IoT-Based Ambulance Navigation to Nearby Hospitals with Auto Green Signal

Activation Submitted in Partial Fulfillment of the Requirements for the

Naan Mudhalvan Mandatory Courses

Industrial IoT and Industry 4.0

Submitted by

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BONAFIDE CERTIFICATE

Certified that this project report **"IoT-Based Ambulance Navigation to Nearby Hospitals with Auto Green Signal Activation"** is Bonafide work of **ROHANSHAJ K R (513121106078)** who carried out the work under my supervision.

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Project work Viva-Voce Examination held on _____

INTERNAL EXAMINER **EXTERNAL EXAMINER**

Objective

The overarching objective of our IoT-based project is to revolutionize emergency medical services by seamlessly integrating cutting-edge technology into ambulance navigation systems. Our focus extends beyond mere transportation; we aim to optimize response times, enhance patient care, and create a safer urban environment.

Enhancing Ambulance Navigation

Ambulances play a critical role in emergency medical services. However, navigating through congested city streets can be challenging, especially during peak hours or when faced with unexpected roadblocks. By integrating GPS modules into ambulances, we enable real-time tracking. These high-precision modules continuously transmit location updates to a central server, ensuring accurate navigation. Our system goes beyond basic GPS functionality. It considers factors such as traffic congestion, road closures, and optimal routes to hospitals.

Database of Nearby Hospitals

We maintain an extensive database of nearby hospitals, including their geographical coordinates. This database serves as the foundation for our proximity calculations. Hospitals are ranked based on their distance from the ambulance's current location. Proximity is a crucial factor in determining which hospital should receive priority during emergencies. The database is regularly updated to account for changes in hospital locations or new facilities.

Communication Infrastructure

Ambulances transmit real-time location data via cellular networks to the central server. This communication link ensures seamless coordination. The central server processes incoming data, calculates proximity, and manages communication with traffic signal control units. Our communication protocols adhere to industry standards, ensuring reliability and security.

Traffic Signal Control Units

Strategically placed at intersections, these intelligent units monitor traffic flow. When an ambulance approaches an intersection, the system dynamically adjusts traffic lights. Green signals are activated in the ambulance's path, creating a clear corridor. The goal is to minimize delays and facilitate smooth movement for emergency vehicles.

Introduction

In an increasingly interconnected world, the demand for efficient emergency medical services has reached unprecedented levels. Urbanization, population growth, and the complexities of modern life underscore the need for rapid and effective healthcare responses. Our project aims to bridge the gap between emergency situations and timely medical attention by leveraging the power of the Internet of Things (IoT).

The Urban Challenge

Urban centers are bustling hubs of activity, but they also present unique challenges. Traffic congestion, unpredictable road conditions, and crowded streets can significantly impact emergency response times. Ambulances, often racing against the clock, must navigate through this urban maze to reach patients swiftly. Every minute counts, especially during critical medical emergencies.

The IoT Solution

Our project proposes an innovative solution that seamlessly integrates IoT principles into ambulance navigation systems. By combining real-time GPS tracking, communication infrastructure, and smart traffic signal control, we create a holistic ecosystem that prioritizes patient well-being.

