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Siren Swift Traffic Solutions

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Abstract

The population has increased dramatically as a result of urbanization and industrialization, which has also increased the diversity of cars on the road. The biggest obstacles for emergency vehicles, such as ambulances transporting critical patients, are the resulting traffic jams and congestion. These vehicles are unable to arrive at their destination in time, which results in the loss of life. We propose the SSTCS (Siren Swift Traffic Control System) as a solution to lessen this. The idea behind this plan is to minimize the delays brought on by traffic congestion by ensuring a fluid flow for emergency vehicles, such as ambulances, to reach hospitals on time. The current state of traffic congestion can be resolved with the use of this SSTCS combined with software. This totally automated system helps to minimize travel time to the hospital by locating the accident scene, managing traffic signals, and finding the location. During emergencies, this device saves time by controlling the traffic signals. With this, our patient may schedule an ambulance and hospital for when things go serious.

Keywords: Traffic, Ambulance, Emergency services, patient, hospital.

INTRODUCTION

The country's growing road network, increased motorization, and increased urbanization have all contributed to a sharp rise in the number of traffic accidents. There are several detrimental implications of traffic congestion on a nation's transportation system. While it may appear easy, getting a patient from their home to the hospital in an emergency can be challenging, especially during rush hour. Frequently, ambulances carry critical or emergency patients who must be sent to the hospital as soon as possible to receive the proper care, increasing the likelihood that the patient may survive in a critical state. A patient may not survive if there is ambulance takes too long to arrive at the hospital. 95% of heart attack cases, according to surveys, can be handled if the ambulance can get to the hospital at this time without becoming caught in traffic. In order to accomplish this, passing cars must give way to the ambulance on the road. However, occasionally the ambulance gets caught in the traffic, which causes a significant delay while waiting for the traffic to clear. With the help of cutting-edge technologies like the Internet of Things, or IoT [1], we can get beyond these constraints. Wired or wireless networking technologies can be used to connect different hardware and software implementations. The primary idea of this plan is to minimize the delays brought on by traffic congestion by ensuring a fluid flow for emergency vehicles, such as ambulances, to reach hospitals on time [2] When an ambulance is approaching, traffic lights can be programmed to turn on automatically at a specific distance. Using outdated technology, an RF transmitter is affixed to the top of the ambulance, and RF receivers are positioned at an appropriate distance from the traffic signal on each route that leads to it [3]. Using a switch on the steering wheel, the ambulance's driver first turns on the transmitter. This causes the microcontroller to be interrupted by raising the receiver output. The interrupt subroutine starts with a scan of all the port pins to identify which lane the ambulance is approaching and turns that lane green.

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In addition, should the patient be in a critical state (heart attack, pregnancy, etc.), the patient can use our website to conveniently schedule an ambulance. The driver will utilize the website to access Google Maps in order to get at the destination on time [5]. The website notifies the traffic signal server of an emergency if the ambulance stops while traveling. The ambulance's current position is used to determine which signal is the closest. And that specific indicator is turned green until the ambulance passes by, at which point it returns to its normal control pattern [7]. Our website also offers the possibility for them to make hospital reservations. A notice is issued to the traffic management system and all traffic cops on that route after an ambulance is booked. Following all of this, the identical traffic control concept is put into practice.

MODE OF OPERATION

Software

The suggested framework may identify the optimal route based on a variety of optimization criteria, including distance, fuel cost, and trip time [1]. The existing situation of traffic congestion can be significantly resolved with the aid of this Intelligent Transportation System connected with the GPS [2]. In order to facilitate emergency requests, we created an intuitive ambulance request system that enables users to provide information about their location, desired hospital, and emergency scenario. Users can also choose from a list of local hospitals by accessing this list. Our system's real-time tracking of ambulance positions on a map, which gives customers insight into arrival timeframes, is one of its primary features. When a reservation is confirmed, automatic communications with relevant information are sent to the ambulance service and the assigned hospital as shown in Figure 1. This technique makes it possible to move the ambulance quickly from the scene of the accident to the hospital. It has been demonstrated that is effective in controlling authoritative vehicles in addition to ambulances. This method saves time and is more accurate [3]. It has been demonstrated that the ITS is effective in controlling authoritative vehicles in addition to ambulances. This approach saves time without sacrificing accuracy [4]. To ensure simplicity of use, our website is created with a straightforward and intuitive layout. Extensive testing was carried out to detect and fix any problems, guaranteeing excellent performance in all user interactions. The system was designed to be scalable, allowing for future increases in user foundation and upgrades. Maintaining continuous maintenance, such as routine checks and upgrades, is essential to keeping the platform operating safely and smoothly.

