

Design and Implementation of Traffic Monitoring for Indian Smart Cities

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Abstract—Traffic monitoring is an essential component of smart city development in India. Indian cities face significant traffic congestion, which not only results in economic losses but also affects the quality of life of citizens and death of patients due to the late arrival to the hospitals. Therefore, smart traffic management systems have become a priority for Indian cities to enhance mobility, reduce congestion, and improve the safety of road users. There are several approaches that Indian cities can take to implement traffic monitoring systems. One of the most common approaches is the use of intelligent transportation systems (ITS) that incorporate advanced technologies such as real-time traffic monitoring, predictive analytics, and adaptive traffic signal control. In this article, Real-time traffic monitoring systems are discussed, which includes the use of sensors, cameras, and other monitoring devices to collect data on traffic flow, speed, and density. It provides a safe path for the Ambulance by making use of RFID Technology. Also IR sensors are used near school zones to reduce the accidents, while crossing the roads by alerting the driver to reduce the speed of the vehicle.

Index Terms— Arduino, Atmega1280, Control system, Detection, Smart Traffic light.

I. INTRODUCTION

As compared to the 4G network, the 5G network aims to provide high speed and low latency during communications. Due to rapid growth of population there is a substantial scarcity of many facilities in urban regions, such as food, transportation, healthcare, and so on To address this issue, it is necessary to efficiently deploy current resources and modernize existing facilities. In this perspective, certain countries have proposed Smart City projects to increase digital infrastructure and thereby virtually link all resources for better planning, distribution, and consumption[1]. Similarly, the Indian Government has declared the classification of more than 100 cities as smart cities. Thousands of sensors, or the Internet of Things, will be installed in a smart city (IoT). Traffic monitoring design and implementation aid in solving traffic congestion problems in developing countries[2].

One of the biggest issues in smart cities is traffic signal control. Traffic control at road crossings is critical for city administrations in many contemporary cities. Timer circuits are used in modern systems. These timing circuits are ineffective because they do not take into account the current traffic flow at the crossing.

Additional difficulties include ambulances being slowed up by a red traffic signal and losing vital time on their

way to the hospital. Traffic congestion frequently results in lost time, decreased worker productivity, delivery delays, and overall cost increases. The designed system intends to provide a free path for the emergency vehicle.

II. LITERATURE REVIEW

The current effort focuses on the specific studies released in India on the relationship between Radio Frequency Identification (RFID) technology and Indian librarians.

Samik Shome, Parag Rijwani, and Deepak Danak [1] concentrated on RFID real-time applications. RFID is widely employed by numerous firms to increase business operational competency. RFID benefits businesses by allowing them to deal with a diverse variety of products, more things with cost and time adaptation, and maintain consistency standardization throughout linked supply chains. It is necessary to understand the numerous RFID applications for industrial businesses.

Ghazal [2] and Team concentrated on the Smart traffic light control system's functionality. The IR transmitter and receiver are installed here on either side of a road. As a vehicle passes between the IR sensors on the road, the system activates and the car counter is incremented. Data on traffic density were collected and analyzed for various routes and intersections. The delays of green lights are dynamically changed at the high-traffic lane. Unsystematic monitoring can lead to automobile accidents, traffic delays, and highway congestion. This places a significant burden on businesses and workers.

P. Gupta and M. Margam [3] RFID technology may be used to library services. The issue is the high cost of implementation. when applied in big numbers in libraries, it will bring advantages and benefits by automating and solving complicated issues.

Pandey and Mahajan [4] concentrated on RFID technology in libraries. He said that this technique is imminent, efficient, and low-cost in terms of library security. It may also function as a security device, replacing standard electromagnetic security strips.

Naga Lakshmi [5] discussed the adoption, challenges, and best practises of RFID technology in libraries. The author believes that the introduction of RFID in libraries should follow a review of privacy policies in order to safeguard patrons and standards. Most Indian colleges have begun to use RFID to track library materials.

Abugabah et al. [6] concentrate on issues of healthcare service delivery. RFID technology has the capacity to track medical assets and interact with nearly every medical gadget, pharmaceutical substance, IT system, or individual patient deployed in hospitals worldwide. The issues provide light on growing potential for effective RFID data handling and administration, as well as suggestions for large-scale deployment and worldwide acceptance.

