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Description of Hardware and Software Components with Graphs and Simulation Outputs for the Human Detection and Rescuing Sensor Technology

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Abstract: **The advent of new high-speed technology and the growing computer capacity provided realistic opportunity for new robot controls and realization of new methods of control theory. This technical improvement together with the need for high performance robots created faster, more accurate and more intelligent robots using new robots control devices, new drives and advanced control algorithms. This Project deals with live personal detection robot is based on 8 bit Microcontroller. This Robot follows which is drawn over the surface. Here we are using PIR sensor for detect the which are detect human. The project is mainly used in the DEBRIS for Earth quake rescue. Internally it consists of IR sensors. The infrared sensors are used to sense the live persons. All the above systems are controlled by the Microcontroller. In our project we are using the popular 8 bit microcontroller. The Microcontroller is used to control the motors. It gets the signals from the PIR sensors and it drives the motors according to the sensor inputs. Two DC Gare motors are used to drive the robot.**

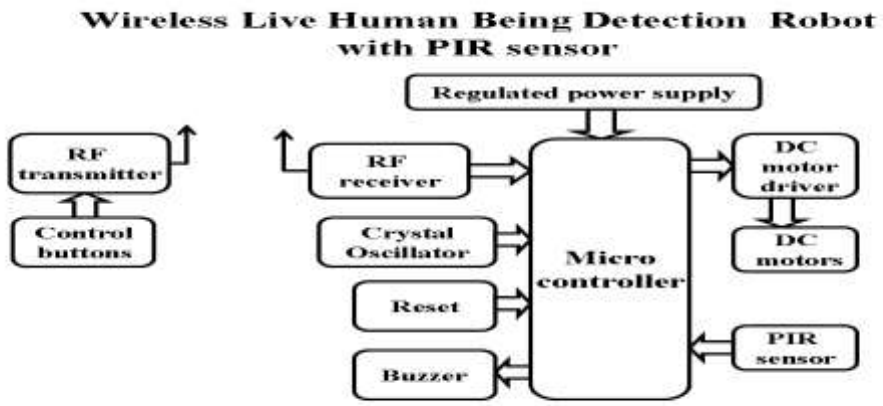
Keywords: **IR sensors, Microcontroller.**

I. INTRODUCTION

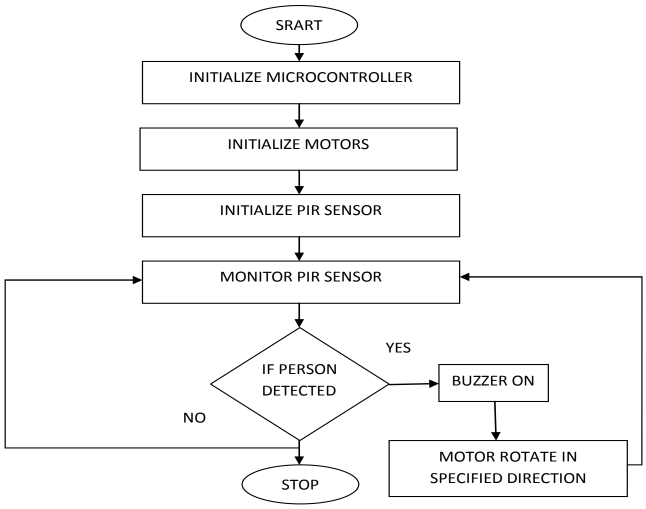
Hardware Requirements

1. POWER SUPPLY
2. MICRO CONTRODLLER (AT89S52)
3. DC GARE MOTOR
4. RELAYS
5. PIR SENSOR
6. SIMULATION
7. TOOL: KEIL MICROVISION
8. LANGUAGE: EMBEDDED “C “LANGUAGE

Block Diagram:



Flow chart and Algorithm



Flow chart and Algorithm

Algorithm

Step 1: Start

Step 2: Initialize micro controller

Step 3: Initialize motors

Step 4: Initialize PIR sensor

Step 5: Monitor PIR sensor

Step 6: If person detected Buzzer on motor rotates in specified direction

Step 7: Monitor PIR sensor

Step 8: Stop

II. DESCRIPTION OF HARDWARE COMPONENTS

Microprocessors brought the concept of programmable devices and made many applications of intelligent equipment. Most applications, which do not need large amount of data and program memory, tended to be costly.The microprocessor system had to satisfy the data and program requirements so, sufficient RAM and ROM are used to satisfy most applications .The peripheral control equipment also had to be satisfied. Therefore, almost all-peripheral chips were used in the design. Because of these additional peripherals cost will be comparatively high.

An example:

8085 chip needs:

AT89S52

In addition, the AT89S52 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port, and interrupt system to continue functioning. The Power Down Mode saves the RAM contents but freezes the oscillator, disabling all other chip functions until the next hardware reset. The Flash program memory supports both parallel programming and in Serial In-System Programming (ISP). The 89S52 is also In-Application Programmable (IAP), allowing the Flash program memory to be reconfigured even while the application is running.

Features

Compatible with MCS-51® Products

• 8K Bytes of In-System Programmable (ISP) Flash Memory

– Endurance: 1000 Write/Erase Cycles

• 4.0V to 5.5V Operating Range

• Fully Static Operation: 0 Hz to 33 MHz

• Three-level Program Memory Lock

• 256 x 8-bit Internal RAM

• 32 Programmable I/O Lines

• Three 16-bit Timer/Counters

• Eight Interrupt Sources

• Full Duplex UART Serial Channel

• Low-power Idle and Power-down Modes

• Interrupt Recovery from Power-down Mode

• Watchdog Timer

• Dual Data Pointer

-Power-off Flag

The 8052 Oscillator and Clock:

The heart of the 8051 circuitry that generates the clock pulses by which all the internal all internal operations are synchronized. Pins XTAL1 And XTAL2 is provided for connecting a resonant network to form an oscillator. Typically a quartz crystal and capacitors are employed. The crystal frequency is the basic internal clock frequency of the microcontroller. The manufacturers make 8051 designs that run at specific minimum and maximum frequencies typically 1 to 16 MHz.