The Human Impact

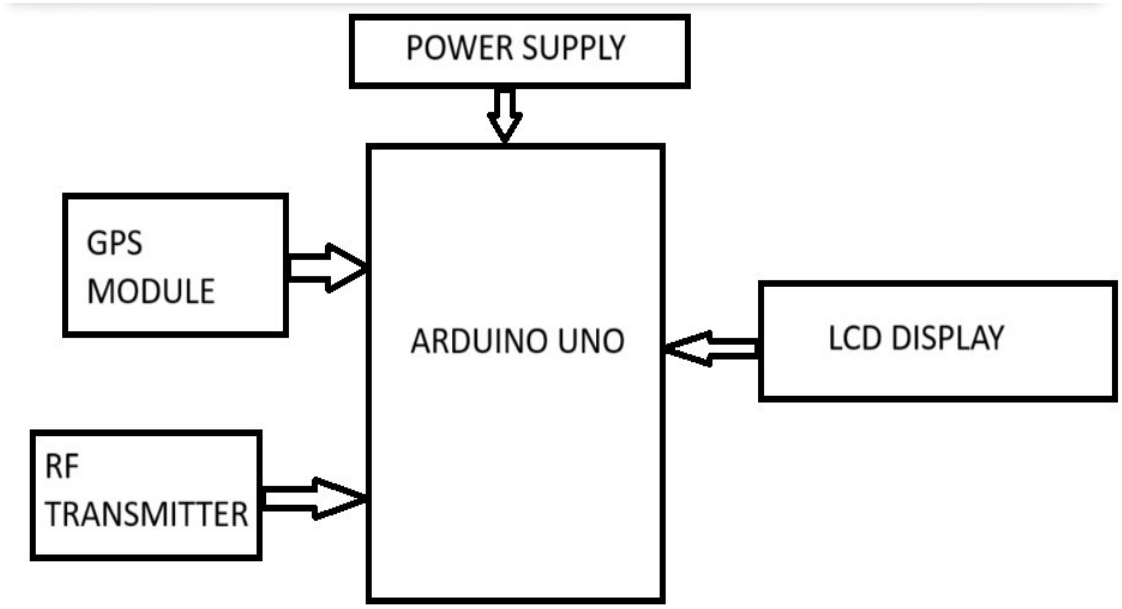
At the heart of our project lies the desire to save lives. Whether it's a heart attack, a severe accident, or a medical crisis, timely access to medical facilities can make all the difference. Imagine a scenario where an ambulance can seamlessly navigate through traffic, green signals aligning its path, and hospitals receiving advance alerts. Lives are saved, families find solace, and communities thrive.

Beyond Emergencies

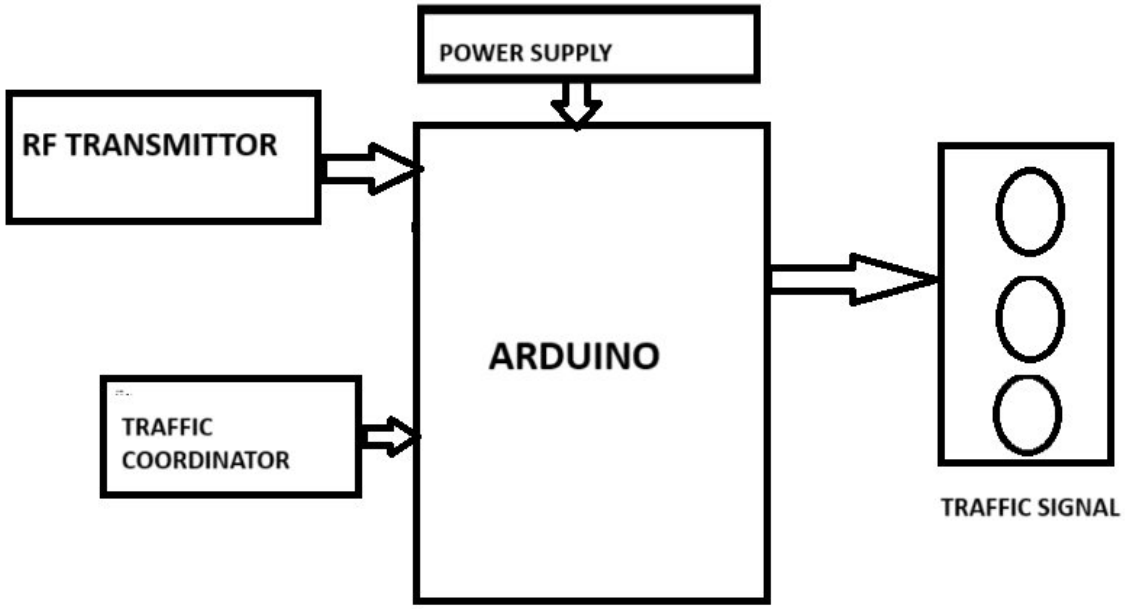
While our focus is on emergencies, the benefits extend beyond critical situations. Efficient ambulance navigation contributes to overall traffic management. By dynamically adjusting traffic signals, we reduce congestion, minimize environmental impact, and enhance commutes .

