GREEN WAVE:
INTELLIGENT TRAFFIC LIGHTS

Project report submitted in partial fulfilment of the requirements for the course-Digital Electronics and Computer Architecture (23IC001) of

Bachelor of Engineering

in

Computer Science and Engineering

Submitted by

Aniket Singla

(2310992100)

Ishika Dhawan
(2310992101)

Ishpreet Kaur
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Jai Aditya Singh
(2310992103)

Group:-24 (A) B.E.-2023 Batch

Chitkara University Institute of Engineering and Technology
Department of Interdisciplinary Courses in Engineering (DICE)
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Under the Supervision of

Dr. Anchal Thakur

Assistant Professor

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CHITKARA UNIVERSITY

DICE DEPARTMENT OF INTERDISCIPLINARY COURSES IN ENGINEERING

CHITKARA UNIVERSITY INSTITUTE OF ENGINEERING & TECHNOLOGY, PUNJAB

(Accredited by NAAC with Grade 'A+')

DEPARTMENT OF INTERDISCIPLINARY COURSES IN ENGINEERING

CERTIFICATE

This is to certify that the project titled **"GreenWave: Intelligent Traffic Lights"** submitted to the **Chitkara University Institute of Engineering and Technology (CUIET)** by **Aniket Singla (2310992100), Ishika Dhawan (2310992101), Ishpreet Kaur (2310992102), Jai Aditya Singh (2310992103)** is a bonafide record of the work done by the students towards partial fulfilment of requirements for the course- Digital Electronics and Computer Architecture (23IC001) of **Bachelor of Engineering in Computer Science and Engineering.**

	Supervisor	**Project/Lab Faculty**	**Course/Project Coordinator**
Signature			
Name	**Dr. Anchal Thakur**	**Dr. Anchal Thakur**	**Dr. Gaurav Sharma**
Designation	**Assistant Professor**	**Assistant Professor**	**Associate Professor**
Department	**Department of computer science and Engineering**	**Department of computer science and Engineering**	**Department of Interdisciplinary Courses in Engineering**

Place: Chitkara University, Rajpura, Punjab

Date: 7th December 2023

Candidates' Declaration

We, **Aniket Singla (2310992100), Ishika Dhawan (2310992101), Ishpreet Kaur (2310992102), Jai Aditya Singh (2310992103)**, of **Group- 4**, B.E. -2023 batch of Chitkara University, Punjab hereby declare that the Digital Electronics and Computer Architecture (DECA) project entitled **"GreenWave: Intelligent Traffic Lights"** Is an original work and data provided in the study is authentic to the best of our knowledge. This project has not been submitted by us to any other institute for the award of any other course.

Contribution Details:

Sr. No.	Student Name	Roll No.	Contact Number	Contribution in Project	Signature
1.	Aniket Singla	2310992100	7814416957	Brought Hardware Components, coding of the logic	
2.	Ishika Dhawan	2310992101	9872314240	Hardware connections, coding	
3.	Ishpreet Kaur	2310992102	9914531745	Coding, Equipment Arrangement, Report Making	
4.	Jai Aditya Singh	2310992103	7696671305	Coding, report, abstract	

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We would like to express our sincere gratitude to our supervisor**, Dr Anchal Thakur(Assistant Professor),**Her constant motivation, guidance and support helped us a great deal to achieve this feat.

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We wish a deep sense of gratitude and heartfelt thanks to the management for providing excellent lab facilities and tools.

ABSTRACT

GreenWave is a pioneering digital electronics and computer architecture project that revolutionizes urban traffic management, specifically targeting the challenge of emergency vehicle response during critical situations. This innovative project involves the installation of advanced sensors within traffic signal lights and emergency vehicles to ensure that they encounter minimal traffic obstacles when responding to emergencies. A powerful data processing system analyses sensor data in real-time to identify emergencies and adjust traffic signals accordingly. A dedicated control unit for traffic lights is designed to dynamically modify signal timings to create green corridors for approaching emergency vehicles.

