8051 Microcontroller-Based Intelligent-Lifeline Ambulance Route Clearing

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1. ABSTRACT :

Everything is moving swiftly in the twenty-first century, therefore we are forced to move quickly to avoid the inevitable traffic congestion and accidents. This will have an impact on the main emergency ambulance service. We are creating "Lifeline-Intelligent Route Clearing" for Ambulances, which sends out an alert when an ambulance is approaching a traffic signal, to overcome the problems with manual route clearing based on ambulance sirens. This project's objective is to "design and develop an embedded microcontroller system for a traffic light controller using sensor technologies." The project's main purpose is to design and deploy an intelligent traffic signal system. The traffic light receives a similar alarm as a result of this system's capacity to evaluate an ambulance's appearance at a particular distance. We mostly employ infrared sensors to identify the presence of automobiles since this technology is practical, affordable and prepared to be used during high-traffic hours. The microprocessor has the ability to regulate the complete setup, keep an eye on the sensor, and postpone the traffic lights. The AT89S52 is an 8-bit microcontroller that has 256 bytes of RAM, 8k bytes of flash ROM, and an infrared sensor with IR LEDs (TX/RX), TSOP 1738 (RX), as well as red, green, and yellow LEDs for indication. Because of its programming and usability, it is picked for use.

KEYWORDS: IR sensors, RFID systems, Traffic congestion, Traffic light controller, AT89S52 Microcontroller.

2. INTRODUCTION:

How to manage the amount of traffic on the roads is one of the biggest social problems facing contemporary society. The traffic control system is a major problem in emerging cities. Urban population growth and the middle class are major contributors to the increase of vehicles in these cities.

Large cities like India commonly experience loss of life as a result of ambulances becoming stuck in traffic due to inefficient traffic management and control. In contrast to Western countries, Indian towns lack emergency-only lanes due to poor road layout and infrastructure. In circumstances where patients' lives depend on the fast arrival of an ambulance at the hospital, an alternative strategy to the aforementioned problem would take too long.

A separate emergency lane system has the drawback of being rarely utilized in addition to being extremely expensive. Furthermore, because of the system's traffic congestion and discomfort, the width of the route for regular traffic will be lowered. There are many examples of ambulances getting caught in heavy traffic, forcing the ambulance to wait for a few minutes to many hours for the traffic to pass. The patient's life may be in jeopardy if they don't get the correct care when they need it. can avoid this risk and save lots of lives. The way ambulances will be cleared thanks to a novel technology that is presented in this research that follows the notion of one path clearance. The microcontroller 8051 implements this situation.

The project to enable the traffic system at the intersection is controlled by the microcontroller AT89S52. By setting the microcontroller's appropriate port pin to high, the LEDs are automatically switched on and off. Only one light is on at a given time—green—and the other is red. The present group's yellow LED flashes repeatedly when the color changes from green to red, and then the incoming group is converted to green. A loop of this procedure keeps on. The density at a traffic light is detected in this article using IR sensors in an across-the-road layout. The time at which the traffic lights are assigned determines the vehicle density. The emergency vehicle's Bluetooth is used to activate clearance to the emergency vehicle.

3. LITERATURE SURVEY:

Around the world, traffic congestion and transportation delays are getting worse due to the growing number of automobiles on the road. Ambulances, fire trucks, and police cars need to be able to react to emergency calls as quickly as possible. How soon emergency vehicles can get to an incident's location determines how well emergency services perform. Traffic congestion

can result in delays for emergency vehicles, which can result in casualties and property damage. To increase the efficiency of emergency services transportation and reaction times, a smart traffic management system based on priority and traffic density is required.

The best way to detect green light sequences using traffic data has been the subject of extensive research. Numerous traffic management plans have been put in place to give emergency vehicles priority. A significant portion of this research is focused on intelligent traffic management technologies intended to provide emergency vehicle passage. Cameras are used to monitor the flow of traffic, while lane center edges and an area-based image processing method are used to estimate traffic characteristics.

