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For Refinery & Autonomous Based Robot through the Android Mobile

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Abstract

Oil and gas refineries can be a dangerous environment for numerous reasons, including heat, toxic gasses, and unexpected catastrophic failures. In order to augment how human operators interact with this environment, a mobile robotic platform is developed. This paper focuses on the use of Wi-Fi for communicating with and localizing the robot. More specifically, algorithms are developed and tested to minimize the total number of Wi-Fi access points (APs) and their locations in any given environment while taking into consideration the throughput requirements and the need to ensure every location in the region can reach at least k APs. When multiple Wi-Fi APs are close together, there is a potential for interference. A graph-coloring heuristic is used to determine AP channel allocation. In addition, Wi-Fi fingerprinting based localization is developed. All the algorithms implemented are tested in real world scenarios with the robot developed and results are promising.

Here by using the Wi-Fi technology we can control the robot and in this project we can develop the sensor communication temp, humidity and fire. So we can monitor total all these sensors

Introduction

This template, modified in MS Word 2007 and saved as a "Word 97-2003 Document" for the PC, provides authors with most of the formatting specifications needed for preparing electronic versions of their papers. All standard paper components have been specified for three reasons: (1) ease of use when formatting individual papers, (2) automatic compliance to electronic requirements that facilitate the concurrent or later production of electronic products, and (3) conformity of style throughout a conference proceedings. Margins, column widths, line spacing, and type styles are built-in; examples of the type styles are provided throughout this document and are identified in italic type, within parentheses, following the example. Some components, such as multi-leveled equations, graphics, and tables are not prescribed, although the various table text styles are provided. The formatter will need to create these components, incorporating the applicable criteria that follow.

Ease of Use

An embedded system is a system which is going to do a predefined specified task is the embedded system and is even defined as combination of both software and hardware. A general-purpose definition of embedded systems is that they are devices used to control, monitor or assist the operation of equipment, machinery or plant. "Embedded" reflects the fact that they are an integral part of the system. At the other extreme a general-purpose computer may be used to control the operation of a large complex processing plant, and its presence will be obvious.

All embedded systems are including computers or microprocessors. Some of these computers are however very simple systems as compared with a personal computer.

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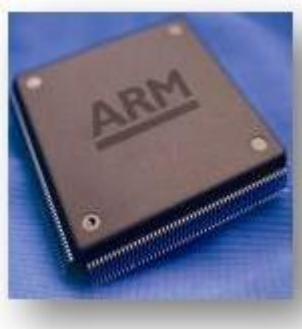
The very simplest embedded systems are capable of performing only a single function or set of functions to meet a single predetermined purpose. In more complex systems an application program that enables the embedded system to be used for a particular purpose in a specific application determines the functioning of the embedded system. The ability to have programs means that the same embedded system can be used for a variety of different purposes. In some cases a microprocessor may be designed in such a way that application software for a particular purpose can be added to the basic software in a second process, after which it is not possible to make further changes. The applications software on such processors is sometimes referred to as firmware.

ARM PROCESSOR OVERVIEW:

ARM stands for Advanced RISC Machines. It is a 32 bit processor core, used for high end application.
It is widely used in Advanced Robotic Applications.



History and Development:

- ARM was developed at Acron Computers ltd of Cambridge, England between 1983 and 1985.
- RISC concept was introduced in 1980 at Stanford and Berkley.
- ARM ltd was found in 1990.
- ARM cores are licensed to partners so as to develop and fabricate new microcontrollers around same processor cores.

Key features:

1. 16-bit/32-bit ARM7TDMI-S microcontroller in a tiny LQFP64 package.
2. 8 kB to 40 kB of on-chip static RAM and 32 kB to 512 kB of on-chip flash memory.
   128-bit wide interface/accelerator enables high-speed 60 MHz operation.
3. In-System Programming/In-Application Programming (ISP/IAP) via on-chip boot loader software. Single flash sector or full chip erase in 400 ms and programming of
   256 bytes in 1 ms.

