Realtime Implementation of LIFI based Zone Sensing and Adaptive Lighting System for Automobile

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Abstract:- **This project aims to design and develop a system to automatically alert the vehicles by sensing special zones for low speed driving. To implement an automatic light beam dimmer and brighter system based on light intensity of the front vehicles .A brilliant zone detecting framework utilizing Li-fi is appropriate for the use of remote correspondence which is quick, dependable and blunder free. The transmitter of the proposed framework is utilizing noticeable light LEDs that differs in power significantly speedier than the human eye. Headlight of vehicles pose a great danger during night driving. The drivers of most vehicles use high, bright beam while driving at night. This causes a discomfort to the person travelling from the opposite direction and therefore experiences a sudden glare for a short period of time. In this project, an automatic headlight dimmer which uses a Light Dependent Resistor(LDR) sensor has been designed to dim the headlight of our vehicles to avoid human eye effects. This automatically switched the high beam into low beam, therefore reducing the glare effect by sensing the light intensity value of approaching vehicle and also eliminated the requirement of manual switching by the driver which has not done at all times. The system device was able to automatically switch the headlight to low beam when it sensed a vehicle approaching from the opposite side using LDR sensor. It was observed that the maximum spread angle of headlight was 135 degree. At the time the spread light from other sources reached the sensor, its intensity would be very much reduced below the triggering threshold level. The sensitivity of a photo detector determined the relationship between the light falling on the device and the resulting output signal.**

Key Words: LIFI, Photodiode

INTRODUCTION

Humankind has been utilizing light as a communication medium for many years, and light continues to be of great benefit in the field of communication. Fire has been used to make smoke signals on clouds; that is a kind of visual communication. After the invention of the electric light bulb by Thomas Alva Edison in the 19th century, new ways were developed to use light to communicate. The invention of the electric bulb led to the invention of the Signal Lamp, a visual signaling device used for optical communication invented by Arthur C. W. Aldis. Typically, the Signal Lamp uses Morse code to give information to the observer by making shutters mounted on the front of the lamp open and close.The idea of using light as a communication medium was implemented by Alexander Graham Bell in 1880 with his invention of the photo phone, a device that transmitted a voice signal on a beam of light. Bell focused sunlight with a mirror and then talked into a mechanism that vibrated the mirror. The vibrating beam was picked up by the detector at the receiving end and decoded back into the voice signal, the same procedure as the phone did with electrical signals. But Bell could not generate a useful carrier frequency, nor was he able to transmit the light beam from point to point. Obstacles in nature such as fog and rain — which could interfere with the photo phone — made Bell stop any future research into his invention. With the invention of LED (Light Emitting Diode), the idea of using light as a communication medium has started again. VLC uses white Light Emitting Diodes (LED), which send data by flashing light at speeds undetectable to the human eye. One major advantage of VLC is that we can use the infrastructure around us without having to make any changes to it. LEDs' ability to transfer information signals over light (light which is between 400THz to 800THz of frequency and whose wavelength is between 400nm to 700nm) makes it a very good communication medium.

The gigabits class communication speeds for short, medium and long ranges and both the directional data transfer using line-of sight, reflections and much more activities. A German Physicist Herald Hass invented the transfer of data through light fidelity. The invention will be supplanted for Wi-Fi, the data transmitted at the range of 500Mbps. This technology uses all kind of light spectrum like white light, infrared. The Li-Fi is not a limited to LED or Laser technologies or to a particular receiving technique. Li-Fi is a framework for all of these providing new capabilities to current and future services, applications and end users. Nowadays Wi-Fi is very useful technology in all the public sectors like home, cafes, airport, paying guest rooms, colleges, etc. Due to this radio frequency is getting blocked day by day, at the same time usage of wireless data is increasing exponentially every year.

Everyone is likes to use wireless data but the capacity is going down. But the wireless radio frequencies are getting higher, complexities are increasing and RF interferences continue to grow. In order to overcome this problem in future we are using this Li-Fi technology in 2011. The Li-Fi is a wireless communication system in which light is used as a carrier signal instead of traditional radio frequency as in Wi-Fi.

