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Intelligent Transport System for Connected Vehicles

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Abstract: The development of intelligent transport system has become a necessity today. There have been many challenges in this forum even though many technical innovations have emerged. To enhance the technology in the transport system our model will be a suitable solution. In our research work we have surveyed about the difficulties we face in our real time vehicular transport. In order to ease the vehicular transport we have come up with the model known as "Intelligent Transport System for Connected Vehicles". As this system incorporates connected vehicle we construct a wireless mesh network with help of a Zigbee module. RFID reader is used, which is able to read the tag on the road which enables us to track the path of the vehicle. Infrared sensor senses the traffic in the corresponding route and transmits the information to the entire connected vehicle via Zigbee module and display in every connected vehicle via the LCD display. Proteus 8.0 is used to simulate our proposed model.

I. INTRODUCTION

An Embedded System is a combination of computer hardware and software, and perhaps additional mechanical or other parts, designed to perform a specific function. An embedded system is a microcontroller-based, software driven, reliable, real-time control system, autonomous, or human or network interactive, operating on diverse physical variables and in diverse environments and sold into a competitive and cost conscious market.

An embedded system is not a computer system that is used primarily for processing, not a software system on PC or UNIX, not a traditional business or scientific application. High-end embedded & lower end embedded systems. High-end embedded system - Generally 32, 64 Bit Controllers used with OS. Examples: Personal Digital Assistant and Mobile phones etc.

XBee (S2) 2mw XBee ZB (a.k.a. Series 2) module is used for embedded solutions providing wireless end-point connectivity to devices.This module incorporates the ZigBee PRO Feature with Set mesh networking protocol. Series 2 modules allow you to create complex mesh networks, it does not offer any 802.15.4-only firmware; it is always running the ZigBee mesh firmware. This module has the lowest current draw of any Digital RF product. However, the infrastructure of a ZigBee network is more complex and requires more configurations to fully implement. This module can give range of 40 meters indoor or 120 meters outdoor. This XBee wireless device can be directly connected to the serial port (at 3.3V level) of your microcontroller. By using a logic level translator it can also be interfaced to 5V logic (TTL) devices having serial interface. This module supports data rates of up to 250kbps. They are designed for high-throughput (35kbps) applications requiring low latency and predictable communication timing.

II. SYSTEM MODEL

To save lives and prevent injuries on roadways, communication among vehicles and between vehicles and the roadside is required. Such advanced, wireless communication is supported by Dedicated Short-Range Communications (DSRC). Data transmitted from the roadside to the vehicle could warn a driver that it is not safe to enter an intersection. Vehicles could serve as data collectors and anonymously transmit traffic and road condition information from every major road within the transportation network. Such data would provide transportation agencies with the information needed to implement active strategies to relieve traffic congestion. Connected vehicles are vehicles that use any of a number of different communication technologies to communicate with the driver, other cars on the road (Vehicle-to-Vehicle [V2V]), roadside infrastructure (Vehicle-to-Infrastructure [V2I]), and the "Cloud" [V2C]. This technology can be used to not only improve vehicle safety, but also to improve vehicle efficiency and commute times. Most individuals said that it is important for

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personal communication devices to integrate with connected vehicles, as well as for such vehicles to have Internet connectivity. The majority of respondents expressed a desire to have this technology in their vehicle. Willingness to pay for connected vehicle technology was very similar across the three countries. The main implications of these results are that the general public in the three countries surveyed feel positive about connected vehicles, have optimistic expectations of the benefits (while still maintaining some concerns), and generally desire connected - vehicle technology when it becomes available.