Power Supply:

- The input to the circuit is applied from the regulated power supply. The ac. input i.e., 230V from the mains supply is step down by the transformer to 12V and is fed to a *rectifier*. The output obtained from the rectifier is a pulsating dc voltage. So in order to get a pure dc voltage, the output voltage from the rectifier is fed to a filter to remove any ac components present even after rectification. Now, this voltage is given to a voltage regulator to obtain a pure *constant dc voltage.*

- The abbreviation “i.e.” means “that is,” and the abbreviation “e.g.” means “for example.”

An excellent style manual for science writers is [7].

TEMPERATURE SENSOR

Temperature Sensor which converts temperature value into electrical signals. We used IC called LM 35 as a temperature sensor. LM35 series sensors are precision integrated-circuit temperature sensors whose output voltage is linearly proportional to the Celsius temperature. The LM35 requires no external calibration since it is internally calibrated. . The LM35 does not require any external calibration or trimming to provide typical accuracies of ±1⁄4°C at room temperature and ±3⁄4°C over a full −55 to +150°C temperature range.

The LM35’s low output impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy. It can be used with single power supplies, or with plus and minus supplies. As it draws only 60 µA from its supply, it has very low self-heating, less than 0.1°C in still air.

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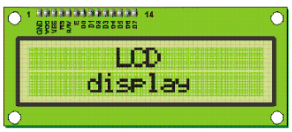
TEMPERATURE SENSING CIRCUIT

The methods of temperature measurement may be divided into two main classes according as the exchange of heat between the testing body and the hot system takes place by contact or by radiation across a space. In the contact methods, thermometers or thermocouples are used and they are immersed in solids or liquids.

LIQUID CRYSTAL DISPLAY

LCD stands for **L**iquid **C**rystal **D**isplay. LCD is finding wide spread use replacing LEDs (seven segment LEDs or other multi segment LEDs) because of the following reasons:

1. The declining prices of LCDs.
2. The ability to display numbers, characters and graphics. This is in contrast to LEDs, which are limited to numbers and a few characters.
3. Incorporation of a refreshing controller into the LCD, thereby relieving the CPU of the task of refreshing the LCD. In contrast, the LED must be refreshed by the CPU to keep displaying the data.
4. Ease of programming for characters and graphics.
5. These components are "specialized" for being used with the microcontrollers, which means that they cannot be activated by standard IC circuits. They are used for writing different messages on a miniature LCD.



A model described here is for its low price and great possibilities most frequently used in practice. It is based on the HD44780 microcontroller (*Hitachi*) and can display messages in two lines with 16 characters each. It displays all the alphabets, Greek letters, punctuation marks, mathematical symbols etc. In addition, it is possible to display symbols that user makes up on its own. Automatic shifting message on display (shift left and right), appearance of the pointer, backlight etc. are considered as useful characteristics.

Pins Functions:

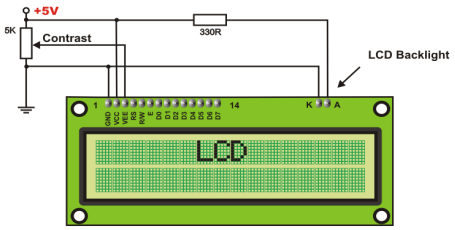
There are pins along one side of the small printed board used for connection to the microcontroller. There are total of 14 pins marked with numbers (16 in case the background light is built in). Their function is described in the table below:

TABLE:2

Function	Pin Number	Name	Logic State	Description
Ground	1	Vss	-	0V
Power supply	2	Vdd	-	+5V
Contrast	3	Vee	-	0 – Vdd
Control of operating	4	RS	0 1	D0 – D7 are interpreted as commands D0 – D7 are interpreted as data
	5	R/W	0 1	Write data (from controller to LCD) Read data (from LCD to controller)
	6	E	0 1 From 1 to 0	Access to LCD disabled Normal operating Data/commands are transferred to LCD
Data / commands	7	D0	0/1	Bit 0 LSB
	8	D1	0/1	Bit 1
	9	D2	0/1	Bit 2
	10	D3	0/1	Bit 3
	11	D4	0/1	Bit 4
	12	D5	0/1	Bit 5
	13	D6	0/1	Bit 6
	14	D7	0/1	Bit 7 MSB

LCD screen:

LCD screen consists of two lines with 16 characters each. Each character consists of 5x7 dot matrix. Contrast on display depends on the power supply voltage and whether messages are displayed in one or two lines. For that reason, variable voltage 0-Vdd is applied on pin marked as Vee. Trimmer potentiometer is usually used for that purpose. Some versions of displays have built in backlight (blue or green diodes). When used during operating, a resistor for current limitation should be used (like with any LE diode).



