PERSON FOLLOWED BY AUTONOMOUS ROBOTIC CAR

Project report submitted in partial fulfillment of the requirement for the degree of

BACHELOR OF TECHNOLOGY IN
ELECTRONICS AND COMMUNICATION ENGINEERING

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List of Acronyms and Symbols

Abbreviation	Full form
IC	Integrated circuit
LED	Light Emitting Diode
LCD	Liquid Crystal Display
CPU	Central processing unit
MHz	Mega Hertz
KHz	Kilo Hertz
RPM	Revolution per second

ACKNOWLEDGEMENT

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DECLARATION

We hereby declare that the work reported in the B.Tech Project Report entitled **"Person Followed By an Autonomous Robotic Car"** submitted at **Jaypee University of Information Technology, Waknaghat, India** is an authentic record of our work carried out under the supervision of **Ms. Pragya Gupta.** We have not submitted this work elsewhere for any other degree.

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This is to certify that the above statement made by the candidates is correct to the best of my knowledge.

Ms. Pragya Gupta
(Project Coordinator)

Date:

ABSTRACT

Person followed by the autonomous robotic car is one of the vital aspects of artificial intelligence. it's an autonomous robotic car that is ready to follow a selected person for whom the directions are fed into it. the most reason to style this autonomous robotic car is to manoeuvre it mechanically that follows someone. These sorts of robots use optical sensors to follow someone. The array of 4 sensors makes the movement of robot precise and versatile. This automotive use DC motors to regulate the movement of the wheels. Moreover, the speed of all the motors and follow someone is performed by the Arduino Uno interface. This project aims to implement the formula and win an honest performance. This autonomous robotic automotive be accustomed mould up to 5kg and can also be employed in hospitals to hold little required objects like scissors, cotton and lots of alternative, can also be used for industrial functions that simply must follow a selected person and reach from one position to an alternative to a selected distance. A wide choice of human-robot agreeable applications in different areas, such as delivering, medicinal services, the stage, and social associations, need A self-ruling mechanical vehicle to follow its human buddy. Totally extraordinary working situations and applications make different difficulties by including imperatives the determination of sensors, level of self-sufficiency, and elements of an individual after robot. Specialists have tended to these difficulties from various perspectives and added to the occasion of a larger than average assortment of writing. This paper gives an exhaustive synopsis of the writing by arranging totally various parts of individual after via independent robots. Likewise, the comparing operational difficulties are known to help various style choices for ground, submerged, and elevated inevitabilities. moreover, dynamic systems for observation, arranging, control, and communication are complicatedly referenced and their importance in fluctuated operational consequences is presented. At that point some of the remarkable procedures are subjectively thought about, comparing reasonable items are represented, and their possibility is broke down for various use cases. In addition, numerous imminent application regions are known, and open issues are featured for future investigation.

CHAPTER 1 INTRODUTION

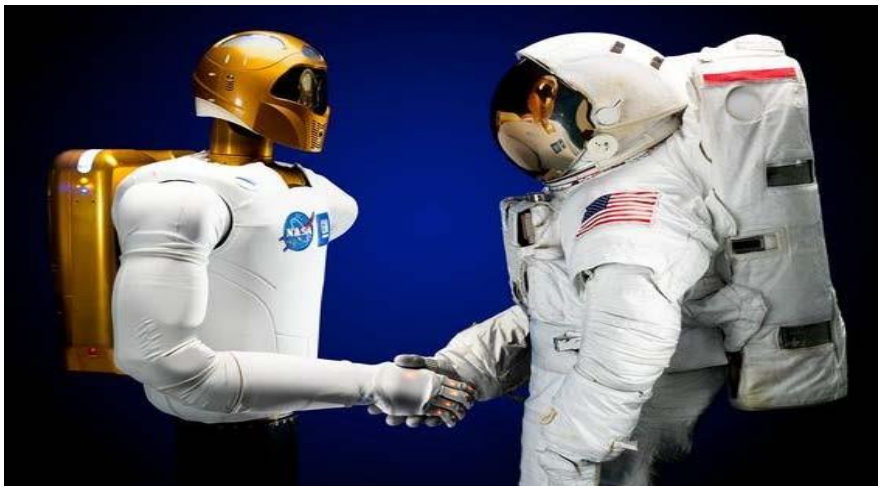


Figure 1: Robot Designed for Space Programs

Mechanical innovation has swelled obviously in recent years. Such developments were exclusively a fantasy for population a set of years back. Anyway during this fast paced world, need of the hour is component like "A Human Followed by a Robot" which will act and follow human instructions in this modern world. Some of them are-

- To perform out this with extreme precise,
- Robotics system needs a system that allows it to take the instructions from the individual and act accordingly.
- The machine should to be sufficient enough to follow the human inside the packed territories, clear environmental factors and in inside and outside spots.
- The picture procedure distributed to ask the information concerning the earth outwardly could be an essential factor. the ensuing focuses should be thoroughly noted while doing the procedure.

The light conditions should be awfully steady and won't vary.
The reaches should be set appropriately for the predetermined environmental factors on that to play out the interest. The objective shouldn’t' be horribly far away from the visual detecting component in light of the fact that the separation matters tons. We ought to keep away from the usage of such hues round the system that matches immediately of the objective. In any case the system would get befuddled. normally human after robots are outfitted with numerous entirely unexpected various blend of sensors for example light-weight recognition and travel detecting component, recurrence distinguishing proof module (RFID), optical maser officer discoverer (LFR), infrared (IR) detecting modules, warm imaging sensors, camera, remote transmitter/beneficiary and so forth for acknowledgment and finding the target. Modules work as one to identify and follow the objective. The capacity of a robot to follow and follow a moving item can be utilized for a few purposes.

1.1 Background of Robotics

Leonardo Vinci made a lot of human-inspired, AI robot-like human in the 1500's.

Figure 2: Leonardo da Vinci model of a Humanoid Robot with its Internal Mechanisms

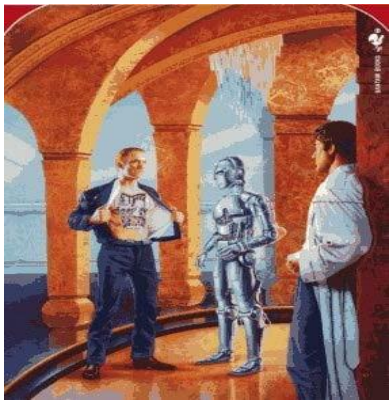


Figure 3: Asimov Humanoid Robots

The word robot starting showed up in print inside the 1920 play. Robota is Czechoslovakian word for **worker**. As the popular belief among human race is that the robots dominate and kill the humanity.

Figure 4: Rossums's Universal Robots

"When Young Rossum took a glance at human body, he could make out at once that it was highly advanced. Robotic machines have outstanding learning capabilities.

Isaac Asimov authored and promoted the term man-made consciousness through a few sci-fi books. Isaac Asimov was a one behind the idea for prevailing robotic machines; Isaac Asimov anecdotal the 3 Laws of Robotics:
1) A component probably won't harm an individual's or, through inaction, grant an individual's to come back to harm.
2) A component ought to adjust the requests given by gatherings of individuals, aside from once such requests strife with the essential Law.
3) A system ought to safeguard its own reality as long in light of the fact that it doesn't strife with the essential or Second Laws.

Joseph Engleberger and St. George Devoe were the founders of business robots. Their organization, Unimation, designed the essential mechanical system, the catamount (Programmable Universal Manipulator Arm, a later form demonstrated as follows), of arm of a human.

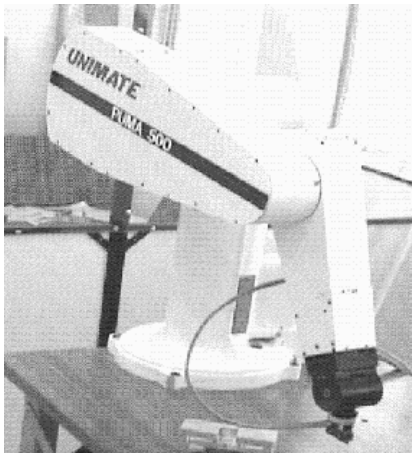


Figure 5: Puma Factory Based Robot

1.2 Types of Automation

Automation is categorised into 3 sorts. They are,

1) FIXED Automation
2) Programmable Automation
3) versatile Automation.

1.2.1 Fixed Automation:-

It is the automation during which the sequence of process or assembly operations to be allotted is fixed by the instrumentation configuration. In fixed automation, the sequences of operations (which are simple) are integrated during a piece of kit. Therefore, it's tough to alter changes within the style of the merchandise. It's used wherever high volume of production is needed Production rate of fixed automation is high. During this automation, no new merchandise are processed for a given sequence of assembly operations.

Features:-

i) High volume of production rates,
ii) comparatively inflexible in product selection (no new merchandise are produced). Ex:- Automobile industries … etc.

1.2.2 Programmable Automation:-

It is the automation during which the instrumentation is intended to accommodate numerous merchandise configurations so as to vary the sequence of operations or assembly operations by suggests that of management program. differing kinds of programs is loaded into the instrumentation to supply merchandise with new configurations (i.e., new products). It's utilized for batch production of low and medium volumes.
For each new batch of various organized product, a brand new management program like the new product is loaded into the instrumentation. This automation is comparatively economic for tiny batches of the merchandise.

Features:-

i) High venture typically reason,

ii) Lower creation rates than secured mechanization,

iii) Flexibility and Changes in item arrangement,

iv) Extra proper for bunch creation.

Ex: - Industrial component, North Carolina machines apparatuses… etc

1.2.3 Versatile Automation:-

A pc integrated producing system that is AN extension of programmable automation is referred as versatile automation. It's developed to attenuate the time loss between the transformations of the batch production from one product to a different whereas reloading. The program to supply new product and ever-changing the physical setup i.e., it produces completely different product with no loss of your time. This automation is additional versatile in interconnecting work stations with material handling and storage system.

Features:-

i) High cost for a custom engineering system.
ii) Medium Production cycles
iii) Flexibility to affect product style variation,
iv) Continuous production of variable mixtures of product. Ex:- versatile producing systems (FMS)

Advantages:-

1. High Production rates
2. Time interval decreases
3. Storing capability decreases
4. Human errors square measure eliminated.
5. Labour value is decreases.

Disadvantages:-

1. Initial value of draw material is extremely high,
2. Maintenance value is high,
3. Needed high consummate Labour
4. Indirect value for analysis development & programming will increase.

Reasons for implementation of automatic systems in manufacture industries:-

The reasons for the implementation of automatic systems in producing industries square measure as follows,

(i)To Increase the Productivity Rate of Labour
(ii)To Decrease the price of Labour

Need For using robotics in industries:-

Industrial mechanism plays a major role in automatic producing to perform completely different varieties of applications.

1. Robots may be engineered a operating capability superior to those of kinsfolk. In terms of strength, size, speed, accuracy…etc.

2. Robots are higher than humans to perform easy and repetitive tasks with higher quality and Consistence's.

3. Robots don't have the constraints and negative attributes of human works .such as fatigue, need for rest, and diversion of attention…..etc.

