A SMART SWITCH TO CONNECT AND DISCONNECT ELECTRICAL DEVICES AT HOME BY USING INTERNET

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Abstract -*IoT (Internet of Things) one of the most exiting trends and innovation in the recent history of technological advancement. Also the advances in computer hardware, embedded system devices, networking devices, display devices, control devices, software enhancements etc. has tremendously supported IoT to grow slowly and steadily from leaps to bounds. With computation, connectivity, and data storage becoming more advanced and universal there has been an explosion of IoT based application solutions in diversified domains from health care to public safety, from assembly line scheduling to manufacturing and various other technological domains. IoT can be defined as a network of physical objects, devices that contain embedded technology (like intelligent sensors, controllers etc.) which can communicate, sense, or interact with internal or external systems. In other words, when objects can sense and communicate, it changes how and where decisions are made, and who makes them and accordingly operations can be carried out. In this paper a Smart Switch is developed to control household items using GPRS enabled Smartphone using KEIL software and LC2148.Various IoT based applications have been explored and possible approach for enhancing the use of this technology have been discussed in this paper. Future directions and suggestions for effectively and efficiently improving the IoT based application areas have been touched upon. In this paper we have tried to provide a holistic perspective on IoT and IoT based applications, application areas, research challenges in IoT, trends and future possibilities.*

Key Words: **Smart switch, IoT, KEIL software, Embedded C,LC2148 microcontroller, LCD**

1. INTRODUCTION

Internet of Things(IoT) is the network of physical, devices accessed through the Internet. These objects contain embedded technology to interact with internal states or the external environment. When these objects sense and communicate, it changes how and where decisions are made, and who makes them. It is a modern wireless communication technology having its application areas in various diversified domain areas. The basic idea of this concept is the pervasive presence around us of a variety of things or objects – such as Radio-Frequency Identification (RFID) tags, sensors, actuators, mobile phones, etc. – which, through unique addressing schemes, are able to interact with each other and cooperate with their neighbors to reach common goals. It refers to the ever-growing network of physical objects that have an IP address associated with it for internet connectivity and addressing, and the communication that occurs between these objects and other Internet-enabled devices and systems that enables in some decision making process for applications in health care monitoring, assembly line scheduling, etc.. In other language we can say that IoT is a system of various interrelated computing devices, digital systems, machines, sensors, objects, animal or people that have a unique identifier associated with them, and the ability to transfer data over a network without the need of human-to-computer or human-to-human interaction. IoT is a technology that has evolved with convergence of various technologies like wireless communication, MEMS (micro-electromechanical systems), Wireless Sensor Network, Mobile Communication etc.. This convergence has proved to be vital as it has led to bringing operational technology (OT) and information technology (IT) on a common platform, which in turn allows unstructured machine-generated data to be further analyzed for initiating further improvements in decision making process in automation. Operational technology (OT) is combination of hardware and software that detects or causes a change through the direct monitoring and/or control of physical devices, processes and events in the enterprise. It comprises the devices, sensors and software necessary to control and monitor plant and equipment etc. Information Technology (IT), on the other hand, combines all necessary technologies for information processing. Information Technology is the application of computers to store, retrieve, transmit and manipulate data, often in the context of a business or other enterprise. IT is considered a subset of information and communications technology (ICT).In conventional approaches we have computers and Internet being dependent on human beings for information. Nearly majority of data available across the globe on Internet were first captured, generated by humans either by typing, or applying an external trigger event, or by other various modes of creating data. The issues associated with it are that people have limited time, are bound to commit errors while generating data i.e. capturing data will have accuracy issues. With the recent advances in technologies Internet is becoming more widely available, The cost of connecting is decreasing, more devices are being created with Wi-Fi capabilities and sensors built into them, technology costs are going down, and smart-phone penetration is sky-rocketing. This factors have made possibilities for IoT based applications reach new heights whereby creating wider scope for further advances. With this there has been a wide scope of increase in applications of IoT ranging from healthcare, telecom, oil field maintenance, transportation etc.. There are basically few key focus areas that one has to consider while deciding upon IoT based applications. Smart

Switch (SS), which is a device capable of connecting or disconnecting any device remotely Power that is connected to the outlet at home making use of internet. In this case, the SS acts as intermediary between electricity and the appliance. Furthermore, the proposed device can be controlled even without the use of internet, that is, if users do not have Internet can control the SS a locally within the building, using the local IP SS and using a computer, smart phone or tablet with access to the local network.

