Technocane – A guide for blind

Major Project Report
submitted in partial fulfilment of the requirement for the award of the degree of

Bachelor of Technology

In

Electronics and Communication

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Declaration

We, ***Ankita Sakhuja(A50105111078)*** , and , ***Ketan Lohani(A50105111037) ,*** students of Bachelor of Technology in Department of Electronics and Communication Engineering, Amity School of Engineering and Technology, Amity University Haryana, hereby declare that we are fully responsible for the information and results provided in this project report titled ***"Technocane"*** submitted to Department of Electronics and Communication Engineering, Amity School of Engineering and Technology, Amity University Gurgaon ,Haryana for the partial fulfillment of the requirement for the award of the degree of ***Bachelor of Technology in Electronics and Communication Engineering***. We have taken care, in all respects to honour the intellectual property rights and have acknowledged the contributions of others for using them. We further declare that in case of any violation of intellectual property rights or copyrights, we will be fully responsible for the same. Our supervisor, Head of department and the Institute should not be held for full or partial violation of copyrights if found at any stage of my degree.

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Certificate

This is to certify that the work in the project report entitled ***“Technocane”*** by ***Ankita Sakhuja*** (***A50105111078) and Ketan Lohani (A50105111037)*** is a bonafide record of project work carried out by them under my supervision and guidance in partial fulfilment of the requirements for the award of the degree of Bachelor of Technology in Electronics and Communication Engineering in the Department of Electronics and Communication Engineering, Amity School of Engineering and Technology, Amity University Haryana, Gurgaon. Neither this project nor any part of it has been submitted for any degree or academic award elsewhere.

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It would be unfair if we do not mention the invaluable contribution and timely cooperation extended by staff members of our department.

We would like to thank our Institution without which this project would have been a distant reality. We also extend out heartfelt thanks to our family and well-wishers.

Department of Electronics and Communication

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Abstract

"Technocane" as a working system involves a theoretical model and a system concept to provide a smart electronic aid for blind people. The system is intended to provide overall measures – Artificial vision and object detection. The aim of the overall system is to provide a low cost and efficient navigation aid for blind which gives a sense of artificial vision by providing information about the environmental scenario of static and dynamic objects around them. It consists of a simple walking stick equipped with sensors to give information about the environment Ultrasonic sensors are used to calculate distance of the obstacles around the blind person to guide the user towards the available path. Output is in the form of alarm which the blind person can hear. The hardware consists of Atmega8 microcontroller, sensors and alarm. This project uses regulated 5V, 750mA power supply. Unregulated 12V DC is used for relay. The Technocane is a simple and purely mechanical device to detect static obstacles on the ground, uneven surfaces, holes and steps through simple tactile-force feedback. This device is light, portable, but its range is limited to its own size and is not usable for dynamic components. The main component of this system is the infrared sensor and ultrasound sensor which is used to scan a predetermined area around blind by emitting-reflecting waves. The reflected signals received from the barrier objects are used as inputs to microcontroller . This project works very well even in night and day timings, irrespective of the lighting intensity. This project is reliable and effective.

KEYWORDS: Technocane, Ultrasonic sensor ,Atmega8, IR sensor

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Chapter 1

INTRODUCTION

1.1 Background

Vision is the most important part of human physiology as 83% of information human being gets from the environment is via sight. The 2011 statistics by the World Health Organization (WHO) estimates that there are 285 billion people in world with visual impairment, 39 billion of which are blind and 246 with low vision . The traditional and oldest mobility aids for persons with visual impairments are the walking cane (also called white cane or stick) and guide dogs. The most important drawbacks of these aids are necessary skills and training phase, range of motion and very little information conveyed. With the rapid advances of modern technology, both in hardware and software front has brought potential to provide intelligent navigation capabilities. Recently there has been a lot of Electronic Travel Aids (ETA) designed and devised to help the blind navigate independently and safely. Also high-end technological solutions have been introduced recently to help blind persons navigate independently .Many blind guidance systems use ultrasound because of its immunity to the environmental noise. Another reason why ultrasonic is popular is that the technology is relatively inexpensive, and also ultrasound emitters and detectors are small enough to be carried without the need for complex circuit.

1.2 Objective

The main objective of this project is to provide artificial guidance to the visually impaired people with the help of a microcontroller ,sensors, and, an alarm physically mounted on a stick.

The objective of the research project was to identify and analyze technologies that aid the blind and visually impaired in educational preparation for work, and in employment. The research also aimed at identifying strategies that either assist or aid employed blind and visually impaired workers in developing their skills to participate at higher levels in their current employment positions. As well, the research aimed to provide conclusions and recommendations that would inform the development of better education mechanisms for the blind and visually impaired.

1.3 Current technology

The traditional and oldest mobility aids for persons with visual impairments are the walking cane (also called white cane or stick) and guide dogs. The most important drawbacks of these aids are necessary skills and training phase, range of motion and very little information conveyed.

With the rapid advances of modern technology, both in hardware and software front has brought potential to provide intelligent navigation capabilities. Recently there has been a lot of Electronic Travel Aids (ETA) designed and devised to help the blind navigate independently and safely.

Also high-end technological solutions have been introduced recently to help blind persons navigate independently. In the current system following is lagging :

- Current system works on static methods
- Current system is very inefficient
- Current system conveys a very little information

1.4 Proposed Technology

The objective of the research project was to identify and analyze technologies that aid the blind and visually impaired in educational preparation for work, and in employment.

The research also aimed at identifying strategies that either assist or aid employed blind and visually impaired workers in developing their skills to participate at higher levels in their current employment positions.

As well, the research aimed to provide conclusions and recommendations that would inform the development of better education mechanisms for the blind and visually impaired.

- System provides more information and guidance
- It is cost effective
- Integrity is expected to be more for this system
- Provides flexibility

Chapter 2

TECHNOLOGIES USED

2.1 Basic Concept

The main component of this system is the infrared sensor and ultrasound sensor which is used to scan a predetermined area around blind by emitting-reflecting waves. The reflected signals received from the barrier objects are used as inputs to microcontroller .This projects works very well even in night and day timings, irrespective of the lighting intensity. This project is reliable and effective. The following block diagram depicts the generalized view of our requirements and assessments.

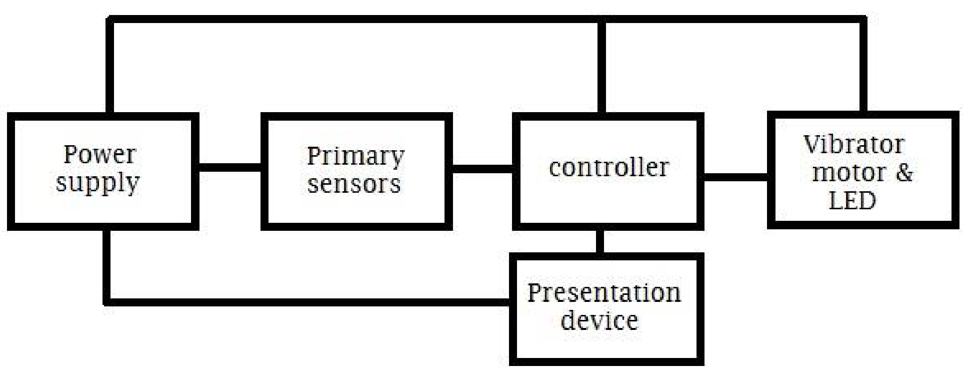

Fig 1 : Generalized Block Diagram of project

2.2 Embedded Systems

The main objective of undertaking this topic in our report is very simple because main mechanism is done by a microcontroller and microcontroller cannot be explained without introducing to Embedded systems.

An embedded system is a system that has software embedded into hardware, which makes system dedicated for an application (s) or specific part of an application or product or part of a larger system. It processes a fixed set of pre-programmed instructions to control electromechanical equipment which may be part of an even larger system (not a computer with keyboard, display, etc).

Furthermore any machinery which has **mechanical parts, electronic circuits and software** can be termed as an **embedded system**.