4. Robots are utilized in industries to avoid wasting the time compared to kinsfolk.

5. Robots are in worth poor operating conditions

6. Improved operating conditions and reduced risks.

1.2.4 CAD/CAM & Robotics:-

CAD/CAM may be a term which suggests laptop motor-assisted style and laptop motor-assisted producing. It'sthe technology involved with the employment of digital computers to perform bound functions in style & production.

CAD:- CAD may be outlined because the use of laptop systems to help within the creation modification, analysis
OR optimisation of style.

Cam:- CAM may be outlined because the use of ADPS to arrange, manage & management the operation of a producing plant, through either direct or in direct laptop interface with the plants production resources.

1.2.5 Specifications of robotics:-

1. Angle of motion

2. Work stations

3. Speed

4. Acceleration

5. Pay load capability

6. Accuracy

1.3 More Information

"Robotics" is outlined because the science of coming up with and building Robots that are appropriate for real
life application in automatic producing and different non-manufacturing environments. It’s the subsequent objectives,

1. To extend productivity

2. Cut back production life

3. Minimize labour demand

4. Increased quality of the product

5. Minimize loss of man hours, on account of accidents.

6. Build reliable and high speed production.

1.4 Classification of Robots

the robots are classified as

1) Programmable/Reprogrammable purpose robots

2) Tele-operated, Man controlled robots

3) Intelligent robots.

Robots are utilized in producing and assembly units like,

1) Spot or arc attachment

2) elements assembly

3) Paint spraying .

4) Material, handling

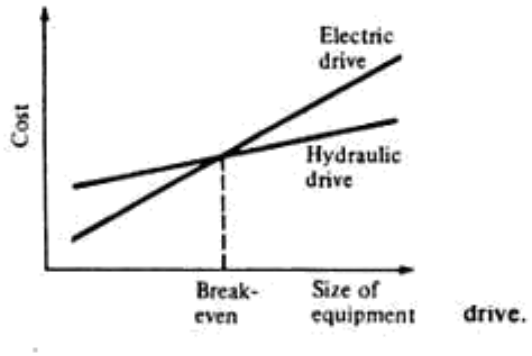
4) loading and unloading

1.5 Varieties of Drive Systems

1. Hydraulic drive

2. Electric drive

3. Pneumatic drive



Cost vs. size for electric drive and hydraulic drive.

Figure 6: Cost vs. Size for electric drive and hydraulic

1.4.1 Hydraulic drive:-

Water driven drive and electrical drive circular segment the 2 primary sorts of drives utilized on extra refined robots. Pressure driven drive is for the most part identified with bigger robots, similar to the Unimate 2000 arrangement. The standard thing favourable circumstances of the water driven drive framework square measure that it furnishes the component with bigger speed and quality. The detriments of the water driven drive framework square measure that it for the most part adds to the ground house required by the system, which a component is slanted to spill on that could be an aggravation. This sort of framework can even be referred to as non-air battery-fuelled chambers. During this framework, oil is utilized as a working liquid as opposed to packed gas. Component might want siphon to get the ideal weight and rate. This frameworks square measure very convoluted, costly and needs upkeep.

1.4.2 Electrical drive:-

Electric drive frameworks don't regularly offer the high measure of speed or capacity to be utilized as water driven frameworks. Notwithstanding, the precision and repeatability of electrical drive robots square measure here and there higher. Therefore, electrical robots will in general be littler. Need less floor house and their applications incline toward extra exact work like get together. During this System, power is created by an electrical flow. It required next to no support and along these lines the activity is commotion less.

1.4.3 Gas drive:-

In this system, air is employed as a operating fluid, thence it's conjointly known as air-powered cylinders. Air is compressed within the cylinder with the help of pump
the compressed gas is employed to get the ability with needed quantity of pressure and flow rates.

1.5 Applications of robots:-

Present Applications of Robots:-
(i) Material transfer applications
(ii) Machine loading and unloading
(iii) Process operations like,

(a) Spot fastening

(b) Continuous arc fastening

(c) Spray coating

(d) Drilling, routing, machining operations

(e) Grinding, sharpening debarring wire brushing

(g) optical maser drilling and cutting etc.

(iv) Assembly tasks, assembly cell styles, elements pairing.

(v) Examination, automation or take a look at
Equipment.

Future Applications of Robots:-

The profile of the longer term mechanism supported the analysis activities can embrace the subsequent,

(i) Intelligence

(ii) Device capabilities

(iii) Telepresence

(iv) Mechanical style

(v) Quality and navigation (walking machines)

(vi) Universal gripper

(vii) Systems and integration and networking

(viii) FMS (Flexible producing Systems)

(Ix) unsafe and inaccessible non-manufacturing environments

1.6 Classification of Robots (or) Classification by co-ordinate system and management system:-

-> Co-ordinate systems:-

Industrial robots area unit on the market during a expanded range of attributes such as size, shape, and physical configuration. The major chunk of today's marketis on the robots having one among the essential arrangement :

I. Polar configuration

2. Cylindrical configuration

3. Co-ordinate configurable

4. Jointed-arm configuration

1.6.1 Polar configuration:-

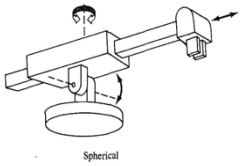


Figure 7: Spherical

The polar configuration is pictured partially (a) of Fig. It makes use of a telescoping upper limb that can be raised up or down against the pivot. These varied number of joints provide the robot with the ability to move its upper limb at intervals , thence the term "spherical coordinate" robot is typically applied to the current sort. A variety of business robots possess the polar configuration

1.6.2 Cylindrical Configurations:-

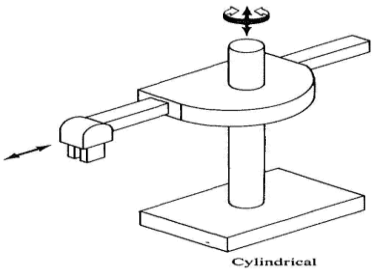


Figure 8: Cylindrical

The cylindrical configurable, as shown in fig,8 Use a vertical column and a slide to rapt the column up or down. The device arm is attached to the slide, so that it can rapt in relation to the column radially. The mechanism is capable enough to cover the area by directing the column which approximates a cylinder.

1.6.3 Cartesian coordinate configurable:-

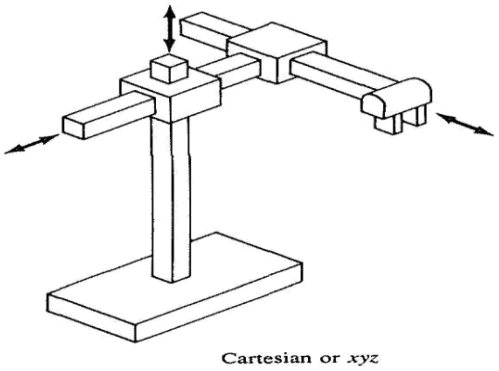


Figure 9: Cartesian

The coordinate mechanism, illustrated partially C) of Fig, uses 3 perpendicular slides to construct the x, y, and z axes. alternative names are generally applied W this configuration, together with xyz mechanism and rectilinear mechanism, By moving three slides in comparison to each another, the mechanism is efficient of operation among rectangular envelope shaped work area.

1.6.4 Connected Arm Type

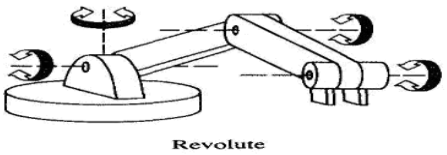


Figure 10: Revolute

The connected-arm robot is pictured in Fig. Its arrangement is similar to humanoid upper limb It is consists of a pair of vertical components, in comparison to the human upper limb set on a vertical pedestal. These components are joined by two joints similar to that of elbow and shoulder

1.6.5 Control systems:-

With relation to robotics, the motion system control system to manage the movement of the end-effectors or tool

1. Restricted sequence robots (Non-servo)

2. Playback robots with purpose to purpose (servo)

3. Replay robots with continuous path management,

4. Intelligent robots.

1. Restricted sequence robots (Non-servo):-

Restricted sequence robots don't offer servo controlled to inclined relative positions of the joints, instead area unit they're} controlled by setting limit switches & are mechanical stops. there's usually no feedback related to a restricted sequence robot to point that the specified position, has been achieved usually skinny kind of robots involves easy motion as choose & place operations.

2. Purpose to purpose motion:-

This type robots square measure capable of dominant rate acceleration & path of motion,

from the start to the top of the trail. It uses advanced management programs, PLC's (programmable logic controller's) computers to regulate the motion.

The purpose to purpose management motion robots square measure ability of play acting motions that consists of a series of desired point location. The robot is hard & recorded, unit

3. Continuous path motion:-

In these robots square measure capable of playacting motion cycle during which the trail followed by the robot in controlled. The robot move through a series of closely area purpose that describe the specified path.

Ex: - painting, arc attachment & complicate assembly operations.

4. Intelligent robots:-
These types of robots not solely programmable motion cycle however conjointly act with its setting during a means those years intelligent. It taken make logical decisions based on sensor data receive from the operation.

There robots are usually programmed using an English like symbolic language not like a computer programming language.

CHAPTER 2 DIFFERENT PHASE PROTOTYPES OF ROBOTS

We introduce how, beginning from the fundamental design parameters demonstrated and applying a strict and methodological planning process, design requirements are gained in accordance with the various educational, usable, artistic, productive and economic considerations proposed for implementation by this strategy.
During the first step-the, development of the robots was taken inspiration from research papers and various models we came across the internet while researching for the topic. The core design approach was changed for that point by introducing a continuous period of enhancement
The second phase is oriented towards researching from the previous research work on this topic, i.e. going through the past research analysis done by our seniors across the world.
Then we decided among ourselves to work on Autonomous branch of the robotics.
Autonomous Robotics talks on robotic device theories and implementations worthy of any levels of self-sufficiency. It highlights publications that include real-world performance data on actual robots. System covers: regulation of autonomous robots · real-time perception · autonomous motorized and monitoring robots · autonomous system software architectures · distributed learning, monitoring and adaptation architectures · analysis of autonomous robotic devices · sensor fusion · autonomous device theory · terrain mapping and identification · auto-reproducing intelligent structure systems.

2.1 METHODOLOGY ONE: Designing Process

The methodology developed by authors Phal as well as Beitz for the robot's initial design, which can be seen in Figure 11, was sought. The requisites of the user were identified in the first phase of the methodology. Which include, from a broad view, the requirements made by the manufacturing company, the vendor, the end user, and so forth, and become the launch point for conceptual design.

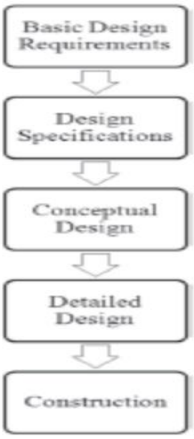


Figure11: Basic Design Methodology

Since the robot is not a computer whose function is confined to the execution of a job,

2.2 Basic design methodology

The fundamental design methodology consists of the following five steps [5]:

- Fundamental design requirements: It is based on clarifying the specific specifications of the robot.
- Layout specifications: These are requirements that have been interpreted into the vocabulary of engineering. We will write a proposed design after the basic design criteria phase which is a set of conditions that the design will satisfy. This knowledge will be used to devise solutions to ensure that account is taken of the interests of all customers. Graphs, diagrams, and algorithms, amounts in this step.
- Conceptual model: This part focuses with the design process in creating a practical prototype.
- Conceptual description: In this process, the current practical architecture is enhanced and complemented to satisfy all design criteria and requirements while at the same time rendering the robot producible.
- Development: This stage involves also parts production but also computer tuning.