Areas of Application: Emergency Vehicle Priority, Communication Infrastructure

Technology Stack: Ultrasonic sensors; Arduino UN, LED

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CHAPTER 1

INTRODUCTION

In the ever-evolving landscape of urban transportation, traffic congestion and delayed emergency response times pose significant challenges. The "GreenWave" project emerges as a groundbreaking solution designed to revolutionize urban traffic management, specifically targeting the critical issue of emergency vehicle response during life-threatening situations.

Problem Statement:

Urban areas often grapple with traffic congestion, hindering the swift movement of emergency vehicles through intersections. Traditional traffic signal systems lack the adaptability to prioritize emergency vehicles, leading to potentially life-threatening delays in reaching critical locations.

Objective:

GreenWave aims to create a seamlessly integrated, intelligent traffic signal prioritization system. By employing advanced technologies such as Radio-Frequency Identification (RFID), real-time sensors, and smart signal control, the project seeks to provide an unimpeded pathway for emergency vehicles, ensuring rapid response times and potentially saving lives during emergencies.

Brief Introduction:

In urban landscapes where traffic congestion and emergency response times intersect, the GreenWave project emerges as a transformative solution. This innovative initiative leverages advanced technologies, including RFID and real-time sensors, to create an

intelligent traffic signal prioritization system. The primary focus is on optimizing traffic flow for emergency vehicles, ensuring swift and unobstructed passage during critical situations. GreenWave represents a significant leap toward redefining urban traffic management, enhancing public safety, and setting new standards for responsive infrastructure.GreenWave strives to significantly reduce emergency response times, contributing to enhanced public safety and the well-being of urban communities. By prioritizing traffic signals for emergency vehicles in a smart and automated manner, the project seeks to address a critical aspect of urban infrastructure, ensuring a more responsive and adaptive traffic management system. GreenWave strives to significantly reduce emergency response times, contributing to enhanced public safety and the well-being of urban communities. By prioritizing traffic signals for emergency vehicles in a smart and automated manner, the project seeks to address a critical aspect of urban infrastructure, ensuring a more responsive and adaptive traffic management system.

CHAPTER 2

RELATED WORK

Overview:

It's essential to note that the adoption of smart traffic systems is a global trend, and different cities and countries may have implemented or tested various technologies to address their specific traffic challenges.

Singapore has been at the forefront of implementing smart traffic management systems. The city-state has deployed intelligent transport systems, including adaptive traffic lights and real-time monitoring, to manage traffic congestion efficiently.

Various cities in China, including Beijing and Shanghai, have been investing in smart city initiatives, which often include intelligent traffic management systems. These systems may use AI algorithms and sensors to optimize traffic flow.

SCATS (Sydney Coordinated Adaptive Traffic System) - SCATS is a widely used adaptive traffic control system that originated in Sydney, Australia. It has been implemented in various cities globally. SCATS uses real-time traffic data from sensors to dynamically adjust signal timings at intersections, optimizing traffic flow and reducing congestion.

Hangzhou City Brain - Hangzhou's City Brain is an AI-powered traffic management system developed by Alibaba Cloud. It uses a combination of artificial intelligence, data analytics, and real-time monitoring to optimize traffic signal timings and manage congestion. The system aims to improve overall urban transportation efficiency.

India has been exploring and implementing various smart city initiatives, including intelligent traffic management systems, in several cities.

Surat Adaptive Traffic Management System - Surat has been working on an Adaptive Traffic Management System that uses real-time data to adjust traffic signal timings. The system aims to enhance traffic flow and reduce congestion by dynamically responding to changing conditions.

Ahmedabad has implemented an Intelligent Traffic Management System that includes features like adaptive signal control, traffic surveillance, and violation detection. This system is designed to improve the overall efficiency of the city's traffic management.

Various cities across India, such as Pune, Surat, and Bhopal, have set up Integrated Command and Control Centers. These centers aim to integrate various urban services, including traffic management, through the use of technology and data analytics.