SYSTEM MODEL

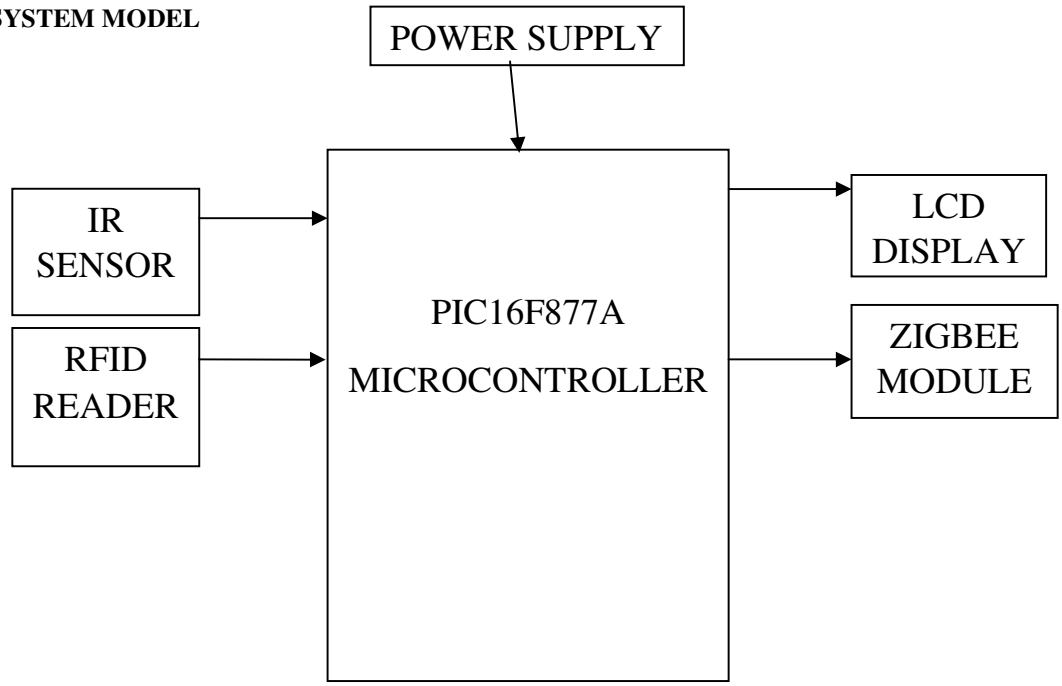

Figure 4.1 Block Diagram

Peripheral Interface Controller (PIC) is a microcontroller developed by Microchip. PIC microcontroller is fast and easy to implement program when we compare other microcontrollers like 8051. The ease of programming and easy to interfacing with other peripherals PIC became successful microcontroller. Figure 4.2 shows an example of PIC microcontroller.We know that microcontroller is an integrated chip which consists of RAM, ROM, CPU, TIMERS, and COUNTERS etc. PIC is a microcontro0ller which also consists of RAM, ROM, CPU, timers, counter, ADC (analog to digital converters), DAC (digital to analog converter). PIC also supports the protocols like CAN, SPI, UART for interfacing with other peripherals. PIC mainly used modified Harvard architecture and also supports RISC (Reduced Instruction Set Computer) by the above specification RISC and Harvard we can easily that PIC is faster than the 8051 based controller which is made-up of Von-Newman architecture.

PIC Microcontroller Architecture

CPU: CPU is not different from other microcontrollers CPU. PIC microcontroller CPU consists of Arithmetic logic unit, memory unit, control unit, Accumulator etc. we know that ALU mainly used for arithmetic operations and taking the logical decisions, memory used for storing the instruction which is to processed and also storing the instructions after processing, Control unit is used for controlling the all the peripherals which are connected to the CPU both internal peripherals and external peripherals. Accumulator is used for storing the results and used for further processing.

Memory: Memory module in the PIC consists of RAM, ROM and STACK.

RAM: we know that RAM (Random Access Memory) which is a volatile memory used for storing

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the data temporarily in its registers. RAM memory is divided in to Banks, in each banks we have number of registers. The RAM registers is divided into 2 types. They are General purpose registers and Special purpose registers.

GPR: general purpose registers as the name implies for general usage. For example if we want to multiply any two numbers using PIC we generally take two registers for storing the numbers and multiply the two numbers and store the result in other registers. So general purpose registers will not have any special function or any special permission, CPU can easily access the data in the registers.

SPR: Special function registers are having the specific functions, when we use this register they will act according to the functions assigned to them. They cannot be used like normal registers. For example you cannot use STATUS register for storing the data, STATUS registers are used for showing the status of the program or operation. User cannot change the function of the Special function register; the function is given by the vendor at the manufacturing time.