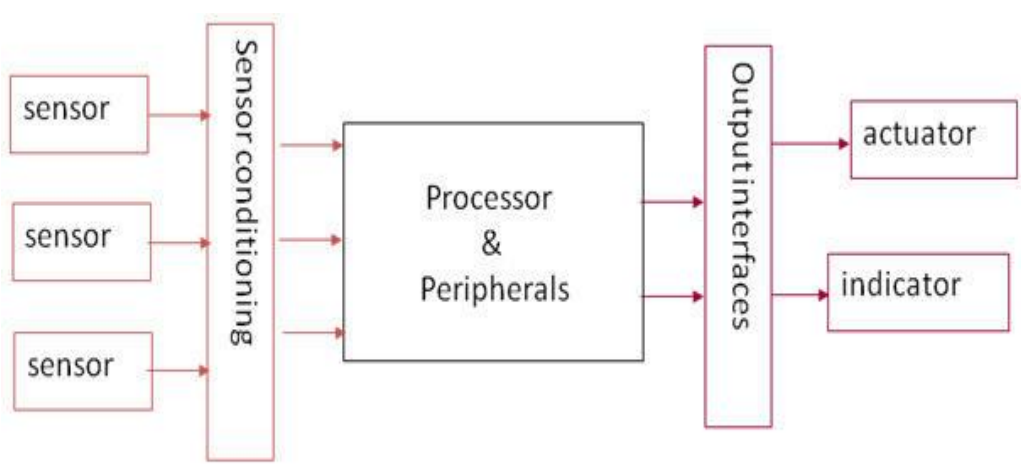

Fig 2 : Block diagram of Embedded system

2.2.1 Elements of an Embedded System

- ***Microcontroller***

Microcontrollers are single chip semi conductor device which is a computer on chip. In other words it is a smaller version of a computer but not a complete computer. Its CPU contains an Arithmetic & Logic Unit (ALU), a Program Counter (PC), a Stack Pointer (SP), registers, a clock and interrupts circuit on a single chip. To make complete micro computer, one must add memory usually ROM and RAM, memory decoder, an oscillator, a number of serial and parallel ports

However, the uC by itself, cannot accomplish much; it needs several external inputs :power, for one; a steady clock signal, for another. Also, the job of programming it has to be accomplished by an external circuit. So typically, a microcontroller is used along with a circuit which provides these things to it; this combination is called a microcontroller board. The AVR microcontroller that you have received, is one such microcontroller board. The actual microcontroller at its heart is the chip called **Atmel8.**

The advantages that AVR offers over other microcontroller boards are largely in terms of reliability of the circuit hardware as well as the ease of programming and using it.

A Microcontroller is designed to cater for large amount of applications and hence is produced in bulk. Using it in an embedded system offers various benefits. Design time is low as only software is to be developed, no digital design is involved. **Typical characteristics of a Microcontroller are relatively high cost, high speeds, higher Power consumption, large architecture, large memory size, onboard flash and cache, an external bus interface for greater memory usage.**

- ***Software***

If hardware forms the body of the embedded systems, software is a soul of embedded systems. The software lends the functionality to an embedded system. Variety of languages has emerged as the tasks to be performed by embedded systems are of quite diverse nature.

- ***Interface to physical world***

Embedded systems interface with the physical world through sensors and Actuators. Sensors act as "senses" for an embedded system, whereas actuators act as "limbs". Varieties of sensors working on variety of sensing principles are used in embedded systems. Light, temperature, acceleration, speed, mass, distance, etc. are common physical parameters which are sensed. Motors are one of the actuators used in many systems.

2.2.2 Application areas of Embedded Systems

- Medical Systems
  - pace maker, patient monitoring systems, injection systems, intensive care units

- Office Equipment
  - printer, copier, fax

- Tools
  - Multimeter , oscilloscope, line tester, GPS

- Banking
  - ATMs, statement printers

- Transportation
  - (Planes/Trains/[Automobiles] and Boats)
  - radar, traffic lights, signaling systems

2.3 Hardware

This project consist of 3 basic function viz. *obstacle judgement, water sensing, and providing assumptions to the user.*

Main hardware component required for this project are listed below:

- ATMEL ATMEGA 8 (an AVR based microcontroller)
- PIR sensor –passive infrared sensors
- Ultrasonic sensors
- Water sensor(two wires)
- Voltage regulator
- LDR sensors
- Power supply
- Master board (PCB) consisting of regular components which subject to change as per the requirements.
- Miscellaneous : alarm, switches, connecting wires, resistors, relays etc.

2.4 Software

If hardware forms the body of the embedded systems, software is a soul of embedded systems. The software lends the functionality to an embedded system.

Variety of languages has emerged as the tasks to be performed by embedded systems are of quite diverse nature.

We’re using Atmel Studio 6 for writing code of our project.

Atmel® Studio 6 is the integrated development platform (IDP) for developing and debugging Atmel ARM® Cortex®-M and Atmel AVR® microcontroller (MCU) based applications.

The Atmel Studio 6 IDP gives you a seamless and easy-to-use environment to write, build and debug your applications written in C/C++ or assembly code.

Atmel Studio 6 is free of charge and is integrated with the Atmel Software Framework (ASF)—a large library of free source code with 1,600 ARM and AVR project examples.

ASF strengthens the IDP by providing, in the same environment, access to ready-to-use code that minimizes much of the low-level design required for projects

Chapter 3

LITERATURE SURVEY

This chapter defines the survey of the elements which we ought to include in out project. It contains the block diagram of the project , the details of all the individual components being used to make the project. It also displays the hardware design as to how it would look physically.

We ought to design a structure which is compatible for every condition and gives output with an efficiency of 100%. Our project is divided into three basic parts :

- Sensors (which will detect the prevailing conditions)
- Microcontroller(which will process on the input given b sensors according to the given set of program embedded into it)
- Alarm , which we have used as our output system

3.1 Block Diagram And Description

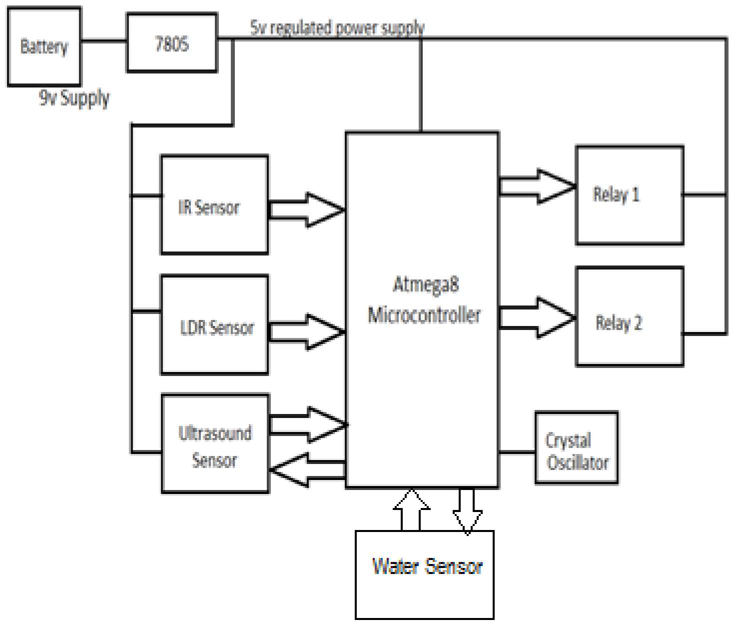

Fig 3 : Block diagram of Technocane

We will generalize the block diagram and would discuss about each of the three major elements in our system in the coming sections.

3.2 Sensors

A **sensor** is a transducer whose purpose is to sense (that is, to detect) some characteristic of its environment. It detects events or changes in quantities and provides a corresponding output, generally as an electrical or optical signal. Sensors are used in everyday objects such as touch-sensitive elevator buttons (tactile sensor) and lamps which dim or brighten by touching the base, besides innumerable applications of which most people are never aware. With advances in micromachinary and easy-to-use microcontroller platforms, the uses of sensors have expanded beyond the more traditional fields of temperature, pressure or flow measurement, for example into MARG sensors. Moreover, analog sensors such as potentiometers and force-sensing resistors are still widely used. Applications include manufacturing and machinery, airplanes and aerospace, cars, medicine and robotics.

Sensors are hardware components that can provide your computer with information about your computer's location, surroundings, and more. Programs on your computer can access information from sensors, and then store or use it to help you with everyday tasks or to improve your computer experience.

There are two types of sensors:

- Sensors that are built in to your computer
- Sensors that are connected to your computer by a wired or wireless connection

Some examples of sensors include a location sensor, such as a GPS receiver, that can detect your computer's current location. A program could then use that location to provide you with information about nearby restaurants or driving directions to your next destination. A light sensor installed on your computer could detect the light in your surroundings, and then adjust the screen brightness to match it.

Hence in order to work on the prevailing inputs we have used a list of sensors which are given as follows**:**

- **IR Sensor**
- **LDR Sensor**
- **Ultrasonic Sensor**
- **Water Sensor(Two wires)**

3.2.1 IR Sensor

A **passive infrared sensor** (**PIR sensor**) is an electronic sensor that measures infrared (IR) light radiating from objects in its field of view. They are most often used in PIR-based motion detectors.

The PIR Sensor module allows you to sense motion. It is almost always used to detect the motion of a human body within the sensor's range. It is often referred to used "PIR", "Pyroelectric", "Passive Infrared" and "IR Motion" sensor. The module has an on-board pyroelectric sensor, conditioning circuitry and a domb shaped Fresnel lens.

An infrared sensor is an electronic instrument which is used to sense certain characteristics of its surroundings by either emitting and/or detecting infrared radiation. Infrared sensors are also capable of measuring the heat being emitted by an object and detecting motion.

3.2.1.1 Infrared Radiation Theory

Infrared waves are not visible to the human eye. In the electromagnetic spectrum, infrared radiation can be found between the visible and microwave regions. The infrared waves typically have wavelengths between 0.75 and 1000µm.

The wavelength region which ranges from 0.75 to 3µm is known as the near infrared regions. The region between 3 and 6µm is known as the mid-infrared and infrared radiation which has a wavelength greater higher than 6µm is known as far infrared.

Infrared technology finds applications in many everyday products. Televisions use an infrared detector to interpret the signals sent from a remote control. The key benefits of infrared sensors include their low power requirements, their simple circuitry and their portable features.

