

SMART TRAFFIC CONTROL WITH AMBULANCE DETECTION USING ARDUINO

Submitted in partial fulfilment of the requirements for the award of
Bachelor of Engineering degree in Electronics and Communication Engineering

by

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ENGINEERING
SCHOOL OF ELECTRICAL AND ELECTRONICS**

SATHYABAMA

**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

Accredited with Grade "A" by NAAC

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APRIL 2023



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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of **Nali Venkata Giridhar (39130309)** and **Nallu Murali Krishna (39130314)** who carried out the project entitled "SMART TRAFFIC CONTROL WITH AMBULANCE DETECTION USING ARDUINO" Under our supervision from November 2022 to April 2023.

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DECLARATION

We, NALI VENKATA GIRIDHAR and NALLU MURALI KRISHNA hereby declare that the project report entitled “SMART TRAFFIC CONTROL WITH AMBULANCE DETECTION USING ARDUINO” done by us under the guidance of **Ms. F. V. JAYASUDHA M.E., (Ph.D.)** at SATHYABAMA INSTITUTE OF SCIENCE AND TECHNOLOGY, CHENNAI is submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering degree in Electronics and Communication Engineering.

DATE: 19-04-2023

PLACE: CHENNAI

SIGNATURE OF THE CANDIDATES

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2. N. Murali Krishna

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ABSTRACT

Due to more population in our country, everyone needs to be hurry in their works. This leads to a very high traffic, many accidents. Most human deaths occurs because of ambulance not reaching the victim in time due to heavy traffic in between. For this we implemented a project called “SMART TRAFFIC CONTROL WITH AMBULANCE DETECTION USING ARDUINO”. The main objective of this project used to identify the ambulance and to control the traffic for providing free path in a road to reach the ambulance to hospital quickly.

In the existing literature, less focus is given towards the problem of providing a clear path for ambulance during traffic congestions. To solve these issues, an RF RT-RX based system is proposed, which manages and regulates the traffic signals at junctions when the ambulance approaches.

In this project, the main theme is based on Arduino and RF communication. The RF transmitter is connected to the ambulance and RF receiver is placed on the traffic light pole. When the ambulance comes near to the traffic signal, the driver will be able to modify the traffic signal to his desired path (way to hospital nearby). Then the desired path alone gives the green and remaining all will be given with red one.

The proposed framework is modelled by means of an experimental setup using Arduino and LED displays which simulates a real time traffic scenario. The simulation results illustrate the better performance of the proposed framework in terms of detection as well as management of emergency vehicle by providing passage out of traffic congestions

TABLE OF CONTENTS

CHAPTER No.	TITLE	PAGE No.
	ABSTRACT	v
	LIST OF FIGURES	ix
	LIST OF TABLES	x
	LIST OF ABBREVIATIONS	xi
1	INTRODUCTION	1
	1.1 Arduino mega 2560	2
	1.1.1 Over view	2
	1.1.2 Summary	2
	1.1.3 Power	3
	1.1.4 Memory	4
	1.1.5 Input and Output	4
	1.1.6 Communication	6
	1.1.7 Programming	6
	1.1.8 Automatic(software)reset	6
	1.1.9 Usb overcurrent protection	7
	1.1.10 Physical characteristics and shield compatibility	7
	1.2 RF Module	8
	1.2.1 Features of RF module	8
	1.2.2 RF Transmitter	9
	1.2.3 RF Receiver	10
	1.3 Problem statement	12

1.4	Objective	12
2	LITERATURE SURVEY	13
2.1	GPS based tracking and health parameter detection.	13
2.2	RFID & cloud approach	13
2.3	Density-based clustering	14
2.4	Intelligent accident detection and RF Communication	14
2.5	Restful API	15
2.6	Ambulance detection using image processing and neural networks	16
3	OVER VIEW OF PROPOSED WORK	18
3.1	Existing system	19
3.2	Proposed methodology	18
3.3	Components required	19
3.3.1	Software components	19
3.3.2	Hardware components	19
3.4	Advantages for the proposed methodology	20
4	IMPLEMENTATION OF THE PROPOSED WORK	21
4.1	RF Module	21
4.2	RF based wireless remote using TX-RX modules	22
4.3	System block diagram	24
4.3.1	Encoder	24
4.3.2	Decoder	24
4.3.3	RF Transmitter and Receiver Module	25
4.3.4	Embedded Microcontroller	25
4.4	Project system working	26
4.5	The traffic light sequences	27
4.5.1	The Normal Sequence	27

	4.5.2 The Emergency Mode Sequence	28
5	RESULTS AND DISCUSSION	31
	5.1 Normal situation	31
	5.2 Emergency situation	32
6	CONCLUSION	34
	REFERENCES	35

LIST OF FIGURES

FIGURE NO.	TITLE	PAGE NO.
1.1	Arduino mega 2560	2
1.2	RF-Transmitter	9
1.3	RF-Transmitter circuit	9
1.4	RF-Receiver	10
1.5	RF-Receiver pins	11
1.6	RF-Receiver circuit	11
4.1	RF components with circuit	22
4.2	RF Tx-Rx Module	23
4.3	RF Transmitter and Receiver Encoding & Decoding Module	24
4.4	Project block diagram	25
4.5	Full project view	26
4.6	The green light of traffic light 1 is on for 30 seconds	27
4.7	The yellow light of traffic light 1 is on for 2 seconds	28
4.8	The green light of traffic light 1 is on	29
4.9	The green light of traffic light 4 is on for 10 seconds	29
4.10	The sequence of the traffic light is going to back normal	30

4.11	The sequence of the traffic light is back to normal	30
5.1	The yellow light glows for 2 seconds	31
5.2	The yellow light turns into green for 30 seconds	31
5.3	In the normal situation the light changes from lane 2 to 3	32
5.4	The green light is on for lane 1 for switching the first button	32
5.5	The green light is on for lane 2 for switching the 2 button	33
5.6	The green light is on for lane 3 for switching the third button	33
5.7	The green light is on for lane 4 for switching the fourth button	33

LIST OF TABLES

TABLE NO.	TITLE	PAGE NO.
1.1	Arduino mega 2560 pins	2
4.1	Truth Table for First 30 Seconds of the Sequence	27
4.2	Truth Table for Next 2 Seconds of the Sequence	28

LIST OF ABBREVIATIONS

RF	Radio Frequency
RF-RT	Radio Frequency Transmitter
RF-RX	Radio Frequency Receiver
LED	Light Emitting Diode
UART	Universal Asynchronous Receiver/Transmitter
USB	Universal Serial Bus
AC	Alternate Current
DC	Direct Current
SRAM	Static Random Access Memory
EEPROM	Electrically Erasable Programmable Read-only Memory
FTDI	Future Technology Devices International
GND	Ground
I/O	Input/Output
PWM	Pulse Width Modulation
SPI	Serial Peripheral Interface
TTL	Time to Live

I2C	Inter-Integrated Circuit
AREF	Analogue Reference
TWI	Two-Wire Interface
ICSP	In-Circuit Serial Programming
DTR	Data Terminal Ready

CHAPTER 1

INTRODUCTION

In developing countries like India population is significantly growing. With the increase in the population the number of vehicles also increases. This results in a number of problems such as heavy traffic jams, violation of the traffic rules and sometimes even accidents. For instance, as per the Indian Government report, the number of road accidents increased to 426 deaths per day, in major cities such as Chennai, Hyderabad, and Delhi. Further, traffic congestions lead to long waiting times, fuel loss and also the wastage of money. Specifically, traffic congestions result in high pollution levels which affect the health of the local people, commuters and animals. In general, traffic congestions are also associated with few more traffic problems such as ambulances get blocked. Precisely, the traffic congestion often blocks the path of the ambulance which may prove fatal at times. Also, the number of deaths due to delay in arrival of ambulances have increased to a greater extent in recent times. Therefore, Ambulance needs to be on time to prevent loss of human life. Thus, helping an Ambulances to move out of traffic congestion is very much essential in the current traffic scenario. In order to solve the above given problems, by using ARDUINO and RF communication. The RF transmitter is connected to the ambulance and RF receiver is placed on the traffic light pole. When the ambulance comes near to the traffic signal, the driver will be able to modify the traffic signal to his desired path (way to hospital nearby). Then the desired path alone gives the green and remaining all will be given with red one.