During dark and unlit conditions, our eye switches to scotopic vision which has the range of 30-45 µcd/m2.. It takes 4 seconds for our eyes to change from photopic vision to scotopic vision. This is also an example of TROXLER effect. As the brightness increases, the strain to focus on an object increases. The headlight has to be adjusted according to the light requirement by the driver. During pitch black conditions where there are no other sources of light, high beam is used. In all other cases, low beam is preferred. But in two way traffic, there are vehicles plying on both sides of the road. So when the bright light from the headlight of a vehicle coming from the opposite direction falls on a person, it glares him for a certain amount of time. This causes disorientation to that driver. The number of vehicles on our roads is burgeoning day by day. This is turn forced almost all this vehicle manufactures to think about the extra safety instruments and electronic controls to attach with these products for giving the users a safety derived in all road conditions through a mass flow traffics .if asked, one should always mention that the right driving is very cumbersome due to the dazzling light problems and the frequent dipping of head lights by manual means that often cause fatigue to the driver particularly at the time of peak traffic. So naturally to get rid of this perennial problem, an automatic mechanism has to come up to dip and dim the headlamp automatically whenever required. For keeping a motor vehicle under perfect control and reins of the driver, different types of control and accessories are provided in an automobile around the driver seat, on the dash board and at the foot board. Simply, an automatic dimmer and dipper is a unit, which can automatically judge when the head light beam needs to be lowered, and which dip the headlamp from which the beam to a dipped beam.

MOTIVATION AND OBJECTIVE

Upon detailed investigation of VLC research, it was found that not a lot of research has been done to develop this technology for commercial use. But because research into VLC is relatively new, the possibilities are wide open. A lot of research is being done to make this technology available for commercial use in various fields, including Internet access and vehicle-to-road communication using traffic signal lights. From our review of the literature, it became evident that work should be done to look into the possibility of designing a new model that could fit the present infrastructure for indoor applications. Therefore, the objectives of the research presented in this thesis can be summarized as follows:

- Develop a prototype of VLC and demonstrate its efficacy by using commercial LEDs.
- Present detailed experimental work on the prototypes and discuss the performance.
- Suggest a guideline for the design and implementation of future development of the prototypes.

CONTRIBUTIONS

As the contributions of this thesis, the models proposed in this thesis were designed with RS-232 and USB. As a result, they can be easily integrate with the present infrastructure. The first prototype was integrated with the existing Terminal Emulation Program (Hyper-Terminal), which was already present in the computer. The second prototype is designed for simple connection to the computer USB comports; it needs Terminal v1.9b software, which is available for free. For better understanding of the commercial use of the white LEDs for lighting and transmission range, illumination distribution and power distribution of the white LEDs were then measured and plotted. These designs, when truncated further, can be used as plug-in devices for low-cost commercial usage.

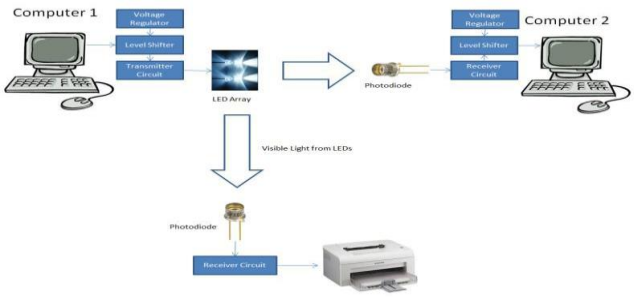
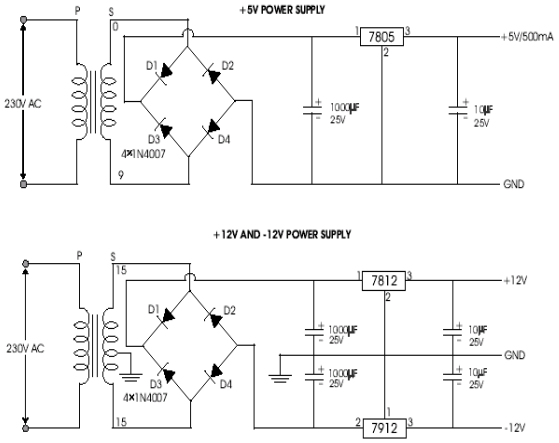
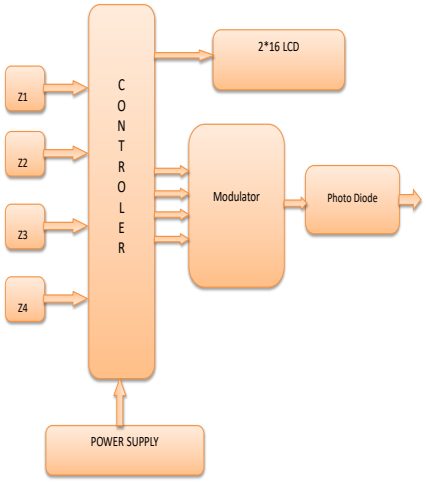


