# An Intelligent Traffic Light Controlled Vehicle Movement Using MIWI Technology For Reducing CO2 Emission

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***Abstract*— Nowadays, rising fuel costs and the harmful effects of air pollutants has been the subject of considerable public debate. Generally, vehicles' stop-and-go driving consume more fuel and emit more CO2 than constant speed driving.**
**To reduce vehicles' CO2 emissions, reduction of vehicles' stop and go process is a must. After smoothing vehicles' travels, more vehicles can pass intersections with less waiting time and fewer short-time stops; therefore, the vehicles' CO2 emissions can be reduced. Simulation results indicate that the proposed scheme performs much better than the adaptive fuzzy traffic light control method: The average waiting time, short-time stop times, and CO2 emissions are greatly reduced, and the nonstop passing rate is greatly improved.**

***Keywords*— Wireless personal area network(WPAN), Peripheral Interface Controller (PIC), CO2 emission, Electronic toll collection (ETC), real-time traffic light control, speed control.**

## 1. Introduction

In the past few years, we have been observing that due to the global warming, the glaciers are being converted to into the water bodies due to the global warming, and the main cause of the global warming is the pollution. During the last 100 years, the global mean sea level has risen between 10 and 25 cm (18-cm average). The pollution, specially the air pollution, are harmful gas emissions from the vehicles like CO2, SO2, etc.

This project is eco-friendly and would prove to be a strong weapon for reducing the air pollution from the vehicles and saving of the fuel consumption , too. The layout of the project contains three motes, one for the traffic signal, and the rest for the vehicles. We are making use of the MIWI and WPAN technology, i.e.. personal area network. The three motes communicate with each other according to the signal shown by the traffic light.

## 2. Existing System

With increasing vehicle usage, there may be more traffic and longer wait times at traffic signals (e.g., at a traffic intersection or a railway crossing).

Fuel may be wasted when drivers keep their vehicles running while waiting for the traffic signal to turn "green" or waiting for a train to pass at a railway crossing. Most drivers may not switch off their engines in these situations.Drivers who do switch off their engines may do so inefficiently. For example, a driver may switch off the engine, only to start it up a short time later. In such cases, more fuel may be consumed in restarting the engine. Some traffic signals may have clocks that indicate remaining durations before the signals change. However, drivers in vehicles waiting at the back of the queue may not be able to view the clock.

## 3. Proposed System

With the help of wireless technology (WPAN) we are going to build an intelligent traffic light control system which is said to control the speed of the engine. The microcontroller in the vehicle is said to be indicated with the led in the traffic signal and which gets the value through the WPAN and the microcontroller will give a signal to the engine to stop therefore the engine stops the ignition process and therefore the gas emission is prevented in a larger extent.That is every car produces 0.196 pounds for every 30 seconds of co2 content in air during its stay in signal.

## 4. BLOCK DIAGRAM

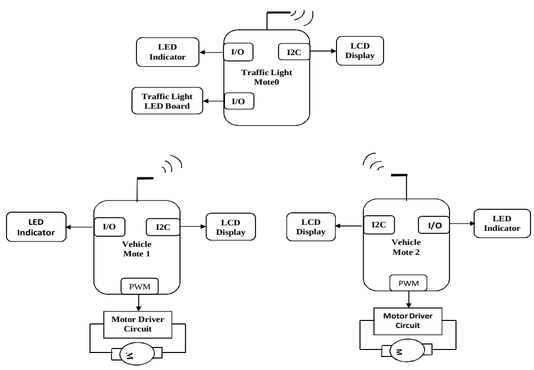



**Fig 1: Block Diagram showing motes.**

5. Circuit Diagram

There are two circuit diagrams for this project : one for traffic light and one for the vehicle. The first diagram is for the traffic signal, other for the vehicle.