3.2.1.2 The Working Principle of Infrared Sensors

All objects which have a temperature greater than absolute zero (0 Kelvin) possess thermal energy and are sources of infrared radiation as a result. Sources of infrared radiation include blackbody radiators, tungsten lamps and silicon carbide. Infrared sensors typically use infrared lasers and LEDs with specific infrared wavelengths as sources.

Fig 4: Implementing Infrared Theory

A transmission medium is required for infrared transmission, which can be comprised of either a vacuum, the atmosphere or an optical fiber.

Optical components, such as optical lenses made from quartz, CaF_2, Ge and Si, polyethylene Fresnel lenses and Al or Au mirrors, are used to converge or focus the infrared radiation. In order to limit spectral response, band-pass filters can be used.

Next, infrared detectors are used in order to detect the radiation which has been focused. The output from the detector is usually very small and hence pre-amplifiers coupled with circuitry are required to further process the received signals.

3.2.1.3 Pin layout

Fig 5(a) : Pin Layout of IR sensor

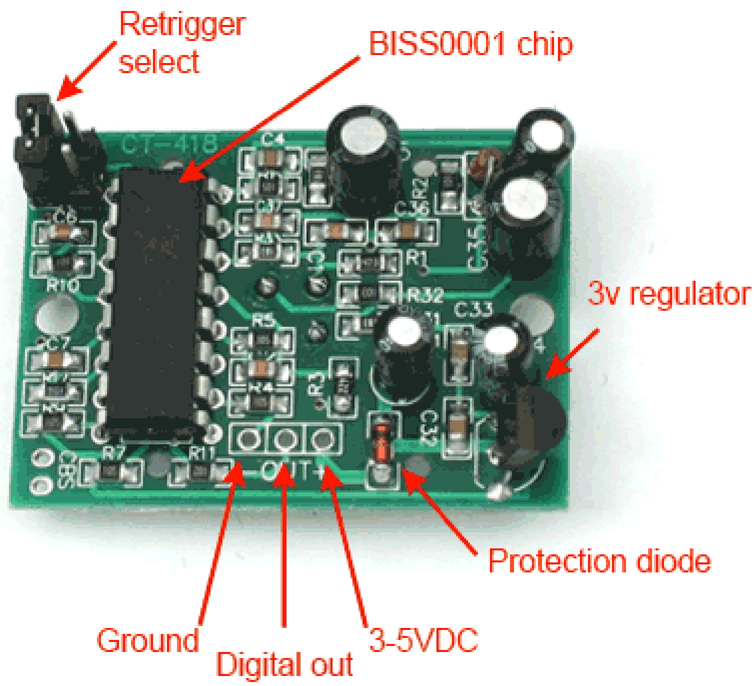

Fig 5(b): Pin Layout of IR sensor

- PIRs are basically made of a Pyro electric sensor (which you can see above as the round metal can with a rectangular crystal in the center), which can detect levels of infrared radiation.
- Everything emits some low level radiation, and the hotter something is, the more radiation is emitted. The sensor in a motion detector is actually split in two halves. The reason for that is that we are looking to detect motion (change) not average IR levels.
- The two halves are wired up so that they cancel each other out. If one half sees more or less IR radiation than the other, the output will swing high or low.
- Along with the pyro electric sensor is a bunch of supporting circuitry, resistors and capacitors. It seems that most small hobbyist sensors use the BISS0001 ("Micro Power PIR Motion Detector IC") , undoubtedly a very inexpensive chip.
- This chip takes the output of the sensor and does some minor processing on it to emit a digital output pulse from the analog sensor.

- For many basic projects or products that need to detect when a person has left or entered the area, or has approached, PIR sensors are great.
- They are low power and low cost, pretty rugged, have a wide lens range, and are easy to interface with.
- Note that PIRs won't tell you how many people are around or how close they are to the sensor, the lens is often fixed to a certain sweep and distance (although it can be hacked somewhere) and they are also sometimes set off by house pets. Experimentation is key!

3.2.1.4 Working of IR sensors

- PIR sensors are more complicated than many of the other sensors explained in these tutorials (like photocells, FSRs and tilt switches) because there are multiple variables that affect the sensors input and output.

- The PIR sensor itself has two slots in it, each slot is made of a special material that is sensitive to IR.
- The lens used here is not really doing much and so we see that the two slots can 'see' out past some distance (basically the sensitivity of the sensor). When the sensor is idle, both slots detect the same amount of IR, the ambient amount radiated from the room or walls or outdoors.
- When a warm body like a human or animal passes by, it first intercepts one half of the PIR sensor, which causes a *positive differential* change between the two halves . When the warm body leaves the sensing area, the reverse happens, whereby the sensor generates a negative differential change. These change pulses are what is detected.

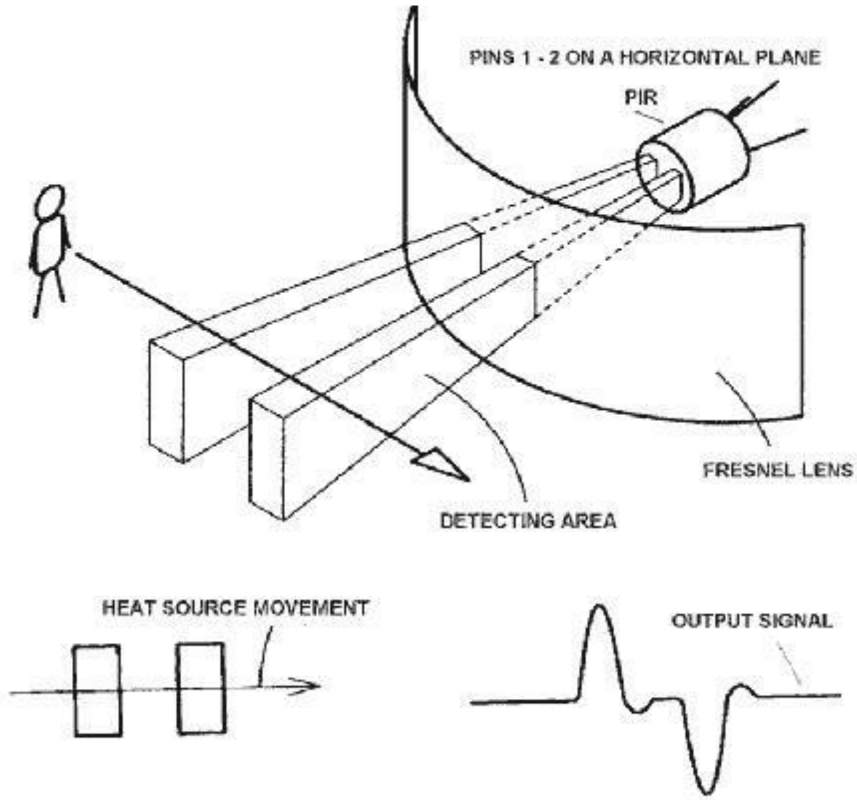

Fig 6 : Working Of PIR Sensor

3.2.1.5 Product Features

- ✓ Brand New and High Quality.
- ✓ Color: White + Green
- ✓ Infrared Sensor with Control Circuit Board
- ✓ The Sensitivity and Holding Time Can be Adjusted
- ✓ Working Voltage Range: DC 4.5V- 20V
- ✓ Current Drain:<60uA
- ✓ Detection Range: <140°
- ✓ Voltage Output: High/Low level Signal: 3.3V TTL output
- ✓ Detection Distance: 3--7M (can be adjusted)
- ✓ Delay Time: 5-200S (Can be Adjusted, Default 5s +-3%)

- ✓ Blockade time: 2.5 S (Default)
- ✓ Trigger: L: Non-repeatable trigger H: Repeat Trigger (Default)
- ✓ Work temperature: -20-+80°C
- ✓ Trigger Method: L Unrepeatable Trigger / H Repeatable Trigger
- ✓ Material: Mixed Material
- ✓ Dimension: 3.2cm x 2.4cm x 1.8cm (Approx.)
- ✓ Sensitive Setting: Turn to Right, Distance Increases (About 4M); Turn to Left, Distance Reduce (About 1M)

3.2.2 Ultrasonic Sensor

Ultrasonic sensors (also known as transceivers when they both send and receive, but more generally called transducers) work on a principle similar to radar or sonar which evaluate attributes of a target by interpreting the echoes from radio or sound waves respectively.

- ➢ Ultrasonic sensors generate high frequency sound waves and evaluate the echo which is received back by the sensor.
- ➢ Sensors calculate the time interval between sending the signal and receiving the echo to determine the distance to an object.
- ➢ This technology can be used for measuring wind speed and direction (anemometer), tank or channel level, and speed through air or water.
- ➢ For measuring speed or direction a device uses multiple detectors and calculates the speed from the relative distances to particulates in the air or water.
- ➢ To measure tank or channel level, the sensor measures the distance to the surface of the fluid. Further applications include: humidifiers, sonar, medical ultrasonography, burglar alarms and non-destructive testing.