Fig.1: VLC Prototype Model.

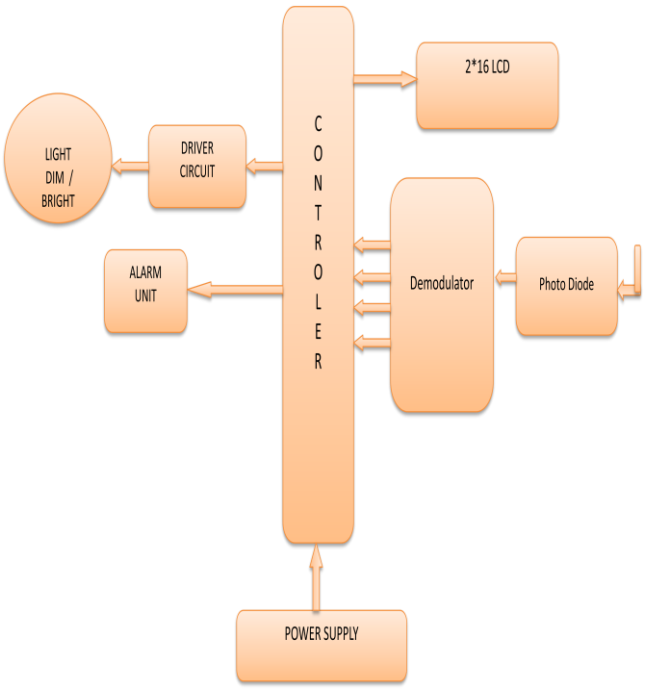
The above Fig. 1 illustrates the basic idea of the entire model design. The basic idea is to make two computers talk with each other using free space light propagation. Two models with different interfaces were proposed, namely RS-232 and USB. Prototype 1 was designed to be compatible with RS-232 interface and Prototype 2 was designed to be compatible with the USB interface.

BLOCK DIAGRAM FOR LIFI TRANSMITTER MODULE





BLOCK DIAGRAM FOR CAR MODULE



POWER SUPPLY

A suitable ready-built mains power supply unit, such as those used to control model trains, will include a transformer. If the unit does not have a fuse or a cut-out on the output of the transformer, you will also need to add a fuse of an appropriate rating. This fuse is in addition to the mains fuse in the unit's plug and is needed to protect the low voltage winding of the transformer and any circuits you connect to it. Although we won't be building the transformer block of our 5V regulated power supply, it is interesting to know how it works in the figure below,

RELAY

Electromagnetic relays were once the main ingredient in automated machinery. Factories used to control everything from conveyors to robots with huge panels filled with hundreds of relays clacking away, each in turn. This method had several drawbacks, but for years it was the only method available.

Recently, Programmable Logic Controllers (PLCs) have replaced banks of relays for automation needs. Relays are still used in small applications where a PLC would be overkill. They come in several varieties to suit a wide range of applications. Relays have a huge number of uses, but a few very common ones constitute the vast majority. Holding circuits are used to hold power on until the connection is Broken by another signal. This is achieved by connecting one of the relay's own contacts to its coil — once the relay is turned on, it stays on. . Relays are also useful for allowing one signal to switch connections at two or more different voltages since the contacts are isolated from each other. But most often, they are used to switch connections that are at different voltages than the control power.

In many cases, control power and signals generated by sensors are generated at low voltages. This is for reasons of safety and efficiency. Low voltage signals, however, are inefficient for doing high-wattage work, so a relay is used to allow the low voltage signal to switch a higher-voltage connection to do work, such as pull in a large solenoid, run a motor.