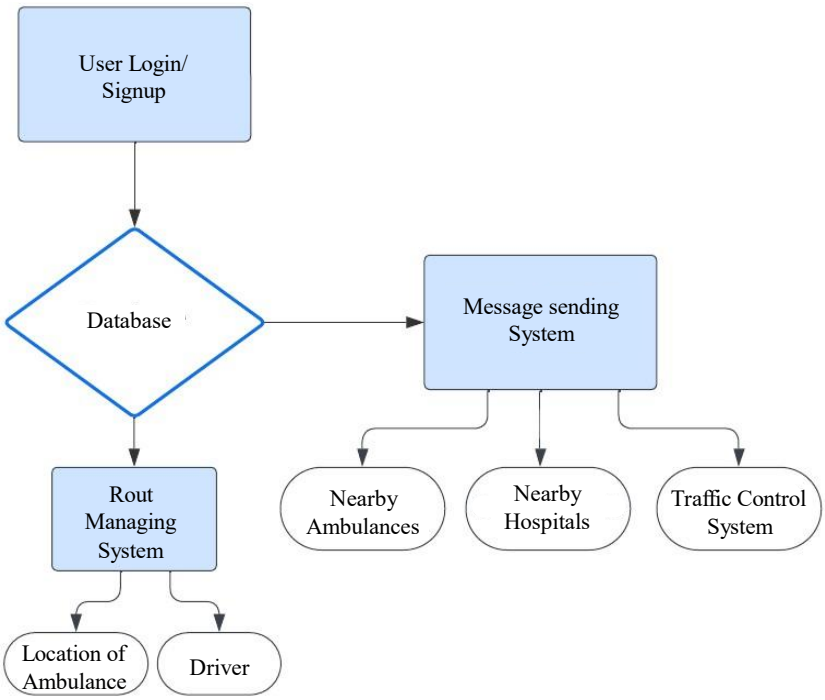


Figure 1. Working Flow of Software.

Hardware

a. *Arduino Uno*: Traffic light response to ambulance signals is a skill of the Arduino Nano, a small microcontroller board running on the ATmega328P processor. The Arduino Uno dynamically modifies traffic lights to prioritize ambulance passage while guaranteeing the safety of other vehicles by integrating sensors on ambulances to detect their approach [5]. This adaptable platform makes effective ambulance traffic management in urban settings possible. The data pertaining to the ambulance's present and prospective locations is transmitted directly from the vehicle. Traffic is optimally controlled with the use of this information [6]. It is frequently used in robotics, prototyping, and DIY electronics projects. After the system is deployed, it must be regularly maintained and monitored to guarantee its reliability and optimal performance. An arrangement of Arduino Uno is shown in Figure 2.

b. *IR Sensor:* A proximity sensor, object detector, motion detector, and infrared remote-control system is just a few uses for an IR (Infrared) sensor module, which is an electrical device that can detect infrared radiation in its surroundings. These modules are especially helpful for keeping an eye on traffic on certain routes. The IR sensor module notifies the Arduino microcontroller when it detects high traffic. The Arduino then modifies the timing of the traffic light to allow more vehicles to pass through by lengthening its duration [7]. An IR sensor module must first be connected to a power supply and ground in order to function properly. To enable data transmission and processing, connect the output pin of the module to a microcontroller or other suitable device. Infrared sensor is represented schematically in Figure 3.

c. *RFID Card & Card Reader:* Figure 4 shows RFID card reader, RFID tags are electronic data storage devices that may be accessed wirelessly via radio waves [8]. An RFID reader is a device that reads and occasionally writes data to RFID tags. Utilizing sensors and RFIDs to identify cars and determine their location; the data is then transferred via a wired connection to a central controlling center for additional processing [9]. Every ambulance is allocated an RFID card, each of which has a unique code, which the RFID scanner detects and scans. The Arduino then uses this data to do additional actions after receiving it from the RFID reader [10]. The RFID reader must be powered on for this procedure to work. The Arduino will make a specific route clean by altering the traffic signals once it detects the ambulance.

d. *Traffic Light Module:* It usually has integrated circuitry to manage its functioning along with LED lights organized in a pattern that resembles a traffic signal sequence. These lights are interfaced with an Arduino microcontroller, which regulates their regular functions. Furthermore, the Arduino handles the data that it gets from RFID card readers and infrared sensors. The Arduino then instructs the Traffic Light Module to turn on certain lights to green so that cars can pass through based on the data it has received.