Mandeep and Kaur [7] explored the benefits, drawbacks, and uses of RFID systems in instance or class identification, location identification, payment systems, and security and access control. The authors go into great length on the principles involved in RFID technology.

Nafea [8] and his team created a convenient traffic system that enables for the seamless circulation of automobiles, which will aid in the development of a smarter city. The system setup reduces the possibility of traffic congestion generated by the already deployed traffic system. This reduces the workload of police who must guide traffic when traffic signals are not functioning or in the event of an emergency.

Satya Priya [9] Congestion in cities is a major issue, particularly in developing countries. Highlights the numerous approaches made to enhance the global transportation system. Parking space is growing extremely limited as the number of vehicles on the road grows. To address this issue, several parking lots have placed sensors that identify when a car enters or departs a parking lot, allowing them to track capacity and notify drivers when it is full. Internet of Things technologies have created new potential for smart systems today. Intelligent algorithms in IoT make the Internet a platform for networked sensors and actuators. Using the connected-intelligence approach, this improves the efficiency of traditional systems [10].

A. Saini [11]. This data can be used for the following purposes: A smartphone application that is an improved version of Google Maps. As the population expands, so does the number of cars on the road, resulting in more accidents and traffic bottlenecks.

III. TECHNIQUES IMPLEMENTED

A camera, towers, yellow, green, and red indicators, an IOT platform for analytics, and ultrasonic/IR sensors are the major components of the traffic control system. Input devices are the ultrasonic/IR sensors and camera, output devices are the indicators, and the network is used to communicate with people. The four-way traffic lane is used to provide a clear path for cars travelling in the other three directions. avoids the issues that are typical

with traditional traffic light recognition systems, particularly those that employ image processing techniques to determine traffic light state. The technique yields a high-performance, low-cost system. [12] The system is mostly executed with cameras as the foundation. It is made up of three layers, the first of which contains cameras that collect images [13].

A. Flowchart for traffic monitoring system

The flowchart of Traffic Monitoring System's is depicted in Figure 1. Initially the vehicle consists of the RFID reader and Tag. The RFID Reader is placed around 100 meters away from the Traffic light (Junction). When the Tag is detected by the reader, it sends the signal to the Arduino uno. The decision device makes the decision. If the card is valid, the control signal is switched to GREEN light in any one direction (Emergency path). Other three directions, the control signal is switched to RED Light. This provides free path for the emergency vehicle to cross the junction and to reach the final destination at the earliest.

As a vehicle approaches or leaves the crossing, the RFID readers, analyzes and transmits the collected data to the Arduino board.

Since the vehicle is RFID enabled, the RFID Reader at the receiver tracks it and sends the signal to the Arduino. The decision-making system decides whether or not it is an emergency vehicle. The traffic signal is switched GREEN , if it's an emergency vehicle.