ROM: We know that ROM (Read Only memory) is a non-volatile memory used for storing the data permanently. In microcontroller ROM will store the complete instructions or program, according the program microcontroller will act. Rom is also called program memory in this memory user will write the program for microcontroller and save it permanently and get executed by the CPU. According to the instruction executed by the CPU the PIC microcontroller will perform the task. In ROM there are different types which are used in different PIC microcontrollers. EEPROM: In the normal ROM we can write the program for only one time we cannot reuse.

Flash Memory: flash memory is also PROM in which we can read write and erase the program more than 10,000 times. Mostly PIC microcontroller uses this type of ROM.

Stack: when an interrupt occur PIC has to first execute the interrupt and the existing process address which is being executed is stored in the stack. After completing the interrupt execution, PIC will call the process with the help of address which is stored in stack and get executing the process.

Bus: Bus is mainly used for transferring and receiving the data from one peripheral to another. There are two types of buses.

- Data Bus: It is used to transfer/receive only the data.
- Address bus: It is used to transmit the memory address from peripherals to CPU.

CIRCUIT DIAGRAM

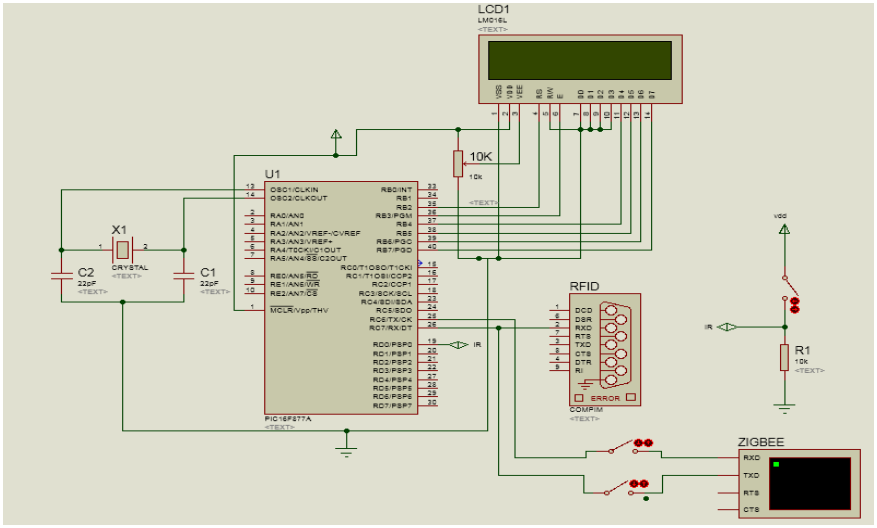

Figure Simulation Setup

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The above diagram depicts the circuit connection of components that is to be placed in every module for collecting information regarding traffic status.

OPERATIONS IN THE WORKING SYSTEM

In this model, the inconvenience in the vehicular transportation is controlled by sharing the information regarding the traffic among the vehicles. The concept of connected vehicles is introduced in this system to share the traffic information. The vehicles are connected via the Zigbee module (Xbee s2) in a mesh network. In order to sense the traffic in this model we use IR sensor which senses the obstacle in the path where the infrared radiation is emitted and depending upon the intensity of the reflected light the obstacle is sensed. If this obstacle is sensed beyond a threshold time level it is considered as traffic as shown in Table 4.2. Now this information is displayed in the corresponding vehicle which is shared to other vehicles which are connected in this mesh network and the shared information is displayed on the LCD display placed in every vehicle. In addition to this in order to track the route of the vehicle we use RFID reader which reads the RFID tag in the road track.

III. RESULTS AND DISCUSSIONS

3.1 SIMULATION OUTPUT

Step 1:

The above figure explains about the information which is being transmitted when the traffic is detected by the IR sensor and the RFID reader reads the corresponding route of the vehicle which is of dense traffic.