- Systems typically use a transducer which generates sound waves in the ultrasonic range, above 18,000 hertz, by turning electrical energy into sound, then upon receiving the echo turn the sound waves into electrical energy which can be measured and displayed.
- The technology is limited by the shapes of surfaces and the density or consistency of the material. Foam, in particular, can distort surface level readings.

3.2.2.1 Transducer

An ultrasonic transducer is a device that converts energy into ultrasound, or sound waves above the normal range of human hearing. While technically a dog whistle is an ultrasonic transducer that converts mechanical energy in the form of air pressure into ultrasonic sound waves, the term is more apt to be used to refer to piezoelectric transducers that convert electrical energy into sound. Piezoelectric crystals have the property of changing size when a voltage is applied, thus applying an alternating current (AC) across them causes them to oscillate at very high frequencies, thus producing very high frequency sound waves.

- The location at which a transducer focuses the sound can be determined by the active transducer area and shape, the ultrasound frequency, and the sound velocity of the propagation medium.
- The example shows the sound fields of an unfocused and a focusing ultrasonic transducer in water.
- Since piezoelectric crystals generate a voltage when force is applied to them, the same crystal can be used as an ultrasonic detector. Some systems use separate transmitter and receiver components while others combine both in a single piezoelectric transceiver.
- Non-piezoelectric principles are also used in construction of ultrasound transmitters. Magnetostrictive materials slightly change size when exposed to a magnetic field; such materials can be used to make transducers. A capacitor microphone uses a thin plate which moves in response to ultrasound waves;

changes in the electric field around the plate convert sound signals to electric currents, which can be amplified.

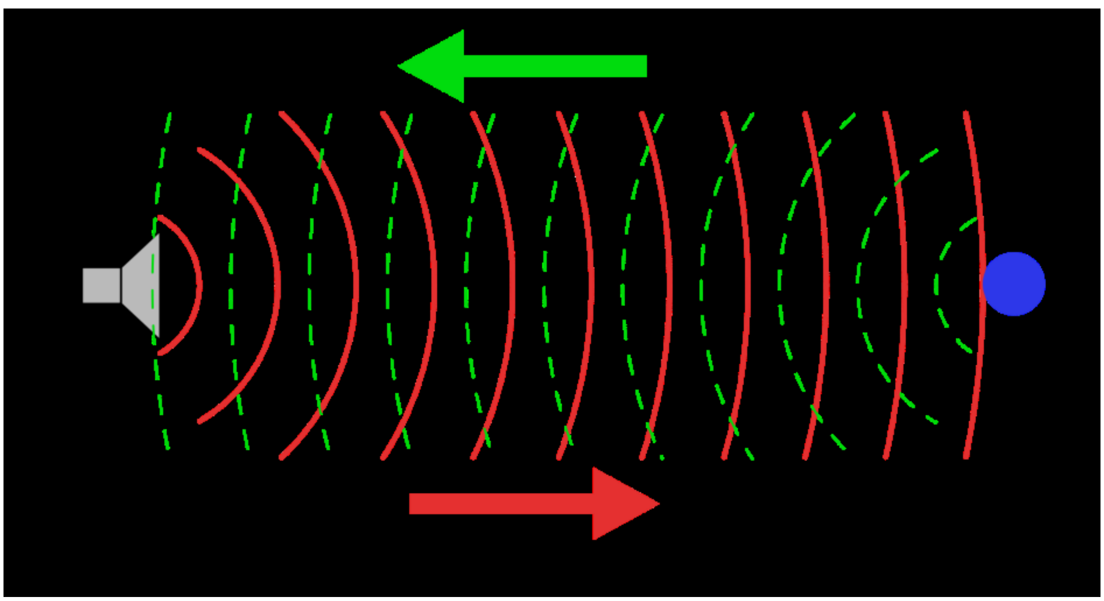

Fig 7 (a): Pin Description of Ultrasonic sensor

(b) Wave Description of Ultrasonic sensor

3.2.2.2 Product Features

Module main technical parameters:

1. Working Voltage : 5V(DC)
2. Static current: Less than 2mA.
3. Output signal: Electric frequency signal, high level 5V, low level 0V.
4. Sensor angle: Not more than 15 degrees.
5. Detection distance: 2cm-450cm.
6. High precision: Up to 0.3cm
7. Input trigger signal: 10us TTL impulse
8. Echo signal : output TTL PWL signal

Mode of connection:

1. VCC
2. trig(T)
3. echo(R)
4. GND

The HC-SR04 ultrasonic sensor uses sonar to determine distance to an object like bats or dolphins do. It offers excellent range accuracy and stable readings in an easy-to-use package. It operation is not affected by sunlight or black material like Sharp rangefinders are (although acoustically soft materials like cloth can be difficult to detect). Ultrasonic Ranging Module HC-SR04 provides 2cm-300cm non-contact distance sensing capabilities, Ranging accuracy up to 3mm; module comprises an ultrasonic transmitter, a receiver and a control circuit.

3.2.3 LDR Sensor

A **photoresistor** or **light-dependent resistor** (**LDR**) or **photocell** is a light-controlled variable resistor. The resistance of a photoresistor decreases with increasing incident light intensity; in other words, it exhibits photoconductivity. A photoresistor can be applied in light-sensitive detector circuits, and light- and dark-activated switching circuits.

A photoresistor is made of a high resistance semiconductor.

- In the dark, a photoresistor can have a resistance as high as several megohms (MΩ), while in the light, a photoresistor can have a resistance as low as a few hundred ohms.
- If incident light on a photoresistor exceeds a certain frequency, photons absorbed by the semiconductor give bound electronsenough energy to jump into the conduction band.
- The resulting free electrons (and their hole partners) conduct electricity, thereby lowering resistance. The resistance range and sensitivity of a photoresistor can substantially differ among dissimilar devices. Moreover, unique photoresistors may react substantially differently to photons within certain wavelength bands.

A photoelectric device can be either intrinsic or extrinsic. An intrinsic semiconductor has its own charge carriers and is not an efficient semiconductor, for example, silicon. In intrinsic devices the only available electrons are in the valence band, and hence the photon must have enough energy to excite the electron across the entire bandgap.

- ➢ Extrinsic devices have impurities, also called dopants, added whose ground state energy is closer to the conduction band; since the electrons do not have as far to jump, lower energy photons (that is, longer wavelengths and lower frequencies) are sufficient to trigger the device.
- ➢ If a sample of silicon has some of its atoms replaced by phosphorus atoms (impurities), there will be extra electrons available for conduction. This is an example of an extrinsic semiconductor.

3.2.3.1 Design Considerations

Photoresistors are less light-sensitive devices than photodiodes or phototransistors: the two latter components are truesemiconductor devices, while a photoresistor is a passive component and does not have a PN-junction. The photoresistivity of any photoresistor may vary widely depending on ambient temperature, making them unsuitable for applications requiring precise measurement of or sensitivity to light.

Photoresistors also exhibit a certain degree of latency between exposure to light and the subsequent decrease in resistance, usually around 10 milliseconds. The lag time when going from lit to dark environments is even greater, often as long as one second. This property makes them unsuitable for sensing rapidly flashing lights, but is sometimes used to smooth the response of audio signal compression

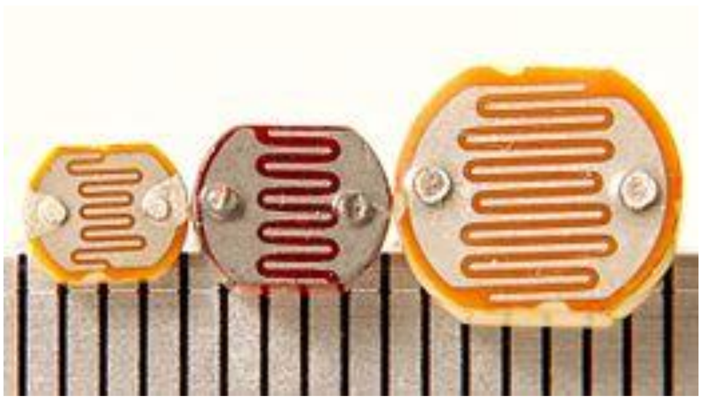

Fig 8: Design consideration of LDR

3.2.3.2 *Product Description*

In light sensor we use LDR which will sense a excessive light and due to this light our circuit will trigger and alarm will be on. LDR is basically use for a excessive light like, car headlight in night.