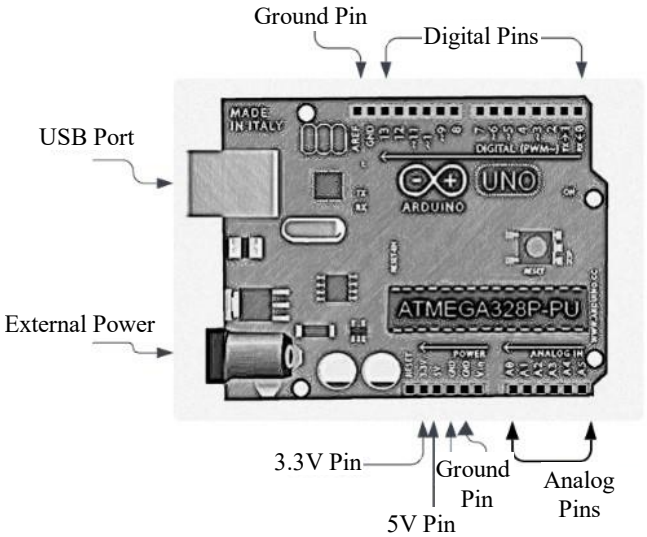
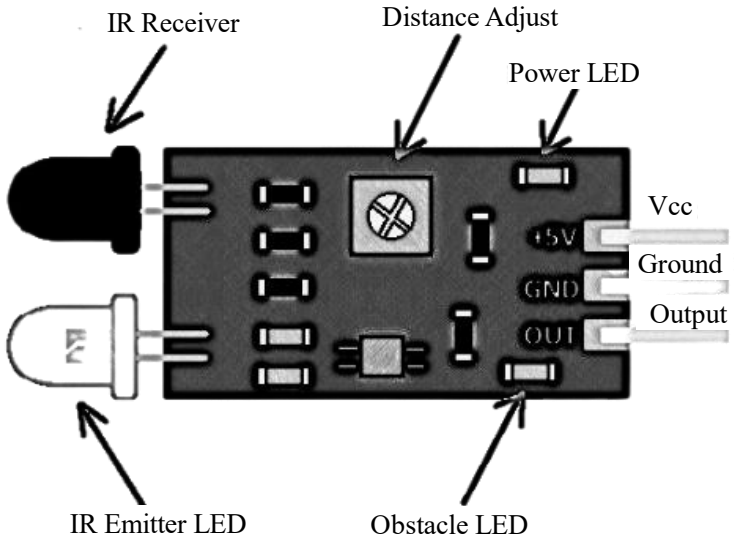


Figure 2. Arduino Uno



Infrared (IR) sensor

Figure 3. Infrared Sensor.

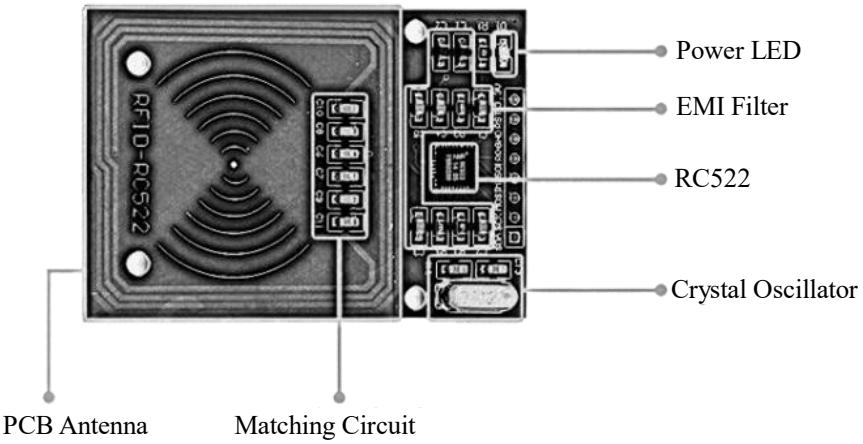


Figure 4. RFID Card Reader.