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LCD Basic Commands:

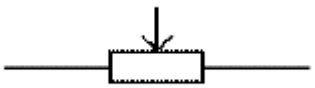
All data transferred to LCD through outputs D0-D7 will be interpreted as commands or as data, which depends on logic state on pin RS:RS = 1 - Bits D0 - D7 are addresses of characters that should be displayed. Built in processor addresses built in "map of characters" and displays corresponding symbols.

Displaying position is determined by DDRAM address. This address is either previously defined or the address of previously transferred character is automatically incremented.

- To perform time delay functions. Relays can be used to act as an mechanical time delay device by controlling the release time by using the effect of residual magnetism by means of a inserting copper disk between the armature and moving blade assembly.

POTENTIOMETER:

- Variable resistors used as potentiometers have all **three terminals** connected. This arrangement is normally used to **vary voltage**, for example to set the switching point of a circuit with a sensor, or control the volume (loudness) in an amplifier circuit. If the terminals at the ends of the track are connected across the power supply, then the wiper terminal will provide a voltage which can be varied from zero up to the maximum of the supply.



Potentiometer Symbol

Presets:

- These are miniature versions of the standard variable resistor. They are designed to be mounted directly onto the circuit board and adjusted only when the circuit is built. For example, to set the frequency of an alarm tone or the sensitivity of a light-sensitive circuit, a small screwdriver or similar tool is required to adjust presets.
- Presets are much cheaper than standard variable resistors so they are sometimes used in projects where a standard variable resistor would normally be used.
- Multi turn presets are used where very precise adjustments must be made. The screw must be turned many times (10+) to move the slider from one end of the track to the other, giving very fine control.

PRESSURESENSOR

Speed and reliability. Honeywell S&C offers electronic speed and position sensors designed for enhanced reliability and an extended life. Honeywell uses multiple technologies to detect a change in magnetic field and create an electronic signal for control system interface. These technologies offer the ability to detect speed, direction, or position of a moving ferrous metal or magnetic target. Sensing is accomplished without contacting the target, and there are no moving parts. This eliminates mechanical wear of the sensor or target. Honeywell offers a comprehensive line-up of Hall-effect, magnetoresistive, and variable reluctance sensors which provide electrical compatibility to most control system interfaces. We also offer a variety of sensor package types designed to enable mounting flexibility and wire harness interface compatibility. The Honeywell Speed and Position portfolio has been developed to support potential transportation and industrial customer application requirements.

Speed and Direction sensors 1GT Series.

Features: Fast operating speed
• Reverse polarity and transient protection
• EMI resistant
• Wide continuous operating temperature range • Probe-style package
• Enhanced low speed performance
• Output amplitude not dependent on RPM

Benefits: Sealed in probe-style package for physical protection and cost-effective installation. Sensor electronically self-adjusts to slight variations in run out

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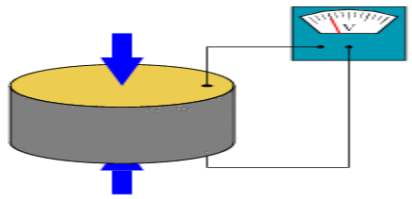
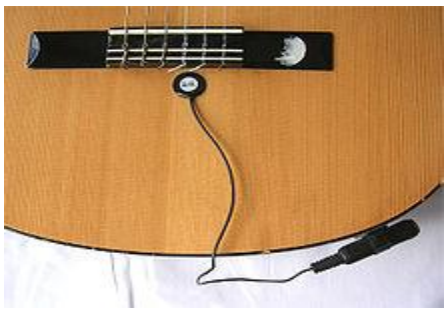
and temperature, often simplifying installation and maintenance. Circuit senses movement of targets in camshaft and crankshaft speed and position, transmission speed, and tachometer applications, as well as anti-skid and traction control applications.

A piezoelectric sensor is a device that uses the piezoelectric effect to measure pressure, acceleration, strain or force by converting them to an electrical signal.