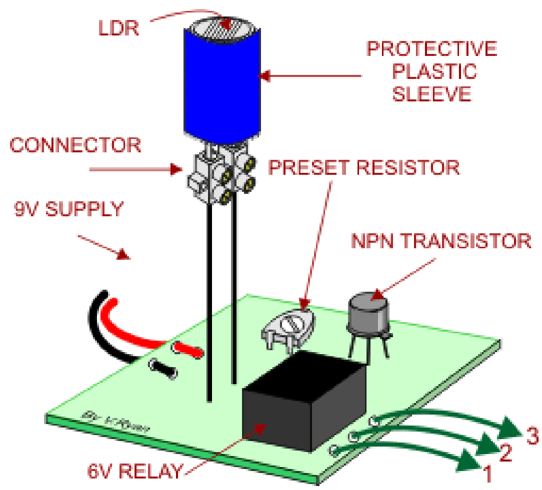

Fig 9: Pin description of LDR sensor

3.3 ATmega8(L)

The Atmel AVR ATmega8 is a low-power CMOS 8-bit microcontroller based on the AVR RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega8 achieves throughputs approaching 1MIPS per MHz, allowing the system designer to optimize power consumption versus processing speed**.**

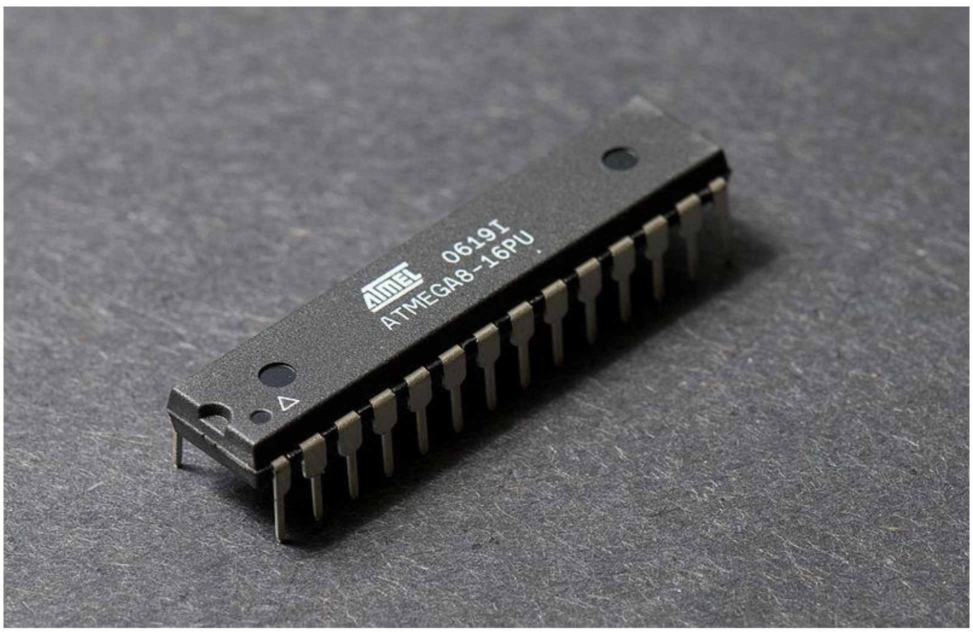

Fig 10: Screen layout of ATmega8

3.3.1 Pin Layout

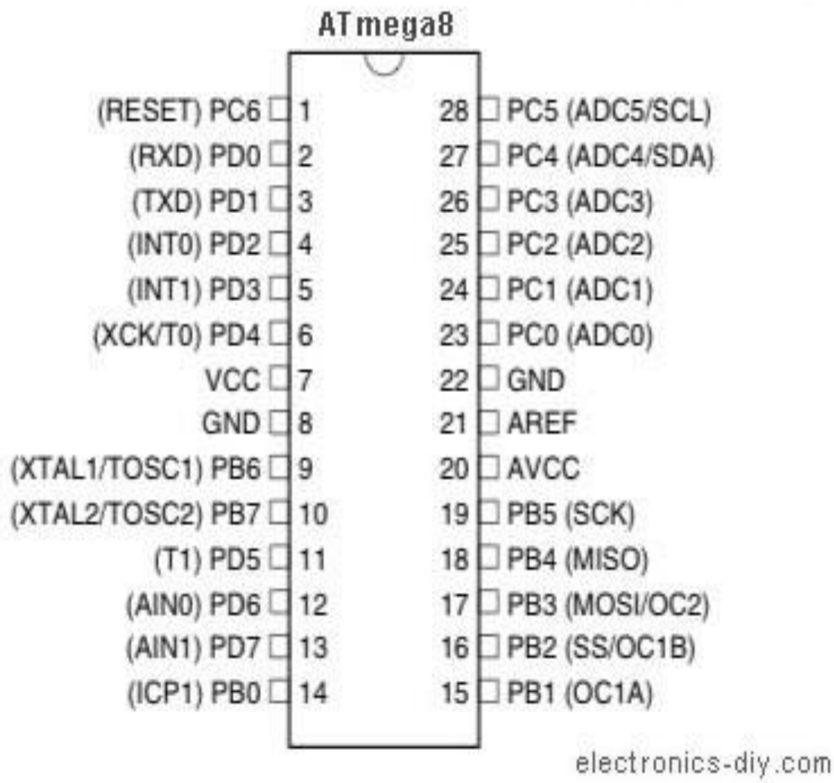

Fig 11 : Pin Layout of ATmega8

- **Memory:** It has **8 Kb** of Flash program memory (10,000 Write/Erase cycles durability), **512Bytes** of EEPROM (100,000 Write/Erase Cycles). **1Kbyte** Internal SRAM

- **I/O Ports:** 23 I/ line can be obtained from three ports; namely Port B, Port C and Port D.

- **Interrupts:** Two External Interrupt source, located at port D. 19 different interrupt vectors supporting 19 events generated by internal peripherals.

- **Timer/Counter:** Three Internal Timers are available, two 8 bit, one 16 bit, offering various operating modes and supporting internal or external clocking.

- **SPI (Serial Peripheral interface):** ATmega8 holds three communication devices integrated. One of them is Serial Peripheral Interface. Four pins are assigned to Atmega8 to implement this scheme of communication.

- **USART:** One of the most powerful communication solutions is **USART** and ATmega8 supports both synchronous and asynchronous data transfer schemes. It has three pins assigned for that. In many projects, this module is extensively used for PC-Micro controller communication.

- **TWI (Two Wire Interface):** Another communication device that is present in ATmega8 is Two Wire Interface. It allows designers to set up a commutation between two devices using just two wires along with a common ground connection, As the TWI output is made by means of open collector outputs, thus external pull up resistors are required to make the circuit.
- **Analog Comparator:** A comparator module is integrated in the IC that provides comparison facility between two voltages connected to the two inputs of the Analog comparator via External pins attached to the micro controller.
- **Analog to Digital Converter:** Inbuilt analog to digital converter can convert an analog input signal into digital data of **10bit** resolution. For most of the low end application, this much resolution is enough.

3.3.2 Architecture

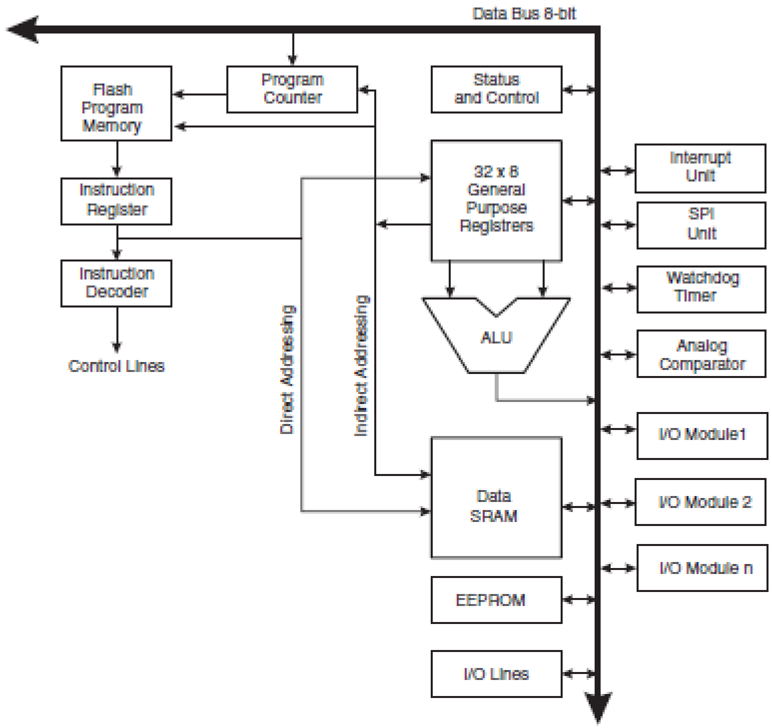

Fig 12: Architecture of ATmega8

- In order to maximize performance and parallelism, the AVR uses a Harvard architecture – with separate memories and buses for program and data. Instructions in the Program memory are executed with a single level pipelining.

- While one instruction is being executed, the next instruction is pre-fetched from the Program memory. This concept enables instructions to be executed in every clock cycle. The Program memory is In-System Reprogrammable Flash memory.

- The fast-access Register File contains 32 × 8-bit general purpose working registers with a single clock cycle access time. This allows single-cycle Arithmetic Logic Unit (ALU) operation.

- In a typical ALU operation, two operands are output from the Register File, the operation is executed, and the result is stored back in the Register File – in one clock cycle.

- Six of the 32 registers can be used as three 16-bit indirect address register pointers for Data Space addressing – enabling efficient address calculations. One of the these address pointers can also be used as an address pointer for look up tables in Flash Program memory.

- The ALU supports arithmetic and logic operations between registers or between a constant and a register. Single register operations can also be executed in the ALU. After an arithmetic operation ,the Status Register is updated to reflect information about the result of the operation.

- The Program flow is provided by conditional and unconditional jump and call instructions, able to directly address the whole address space. Most AVR instructions have a single 16-bit word format.