WORKING METHODOLOGY

Our website offers a simplified login and registration process, safely saving users' credentials in a database. Users who register are granted access to a map showing hospitals in the vicinity as well as ambulances that are available within a 10-kilometer radius. After calculating the direct distance, we use the Google API to request a matrix distance [11]. Bookings for ambulances are made using a simple form, and all booking information is stored in the database. Patient data is automatically shared with the chosen hospital, ambulance service, and traffic control system upon the booking of an ambulance. The website allows users to track the ambulance's real-time location and gives navigational assistance with route details and the patient's current location. The Arduino technology is utilized by the system to incorporate an advanced traffic management mechanism. A special card, similar to a FAS Tag, is attached to ambulances, and it is scanned 500 meters before they approach a traffic light as shown in Figure 5 [12]. This data is analysed by an Arduino-based controlling unit, which uses infrared sensors to identify traffic jams at crossings. The traffic light changes when ambulance passage if congestion is detected, returning to regular operation after the ambulance has cleared the intersection. Real-time updates are shared with hospitals, concerned authorities, and users throughout this process. Hospitals receive updates on patient information and the estimated time of arrival (ETA) to help with timely

patient treatment. In order to provide quick and secure patient transportation in emergency scenarios, this system leverages hardware integration, geolocation services, and real-time data handling to maximize emergency response.