1.1 ARDUINO MEGA 2560

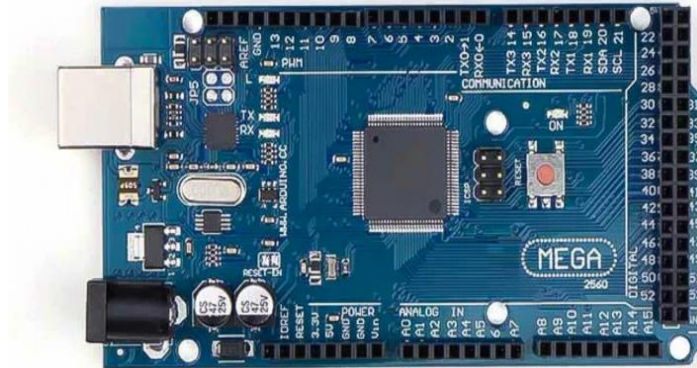


Fig 1.1 Arduino mega 2560

1.1.1 - Overview

The Arduino Mega 2560 is a microcontroller board based on the ATmega2560 (datasheet). It has 54 digital input/output pins (of which 14 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC to-DC adapter or battery to get started. The Mega is compatible with most shields designed for the Arduino Duemilanove or Diecimila.

1.1.2 - Summary

Table 1.1 Arduino mega 2560 pins

Microcontroller	ATmega 2560
Operating Voltage	5V
Input Voltage(recommended)	7-12V
Input Voltage(limits)	6-20V
Digital I/o Pins	54(of which 14 provided PWM output)
Analog Input Pins	16
DC Current per I/o Pin	40 mA
DC Current for 3.3v pin	50 mA
Flash Memory	256 KB of which 8KB used by bootloader
SRAM	8KB
EEPROM	4KB

1.1.3- Power

The Arduino Mega can be powered via the USB connection or with an external power supply. The power source is selected automatically.

External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the Gnd and Vin pin headers of the POWER connector.

The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may be unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts.

The Mega2560 differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter

- **VIN.** The input voltage to the Arduino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.
- **5V.** The regulated power supply used to power the microcontroller and other components on the board. This can come either from VIN via an on-board regulator, or be supplied by USB or another regulated 5V supply.
- **3V3.** A 3.3 volt supply generated by the on-board regulator. Maximum current draw is 50 mA.
- **GND.** Ground pins

1.1.4-Memory

The ATmega2560 has 256 KB of flash memory for storing code (of which 8 KB is used for the bootloader), 8 KB of SRAM and 4 KB of EEPROM (which can be read and written with the EEPROM library).

1.1.5-Input and Output

Each of the 54 digital pins on the Mega can be used as an input or output, using pin Mode() , digital Write(), and digital Read() functions. They operate at 5 volts. Each pin can provide or receive a maximum of 40 mA and has an internal pull-up resistor (disconnected by default) of 20-50 Kilo ohms. In addition, some pins have specialized functions.

- **Serial: 0 (RX) and 1 (TX); Serial 1: 19 (RX) and 18 (TX); Serial 2: 17 (RX) and 16 (TX); Serial 3: 15 (RX) and 14 (TX).** Used to receive (RX) and transmit (TX) TTL serial data. Pins 0 and 1 are also connected to the corresponding pins of the ATmega8U2 USB-to-TTL Serial chip.
- **External Interrupts: 2 (interrupt 0), 3 (interrupt 1), 18 (interrupt 5), 19 (interrupt 4), 20 (interrupt 3), and 21 (interrupt 2).** These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value. See the attach Interrupt() function for details.
- **PWM: 0 to 13.** Provide 8-bit PWM output with the analog Write() function.
- **SPI: 50 (MISO), 51 (MOSI), 52 (SCK), 53 (SS).** These pins support SPI communication using the SPI library. The SPI pins are also broken out on the ICSP header, which is physically compatible with the Uno, Duemilanove and Diecimila.
- **LED: 13.** There is a built-in LED connected to digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.

- **I2C: 20 (SDA) and 21 (SCL).** Support I2C (TWI) communication using the Wire library (documentation on the Wiring website). Note that these pins are not in the same location as the I2C pins on the Duemilanove or Diecimila.

The Mega2560 has 16 analog inputs, each of which provide 10 bits of resolution (i.e. 1024 different values). By default they measure from ground to 5 volts, though is it possible to change the upper end of their range using the AREF pin and analogReference() function.

There are a couple of other pins on the board:

- **AREF.** Reference voltage for the analog inputs. Used with analogReference().
- **Reset.** Bring this line LOW to reset the microcontroller. Typically used to add a reset button to shields which block the one on the board.

1.1.6-Communication

The Arduino Mega2560 has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers. The ATmega2560 provides four hardware UARTs for TTL (5V) serial communication. An ATmega8U2 on the board channels one of these over USB and provides a virtual com port to software on the computer (Windows machines will need a .inf file, but OSX and Linux machines will recognize the board as a COM port automatically. The Arduino software includes a serial monitor which allows simple textual data to be sent to and from the board. The RX and TX LEDs on the board will flash when data is being transmitted via the ATmega8U2 chip and USB connection to the computer (but not for serial communication on pins 0 and 1). A Software Serial library allows for serial communication on any of the Mega2560's digital pins. The ATmega2560 also supports I2C (TWI) and SPI communication. The Arduino software includes a Wire library to simplify use of the I2C bus; see the documentation on the Wiring website for details. For SPI communication, use the SPI library.

1.1.7-Programming

The Arduino Mega can be programmed with the Arduino software (download). For details, see the reference and tutorials.

The ATmega2560 on the Arduino Mega comes preburned with a bootloader that allows you to upload new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol (reference, C header files). You can also bypass the bootloader and program the microcontroller through the ICSP (InCircuit Serial Programming) header;

1.1.8-Automatic (Software) Reset

Rather than requiring a physical press of the reset button before an upload, the Arduino Mega2560 is designed in a way that allows it to be reset by software running on a connected computer. One of the hardware flow control lines (DTR) of the ATmega8U2 is connected to the reset line of the ATmega2560 via a 100 nano farad capacitor. When

this line is asserted (taken low), the reset line drops long enough to reset the chip. The Arduino software uses this capability to allow you to upload code by simply pressing the upload button in the Arduino environment. This means that the bootloader can have a shorter timeout, as the lowering of DTR can be well-coordinated with the start of the upload. This setup has other implications. When the Mega2560 is connected to either a computer running Mac OS X or Linux, it resets each time a connection is made to it from software (via USB). For the following half-second or so, the bootloader is running on the Mega2560. While it is programmed to ignore malformed data (i.e. anything besides an upload of new code), it will intercept the first few bytes of data sent to the board after a connection is opened. If a sketch running on the board receives one-time configuration or other data when it first starts, make sure that the software with which it communicates waits a second after opening the connection and before sending this data. The Mega2560 contains a trace that can be cut to disable the auto-reset. The pads on either side of the trace can be soldered together to re-enable it. It's labeled "RESET-EN". You may also be able to disable the auto-reset by connecting a 110 ohm resistor from 5V to the reset line.

1.1.9-USB Overcurrent Protection

The Arduino Mega2560 has a resettable polyfuse that protects your computer's USB ports from shorts and overcurrent. Although most computers provide their own internal protection, the fuse provides an extra layer of protection. If more than 500 mA is applied to the USB port, the fuse will automatically break the connection until the short or overload is removed.

1.1.10-Physical Characteristics and Shield Compatibility

The maximum length and width of the Mega2560 PCB are 4 and 2.1 inches respectively, with the USB connector and power jack extending beyond the former dimension. Three screw holes allow the board to be attached to a surface or case. Note that the distance between digital pins 7 and 8 is 160 mil (0.16"), not an even multiple of the 100 mil spacing of the other pins. The Mega2560 is designed to be compatible with most shields designed for the Uno, Diecimila or Duemilanove. Digital pins 0 to 13 (and

the adjacent AREF and GND pins), analog inputs 0 to 5, the power header, and ICSP header are all in equivalent locations. Further the main UART (serial port) is located on the same pins (0 and 1), as are external interrupts 0 and 1 (pins 2 and 3 respectively). SPI is available through the ICSP header on both the Mega2560 and Duemilanove / Diecimila. Please note that I2C is not located on the same pins on the Mega (20 and 21) as the Duemilanove / Diecimila (analog inputs 4 and 5).

1.2-RF MODULE

In genera, the wireless systems designer has two overriding constraints: it must operates over a certain distance and transfer a certain amount of information with a data rata. The RF modules are very small in dimension and have a wide operating voltage range i.e.(3V to 12V).