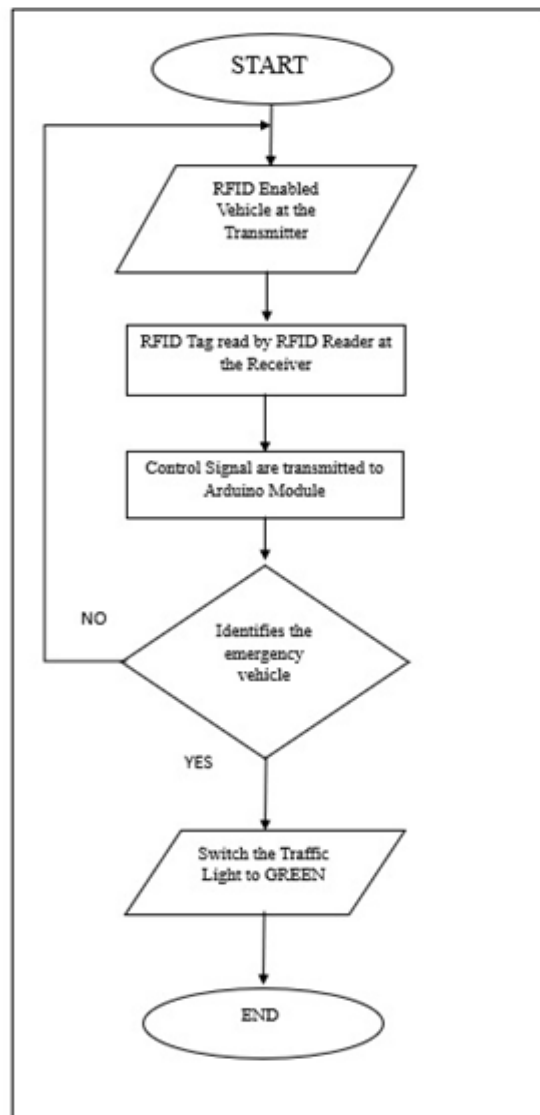


Figure 1. Flowchart of Traffic Monitoring System Using RFID

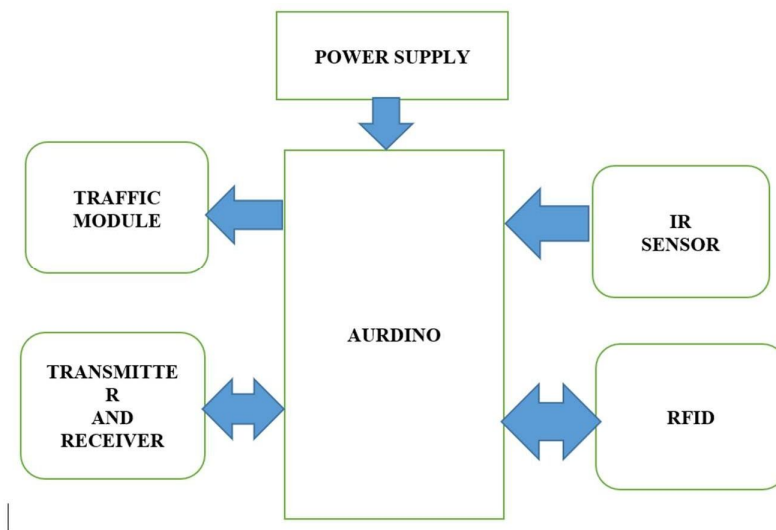


Figure.2 Block diagram of Traffic Monitoring System

Figure 2: The above figure explains the primary goal of the smart traffic monitoring system, depicted in Figure 2, is to assign timings to traffic lights based on the volume of traffic on a lane. The road is divided into four evenly spaced sections to measure the quantity of traffic on each lane. These sections are identified as L1, L2, L3, and L4. The control signals are sent to the traffic module by the sensor, which contains a transmitter and a receiver. When the ambulance is in a busy location, the traffic signal is immediately set to clear (GREEN) traffic at the intersection, although without the help of traffic cops. Also useful for parking near intersections.

The concentration of population in and around emerging urban areas is expected to increase congestion, necessitating the need for transportation solutions that enable sustainable urban expansion based on safety, efficiency, and environmental concerns.

Parking monitoring is an important component of such a system, in which a network of sensors collects data to generate a real-time map of public space occupancy in order to efficiently divert traffic and relieve congestion [14].

IV. RESULTS AND DISCUSSIONS

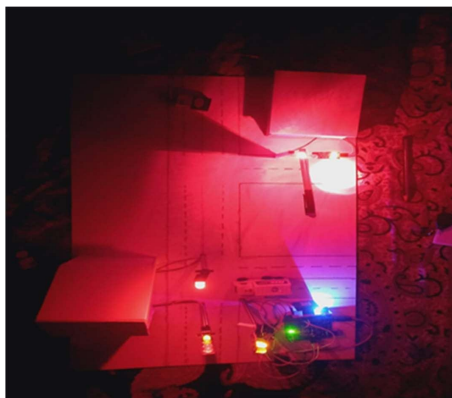


Figure 3a. Model of traffic monitoring system

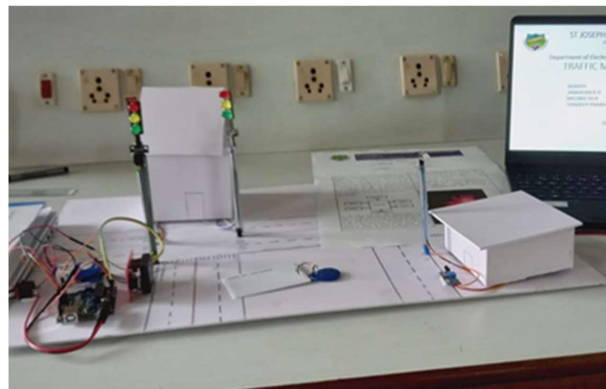


Figure 3b. Model of traffic monitoring system

Figures 3a and 3b depict the RFID reader at the intersection 100 metres away from the traffic module, and another RFID reader (tag) put in the ambulance, which detects the ambulance and provides the control signal when it passes past the RFID reader. The traffic module activates the GREEN signal automatically.

