



IJRASET

International Journal For Research in
Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 11 Issue: V Month of publication: May 2023

DOI: <https://doi.org/10.22214/ijraset.2023.52271>

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Development of Automated Systems in Vehicles to Prevent Signal Jumping

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Abstract: This work explores the development of automated systems in vehicles to prevent signal jumping, which is a major road safety issue. Advanced sensors and algorithms are utilized to detect traffic signals and maintain a safe speed and distance from other vehicles. The goal is to reduce the number of accidents caused by human error and improve driving experiences. The proposed system has the potential to significantly enhance road safety and help prevent dangerous driving behaviour, such as signal jumping.

This work presents the development of automated systems in vehicles to prevent signal jumping, a leading cause of road accidents. The system incorporates advanced sensors and algorithms to accurately detect traffic signals and regulate the vehicle's speed and distance from other vehicles. The goal is to enhance road safety and reduce the incidents of signal jumping caused by human error. The results of this study demonstrate the potential of these technologies to improve driving experiences and make our roads safer for all.

I. INTRODUCTION

The development of automated systems in vehicles to prevent signal jumping is a crucial step towards improving road safety and reducing traffic violations. Signal jumping, also known as running a red light, is a major contributor to accidents and fatalities on roads. Automated systems, such as cameras and sensors, can detect when a vehicle crosses a red light and trigger an alert to the driver or the relevant authorities.

This technology can greatly reduce the number of incidents caused by signal jumping, promoting safer roads and reducing the risk of accidents. These systems use advanced sensors and algorithms to detect traffic signals and maintain a safe speed and distance from other vehicles, minimizing the risk of signal jumping and other dangerous driving behaviors.

Automation is the frequently spelled term in the field of electronics. Automation brought many revolutions in the existing technologies. One among the technologies, which had greater developments, is the Camera. These had greater importance than any other technologies due its user-friendly nature. Camera based devices can be easily reachable to the common man due to its simpler operation, and at the same time it challenges the designers of the device.

The situation where the driver wants to violate the traffic signal, in that case, the camera keeps monitoring this scenario and sends to the PC with MATLAB. The MATLAB code which we developed reduces the speed of the vehicle automatically. The controlling part is done by the Microcontroller which controls the DC Motors.

Microcontroller controls the whole system. The Microcontroller gets input from camera and acts accordingly on the vehicle speed. The Microcontroller is programmed using Embedded C language.

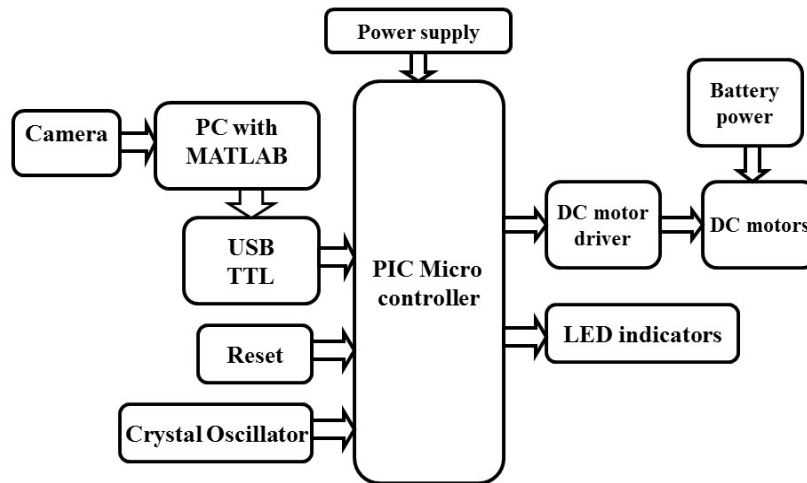
II. PROPOSED SYSTEM

We propose a process to make automation observable and directable for other road users by considering vehicle motion. In this project a camera is attached to the vehicle which scans the traffic signals and acts accordingly to them.