“A relay is an electrical switch that opens an closes under the control of another electrical circuit.” Relays are one of the oldest, simplest, and yet, easiest and most useful devices. Before the advent of the mass produced transistor, computers were made from either relays or vacuum tubes, or both.The classic electromagnetic relay is a switch which is thrown by an electromagnet. A relatively low current applied to the magnet can throw the switch, allowing a higher current to flow through that switch. The solenoid of most automobiles can be considered an electromagnetic relay.

In digital applications, it has been surpassed by the solid state relay. These relays have no moving parts, so they can switch very quickly in response to a control signal. They are built from semiconductors, and they cannot handle the current that an electromagnetic relay could but their advantage is speed. High current solid-state relays often require heat sinks to drain excess heat.

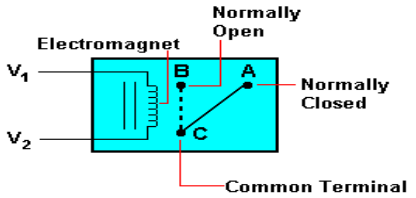


Fig.2 Power Supply

Relay Contact Information:

Relay contacts on most of our kits and in the industrial world are labeled with

NO (Normally Open), NC (Normally Closed), and CT (Common Terminal).

A relay contact is a switch, nothing more, nothing less. It does not provide power; it simply opens and closes an electrical circuit, just like the light switch on a wall. When the relay is de-energized or turned off there is an electrical connection between NC and Common hence normally closed. In the off state there is not a connection between NO and common, hence normally open. When the relay is energized or turned on the NO and C makes an electrical connection and the electrical connection between NC and C is removed.

RELAY WORKING

When a current flows through the coil, the resulting magnetic field attracts an armature that is mechanically linked to a moving contact. The movement either makes or breaks a connection with a fixed contact. When the current to the coil is switched off, the armature is returned by a force approximately half as strong as the magnetic force to its relaxed position. Usually this is a spring, but gravity is also used commonly in industrial motor starters. Most relays are manufactured to operate quickly. In a low voltage application, this is to reduce noise. In a high voltage or high current application, this is to reduce arcing.

If the coil is energized with DC, a diode is frequently installed across the coil, to dissipate the energy from the collapsing magnetic field at deactivation, which would otherwise generate a spike of voltage and might cause damage to circuit components. If the coil is designed to be energized with AC, a small copper ring can be crimped to the end of the solenoid. This "shading ring" creates a small out-of-phase current, which increases the minimum pull on the armature during the AC cycle.

PHOTODIODE

A photodiode is a semiconductor device that converts light into current. The current is generated when photons are absorbed in the photodiode. A small amount of current is also produced when no light is present. Photodiodes may contain optical filters, built-in lenses, and may have large or small surface areas

A photodiode converts the incident light into the current. It works on the principle called photo-conduction, whereas LED works on the principle of electro-luminance. The photodiode is a type of photodetector which converts the light to either current or voltage.

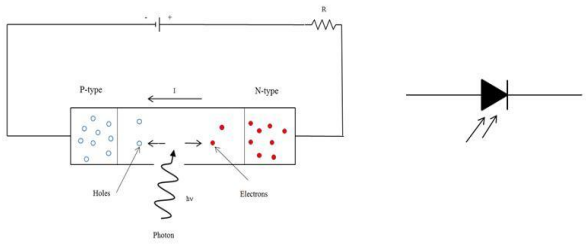


Fig.3 Photo diode

Fig.3 Basic biasing arrangement and construction of photodiode and Circuit symbol representation of photodiode. A photodiode is a type of photodetector capable of converting light into either current or voltage, depending upon the mode of operation. Photodiodes are similar to regular semiconductor diodes except that they may be either exposed (to detect vacuum UV or X-rays) or packaged with a window or optical fibre connection to allow light to reach the sensitive part of the device. Many diodes designed for use specifically as a photodiode will also use a PIN junction rather than the typical PN junction.

LIFI MODULE:

Li-Fi is wireless and uses similar 802.11 protocols, but it uses ultraviolet, infrared and visible light communication (instead of radio frequency waves), which has much bigger bandwidth.One part of VLC is modeled after communication protocols established by the IEEE 802 workgroup. However, the IEEE 802.15.7 standard is out-of-date: it fails to consider the latest technological developments in the field of optical wireless communications, specifically with the introduction of optical orthogonal frequency-division multiplexing (O-OFDM) modulation methods which have been optimized for data rates, multiple-access and energy efficiency. The introduction of O-OFDM means that a new drive for standardization of optical wireless communications is required.

