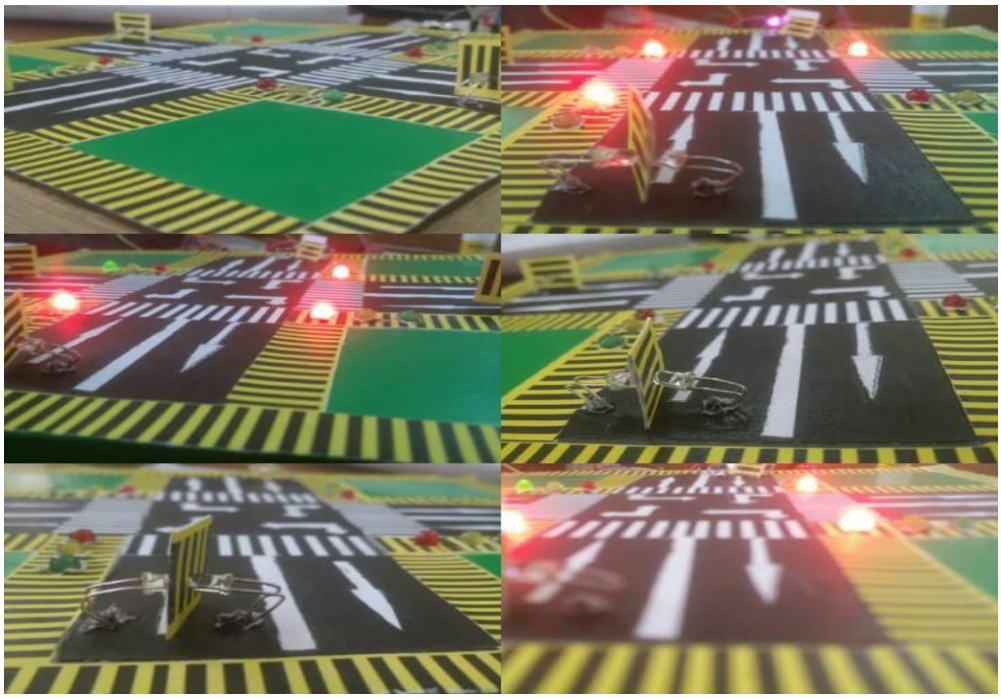
UET
UNIVERSITY of ENGINEERING & TECHNOLOGY LAHORE

# Traffic Density-Based
# Traffic Signal Regulation Project



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# Acknowledgements

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We would like to thank our supervisor Prof. Fahad Ijaz for his valuable advice and guidance throughout this work. His guidance and vision played an essential role in helping us set our goals. Last but not the least, we owe this to our families who have shown great patience and boundless support for ourselves throughout our study tenure.

# Abstract

Nowadays, controlling the traffic becomes major issue because of rapid increase in automobiles and also because of large time delays between traffic lights. So, in order to rectify this problem, we will go for density based traffic signal regulation project.

In this project, we will use IR sensors to sense the traffic density. We have to arrange one IR sensor for each road; these sensors always sense the traffic on that particular road. All these sensors are interfaced to the microcontroller. Based on these sensors, controller detects the traffic and controls the traffic system.

According to the signal being opened, the relative information and the time remaining is shown on the LCD. We are using the quite handy Texas Instruments' **ARM-based Tiva-C series microcontroller TM4C123GH6PM** Launchpad.

# Components and equipment

- TM4C123gh6PM ARM microcontroller
- Vero board
- IR sensors -4
- LED's-12(4-red,4-green,4-yellow)
- Connecting wires
- Decorative items
- LCD 1602
- Cardboard
- Wood

# Basic principle:

The main heart of this traffic system is the microcontroller. IR sensors are used to detect the density of traffic and are connected to the PORT F (PF0, PF1, PF2, and PF4) of the microcontroller and traffic lights are connected to PORT A, E (PA4, PA5, PE2, PE1), PORT F (only PF3) and PORT D, E (PE4, PE3, PD2, PD3). If there is traffic on road then that particular sensor output becomes logic 1 otherwise it is logic 0. By receiving these IR sensor outputs, we have written the program to control the traffic lights for different timing as per required depending on the traffic density.