Memories

Types of memory:

The 8052 have three general types of memory. They are on-chip memory, external Code memory and external Ram. On-Chip memory refers to physically existing memory on the micro controller itself. External code memory is the code memory that resides off chip. This is often in the form of an external EPROM. External RAM is the Ram that resides off chip. This often is in the form of standard static RAM or flash RAM.

a) Code memory

Code memory is the memory that holds the actual 8052 programs that is to be run. This memory is limited to 64K. Code memory may be found on-chip or off-chip. It is possible to have 8K of code memory on-chip and 60K off chip memory simultaneously. If only off-chip memory is available then there can be 64K of off chip ROM. This is controlled by pin provided as EA

b) Internal RAM

The 8052 have a bank of 256 bytes of internal RAM. The internal RAM is found on-chip. So it is the fastest Ram available. And also it is most flexible in terms of reading and writing. Internal Ram is volatile, so when 8051 is reset, this memory is cleared. 256 bytes of internal memory are subdivided. The first 32 bytes are divided into 4 register banks. Each bank contains 8 registers. Internal RAM also contains 256 bits, which are addressed from 20h to 2Fh. These bits are bit addressed i.e. each individual bit of a byte can be addressed by the user. They are numbered 00h to FFh. The user may make use of these variables with commands such as SETB and CLR.

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Special Function registered memory:

Special function registers are the areas of memory that control specific functionality of the 8052 micro controller.

a) Accumulator (0E0h)

As its name suggests, it is used to accumulate the results of large no of instructions. It can hold 8 bit values.

b) B registers (0F0h)

The B register is very similar to accumulator. It may hold 8-bit value. The b register is only used by MUL AB and DIV AB instructions. In MUL AB the higher byte of the product gets stored in B register. In div AB the quotient gets stored in B with the remainder in A.

C) Stack pointer (81h)

The stack pointer holds 8-bit value. This is used to indicate where the next value to be removed from the stack should be taken from. When a value is to be pushed onto the stack, the 8052 first store the value of SP and then store the value at the resulting memory location. When a value is to be popped from the stack, the 8052 returns the value from the memory location indicated by SP and then decrements the value of SP.

d) Data pointer

The SFRs DPL and DPH work together work together to represent a 16-bit value called the data pointer. The data pointer is used in operations regarding external RAM and some instructions code memory. It is a 16-bit SFR and also an addressable SFR.

e) Program counter

The program counter is a 16 bit register, which contains the 2 byte address, which tells the 8052 where the next instruction to execute to be found in memory. When the 8052 is initialized PC starts at 0000h. And is incremented each time an instruction is executes. It is not addressable SFR.

f) PCON (power control, 87h)

The power control SFR is used to control the 8051's power control modes. Certain operation modes of the 8051 allow the 8051 to go into a type of "sleep mode" which consumes much lee power.

g) TCON (timer control, 88h)

The timer control SFR is used to configure and modify the way in which the 8051's two timers operate. This SFR controls whether each of the two timers is running or stopped and contains a flag to indicate that each timer has overflowed. Additionally, some non-timer related bits are located in TCON SFR. These bits are used to configure the way in which the external interrupt flags are activated, which are set when an external interrupt occurs.

TF1	TR1	TF0	TR0	IE1	IT1	IE0	IT0

h) TMOD (Timer Mode, 89h)

The timer mode SFR is used to configure the mode of operation of each of the two timers. Using this SFR your program may configure each timer to be a 16-bit timer, or 13 bit timer, 8-bit auto reload timer, or two separate timers. Additionally you may configure the timers to only count when an external pin is activated or to count "events" that are indicated on an external pin.

Gate	C/T	M1	M0	Gate	C/T	M1	M0
TIMER 1				TIMER 0			

i) TO (Timer 0 low/high, address 8A/8C h)

These two SFRs taken together represent timer 0. Their exact behavior depends on how the timer is configured in the TMOD SFR; however, these timers always count up. What is configurable is how and when they increment in value.

j) T1 (Timer 1 Low/High, address 8B/ 8D h)

These two SFRs, taken together, represent timer 1. Their exact behavior depends on how the timer is configured in the TMOD SFR; however, these timers always count up..

k) P0 (Port 0, address 90h, bit addressable)

This is port 0 latch. Each bit of this SFR corresponds to one of the pins on a micro controller. Any data to be outputted to port 0 is first written on P0 register. For e.g., bit 0 of port 0 is pin P0.0, bit 7 is pin p0.7. Writing a value of 1 to a bit of this SFR will send a high level on the corresponding I/O pin whereas a value of 0 will bring it to low level.

l) P1 (port 1, address 90h, bit addressable)

This is port latch1. Each bit of this SFR corresponds to one of the pins on a micro controller. Any data to be outputted to port 0 is first written on P0 register. For e.g., bit 0 of port 0 is pin P1.0, bit 7 is pin P1.7. Writing a value of 1 to a bit of this SFR will send a high level on the corresponding I/O pin whereas a value of 0 will bring it to low level

m) P2 (port 2, address 0A0h, bit addressable):

This is a port latch2. Each bit of this SFR corresponds to one of the pins on a micro controller. Any data to be outputted to port 0 is first written on P0 register. For e.g., bit 0 of port 0 is pin P2.0, bit 7 is pin P2.7. Writing a value of 1 to a bit of this SFR will send a high level on the corresponding I/O pin whereas a value of 0 will bring it to low level.

n) P3 (port 3, address B0h, bit addressable) :

The Interrupt Enable SFR is used to enable and disable specific interrupts. The low 7 bits of the SFR are used to enable/disable the specific interrupts, where the MSB bit is used to enable or disable all the interrupts. Thus, if the high bit of IE is 0 all interrupts are disabled regardless of whether an individual interrupt is enabled by setting a lower bit.