Diagram1: Traffic Signal

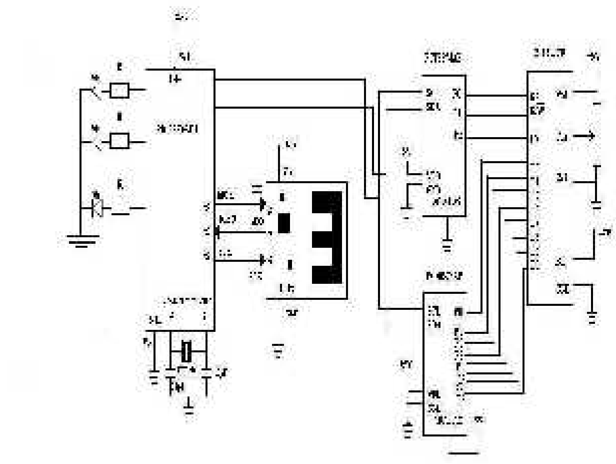


**Fig 2: Circuit Diagram for traffic light.**

Diagram 2: Vehicle

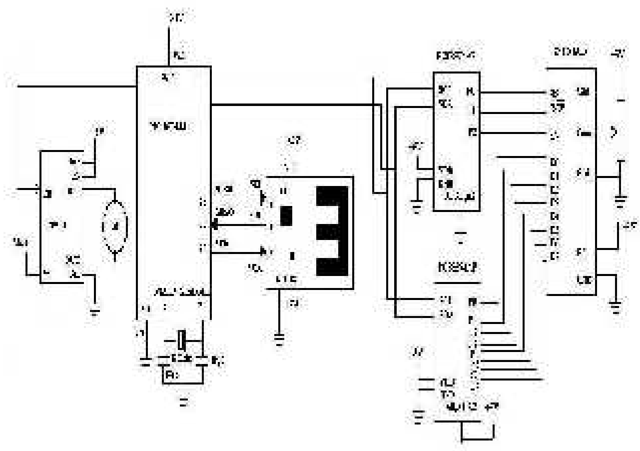


**Fig 3: Circuit Diagram of the Vehicle.**

**Explanation**

The components of the circuit diagram have been explained in detail as follows: PIC is a family of modified Harvard architecture microcontrollers made by Microchip Technology, derived from the PIC1650 originally developed by General Instrument's Microelectronics Division. The name PIC initially referred to "**Peripheral Interface Controller**".

PICs are popular with both industrial developers and hobbyists alike due to their low cost, wide availability, large user base, extensive collection of application notes, availability of low cost or free development tools, and serial programming (and re-programming with flash memory) capability. They are also commonly used in educational programming as they often come with the easy to use 'pic logicator' software.

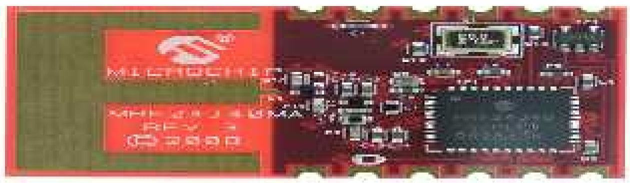


**Fig 4: A PIC Microcontroller**

6. SERIAL PERIPHERAL INTERFACE

Serial Peripheral Interface is a simple interface which enables to communicate microcontroller and peripheral chips or intercommunicate between two or more microcontrollers. Serial Peripheral Interface bus sometimes called four wire interfaces may be used to interface such chips or devices like: LCD, sensors, memories, ADC, RTC. The range of usage is huge.

SPI Bus uses synchronous protocol, where transmitting and receiving is guided by clock signal generated by master microcontroller. SPI interface allows connecting several SPI devices while master selects each of them with CS (Chip Select) signal – (Underline means that active is LOW).

SPI bus consists of four signal wires:

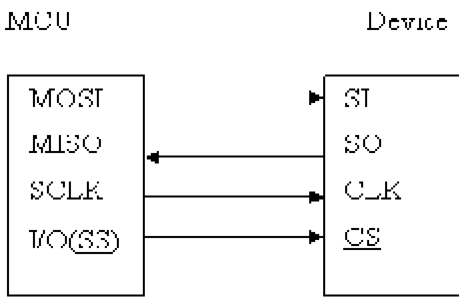
Master Out Slave In (MOSI),

Master In Slave Out (MISO),

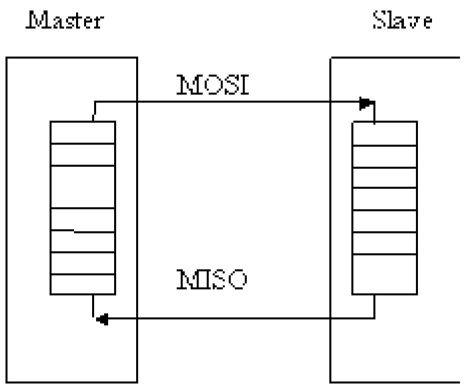
Serial Clock (SCLK or SCK)