The vehicle has the capability to stop when signal turns red without any human interference automatically and responds to other traffic signals also even in situations where driver is unaware of traffic signals or wontedly speeding over red light it stops the vehicle.

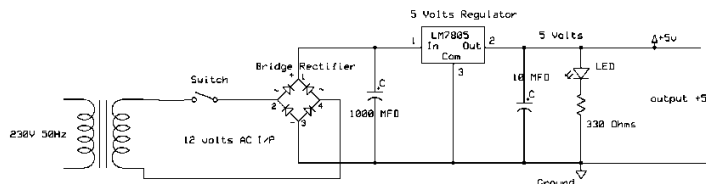
Camera's output is sent to pc which analyses and sends instruction to motor.

Block diagram: Development of automated system in vehicles to prevent signal jumping



A. Regulated Power Supply

REGULATED POWER SUPPLY



The A power supply may include a power distribution system as well as primary or secondary sources of energy suas

- 1) Conversion of one form of electrical power to another desired form and voltage, typically involving converting AC line voltage to a well-regulated lower-voltage DC for electronic devices. Low voltage, low power DC power supply units are integrated with the devices they supply, such as computers and household electronics.
- 2) Batteries.
- 3) Chemical fuel cells and other forms of energy storage systems.
- 4) Solar power.
- 5) Generators or alternators.

B. Microcontroller

The PIC16F73 CMOS FLASH-based 8-bit microcontroller is upward compatible with the PIC16C73B/74B/76/77, PIC16F873/874/876/877 devices. It features 200 ns instruction execution, self-programming, an ICD, 2 Comparators, 8 channels of bit Analog-to-Digital (A/D) converter, 2 capture/compare/PWM functions, a synchronous serial port that can be configured as either 3-wire SPI or 2-wire I2C bus, a USART, and a Parallel Slave Port.

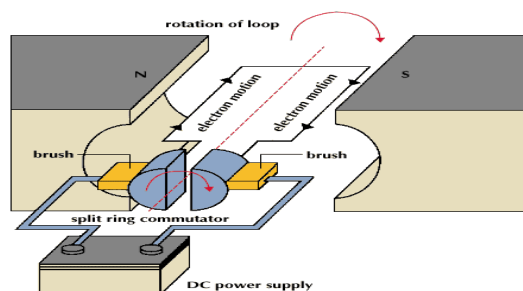
Power-up Timer (PWRT) and oscillator Start-up Timer (OST)

- 1) Watchdog Timer (WDT) with its own on-chip RC oscillator for reliable operation
- 2) Programmable code protection
- 3) Power saving SLEEP mode

- 4) Selectable oscillator options
- 5) In-Circuit Serial Programming (ICSP) via two Pins

Since PIC16F73 is a RISC microcontroller, that means that it has a reduced set of instructions, more precisely 35 instructions. (Ex. Intel's and Motorola's microcontrollers have over hundred instructions) All of these instructions are executed in one cycle except for jump and branch instructions.

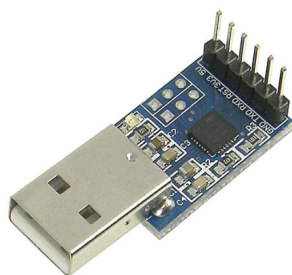
C. Dc Motor



The DC motor has two basic parts: the rotating part is called armature and the stationary part the coils of wire called the field coils. The stationary part is known as stator. When voltage is applied to motor, current begins to flow through coil from the negative terminal to the positive terminal. This sets up a strong magnetic field. Current also begins to flow through the brushes into a commutator segment and then through an armature coil. The current flows through the coil back to the brush that is attached to other end of the coil and returns to the DC power source. The current flowing in the coil sets up a strong magnetic field.