Basically the RF modules are 433 MHZ RF transmitter and receiver modules. The transmitter draws no power when transmitting logic zero while fully suppressing the carrier frequency thus consume significantly low power in battery operation. When logic one is sent carrier is fully on to about 4.5mA with a 3volts power supply. The data is sent serially from the transmitter which is received by the tuned receiver. Transmitter and the receiver are duly interfaced to two microcontrollers for data transfer.

1.2.1-Features of RF Module:

- Receiver frequency 433MHZ
- Receiver typical frequency 105Dbm
- Receiver supply current 3.5mA
- Low power consumption
- Receiver operating voltage 5v
- Transmitter frequency range 433.92MHZ
- Transmitter supply voltage 3v-6v
- Transmitter output power 4v-12

1.2.2- RF TRANSMITTER

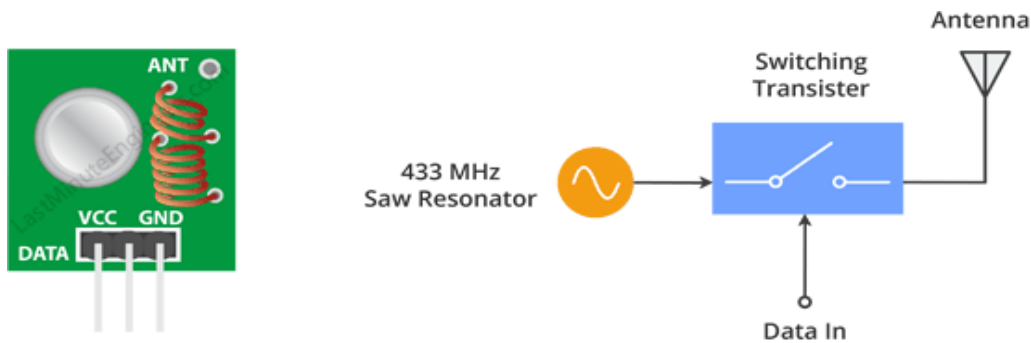


Fig 1.2 RF-Transmitter

This little module is a transmitter among two. It is really simple as it looks. The heart of the module is the SAW resonator which is tuned for 433.xx MHz operation. There is a switching transistor and a few passive components, that's it.

When a logic HIGH is applied to the DATA input, the oscillator runs producing a constant RF output carrier wave at 433.xx MHz and when the DATA input is taken to logic LOW, the oscillator stops. This technique is known as Amplitude Shift Keying, which we will discuss in detail shortly.

RF Transmitter Circuit:

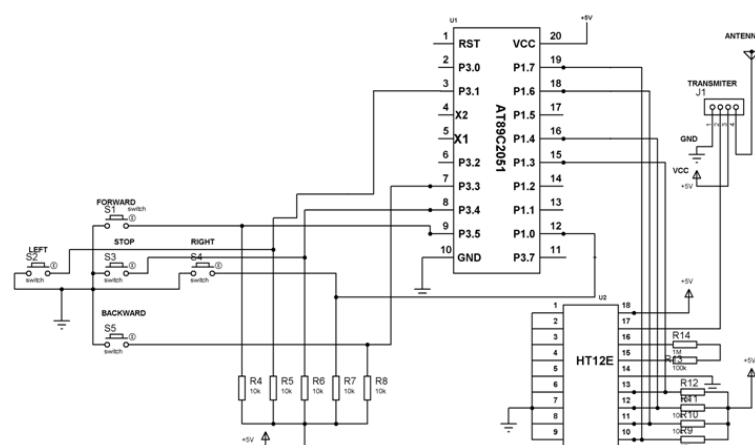


Fig 1.3 RF-Transmitter circuit

DATA pin- accepts digital data to be transmitted.

VCC pin-supplies power for the transmitter. This can be any positive DC voltage between 3.5V to 12V. Note that the RF output is proportional to the supply voltage i.e. the higher the Voltage, the greater the range will be.

GND is a ground pin

ANTENNA-is a pin for external antenna. As discussed earlier, you will want to solder a 17.3 cm piece of solid wire to this pin for the improved range.

As we will be sending data between two Arduino boards, we will of course need two Arduino boards, two breadboards and a couple of jumper wires.

The wiring for the transmitter is fairly simple. It has only three connections. Connect the VCC pin to 5V pin and GND to ground on the Arduino. The Data-In pin should be connected to Arduino's digital pin #12. You should try and use pin 12 as by default the library we'll be using in our sketch uses this pin for data input.

1.2.3- RF RECEIVER

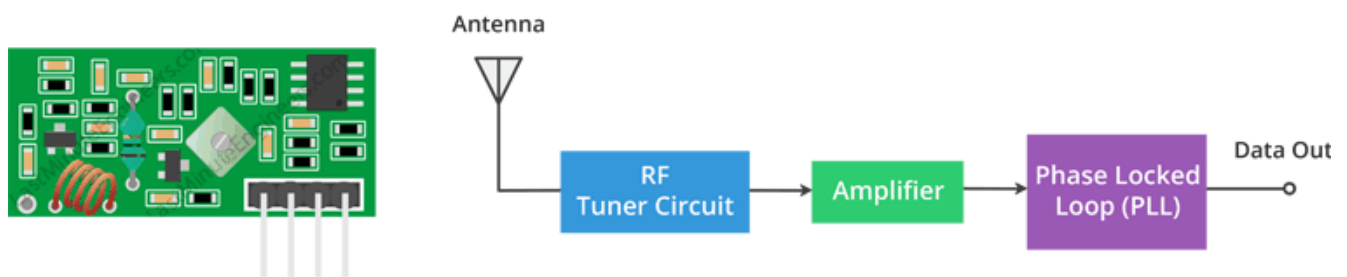


Fig 1.4 RF-Receiver

This one is a receiver module. Though it looks complex, it is as simple as the transmitter module. It consists of a RF tuned circuit and a couple of OP Amps to amplify the received carrier wave from the transmitter. The amplified signal is further fed to a PLL(PHASE LOCK LOOP) which enables the decoder to “lock” onto a stream of digital bits which gives better decoded output and noise immunity.

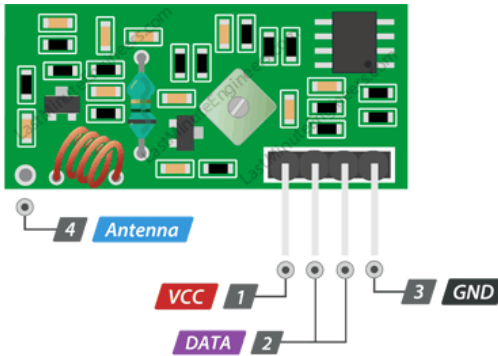


Fig 1.5 RF-Receiver pins

VCC-supplies power for the receiver. Unlike the transmitter, supply voltage for receiver needs to be 5V.

RF Receiver Circuit

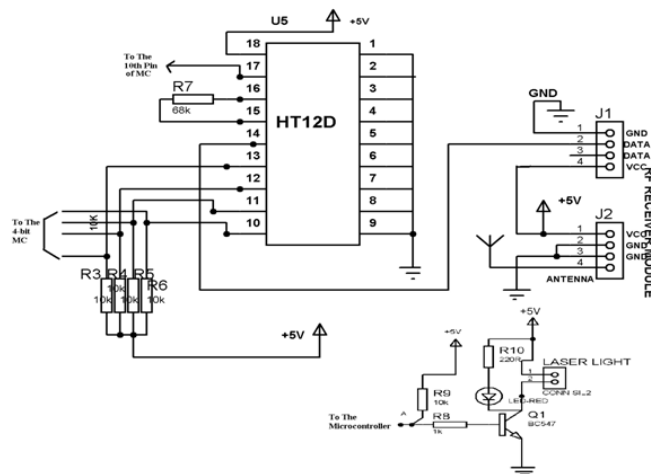


Fig 1.6 RF-Receiver circuit

DATA pin-pins output the digital data received. The two center pins are internally tied together, so you can use either one for data out.

GND-is a ground pin.

ANTENNA- is a pin for external antenna which is often unmarked. It is the pad in the lower left of the module, right next to the small coil. Again, you will want to solder a 17.3 cm piece of solid wire to this pin for the improved range. Once you have the transmitter wired you can move on to the receiver. The wiring for the receiver is just as easy as the transmitter was.

Once again there are only three connections to make. Connect the VCC pin to 5V pin and GND to ground on the Arduino. Any of the middle two Data-Out pins should be connected to digital pin #11 on the Arduino.

1.3-PROBLEM STATEMENT

- Giving the traffic signal access to ambulance driver.
- Giving a free path for ambulance is a challenging task as accuracy is limited.