EA	--	ET2	ES	ET1	EX1	ET0	EX0

p) IP (Interrupt Priority, 0B8h)

The interrupt priority SFR is used to specify the relative priority of each interrupt. On 8051, an interrupt maybe either low or high priority. An interrupt may interrupt interrupts. For e.g., if we configure all interrupts as low priority other than serial interrupt. The serial interrupt always interrupts the system, even if another interrupt is currently executing. However, if a serial interrupt is executing no other interrupt will be able to interrupt the serial interrupt routine since the serial interrupt routine has the highest priority.

--	--	PT2	PS	PT1	PX1	PT0	PX0

q) PSW (Program Status Word, 0D0h)

The program Status Word is used to store a number of important bits that are set and cleared by 8052 instructions. The PSW SFR contains the carry flag, the auxiliary carry flag, the parity flag and the overflow flag. Additionally, it also contains the register bank select flags, which are used to select, which of the "R" register banks currently in use.

CY	AC	F0	RS1	RS0	OV	--	P

r) SBUF (Serial Buffer, 99h)

SBUF is used to hold data in serial communication. It is physically two registers. One is writing only and is used to hold data to be transmitted out of 8052 via TXD. The other is read only and holds received data from external sources via RXD. Both mutually exclusive registers use address 99h.

I/O ports:

One major feature of a microcontroller is the versatility built into the input/output (I/O) circuits that connect the 8052 to the outside world. The main constraint that limits numerous functions is the number of pins available in the 8051 circuit. The DIP had 40 pins and the success of the design depends on the flexibility incorporated into use of these pins. For this reason, 24 of the pins may each used for one of the two entirely different functions which depend, first, on what is physically connected to it and, then, on what software programs are used to "program" the pins.

PORT 0

Port 0 pins may serve as inputs, outputs, or, when used together, as a bi directional low-order address and data bus for external memory. To configure a pin as input, 1 must be written into the corresponding port 0 latch by the program. When used for interfacing with the external memory, the lower byte of address is first sent via PORT0, latched using Address latch enable (ALE) pulse and then the bus is turned around to become the data bus for external memory.

PORT 1

Port 1 is exclusively used for input/output operations. PORTS 1 pin have no dual function. When a pin is to be configured as input, 1 is to be written into the corresponding Port 1 latch.

PORT 2

Port 2 maybe used as an input/output port. It may also be used to supply a high –order address byte in conjunction with Port 0 low-order byte to address external memory. Port 2 pins are momentarily changed by the address control signals when supplying the high byte a 16-bit address. Port 2 latches remain stable when external memory is addressed, as they do not have to be turned around (set to 1) for data input as in the case for Port 0.

PORT 3

Port 3 may be used to input /output port. The input and output functions can be programmed under the control of the P3 latches or under the control of various special function registers. Unlike Port 0 and Port 2, which can have external addressing functions and change all eight-port b se, each pin of port 3 maybe individually programmed to be used as I/O or as one of the alternate functions. The Port 3 alternate uses are:

Interrupts:

The AT89S52 has a total of six interrupt vectors: two external interrupts (INT0 and INT1), three timer interrupts (Timers0, 1, and 2), and the serial port interrupt. These interrupts are all shown in Figure 10. Each of these interrupt sources can be individually enabled or disabled by setting or clearing a bit in Special Function Register IE. IE also contains a global disable bit, EA, which disables all interrupts at once. Note that Table 5 shows that bit position IE.6 is unimplemented.

Timer 2 interrupt is generated by the logical OR of bits TF2 and EXF2 in register T2CON. Neither of these flags is cleared by hardware when the service routine is vectored to. In fact, the service routine may have to determine whether it was TF2 or EXF2 that generated the interrupt, and that bit will have to be cleared in software. The Timer 0 and Timer 1 flags, TF0 and TF1, are set at S5P2 of the cycle in which the timers overflow. The values are then polled by the circuitry in the next cycle. However, the Timer 2 flag, TF2, is set at S2P2 and is polled in the same cycle in which the timer overflows.

Power Supply

Transformer:

A transformer steps down high voltage AC mains to low voltage AC. Here we are using a center-tap transformer whose output will be sinusoidal with 36volts peak to peak value.The low voltage AC output is suitable for lamps, heaters and special AC motors. It is not suitable for electronic circuits unless they include a rectifier and a smoothing capacitor. The transformer output is given to the rectifier circuit.

Rectifier:

A rectifier converts AC to DC, but the DC output is varying. There are several types of rectifiers; here we use a bridge rectifier.

The Bridge rectifier is a circuit, which converts an ac voltage to dc voltage using both half cycles of the input ac voltage. The Bridge rectifier circuit is shown in the figure. The circuit has four diodes connected to form a bridge. The ac input voltage is applied to the diagonally opposite ends of the bridge. The load resistance is connected between the other two ends of the bridge.