- 1) Delivers up to 5 A continuous 6 A peak current
- 2) Optimized for DC motor management applications
- 3) Operates at supply voltages up to 40 V
- 4) Very low RDS ON
- 5) typ. 200 mΩ @ 25 °C per switch

D. USB TTL



- 1) Single-Chip USB to UART Data Transfer
- 2) Integrated USB transceiver; no external resistors required
- 3) Integrated clock; no external crystal required
- 4) Integrated 1024-Byte EEPROM for vendor ID, product ID, serial number, power descriptor, release number, and product description strings
- 5) On-chip power-on reset circuit
- 6) On-chip voltage regulator: 3.3 V output
- 7) 100% pin and software compatible with CP2101

USB Function Controller
 USB Specification 2.0 compliant; full-speed (12 Mbps)
 USB suspend states supported via SUSPEND pins

Pin	Description
VCC	Integrated 3.3v) supply with on chip linear regulator output with 3.15-3.3v
RXD	Asynchronous data input (UART Receive)
TXD	Asynchronous data output (UART Transmit)
GND	Ground port
VCC	Integrated 5V(supply with on-chip linear regulator output within 5V)

E. Crystal Oscillator

Each port has different function. Most of them can be used as I/O port. The crystal oscillator speed that can be connected to the PIC microcontroller range from DC to 20Mhz. Using the CCS C compiler normally 20Mhz oscillator will be used and the price is very cheap. The 20 MHz crystal oscillator should be connected with about 22pF capacitor. Please refer to my circuit schematic.

F. Software Description

This project is implemented using following software's:

- 1) Express PCB – for designing circuit
- 2) PIC C compiler - for compilation part



Express PCB has been used to design many PCBs (some layered and with surface-mount parts. Print out PCB patterns and use the toner transfer method with an Etch Resistant Pen to make boards

The select tool: It is obvious what this does. It allows you to move and manipulate parts.

- a) The zoom to selection tool: does just that.
- b) The place pad: button allows you to place small soldier pads which are useful for board connections or if a part is not in the part library but the part dimensions are available.
- c) The place component: tool allows you to select a component from the top toolbar and then by clicking in the workspace places that component in the orientation chosen using the buttons next to the component list.
- d) The place trace: tool allows you to place a solid trace on the board of varying thicknesses.
- e) The Insert Corner in trace: button does exactly what it says. When this tool is selected, clicking on a trace will insert a corner which can be moved to route around components and other traces.

PIC C COMPILER

PIC C is not much different from a normal C program. If you know assembly, writing a C program is not a big deal. In PIC, we will have a main function, in which all application specific work will be defined. In case of embedded C, you won't have any operating system running in there. So, you have to make sure that your program or main file should never exit by any chance. This can be done with the help of simple while or for loop as they are going to run infinitely. We must add header file for controller you are using, otherwise you will not be able to access registers related to peripherals.

```
#include <16F876.h> // header file for PIC 16F876//
```

G. MATLAB

MATLAB is used in a wide range of applications, including signal and image processing, communications, test and measurement, financial modelling, analysis, and computational biology. For a million engineers and scientists in industry and academia, MATLAB is the language of technical computing.

The MATLAB system consists of five parts:

- 1) The MATLAB language

This is a high-level matrix language with control flow statements, functions, data structures, and object-oriented programming features.

2) *The MATLAB Working Environment*

This are the set of tools and facilities that you work with as the MATLAB user. It includes facilities for managing the variables and importing and exporting data. It includes the tools for developing, managing, debugging, and MATLAB's applications.

3) *Handles Graphics*

This is MATLAB graphics system. It includes high-level commands for 2-D and 3-D data visualization, image processing, animation, and presentation graphics.

4) *The MATLAB Mathematical Function Library*

This is a vast collection of computational algorithms from elementary functions like sum, sine, cosine, and complex arithmetic, to more sophisticated functions like matrix inverse, matrix eigenvalues, Bessel functions, and fast Fourier transforms.

5) *The MATLAB Application Program Interface (API)*

This is a library that allows you to write C programs that interact with MATLAB. It includes facilities for calling the routines from MATLAB, MATLAB as a computational engine, and for reading and writing MAT-files.