The objective of this paper is to provide insight into IoT and aid them in understanding what IoT is all about, what trends are there in current scenario, what still needs to be addressed and what scope does this technology hold in future. The paper is organized as follows: IoT, hardware components of Smart Switch,LC2148 microprocessor, interfacing of LCD Software components of SS and insight of future scope

2.INTERNET OF THINGS (IoT)

The term IoT came into existence in 1999 in the context of supply chain management, industrial automation, assembly line scheduling etc. But, over a period of time with technology advancement the definition has been more inclusive covering wide range of applications like healthcare, utilities, transport, etc., but the ultimate goal of making computer devices sense information without the aid of human intervention remains the same. The connected objects are aided with Internet enables us to create an environment where we are able to harvest information from the environment and interact with physical world and enable various services for analytics, application control and communication for decision making process in various automated processes. The addition of various embedded devices supporting open standards for wireless communication like Bluetooth, Wi-Fi, RFID etc. and optimization in sensor nodes and devices has transformed the overall scenario of Internet that has enabled us to create smart environment for our day to day living. The worldwide information sharing and diffusion, interconnecting physical objects with computing/ communication capabilities across a wide range of services and technologies can be achieved using IoT technology. The IoT can be viewed as an advanced technology that resides on few basic pillars as mentioned

(i)Anything is identifiable Anytime and Anywhere
(ii)Anything can communicate at Anytime and Anywhere
(iii)Anything interacts Anywhere and at Anytime

FIG 1 IoT

The UART0 Baud Rate Generator block, U0BRG, generates the timing enables used by the UART0 TX block. The U0BRG clock input source is the VPB clock (PCLK). The main clock is divided down per the divisor specified in the U0DLL and U0DLM registers. This divided down clock is a 16x oversample clock, NBAUDOUT. The interrupt interface contains registers U0IER and U0IIR. The interrupt interface receives several one clock wide enables from the U0TX and U0RX blocks. Status information from the U0TX and U0RX is stored in the U0LSR. Control information for the U0TX and U0RX is stored in the U0LCR

UART1 TX Holding Register FIFO (U1THR). The UART1 TX Shift Register(U1TSR) reads the data stored in the U1THR and assembles the data to transmit via the serial output pin, TXD1. The UART1 Baud Rate Generator block, U1BRG, generates the timing enables used by the UART1 TX block. The U1BRG clock input source is the VPB clock (PCLK). The main clock is divided down per the divisor specified in the U1DLL and U1DLM registers. This divided down clock is a 16x oversample clock, NBAUDOUT The modem interface contains registers U1MCR and U1MSR. This interface is responsible for handshaking between a modem peripheral and the UART1

3.HARDWARE COMPONENTS OF SMART SWITCH SS

3.1 Power Supply: This section is meant for supplying Power to all the sections mentioned above. It basically consists of a Transformer to step down the 230V ac to 9V ac followed by diodes. Here diodes are used to rectify the ac to dc. After rectification the obtained rippled dc is filtered using a capacitor Filter. A positive voltage regulator is used to regulate the obtained dc voltage.

3.2 Microcontroller: This section forms the control unit of the whole project. This section basically consists of a Microcontroller with its associated circuitry like Crystal with capacitors, Reset circuitry, Pull up resistors (if needed) and so on. The Microcontroller forms the heart of the project because it controls the devices being interfaced and communicates with the devices according to the program being written.

3.3 MAX 232: The microcontroller can communicate with the serial devices using its single Serial Port. The logic levels at which this serial port operates is TTL logics. But some of the serial devices operate at RS 232 Logic levels. For example PC and GSM etc. So in order to communicate the Microcontroller with either GSM modem or PC, a mismatch between the Logic levels occurs. In order to avoid this mismatch, in other words to match the Logic levels, a Serial driver is used. And MAX 232 is a Serial Line Driver used to establish communication between microcontroller and PC (or GSM)

3.4 LCD Display: This section is basically meant to show up the status of the project. This project makes use of Liquid

Crystal Display to display / prompt for necessary information.

3.5 GPRS: This section consists of a GPRS modem. The modem will communicate with microcontroller using serial communication. The modem is interfaced to microcontroller using MAX 232, a serial driver. The Global Packet Radio Service is a TDMA based digital wireless network technology that is used for connecting directly to internet. GPRS module will help us to post data in the web page directly.