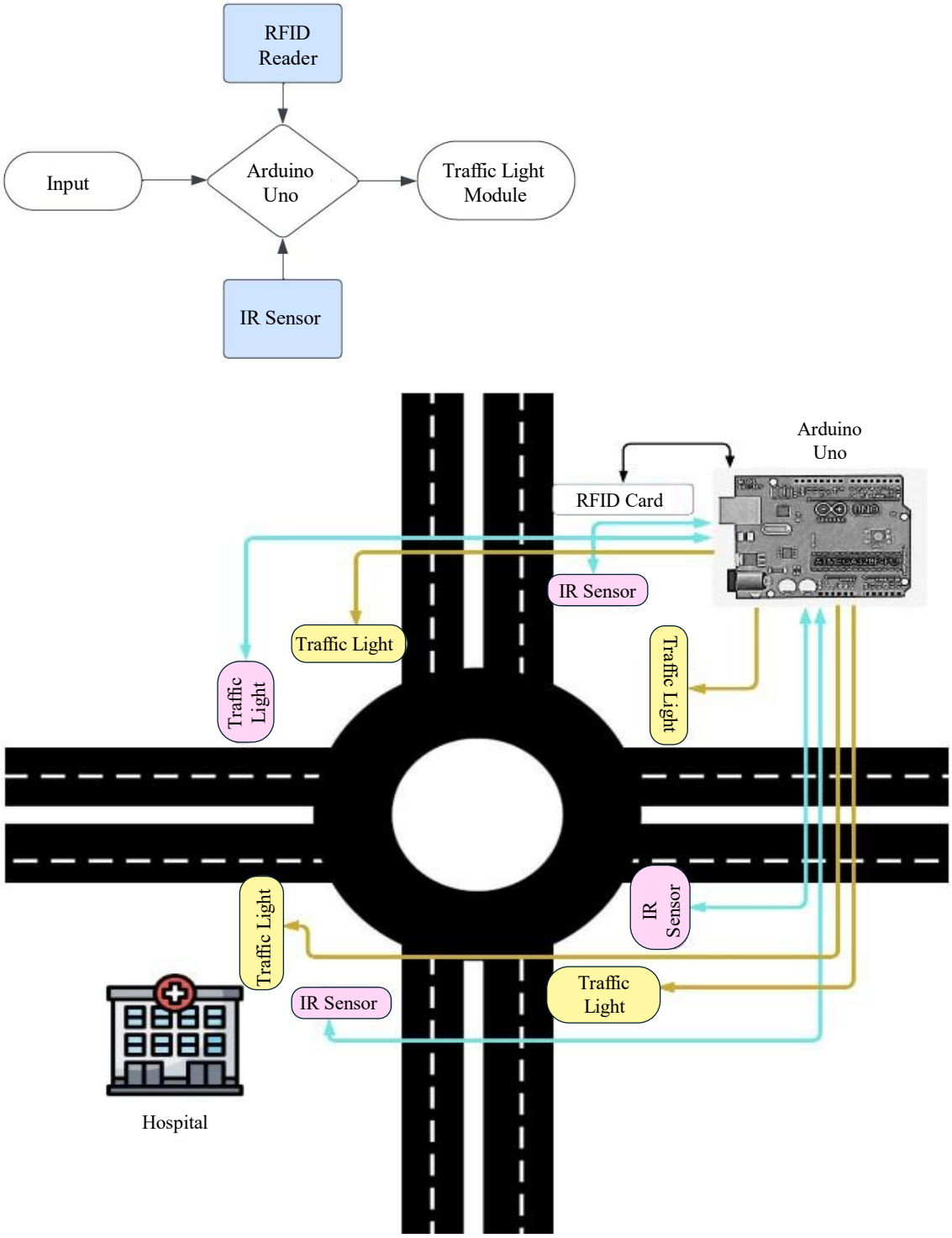


Figure 5. Flow of Traffic Control System.

ADVANTAGES

a. *Priority Passage:* Ambulances that are outfitted with automated traffic management systems are entitled to priority passage at crossings. This allows them to get to their destination more quickly and may even save lives if traffic lights are changed to their advantage.

b. *Shorter Response Times:* Ambulances may respond to situations more quickly by using their enhanced traffic management skills to get to victims' locations on time and offer them medical care.
c. *Increased Safety:* These devices can lessen the chance of crashes and accidents involving the ambulance and other cars by managing traffic flow around the vehicle.
d. *Minimized Traffic interruption:* Because automatic traffic control systems can manage traffic at junctions without needlessly slowing down other drivers, they can assist reduce the interruption that emergency vehicles cause to regular traffic flow.
e. *Improved Communication:* By integrating these systems with emergency response networks and other traffic management technologies, ambulances, traffic signals, and dispatch centers may work together more effectively.
f. *Efficient Resource Utilization:* Automatic traffic control systems can enable emergency services respond to a higher volume of occurrences with the same amount of staffing and equipment by streamlining ambulance routes and reducing delays.

DISADVANTAGES

a. *Cyberattack vulnerability:* Automated traffic control systems may be subject to cyberattacks, which might provide troublemakers the capacity to tamper with traffic lights and obstruct ambulance routes.
b. *Absence of human judgment:* Automated systems might not be able to make intelligent decisions in intricate traffic circumstances, which could result in ambulance routes being chosen less than optimally.
c. *The possibility of system errors:* Errors in data processing or technical issues could lead to incorrect course selection or navigational directions, which would delay ambulances.
d. *Financial considerations:* Automatic traffic control system implementation and upkeep can be costly, and municipalities may have financial restrictions that restrict the systems coverage or efficacy, which might affect the time it takes for ambulances to arrive.
e. *Lack of adaptability:* Automatic systems may fail to take into account dynamic elements like accidents or road closures, which could impede the ambulance's movement.
f. *Technology dependence:* If the system malfunctions or fails altogether, it may cause further delays in the ambulance's response time or route planning, which may have an effect on emergency services.

APPLICATIONS

a. To guarantee ambulances can quickly maneuver through traffic in order to patients who are in need without any delays.
b. Give patients the ability to swiftly and easily schedule ambulances, particularly for urgent medical situations.
c. Streamline traffic in general and eliminate congestion to expedite emergency response time.
d. For smooth patient care, improve cooperation between hospitals, emergency response teams, and traffic authorities.

CONCLUSION

To sum up, the implementation of the Siren Swift Traffic Control System (SSCS) represents a noteworthy progress in managing traffic congestion during emergencies. This automated technology, which is seamlessly connected with the current traffic control software, provides unmatched efficiency in accelerating the delivery of emergency vehicles, especially ambulances, to hospitals. In order to improve emergency response times and possibly save lives, the SSTCS is essential in controlling traffic signals and cutting down on delays. With its use, traffic management will enter a new era that will use technology to guarantee prompt and efficient emergency interventions, protecting public health and safety.

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