- Every Program memory address contains a 16-bit or 32-bit instruction. During interrupts and subroutine calls, the return address Program Counter (PC) is stored on the Stack.

3.3.3 Fetch Cycles

Following figure shows the parallel instruction fetches and instruction executions enabled by the Harvard architecture and the fast-access Register File concept. This is the basic pipelining concept to obtain up to 1MIPS per MHz with the corresponding unique results for functions per cost,functions per clocks, and functions per power-unit.

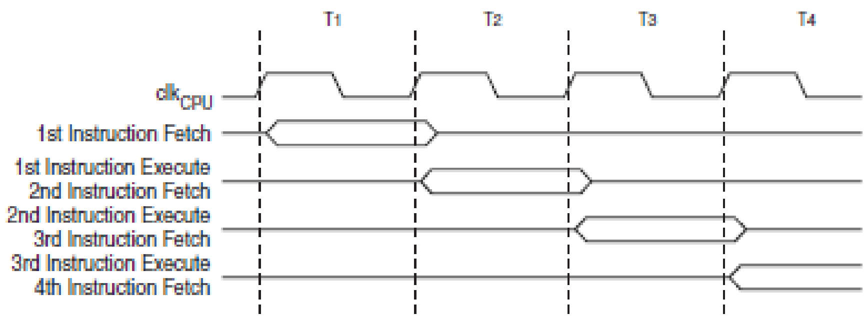

Fig 13: Timing Diagram of Parallel Instruction and Instruction Executions

Following figure shows the internal timing concept for the Register File. In a single clock cycle an ALU operation using two register operands is executed, and the result is stored back to the destination register.

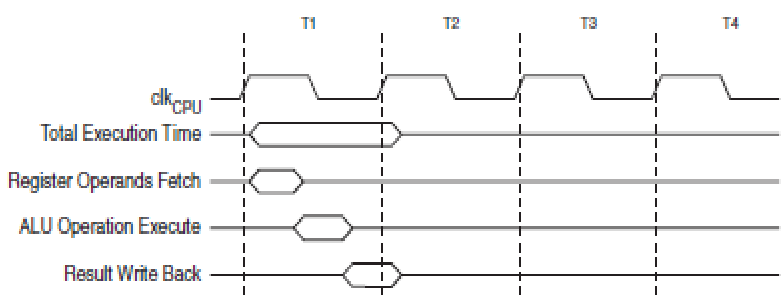

Fig 14: Single Cycle ALU Operation

3.3.4 Interrupts

This section describes the specifics of the interrupt handling performed by the ATmega8.

Vector No.	Program Address[2]	Source	Interrupt Definition
1	0x000[1]	RESET	External Pin, Power-on Reset, Brown-out Reset, and Watchdog Reset
2	0x001	INT0	External Interrupt Request 0
3	0x002	INT1	External Interrupt Request 1
4	0x003	TIMER2 COMP	Timer/Counter2 Compare Match
5	0x004	TIMER2 OVF	Timer/Counter2 Overflow
6	0x005	TIMER1 CAPT	Timer/Counter1 Capture Event
7	0x006	TIMER1 COMPA	Timer/Counter1 Compare Match A
8	0x007	TIMER1 COMPB	Timer/Counter1 Compare Match B
9	0x008	TIMER1 OVF	Timer/Counter1 Overflow
10	0x009	TIMER0 OVF	Timer/Counter0 Overflow
11	0x00A	SPI, STC	Serial Transfer Complete
12	0x00B	USART, RXC	USART, Rx Complete
13	0x00C	USART, UDRE	USART Data Register Empty
14	0x00D	USART, TXC	USART, Tx Complete
15	0x00E	ADC	ADC Conversion Complete
16	0x00F	EE_RDY	EEPROM Ready
17	0x010	ANA_COMP	Analog Comparator
18	0x011	TWI	Two-wire Serial Interface
19	0x012	SPM_RDY	Store Program Memory Ready

Fig 15: Different types of Interrupts

3.4 Battery and Buzzer

- BATTERY
  - ➢ We are using 9v dry rechargeable battery.
  - ➢ The battery has both terminals in a snap connector on one end. The smaller circular (male) terminal is positive, and the larger hexagonal or octagonal (female) terminal is the negative contact.

- The connectors on the battery are the same as on the connector itself; the smaller one connects to the larger one and vice versa.
- The same snap style connector is used on other battery types in the Power Pack (PP) series. Battery polarization is normally obvious since mechanical connection is usually only possible in one configuration.
- A problem with this style of connector is that it is very easy to connect two batteries together in a short circuit, which quickly discharges both batteries, generating heat and possibly a fire.
- The clips on the nine-volt battery can be used to connect several nine-volt batteries in series to create higher voltage

- BUZZER

  - A **buzzer** or **beeper** is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric.
  - Typical uses of buzzers and beepers include alarm devices, timers and confirmation of user input such as a mouse click or keystroke.
  - A piezoelectric element may be driven by an oscillating electronic circuit or other audio signal source, driven with a piezoelectric audio amplifier.
  - Sounds commonly used to indicate that a button has been pressed are a click, a ring or a beep.

Fig 16 : Buzzer

3.5 LM-7805 Positive Voltage Regulator

Voltage regulator is used to provide regulated 5V dc to the circuit. We will use LM-7805 Positive voltage regulator which is A7800 series regulator having following attributes :

-- 3 terminal regulator

-- output current up to 1.5A

-- high power-dissipation capability

-- internal Short-circuit current limiting

-- internal Thermal-Overload protection

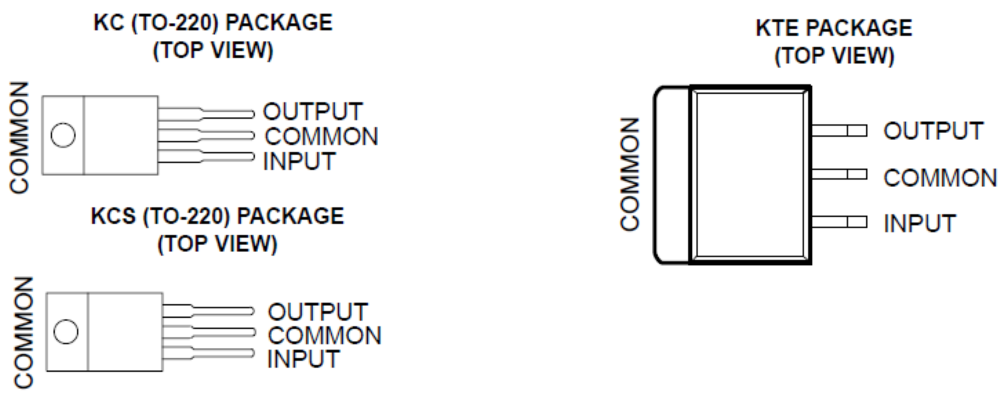

Fig 17: Pin Description of 7805 Voltage Regulator

This series of fixed-voltage integrated-circuit voltage regulators is designed for a wide range of applications. These applications include on-card regulation for elimination of noise and distribution problems with single-point regulation.

Chapter 4

INTERFACING

This chapter deals with the circuit diagram of interfacing sensors with microcontroller. Interfacing is the most crucial tenure for any project development because this phase takes the major point of time and the debugging process even takes more.

4.1 Interfacing all sensors

Hence in order to work on the prevailing inputs we have used a list of sensors which are given as follows**:**

- **IR Sensor**
- **LDR Sensor**
- **Ultrasonic Sensor**

4.1.1 Interfacing IR sensor with ATmega8

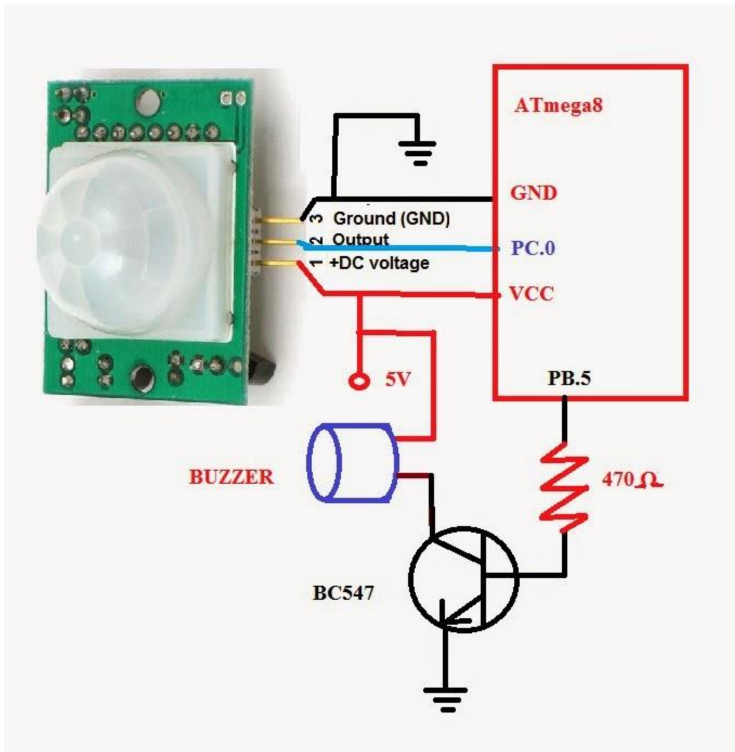

Fig 18: Interfacing IR sensor with ATmega8

Most of the time pin configuration will be printed on the sensor . But some sensors available in India are not describing pin configurations properly. But the standard notation of pin will be like all ways ‘middle pin will be output’. So if you identify the GROUND then remaining pin will be VCC.

