

Design of Road surveillance system for low visibility, bad weather and emergency situations

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Traffic accidents are major causes of death and disability worldwide. Lack of visibility due to Fog and darkness are main causes of accidents. These accidents may turn into fatalities and long traffic jams if proper actions are not taken. In this paper we initially review the accident data and scenarios and then propose a road surveillance system in low visibility and emergency. This proposed system that mainly performs three tasks as turning ON road-alert lights, if a vehicle unexpectedly stops on road-side due to any technical fault or accidents. This will help upcoming vehicles to have prior information of unexpectedly stopped vehicle that will reduce accident due to vehicles collision, other side turning ON road-street lights automatically with darkness detection. This will reduce accident by improving visibility in night or fog and Send Emergency Notification to the control room if vehicle remain still for more than 20 seconds. This will help in taking proper and timely action in case of emergencies avoiding fatalities and traffic jams for hours. The system is based on Arduino and GSM module and tested for each of the three scenarios (fog, darkness, emergency). The result shows that the proposed system worked efficiently in each condition and can be used to improve traffic safety.

Keywords: Ultrasonic sensors, LDR, Relay, Surveillance

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Introduction

As we know that, in our country road accidents are one of the most critical problems among all the disasters. Everyday Road accidents are causing Fatalities and injuries at increasing rate. According to a study [1] 2,650 people die and 9,000 people get injured weekly due to traffic accidents. Road safety is the major issues as well as challenge for the authorities to control the road accidents and provide quick rescue response in the case of emergency. One major reason behind road accidents is improper visibility due to fog or darkness. The situations become worse when proper actions are not taken timely resulting in long traffic jams and fatalities. This motivated us to propose a Road surveillance system in low visibility and Emergency.

The main aim of propose surveillance system is to improve road safety and driving experience during bad weather conditions, darkness and emergency. The proposed surveillance system uses Arduino, LDRs, Relays, Ultrasonic sensor, and GSM module to deal with three types of road scenarios i.e. 1) Foggy weather condition, 2) Lack of visibility due to darkness 3) Emergency situation. The rest of the paper organized as follows section II presents the literature survey of existing road surveillance system. Section III includes the research gap. Section IV describes the methodology of the proposed system. Section V includes the results. Section VI presents conclusion of the paper.

Literature Review

Researchers have proposed various systems to handle road accident due to low visibility, foggy weather, people mistakes. Existing system [2] road safety during fog uses PLC that count the number of vehicles will enter at particular area and that vehicle passing through all the sensors. So, if the number of vehicles is less than entering into that particular area that means something is wrong inside then automatically a buzzer will be raised and signals before that area will be red.

On other side barriers will be closed automatically so that another vehicle cannot enter and prevent to strike again. Work in [3] discusses about the task to detect foreground objects from video sequences with fog and then enhance their visibilities.

The author used novel metric to measure image fog property that decide whether the image scene is obscured by fog or not. In [3], authors proposed a novel approach for object detection in fog.

This approach is based on an atmospheric scattering.

Study in [4] aims to find the vehicle accident location by means of sending a message using a system that is placed inside of vehicle system.

In article [4], an Arduino microcontroller ATMEGA 2560, GPS and GSM modules which helps to trace the vehicle anywhere on the globe. The exact location of the vehicle is sent to the remote devices (mobile phones) using GSM modem.

Work in [5] presents an automatic surveillance system using Raspberry pi and Arduino. It increases the usage of technology to provide essential security in the street area and for other control application. The proposed security system captures information and transmits it via email.

Accident detection and alert system in [6] deals with accident that occurs due to carelessness of the person who is driving the vehicle.

This system involves an accident alerting system which alerts the person who is driving the vehicle. If a person is not in a position to control the vehicle then the accident occurs. Once the accident occurs to the vehicle this system will send information to registered mobile number. System.

Existing system [7] deals with car emergency rescue alert that aims at building an integrated system for emergency rescue services in the event of a road accident.