The methodology already shown was used during the robot's initial manufacturing process. Nevertheless, since the main objective of the robot is to be used as a learning experience, and at the time, there were no elements allowing the development of any kind of knowledge when manipulating it, it was necessary to stop the process at the conceptual design stage, in order to be able to integrate different components that aim to enhance the knowledge acquisition while using the robot. Some additional features, such as the arrangement of modules, various types of sensors and processing cards that were installed for this purpose into the prefabricated device.

2.3 Modified Design Methodology

Realizing that the purpose of the machine is to educate, it is vital to assess which formational aspects the device can approach. The design parameters were accompanied with those aspects. It was converted into a transition on the technique of basic architecture (Fig 12). Hereafter the latest approach is called Revised Project Process.

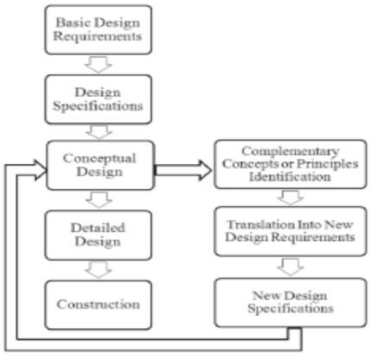


Figure 12: Modified Design Cycle

As illustrated in Fig. 12, that loop consists of eight steps. The first three steps are usually similar to the fundamental methodology as shown in Fig. 11. Modifications are addressed in the next five steps along with the new part of the loop.
Classification of complimentary ideas or values: The values and physical principles associated with the robot are discussed during this point, trying to match the simple criteria initially stated, and thereby increasing young people's awareness can be obtained by the use of the robot. Then, repeat the following steps: project planning, particulars design and production to modify the robot under development. At this stage, there is input on the proposed design for the criteria that were not taken into account at the initial level. This adjustment, and the incorporation of the different phases of the design process, enables one to address the implementation of the product parameters in a smoother and more coordinated manner, so as a result, the new system design.

The structure in framework activity is mostly straightforward when contrasted with different frameworks accessible to the people. The ultrasonic sensors lock the objective when the framework is turned on. The Sensors measure the separation between the client and automated vehicle. It keeps up the sufficient separation as indicated by us when planning the vehicle. The separation determined is maximum between 15 to 20 centimeters. We know that the framework is small scale as compared to the prototype of the vehicle, so relegated guidelines are less. The qualities fluctuate when the dimensions of the mechanical vehicle are altered.

2.4 METHODOLOGY TWO: Interface of the Loop OF Designs

Basic requirements regarding design the structure in framework activity is mostly straightforward when contrasted with different frameworks accessible to the people. We know that the framework is small scale as compared to the prototype of the vehicle, so relegated guidelines are less. The qualities fluctuate when the dimensions of the mechanical vehicle are altered.

Design specifications

As the design criteria mentioned above concentrate on the capacity of the robot to execute those tasks, certain criteria may be known as design specifications. The preceding stage will follow conceptual specification. There are, however, other requirements that must be added:

The robot needs to cost at least as possible.

Installation of the robot will be as simple as possible.

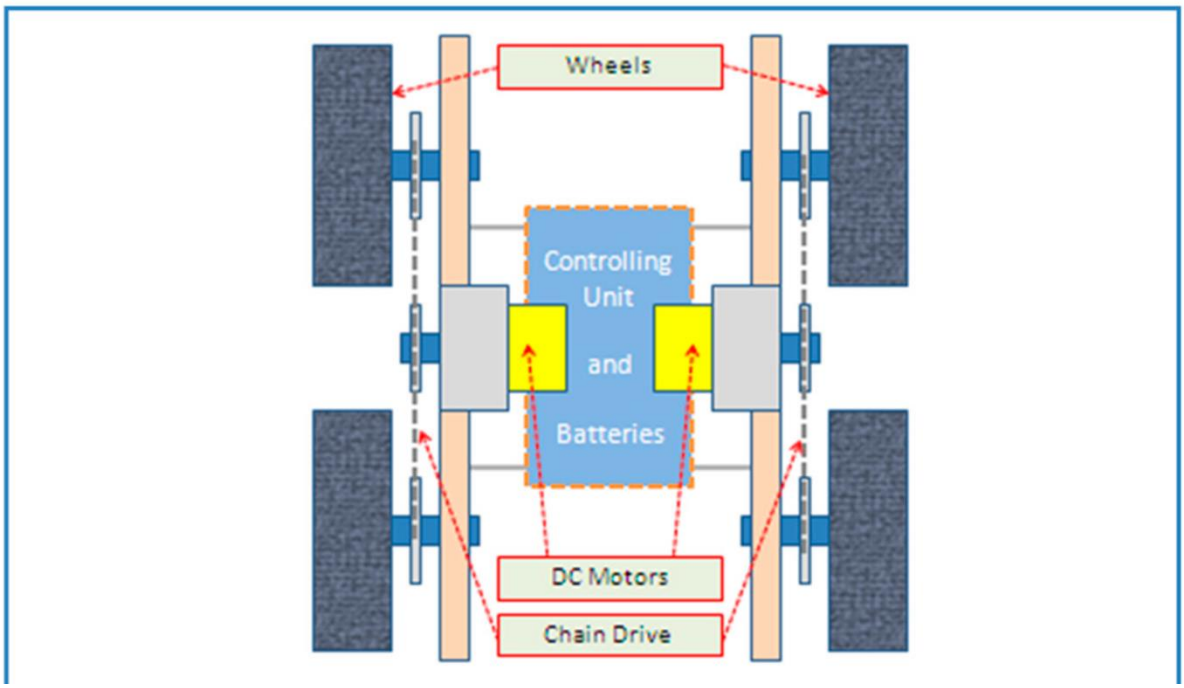


Figure 13: Basic System Design of Robot Car

There is got to correction the engines and body of the car according to of commonplace supporter, mechanical truck is as appeared inside the figure, higher than the need of the territory any place it's utilized. The fundamental framework there's required to fluctuate the engines and body of the truck according to the need of the zone any place it's utilized. The fundamental arrangement of run of the mill supporter automated truck is as demonstrated inside the figure higher than the Controlling unit goes to be arduino uno for the robot.

2.5 Overview of Block Diagram

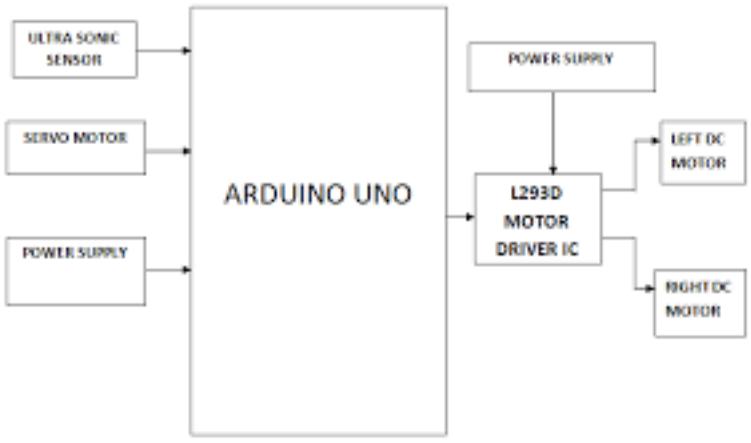


Figure 14: Diagram of a Robotic Car with Ultrasonic Sensor and Arduino Uno

The principal purpose of this project work is to implement a robotic car model that follows an individual that having management unit Arduino Uno and by mistreatment supersonic sensing element. The supersonic detecting component might be a low voltage and current gadget. Supersonic detecting component needn't bother with a transmitter and collector for transmission and gathering of the sign. Since the supersonic detecting component chips away at the rule of reflection. The supersonic detecting component is set at the front of the truck. supersonic detecting component are utilized in this method. Supersonic detecting component is set inside the centre of the vehicle by rise. The microcontroller looks at the information from three sensors and chooses the development of the next step. The lowest cost acquired when examinations from the yields of the supersonic detecting component is considered. On the off chance that the value of detecting component one is least, at that point the vehicle can move inside the forward heading. In the event that the value from detecting component a couple of is least it'll develop to be correct bearing. So also, the development of the truck inside the left bearing is determined. The hole of the truck and along these lines the client is kept up. This strategy is extra conceivable to utilize on the grounds that it is snappy and extra right than the other framework. The wheels of the vehicle square measure associated with the engine drivers. The engine drivers square measure constrained by the microcontroller that is Arduino Uno.

2.2 Conceptual structure

The robot's initial conceptual design features include:

- Movement: four main driving wheels, each with a motor, and two wheels that allows turning of the robot. Within the robot the four wheels are in a fixed position.

- Structure: A solid structure of four parts. The driving part of the robot is in the rear level, the control part is in the middle level, and the sensors are in the top level.

- Sensor: Infrared sensors and then an ultrasonic sensor are located in the structure's top floor. There is a fixed location on these sensors.

2.3 Description of the values or related ideas:

- Rigid body balance: it lets the robot stay in a neutral posture.

- Friction: enables the robot to travel through the interaction between the ground and the tires.

- Centre of gravity: it helps the robot to achieve a steady posture and lose that posture while running on rough ground.

- Utilizes of complementary sensors: sensors are instruments capable of sensing, converting into electrical variables, physical and chemical magnitudes called instrumental variables (air temp, air temperature, distance, velocity, etc.)

- Passive sensors: resistor based on light (LDR), electrical transfer, microphone

2.4 New demands on design

1. The assistance position of the robot must be stationary.

2. The position of the elements of the robot having a relevant weight must be changeable without affecting their functions. Their weight is important, since they depend on the balance of the robot.

3. The coefficient of friction between both the wheels and the ground shall be changeable.

4. The assembly has to be done by the team-members who enrolled.

5. The artistic feature of the robot must be configurable by the students who participate.

2.5 New requirements concerning architecture

Changing the location of the batteries inside the robot has to be necessary.
The robot's central assembly must be simple and fast, using common tools and hands and by our team members who are not professionals in engineering nor robotics.
The robot should have at least one feature that can be personalized by the end users. The robot must have and use different types of sensors such as: LDR, electrical switch, light-emitting diode (LED), reflective surface ,infrared LED.

2.6 Model design (second stage)

The new features that enable the robot to uphold the specifications mentioned are: The connection substance between the wheels and the ground can be changed using different bands of items placed around the wheels. The batteries can be placed inside the robot in three main ways. That enables the location of the centre of mass to be modified.
Within the robot system the running motors can be moved using directions. This allows one to have different modifications in the supports, which in effect modifies the state of equilibrium. The shape of the robot allows the previously mentioned sensors to be connected to it.

