PROJECT INNOVATION
Traffic Management System

TEAM DETAILS

Mentor	Mrs.M.Maheswari
Leader	M.Keerthika
Members	M.Abinaya R.Deepa K.Divya R.Mahalakshmi
Project Innovation	Traffic management is the arranging, observing and control or impacting of activity. It expects to: boost the adequacy of the utilization of existing foundation; to guarantee dependable and safe operation of transport; to address ecological objectives; and guarantee reasonable assignment of framework space street space,rail openings, and so forth.

ABSTRACT

Traffic management is the focus area for most urban dwellers and planners. Congestion is the most important major obstacle that has been seen in many countries including India. Countries To avoid this obstacle means how to manage the traffic smoothly. Traffic congestion mainly focuses on the signals failure, reduced law enforcement and improper traffic management. Existing foundation can't be extended increasingly and subsequently the main choice accessible is to enhance the administration of the traffic. Traffic congestion is not a good sign for our country as well as it creates a negative impact starting from economy to the leaving standard. Consequently the opportunity has already come and gone to viably deal with the traffic congestion. Many methods are designed to manage the traffic and minimize the congestion. Out of all the techniques, infrared sensor, inductive loop detection, video data analysis, wireless sensor network, etc. are used to somewhat solve the congestion in the traffic and to manage the traffic smartly. But in the above said methods having some demerits like much time to take for installation, maintenance cost is very high. Actually, our objective is to develop a new technology or method; that will solve the above problems and produce better result within a stipulated time. To overcome the challenges, a new method arises called as Radio Frequency Identification (RFID). By this innovation, it will require less time for establishment with lesser expenses when contrasted with different strategies for traffic blockage administration.

COMPONENTS REQUIRED

- Micro controller(Arduino Mega)
- Micro controller(Arduino uno)
- LEDs
- IR sensor
- Jumper wires
- Wireless sensor
- Wokwi simulator
- Bread board

Description of components

Micro controller(Arduino Mega)

- The Arduino Mega is a microcontroller board based on the ATmega2560. It has 54 digital input/output pins (of which 14 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button.
- It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.
- Never fear for accidental electrical discharge, either since since the Mega also includes a plastic base plate to protect it!

Micro controller(Arduino uno)

- Development Environment. It can run on both online and offline platforms. The Arduino UNO is a standard board of Arduino. Here UNO means 'one' in Italian. It was named as UNO to label the first release of Arduino Software. It was also the first USB board released by Arduino. It is considered as the powerful board used in various projects. Arduino.cc developed the Arduino UNO board.

- Arduino UNO is based on an ATmega328P microcontroller. It is easy to use compared to other boards, such as the Arduino Mega board, etc. The board consists of digital and analog Input/Output pins (I/O), shields, and other circuits.

- The Arduino UNO includes 6 analog pin inputs, 14 digital pins, a USB connector, a power jack, and an ICSP (In-Circuit Serial Programming) header. It is programmed based on IDE, which stands for Integrated

The components of Arduino UNO board
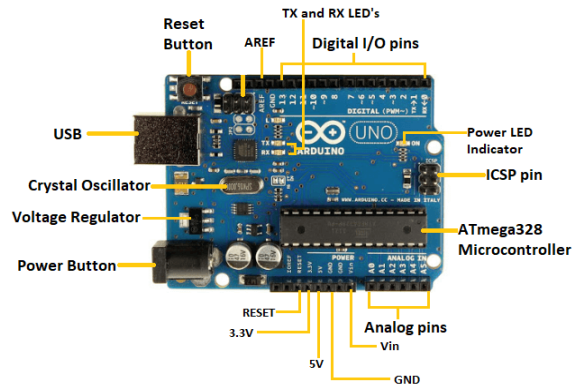
- **ATmega328 Microcontroller**- It is a single chip Microcontroller of the ATmel family. The processor code inside it is of 8-bit. It combines **Memory (SRAM, EEPROM, and Flash), Analog to Digital Converter, SPI serial ports, I/O lines, registers, timer, external and internal interrupts, and oscillator.**

- **ICSP pin** - The In-Circuit Serial Programming pin allows the user to program using the firmware of the Arduino board.

- **Power LED Indicator**- The ON status of LED shows the power is activated. When the power is OFF, the LED will not light up.

- **Digital I/O pins**- The digital pins have the value HIGH or LOW. The pins numbered from D0 to D13 are digital pins.

- **TX and RX LED's**- The successful flow of data is represented by the lighting of these LED's.

- **AREF-** The Analog Reference (AREF) pin is used to feed a reference voltage to the Arduino UNO board from the external power supply.

- **Reset button**- It is used to add a Reset button to the connection.

- **USB**- It allows the board to connect to the computer. It is essential for the programming of the Arduino UNO board.

- **Crystal Oscillator**- The Crystal oscillator has a frequency of 16MHz, which makes the Arduino UNO a powerful board.

- **Voltage Regulator**- The voltage regulator converts the input voltage to 5V.

- **GND**- Ground pins. The ground pin acts as a pin with zero voltage.

- **Vin**- It is the input voltage.