1.4- OBJECTIVE

The objectives are detailed as follows :

- To facilitate the free path for ambulance for reaching to hospital in quick time.
- Use RF RT-RX module to communicate for long range.
- Use alarm in the junction road to indicates that ambulance coming near to traffic signal.

CHAPTER 2

LITERATURE SURVEY

Many people done projects on ambulance tracking and detection using different ways. Here we have collected some references. And we came up with a project which detects ambulance by using **RF module**. Here we listed some of the references related to ambulance detection for free path in traffic.

2.1 PROJECT TITLE : GPS based tracking and health parameter detection.

Author Name : Shivali Walvekar and Kinjal More

Year of Publishing : 2016

Description : It displays the current location of ambulances and patient's health parameter on the LCD display and sends that information to the hospital. Health monitoring systems have rapidly evolved recently, and smart systems have been proposed to monitor patient current health conditions, in our proposed and implemented system, we focus on monitoring the patient's blood pressure, and his body temperature. Based on last decade statistics of medical records, death rates due to hypertensive heart disease, shows that the blood pressure is a crucial risk factor for atherosclerosis and ischemic heart diseases; thus, preventive measures should be taken against high blood pressure which provide the ability to track, trace and save patient's life at appropriate time is an essential need for mankind. The objective of this work is providing an effective application for Real Time Health Monitoring and Tracking. The system will track, trace, monitor patients and facilitate taking care of their health; so efficient medical services could be provided at appropriate time.

2.2 PROJECT TITLE : RFID & cloud approach

Author Name : B.Janani Saradha, G.Vijayshri, T.Subha

Year of Publishing : 2017

Description : The RFID tag helps in controlling the flow of traffic by changing the traffic lights. A New Approach for Intelligent Traffic Control System using Raspberry pi . An intelligent traffic control system is employed for a smooth flow of traffic. A Radio

Frequency Identification (RFID) tag is placed inside each vehicle in such a way that changes such as removing, destroying or tampering cannot be made to the RFID tag. The RFID reader, system-on-chip is made to read the RFID tags that are placed inside the vehicle. The system is made to count the vehicles that pass the signal which is used to control congestion present in the network by regulating the green signal duration of the congested path. However, its range is limited by the RFID Reader

2.3 PROJECT TITLE: Density-based clustering

Author Name: Chennakesava Reddy Kamireddy, Bingisateesh, Keshavamurthy

Year of Publishing: 2016

Description: It groups the major accidental areas into clusters and assign an ambulance to each of them, thereby reducing the average distance travelled by the ambulance Traffic congestion is a severe problem in most of the cities across the world and it has become a nightmare for the citizens. It is caused by delay in signal, inappropriate timing of traffic signaling etc. The delay of traffic light is hard coded and it does not depend on traffic. Therefore, for optimizing traffic control, there is an increasing demand in systematic quick automatic system. This paper is designed to develop a density based dynamic traffic signal control. The signal timing changes automatically on sensing the traffic density at the junction. The microcontroller used in this project is ARDUINO. The system contains IR sensors (transmitter and receiver) which will be mounted on the either side of the road on poles. It gets activated and receives the signal as the vehicles passes close by it.

2.4 PROJECT TITLE: Intelligent accident detection and RF communication

Author Name: Bhandari Prachi, Dalvi Kasturi and Chopade Priyanka

Year of Publishing: 2014

Description : The sensors placed in the vehicles helps in automatic accident detection and inform it the ambulance Recently technological and population development, the

usage of vehicles are rapidly increasing and at the same time the occurrence accident is also increased. Hence, the value of human life ignored. No one can prevent the accident, but can save their life by expediting the ambulance to the hospital in time. A new vivid scheme called Intelligent accident detection system is introduced. The objective of this scheme is to minimize the delay caused by traffic congestion and to provide the smooth flow of emergency vehicles. The concept of this scheme is to green the traffic signal in the path of ambulance automatically with the help of RF Module. So that the ambulance can reach the spot in time and human life can be saved and the accident location is identified sends the accident location immediately to the main server. The main server finds the nearest ambulance to the accident zone and sends the exact accident location to the emergency vehicle. The control unit monitors the ambulance and provides the shortest path to the ambulance at the same time it controls the traffic light according to the ambulance location and thus arriving at the hospital safely. This scheme is fully automated, thus it locates the accident spot accurately, controls the traffic lights, provide the shortest path to reach the location and to the hospital in time.

2.5 PROJECT TITLE: Restful API

Author Name: CS Vikas and Ashok Immanuel

Year of Publishing: 2017

Description: It's a web-based application that shows the nearest ambulances, clinic and pharmacies to the user. Saving peoples live is the most important in today's world. The best way to save lives is to have an ambulance system which is effective and can be reachable to the user/client, this paper gives the solution which focus to make the ambulance available to a nearby user/client/patient in the least possible time which will help save many lives. After extensive study and analysis new technology evolved. Navigator. geolocation method based on RestFUL Web Services is used this will help the ambulance location to be updated in the database so that it can be seen by the user who is using this application and makes it easy for him to book the ambulance. The client's location will be pin pointed on the google map and even the ambulance which is nearby the user will be pin pointed on the map, once the patient is on board the ambulance location is taken and then the list of hospitals are pointed out on the

map which helps the ambulance driver to choose the nearby hospital to take the patient on time. REST FUL Web service is a service that is being offered by one electronic device to another electronic device, to help communicating with each other via the WWW (World Wide Web). In Web service, the Web technology used to make it better to communicate is HTTP (Hypertext Transfer Protocol), it is designed in such a way to help in better communication between the human and machine, this is also helpful for the communication between machines, more specifically for transferring machine readable file formats such as XML and JSON. The Web service provides a typical object-oriented Web-based interface to a database server, utilized for example a mobile application, another Web server, or by a mobile application, that provides a user interface to the end user. Another common application offered to the end user may be mash up, where a Web server consumes several Web services at different machines and compiles the content into one user interface⁶. A conferencing API (Application Program Interface) or any API for that matter allows communication to take place between a software application and a remote application over the Internet through a series of calls. An API is a definition, an interface, it is something that defines the way in which two or more entities communicate. Using APIs, the calls between applications are managed through Web services. Web services are a collection of technological standards and protocols, which help in an effective completion of communication, languages including XML (Extensible Markup Language), JSON and other programming language can be used.

2.6 PROJECT TITLE : Ambulance detection using image processing and neural networks

Author Name : K Agrawal, M K Nigam , S Bhattacharya

Year of Publishing : 2021

Description : In this project they propose a method that offers much more reliable vehicle detection with less time required compared to other deep convolutional approaches. The device is designed to track vehicles in traffic through video surveillance. Unlike other convolutional neural network approaches that identify

specified objects, the modified convolutional deep learning approach increases the accuracy of detecting ambulances . Ambulance Detection using Image Processing and Neural Network is a vehicle detection and tracking system, which recognizes the vehicle (i.e., Ambulance in this case) amidst the traffic congestion. Due to the fact from past few years, the range of vehicles usage of the road is growing each day that results in traffic congestion, for better management of this traffic this system is useful. Traffic Congestion, as mentioned above, can be observed at an ever-growing pace in countries like India and Thailand, where the roads' width and length make it impossible to make a separate lane for the emergency vehicle (like that of ambulance); Hence making it hard for the vehicle to pass through the traffic at the earliest possible time. The Ambulance tracking system is activated at the mapped junctions and that program detects the ambulance coming close to it and turns the traffic light to Green for the next 15 seconds. Geocoding is the practice of transforming addresses (like a physical address) to location information (like longitude and latitude) that can be used to locate a label on a map or to mark a grid. They plan to provide ambulances with this software to make it easy to transform addresses into a programmable format for review and retrieval. This data is converted to a system that shows all the crossings it must pass to meet the endpoint.

CHAPTER 3

OVERVIEW OF PROPOSED WORK

3.1 EXISTING SYSTEM

Ambulance Detection using Image Processing and Neural Network is a vehicle detection and tracking system, which recognizes the vehicle (i.e., Ambulance in this case) amidst the traffic congestion. Due to the fact from past few years, the range of vehicles usage of the road is growing each day that results in traffic congestion, for better management of this traffic this system is useful. Traffic Congestion, as mentioned above, can be observed at an ever-growing pace in countries like India and Thailand, where the roads' width and length make it impossible to make a separate lane for the emergency vehicle (like that of ambulance); Hence making it hard for the vehicle to pass through the traffic at the earliest possible time. The Ambulance tracking system is activated at the mapped junctions and that program detects the ambulance coming close to it and turns the traffic light to Green for the next 15 seconds. Geocoding is the practice of transforming addresses (like a physical address) to location information (like longitude and latitude) that can be used to locate a label on a map or to mark a grid. They plan to provide ambulances with this software to make it easy to transform addresses into a programmable format for review and retrieval. This data is converted to a system that shows all the crossings it must pass to meet the endpoint.