2.7 Comprehensive interior design

After the basic and functional principles in the stages of the design phase have met the criteria of the design, this becomes necessary to define the physical and angular attributes of the aspects that will shape the robot to ensure that neither attachment interferes with one another, facilitating the production of all the set functions. The main components of the design phase are: speeding wheel sizing and the freewheel
Selection of material for moving wheels
Tailoring of the structural surfaces, placement of the guides and mounting positions for each form and motor part collection
Distribution of all the working elements inside the robot

The robot components are grouped into subassemblies

2.8 Construction

Because the layout of the robot must be customizable, its construction project was split into initial subgroups to facilitate the consequent assembly of components. This preliminary process started by choosing the pieces to be joined together with glue. These site-sets were already: the framework tiles, the moving unit and each of the printed circuit boards of the system, either general or any of the sensors in dispute.
Glue is used to secure the in the plates, allowing the sensors to be easily attached or replaced. The wheels are connected to the engine shaft by inserting it into the shaft. This package is then connected to the structures to allow this moving system to be placed in the framework of the device. Originally, the designed circuitry and all their electrical components are mounted, setting only the cables used to connect to the batteries and sensors. From such a point, several other robot design operations are assembly operations using basic tools such as screwdriver

2.9 RESULTS

It provides a distinction with the concepts of physics that can be taught from the robot, for both the model with the original approach as well as for the project with the changed process. This affirms how the change in the design approach used in this case is helping to supplement what this robot will understand and teach.

Physics Principles	With the Basic Design Methodology	With the Modified Design Cycle
Electronics	- Ohm´s law - Series resistors - Voltage divider - Electric motor DC	- Ohm´s law - Series resistors - Voltage divider - Electric motor DC
Sensor	- Passive sensors: light emitting diode (LED) Active sensors: ultrasound, infrared	- Passive sensors: light emitting diode (LED), light dependent resistor (LDR), electric switch, microphone - Active sensors: ultrasound, infrared, phototransistor reflective objetc sensor
Mechanical Physics		- Rigid bodies equilibrium - Friction - Center of gravity
Algorithmics		- Sequential structure - Cyclic structure - Logic decision structure
Other Aspect		- Robot esthetics - Robot assemble

Figure 15: The principles of physics to tackle

2.6 System parts

The system is consisted of a four wheel robotic car mounted on an impact unit beside completely unique module and sensors i.e. inaudible device, arduino uno, motor driver defend, servo motor, wheels (4x), infrared device (2x), dc power switch, li-on battery (2x).The inaudible device is vertically self-adjusting and is at first mounted on mechanism at a height of two linear unit. from ground to reinforce the visual capability and effectiveness. This robotic vehicle is controlled by the microcontroller by keeping associate adequate distance. This Arduino Human Following mechanism are going to be run on four wheels during which every of the wheels goes to attach with the L293D motor driver by the motors. Once inaudible device detects it's progressing to move therein explicit direction.

2.7 Design Drawings and Materials

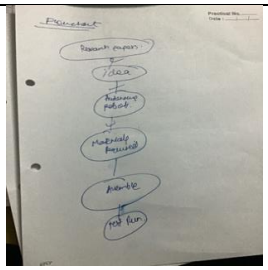
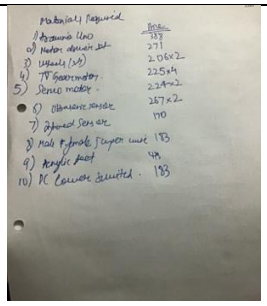
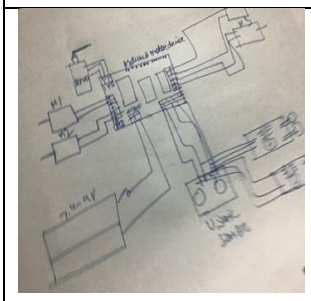
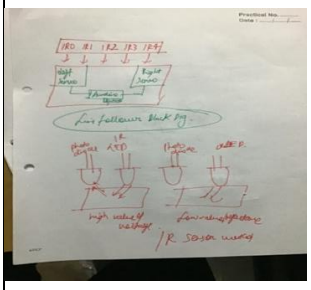
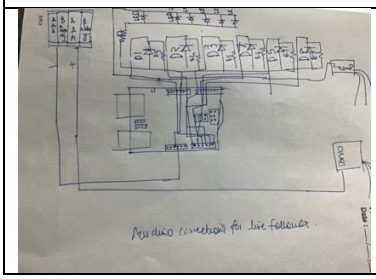
The design is a collection of materials and parts to represent our concept for the model to be built. The materials used are of sufficient quality to express the realization of our concept by them. Each team member shows up with two sets of materials. Ideally the team will find all the details they need to create our design inside your design packet pages. Naturally in real life, designers typically have the ability to communicate their "dream" of a product to a production professional for oral, written, and other means of technical communication (graphics, templates, videos). As an engineering professional doing design work, you will always find the completion of a written design record necessary. Written design records are necessary for the protection of intellectual property rights (patens), for the maintenance and upgrade of design, For professional validation and promotion and peer review (the process by which peers criticize a design in the design staff).

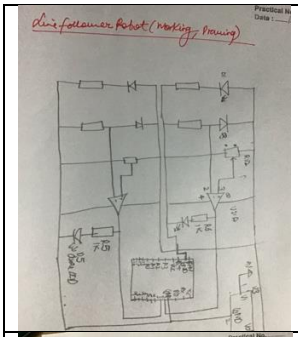
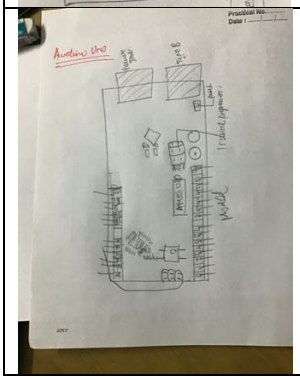
We had to construct test robots before reaching our final robot. The idea behind doing multiple robots is that we would be able to identify the mistakes and rectify them in the initial stages of our robots and when the final robots is ready it will be perfect without any mistakes either machinery or human error.

The Planning we did consisted of 3 stages:

1) Initial Stage
2) Intermediate Stage
3) Final Stage

Table 2.1: Step by step flowchart

	Flowchart of events
	Materials list with pricing.
	Block diagram of robot following human.
	IR sensor working, Line Follower Block Dig.
	Arduino Corrections for Line Follower.

	Full Line Follower Robot (Working, Drawing).
	Arduino Working and pin configuration.

2) Intermediate Stage-:

In the this stage we were primarily concerned with the management of funds required for the raw materials like glue gun, screwdrivers to the complex electronic equipment like the L293D Motor driver. We created a table of cost vs components we needed for the completion of our project. The table is as follows:

Table 2.2: Cost vs Components

COMPONENT NAME	**PRICE(in rupee)**
ARDUINO-UNO	460
MOTOR DRIVER SHILD	306
WHEELSx4	203
TT GEAR MOTORx4	680

SERVO MOTOR	231
ULTRASONIC MOTOR	114
INFRARED SENSOR	216
18650 Li-on Battery (2x	1186
18650 Battery Holder	168
Male and Female Jumper wire	176
Acrylic Sheet	200
DC Power Switch	148
TOTAL	**4088**

3) Final Stage -:

We received the material's through online mode and started assembling based upon our hit and trial methods for the robot making. We carefully examined each and every part before placing into our robot and connection were double checked by our team time and again because loose connections were a cause of major failure in our previous robots.

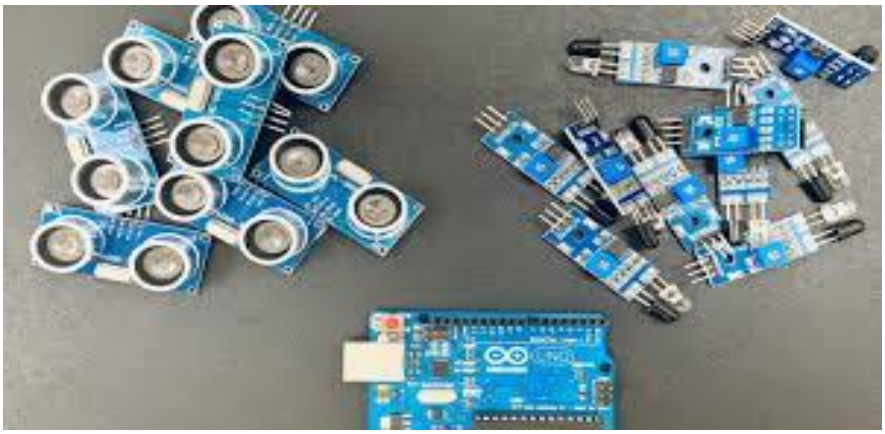


Figure 16: Sensor with arduino board

IR Sensor vs Ultrasonic Sensor Which is better??

Property	**Leap Motion**	**Ultrasounds**
Detected Points	continuous detection	one sensor per key
Hardware requirements	Android via laptop	Android via Arduino
fps	30∼300	200
False positive	too many	few
False negative	few	none
Latency	acceptable	excellent
Tactile feedback	discrete-space (surface tapping)	continuous (dipping on mesh)
Subjects' tolerance	low (gloves)	good (mesh)
Full Android integration	not yet	through Arduino ADK

Figure17: Ultrasonic Sensor vs IR Sensor

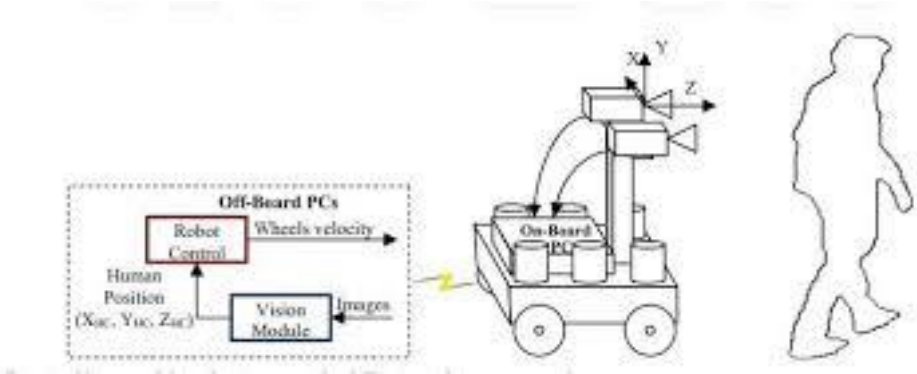


Figure 18: Layout of Robot following Human

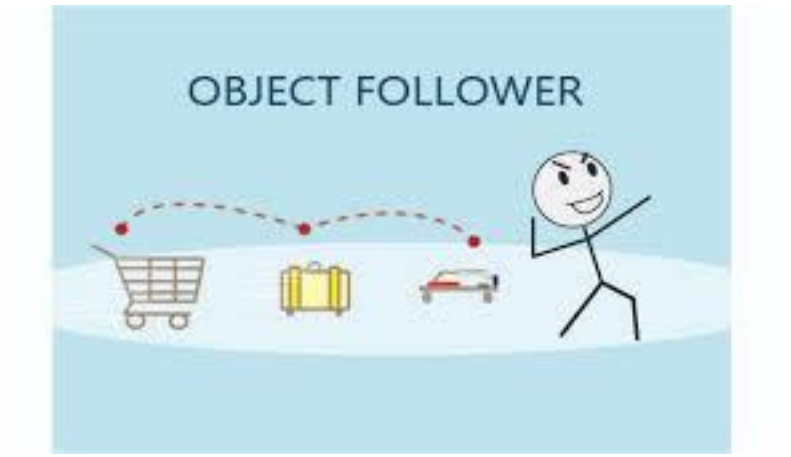


Figure 19: Example of robot can also be used as a shopping cart

Our Robot Can Also be used as Shopping carts to be used be people ,
They just have to walk in front and the cart will follow them around the mart.