Block Diagram

AMBULANCE BLOCK DIAGRAM

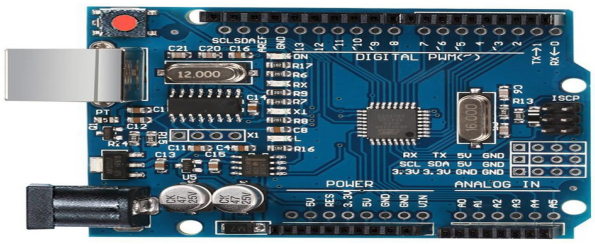


TRAFFIC CONTROL BOARD



HARDWARE AND COMPONENT DESCRIPTION

Arduino UNO R3



Arduino boards are single-board microcontrollers. These small circuit boards come with everything you need to get started, including a central processing unit (CPU), memory, and input/output (I/O) pins. There are many varieties of Arduino boards available, each with different features and capabilities. A popular starter board is the Arduino Uno. Here Uno is used as main computation unit in both ambulance and traffic light.

433 MHz rf module

RF 433MHz is a pair of electronic RF transmitters and receiver modules used to send and receive radio signals between any two devices. The data is sent by the transmitter module from the transmitter end, and it is received by the receiver module at the receiver end. This RF signal will have a frequency of 433MHz. Range in open space (standard conditions): 100 meters.

An RF transmitter module is a small PCB sub-assembly capable of transmitting a radio wave and modulating that wave to carry data. Transmitter modules are usually implemented alongside a microcontroller which will provide data to the module which can be transmitted.

Neo 6M GPS module

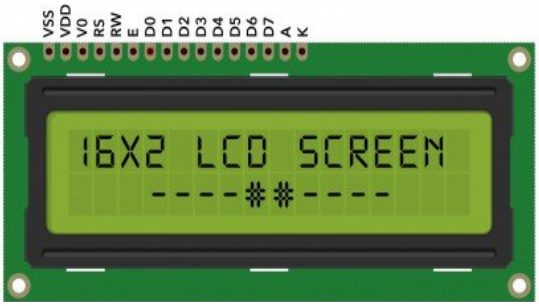
The new NEO 7 series introduces the Ublox Neo 6M GPS Module, a highly sensitive and low-power module offering 56 channels for precise position updates at a rate of 10Hz. Featuring a protective moulded plastic case, this module is perfect for aerial applications on aircraft or quadcopters, shielding it from the elements. UBLOX NEO-6M GPS Module has a battery for power backup and EEPROM for storing configuration settings. The antenna is connected to the module through a Ulf cable which allows for flexibility in mounting the GPS such that the antenna will always see the sky for best performance. This GPS module is location section of nearby hospitals in ambulance.

LED (TRAFFIC SIGNAL)

LED stands for light emitting diode. LED lighting products produce light up to 90% more efficiently than incandescent light bulbs. How do they work? An electrical current pass through a

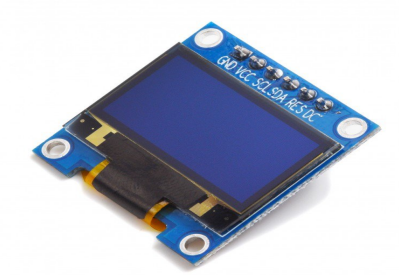
microchip, which illuminates the tiny light sources we call LEDs, and the result is visible light. These colorful lights are connected to Arduino, they help in displaying the traffic signal.