3.6 DC Motor: DC motor is an output for this project. And DC motor is connected to microcontroller. And this motor controlled by the microcontroller with the respective inputs given by us. Its speed will be varied according to the speed set by the switches.

3.7 DC Fan: Dc fan is the output section. Dc fan needs dc supply. So we can directly add the dc motor to micro controller with transistor logic

4.BLOCK DIAGRAM OF SMART SWITCH SS
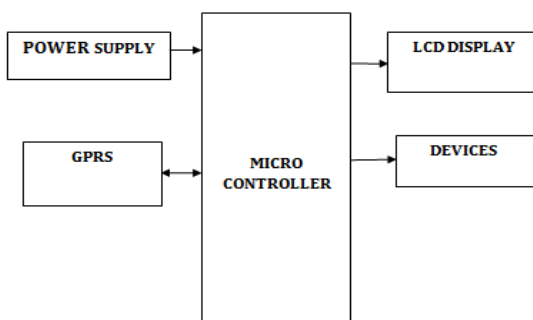
FIG 2 BLOCK DIAGRAM OF SS

4.1 POWER SUPPLY: The power supply is designed to convert high voltage AC mains electricity to a suitable low voltage supply for electronic circuits and other devices. A power supply can by broken down into a series of blocks, each of which performs a particular function. A D.C. power supply which maintains the output voltage constant irrespective of A.C mains fluctuations or load variations is known as "Regulated D.C Power Supply"

4.2 TRANSFORMER:A transformer is an electrical device which is used to convert electrical power from one electrical circuit to another without change in frequency

4.3FULL WAVE RECTIFIER: A bridge rectifier makes use of four diodes in a bridge arrangement to achieve full-wave rectification. This is a widely used configuration, both with individual diodes wired as shown and with single component bridges where the diode bridge is wired internally.

4.4REGULATOR: Voltage regulator ICs is available with fixed (typically 5, 12 and 15V) or variable output voltages. The maximum current they can pass also rates them. Negative

voltage regulators are available, mainly for use in dual supplies. Most regulators include some automatic protection from excessive current ('overload protection') and overheating ('thermal protection'). Many of the fixed voltage regulator ICs have 3 leads and look like power transistors, such as the 7805 +5V 1A regulator shown on the right. The LM7805 is simple to use. You simply connect the positive lead of your unregulated DC power supply (anything from 9VDC to 24VDC) to the Input pin, connect the negative lead to the Common pin and then when you turn on the power, you get a 5 volt supply from the output pin.

5.LIQUID CRYSTAL DISPLAY:

Liquid crystal displays (LCDs) have materials, which combine the properties of both liquids and crystals. Rather than having a melting point, they have a temperature range within which the molecules are almost as mobile as they would be in a liquid, but are grouped together in an ordered form similar to a crystal.

Pin	symbol	I/O	Description
1	Vss	--	Ground
2	Vcc	--	+5V power supply
3	VEE	--	Power supply to control contrast
4	RS	I	RS=0 to select command register RS=1 to select data register
5	R/W	I	R/W=0 for write R/W=1 for read
6	E	I/O	Enable
7	DB0	I/O	The 8-bit data bus
8	DB1	I/O	The 8-bit data bus
9	DB2	I/O	The 8-bit data bus
10	DB3	I/O	The 8-bit data bus
11	DB4	I/O	The 8-bit data bus
12	DB5	I/O	The 8-bit data bus
13	DB6	I/O	The 8-bit data bus
14	DB7	I/O	The 8-bit data bus

FIG 3 PIN DESCRIPTION OF LCD

The LCDs used exclusively in watches, calculators and measuring instruments are the simple seven-segment displays, having a limited amount of numeric data. The recent advances in technology have resulted in better legibility, more information displaying capability and a wider temperature range. These have resulted in the LCDs being extensively used in telecommunications and entertainment electronics. The LCDs have even started replacing the cathode ray tubes (CRTs) used for the display of text and graphics, and also in small TV applications.