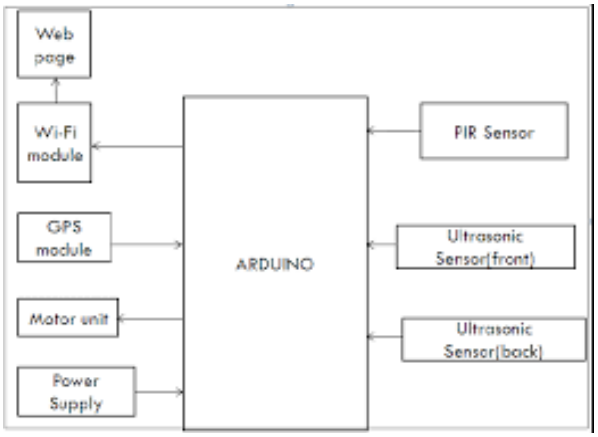


Figure 20: Block chart of our project

Person Being Followed By robot Flow diagram a more advanced approach with wifi module and web page, but unfortunately we couldn’t have the necessary time and resources to make this.

CHAPTER 3 MATERIALS AND METHODOLOGY

According to our diagram the output coming out of the ultrasonic detector is input again in the Arduino uno, in keeping up to date with the codes that are implanted into the controller to produce specified result. It'll be steam-powered by a 9v battery. Whenever a supersonic detector (HC-SR04) detects a personality's part inside a variety of fifteen to twenty cm motors can get the output from L293D motor driver that itself planning to have the output from ultrasonic detector and it's planning to move therein specific direction.

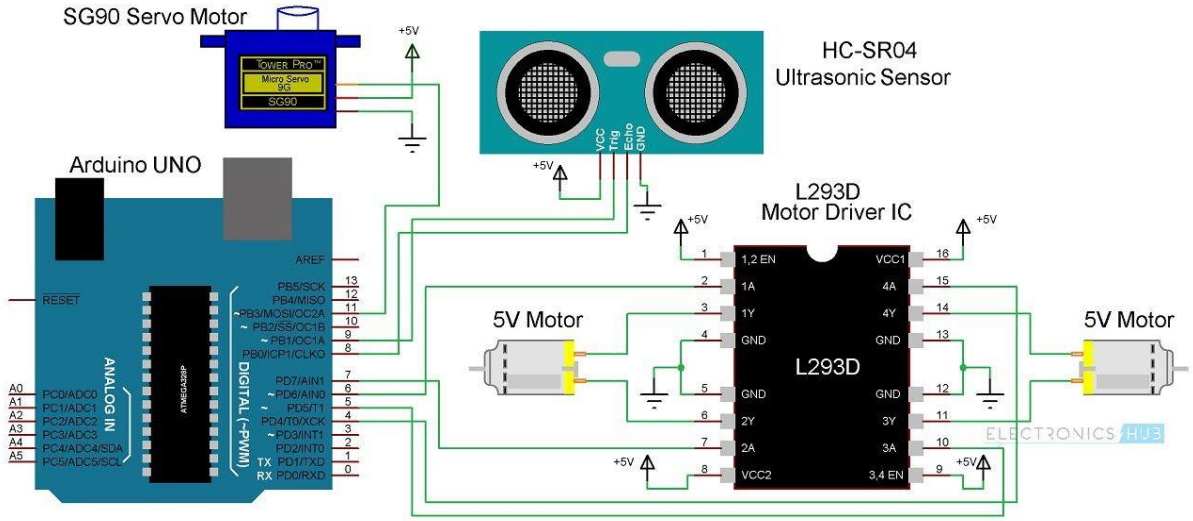


Figure 21: Block Diagram of Robotic Car Following Human

3.1 Materials Used

Main components of our project are:-

1) Ultrasonic Sensor (HC-SR04)
2) Motor Diver Module (L293D)
3) Controlling DC Motors
4) Arduino Uno
5) IR Sensor
6) Servo motor

3.1.1 Ultrasonic Sensor

Ultrasonic detecting component transmits the ultrasonic waves from its detecting component head partner degree again gets the ultrasonic waves reflected from an article.

There square measure a few applications utilize ultrasonic sensors like guidance caution, programmed entryway openers and so on. The ultrasonic detecting component is extremely incredible, conservative and incorporates a superior technology. It's each of the transmitter and recipient, comprises of four pins.VCC pin offers 5V flexibly to its detecting component. The trigger pin gives a TTL beats of 15 micro seconds, Ultrasonic detection component HC-SR04 is shown in Figure 22.

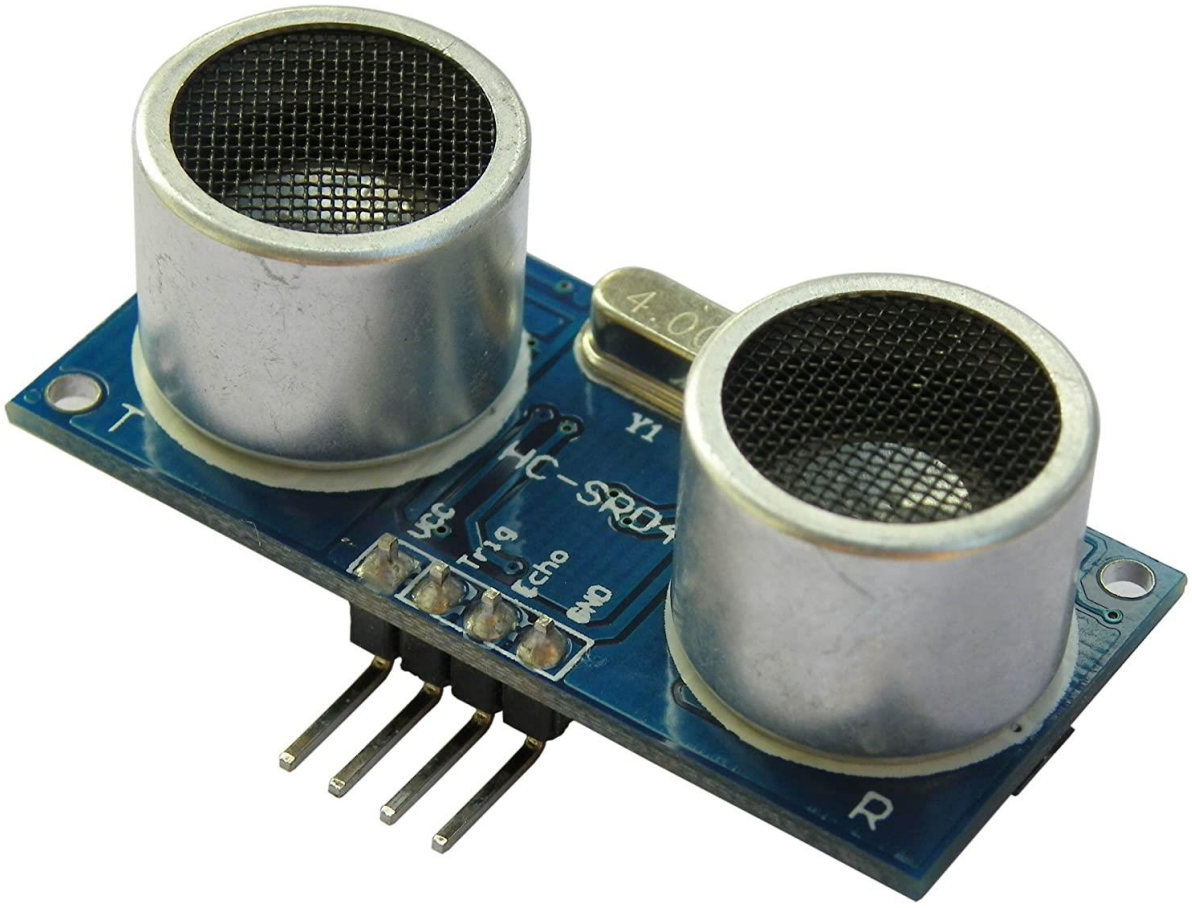


Figure 22: Ultrasonic Sensor (HC-SR04)

Timing Diagram

The fleeting course of action outline is appeared beneath in Fig. 20. The signs spread in the atmosphere at the speed of sound. In the event that they hit any article, at that point they reproduce back reverberation sign to the identifier through that arduino uno gets the yield. The supersonic finder consists of a multi-vibrator, attached to the base. The supersonic indicator truly comprises of 2 sections; the cathode that creates a forty kilohertz acoustic wave and identifier distinguishes forty kilohertz acoustic wave and imparts electrical sign back to the microcontroller.

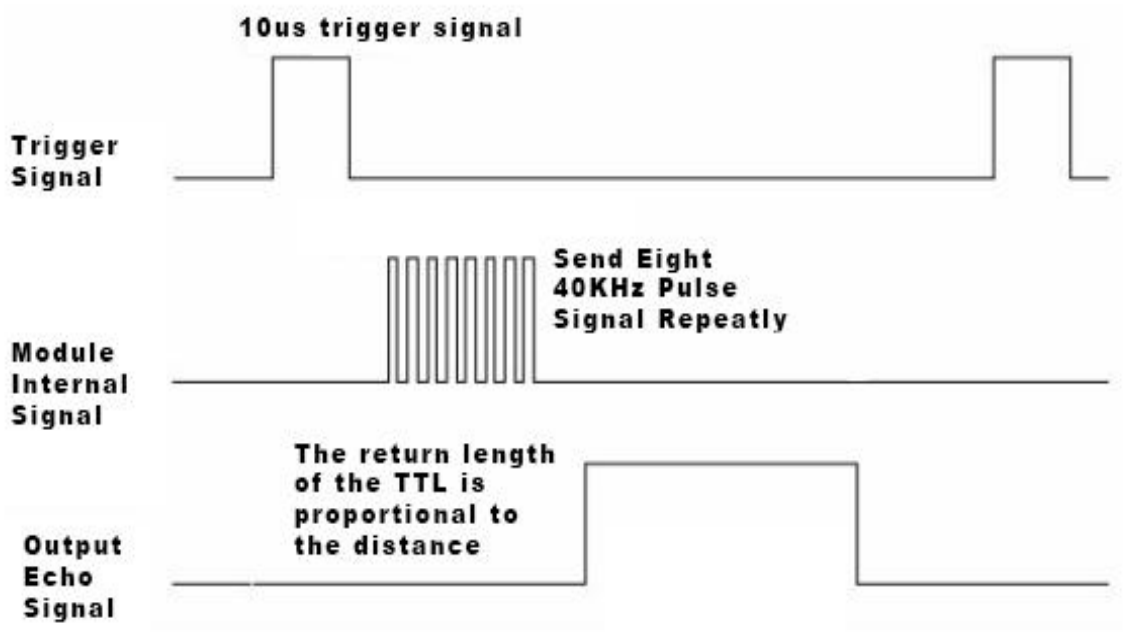


Figure 23: Timing Diagram of Ultrasonic Sensor

Principle of Operation

The man job of ultrasonic sensor HC-SR04 is adding ultrasonic distance capabilities to projects. The HC-SR04 gets triggered by a ten microsecond high signal on the trigger pin. Once it gets pulled low again, the module sends out eight 40 kHz sound pulses. If any object came in the detection range, the sound pulses get reflected by that object, and the module receives the echo by which it measure the distance. The time between sending the eight pulses and receiving the echo can be used to calculate the distance to the object that reflected the sound.