Traditional traffic consists of a store emitter or lighting emitter that may detect issues including accessory noise and sight black lines. In recent years, technologies like infrared (IR) and GPS have been employed to estimate the current traffic density and identify the presence of emergency vehicles. Emergency vehicles are located using RFID tags, and the inductive loop approach is utilized to count them all. widely used traffic detection techniques, including radar, microwave, ultrasonic, and video-based detection.

There are several emergency vehicle pre-empting (EVP) system designs available today, including radio-based emitter/detectors, strobe light systems, infrared emitters, acoustic systems, and infrared emitters. Pre-emption typically operates on the premise that when sensors at each intersection detect an emergency vehicle, the traffic light control turns on the green light and keeps it on until the emergency vehicle is present at the intersection. Actor coordination is another application of the info-gap decision theory.

The green Wave system may be discovered, and it sends a green wave to emergency vehicles by turning on the green lights in their route. Intelligent traffic management systems can be designed using technologies like RFID, Zigbee, and the worldwide system for mobile communication (GSM), however, if the wave is diffused, the vehicle queue in the green Wave stops moving and might cause oversaturation.

In, an automated lane-clearing system for ambulances based on RFID and GPS is suggested. By automatically clearing the lane before the ambulance reaches the intersection, this system's primary objective is to shorten the distance an ambulance must drive to reach a hospital. The connection admission control (CAC) algorithm has demonstrated that it performs better in terms of QoS and complexity when used with vehicular ad-hoc networks (VANETs), which have been proven to be effective communication channels between emergency vehicles and traffic control systems. To manage the congested traffic flow and monitor real-time traffic, fuzzy control techniques have been modified.

4. HARDWARE REQUIREMENTS:

SI. NO.	Name of the Components	Type
1	Transformer	Step down 230/12 V,50hz
2	Bridge Rectifier	Diode(IN 4007)
3	Filter	Capacitive(1000uF)
4	Voltage Regulator	Zener(LM 7805)
5	IR Sensor	LED + Photo Diode
6	Microcontroller	AT89S52

4.1 TRANSFORMER:

A step-down transformer(figure :4) is an electrical apparatus that lowers the voltage of a source of power other than current (AC). It is made up of an iron core, primary winding, and secondary winding. The iron core's magnetic field changes when an AC voltage is delivered to the primary winding. The voltage in the secondary winding is then present in this magnetic field, although it is smaller in magnitude than the voltage in the main winding.

The concept of mutual induction, often known as Faraday's law of electromagnetic induction, underlies how a transformer operates and says that the amount of voltage is inversely proportional to the rate of change in magnetic flux. In other words, when a coil is close to a coil that is carrying current and has magnetic flux present, the current in the coil is induced, and the induced current is directly inversely proportional to the rate of change of the current.

4.2 BRIDGE RECTIFIER:

A rectified DC power source is needed by many electronic circuits in order to power various electronic components from the available AC power. The AEC power supply is transformed into a DC power supply using the main supplied rectifiers, of which the bridge rectifier is the most effective. The type of full wave rectifier known as a bridge rectifier is one that utilizes four or more diodes in a bridge circuit design to effectively convert alternative to AC to direct DC.

4.3 FILTER:

A filter is a circuit that allows some frequencies to pass while attenuating others. In this area of electronics, a filter may therefore be used to remove crucial frequencies from signals that also contain unwanted or irrelevant frequencies.

A capacitor is used to filter out a certain frequency; alternatively, an electrical circuit's filter capacitor is known to filter out a range of frequencies. Typically, a capacitor does this by filtering out signals with low frequencies. These all have frequencies that are close to zero hertz (HZ). DC signaling. In order to filter out undesirable frequencies, this capacitor is utilized. These are quite prevalent in a variety of equipment types, including electrical and electronic equipment as well as applications in several fields.

The capacitive reactance principle is the key governing factor in how this capacitor functions. It is nothing more than how the capacitor's impedance reacts to the frequency of the signal passing through it. With the exception of the signal's frequency, a nonreactive component is analogous to a resistor with a comparable resistance to the signal. This gauges the resistance of the resistor at 1 Hz and 100 kHz throughout.