It is very simple. Most of these sensors are made of using BISS0001 (16 pin DIL package). 7th pin of this IC is GND. So take a multimeter and check for short circuit test and beep sound. then it will be your sensor ground and opposite side pin will be Vcc.

As the sensor provides 3.3V signal it may be little difficult to interface with microcontrollers working at Vcc = 5V(most 8 bit hobby controllers like AT89S51). At the same time it will be easy to interface with low powered microcontrollers like LPC2148. You better check your microcontroller Logic voltage levels.

Actually we interfaced this sensor to ATmega8 MCU which can detect even 3.3 volt logical signal. So we successfully connected this PIR sensor to the ATmega8 microcontroller.

4.1.2 Interfacing Ultrasonic sensor with ATmega8

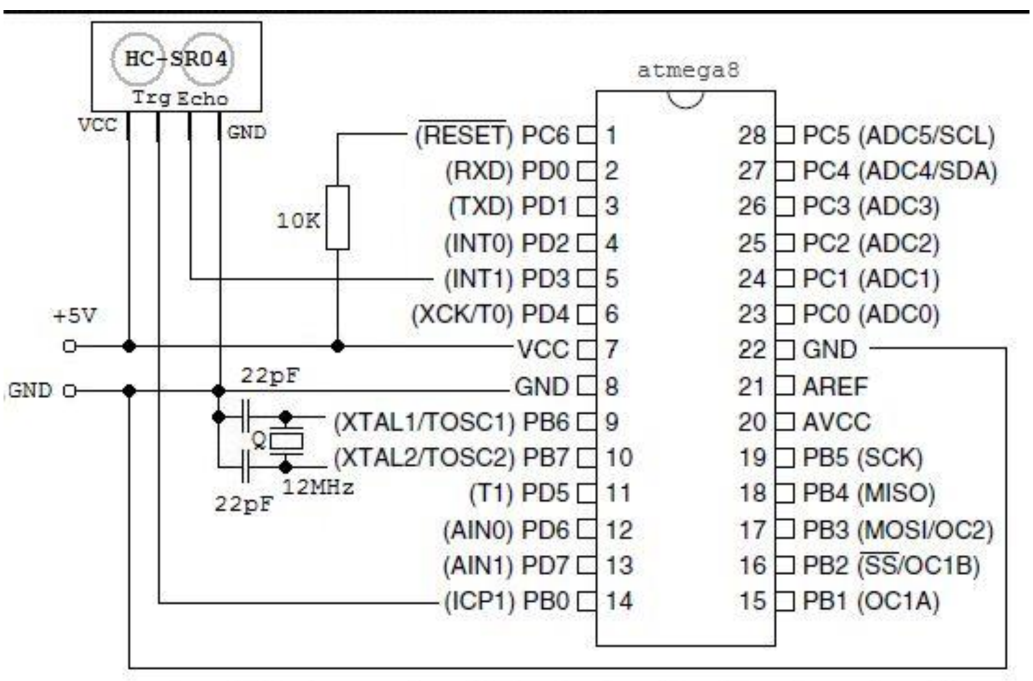

Fig 19: Interfacing Ultrasonic Sensor with ATmega8

The sensor we are using is a 4 pin sensor, one for Vcc, one for ground and the other two pins are echo and trigger .

However there are sensors, that have three pins, mainly Vcc, ground, and the third pin to connect to microcontroller. The working principle is pretty much the same, but it will have one input lines instead of two and also since the number of input line has changed, the coding will also changed, but the main logic will remain the same.

The sensor will usually have all the pins marked on the board itself. For the project, we will be using a **HC-SR04 sensor.** The operation to be followed is:-

- Send a short, but long enough 10us pulse on the trigger pin
- Wait for the echo line to go high
- Time the length of the line it stays high

According to the datasheet you should send trigger pulse after an interval of 50us or more.

4.1.3 Interfacing LDR sensor with ATmega8

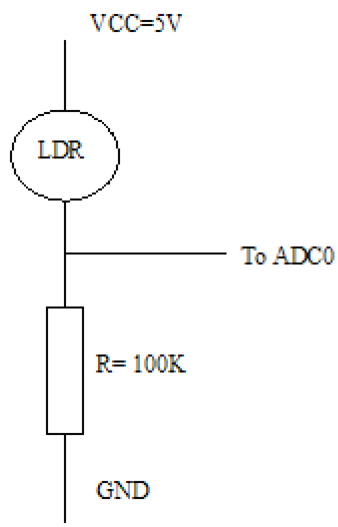

Fig 20 : Interfacing LDR

You have to connect a LDR (light dependant resistor) as shown above. Get Vcc and GND from connecter labeled **5v** and **GND** on the PCB. After burning the code on chip, use a light source to throw some light on LDR, the ADC will show a value between 0-1024 depending on light. For dark the value should be close to 0 while for bright condition the value will become close to 1000.

Chapter 5

DESIGN, DEVELOPMENT AND FABRICATION

In the previous chapter , we learned about interfacing single element to our microcontroller. This chapter defines the design ,process of development and the fabrication of the hardware as a whole. It contains the block diagram of the project , the details of all the individual components being used to make the project, the circuit diagram of the project .

It also displays the flow chart explaining the functioning of the project. The program that has been used for the microcontroller has been included in this report.