A piezoelectric disk generates a voltage when deformed

Applications



Piezoelectric disk used as a guitar pickup

- The Piezoelectric sensors have proven to be versatile tools for the measurement of various processes. They are used for quality assurance, process control and for research and development in many different industries.
- In the automotive industry piezoelectric elements are used as the standard devices for engine indicating in developing internal combustion engines. The combustion processes are measured with piezoelectric sensors. The sensors are either directly mounted into additional holes into the cylinder head or the spark/glow plug is equipped with a built in miniature piezoelectric sensor.
- The rise of piezoelectric technology is directly related to a set of inherent advantages. The high modulus of elasticity of many piezoelectric materials is comparable to that of many metals and goes up to 105 N/m². Even though piezoelectric sensors are electromechanical systems that react on compression, the sensing elements show almost zero deflection. This is the reason why piezoelectric sensors are so rugged, have an extremely high natural frequency and an excellent linearity over a wide amplitude range. Additionally, piezoelectric technology is insensitive to electromagnetic fields and radiation, enabling measurements under harsh conditions. Some materials used (especially gallium phosphate or tourmaline) have an extreme stability over temperature enabling sensors to have a working range of up to 1000°C. Tourmaline shows pyro electricity in addition to the piezoelectric effect; this is the ability to generate an electrical signal when the temperature of the crystal changes. This effect is also common to piezo ceramic materials.

Principle	Strain Sensitivity [V/μ*]	Threshold [μ*]	Span to threshold ratio
Piezoelectric	5.0	0.00001	100,000,000
Piezoresistive	0.0001	0.0001	2,500,000
Inductive	0.001	0.0005	2,000,000
Capacitive	0.005	0.0001	750,000

One disadvantage of piezoelectric sensors is that they cannot be used for true static measurements. A static force will result in a fixed amount of charges on the piezoelectric material. While working with conventional readout electronics, imperfect insulating materials, and reduction in internal sensor resistance will result in a constant loss of electrons, and yield a decreasing signal. Elevated temperatures cause an additional drop in internal resistance and sensitivity. The main effect on the piezoelectric effect is that with

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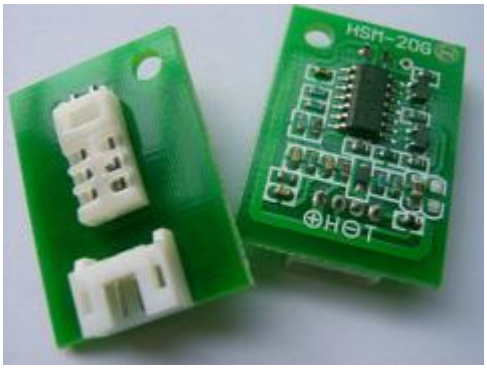
increasing pressure loads and temperature the sensitivity is reduced due to twin-formation. While quartz sensors need to be cooled during measurements at temperatures above 300°C special types of crystals like GaPo4 gallium phosphate do not show any twin formation up to the melting point of the material itself. Anyhow, it would be a misconception that piezoelectric sensors can only be used for very fast processes or at ambient conditions. In fact, there are numerous applications that show quasi-static measurements while there are other applications that go to temperatures far beyond 500°CPiezoelectric sensors are also seen in nature. Dry bone is piezoelectric, and is thought by some to act as a biological force sensor.

Principle of operation

Depending on how a piezoelectric material is cut, three main modes of operation can be distinguished: transverse, longitudinal, and shear.

Humidity Sensors



Wireless Network Technology: Embedded Serial to Wi-Fi Modules

Introduction

Wireless technology has become prevalent in modern society as it presents a solution to the dilemma of making life easier by breaking down the networking barriers of distance and mobility. In a study of the benefits of wireless LAN conducted in 2001[1], 87% of survey respondents credited WLAN to an increase in their quality of life due to the flexibility and mobility of wireless internet connectivity; moreover, WLAN has been attributed to a 22% productivity increase for end-users. The appeal of wireless networking has resulted in the vast expansion of WLAN infrastructure with millions of public, private, and commercial wireless access points dispersed around the globe [2]. Consequentially, the pervasive availability of wireless network access enables the potential for remote data transfer with a variety of electronic devices by means of embedded serial to Wi-Fi modules. For instance, security and surveillance systems employ serial to Wi-Fi modules to stream surveillance video from remotely mounted security cameras to wired network systems [1]. The following review provides an analysis of the features and cost effectiveness of Wi-Fi modules while highlighting the commercial applications of these devices.