Code (hex)	Command to LCD Instruction Register
1	Clear display screen
2	Return home
4	Decrement cursor
6	Increment cursor
5	Shift display right
7	Shift display left
8	Display off, cursor off
A	Display off, cursor on
C	Display on, cursor off
E	Display on, cursor on
F	Display on, cursor blinking
10	Shift cursor position to left
14	Shift cursor position to right
18	Shift the entire display to the left
1C	Shift the entire display to the right
80	Force cursor to beginning of 1st line
C0	Force cursor to beginning of 2nd line
38	2 lines and 5x7 matrix

FIG 4 COMMANDS OF LCD
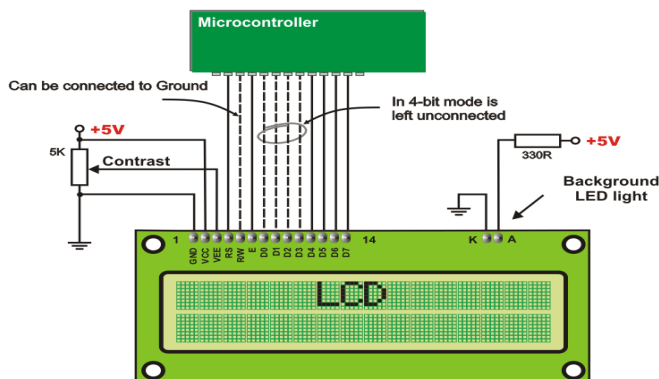
FIG5 INTERFACING OF LCD

6.NETWORK INTERFACE USED IN SS

6.1GPRS (general packet radio service) is a packet-based data bearer service for wireless communication services that is delivered as a network overlay for GSM, CDMA and TDMA (ANSI-I36) networks. GPRS applies a packet radio principle to transfer user data packets in an efficient way between GSM mobile stations and external packet data networks. Packet switching is where data is split into packets that are transmitted separately and then reassembled at the receiving end.

GPRS gives almost instantaneous connection set-up and continuous connection to the Internet. GPRS users will be able to log on to an APN (Access Point Name) and have access to many services or an office network (without the

need to dial-up) and remain continuously connected until they log off, only paying when data is actually transmitted. A physical end-to-end connection is not required because network resources and bandwidth are only used when data is actually transferred. This makes extremely efficient use of available radio bandwidth. Therefore, GPRS packet-based services should cost users less than circuit-switched services since communication channels are being shared and are on a 'as-packets-are-needed' basis rather than dedicated to only one user at a time. It should also be easier to make applications available to mobile users because the faster data rate means that middleware currently needed to adapt applications from fixed line rates to the slower speed of wireless systems will no longer be needed.

6.2GSM (Global System for Mobile) – is known as a 2G (second generation) digital. GSM has maximum data speeds of 9.6 kbit/s and is based on circuit switching technology.
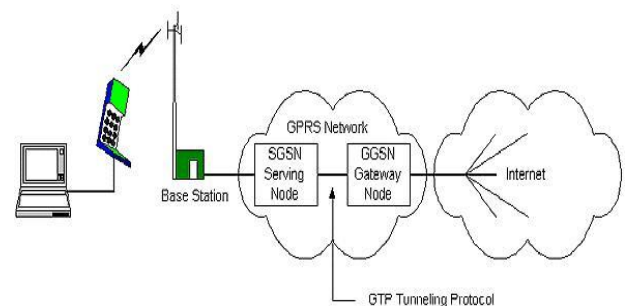

FIG6 GPRS NETWORK

7.SOFTWARE IMPLEMENTATION OF SS

7.1.1 Software used is:
*KEIL µVision using Embedded C programming
*Express PCB for lay out design
*Express SCH for schematic design

7.1.2 Express PCB Express PCB is a Circuit Design Software and PCB manufacturing service. One can learn almost everything you need to know about Express PCB from the help topics included with the programs given.
Details: Express PCB, Version 5.6.0

7.1.3 Express SCH The Express SCH schematic design program is very easy to use. This software enables the user to draw the Schematics with drag and drop options. A Quick Start Guide is provided by which the user can learn how to use it.

Details: Express SCH, Version 5.6.0

a)7.1.4 EMBEDDED C: The programming Language used here in this project is an **Embedded C** Language. This Embedded C Language is different from the generic C language in few things like Data types

b)Access over the architecture addresses.

The Embedded C Programming Language forms the user friendly language with access over Port addresses, SFR Register addresses etc.
Embedded C Data types:
Signed char:

- o   Used to represent the – or + values.