5.1 Block Diagram

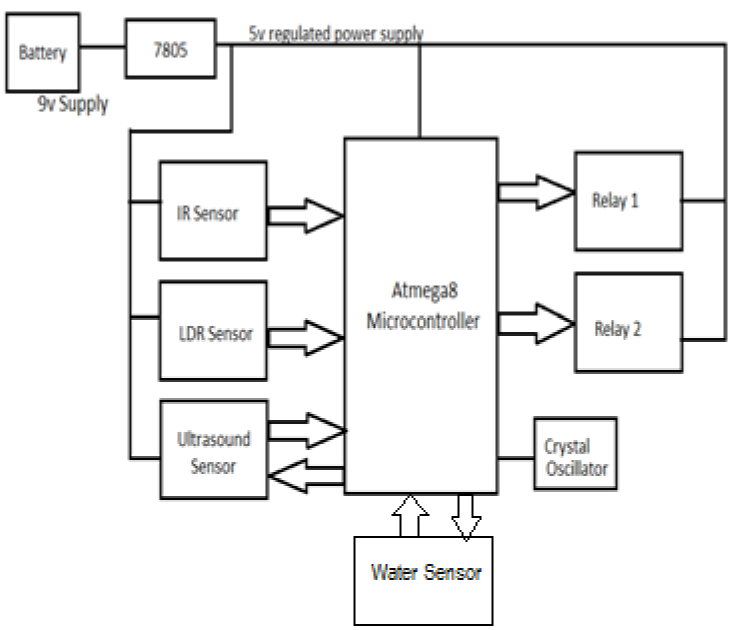

Fig 21 : Block Diagram of Project

5.2 Circuit Design

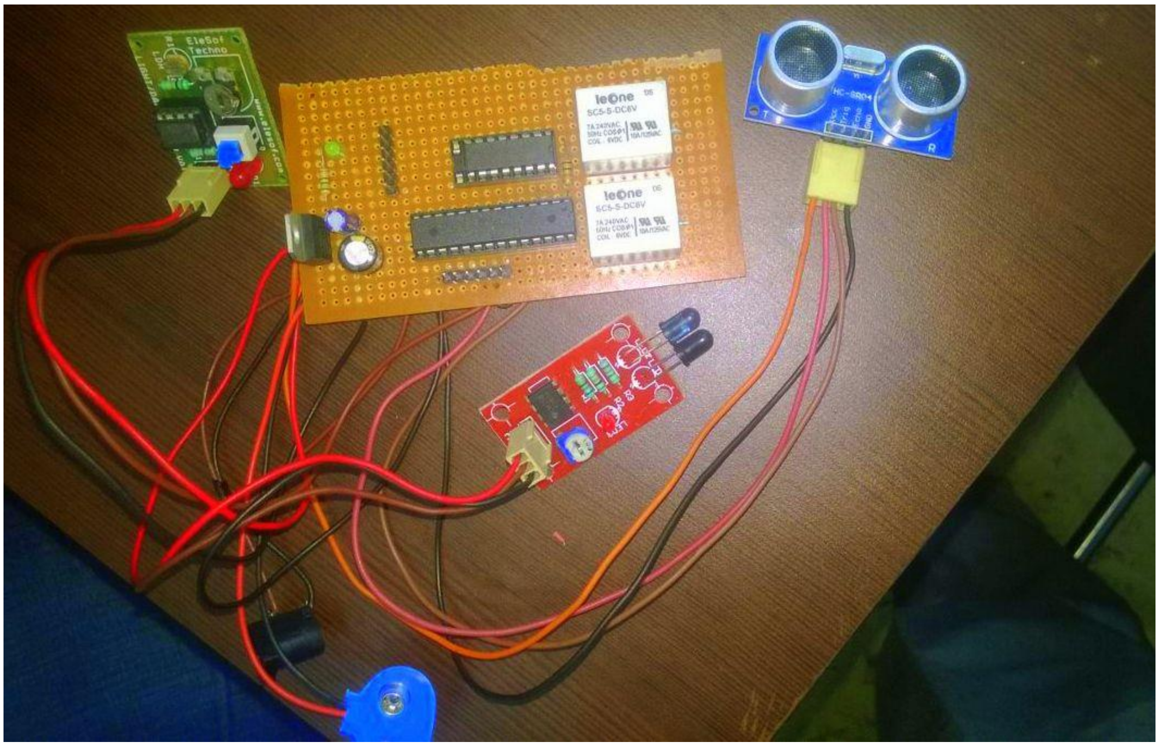

Fig 22 : Circuit Diagram of Technocane

5.3 Flowchart

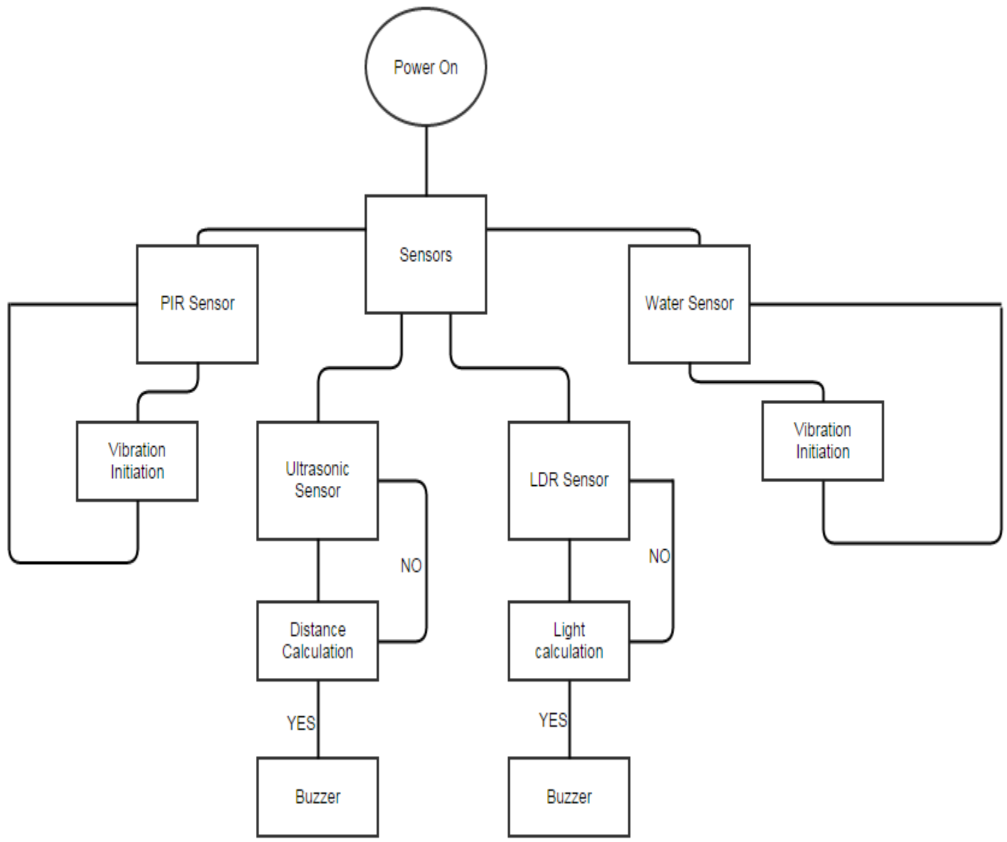

Fig 23 : Flow chart of Technocane

Chapter 6

FEATURES

This chapter deals with the features of this project, its applications , its advantages and disadvantages.

APPLICATION :

- The main application of this project is to provide artificial guidance to the visually impaired people. We see technology coming up in almost every sphere of our work . But, a very little of that technology is applied for the minorities living in this world. The application of our project might be only one , but , it is the most fruitful application coming up. Innovation is always desirable. And innovation which is related to someone's help is much higher than that.

MERITS :

- System provides more information and guidance
- It is cost effective
- Integrity is expected to be more for this system
- Provides flexibility

DE-MERITS :

- User cannot change the settings of distance calculation

- There is no much separation of the alarms for different type of obstacles

The next chapter discusses about the future scope of this project along with the conclusions coming up from this project.

Chapter 7

CONCLUSION AND FUTURE SCOPE

This project elaborates the design and construction of Technocane with the help of different sensors. The circuit works properly to detect the obstacles , pits and water. After designing the circuit which controls the probability of detecting the obstacles, the circuit has also been tested and validated. IR sensor and Ultrasonic sensor are the two main conditions in making the circuit work. If the conditions have been satisfied the circuit will do the desired work according to the specific program which is included in the report. Each sensor will control the buzzer. The detection of any obstacle is successfully controlled by microcontroller. As the person switches on the circuit and starts moving, any obstacle which is expected to lie within a range of 2 feet will be detected by our Ultrasonic Sensor and will give a continuous tone on the buzzer. The detection of pits is done by the IR Sensor which senses pits lying within 2-3cm. We have added LDR sensor for making our project work well in the night time too as it will detect the excessive light coming from the headlight of the vehicles and will ring the buzzer keeping the user safe and secure. Additional sensor added up in our circuit is the water sensing system which will detect the water and will raise the buzzer.

The next section gives an overview of the future scope of the project.

7.1 Future Scope

The project can be further developed to suit other needs as well. Some suggestions are given below to increase the efficiency as well as to overcome the shortcomings of the present project.

1. Voice alarm system can be added to indicate that there is an obstacle in the way.

2. We can increase the complexity of the circuit an can provide the options to the user to change the different modes.

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Microcontroller and Embedded Systems : PANKAJ GUPTA

Practical AVR-Microcontrollers : ALAN TREVENNOR

APPENDIX A

Program designed to automate the white cane and use it as a sensored stick

```
/*
 * blind_stick.c
 *
 * Created: 5/30/2015 12:05:58 PM
 *  Author: AnkitaKetan
 */

#ifndef F_CPU
#define F_CPU 8000000UL // 8 MHz clock speed
#endif


#define PORT_ON(port,pin) port |= (1<<pin)m
#define PORT_OFF(port,pin) port &= ~(1<<pin)

#define trig PORTD4
#define rel_buz PORTB0

#include <avr/io.h>

#include <util/delay.h>
#include<avr/interrupt.h>

volatile long avg = 0;
volatile unsigned char up = 0;
volatile uint32_t running = 0;
volatile uint32_t timercounter =0;
int turn = 0;


ISR(TIMER0_OVF_vect)
{
	if (up) {
		timercounter++;
	}
}

SIGNAL(INT0_vect)
```

```
{
	if(running)
	{ //accept interrupts only when sonar was started
		if (up == 0)
		{ // voltage rise, start time measurement
			up = 1;
			timercounter = 0;
			TCCR0 |= (0 << CS02)|(0 << CS01)|(1 << CS00); // Start/initialize
timer with prescalar 0
			TCNT0 = 0; // Initialize Counter
		}
		else { // voltage drop, stop time measurement
		up = 0;
		avg = (timercounter*256+TCNT0)/58;// divide by 58 to get distance in cm

		running = 0;
	}
}
}
LDR(INT1_vect)
{
	TCCR1A&=(0x00);
	TCCR1B|=(1<<CS00);
	TCNT1=0x000;
	TIMSK|=(1<<TOIE1);

}
void IR(void)
{
	if(PIND & (1<<PD5))
	{
	while(PIND & (1<<PD5))
	{
		PORT_ON(PORTB,rel_buz);
	}
	}
	else PORT_OFF(PORTB,rel_buz);
}
void send_trigger()
{
	PORT_OFF(PORTD,trig);
	_delay_us(5);
	PORT_ON(PORTD,trig);
	running = 1;
	_delay_us(10);
	PORT_OFF(PORTD,trig);
```

```
}
void ultrasound(void)
{
        if (avg >= 400)
        {

                PORT_ON(PORTB,rel_buz);
        }
        else
        {
                PORT_ON(PORTB,rel_buz);
        }
}


int main(void)
{
         DDRD = 0xFB;//pin d3 is used as input and pin d6 as output for trigger
         PORTD = 0x00;
         DDRB = 0xFF;
         PORTB = 0x00;
         DDRC=0xFF;
         PORTC=0x00;

          MCUCR |= (0 << ISC01) | (1 << ISC00); // enable interrupt on
any(rising/dropping) edge
          GICR |= (1 << INT0)|(1<<INT1);  //Turns on INT0

          TIMSK |= (1 << TOIE0);  // enable timer interrupt
          sei();  // enable all(global) interrupts



   while(1)
   {
      if(running == 0)
                {
             _delay_ms(60);
             send_trigger();
      }
                ultra_sound();


   }
}
```