4.4 VOLATAGE REGULATOR:

The term "voltage regulator" refers to a device that regulates the voltage. In essence, it reduces the input voltage to the required level and maintains it there during the supply. This guarantees that the voltage will not decrease even when a load is applied. There are two major uses for the voltage regulator, which are as follows:

- To modify or regulate the output voltage
- To maintain the output voltage at the specified level and constant despite supply voltage variations.

Computers, power generators, and other devices that regulate voltage are utilized to manage the plant's output.

When forward bias causes a Zener diode to function as a typical signal diode, reverse bias causes the silicon semiconductor with a PN junction to act differently. However, the voltage stays constant for a wide variety of currents when the reverse voltage is supplied to it. This serves as a voltage regulator in the DC circuit as a result of its feature. As a voltage regulator, the Zener diode's main goal is to maintain a constant voltage. For example, if 5 V is applied, the voltage becomes constant at 5 V and does not vary.

4.5 IR SENSOR:

An LED(figure:3) that emits infrared light IRLED is a special-purpose LED that generates infrared light with wavelengths ranging from 700 nanometers to one micrometer. Similar to how regular LEDs release light with varied hues, different IR LEDs may produce infrared light with varying wavelengths. A gadget called an IR sensor employs infrared technology to find things or changes in the surroundings. Temperature, mobility, and closeness are just a few of the many physical characteristics that IR sensors can identify.

In conjunction with IR receivers, gallium arsenide or aluminum gallium arsenide IR LEDs are employed. They are frequently employed during censuses. Since infrared radiation cannot be seen by the human eye, IR LEDs seem just like regular LEDs. It is impossible to tell whether the IR LEDs on a cell phone camera are functional.

A basic semiconductor known as a diode, an IR LED allows electrical current to travel in just one way. As the current runs, electrons from one portion of the diode fall into holes in another section of the diode, falling into these holes. Light is created when the electron releases energy in the form of photons.

4.6 MICROCONTROLLER:

One of the first and most well-known microcontrollers, sometimes known as MC551, is the 8051. (figure:5)Intel first presented it. It was first released in 1981 as a complete metal oxide semiconductor. Microcontroller with a basis in NWOS, although later models used CMOS (complementary metal oxide semiconductor) technology. The 80C51 designation for these microcontrollers indicates that they are based on CMOS technology.

The usage of microcontrollers or microprocessors with 16, 32, or 64 bits is prohibited by the system requirements and control criteria. Because of their many intrinsic characteristics, systems incorporating them could be easier to develop. Although they are also quicker and more dependable, the 8-bit microcontroller successfully handles the aforementioned application. Making a 32-bit product using a low-cost 8-bit microcontroller will consign it to failure in any market where there is competition. The main reason to use the 89S52 instead of any other 8-bit microcontroller on the market is that it has 32 I/O lines, three 16-bit timer/counters, an eight-vector clock circuitry, an on-chip oscillator, a full-duplex serial connection, interrupt architecture. It also has 8kB Flash and 256 bytes of data RAM.

The AT89S52 also features two software configurable power-saving modes and static logic allowing operating down to zero frequency. The CPU is turned off in idle mode, but the RAM, timers and counters, serial port, and interrupt system are still operational. The oscillator is frozen in the Power Down Mode, which also disables all other chip operations until the subsequent hardware reset. However, the RAM contents are saved. Both serial in-system programming and parallel programming are supported by Flash program memory (ISP). Additionally, the 89S52 is In-Application Programmable (IAP), making it possible to change the Flash program memory even while the application is executing.

5. SOFTWARE REQUIREMENTS:

5.1 TOOL: KEIL MICROVISION:

Programming MCUs using the 8051 architecture is frequently done using the Keil Au vision IDE. It includes powerful debugging tools, including logic analyzers and watch windows, and supports more than 50 microcontrollers.