III. PROCEDURE

- 1) When the driver wants to violate the traffic signal, in that case, the camera keeps monitoring this scenario and sends to the PC with MATLAB.
- 2) The MATLAB code which we developed reduces the speed of the vehicle automatically.
- 3) The controlling part is done by the Microcontroller which controls the DC Motors
- 4) The controlling device of the whole system is a Microcontroller.
- 5) The Microcontroller gets input from camera and acts accordingly on the vehicle speed.
- 6) The Microcontroller is programmed using Embedded C language.

IV. EXPERIMENTAL RESULTS

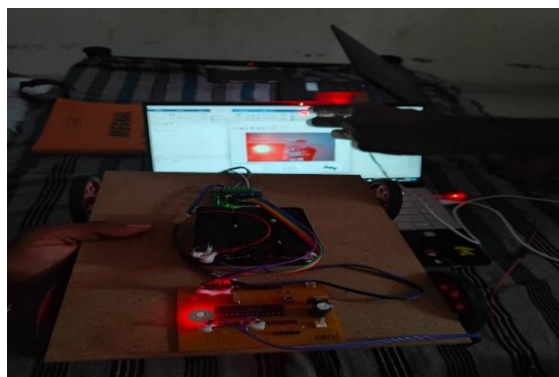


Fig 1. Red signal is captured by the camera and the vehicle stops moving

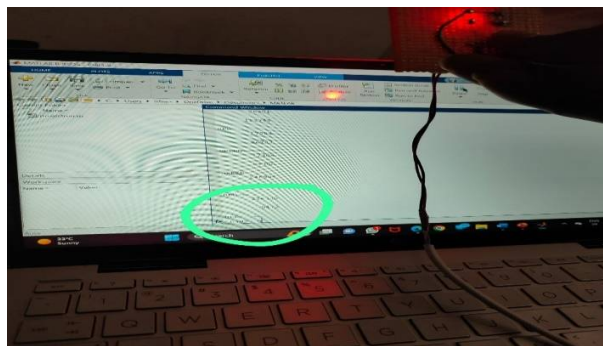


Fig 2. As soon as the signal is captured it send the instructions to the pc with MATLAB



Fig 3. Green signal is captured by the camera and the vehicle starts moving again

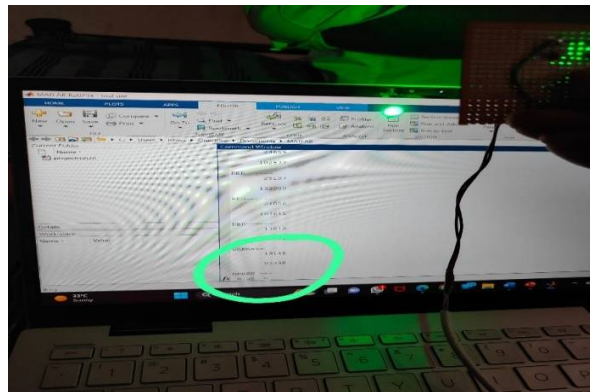


Fig 4. As soon as the signal is captured it send the instructions to the pc with MATLAB

V. CONCLUSION

The development of automated systems in vehicles to prevent signal jumping is an important step towards improving road safety and reducing the risk of accidents caused by human error. These systems can monitor traffic signals, detect when they change, and respond accordingly to ensure that the vehicle stops or proceeds as required. With the increasing adoption of advanced technologies such as machine learning, artificial intelligence, and sensors, the accuracy and reliability of these systems are expected to continue to improve. However, it is important to note that the development of these systems must be accompanied by proper regulations, standards, and certifications to ensure that they are safe, effective, and trustworthy.

VI. FUTURE SCOPE

In future with the help of intelligent traffic management automated systems in vehicles can communicate to receive real-time signal information. This can help vehicles adjust their speed or receive warnings to prevent signal jumping and improve road safety and traffic efficiency. And an alcohol sensor can be added to this model to prevent driver to drive the vehicle while he is boozed

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