Creating Object Focus with an Ultrasonic Sensor

Line follower robots usually equip colour sensors to differentiate between the line they are following and the floor. Obstacle avoiders utilize infrared or ultrasonic sensors to make sure there is nothing in front of them and keep traversing a pre-programmed course. However, focusing on a single object and calculating its trajectory is another kind of problem. Attaching a transmitter to the object and a receiver on the follower is the usual solution, but we will only be using one ultrasonic sensor for a challenge. By having a servo motor sway the sensor side to side in a thirty-degree arc, we can measure the distance of an object from both viewable edges. Assuming we are following an object with a flat back side, we can know if an object is turning left or right by measuring these values against each other.

3.1.2 L293D Motor Driver

L293D H-bridge module will be utilised with the motors that have a voltage between five and 35v dc. Motor driver layout is as shown in fig. 21

Features are as follows:

1. Can be used with the same IC to power Two DC motors.
2. Speed and direction checks are necessary
3. Vcc2 (Vs) motor tension: 4.5V to 36V
4. Current maximum peak current : 1.2A
5. Maximum current in continuous engine: 600mA
6. Supply Vcc1(vss) with voltage: 4.5V to 7V
7. Transition time (at 5Vand 24V): 300ns
8. There is automatic Thermal Shutdown
9. Packages are available in 16-pin DIP,

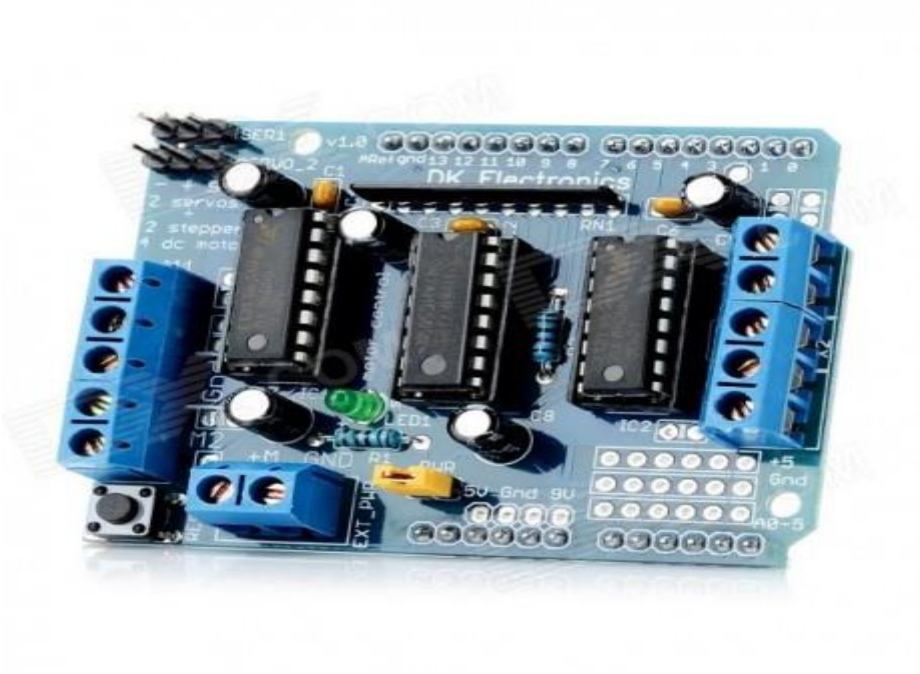


Figure 24: L293D Motor Driver

Table 3.1: Truth Table of Motor Driver (L293D)

Input A (TR1 and TR4)	Input B (TR2 and TR3)	Motor Function
0	0	Motor Stops(OFF)
1	0	Motor rotes forward
0	1	Motor rotates reverse
1	1	Not Allowed

3.1.3 Controlling DC Motors

L293D component is employed to regulate two DC motors. First connect every motor to the motor A and B connections on the L293D. DC Motors is employed to manoeuvre the automotive which can get the output from motor drive from that they're connected. There'll be 2 motors one for left facet and one for right facet.

Figure 25: DC Motor

3.1.4 Arduino-Uno

Arduino Uno is a board that relies on the ATmega328P (datasheet) microcontroller. It has 14 computerized input / yield pins (of which 6 can be used as PWM yields), 6 simple info sources, a 16 MHz earthenware resonator (CSTCE16M0V53-R0), a USB connection, a force jack, an ICSP header and a reset key. It includes everything that is supposed to support the microcontroller; basically link it to a PC with a USB connection or force it to start with an AC-to - DC connector or battery. You can tinker with your Uno without thinking about doing anything wrong, the worst outcome you can imagine is that you should exchange the chip for a few bucks and start again. "Uno" in Italian means one and was chosen to check the arrival of Arduino Software (IDE) 1.0. Arduino Software's Uno board and form 1.0 (IDE) were Arduino’s reference variants, currently developed to fresher discharges. The Uno board is the first in a progression of the Arduino USB sheets, and the Arduino stage reference model.

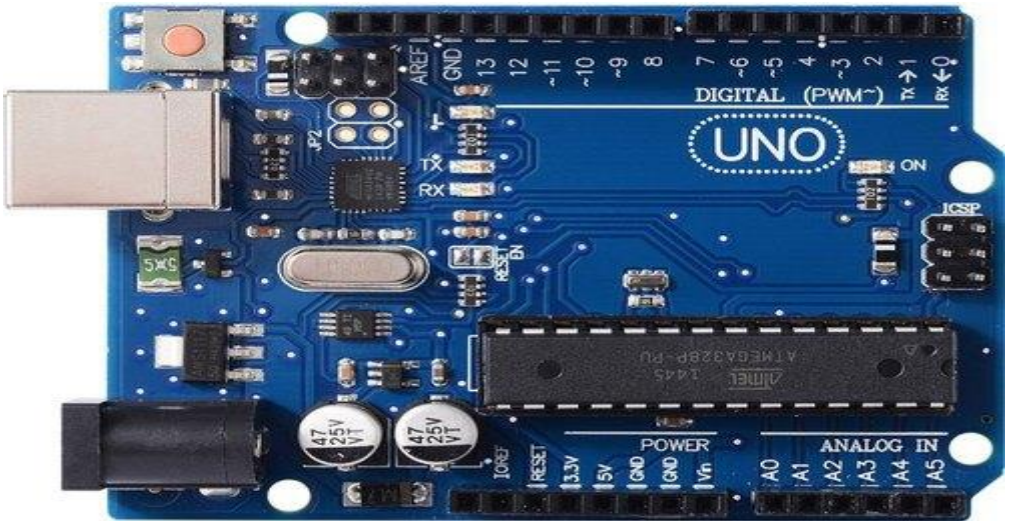


Figure 26: Arduino Uno

ATMEGA 328P-processor

Atmega328 is a single ATMEL created microcontroller for the chip. One growing alternative to the ATmega328 is the ATmega328P "Pico Energy." This is most commonly implemented on the popular Arduino development platform, namely the Arduino Uno or other Arduino models.

Table 3.2: Key Parameters of ATMEGA 328P-PU

Parameter	Value
CPU type	8-bit AVR
Performance	20 MIPS at 20 MHz
Flash memory	32 kB
SRAM	2 kB
EEPROM	1 kB
Pin count	28-pin PDIP, MLF, 32-pin TQFP, MLF
Maximum operating frequency	20 MHz
Number of touch channels	16
Hardware QTouch Acquisition	No
Maximum I/O pins	26
External interrupts	2
USB Interface	No
USB Speed	No

Pin Diagram of Arduino Uno

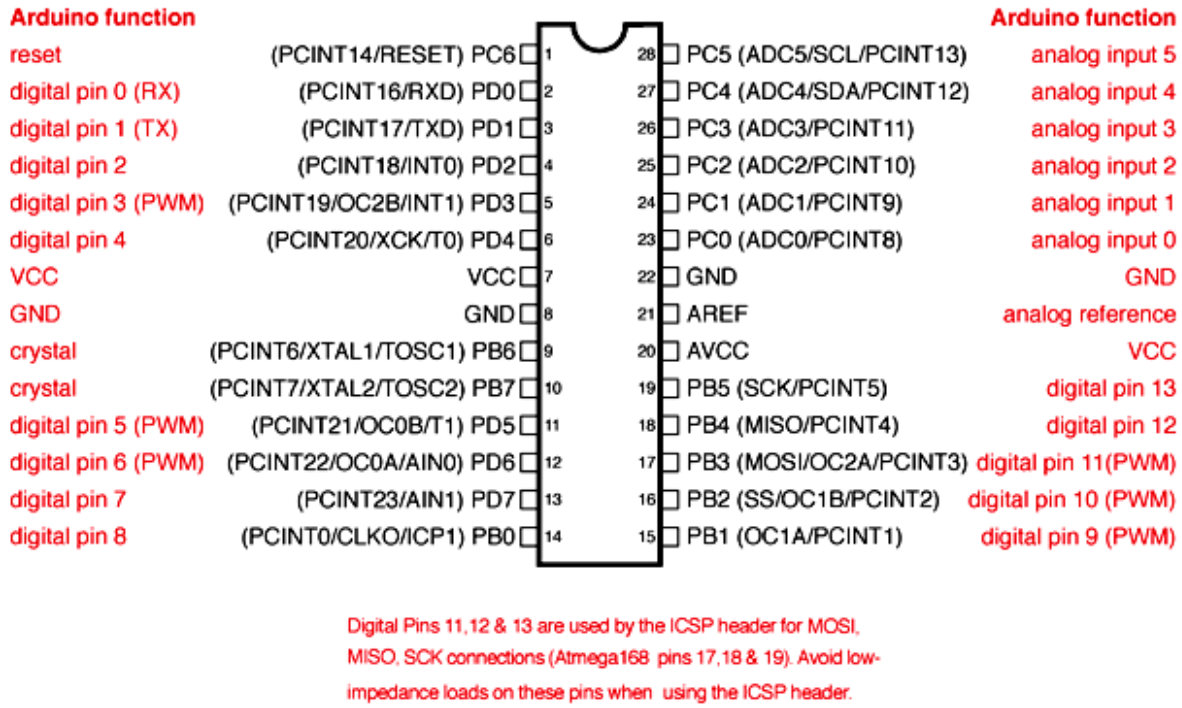


Figure 27: Pin Diagram of Arduino Uno

3.1.5 IR (Infrared Sensor)

An infrared (IR) sensing element is an associated degree device that measures and detects infrared within its surrounding environment. While the temperature activity of each colour of sunshine (separated by a prism) detected that the temperature on the far side alone was the highest of the red lightweight. IR is invisible to the human eye as its wavelength is longer than that of actinic radiation (although it also has a strong spectrum of magnetic attraction). Everything that emits heat (it offers off infrared anything that requires a temperature. There 2 forms of infrared sensors are measured squarely: active and passive. Each of the active infrared sensors emits and notice infrared. There are 2 pieces of active IR sensors: a lightweight emitting diode (LED) and a receiver. As soon as the associated degree object approaches the sensing element, the infrared emission from the junction rectifier reflects off the item and is detected by the receiver.