The AT89C51ED2 microcontroller, which will be used in this study, includes the following features:

- 64 KB FLASH ROM
- On-chipS EEPROM
- 1792 bytes of X-RAM and 256 bytes of RAM
- In- System programming for uploading the program
- 3 Timer/ counters

5.2 LANGUAGE: EMBEDDED ‘ C’:

As a top provider of 8051 microcontrollers (MCUs), Nuvoton provides a range of devices with the top performance necessary for consumer and industrial product success. The 8-bit MCU supports pin compatibility with the conventional 12 T 8051, a wide operating voltage range (2.4V – 5.5V), industrial temperature (-40 °C – 85 °C), 22.1184 internal oscillators (1% accuracy at 25 °C, 5V), configurable Data Flash, a rich set of I/O including PWM, ADC, UART, SPI, I2C, comparator, ISP, and ICP, high noise immunity (8 kV It is among the top options for 8051 MCUs.

In order to carry out a certain task, an embedded system combines computer hardware, software, and sometimes extra mechanical or other components. The microwave oven is an excellent illustration. Tens of millions of them are used daily in almost every household, yet very few people are aware that a processor and software were used to prepare their lunch or supper.

The family room computer stands in stark contrast to this. It too is made up of mechanical, software, and hardware components for computers (disk drives, for example). A personal computer, on the other hand, is capable of many various tasks and is not intended to carry out a single task. To emphasize this disparity, the phrase "general-purpose computer" is frequently used. A general-purpose computer is a blank piece of paper when it is supplied; the maker has no idea what the client will do with it. It may be used by one client as a network file server, another client might use it only for gaming, and a third client would use it to draft the next great American novel.

An embedded system frequently functions as a component of a bigger system. For instance, numerous embedded systems are included in contemporary vehicles and trucks. Three embedded systems work together to monitor and manage the vehicle's emissions, regulate the anti-lock brakes, and display data on the dashboard. These embedded systems may occasionally be linked via a communication network, although it's not a necessity.