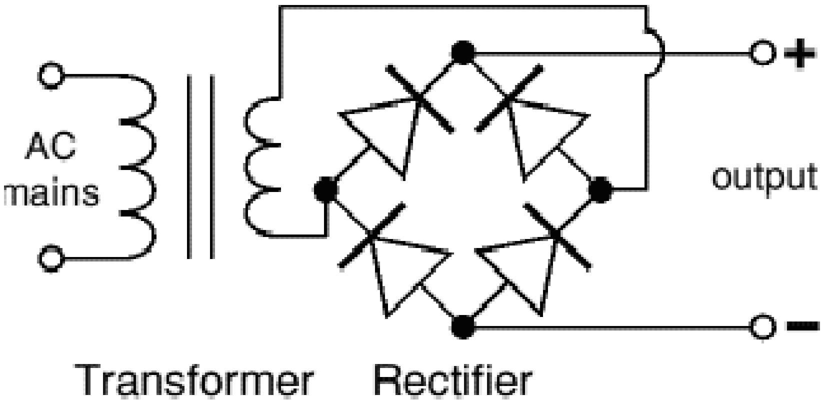


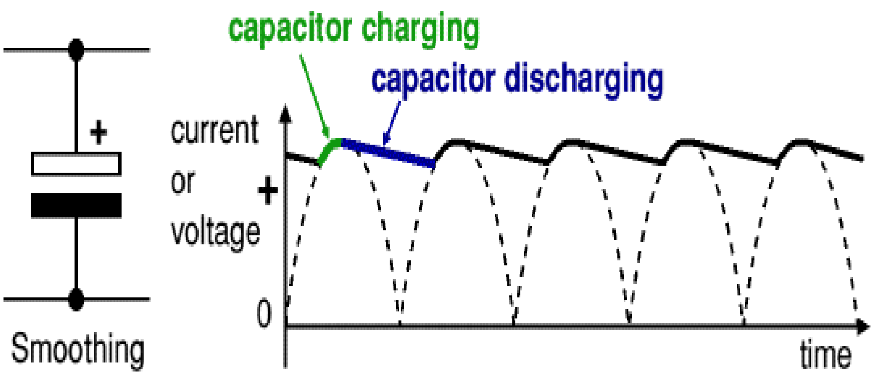
Figure 2.3 Rectifier circuit

The varying DC output is suitable for lamps, heaters and standard motors. It is not suitable for lamps, heaters and standard motors. It is not suitable for electronic circuits unless they include a smoothing capacitor.

***Smoothing or filtering*:**

The smoothing block smoothes the DC from varying greatly to a small ripple and the *ripple voltage* is defined as the deviation of the load voltage from its DC value. Smoothing is also named as filtering.

Filtering is frequently effected by shunting the load with a capacitor. The action of this system depends on the fact that the capacitor stores energy during the conduction period and delivers this energy to the loads during the no conducting period. In this way, the time during which the current passes through the load is prolonging Ted, and the ripple is considerably decreased. The action of the capacitor is shown with the help of waveform.



Smoothing action of capacitor

Regulator:

Regulator eliminates ripple by setting DC output to a fixed voltage. Voltage regulator ICs are available with fixed (typically 5V, 12V and 15V) or variable output voltages. Negative voltage regulators are also available

Many of the fixed voltage regulator ICs has 3 leads (input, output and high impedance). They include a hole for attaching a heat sink if necessary. Zener diode is an example of fixed regulator which is shown here.

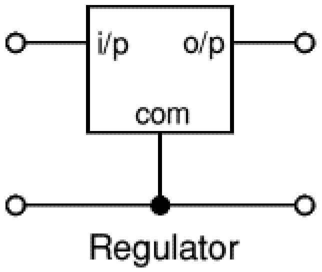
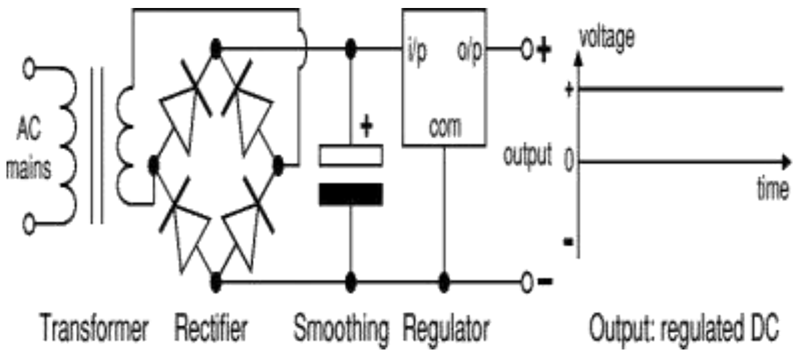


Figure: Regulator

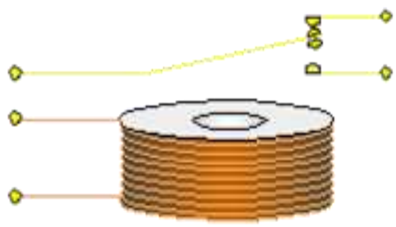
Transformer + Rectifier + Smoothing + Regulator:



Helical gear motor:

A unit which creates mechanical energy from electrical energy and which transmits mechanical energy through the gearbox at a reduced speed.

A gearhead and motor combination to reduce the speed of the motor to obtain the desired speed or torque.

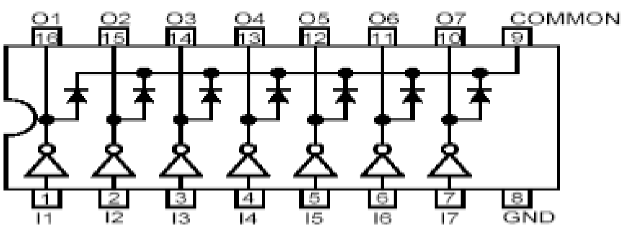


Gearmotors of all types and sizes including single / multiphase, universal, servo, induction and synchronous types. DC gearmotors are configured in many types and sizes, including brushless and servo. A DC gearmotor consists of a rotor and a permanent magnetic field stator and an integral gearbox or gearhead. The magnetic field is maintained using either permanent magnets or electromagnetic windings. DC motors are most commonly used in variable speed and torque applications. A DC servomotor has an output shaft that can be positioned by sending a coded signal to the motor. As the input to the motor changes, the angular position of the output shaft changes as well.