LEDs

- **LED** stands for **light emitting diode**. LED lighting products produce light up to 90% more efficiently than incandescent light bulbs. How do they work? An electrical current passes through a microchip, which illuminates the tiny light sources we call LEDs and the result is visible light. To prevent performance issues, the heat LEDs produce is absorbed into a heat sink.

- **LEDs** are incorporated into bulbs and fixtures for general lighting applications. Small in size, LEDs provide unique design opportunities. Some LED bulb solutions may physically resemble familiar light bulbs and better match the appearance of traditional light bulbs. Some LED light fixtures may have LEDs built in as a permanent light source. There are also hybrid approaches where a non-traditional "bulb" or replaceable light source format is used and specially designed for a unique fixture. LEDs offer a tremendous opportunity for innovation in lighting form factors and fit a wider breadth of applications than traditional lighting technologies

- LEDs use heat sinks to absorb the heat produced by the LED and dissipate it into the surrounding environment. This keeps LEDs from overheating and burning out. **Thermal management** is generally the single most important factor in the successful performance of an LED over its lifetime. The higher the temperature at which the LEDs are operated, the more quickly the light will degrade, and the shorter the useful life will be.

Bread board
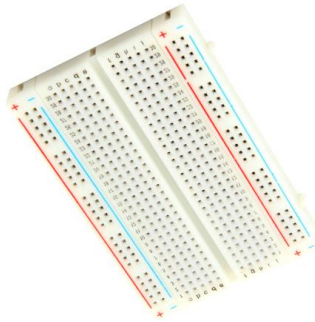
- A breadboard is a solderless construction base used for developing an electronic circuit and wiring for projects with microcontroller boards like Arduino. As common as it seems, it may be daunting when first getting started with using one.

- Hence, with today's breadboard tutorial, I'll be guiding you on how to use a breadboard, alongside establishing a connection with Arduino.

- A Breadboard is simply a board for prototyping or building circuits on. It allows you to place components and connections on the board to make circuits without soldering. The holes in the breadboard take care of your connections by physically holding onto parts or wires where you put them and electrically connecting them inside the board.

- The ease of use and speed are great for learning and quick prototyping of simple circuits. More complex circuits and high frequency circuits are less suited to breadboarding.

- Breadboard circuits are also not ideal for long term use like circuits built on perfboard (protoboard) or PCB (printed circuit board), but they also don't have the soldering (protoboard), or design and manufacturing costs (PCBs).

Wireless sensor

- Wireless sensor networks are becoming more common in the world, mainly because they are cheaper to install and easy to maintain. In addition to this, wireless sensor networks allow for a greater level of flexibility which makes it easier to adapt a sensor system to the needs of the user. Wireless sensors and devices can also help make our world a more sustainable place by reducing the need for metals and other resources.

- Wireless Sensors allows us to collect information about our surrounding environments with very little manual effort. Devices that use wireless technology are everywhere in the modern world. Wireless sensors can tell you a lot about the condition of your machinery. This can depend on your business and the applicate of your wireless sensors. There is a variety of different measurements such as vibration, bearing condition and temperature.

- The major advantage of wireless sensors is that they require low maintenances and only need a small amount of power to function, they can support IoT applications for years before you need to charge or change the battery

Wokwi Simulator
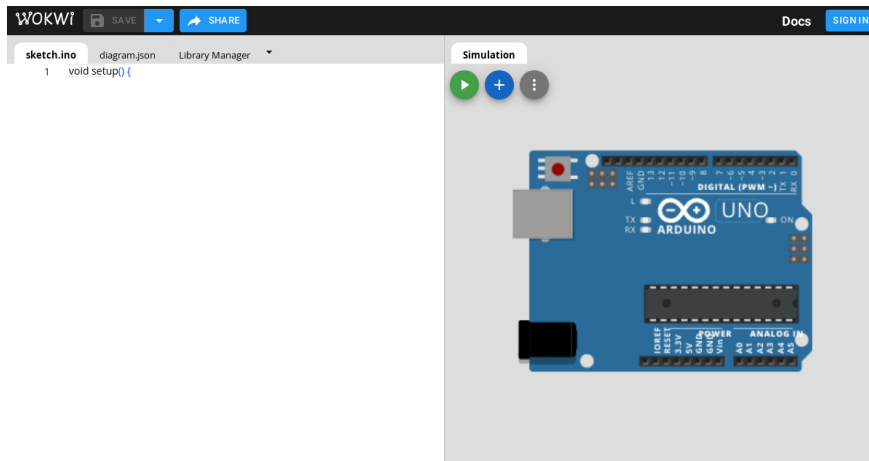
- Wokwi is an online simulator for Arduino and Electronics. It's designed for makers, by makers.

- Wokwi is an online simulator for Arduino, Raspberry Pi Pico, and ESP32 boards, or even your own custom microcontroller board designed to learn programming without the actual hardware

- Wokwi is an embedded systems and IoT simulator supporting ESP32, Arduino, and the Raspberry Pi Pico. Your code never leaves your computer - Wokwi runs the simulation inside VS Code, using the firmware binaries from your project.