3.2 PROPOSED METHODOLOGY

In this project, we proposed a good method to detect an ambulance and to give a clear path for it to reach health centre very quickly. In this project we used mainly three components namely **ARDUINO mega 2560, RF module, Encoder& Decoder**. The traffic controlling is completely controlled by an ambulance driver when the ambulance comes near to the junction where we have traffic signals. When the (RF-RT) Radio frequency transmitter emits the signal with the help of wireless antenna, (RF-RX) Radio frequency receiver takes that signal. The driver confirms the way that he wants to go will be given as green, by default all the other ways will be blocked by red signal.

Simultaneously the buzzer blows, then the people near traffic signals will understand that an ambulance is behind them. They will be alerted and given a free path to the ambulance.

3.3 COMPONENTS REQUIRED

3.3.1 SOFTWARE COMPONENTS

- Embedded 'C'
- RIDE to write code
- ISP to burn the chip

3.3.2 HARDWARE COMPONENTS

- Arduino atmega 2560
- 16X 2 LCD
- Led
- RF Transmitter
- RF Receiver
- Encoder
- Decoder
- Power supply
- Transformer
- PCB board

3.4 ADVANTAGES FOR THE PROPOSED METHODOLOGY

- Short process time.
- Reduced equipment dimension.
- Instant and accurate process control.
- RF module covers over a long range up to above 300 m.
- Arduino mega 2560 comes with more memory space, bigger size, more I/O pins.
- Arduino mega 2560 is fairly low cost and no external programmer or power supply needed.
- Speed communication can be achieved and there are three ways to power the board i.e. either through USB cable, or by using Vin pin of the board, or through Power jack.
- By this method ambulance can reach hospital quickly and can save lives.

CHAPTER 4

IMPLEMENTATION OF THE PROPOSED WORK

4.1 RF Module (RF Transmitter and Receiver Module)

The RF module, as the name suggests, operates at Radio Frequency. The corresponding frequency range varies between 30 kHz & 300 GHz. In this RF system, the digital data is represented as variations in the amplitude of carrier wave. This kind of modulation is known as Amplitude Shift Keying (ASK). Transmission through RF is better than IR (infrared) because of many reasons. Firstly, signals through RF can travel through larger distances making it suitable for long range applications. Next, RF transmission is more strong and reliable than IR transmission.

RF communication uses a specific frequency unlike IR signals which are affected by other IR emitting sources. This RF module comprises of an RF Transmitter and an RF Receiver. The transmitter/receiver (Tx/Rx) pair operates at a frequency of 434 MHz. An RF transmitter receives serial data and transmits it wirelessly through RF through its antenna connected at pin4. The transmission occurs at the rate of 1Kbps - 10Kbps. The transmitted data is received by an RF receiver operating at the same frequency as that of the transmitter. The RF module is often used along with a pair of encoder/decoder. The encoder is used for encoding parallel data for transmission feed while reception is decoded by a decoder. HT12E-HT12D, HT640-HT648, etc. are some commonly used encoder/decoder pair ICs.

A radio frequency (RF) signal begins as an electrical alternating current (AC) signal that is originally generated by a transmitter. This AC signal is sent via a copper conductor which usually a coaxial cable and radiated out of an antenna element in the form of an electromagnetic wave. Changes of current flow in the antenna produce changes in the electromagnetic fields around the

antenna.

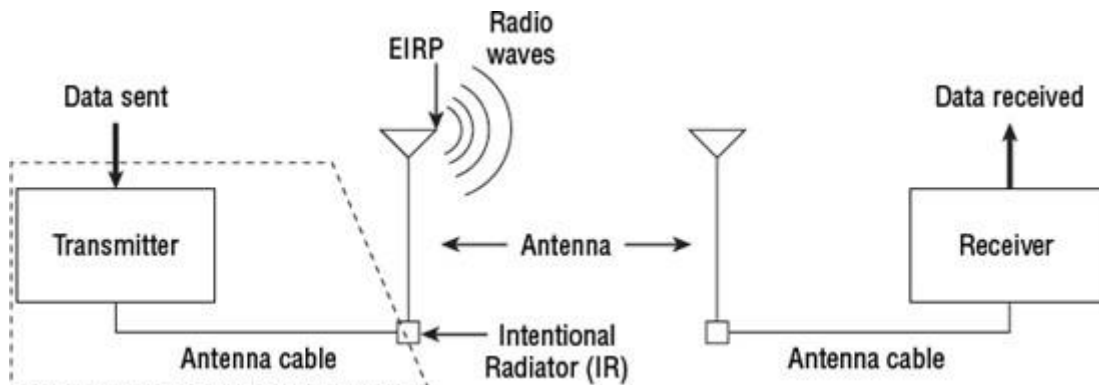


Fig 4.1 RF components with circuit

4.2 RF Based Wireless Remote using TX-RX Modules

This circuit utilizes the RF module, transmitter and receiver (TX-RX) for making a wireless remote, which could be used to drive an output from a distant place. RF module, as the name suggests, uses radio frequency to send signals. These signals are transmitted at a particular frequency and a baud rate. A receiver can receive these signals only if it is configured for that frequency. A four channel encoder/decoder pair has also been used in this system. The input signals, at the transmitter side, are taken through four switches while the outputs are monitored on a set of four light emitting diodes (LED) corresponding to each input switch. The circuit can be used for designing remote appliance control system. The outputs from the receiver can drive corresponding relays connected to any household appliance.

This RF transmission system employs Amplitude Shift Keying (ASK) with transmitter/receiver (Tx/Rx) pair operating at 434 MHz. The transmitter module takes serial input and transmits these signals through RF. The transmitted signals are received by the receiver module placed away from the source of transmission. The system allows one way communication between two nodes, namely, transmission and reception. The RF module has been used in conjunction with a set of four channel encoder/decoder ICs. The encoder converts the parallel inputs (from the remote switches) into serial set of signals. These signals are serially transferred through RF to the reception point. The decoder is used after the RF

receiver to decode the serial format and retrieve the original signals as outputs. These outputs can be observed on corresponding LEDs.

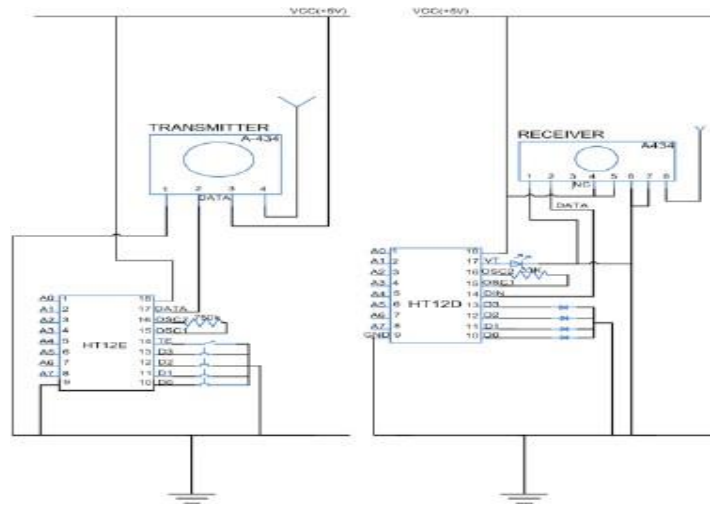


Fig 4.2 RF Tx-Rx Module

Transmission through RF is better than infrared (IR) because of many reasons. Firstly, signals through RF can travel through larger distances making it suitable for long range applications. Besides, while IR mostly operates in line-of-sight mode, RF signals can travel even when there is an obstruction between transmitter & receiver. Next, RF transmission is more strong and reliable than IR transmission. RF communication uses a specific frequency unlike IR signals which are affected by other IR emitting sources. The RF module comprises of an RF Transmitter and an RF Receiver. The transmitter/receiver (Tx/Rx) pair operates at a frequency of 434 MHz. An RF transmitter receives serial data and transmits it wirelessly through RF through its antenna connected at pin4. The transmission occurs at the rate of 1Kbps - 10Kbps. The transmitted data is received by an RF receiver operating at the same frequency as that of the transmitter

The system allows one way communication between two nodes, namely, transmission and reception. The RF module has been used in conjunction with a set of four channel encoder/decoder ICs. Here HT12E & HT12D have been used as encoder and decoder respectively. The encoder converts the parallel inputs (from the remote switches) into serial set of signals. These signals are serially transferred through RF to the reception point. The decoder is used after the RF receiver to decode the serial

format and retrieve the original signals as outputs. These outputs can be observed on corresponding LEDs.