Interacts with serial devices through a custom AT+i Serial Data Format or SerialNet mode. Data transfer speeds can reach up to 3 Mbps in serial mode. Other features of the iWiFi module include a random number generator, capability to send and receive textual or binary email with MIME attachments, retrieval of time data from a Network Time Server, WEP and WPA / WPA2 encryption, 10 TCP/UDP sockets, and two listening sockets. The retail price for the iWiFi module is $59.00; however, the antenna and cable are not included [8].

Despite the fact that the Secure Socket iWiFi module is $10.95 cheaper than the WiFly RN-111b, one must be cognizant of the significantly larger power consumption of the iWiFi module which translates to greater long term energy costs. Nevertheless, each device possesses its own set of advantages and disadvantages which may prove valuable for certain applications.

IEEE Wireless LAN Standards

IEEE 802.11 contains a set of standards that govern WLAN implementation on the 2.4, 3.6, and 5 GHz spectrum bands. The two standards particular to embedded serial to Wi-Fi modules are the 802.11b and 802.11g standards, which are amendments to the

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original 802.11 standard. IEEE 802.11b proposes a modulation technique that maintains a throughput of 4.5 Mbps and a net bit rate of 11 Mbps. The 802.11g standard employs a modulation method similar to the 802.11a standard, and maintains a throughput of 19 Mbps and a net bit rate of 54 Mbps. The similarities between the 802.11 b and g standards are that both define modulation on the 2.4 GHz band and devices implementing these standards are prone to interference by other electronics operating on the spectrum band. The notable difference between the two standards is the capability of faster data transfer speeds on 802.11g devices.

Implementation of Embedded Serial to Wi-Fi Modules

The typical embedded serial to Wi-Fi module is designed for relatively simple installation. The connections involve a DB9 pass through serial cable that links the module to a serial port terminal. For most modules, power is supplied by a 4 -12 VDC unregulated, 3.3V regulated, or in some cases 2-3 V low power battery sources. Initially, users must configure the module by connecting to a PC and utilizing the provided installation software prior to connecting the module to a serial M2M device. A potential difficulty associated with the installation of a Wi-Fi module involves configuring the module for passing through a wireless network security gateway such as the Georgia Tech LAWN system

MOTORS

Motor is a device that creates motion, not an engine it usually refers to either an electrical motor or an internal combustion engine.

It may also refer to:

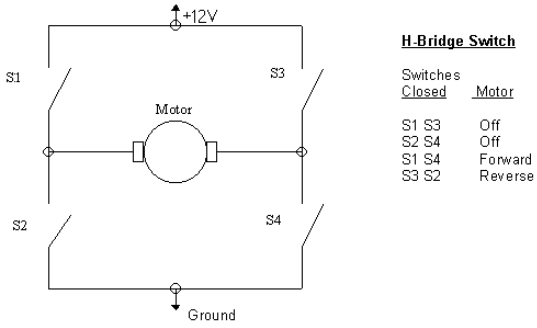
- Electric Motor, a machine that converts electricity into a mechanical motion
- AC motor, an electric motor that is driven by alternating current
- Synchronous motor, an alternating current motor distinguished by a rotor spinning with coils passing magnets at the same rate as the alternating current and resulting magnetic field which drives it
- Induction motor also called a squirrel-cage motor, a type of asynchronous alternating current motor where power is supplied to the rotating device by means of electromagnetic induction

DC motor an electric motor that runs on direct current electricity Brushed DC electric motor an internally commutated electric motor designed to be run from a direct current power source Brushless DC motor a synchronous electric motor which is powered by direct current electricity and has an electronically controlled commutation system, instead of a mechanical commutation system based on brushes

- Electrostatic motor a type of electric motor based on the attraction and repulsion of electric charge
- Servo motor an electric motor that operates a servo, commonly used in robotics
- Internal fan-cooled electric motor, an electric motor that is self-cooled by a fan, typically used for motors with a high energy density

MOTORDRIVER CIRCUIT

- The name "H-Bridge" is derived from the actual shape of the switching circuit which control the motion of the motor. It is also known as "Full Bridge". Basically there are four switching elements in the H-Bridge as shown in the figure below.