CHAPTER 3

HARDWARE COMPONENTS

The GreenWave: Smart Traffic Light system uses the following hardware components:

1. Jumper Wires
2. RFID tag and scanner
3. Arduino UNO
4. Breadboard
5. LED’s

The Arduino is the brain of your project, serving as a microcontroller. It runs the program (sketch) that controls the behaviour of the system. Arduino receives inputs from the RFID scanner, processes the data, and controls the output to the LED.

RFID stands for Radio-Frequency Identification. The RFID scanner reads data from RFID tags using radio-frequency signals. RFID tags are small devices that can store data and transmit it when in proximity to an RFID scanner.

The LED (Light Emitting Diode) is used as a visual indicator, representing the status of the traffic light. LEDs are semiconductors that emit light when an electric current is applied.

Jumper wires are used to connect the digital pins on the Arduino to the corresponding pins on the RFID scanner and LED. Jumper wires create the necessary connections between the various components on the breadboard. For example, connecting the power and ground pins of the RFID scanner to the power rails on the breadboard.

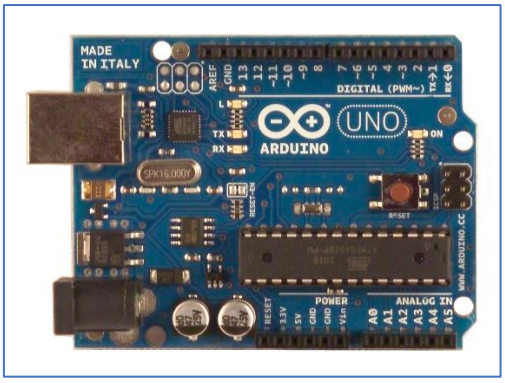

Fig3.1 – Arduino UNO

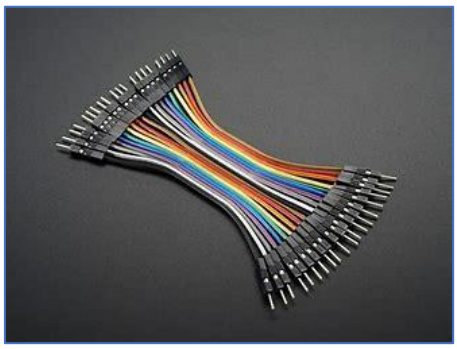

Fig3.2 – Jumper Wires

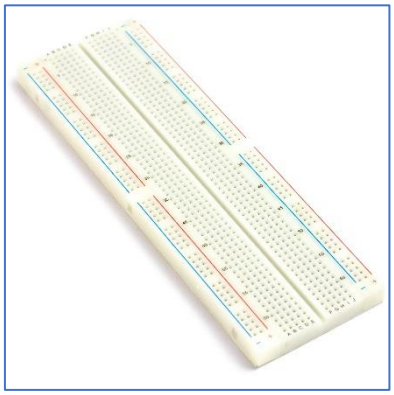

Fig3.3 - Breadboard

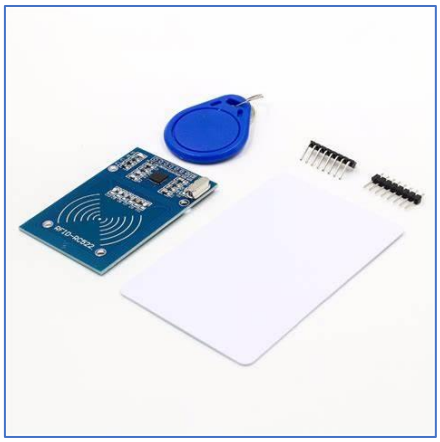

Fig3.4 – RFID tag and scanner

CHAPTER 4
PROJECT DETAILS

GreenWave is a pioneering digital electronics and computer architecture project that revolutionizes urban traffic management, specifically targeting the challenge of emergency vehicle response during critical situations. This innovative project involves the installation of advanced sensors within traffic signal lights and emergency vehicles to ensure that they encounter minimal traffic obstacles when responding to emergencies.

This project combines RFID technology, Arduino programming, and hardware interfacing to create a simple emergency vehicle traffic management system.

