the battery from charger and LED will glow.

4. CONCLUSION

Here we have designed a simple charging station for electric vehicle using microcontroller, relays and RF module that can enable charging for user's vehicle. This RFID charging station authorization system provides a convenient method for a user to enable charging at charging station. The proposed system represents an improvement over the existing system as it allows charging authorization to take place seamlessly at the moment of EV arrival and does not require any other people to involvement. This method will save the operation time by introducing RFID system at charging

station as automatic authorization of user can be involved in this system. RF transmitter and Receiver will give a huge operation range to this system.

FUTURE SCOPE:

a) Here we can use the turbo charger or fast charger for efficient and fast operation, this will save the time required to charging operation.
b) We can connect this charging station system with computer network so we can enable computerized billing instead of manual billing and store data of user for how much time they have used this charging service.

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Reasons can be given and they can be many but nothing can replace the efforts of numerous people behind the work, put in by the creator, giving us constant support all the way. We express our heartily gratitude to Prof. Prakruti Shah, Electrical Engineering. Her invaluable guidance, advice & time from her extremely busy schedule made this work an enthusiastic experience. We wish to express our most sincere gratitude for her whole-hearted cooperation.

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