As you can see in the figure above there are four switching elements named as "High side left", "High side right", "Low side right", "Low side left". When these switches are turned on in pairs motor changes its

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direction accordingly. Like, if we switch on High side left and Low side right then motor rotate in forward direction, as current flows from Power supply through the motor coil goes to ground via switch low side right

ABOUT KEIL SOFTWARE:

It is possible to create the source files in a text editor such as Notepad, run the Compiler on each C source file, specifying a list of controls, run the Assembler on each Assembler source file, specifying another list of controls, run either the Library Manager or Linker (again specifying a list of controls) and finally running the Object-HEX Converter to convert the Linker output file to an Intel Hex File. Once that has been completed the Hex File can be downloaded to the target hardware and debugged. Alternatively KEIL can be used to create source files; automatically compile, link and covert using options set with an easy to use user interface and finally simulate or perform debugging on the hardware with access to C variables and memory. Unless you have to use the tolls on the command line, the choice is clear. KEIL Greatly simplifies the process of creating and testing an embedded application.

Projects:

The user of KEIL centers on "projects". A project is a list of all the source files required to build a single application, all the tool options which specify exactly how to build the application, and – if required – how the application should be simulated. A project contains enough information to take a set of source files and generate exactly the binary code required for the application. Because of the high degree of flexibility required from the tools, there are many options that can be set to configure the tools to operate in a specific manner. It would be tedious to have to set these options up every time the application is being built; therefore they are stored in a project file. Loading the project file into KEIL informs KEIL which source files are required, where they are, and how to configure the tools in the correct way.

KEIL can then execute each tool with the correct options. It is also possible to create new projects in KEIL. Source files are added to the project and the tool options are set as required. The project can then be saved to preserve the settings. The project is reloaded and the simulator or debugger started, all the desired windows are opened. KEIL project files have the extension

Simulator/Debugger:

The simulator/ debugger in KEIL can perform a very detailed simulation of a micro controller along with external signals. It is possible to view the precise execution time of a single assembly instruction, or a single line of C code, all the way up to the entire application, simply by entering the crystal frequency. A window can be opened for each peripheral on the device, showing the state of the peripheral. This enables quick trouble shooting of mis-configured peripherals. Breakpoints may be set on either assembly instructions or lines of C code, and execution may be stepped through one instruction or C line at a time. The contents of all the memory areas may be viewed along with ability to find specific variables. In addition the registers may be viewed allowing a detailed view of what the microcontroller is doing at any point in time.

The Keil Software 8051 development tools listed below are the programs you use to compile your C code, assemble your assembler source files, link your program together, create HEX files, and debug your target program. µVision2 for Windows™ Integrated Development Environment: combines Project Management, Source Code Editing, and Program Debugging in one powerful environment.

- C51 ANSI Optimizing C Cross Compiler: creates re locatable object modules from your C source code,
- A51 Macro Assembler: creates re locatable object modules from your 8051 assembler source code,
- BL51 Linker/Locator: combines re locatable object modules created by the compiler and assembler into the final absolute object module,
- LIB51 Library Manager: combines object modules into a library, which may be used by the linker,
- OH51 Object-HEX Converter: creates Intel HEX files from absolute object modules.

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What's New in µVision3?

µVision3 adds many new features to the Editor like Text Templates, Quick Function Navigation, and Syntax Coloring with brace high lighting Configuration Wizard for dialog based startup and debugger setup. µVision3 is fully compatible to µVision2 and can be used in parallel with µVision2.

CONCLUSION:

The project "Wi-Fi based communication and localization of an autonomous mobile Robot for refinery inspection" been successfully designed and tested**.**

Integrating features of all the hardware components used have developed it. Presence of every module has been reasoned out and placed carefully thus contributing to the best working of the unit.

Secondly, using highly advanced IC's and with the help of growing technology the project has been successfully implemented.

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