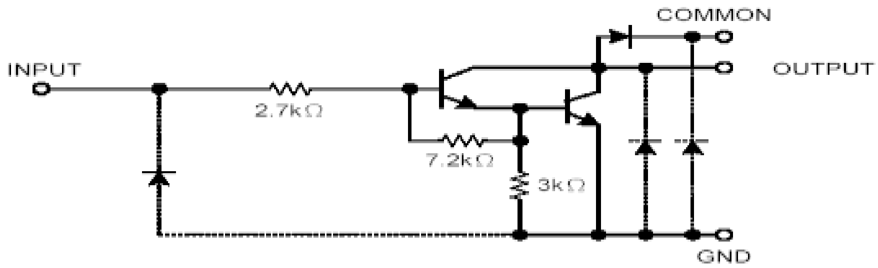
ULN2003

ULN is mainly suited for interfacing between low-level circuits and multiple peripheral power loads,. The series ULN20XX high voltage, high current darlington arrays feature continuous load current ratings. The driving circuitry n-turn decodes the coding and conveys the necessary data to the stepper motor, this module aids in the movement of the arm through steppers

- **PIN CONNECTION**



- **BLOCK DIAGRAM**



- The driver makes use of the ULN2003 driver IC, which contains an array of 7 power Darlington arrays, each capable of driving 500mA of current. At an approximate duty cycle, depending on ambient temperature and number of drivers turned on, simultaneously typical power loads totaling over 230w can be controlled.
- The device has base resistors, allowing direct connection to any common logic family. All the emitters are tied together and brought out to a separate terminal. Output protection diodes are included; hence the device can drive inductive loads with minimum extra components. Typical loads include relays, solenoids, stepper motors, magnetic print hammers, multiplexed LED, incandescent displays and heaters.

Darlington Pair

- A Darlington pair is two transistors that act as a single transistor but with a much higher current gain.
- **What is current gain?**
- Transistors have a characteristic called current gain. This is referred to as its hFE. The amount of current that can pass through the load when connected to a transistor that is turned on equals the input current x the gain of the transistor (hFE) The current gain varies for different transistor and can be looked up in the data sheet for the device. Typically it may be 100. This would mean that the current available to drive the load would be 100 times larger than the input to the transistor.

Why use a Darlington Pair?

In some application the amount of input current available to switch on a transistor is very low. This may mean that a single transistor may not be able to pass sufficient current required by the load.

As stated earlier this equals the input current x the gain of the transistor (hFE). If it is not be possible to increase the input current then we need to increase the gain of the transistor. This can be achieved by using a Darlington Pair.

A Darlington Pair acts as one transistor but with a current gain that equals:

Total current gain (hFE total) = current gain of transistor 1 (hFE t1) x current gain of transistor 2 (hFE t2)

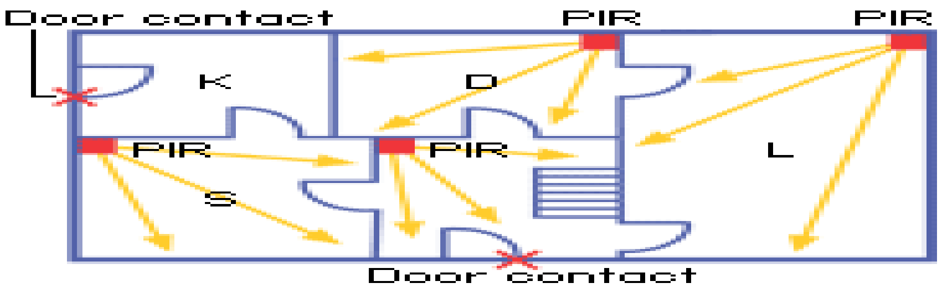
So for example if you had two transistors with a current gain (hFE) = 100:

(hFE total) = 100 x 100

(hFE total) = 10,000

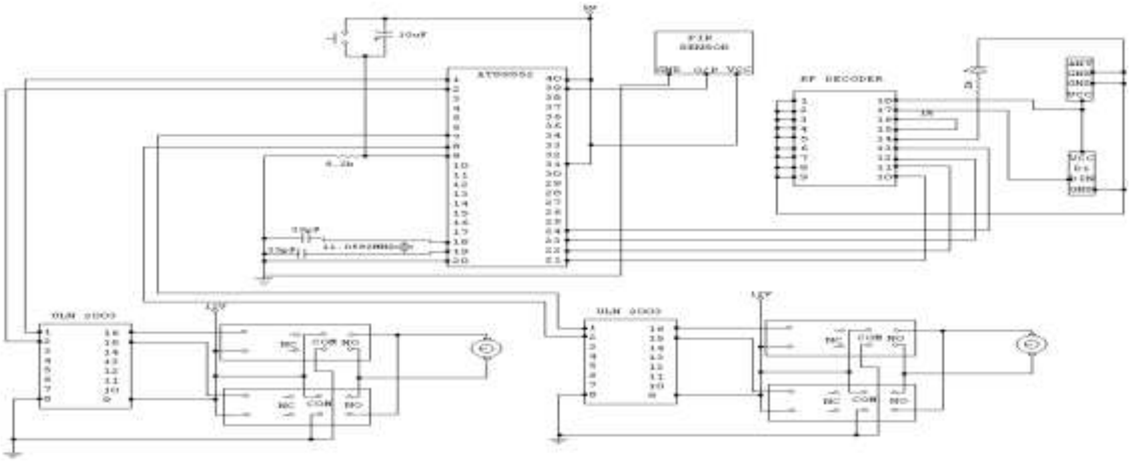
PIR Sensor

More advanced security systems include **passive infrared** (PIR) motion detectors. The "motion sensing" feature on most lights (and security systems) is a **passive** system that detects **infrared energy**. These sensors are therefore known as **PIR** (passive infrared) detectors or **pyro electric** sensors. These sensors "see" the infrared energy emitted by an intruder's body heat. When an intruder walks into the field of view of the detector, the sensor detects a sharp increase in infrared energy. If you have a burglar alarm with motion sensors, you may have noticed that the motion sensors cannot "see" you when you are outside looking through a window. That is because glass is not very transparent to infrared energy. This, by the way, is the basis of a greenhouse. Light passes through the glass into the greenhouse and heats things up inside the greenhouse. The glass is then opaque to the infrared energy these heated things are emitting, so the heat is trapped inside the greenhouse. It makes sense that a motion detector sensitive to infrared energy cannot see through glass windows.