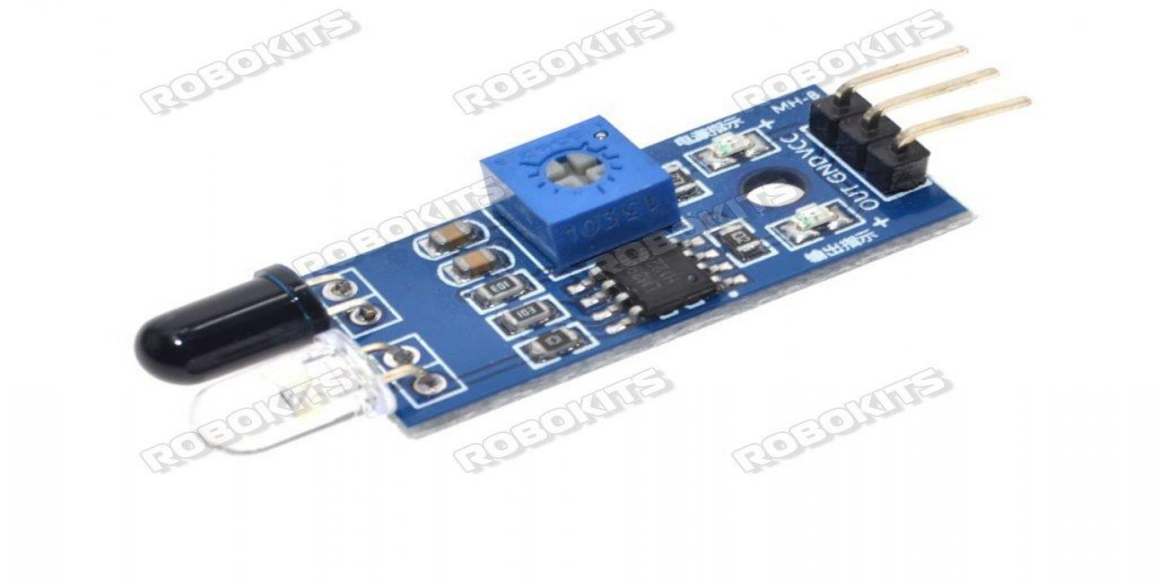


Figure 28: IR Sensor

3.1.6 Servo Motor

Servo motor is a special type of motor which unlike other motors specialized in precise position not in controlling speed. So the other motors where use for speed servo motor sends signal to move at a particular angle. If motor is using DC powered then it is called DC servo motor and if it is AC powered then it is called AC servo motor.

Figure 29: Servo Motor

How Servo Motor works

The servo motor, the actual motor inside a servo motor is brushed dc motor. At the top of the servo motor, under the upper cover, there is a set of gears. These accomplish two main purposes

1) They give the motor mechanical advantage, producing more torque than the output of its own motor.

2) The gears link together the position sensor and the motor. In most servos, the position sensor is a potentiometer. The potentiometer allows the servo to know the exact angle of the motor shaft.

Servo Motor Pros

Absolute Positioning System- Servo motor is mainly used because they allow for a computer to move the motor at a specific angle.

High Torque at High Speed- Due to the gearing system available in servo motor it is able to generate high amount of torque and also move at high speeds.

Servo Motor Cons

Mechanical Complexity- Servos combine a brushed DC motor, set of gears, potentiometer and controller PCB. Because of this much potential points there are a greater number of failures.

Challenge to Mount- In comparison with other types of motors that can be mounted in some holes, servo motors are difficult to incorporate into designs.

Controlling Servo Motor

All motors have three wires coming out of them out of which two will be used for supply one is positive and one is negative. Servo motor is controlled by pulse modulation width which is provided by control wires. There are three pulses in servo motor a minimum pulse, a maximum pulse and a repetition rate. Servo motor can turn in 90 degree from either direction

from its neutral position. Servo motor expects to see a pulse every 20 milliseconds (ms) and the length of the pulse will determine how far the motor turns.

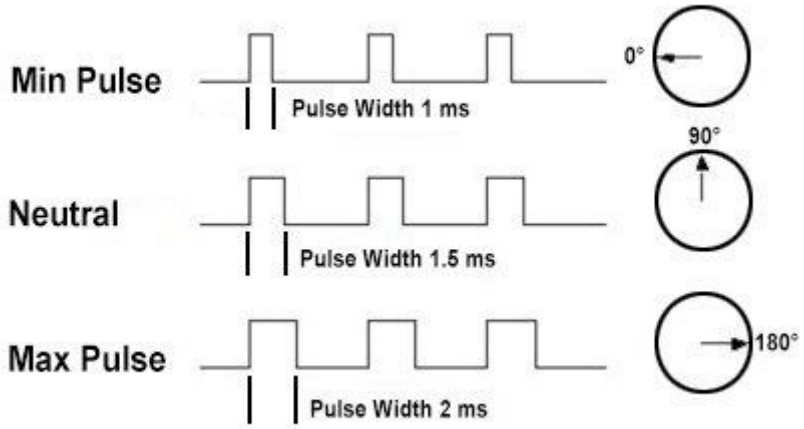


Figure 30: Timing Diagram of Servo Motor

3.2 Methodology Used

A step by step analysis method is taken up having the final goal in mind of completely useful and human-following robot. A suburbanised high down approach is employed for this project. The project is split in to 5 modules. Every module is freelance from each other. Totally different phases were distributed step by step, ranging from basic detector testing and continuing towards obstacle rejection, object detection, object trailing and information transmission.
.

Data obtained by completely different sensors and modules is put together analysed and an intelligent call on the idea of data obtained is created that instruct the automaton to follow a specific direction. Two distinct units are used i.e. microchip and a controller. The process is carried out by microchip and therefore the information is recorded by the sensors is controlled by a controller i.e. Arduino board.

This approach was most fitted as a result of if there's a fault in anyone of the modules then it might not have an effect on the complete system. Thence this provides the most effective attainable results by maintaining accuracy.
Human following maintaining a selected distance from the article and establishing a communication link between micro chip and controller are the most aspects of this project.

CHAPTER 4 WORKING PRINCIPLE AND APPLICATIONS

The Human robot car follows a person using the ultrasonic sensors for their movement. The 8051 Family microcontroller is used to perform the desired operation. The motors are connected via an IC microcontroller for the motor driver.

4.1 Working

The ultrasonic sensor is attached to the robot's front end. The ultrasonic sensor transmits the ultrasonic waves from its sensor head continuously as the robot goes along the desired path. Each time an obstacle appears before it, the ultrasonic waves are reflected from
An object is transferred to the microcontroller and that information. Whatever way we drive the robotic car will follow us. The ultrasonic sensor sends the output to the microcontroller in which the microcontroller sends this input as output to the motor driver by transmitting the waves, and when it hits back.
Now L293D motor driver is going to send the output to dc motors through which our car is going to move. When signal coming from ultrasonic sensor stops it is going to stop. Distance between object and ultrasonic sensor should be of 20cm. If it will be more than that ultrasonic sensor will not detect anything.

4.2 Application

Looking deeply into the environment or our environment, we should be able to understand that "YES" has such an automaton prerequisite that can support and represent humans. Such an automaton is also used for multiple functions. With a number of changes, the automaton additionally acts as a companion for a person.

Some applications of this automaton are:-

1) can help bring hundreds of people who work in schools, libraries, airports etc.

2) Obstacle to avoid automatons is frequently used in mobile robotic navigation.

3) They can be used as automatic vacuum cleaner, for unit work.

4) They can even be used in hazardous environments, wherever fatal human penetration may be.

5) Human follow automaton are often used as a cart in searching stores.

6) Can assist aged folks, special youngsters and babies.

7) Can follow a selected vehicle.

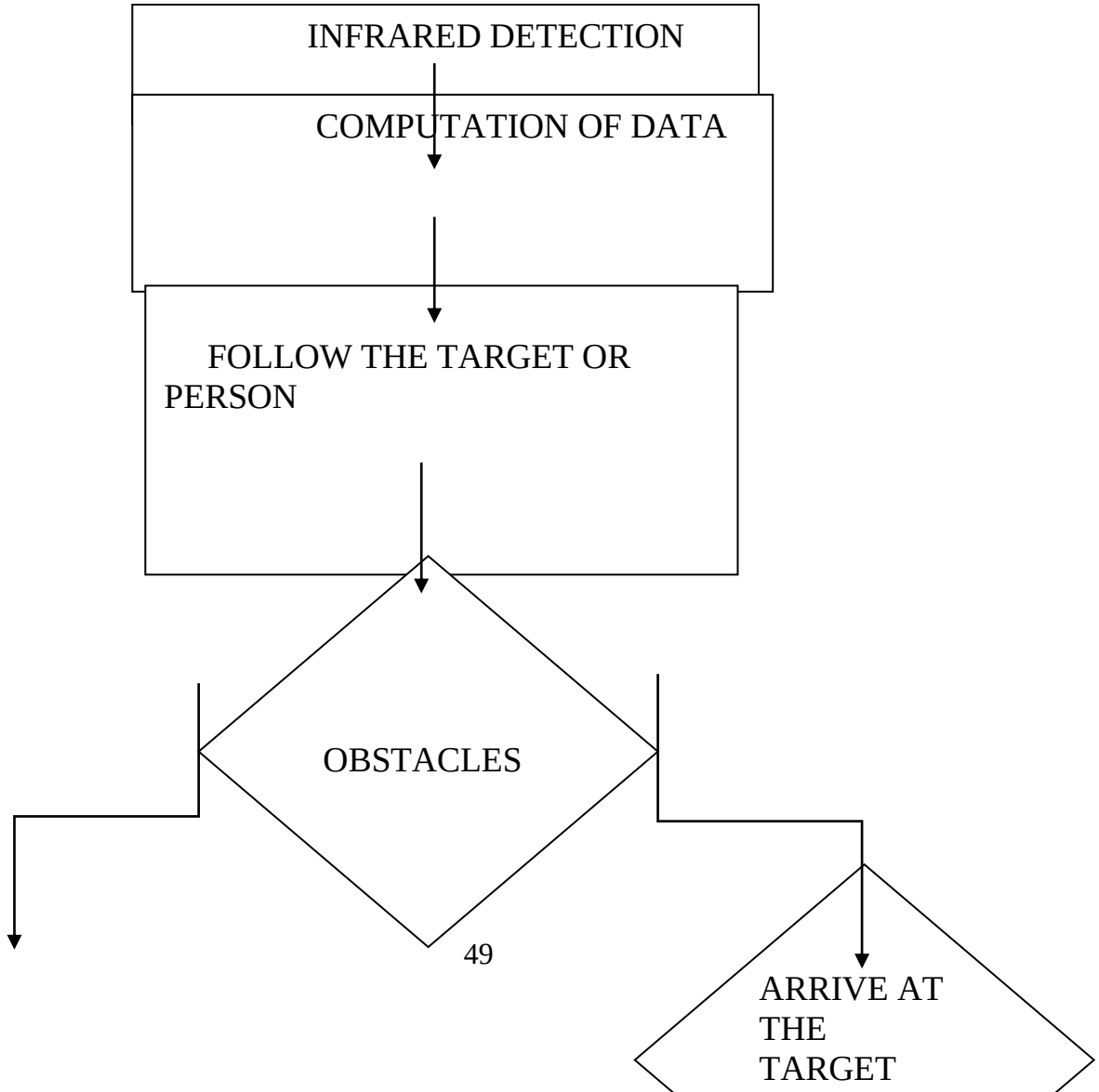
4.3 Difficulties Faced on making Person followed by robot

This area faced many challenges that region unit being Janus-looked by analysts once assembling robots. for instance, somebody following robot should be working appropriately in an exceptionally crowded setting. It mustn't be lost all through after once there's stores of development ahead.