Nonetheless, the IEEE 802.15.7 standard defines the physical layer (PHY) and media access control (MAC) layer. The standard is able to deliver enough data rates to transmit audio, video and multimedia services. It takes into account optical transmission mobility, its compatibility with artificial lighting present in infrastructures, and the interference which may be generated by ambient lighting. The MAC layer permits using the link with the other layers as with the TCP/IP protocol.

The standard defines three PHY layers with different rates:

- The PHY 1 was established for outdoor application and works from 11.67 kbit/s to 267.6 kbit/s.
- The PHY 2 layer permits reaching data rates from 1.25 Mbit/s to 96 Mbit/s.
- The PHY 3 is used for many emissions sources with a particular modulation method called color shift keying (CSK). PHY III can deliver rates from 12 Mbit/s to 96 Mbit/s.[38]

The modulation formats recognized for PHY I and PHY II are on-off keying (OOK) and variable pulse position modulation (VPPM). The Manchester coding used for the PHY I and PHY II layers includes the clock inside the transmitted data by representing a logic 0 with an OOK symbol "01" and a logic 1 with an OOK symbol "10", all with a DC component. The DC component avoids light extinction in case of an extended run of logic 0's.

The first VLC smart phone prototype was presented at the Consumer Electronics Show in Las Vegas from January 7–10 in 2014. The phone uses Sun Partner's CONNECT, a

technique that converts light waves into usable energy, making the phone capable of receiving and decoding signals without drawing on its battery. A clear thin layer of crystal glass can be added to small screens like watches and smart phones that make them solar powered. Smart phones could gain 15% more battery life during a typical day. The first smart phones using this technology should arrive in 2015.

At the heart of this technology is a new generation of high-brightness light-emitting diodes. Very simply, if the LED is on, you transmit a digital 1, if it's off you transmit a 0. They can be switched on and off very quickly, which gives nice opportunities for transmitting data. It is possible to encode data in the light by varying the rate at which the LEDs flicker on an off to give different strings of 1s and 0s. The modulation is so fast that the human eye doesn't notice. There are over 14 billion light bulbs worldwide, they just need to be replaced with LED ones that transmit data.

SOFTWARE REQUIRMENTS

SOFTWARE TOOLS

- Development tool – MPLAB IDE v7.42
- Hardware Compiler - HI-Tech PIC C
- Programmer - PIC Flash
- Hardware Simulation tool - Proteus v7.6Sp0

INTRODUCTION TO EMBEDDED 'C':

Ex: Hitec – c, Keil – c

HI-TECH Software makes industrial-strength software development tools and C compilers that help software developers write compact, efficient embedded processor code.

For over two decades HI-TECH Software has delivered the industry's most reliable embedded software development tools and compilers for writing efficient and compact code to run on the most popular embedded processors. Used by tens of thousands of customers including General Motors, Whirlpool, Qualcomm, John Deere and many others, HI-TECH's reliable development tools and C compilers, combined with world-class support have helped serious embedded software programmers to create hundreds of breakthrough new solutions.

Whichever embedded processor family you are targeting with your software, whether it is the ARM, PICC or 8051 series, HI-TECH tools and C compilers can help you write better code and bring it to market faster.

HI-TECH PICC is a high-performance C compiler for the Microchip PIC micro 10/12/14/16/17 series of microcontrollers. HI-TECH PICC is an industrial-strength ANSI C compiler - not a subset implementation like some other PIC compilers. The PICC compiler implements full ISO/ANSI C, with the exception of recursion. All data types are supported including 24 and 32 bit IEEE standard floating point. HI-TECH PICC makes full use of specific PIC features and using an intelligent optimizer, can generate high-quality code easily rivaling hand-written assembler. Automatic handling of page and bank selection frees the programmer from the trivial details of assembler code.