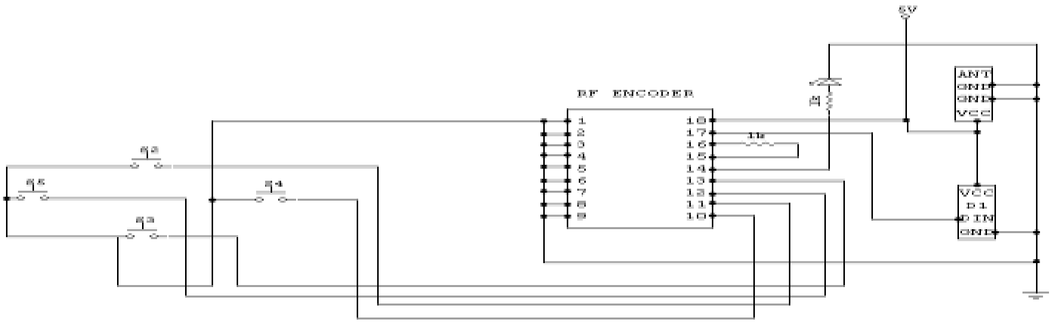


Circuit Diagram

RECEIVER



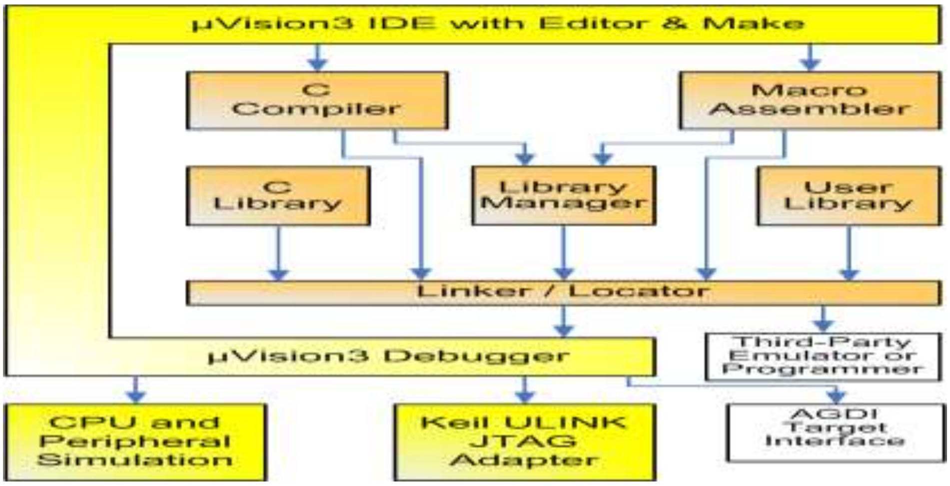
TRANSMITTER



Software Development and Coding

In this chapter the software used and the language in which the program code is defined is mentioned and the program code dumping tools are explained. The chapter also documents the development of the program for the application. This program has been termed as "Source code". Before we look at the source code we define the two header files that we have used in the code.

Tools Used:



Keil Software- internal stages

Keil development tools for the 8051 Microcontroller Architecture support every level of software developer from the professional applications

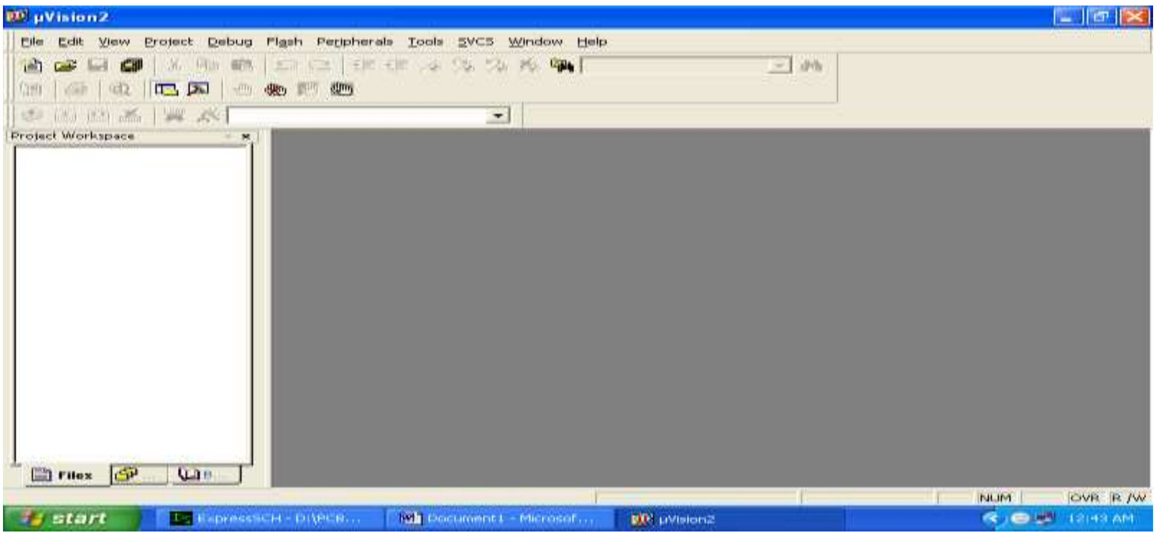
C51 Compiler & A51 Macro Assembler:

Source files are created by the µVision IDE and are passed to the C51 Compiler or A51 Macro Assembler. The compiler and assembler process source files and create replaceable object files.