Here we are using TM4C123gh6PM ARM microcontroller. Here is a brief introduction of TM4C123gh6PM ARM microcontroller:

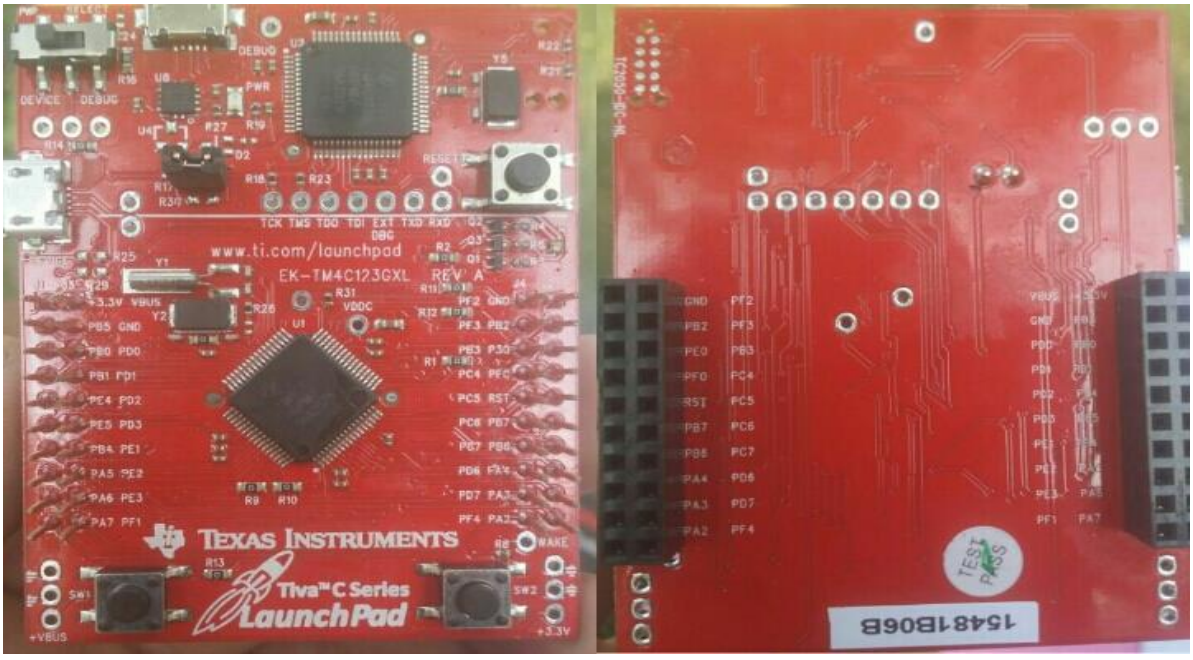
## TM4C123GH6PM:

A **microprocessor** is a computer processor which incorporates the functions of a computer`s central processing unit (CPU) on a single integrated circuit (IC) or at most a few integrated circuits. The microprocessor is a multipurpose, clock driven, register based, programmable electronic device which accepts digital or binary data as input, processes it according to instructions stored in its memory, and provides results as output.

**ARM**, originally **Acorn RISC Machine**, later **Advanced RISC Machine**, is a family of reduced instruction set computing (RISC) architectures for computer processors, configured for various environments. British company ARM Holdings develops the architecture and licenses it to other companies.

A RISC-based computer design approach means processors require fewer transistors than typical complex instruction set computing (CISC) x86 processors in most personal computers.

**TM4C123gh6PM** is a device capable of acting as either a controller or device for a timing intensive asynchronous communications interface based on the DMX512-A protocol with EF1 topology. The PC transmitter will accept commands from a PC via an RS-232 interface and will continuously transmit a serial stream to control up to 512 devices on a RS-485 communication bus. The PC receiver will forward data received from devices on a communications bus and send these to the PC with the RS-232 interface. Devices on the bus will extract information out of the asynchronous data stream and will control one or more devices.



# Design and Procedure:

Our circuit consists of 4 IR sensors, TM4C123gh4PM microcontroller, 4 traffic lights. IR transmitter looks like an LED. This IR transmitter always emits IR rays from it. The operating voltage of this IR transmitter is **3V to 5V**. These IR (infra-red) rays are invisible to the human eye. But we can view these IR rays through a camera.