The project contributes to schoolchildren's safety when crossing roadways. As schoolchildren cross the road, the IR sensor detects the signal and interacts with the system, causing the traffic signal to flash RED in order to stop the cars. Hence, accidents are avoided, and emergency vehicles have a clear road.

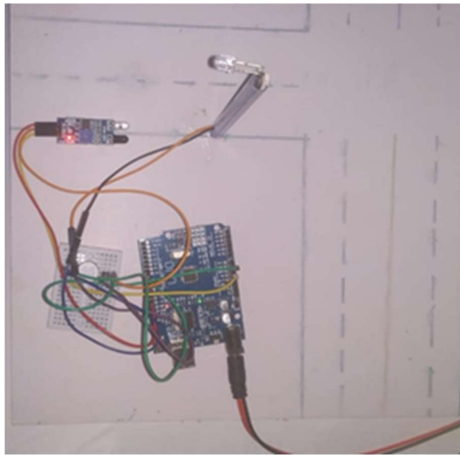


Figure 4a. Traffic monitoring system without Object

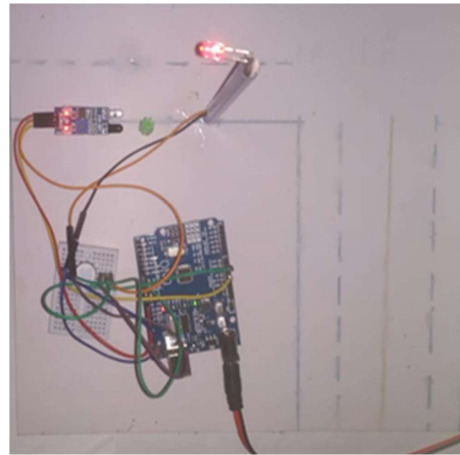


Figure 4b. Traffic monitoring system with Object

Figure 4a illustrates the object/obstacle can be detected by the IR sensor. Without identifying the object, it is in the OFF state.

Figure 4b shows how the IR sensor may identify an object/obstacle. When an item is spotted, the RED signal is activated. So that pedestrians/blind persons may cross the roadways without interruption and wait time is decreased. Accidents in school zones and hospital zones can therefore be prevented.

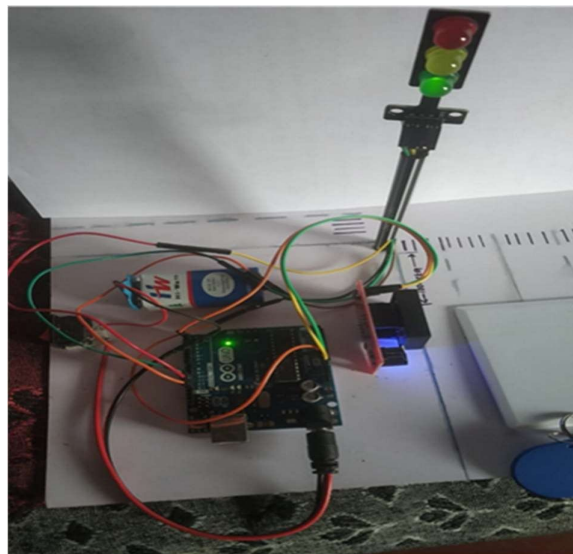


Figure 5. Model of RFID

Figure 5 shows the RFID reader as the main module. When an emergency vehicle (such as an ambulance or VIP person) is 100 metres away from a traffic intersection, the RFID tag is detected and the green light is turned on instantly. Other traffic indicators respond to the controller's commands.

V. CONCLUSION

The Smart Traffic Monitoring System was constructed using a variety of hardware components with the integration of IoT. Traffic is made better using the Internet of Things platform. To relieve traffic congestion and provide cross-road rerouting, the smart traffic management system is deployed. This idea provides a workable strategy for boosting traffic, particularly in major cities. To control traffic conditions more effectively and

efficiently while keeping in mind the most recent traffic management system approach, a smart traffic management system is implemented. It controls traffic flow more efficiently than ever before by communicating with the local server and dynamically adjusting the signal timing based on the volume of traffic on the particular roadside. This helps the emergency vehicle like ambulances to reach the destination at the earliest.

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