The Keil C51 Compiler is a full ANSI implementation of the C programming language that supports all standard features of the C language. In addition, numerous features for direct support of the 8051 architecture have been added.

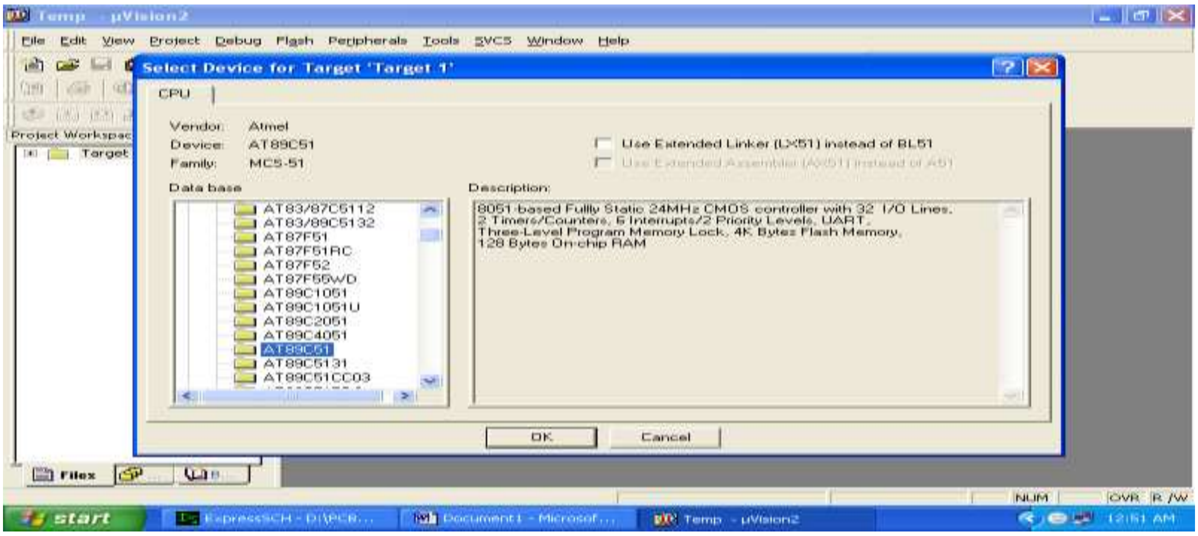
SOURCE CODE

1. Click on the Keil uVision Icon on Desktop
2. The following fig will appear

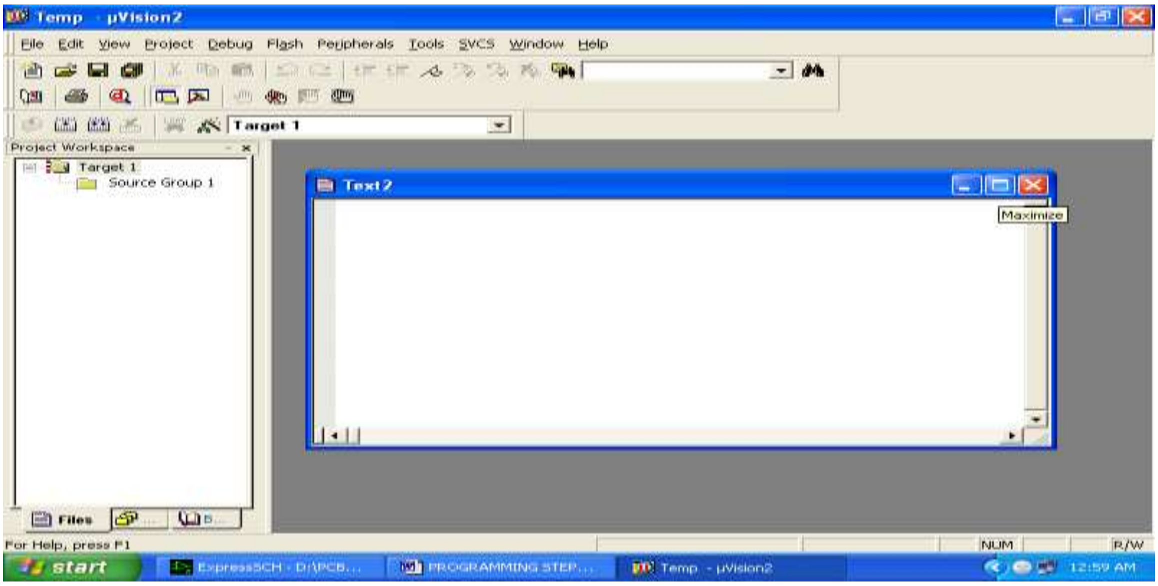


3. Click on the Project menu from the title bar
4. Then Click on New Project
5. Save the Project by typing suitable project name with no extension in u r own folder sited in either C:\ or D:\
6. Then Click on Save button above.
7. Select the component for u r project. i.e. Atmel……
8. Click on the + Symbol beside of Atmel