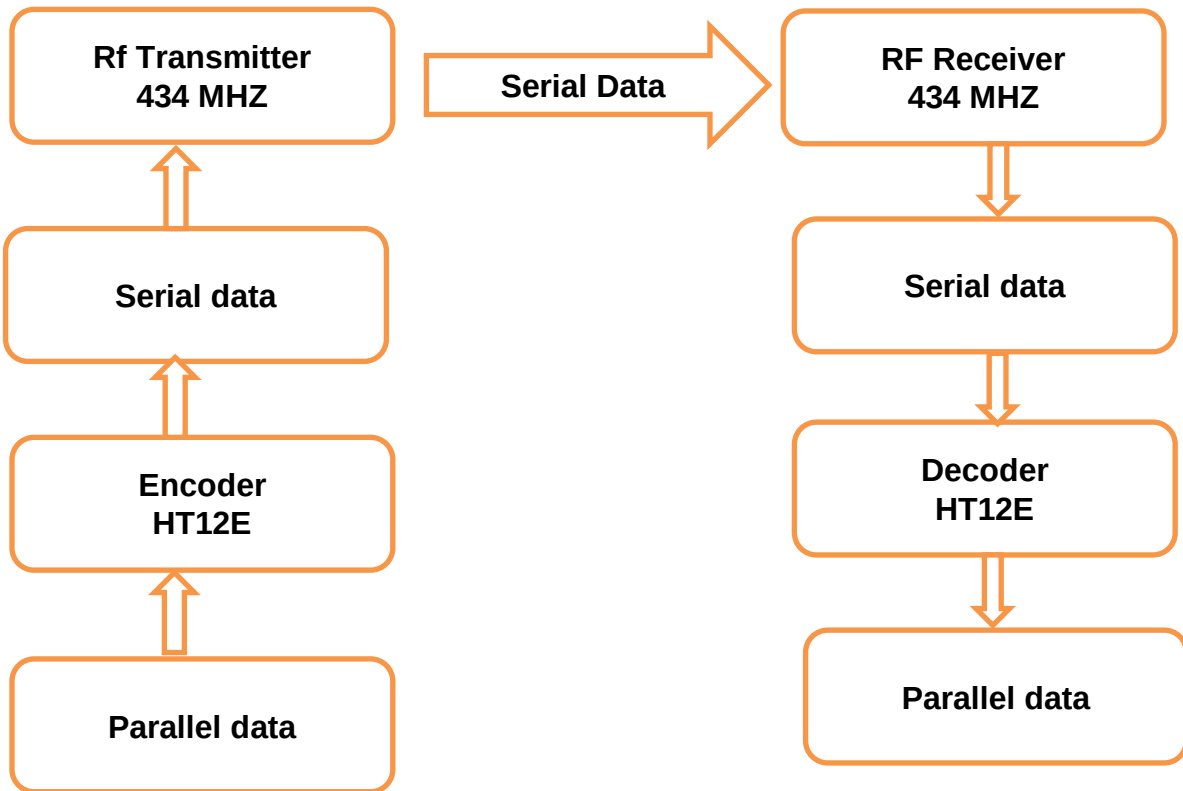


Fig 4.3 RF Transmitter and Receiver Encoding & Decoding Module

4.3 SYSTEM BLOCK DIAGRAM

The block diagram is divided into several parts such as encoder, RF transmitter and receiver, decoder and embedded microcontroller.

4.3.1 ENCODER

Encoding is a popular way of securing data and information; changing the format so that it can only be read by someone with the appropriate decoding equipment or software. An encoder is a device or entity that will encode information in a particular way, compressing, converting or securing it into a different format. Since there are four traffic lights at the intersection, multiple channel encoders will be used for this project.

4.3.2 DECODER

The encoding process essentially scrambles all the pieces of the data up and they are then put back together at the other end by the decoder. A decoder is the device or entity that will remove the information from its previously encoded state and return it to its original format. The decoder must have the same number of channel with the encoder.

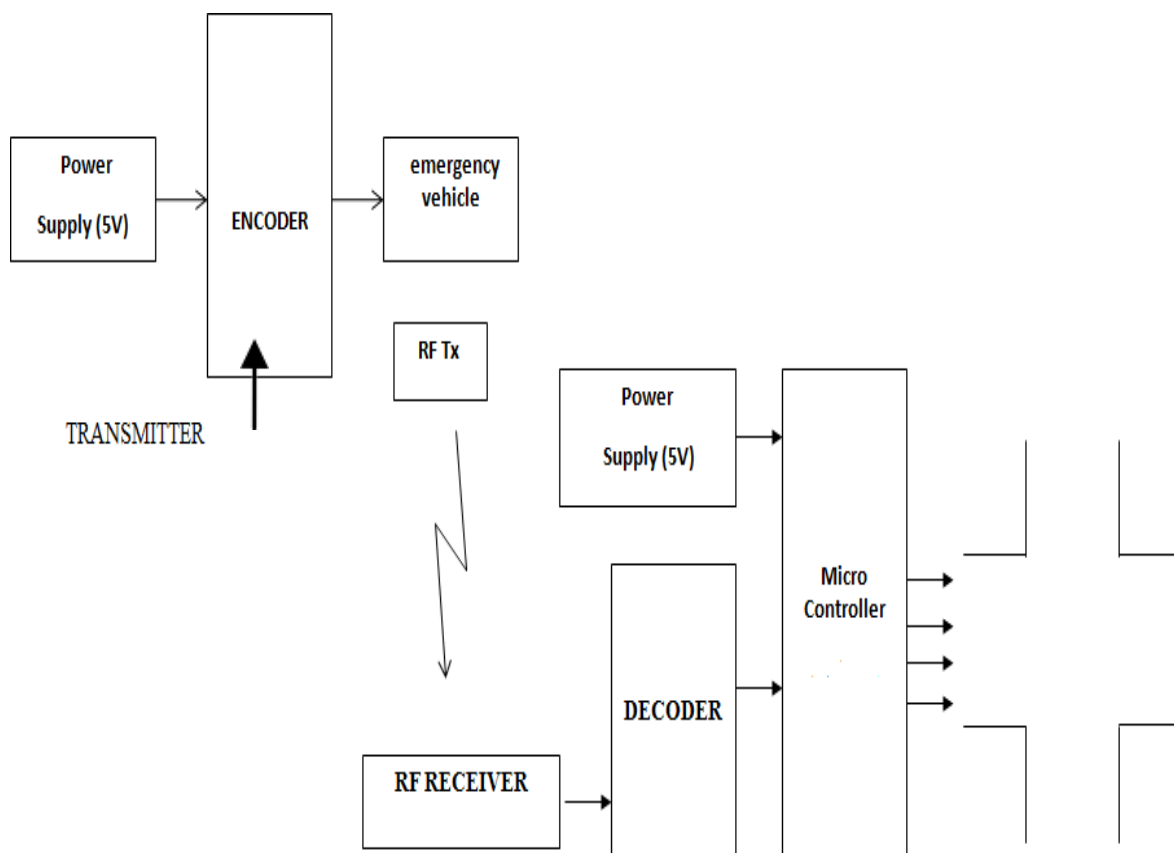


Fig 4.4 Project block diagram

4.3.3 RF Transmitter and Receiver Module

A radio frequency transmitter and receiver module will be used in the circuit to implement wireless communication for this project.

4.3.4 Embedded Microcontroller

PIC 16F877A, a 40-pins PIC will be used to operate the end device system since it has many ports and most importantly it supports UART features.

4.4 PROJECT SYSTEM WORKING

This project uses an Arduino ATmega as a microcontroller. Arduino gets one input from RF sensor which are set so that they receive signal from emergency vehicle coming towards the road. The RF readings are logged into Arduino memory for the first 7 seconds. After the initial 7 seconds, the readings are compared to the set levels so that the output delay for LED is calculated. This happens for the one main control line for the signal output. In a traffic signal system, the green light allows traffic to proceed in the direction denoted. The amber (yellow) light warns that the signal is about to change to red and also indicates ready before signal is about to change to green. The red signal prohibits any traffic from proceeding. A flashing red indication is treated as a stop sign. Here we are adding a new blue traffic signal light called hazard light (It indicates emergency situation to both the traffic and pedestrians), which is triggered only when the emergency vehicle comes 100m far from the traffic signal. Here we are implementing a system in the existing traffic signal which is having four lanes. If the emergency vehicle comes through lane 1, the ambulance siren indicates the free right vehicles in the traffic have to move on to the left side. So that the passing of emergency vehicle is more easier. If in case we are getting a block before the traffic signal we have a free passage with a boom barrier on the dividers of the road which opens only for the emergency vehicles.