Chip Select (CS) for the peripheral.

Some microcontrollers have a dedicated chip select for SPI interfacing called Slave Select (SS).MOSI signal is generated by master – recipient is Slave. MOSI may also be labeled as SI or SDI.MISO signals are generated by slave. In some chips you might find labels SO or SDO.SCLK or SCK are generated by master to synchronize data transfers.CS (SS) signal is also generated by master to select slave chip or device.



Data transfer is organized by using Shift register in both: master and slave. While master shifts register value out through MOSI line then slave shifts data in to its shift register. If there is full duplex used, then send and receive is performed at the same time:




There also is multiple byte stream modes available with SPI bus interface. In this mode master can shift bytes continuously. Using this type of transfer slave select (SS) must remain low until all stream process continues. For example you can write to memory by sending address bytes and Cbyte transfer mode.

7. MIWI Network:

The Microchip MiWi™ P2P Wireless Protocol is a variation of IEEE 802.15.4, using Microchip's MRF24J40MA 2.4 GHz transceiver and any Microchip 8, 16 or 32-bit microcontroller with a Inter Integrated Circuit (I2C). The protocol provides reliable direct wireless communication via an easy-to-use programming interface. It has a rich feature set that can be compiled in and out of the stack to meet a wide range of customer needs – while minimizing the stack footprint.

The MiWi P2P protocol modifies the IEEE 802.15.4 specification's Media Access Control (MAC) layer by adding commands that simplify the handshaking process. It simplifies link disconnection and channel hopping by providing supplementary MAC commands. However, application-specific decisions, such as when to perform energy detect scan or when to jump channels, are not defined in the protocol. Those issues are left to the application developer. IEEE 802.15.4 and the MiWi P2P stack support two topologies: Star and Peer-to-Peer.

A MIWI network is also a kind of personal area network. The figure is an example of a MIWI network. The figure shows networking and communication between the PIC microcontrollers.

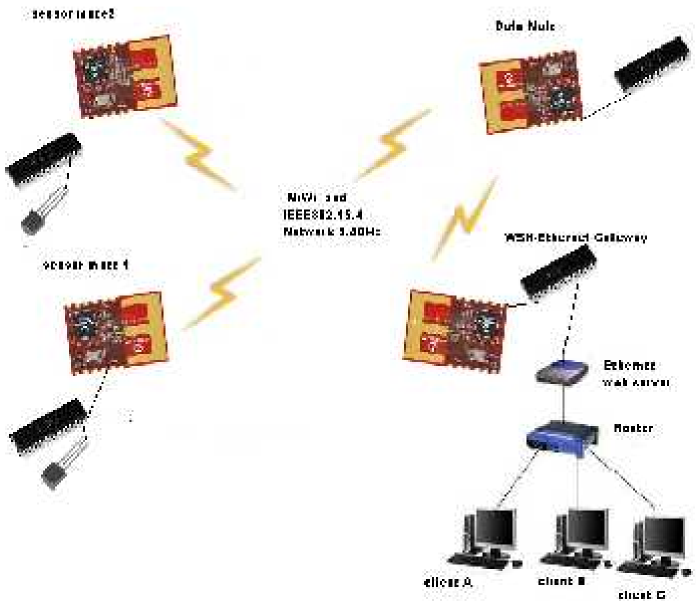



**Fig 5: A MiWi Network**

8. Softwares Used:

The software being used in this project is MPLab. It is a well known software to program a micro-controller and in this proposed traffic light model, coding are written using this software only. One can go for other software too according to their availability and proficiency of the code-writer.