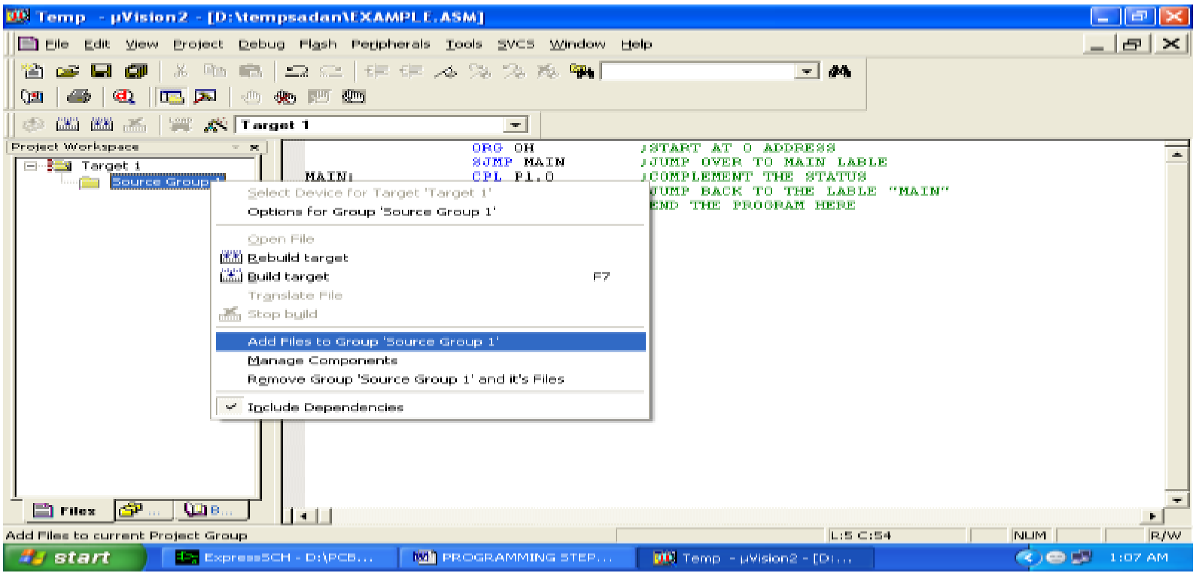
9. Select AT89C51 as shown below



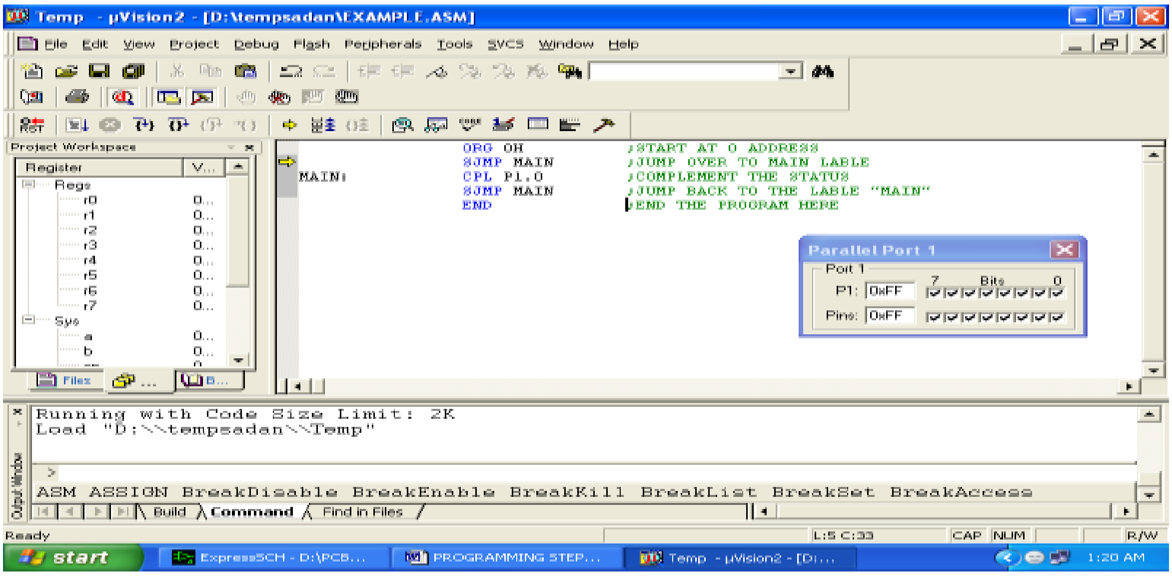
10. Then Click on "OK"
11. then Click either YES or NO………mostly "NO"
12. Now your project is ready to USE
13. Now double click on the Target1, you would get another option "Source group 1" as shown in next page.
14. Click on the file option from menu bar and select "new"
15. The next screen will be as shown in next page, and just maximize it by double clicking on its blue boarder.



16. Now start writing program in either in “C” or “ASM”
17. For a program written in Assembly, then save it with extension “. asm” and for “C” based program save it with extension “ .C”
18. Now right click on Source group 1 and click on “**Add files to Group Source**”



19. Now you will get another window, on which by default “C” files will appear.
20. Now select as per your file extension given while saving the file.
21. Click only one time on option “ADD”
22. Now Press function key F7 to compile. Any error will appear if so happen.
23. if the file contains no error, then press Control+F5 simultaneously.
24. Then Click “OK”
25. Now Click on the Peripherals from menu bar, and check your required port as shown in fig below
26. Drag the port a side and click in the program file.



27. Now keep Pressing function key "F11" slowly and observe.
28. You are running your program successfully

Requirements:

Flash Magic works on any versions of Windows, except Windows 95. 10Mb of disk space is required. As mentioned earlier, we are automating two different routines in our project and hence we used the method of polling to continuously monitor those tasks and act accordingly

III. CONCLUSION

The project "HUMAN DETECTION ROBOT" has been successfully designed and tested. Integrating features of all the hardware components used have developed it. Presence of all reasoned out and placed carefully thus contributing to the best working. The controller makes use of a PIR based input sensor to sense the human being and give us an alert indication. Also use of a remote which is used to control the robot. Hence this project provides best solution for the human to detect terrorist/thief inside the building.

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