EMBEDDED "C" COMPILER

- ANSIC - full featured and portable
- Reliable - mature, field-proven technology
- Multiple C optimization levels
- An optimizing assembler
- Full linker, with overlaying of local variables to minimize RAM usage
- Comprehensive C library with all source code provided
- Includes support for 24-bit and 32-bit IEEE floating point and 32-bit long data types
- Mixed C and assembler programming
- Unlimited number of source files
- Listings showing generated assembler
- Compatible - integrates into the MPLAB IDE, MPLAB ICD and most 3rd-party development tools
- Runs on multiple platforms: Windows, Linux, UNIX, Mac OS X, Solaris

MPLAB INTEGRATION

MPLAB Integrated Development Environment (IDE) is a free, integrated toolset for the development of embedded applications employing Microchip's PIC micro and dsPIC microcontrollers. MPLAB IDE runs as a 32-bit application on MS Windows, is easy to use and includes a host of free software components for fast application development and super-charged debugging. MPLAB IDE also serves as a single, unified graphical user interface for additional Microchip and third party software and hardware development tools. Moving between tools is a snap, and upgrading from the free simulator to MPLAB ICD 2 or the MPLAB ICE emulator is done in a flash because MPLAB IDE has the same user interface for all tools.

Choose MPLAB C18, the highly optimized compiler for the PIC18 series microcontrollers, or try the newest Microchip's language tools compiler, MPLAB C30, targeted at the high performance PIC24 and dsPIC digital signal controllers. Or, use one of the many products from third party language tools vendors. They integrate into MPLAB IDE to function transparently from the MPLAB project manager, editor and compiler.

EMBEDDED DEVELOPMENT ENVIRONMENT

This environment allows you to manage all of your PIC projects. You can compile, assemble and link your embedded application with a single step.

Optionally, the compiler may be run directly from the command line, allowing you to compile, assemble and link using one command. This enables the compiler to be integrated into third party development environments, such as Microchip's MPLAB IDE.

EMBEDDED SYSTEM TOOLS

ASSEMBLER

An assembler is a computer program for translating assembly language — essentially, a

mnemonic representation of machine language — into object code. A cross assembler (see cross compiler) produces code for one type of processor, but runs on another. The computational step where an assembler is run is known as assembly time. Translating assembly instruction mnemonics into opcodes, assemblers provide the ability to use symbolic names for memory locations (saving tedious calculations and manually updating addresses when a program is slightly modified), and macro facilities for performing textual substitution — typically used to encode common short sequences of instructions to run inline instead of in a subroutine. Assemblers are far simpler to write than compilers for high-level languages.

ASSEMBLY LANGUAGE HAS SEVERAL BENEFITS

Speed: Assembly language programs are generally the fastest programs around.

Space: Assembly language programs are often the smallest.

Capability: You can do things in assembly which are difficult or impossible in High level languages.

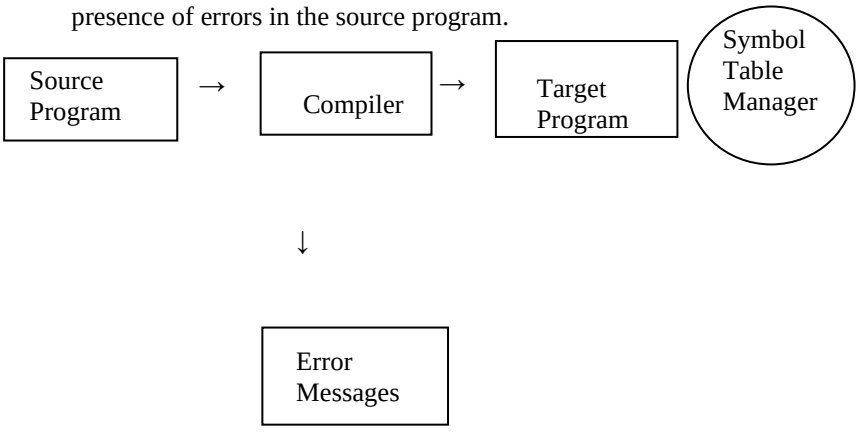
Knowledge: Your knowledge of assembly language will help you write better programs, even when using High level languages. An example of an assembler we use in our project is RAD 51.

SIMULATOR

Simulator is a machine that simulates an environment for the purpose of training or research. We use a UMPS simulator for this purpose in our project.