When an emergency vehicle approaches an intersection, the GreenWave system uses real-time data from the advanced sensors to detect its presence. The integrated RFID technology allows for seamless identification of the emergency vehicle, ensuring precise and immediate communication with the traffic signal system.

Beyond its immediate impact on emergency services, the GreenWave system sets the stage for further advancements in smart city initiatives. As cities evolve, the integration of intelligent transportation systems becomes increasingly essential, and projects like GreenWave pave the way for creating safer, more connected urban environments.

Software Used:

The project involves Arduino programming to control the behaviour of the system. The Arduino Integrated Development Environment (IDE) is commonly used for writing, compiling, and uploading the code to the Arduino board. The Arduino code for the GreenWave system aims to create an intelligent traffic management system that

prioritizes emergency vehicles through the use of RFID technology and advanced sensors.

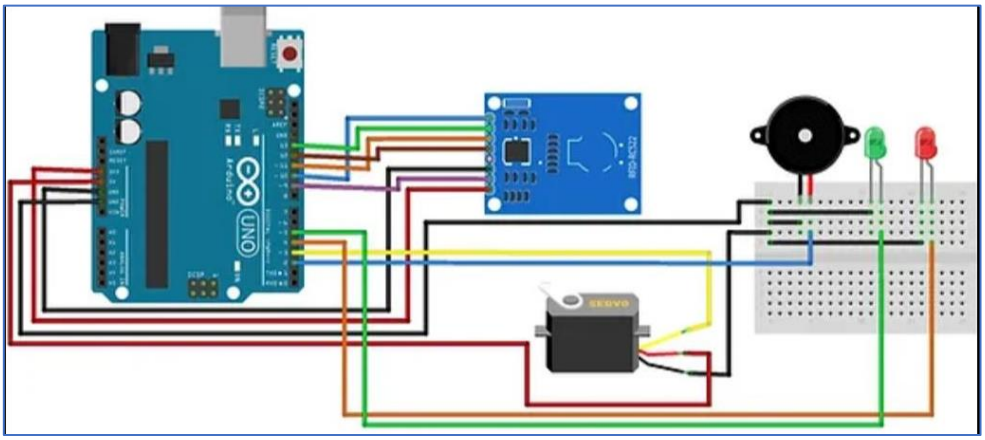

Fig4.1 – Circuit Diagram

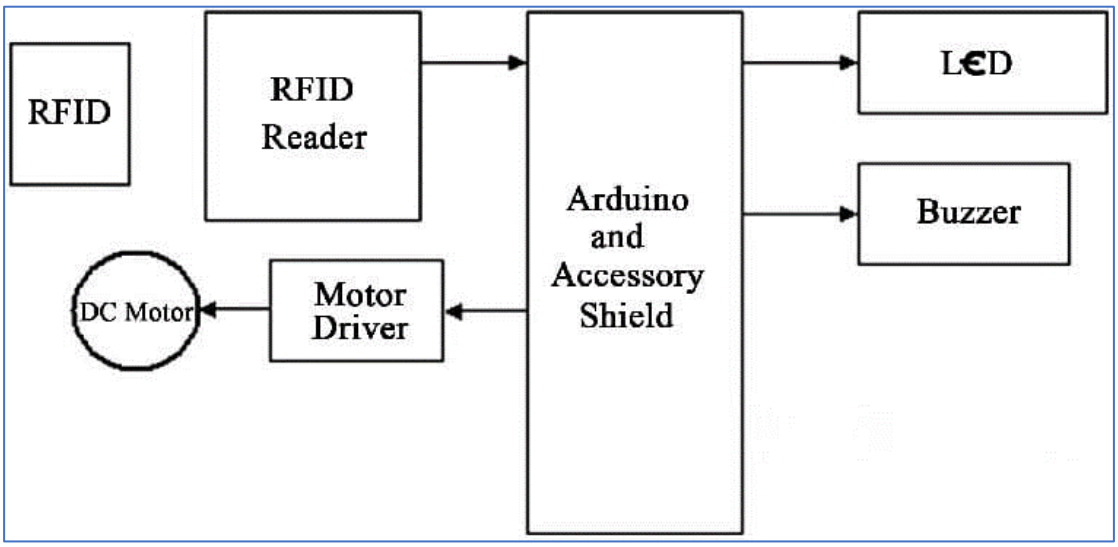

Fig4.2 – Block Diagram

CHAPTER 5

RESULTS

Our project can find applications in various areas where efficient traffic management and emergency vehicle response are critical.