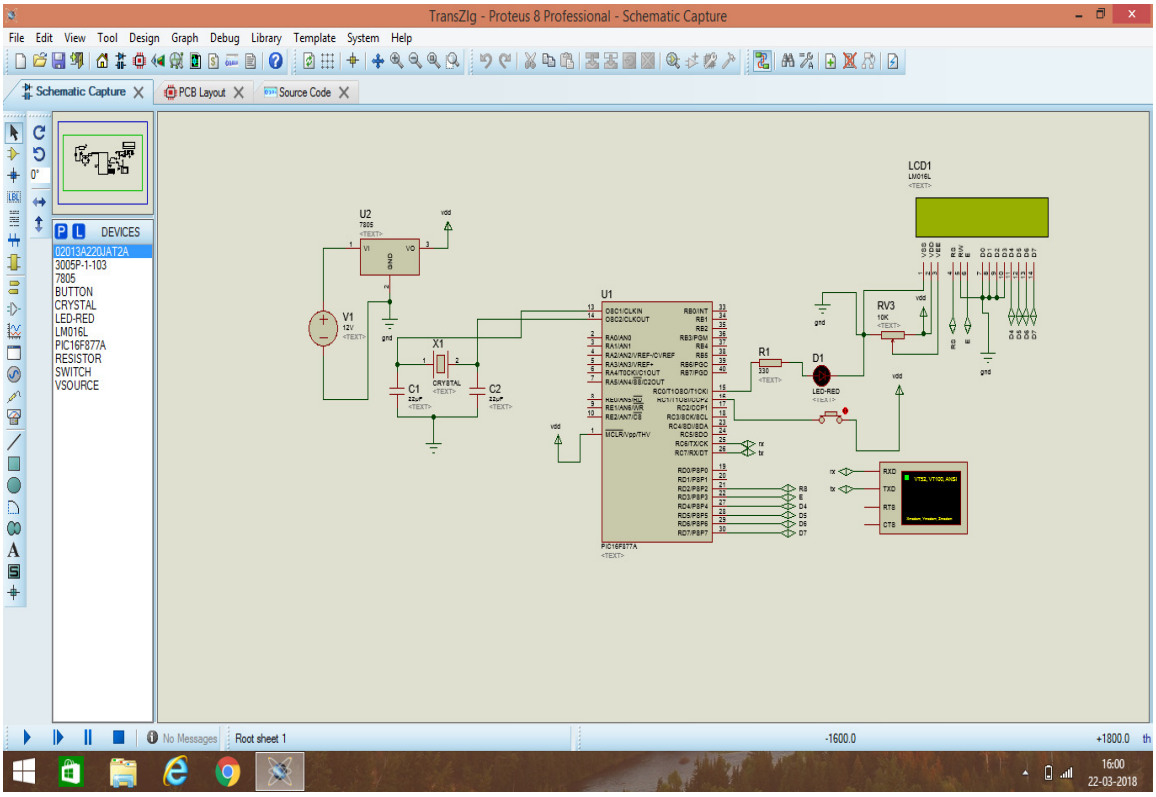

Figure 5.1 Schematic Capture

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Step 2:

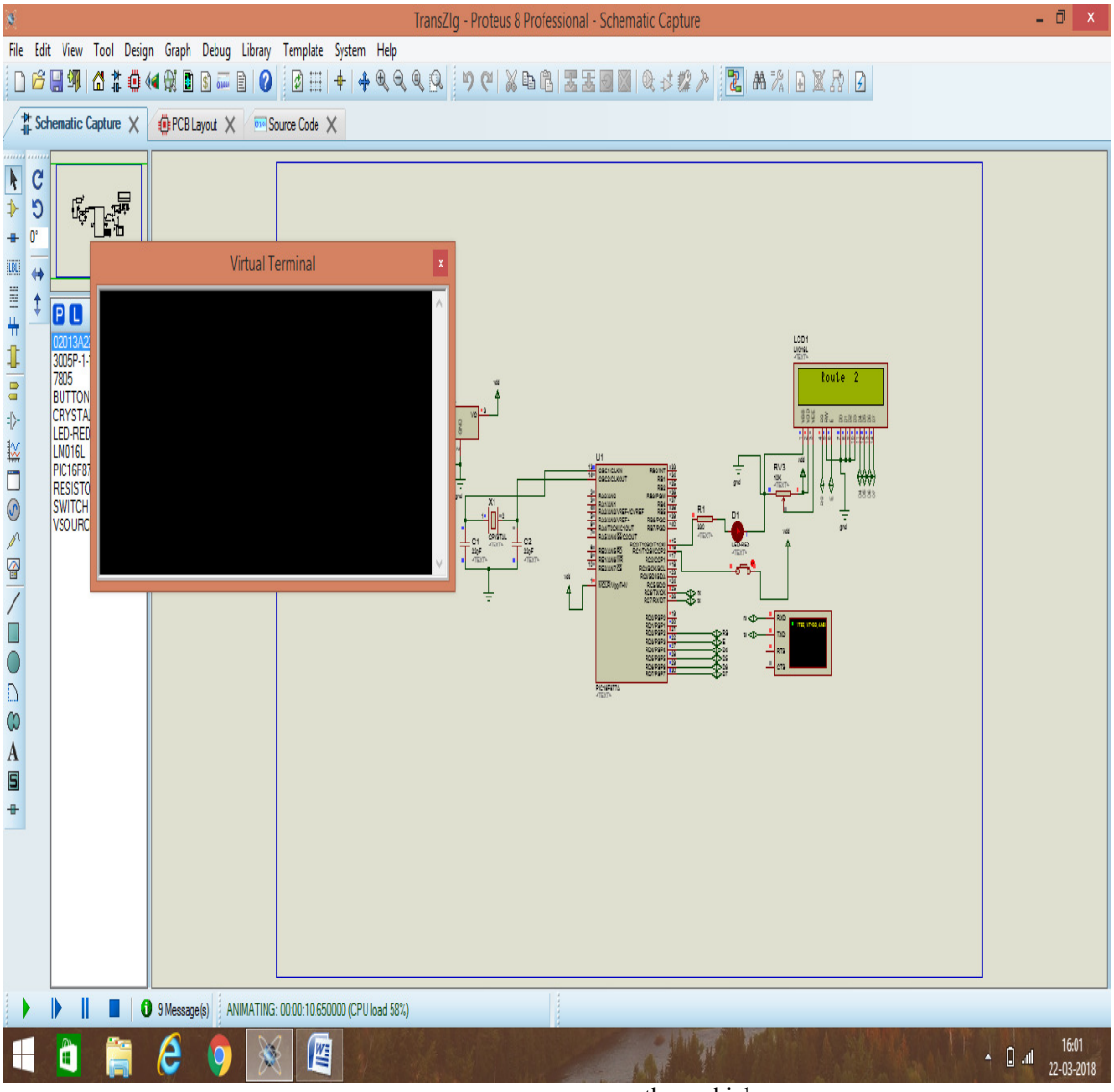

Figure 5.2 Schematic Capture of Route 2 Display

The above figure depicts that the RFID reader has read the corresponding route (Route 2) for which it reads the character "gh……..." then the microcontroller gets this character from the RFID reader and the route is displayed in the LCD display which in turn is transmitted via Zigbee module to the other vehicle.

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Step 3:

which in turn is transmitted via Zigbee module to the other vehicle.