- o   As a result, we have only 7 bits for the magnitude of the signed number, giving us values from -128 to +127.

7.2 KEIL μVision using Embedded C programming

7.2.1 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

7.3 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.

7.4 ARM SOFTWARE:

About KeilARM:

1. Click on the Keil u Vision3 Icon on Desktop
2. The following fig will appear
3. .Click on the Project menu from the title bar
4. .Then Click on New Project
5. .Save the Project by typing suitable project name with no extension in u r own folder sited in either C:\ or D:\
6. Then Click on Save button above.
7. Select the component for u r project. i.e.NXP
8. .Click on the + Symbol beside of NXP
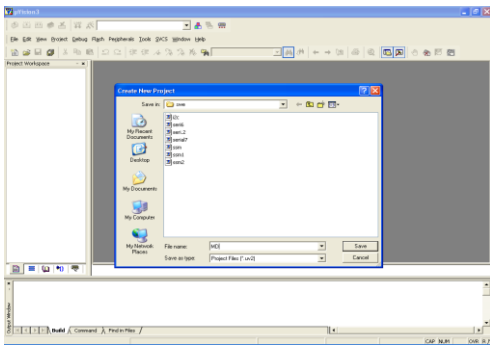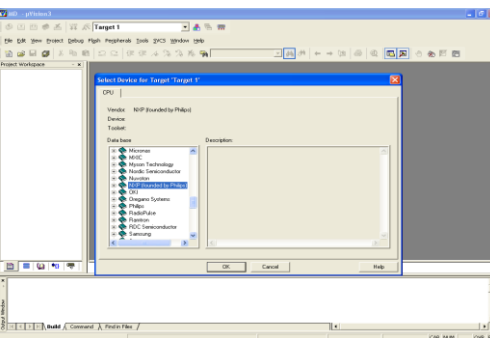
7.5.DETAILED STEPS OF IMPLEMENTATION
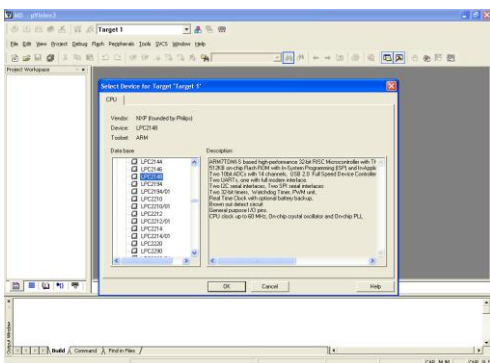
STEP1
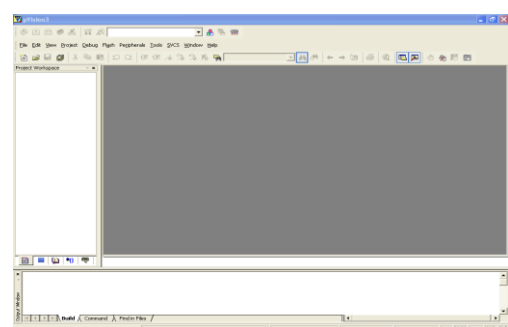
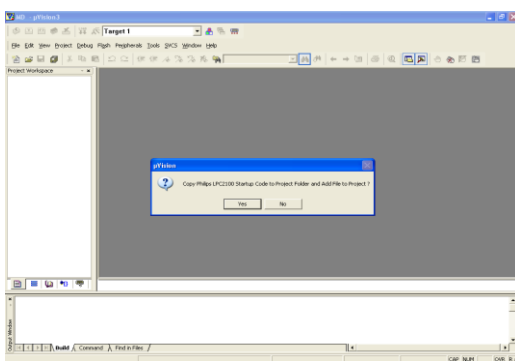**STEP 2**
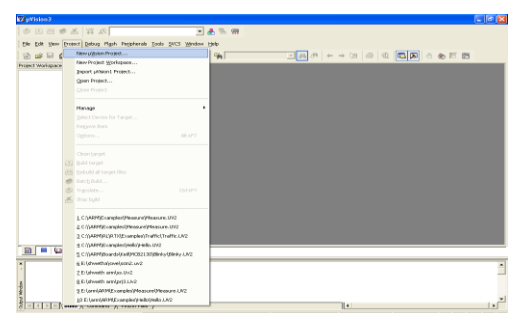
STEP 3