Work in [8] presents automatic street light system in which the street lights will be switched on in the evening before the sun sets and they are switched off the next day morning after there is sufficient light on the roads.

This system is useful to save unnecessary electrical power wastage.

This system uses two Light Dependent Resistor LDR sensors to indicate a day/night time and the photoelectric sensors to detect the movement on the street. The microcontroller PIC16F877A is used as brain to control the street light.

Research GAP

The literature review depicts the most of system are designed to handle single factor causing accidents. Existing systems are designed to handle accidents due to either low visibility problem or bad weather condition. Some articles proposed to alert system via buzzer or alarm to stop incoming vehicle to minimize collision of vehicles. This means that system consider single factor responsible for accident. There is no system that provides solution to deal with three all types of road scenarios i.e. 1) Foggy weather condition, 2) Lack of visibility due to darkness 3) Emergency situations.

Our main motive is to propose a single system that can solve the low visibility problem during darkness, minimize vehicle collision on the road due to foggy weather and send emergency notification to the control room. System will monitor live situation of emergency area to provide rescue facilities.

Methodology

The proposed system “Design of road surveillance system for low visibility and emergency” consists of LDR, Arduino, GSM, Relays, US sensors, Camera and LEDs. Figure1 shows the block architecture diagram of the proposed system.

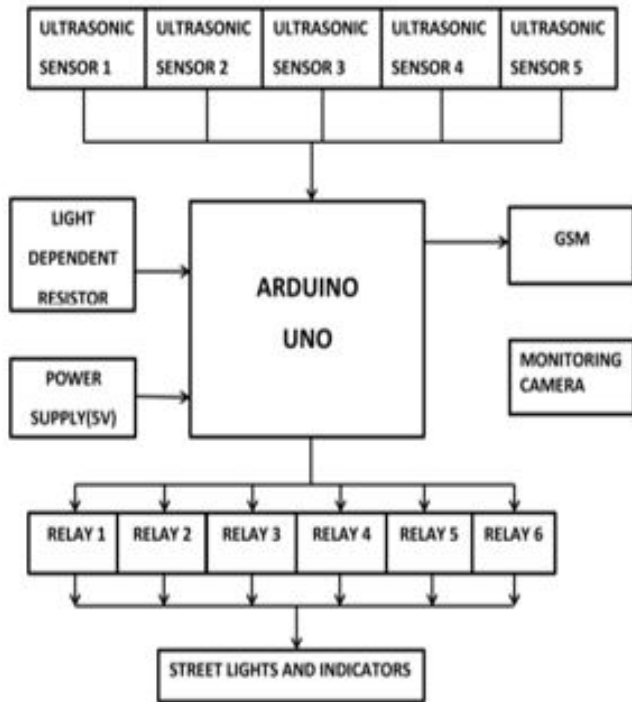


Figure1: Block architecture of the proposed system.