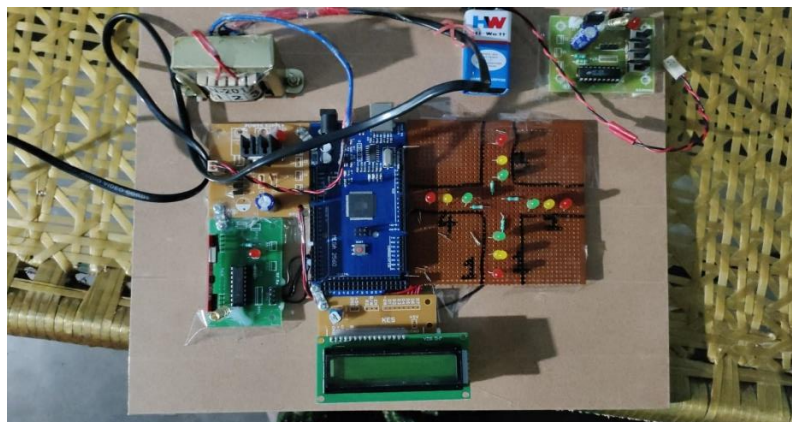


Fig 4.5 Full project view

4.5 The Traffic Light Sequences

4.5.1 The Normal Sequence

The sequence of the traffic lights started as green light of traffic light 1 and red light of other traffic lights are on. The duration for this mode lasted for 30 seconds unless the RF receiver triggers any signal from the transmitter to override the sequence.

Table 4.1 Truth Table for First 30 Seconds of the Sequence

Traffic Light	Red	Yellow	Green
Lane 1	0	0	1
Lane 2	1	0	0
Lane 3	1	0	0
Lane 4	1	0	0

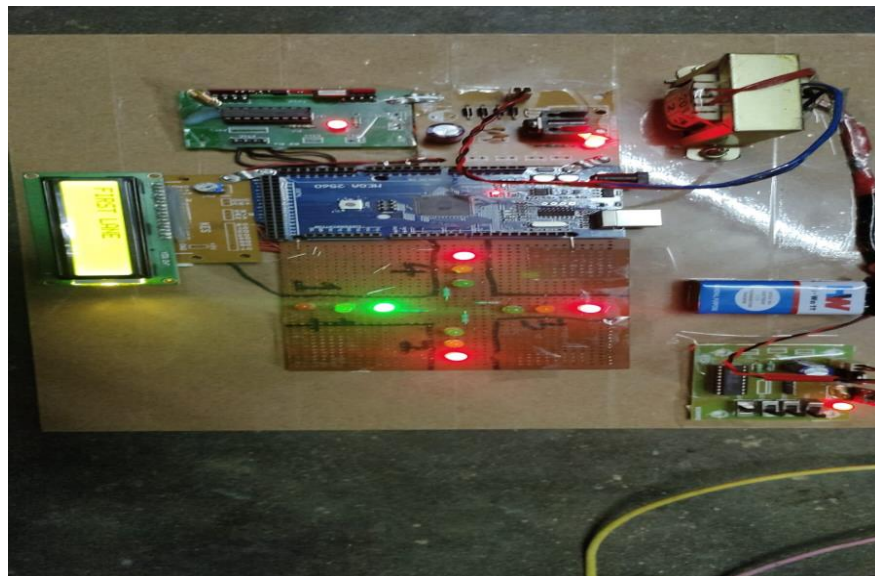


Fig. 4.6 The green light of traffic light 1 is on for 30 seconds

Then, the green light of traffic light 1 is off and the yellow light of the same traffic light is

on for 2 seconds

Table 4.2 Truth Table for Next 2 Seconds of the Sequence

Traffic Light	Red	Yellow	Green
Lane 1	0	1	0
Lane 2	1	0	0
Lane 3	1	0	0
Lane 4	1	0	0

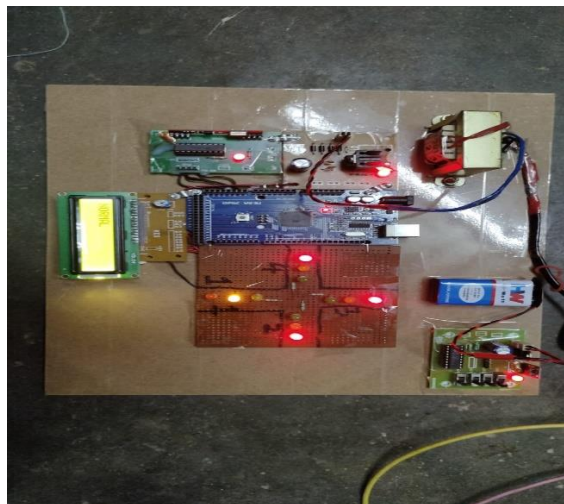


Fig 4.7 The yellow light of traffic light 1 is on for 2 seconds

Next, the sequence turned on the green light of traffic light 2 and the red light of other traffic light for duration of 30 seconds. The same thing happened to the traffic light 3 and traffic light 4 after an interval of the yellow light of each traffic light is on for 2 seconds. The microcontroller will keep repeating this sequence of the traffic light unless the emergency sequence is triggered.

4.5.2 The Emergency Mode Sequence

The emergency mode is triggered when the RF receiver received the transmitted signal from the RF transmitter to override the normal sequence of the traffic light. For example, an ambulance arrives at the traffic light 4 and the green

light of the traffic light 1 is on.

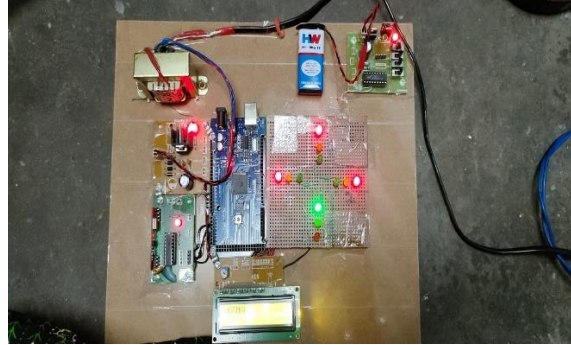


Fig 4.8 The green light of traffic light 1 is on

When the push-on button no.4 is turned on, the RF receiver received the transmitted signal and changed the sequence to the emergency sequence mode. The emergency sequence mode started when the yellow of traffic light 1 is on for 2 seconds. Then the green of traffic light 4 is on for 10 seconds and then the yellow light of the same traffic light is turned on for 2 seconds



Fig 4.9 The green light of traffic light 4 is on for 10 seconds

The emergency sequence mode is ended when the sequence of the traffic light is back to the normal sequence which the green light of traffic light 1 is turned back on for the remaining time before the emergency sequence mode is triggered.



Fig 4.10 The sequence of the traffic light is going to back normal

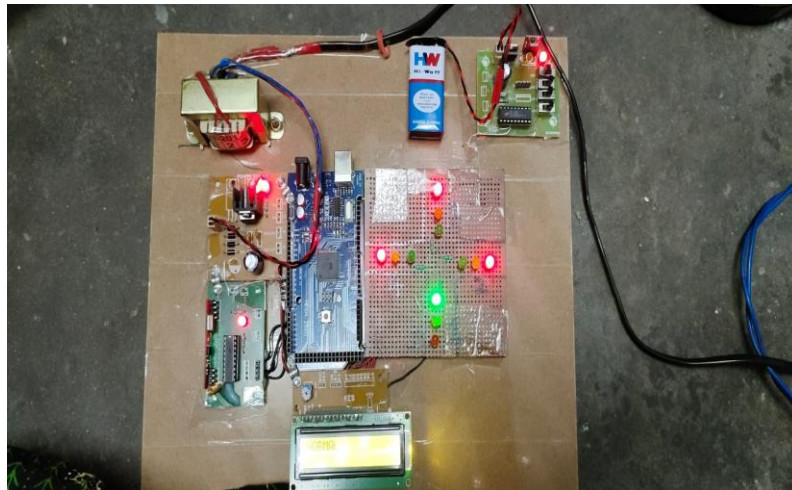


Fig 4.11 The sequence of the traffic light is back to normal

CHAPTER 5

RESULTS AND DISCUSSION

5.1 NORMAL SITUATION

The sequence of the traffic lights started as green light of traffic light 1 and red light of other traffic lights are on. The duration for this mode lasted for 30 seconds unless the RF receiver triggers any signal from the transmitter to override the sequence.