COMPILER

A compiler is a program that reads a program in one language, the source language and translates into an equivalent program in another language, the target language. The translation process should also report the presence of errors in the source program.



There are two parts of compilation. The analysis part breaks up the source program into constant piece and creates an intermediate representation of the source program. The synthesis part constructs the desired target program from the intermediate representation.

COUSINS OF THE COMPILER ARE

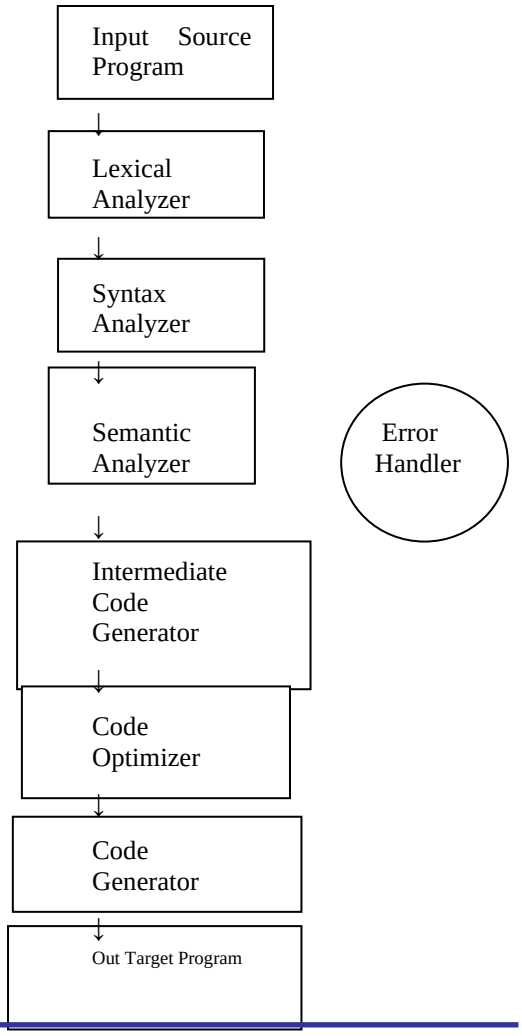
1. Preprocessor.
2. Assembler.
3. Loader and Link-editor.

A naive approach to that front end might run the phases serially.

1. Lexical analyzer takes the source program as an input and produces a long string of tokens.
2. Syntax Analyzer takes an out of lexical analyzer and produces a large tree.
3. Semantic analyzer takes the output of syntax analyzer and produces another tree. Similarly, intermediate code generator takes a tree as an input produced by semantic analyzer and produces intermediate code

PHASES OF COMPILER

The compiler has a number of phases plus symbol table manager and an error handler.



FABRICATION DETAILS

The fabrication of one demonstration unit is carried out in the following sequence.

- Finalizing the total circuit diagram, listing out the components and sources of procurement.
- Procuring the components, testing the components and screening the components.
- Making layout, repairing the interconnection diagram as per the circuit diagram.
- Assembling the components as per the component layout and circuit diagram and soldering components.
- Integrating the total unit, inter wiring the unit and final testing the unit.

PICKIT 3

GENERAL DESCRIPTION

When you factor in all the clones and how long it's been released, I believe there are more PICkit 3's in the world than there are Arduino's. Unfortunately I don't have the numbers to back it up. But who really cares, the fact there are so many of both of these hobbyist tools being used everyday is awesome.

It's been amazing to watch the growth of home electronics hobbyists/makers/inventors/etc. over the last 30+ years. I learned about microcontrollers back in high school; programming my first one on a health kit trainer. I was writing machine language (1's and 0's) back then entering hex code not assembly code. Assembly code was a higher level language.

PRODUCT DESCRIPTION

This is the new PICKIT 3 from Microchip. If you want an official programmer from Microchip, this is it! The PICKIT 3 allows debugging and programming of PIC and dsPIC microcontrollers using the powerful graphical user interface of the MPLAB Integrated Development Environment (IDE).

The MPLAB PICKIT 3 is connected to a PC using a full speed USB interface and can be connected to the target via a Microchip debug (RJ-11) connector (compatible with MPLAB ICD 2/ 3 and MPLAB REAL ICE). The connector uses two device I/O pins and the reset line to implement in-circuit debugging and In-Circuit Serial Programming.

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