A. Working Methods

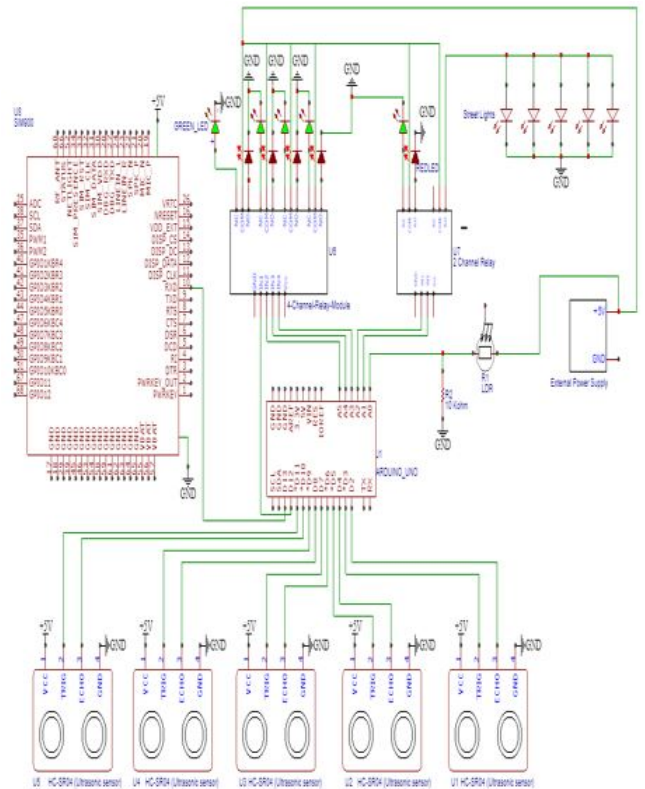


Figure 2: Circuit diagram of the proposed system.

The proposed road surveillance system deals with three types of road scenarios i.e. 1) Foggy weather condition, 2) Lack of visibility due to darkness 3) Emergency situations.

The system turns on by providing 220V ac power supply that is converted into 5v dc supply using voltage regulator.

When vehicle is moving on the road usually without any problem then green light will glow to indicate safe zone but if vehicle unexpectedly stops due to fog, technical fault or illegal attack then red light will glow to alert upcoming vehicles about emergency situations (figure.5) because Ultrasonic sensors detect the object wave then send instruction to microcontroller to glow red light to alert upcoming vehicles. LDR played vital role to manage luminous intensity of street lights.

Relays used here to adjust automatic switch on-off circuits and related components in the case low voltage condition. It works also as remote control of the circuit.

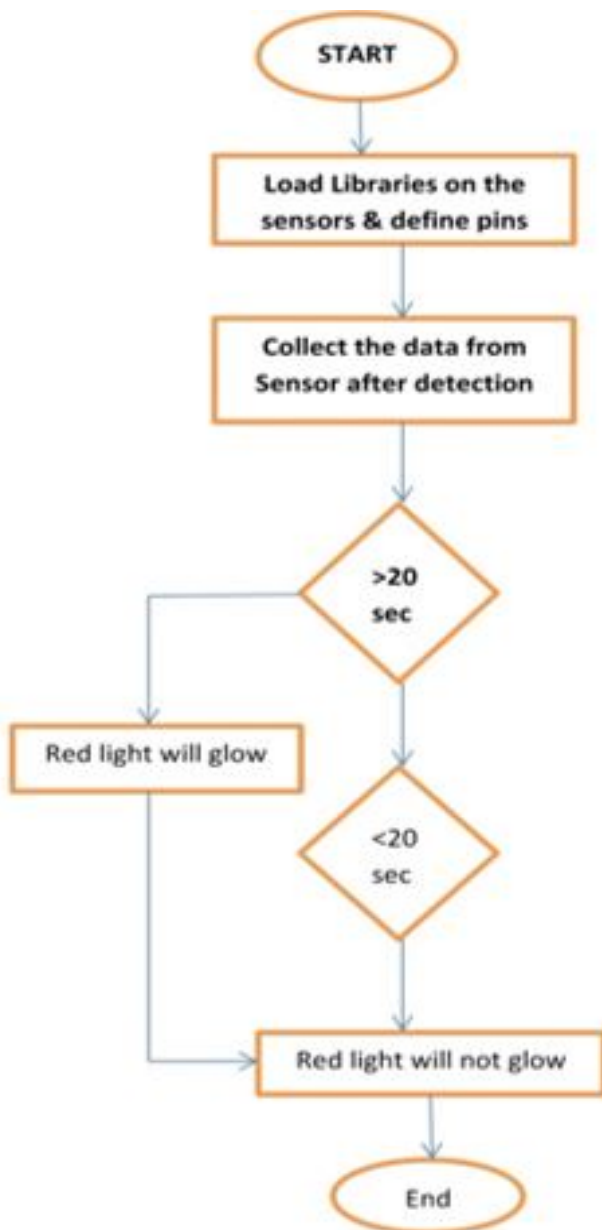


Figure 3: Flowchart for emergency alert during vehicle detection.