6. CIRCUIT DIAGRAM:

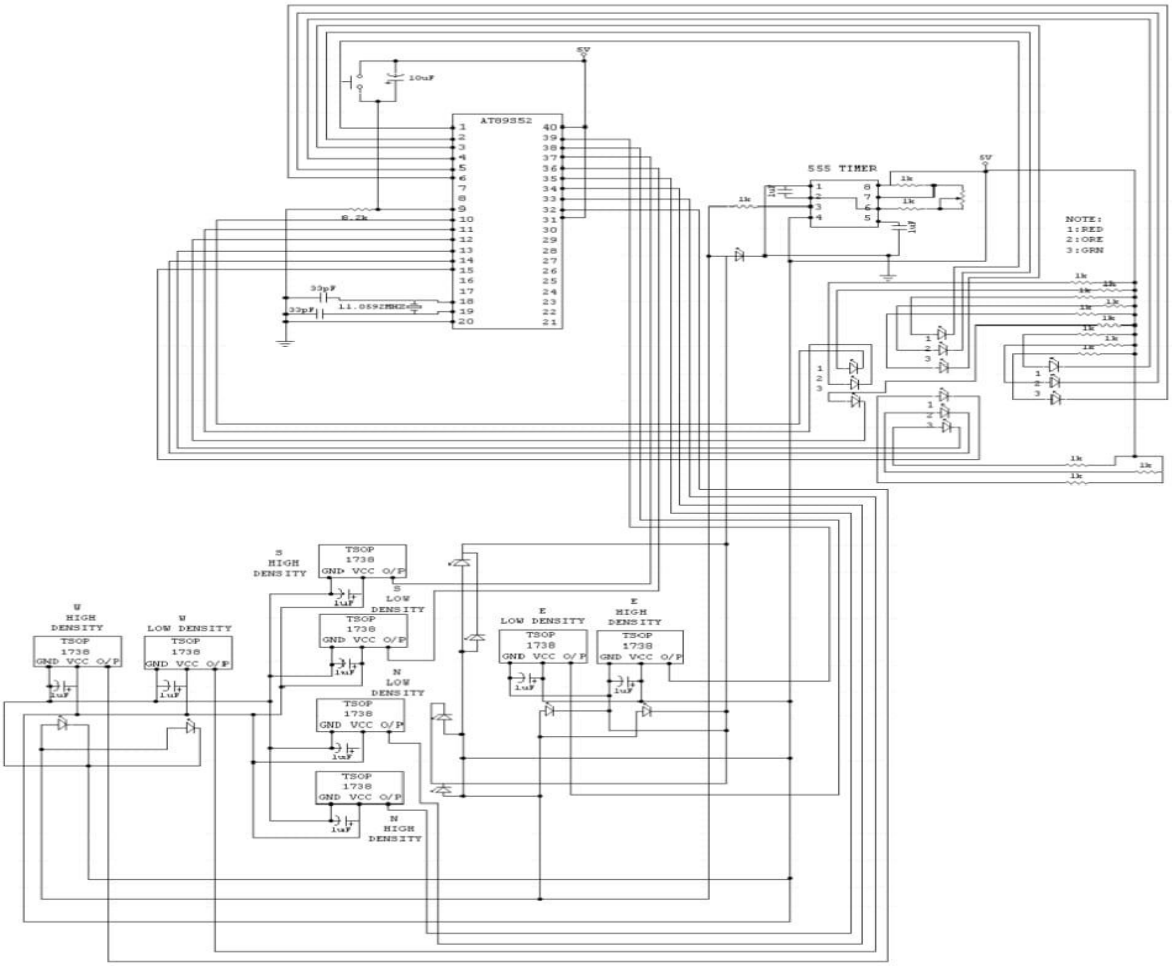
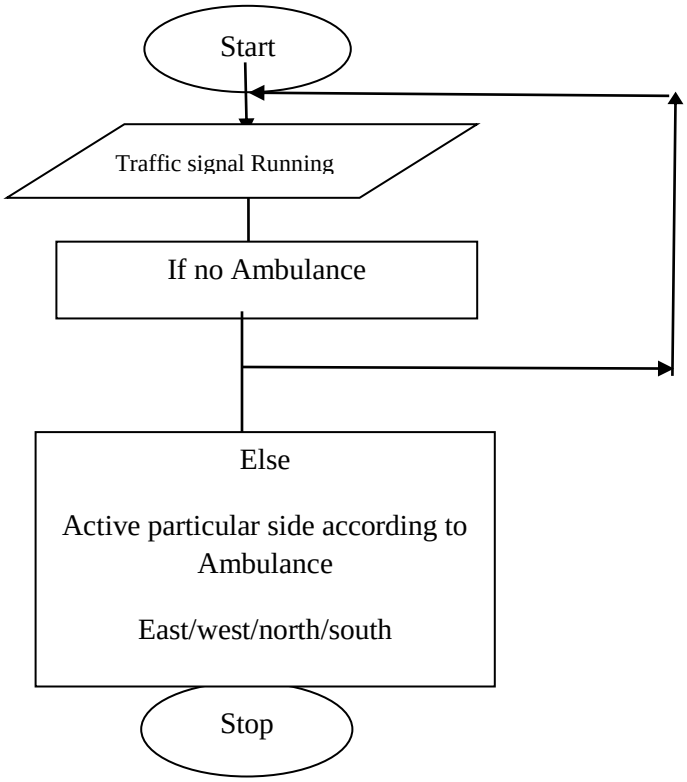


Figure 1: circuit diagram of traffic signal controller

7. FLOW CHART:



8. WORKING PRINCIPLE:

The first part was put into practice by employing RFID technology to provide emergency vehicles like ambulances and fire engines with a priority system.

Essentially, this circuit is a simulation of a four-way lane crossing that occurs in real life. The issues that this initiative largely raises relate to emergency vehicles. The RFID idea is utilized to turn the ambulance lane green and give the ambulance a stop-free path.

The circuit begins to work on the traffic density operation as soon as the power supply is turned on. For the purpose of carrying out this project, a prototype was created.