16X2 LCD OR 0.96” OLED DISPLAY



No	Symbol	Function
1	VSS	Ground
2	VDD	5V +
3	V0	Contrast
4	RS	Register
5	RW	Read/Write
6	E	Enable
7	D0	Data bus
8	D1	Data bus
9	D2	Data bus
10	D3	Data bus
11	D4	Data bus
12	D5	Data bus
13	D6	Data bus
14	D7	Data bus
15	A	Anode (5V+)
16	K	Cathode (GND)

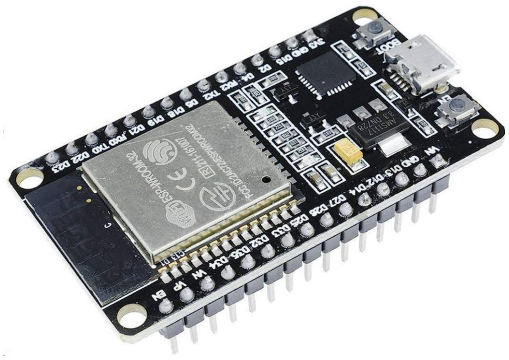
A liquid-crystal display is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals combined with polarizers. Liquid crystals do not emit light directly but instead use a backlight or reflector to produce images in color or monochrome.



A 0.96-inch OLED display is a monochrome graphical display with a resolution of 128 x 64 pixels. It is also known as an organic light-emitting diode (OLED). OLED displays are thinner than LCD displays, produce better colors, and have good brightness. They also have a wide viewing angle of over 160 degrees.These displays help in displaying the Nearest hospital details in Arduino.

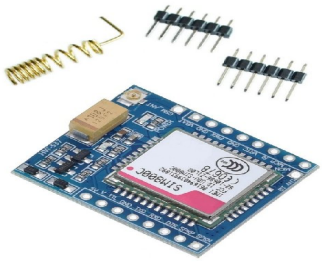
ESP32 (OPTIONAL)

ESP32 is a low-cost, low-power microcontroller chip that provides Wi-Fi and Bluetooth connectivity for embedded devices, also known as IoT devices.



The ESP32 is a single 2.4 GHz chip designed to be robust, versatile, and reliable in a variety of applications and power scenarios. By using this chip, we can implement bt and wifi in our project to improve its efficiency in displaying results.

GPRS MODULE



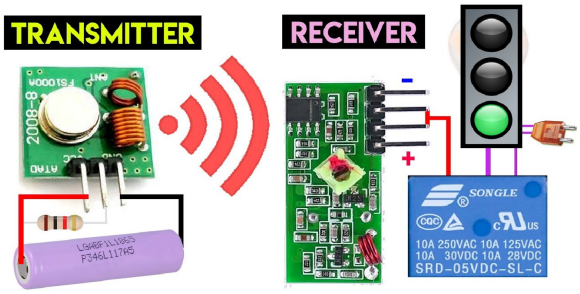
GPRS stands for General Packet Radio Service, which is an extension of GSM that enables higher data transmission rates. GSM stands for Global System for Mobile communication, which is an architecture used for mobile communication in most countries. GPRS is a packet-switching technology that allows information to be transmitted via mobile networks. It is utilized for internet connectivity, multimedia messaging service, and other types of data transmission.

Project Working

Ambulance Setup

I have an Arduino board installed in the ambulance. This Arduino is equipped with an RF transmitter (433MHz) and buttons. The buttons are likely used by the ambulance driver or medical staff to trigger a signal when they need to pass through traffic quickly.