1. **Hospital Zones** :
    - Deploying our project near hospitals and healthcare facilities can be instrumental in providing faster medical assistance during emergencies. This application can be critical for transporting patients and medical personnel quickly to and from healthcare institutions.
2. **Special Events and Convoys :**
    - During special events, parades, or VIP convoys, it's essential to manage traffic efficiently and ensure the smooth passage of designated vehicles. Your project can be applied in these scenarios to create a temporary traffic management system that prioritizes specific vehicles**.**
3. **Emergency Services :**
    - By utilizing RFID tags on emergency vehicles, these vehicles can communicate with traffic signals, gaining priority at intersections. This technology can be particularly beneficial in urban environments where traffic congestion can significantly impact response times.
4. **Critical Infrastructure Protection** :
    - In areas with critical infrastructure such as power plants, airports, or government buildings, rapid response times for emergency services are vital. Implementing your system near these critical locations can

enhance the ability of emergency vehicles to navigate through traffic, ensuring the safety and security of the infrastructure.

5. **Public Safety in Educational Institutions** :
    - Implementing the system near schools and universities can enhance public safety by providing faster response times for emergency services. This is particularly important for incidents such as medical emergencies or fire outbreaks.

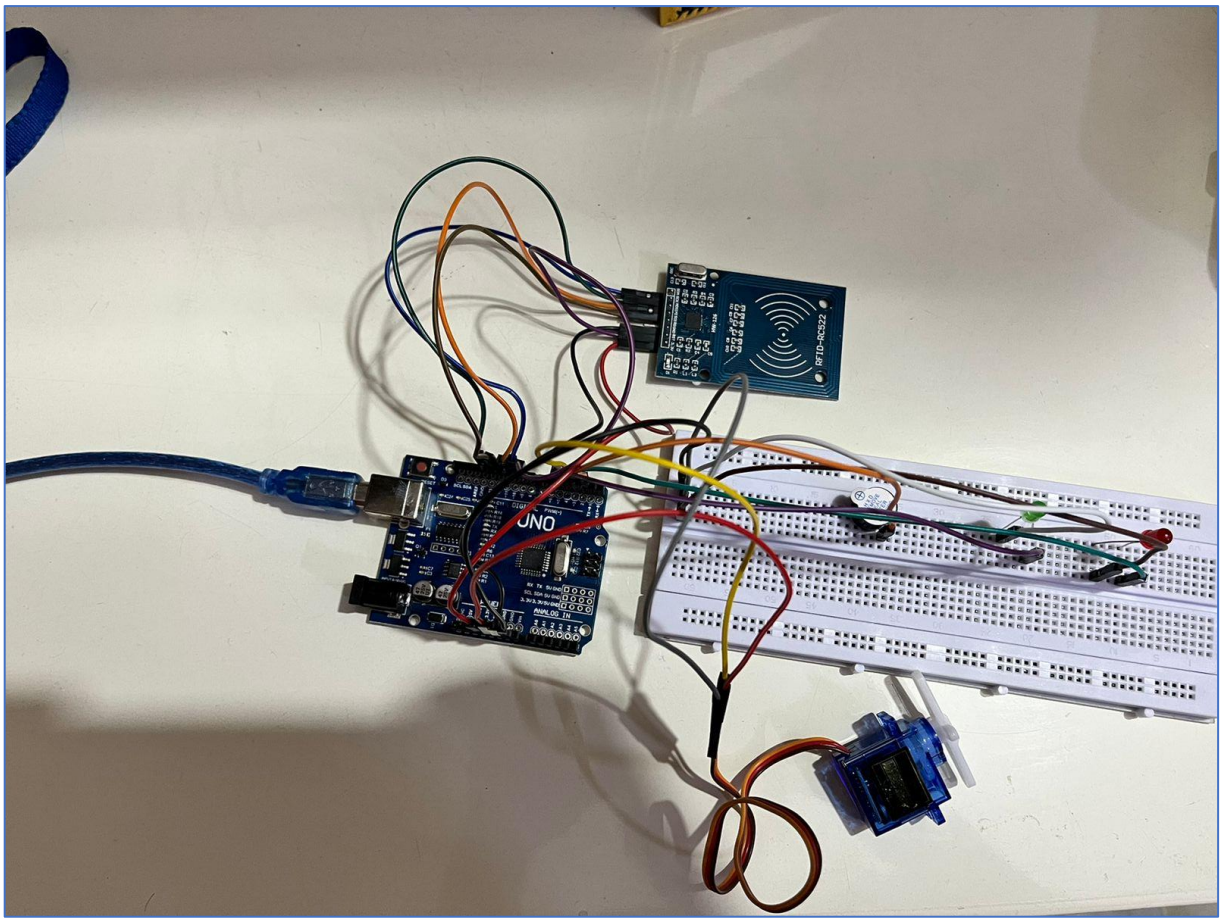

Fig 5.1: Circuits Connections

REFERENCES

Write here the website source links, reports citation, research paper detail, etc.

Sample format

1. C.-C. Cheng and C.-C. Lu, “Robotic Arm Control Based on Internet of Things,” 2019 IEEE Long Island Systems, Applications and Technology Conference (LISAT)., Aug 2017.
2. https://circuitdigest.com/home-automation-projects