STEP 4

SELECT LC2148

STEP 5

Then Click on "OK"

The Following fig will appear

STEP6

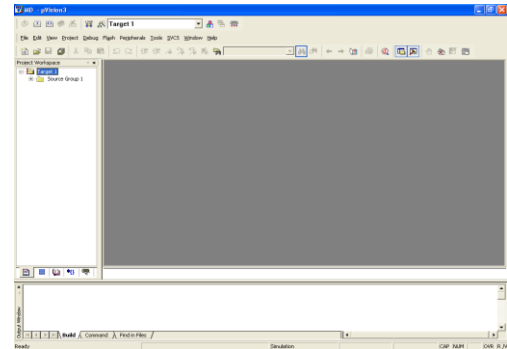## STEP7
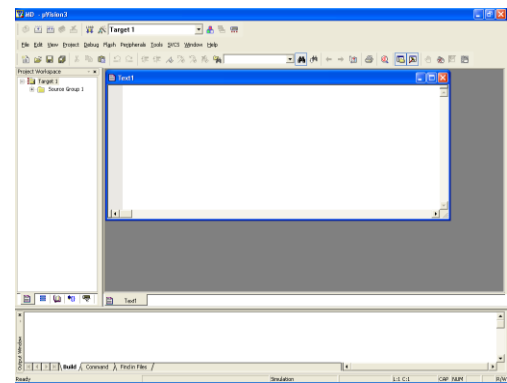
Then Click YES

Now your project is ready to USE

Now double click on the Target1, you would get another option "Source group 1" as shown in next page
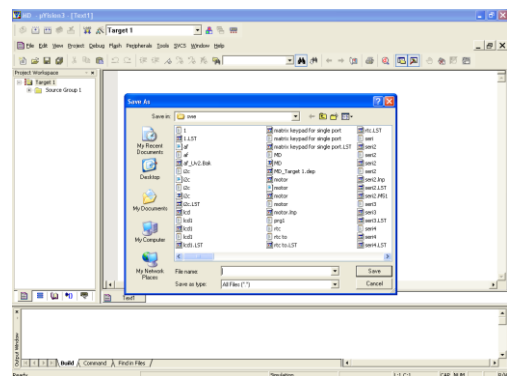
STEP 8

STEP 9
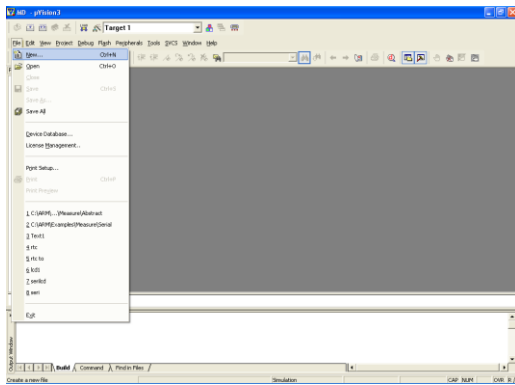
Click on the file option from menu bar and select "new"