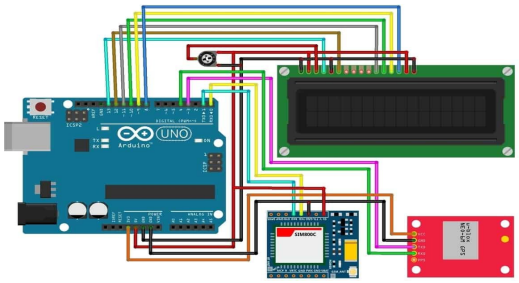
Traffic Light Control



At the traffic lights, there's another Arduino board with an RF receiver (433MHz). This receiver is tuned to receive signals from the ambulance's RF transmitter. When the ambulance is approaching and its Arduino receives a signal (button press), it sends an RF signal to the traffic light Arduino. Upon receiving this signal, the traffic light Arduino processes the command to change the lights to green for the ambulance's direction and red for other directions. This functionality ensures that the ambulance can pass through the intersection quickly and safely.

GPRS Module and GPS Module

The ambulance Arduino also includes a GPRS module and a GPS module (such as the NEO-6M) for communication and location tracking.



When the button is pressed and the traffic lights change, the Arduino uses the GPS module to determine its current location. It then uses the GPRS module to send a message to a designated hospital phone number. This message includes details such as the ambulance's current location and possibly patient details.

LCD Display

To provide feedback and display information, your Arduino in the ambulance is equipped with a 16x2 LCD display. This display shows messages sent to the hospital, confirms successful transmissions, and may also show other metrics or status information related to the system's operation.

CODE

https://github.com/ROHANSHAJ/TEAM-02_NM.git

APPLICATIONS

Emergency Response Optimization

Your system optimizes emergency response by allowing ambulances to quickly navigate through traffic, reducing response times to critical situations. It ensures that ambulances can reach their destinations faster and more efficiently, potentially saving lives during emergencies.

Traffic Management and Safety

The ability to control traffic lights in real time ensures safer passage for ambulances, preventing delays and improving overall traffic management. It reduces the risk of accidents by providing clear priority to emergency vehicles and preventing traffic congestion around hospitals.

Patient Information Transmission

The integration of GPRS messaging allows for the seamless transmission of patient information, including vital signs, medical history, and current condition, to hospitals. Hospitals can prepare in advance based on the information received, ensuring appropriate resources and personnel are ready upon the ambulance's arrival.

Enhanced Communication and Coordination

The use of GPS tracking enables precise location monitoring of ambulances, facilitating better coordination between emergency services and hospitals. Hospitals can track the ambulance's progress in real time, anticipate arrival times, and allocate resources accordingly.

Data Logging and Analysis

Your system can log data such as response times, traffic patterns during emergencies, and hospital response efficiency. Analyzing this data can lead to improvements in emergency protocols, traffic flow management, and resource allocation in healthcare facilities.

Scalability and Adaptability

The modular design of your system allows for scalability to accommodate additional features such as live video feeds from ambulances, automated patient monitoring, or integration with smart city infrastructure. It can be adapted for use in different emergency services scenarios, such as fire trucks or police vehicles, enhancing overall emergency management capabilities.

Public Safety and Community Well-being

Ultimately, your project contributes to public safety and community well-being by ensuring timely emergency response, efficient traffic management, and effective communication between emergency responders and healthcare providers.

Conclusion

The integration of Arduino boards, RF communication, GPS tracking, and GPRS messaging within the ambulance setup marks a significant advancement in emergency response technology. This system's ability to swiftly control traffic lights, navigate congested areas, and transmit critical patient information to hospitals is paramount in improving emergency response times. By streamlining these processes, the project enhances safety for both patients and emergency responders, ensuring that medical assistance reaches those in need promptly and efficiently. Moreover, the project's data logging capabilities offer invaluable insights into emergency protocols, traffic patterns, and resource utilization. This data-driven approach not only supports continuous improvement in emergency management strategies but also lays the foundation for future innovations in healthcare and urban infrastructure. Ultimately, the project's impact extends beyond immediate emergency scenarios, contributing to the overall resilience of communities and bolstering public safety standards for years to come.