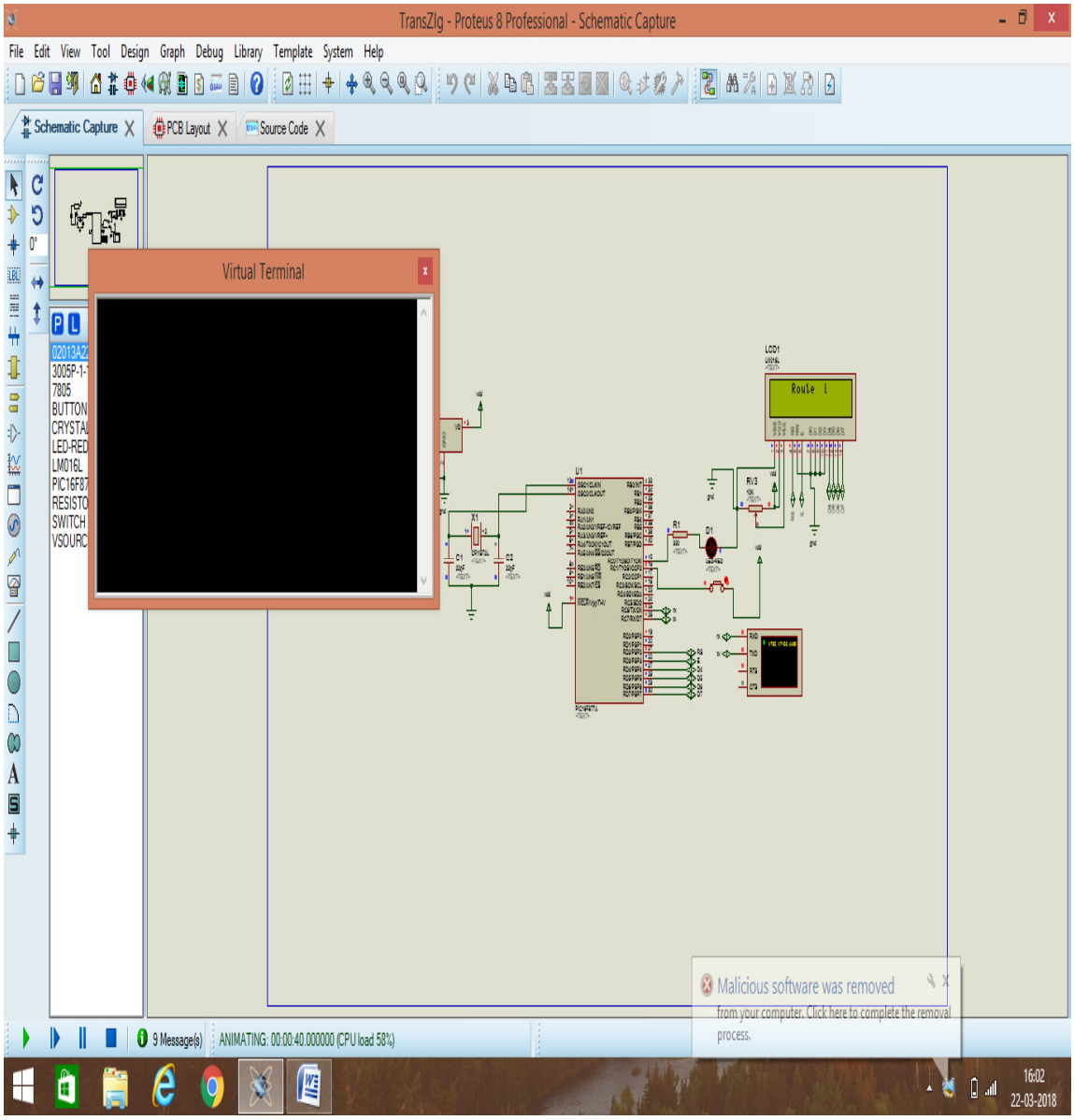

Figure 5.3 Schematic Capture of Route 1 Display

The above figure depicts that the RFID reader has read the corresponding route (Route 2) for which it reads the character ".v……..." then the microcontroller gets this character from the RFID reader and the route is displayed in the LCD display

5.4 HARDWARE IMPLEMENTATION

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Module 1:

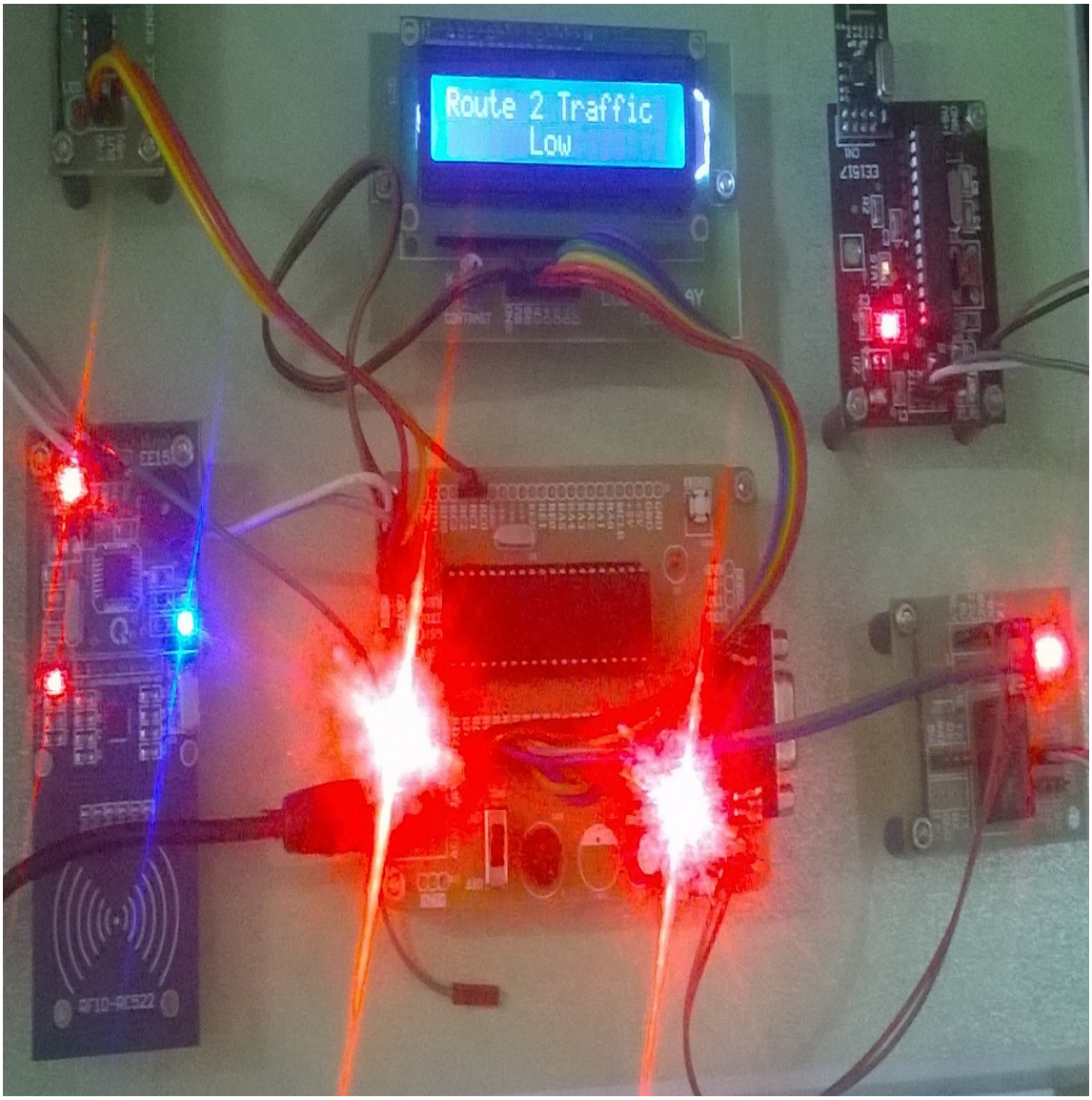

Figure 5.4 Hardware Module 1

The above displayed picture depicts that the traffic status of route 2 is low which is the combined result of the operation of the IR sensor for sensing the obstacle and RFID reader for tracking the corresponding route. The result is displayed on the LCD screen of the corresponding vehicle.