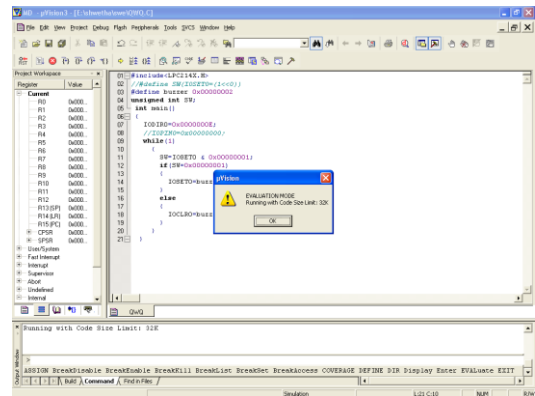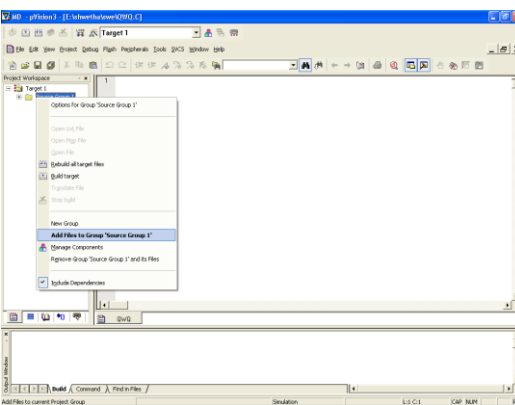The next screen will be as shown in next page, and just maximize it by double clicking on its blue boarder.
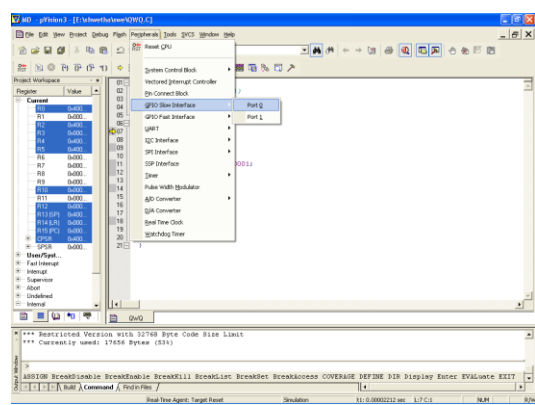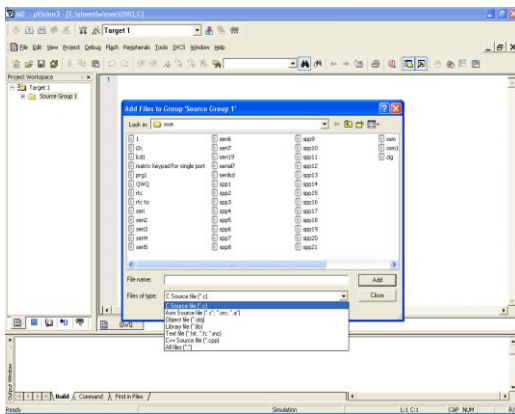
STEP 10

STEP11

STEP 15

STEP 12
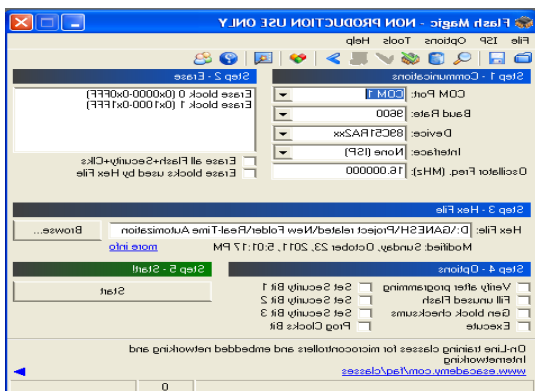

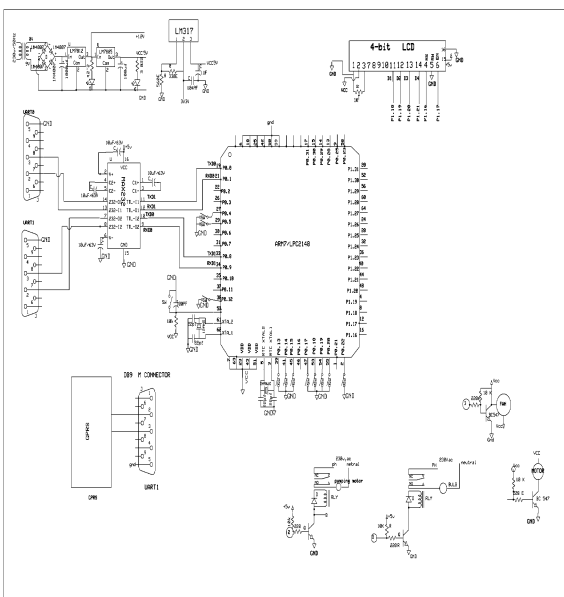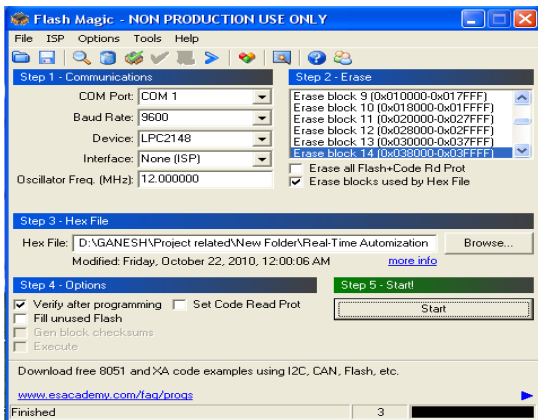**STEP 16**