Jumper Wires
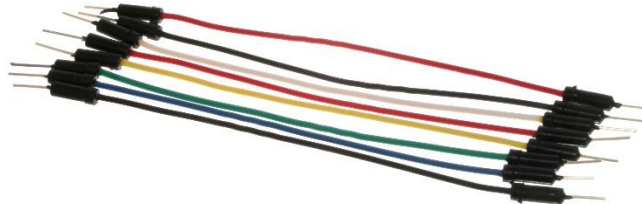
- Jumper wires are simply wires that have connector pins at each end, allowing them to be used to connect two points to each other without soldering.

- Jumper wires are typically used with breadboards and other prototyping tools in order to make it easy to change a circuit as needed. Fairly simple. In fact, it doesn't get much more basic than jumper wires.

- Though jumper wires come in a variety of colors, the colors don't actually mean anything. This means that a red jumper wire is technically the same as a black one. But the colors can be used to your advantage in order to differentiate between types of connections, such as ground or power.

- Although jumper wires come in a variety of colours, they do not actually mean anything. **The wire colour is just an aid to help you keep track of what is connected to which.**

- It will not affect the operation of the circuit. This means that a red jumper wire is technically the same as the black one.

Protocols

Message Queuing Telemetry Transport (MQTT) protocol
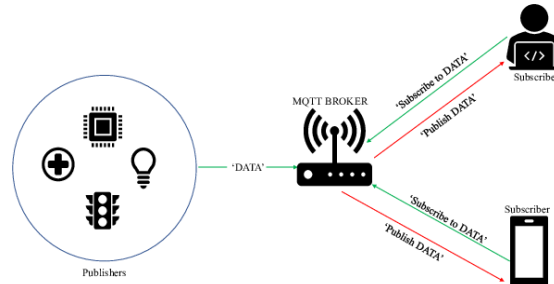
- MQTT stands for **Message Queuing Telemetry Transport.** It is an extremely simple and lightweight messaging protocol (subscribe and publish) designed for limited devices and networks with high latency, low bandwidth or unreliable networks. Its design principles are designed to reduce the network bandwidth and resource requirements of devices and ensure security of supply. In addition, these principles are advantageous for M2M (machine-to-machine) or IoT devices because battery performance and bandwidth are very important.

- The MQTT message protocol is particularly suitable for low-bandwidth and high-latency environments and such for machine-to-machine (M2M) communication. Therefore, the publish-and-subscribe principle, operated via a central broker, is highly popular in the IoT.

- The practical benefit of communication via MQTT is that it relieves the internal network and can still communicate with any number of different systems. Using special software, such as OPC Router, data can be published to other systems. Systems of this kind can be, for example, SAP, OPC UA, SQL or REST. Data from non-MQTT-capable sources can be transferred to other systems for further processing as a Publisher. The reliable message protocol MQTT can accelerate internal communication and create bandwidth capacities.

MQTT protocol offers several benefits for IoT applications:

- **Speed:** MQTT operates in real-time, ensuring no delays outside of QoS.

- **Ease of implementation:** MQTT already has libraries in programming languages such as Elixir and Python.

- **Last will and testament:** In case a client unexpectedly disconnects, you can set message instructions to be sent to all subscribers in order to remedy the situation.

- **Retained messages:** Each topic can have one retained message that a client automatically receives when it subscribes (like a pinned post on social media).

MQTT Use Cases

- MQTT is a versatile messaging protocol with numerous use cases in the IoT realm. Here are some common applications:
- **Telemetry and Sensor Networks:** MQTT is ideal for collecting data from sensors in environmental monitoring, industrial automation, and smart agriculture.
- **Home Automation:** MQTT enables seamless communication between smart devices for controlling and monitoring home systems like lighting, security, and thermostats.
- **Industrial IoT:** MQTT facilitates efficient data exchange between machines, enabling predictive maintenance, remote monitoring, and process optimization.
- **Asset Tracking:** MQTT's ability to handle intermittent connectivity and low power consumption makes it valuable for real-time location tracking of vehicles and valuable assets.
- **Energy Management:** MQTT is employed in smart energy systems for efficient communication between smart meters, energy management systems, and devices, enabling load balancing

Features of Traffic Management System

- **Traffic Jam Detection:** With cloud connectivity, sensors, and CCTV cameras tracking intersections 24×7, technicians can remotely monitor all the streets in real-time from the city's traffic control room.

- **Connected Vehicles:** A smart traffic system using IoT technology can connect with roadside tracking devices to enable direct communication between intelligent vehicles & intersections.

- **Modular Control:** Real-time detection of congestion triggers dynamic adjustments in the systems meant for controlling traffic lights, express lanes, and entry alarms.

- **Emergency Navigation:** A system with edge data processing & programmatic alerting capabilities can alert response units (police, ambulance & tow trucks) in case of a car crash or collision. It reduces the crucial time an injured driver or passenger remains unattended.

- **Road Safety Analytics:** Systems with pattern detection capabilities can immediately flag high cruising speeds and reckless driver or inappropriate pedestrian behavior.

- **Digital Payments:** Commercial traffic management systems enable quick and convenient electronic transactions in real time while ensuring financial data safety.