During darkness street light will glow automatically to resolve the problem of low visibility because LDR adjust light luminous property according to day and night effect (figure.4).

Moreover, if vehicle will remain still for more than 20 seconds then microcontroller will instruct GSM module to send notification of emergency to the control room (figure.6) then control room will access surveillance camera to monitor live situation (figure.7) then control room will inform rescue team to provide help of needy ones.

B. Advantages: In the hilly areas major accidents happens due to low visibility and foggy weather. So the system can be implemented there so reduce accidents.

- Easier to install anywhere.
- Reduce low visibility during darkness.
- Alert upcoming vehicle during fog occur.
- Send notification to the control room about emergency alert.

Results

This section presents the results of proposed system that has been observed under different situations. (Figure.4) depicts the turning on of street lights automatically during night. In this (figure.5), red lights are glowing to alert upcoming vehicle of that respective side regarding emergency situation. These red-light alerts will help upcoming vehicles to understand that there is some emergency ahead and collision due to foggy weather or any external factors will be reduced.

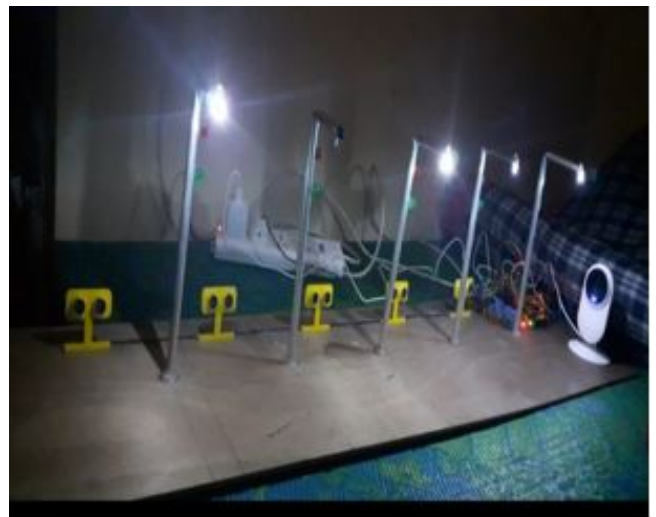


Figure 4: Street Lights are glowing.



Figure 5: Red LEDs are glowing as alert system for upcoming vehicles.

After detection of stopped vehicle on the road for the 20 seconds GSM will send notification of emergency alert to control room as "DANGER...NEED HELP" (figure.6).

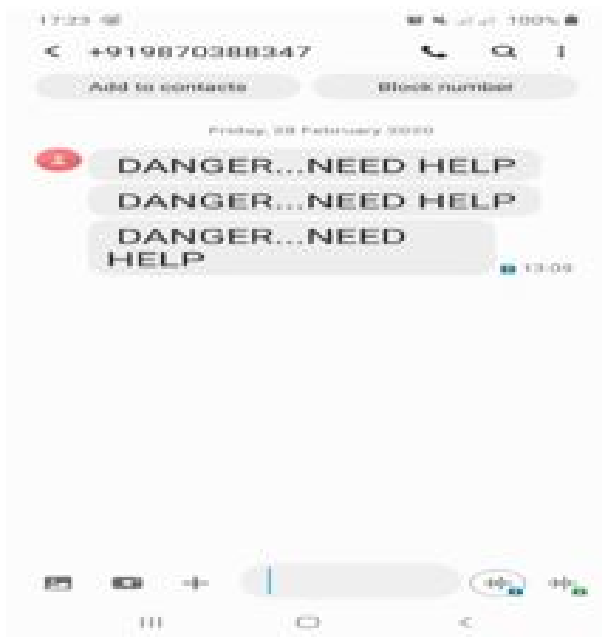


Figure 6: Received notification via GSM.

After getting notification through GSM camera will be access via internet with help of PCs or Smartphone to see live situation of the particular place (figure.7). Now, control rooms will be able to instruct emergency rescue squad to provide them any type of help related to medical, police or any other rescue teams.