A. Embedded Systems:

A general definition of embedded systems is embedded systems are computing systems with tightly coupled hardware and software integration, which are designed to perform a dedicated function. In some cases, embedded systems can function as standalone system. These are the peripherals to communicate Embedded Systems with outside world such as:

Serial Communication Interfaces (SCI): RS-232, RS-422, RS-485 etc.Synchronous Serial Communication Interface: I2C, SPI Universal Serial Bus (USB)

Networks: Ethernet, Controller Area Network, LonWorks, etc

Timers: Capture/Compare and Time Processing Units

Discrete IO: aka General Purpose Input/Output (GPIO)

Analog to Digital/Digital to Analog (ADC/DAC) Embedded system is a dynamic plate-form and flexibility is its weapon. In recent years, it a open field for research and development specially in autonomous area.

B. MPLab:

It is a well known software to program a micro-controller and in this proposed traffic light, coding are written using this software only. One can go for other software too according to their availability and proficiency of the code-writer.

## 9. CONCLUSION AND FUTURE RESEARCH

Although this research is still a proto-type only and for the demonstration purpose only.

We are currently extending this system to allow for real time control over the vehicles so that the pollution can be controlled and fuel consumption can be reduced. The speed of vehicles is also supposed to control using PWM. At the end of the research, we will get a fully automated traffic light controlled vehicle movement with simple control over it and can be used as a real time "INTELLIGENT TRAFFIC LIGHT CONTROL".

## 10. PULSE WIDTH MODULATION

Pulse width Modulation or PWM is one of the powerful techniques used in control systems today. They are not only employed in wide range of control application which includes: speed control, power control, measurement and communication.

Basic Principal of PWM

Pulse-width Modulation is archived with the help of a square wave whose duty cycle is changed to get a varying voltage output as a result of average value of waveform. A mathematical explanation of this is given below.

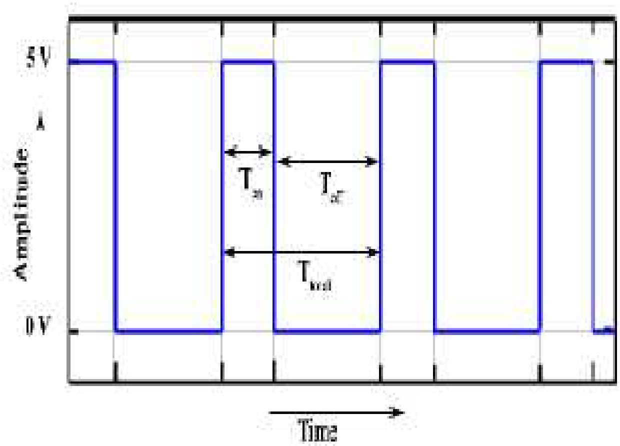



**Fig 6: A square wave PWM.**

Consider a square wave shown in the figure above.

Ton is the time for which the output is high and T*off* is time for which output is low. Let T*total* be time period of the wave such that,

$$T_{total} = T_{on} + T_{off}$$

Duty cycle of a square wave is defined as

$$D = \frac{T_{on}}{(T_{on} + T_{off})} = \frac{T_{on}}{T_{total}}$$

The output voltage varies with duty cycle as...

$$V_{out} = D \times V_{in}$$

$$V_{out} = \frac{T_{on}}{T_{total}} \times V_{in}$$

So you can see from the final equation the output voltage can be directly varied by varying the Ton value.

If Ton is 0, Vout is also 0.

if Ton is Ttotal then Vout is Vin or say maximum.

This was all about theory behind PWM. Now let`s take a look at the practical implementation of PWM on microcontrollers.

PWM Mode (PWM)

In Pulse Width Modulation mode, the CCPx pin produces up to a 10-bit resolution PWM output. Since the CCP1 pin is multiplexed with the PORTC data latch,

the TRISC<2> bit must be cleared to make the CCP1pin an output. Figure shows a simplified block diagram of the CCP module in PWM mode. For a step-by-step procedure on how to set up the CCP module for PWM operation.

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