A four-lane traffic intersection with a total of 8 IR sensor circuits is connected in this circuit. Two IR sensor circuits are linked together on each side. Consequently, eight sensor circuits are connected for the four sides. Using ARM 7 and ARM 9 controllers, we can connect additional IR sensor circuits. However, we have just utilized the AT89S52 microcontroller in this project. For this project, the AT89S52 microcontroller's 32 IO pins were insufficient, therefore we attached only two IR sensor circuits to either side of the junction. In all, this project uses 8 IR sensor circuits over all four sides. Eight IR sensor circuits are linked between P0 and P0 7.

The density of cars that are positioned at a particular distance is measured using an IR sensor. (Figure 6) If there is a lot of traffic on one side, that side is given higher priority, and that side of the traffic is given the green light.

Two IR sensor circuits are linked on either side in this project. If the outputs of two sensor circuits are high, then there is a lot of traffic on that side. The microprocessor receives the signals from the IR sensor circuits and transmits the signals to the traffic lights, instructing them to display a green signal and allow that side to be cleared first. These mechanisms will be used

by the signals on the four sides: SOUTH, NORTH, EAST, and WEST. On the other three sides of the intersection, an identical process will also take place.

One switch is linked to the microcontroller's pin P32 in this design. The priority operation for emergency vehicles is activated when we press the push button for one or two minutes. Anytime a car enters a lane, RFID recognizes(Figure :3) it as an emergency vehicle and transmits a data signal to the microcontroller, which then receives it. Then the microcontroller sends the appropriate signals to the traffic lights to enable the movement of emergency vehicles. Ports P3-3 (GREEN) and P3-4 are associated with these traffic lights (RED).

On each of the other three sides of the intersection, an identical process will take place. If two IR sensor circuit outputs are high on one side but just one is high on the other, the priority is given to that side of the traffic first. The other three sides of the intersection are given priority when the green light is given to that side and the traffic intensity on that side has decreased.

At the traffic crossroads, there is a wireless camera that records videos and transmits them to the Traffic Monitoring Cell through the wireless connection.