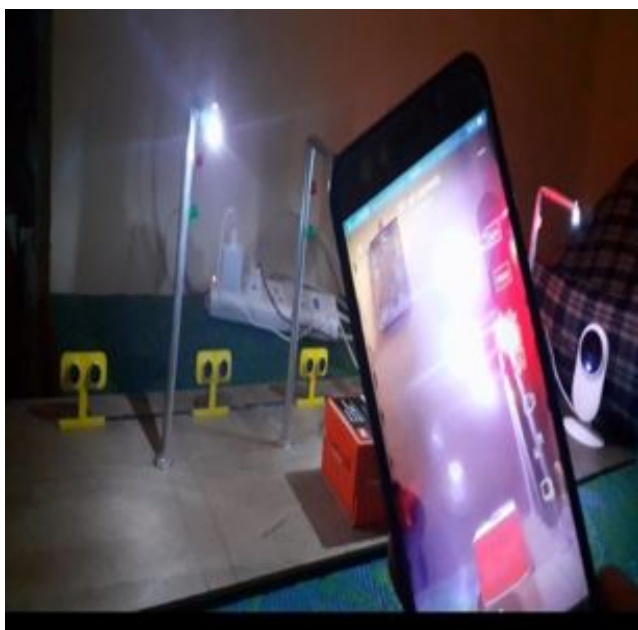


Figure 7: Monitor live situation after accessing camera via internet.

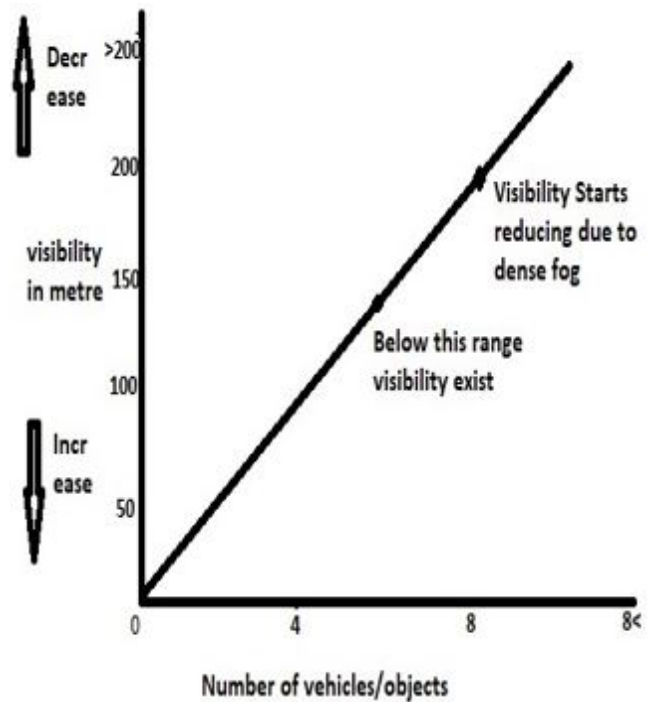


Figure 8: Graph of visibility level versus number of vehicles during fog.

During fog visibility become very less, then vehicle diver cannot be able to see properly on the road it is depend upon the level of fog density.

In (figure.8) we have some observation of real experiences during fog where visibility level become less when vehicles are far away from the exact foggy area it means that the level of visibility depends on the distance gaps.

Conclusion

In this paper a surveillance system is designed to deal with low visibility due to darkness, foggy weather and provide emergency alert to control room. Streets light are here for minimize low visibility during darkness. If a person going somewhere in his vehicle then stops suddenly due to fogs, internal or external faults then upcoming vehicle will get alert via red lights to reduce collision of vehicles. If vehicle remain still for more than 20 seconds then control room will receive notification of emergency alert then will be able to monitor situation via camera to provide them rescue.

Our system is based on road emergency rescue and help. So, it can implement as a type of technology in the hilly area because visibility levels are very low there.

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