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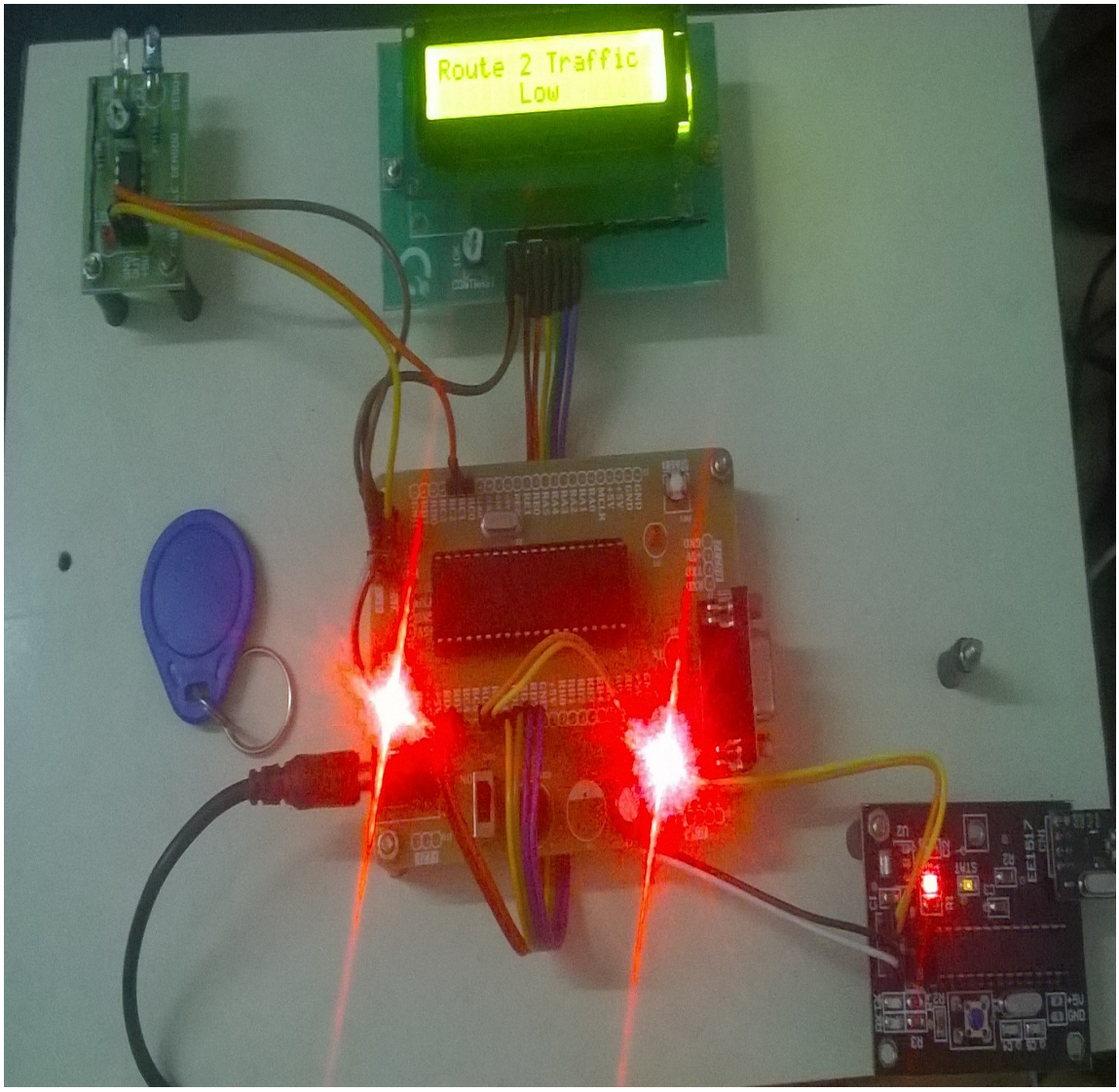
Module 2:

Figure 5.5 Hardware



Module 2

remedy for finding the new way with less traffic or no traffic. At the same time this system is also able to track the route of the vehicle, which is useful for the cops in finding a robbed vehicle. Thus, our proposed system has application in various dimensions. By using a Zigbee module wireless transmission mesh network is constructed. RFID reader is used for tracking the road route and IR sensor is used to sense any obstacle in the path of the particular vehicle. A timer is set to sense a traffic condition, if the presence of the obstacle is sensed beyond this time limit it is considered to be a traffic condition. Now this sensed traffic condition is transferred to the other connected vehicles via the mesh network constructed by the Zigbee module. The transmitted traffic awareness messages are displayed in the LCD displays of the connected vehicle. Thus we have designed a hardware model of an intelligent transport system for connected vehicles.In future this project can be enhanced by using a wireless spectrum band such as TV White Space (TVWS) instead of Zigbee module for constructing the wireless network which would enhance the transmission range of the traffic awareness messages.

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