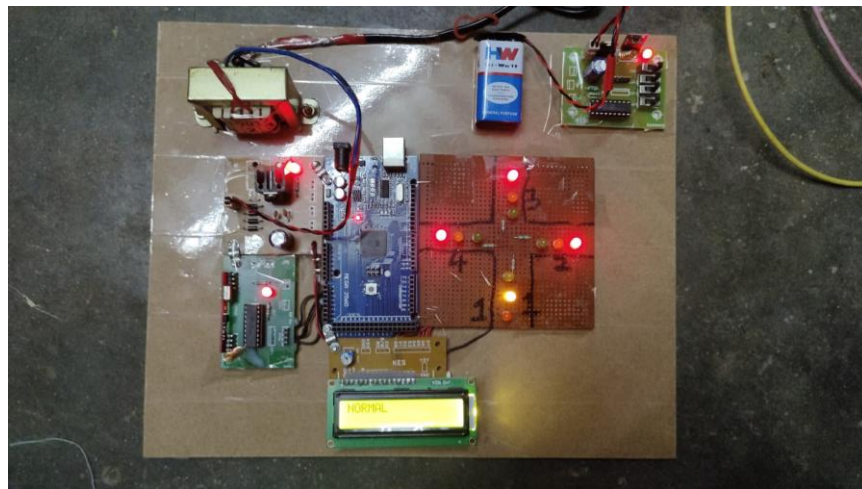


FIG 5.1 The yellow light glows for 2 seconds

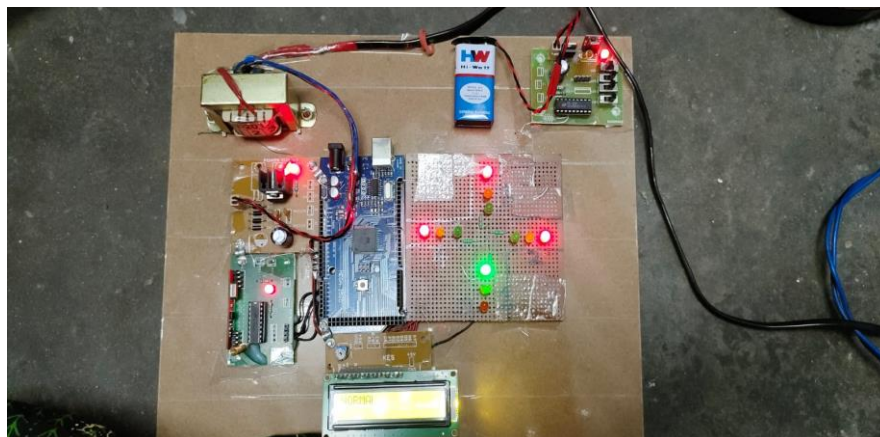


Fig 5.2 The yellow light turns into green for 30 seconds

Starting from lane 1 the green light simultaneously changes to lane 2, 3 and 4 and again it continuous from lane 1 and soon for every 30 seconds .



Fig 5.3 In the normal situation the green light changes from lane 2 to 3

5.2 EMERGENCY SITUATION

When the emergency switch is on by the ambulance driver for lane 1 then the sequence of light changes to green for lane 1 and remaining all the lanes get red light and in the lcd display it shows first lane.

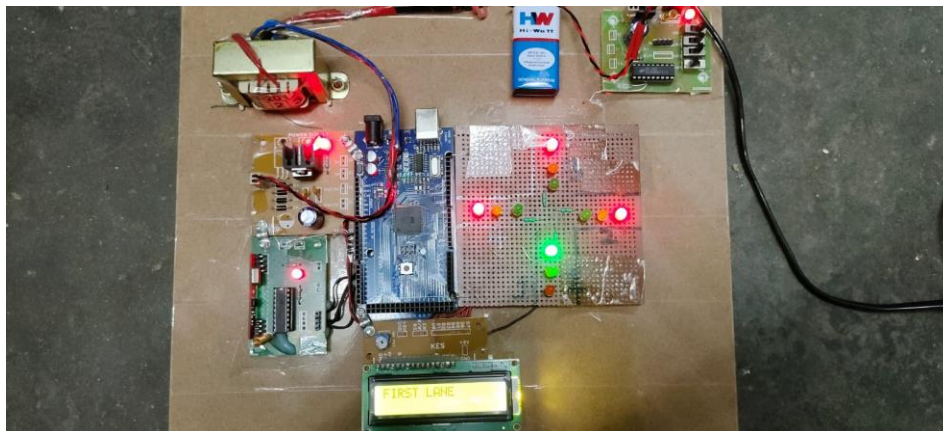


Fig 5.4 The green light is on for lane 1 for switching the first button

When the 2 emergency switch is on then the second lane gets green from any other lanes and all lanes glows red light

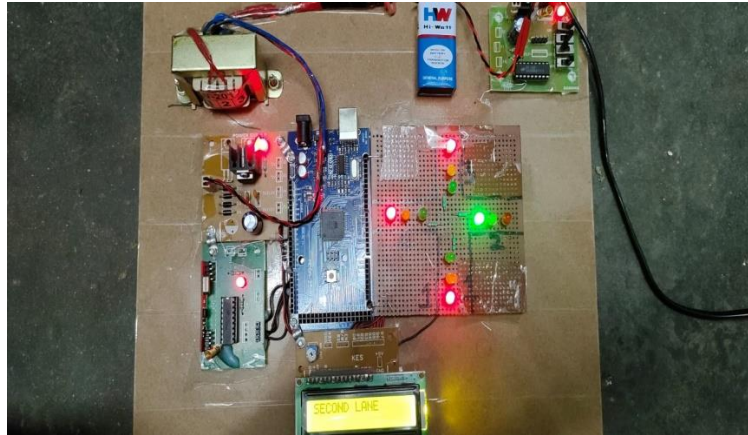


Fig 5.5 The green light is on for lane 2 for switching the second button

The 3 switch is on by the ambulance driver in the emergency situation then the 3 lane light gets green and remaining lanes gets red light

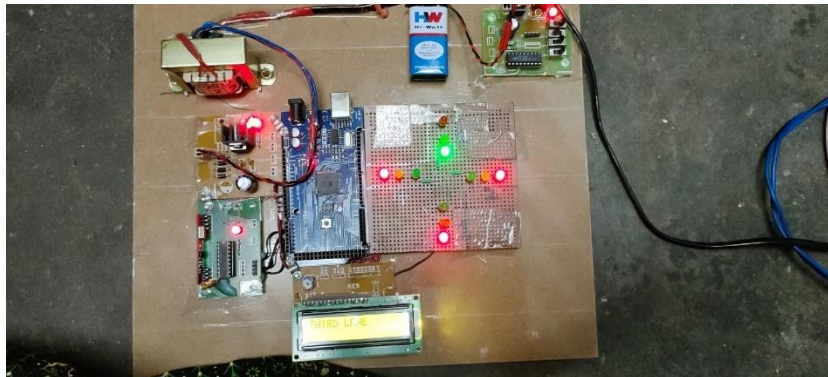


Fig 5.6 The green light is on for lane 3 for switching the third button

And when the ambulance driver switch on the fourth button then the lane 4 gets green and the all remaining lanes glows red light



Fig 5.7 The green light is on for lane 4 for switching the fourth button

CHAPTER 6

CONCLUSION

The existing systems do not effectively handle the problem of providing a clear path for ambulance during traffic congestion. RF-based smart traffic control system proposes a solution to the traffic congestion problem and an efficient method to provide a clear path for ambulance during peak hours. The main aim of this project is to provide a free path for ambulance and to reach the ambulance very quickly to hospital and want to save lives.

As a conclusion, this project have achieved the main objective stated earlier which is analyzing and implementing the wireless communication; the radio frequency (RF) transmission in the traffic light control system for emergency vehicles. The prototype of this project is using the frequency of 434 MHz compared to the range of about 3 kHz to 300 GHz of frequency which have been reserved for the RF theoretically. Besides, the functionality of this project proved that the other objectives have been successfully attained which are designing an emergency sequence mode of traffic light when emergency vehicles passing by an intersection and changing the sequence back to the normal sequence before the emergency mode was triggered. The sequences for this project have been developed using the programming in the microcontroller AT MEGA 2560. In future, this prototype system can be improved by controlling the real traffic situation and the study can be done by investigating the length, reception and transmission issue for the system to be operated with this traffic light system

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