9. HARDWARE KIT:

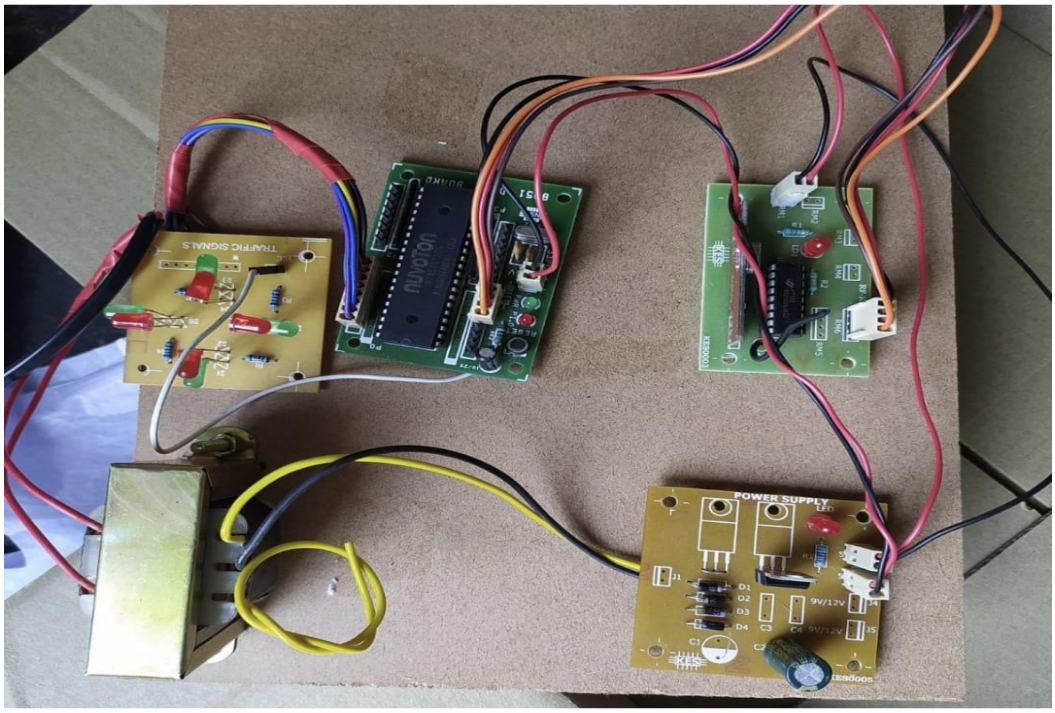


Figure 2: Hardware kit of traffic signal controller

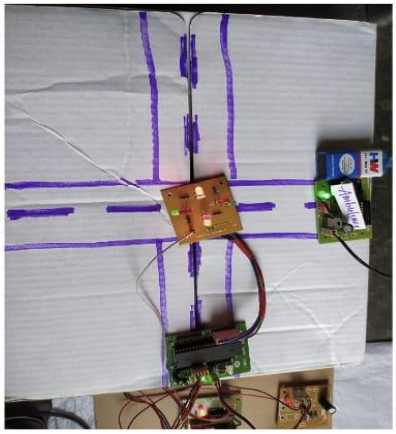


Figure 3: 4 -way traffic junction

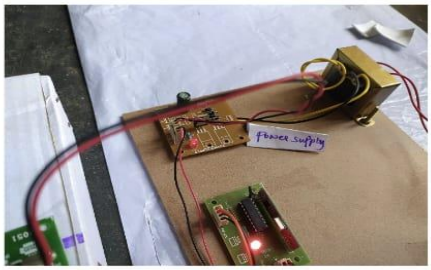


Figure 4: power supply

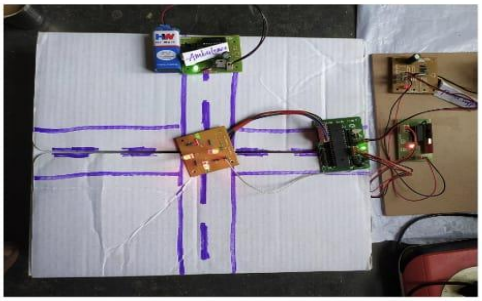


Figure 5: RF receiver is connected into microcontroller

Figure 6: RF transmitter ,Ambulance

10. ADVANTAGES:

- Improves traffic safety.
- Enhances traffic flow
- Improves traffic flow at network intersections.
- Makes way when there is an emergency.
- In times of need, save several lives from traffic.

11. DISADVANTAGES:

- High initial cost.

12. CONCLUSION:

The problem with the traffic lights is a serious one that bothers both residents and governments. The economic, health, financial, and environmental realms are all impacted by conventional, inefficient transportation networks. Car accidents, traffic jams, and road congestion caused by the transportation system's issues and inadequate supervision might place high demands on companies and workers.

The development of technology and the miniaturization of appliances, controls, and sensors have made it possible to create complex, intelligent embedded systems that may solve issues for people and improve lifestyles. By incorporating cutting-edge hardware and software design techniques, our smart traffic light control system aims to help the scientific community improve the current traffic light systems and control the flow of vehicles at crossings.

A traffic light controller that controls the traffic lights at a "+" junction of mono-directional roads makes up the planned smart traffic system. IR sensors placed on each side of the highways allow the system to calculate the traffic density. Based on this information, the duration of the green light will either be shortened to avoid wasteful waiting when there are no cars on the opposite route or prolonged to facilitate a significant flow of vehicles in the event of traffic jams. A portable controller is an addition to the system for emergency vehicles backed up in traffic. The portable controller initiates the XBee wireless system's secure communication with the traffic until the stranded emergency vehicle passes through the junction, the master controller switches to emergency mode and offers a clear route.

To guarantee that the intended system's operations and functionalities are fully validated, it is implemented, realized electronically, and tested. Monitoring and managing a double road junction will help the existing design. Future additions might include a button for pedestrian crossings, delay time displays, as well as failure and auto accident modes. Future research will look at integrating various traffic controllers at various junctions to achieve total synchronization.

Traffic data may be captured and exported to a computer platform to evaluate system performance. Statistical data analysis studies can then be used to better understand the traffic patterns between crossings. To minimize grid electricity use and achieve green energy operations, traffic light controllers might also be powered by solar panels.

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