IR receiver receives IR rays that are transmitted by IR transmitter. Normally IR receiver has high resistance in mega ohms, when it is receiving IR rays the resistance is very low. The operating voltage of IR receiver is also **3V to 5V.**

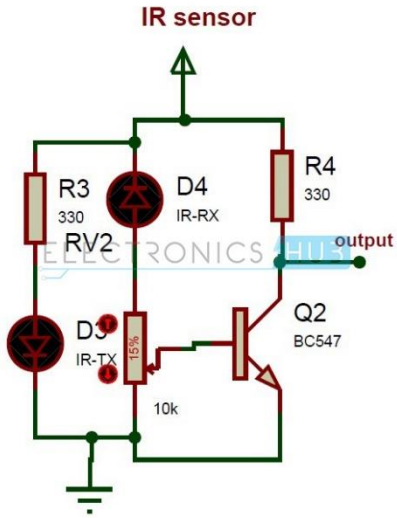
We placed these IR pairs in such a way that when we place an obstacle in between this IR pair, IR receiver cannot receive the IR rays and gives 3-5V across the resistance connected to it for it is connected in reverse-biased.

Instead of traffic lights, you can use LEDs (RED, GREEN, YELLOW). In normal traffic condition, LEDs glows on regular time basis (say 5 sec.). If there is more traffic on any particular path, then green LED of that particular path glows for a bit longer time (say 10sec) in order to normalize the traffic density on every path and red LEDs glow for remaining paths.

In normal traffic condition, we allow the traffic for a time delay of **5sec** for each path.

In dense traffic condition, we allow the traffic for a time delay of **10sec** for that particular path.

## Working of IR sensor:




The above figure shows the IR sensor circuit. Here 330 ohm resistor is used to drop the voltage otherwise IR transmitter may get damaged. To vary the obstacle sensing distance, we have used a potentiometer but here we don't need that. This sensor gives the digital output. The **transmitter** of the IR sensor is **forward biased** and **receiver** is **reversed biased**. Here we are not using transistor in our circuit we have taken our output from the resister across receiver.

# Working:

- Connect DC supply to the board.
- Switch on the supply.
- Burn the program to the TM4C123Gh4PM microcontroller.
- Connect four IR sensors to PORT F (PF0, PF1, PF2, and PF4).
- Connect LEDs to PORT A, E (PA4, PA5, PE2, and PE1), PORT F (only PF3) and PORT D, E (PE4, PE3, PD2, PD3).
- Arrange all this LED's same as like traffic lights.
- Arrange one IR sensor for each road.
- Now run the program for the normal traffic condition based on time basis (5sec for each path).

- Now if you place any obstacle in front of any IR sensor, then the system allows the traffic of that particular path to pass for a longer time period (10sec) by glowing GREEN light.
- The status of each stage is also displayed on the LCD.
- Test the timing of each way in different scenarios.
- Finally, turn off the board power supply.

# Pins connections:

Let's say four traffic paths are denoted by path1, path2, path3 and path4, and R1, R2, R3 and R4 are the red LEDs for each path respectively, similarly G1, G2, G3 and G4 are green LEDs for each path respectively and same goes for yellow LEDs. IR sensors connected to each path labeled as IR1, IR2, IR3 and IR4. So, pins which are used for these LEDs and sensors are:

- J1 +3.3V : DC voltage for LEDs
- J2 GND and J3 GND : Ground for LEDs and IR sensors
- IR1: PF0
- IR2 :PF1
- IR3: PF2
- IR4: PF4
- R1 : PD2
- R2 : PE3
- R3 : PA4
- R4 : PE4
- G1 : PE2
- G2 : PF3
- G3 : PD3
- G4 : PA5
- All yellow LEDs : PE1
- LCD D0-D7: PB0-7
- RS(Register Select) : PA6
- RW(Read/Write) : Ground
- E(Enable) : PA7
- VSS(Ground) and VLC(Contrast) : Ground
- VDD: 3.3V or 5V

# Applications:

- **Controlling traffic:** This project is mainly used to control traffic allowing traffic of one path to pass by restricting others paths.
- **Dense traffic areas:** Useful in metropolitan cities to control the traffic where traffic density is high and people are very much busy.
- **Game projects:** Source code useful in traffic simulation games.

# Conclusion:

This project can prove quite helpful in order to provide a convenient and better way for the authorities to regulate the traffic more efficiently. Especially in the areas where the traffic density is comparatively high, this project's more practical shape might come in quite handy. This traffic controlling project might prove a blessing for the **Metropolitan Cities** of the country that are always busy and contain heavy traffic density at most of the times.

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- IR transmitter and receiver – YouTube
- IR Based Traffic Density Detection And Signal Adjustment Project - YouTube