3. https://www.electronicsforu.com/electronics-projects/15-awesome-automation-projects

APPENDIX A

Source Code of the Project :

```
#include <SPI.h>
#include <MFRC522.h>
#define RST_PIN         9          // Configurable, see typical pin layout above
#define SS_PIN          10         // Configurable, see typical pin layout above
MFRC522 mfrc522(SS_PIN, RST_PIN);  // Create MFRC522 instance
byte accessUID[4]={0x13,0xE6,0xFF,0xFA};
int greenpin=5;
int redpin=4;
int buzzerpin=2;
void setup() {
  pinMode(greenpin,OUTPUT);
  pinMode(redpin,OUTPUT);
  pinMode(buzzerpin,OUTPUT);
  Serial.begin(9600);   // Initialize serial communications with the PC
  while (!Serial);    // Do nothing if no serial port is opened (added for Arduinos based on ATMEGA32U4)
  SPI.begin();      // Init SPI bus
  mfrc522.PCD_Init();   // Init MFRC522
  delay(4);       // Optional delay. Some board do need more time after init to be ready, see Readme
  mfrc522.PCD_DumpVersionToSerial();  // Show details of PCD - MFRC522 Card Reader details
  Serial.println(F("Scan PICC to see UID, SAK, type, and data blocks..."));}
void loop() {
  // Reset the loop if no new card present on the sensor/reader. This saves the entire process when idle.
  if ( ! mfrc522.PICC_IsNewCardPresent()) {
```

```
    return;
  }
  // Select one of the cards
  if ( ! mfrc522.PICC_ReadCardSerial()) {
    return;
  }
  // Dump debug info about the card; PICC_HaltA() is automatically called
  If(mfrc522.uid.uidByte[0]==accessUID[0]&
mfrc522.uid.uidByte[1]==accessUID[1] && mfrc522.uid.uidByte[2]==accessUID[2]
&& mfrc522.uid.uidByte[3]==accessUID[3]){
    Serial.println("access granted");
    digitalWrite(greenpin,HIGH);
    delay(1000);
    digitalWrite(greenpin,LOW);
  } else{
     Serial.println("access denied");
     digitalWrite(buzzerpin,HIGH);
     digitalWrite(redpin,HIGH);
     delay(2000);
     digitalWrite(buzzerpin,LOW);
     digitalWrite(redpin,LOW
} mfrc522.PICC_HaltA();
  }
```