STEP 13

STEP 17
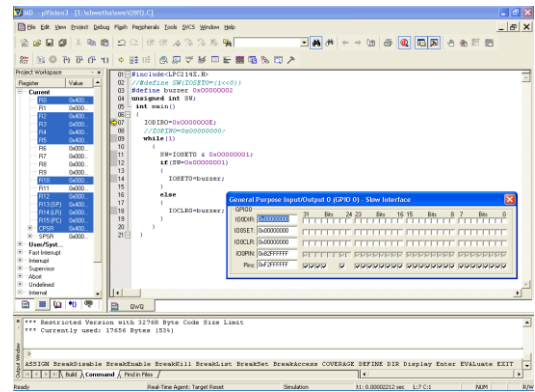
STEP 14
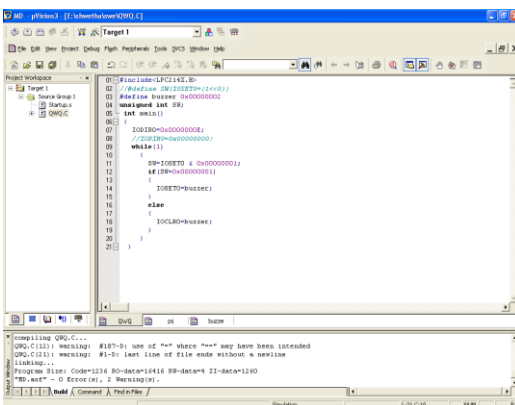
STEP 18

STEP 19

8 CONCLUSIONS

The rapidly advancing mobile communication technology and the decrease in costs make it Possible to incorporate mobile technology into home automation systems. In olden days we were not monitoring the Office and Home appliances by sitting at one place. We had controlled those appliances manually; it takes more time to for controlling. This is disadvantage here like time consuming. Reduction in Manual power, Cost is reducing & Time saving. Low cost easy to implement and low power consumption and controlling is done by using web technology. Household & Industrial applications, Security applications & Used For lab monitoring system. The interconnection of millions of devices in real-time will make the collection of valuable data and provide real-time insights for merchants. Key applications of IOT in retail industry also include supply chain and smart store applications. IOT can bring a big revolution in the process of treatment and diagnosis of diseases. Embedding the medical equipment with IOT devices will help to monitor the patients more effectively. Personal fitness and wellness trackers are already gaining popularity. Remote patient monitoring will also become more efficient with IOT.

IOT connected smart cars are already in the market. Driverless cars and other automobiles are going to rule the future. Already many big companies are pouring money into this IOT connected smart cars and developed them. Soon we might see them on our roads. A study expects that there will be around 94 million connected cars by 2021.

Internet of Things Wearable devices is the future. You can control your car with a smart watch like automatically parking it and for closing or to open the doors. Your wearable device may also detect the dangers around you. We already have devices that track our activity and exercise habits. In near future, we may also be able to easily track our calorie intake and eating habits automatically. So everything is going to be easy except that making everything easy is tough. Let's discuss more on wearable devices in my next blog. Here are some examples of IOT wearable devices that are already available in the market.

Few problems regarding stability intelligence data analysis privacy and security concerns and compatibility poses big challenges for this technology.

FUTURE SCOPE

The experimental results confirm the theory, feasibility and reliability of the card developed, which she performed in a prototype stage and is currently being leading to a commercial stage. As technology is becoming more and more state-of-the-art day by day, and the access of internet in every corner of the world is going to be easily obtainable, so the future of IOT is undoubtedly bright. Achieving greater connectivity is the requirement for progress in the present world; thus the Internet of Things (IoT) has become a vital instrument for interconnecting devices. IoT is going to transform our lives beyond imagination. It would make our life faster, easier and more productive. People now want to have complete access to all products at home when they are on the go or in office. For example, people would be able to switch off the motor or ac running at their home or the lights in car while sitting at their office. That's the kind of smartness IOT technology would bring it to the lifestyle of the people. IoT will surely go a long way with being able to connect to different types of devices and because of the ease of operation that it offers to someone who uses it. We can keep a close eye on things that were beyond our reach like when we are at office, what is going on with our home and kids, even though we have those facilities now too, it would be made lot easier because of the ability to connect to different devices.

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