Moreover, individual after robot creator should consider a region any place there's lopsided floor. The robot should moreover be ready to increase its speed when the person its following is running. The robot should furthermore maintain a strategic distance from impediments, be it static or moving deterrents. The robot should be prepared to identify and obey as human as well as possible. The robot zone and the person being followed in this way should be in a safe separation. The robot should experience forestall once, and keep away from individual crashes.

Programming and Simulation

This programming is done using the Arduino 1.65 with compiling it in ‘’.hex’’ file. Proteus is used to check the simulation process.



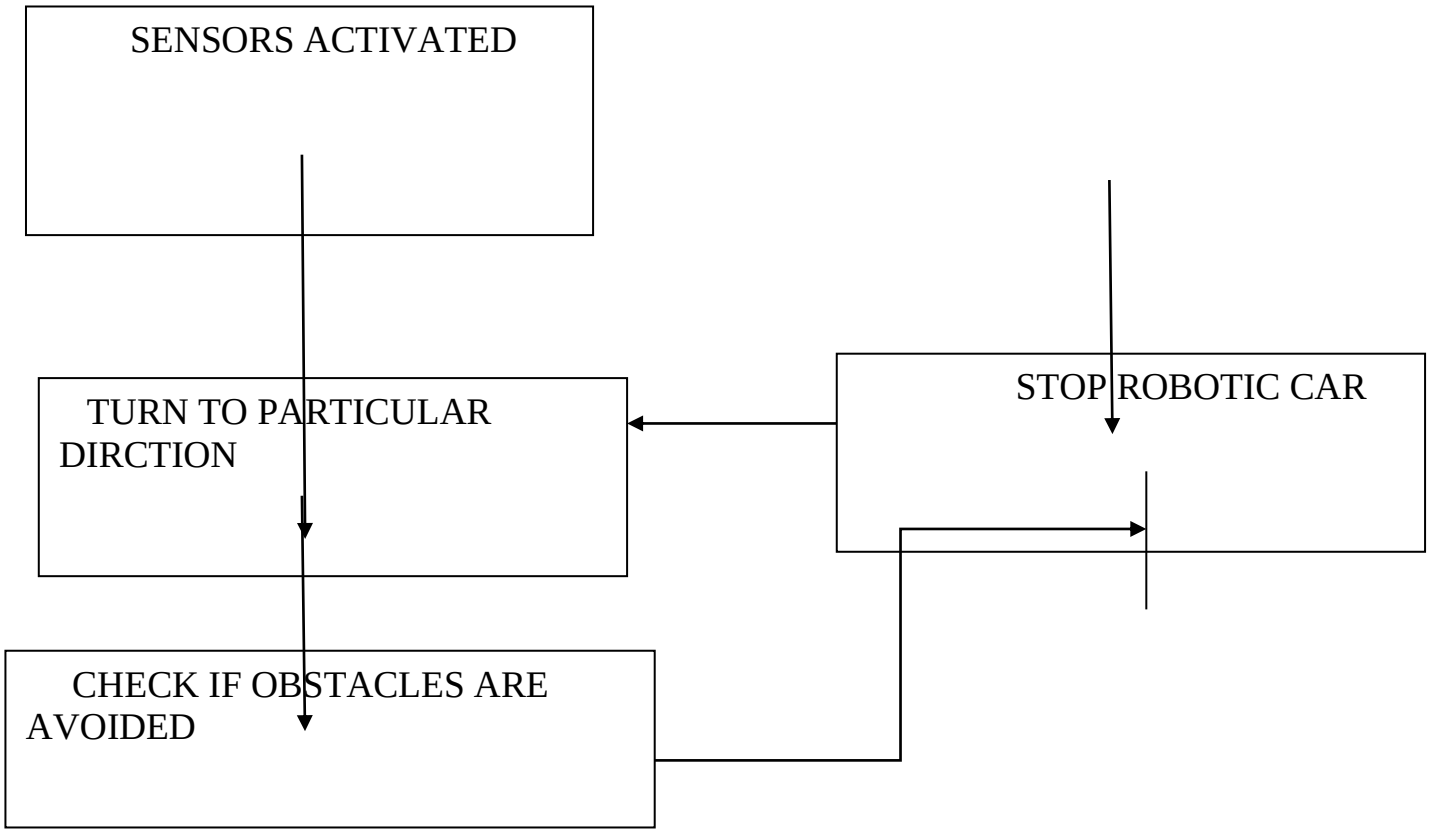


Figure 31: Block Diagram of Programming and Solution

CHAPTER 5 RESULT

The objective of the person following robotic car is to trace and follow the person that is obtained by using inaudible sensors that detects the target in the range of 15cm to 20cm and measures the space and sends it to the microcontroller which controls the movement of the car. We have the car which is having four wheels in which front wheels are used for the left right movement of the car and rear wheels are the reason for its movement. At the beginning we came up with the line follower robot which is nothing than a simple moving robotic car moving on a strip of line as we programmed this in an arduino board. Then we start moving towards our main objective of making a robotic car which is going to follow a person on its own within a desired range as we are making a replica of a car not an original car. So we start giving our project a shape by putting an ultrasonic sensor in the front of our robotic car. Main function of our ultrasonic sensor is that whenever an object comes in front of it, sensor starts working and detects the object by sending the reflection of it. When it detects the object sensor sends the output to the arduino board. After that arduino board sends that result output to the motor driver (L293D) which is programmed to run the motors connected to the wheels at the rear side.

Further we connected two infrared sensors on the both left and right side of the car. Those infrared sensor works for the movement of car in left and right side. Whenever an infrared sensor turns on robotic car moves in that particular direction. If only left sensor turns on then the robotic car will move on the left side and if the right infrared sensor turns on it will move in the right direction. If both infrared sensor turn on it will move in forward direction. Ultrasonic sensor detects the object and when the light emits on the infrared sensor it helps to move the robotic car in particular direction. We have tested the robotic car by performing several tasks. If we increase the speed of our moving robotic car stops moving as car lost the desired distance between person and robotic car. If suddenly any object came up it stops over there and again start moving when detects the person moving. Robotic car is able to move in any direction and due to its small size car gets trouble in moving but if we make a car with proper equipments then no problem is going to occur. We also came up with that this car not only follows a person but it can also detect an object and keep moving behind that object but if it start moving behind any particular object then it will change its route and keep follow that object.

CHAPTER 6 FUTURE WORK

Our project which is based on the application of a robotic car which is going to follow a human can have numerous future applications. This project can give fascinating products to the future world which are going to assist the humans. Although our future is somewhere dependent on robots. So this project can have future work like:-

1. If we place a wireless camera at the front side of our robot then we can make it to follow a single person only. This can help in an organization or any other work place where thousands of people work together. In hospital or company so many project files taken here and there this type of robotic car will assist the person by carrying the files as this can be given any shape just the architecture will be different working of car is going to be same.

2. This robotic can be used by a military person who can't go in dangerous places but by placing a global positioning satellite (gps) for navigation and camera to look for the place this car will assist as a true companion. If the car gets any damage from the enemies then still person who is using it will be safe and not military man there are several work areas where going for a human can be fatal but this car can go there.

3. This robotic car can programmed in this way that it can follow a selected vehicle which can be used by a cop in chasing a car by giving robotic car a proper dimensions and obstacle avoidance so that it will be safe for the pedestrians also.

4. In stores where you have to buy such small and large things which you cannot hold in your hand then this car can be used over there to assist the human. If we connect the car with Bluetooth module and a particular mobile of person who wants the car to follow them then people who are aged or youngsters with babies can use this one so that they will be free to pick anything easily.

5. It can be made using automatically and can be turn into a vacuum cleaner which cleans the house. Robotic car will suck every dust particles and going to clean the house without any helping hands. This will made the work easy, fast and efficient as that time can be used for some other work as well.

CHAPTER 7 CONCLUSION

A successful implementation of a person follower robot is illustrated in this project. This robot does not only have the detection capability but also the tracking and following ability as well. This tracking is basically performed when the human is followed on the basis of detection. It was also kept in mind that the “following” capability of the robot should be as efficient as possible. The different sensors that were integrated with the robot added an additional advantage. This project is going to be the future need and people in different places going to use it. Robotic car made in this project can be mold into any shape and then can be used as a particular person wants to use it. This project presented a simple, cost effective person following robot. The evolution of such projects shows that it can be obstacle avoidance and can follow someone at the same time.

As we are using a development board Arduino Uno which is having a microcontroller ATmega328 which is run by a code written in C language. We mentioned every part of robotic car in code and make a successful code to run the car. The wires and every sensor connect to the car and in the end connected with the Arduino board. Once the code has been loaded, plug in the battery and watch the robotic following the person that comes in the desired range of 15cm to 20cm. The robot challenged the group to cooperate, communicate, and expand understanding of electronics, mechanical systems, and their integration with programming. We have completed our project successfully and in the completion of every task demonstrated the potential of positive group work.

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APPENDIX A

Feeding the Code in Arduino IDE:

The bulk of this project is in the software, so be ready to get your hands dirty with the code. The only library we will use is the Servo library built-in to the Arduino IDE .Let's look athe code:

A.1 PROJECT SOURCE CODE

```
#include<NewPing1.h>
#include<Servo1.h>
#include<AFMotor.h>
#define RIGHT A2
#define LEFT A3
#define TRIGGER_PIN1 A1
#define ECHO_PIN A0
#define MAX_DISTANCE 100


NewPing1 sonar(TRIGGER_PIN, ECHO_PIN1, MAX_DISTANCE1);


AF_DCMotor Motor1(1,MOTOR12_1KHZ);
AF_DCMotor Motor2(2,MOTOR12_1KHZ);
AF_DCMotor Motor3(3,MOTOR34_1KHZ);
AF_DCMotor Motor4(4,MOTOR34_1KHZ);


Servo1 myservo 1;

int posi =0;


void setup() {
  Serial.begin(9600);
myservo1.attach(10);
{
for(posi = 90; posi <= 180; posi += 1){
  myservo.write(posi);
  delay(15);
} for(posi = 180; posi >= 0; posi-= 1) {
  myservo1.write(posi);
  delay(15);
```

```
}for(posi = 0; posi<=90; posi += 1) {
  myservo1.write(posi);
  delay(15);
}
}
pinMode(RIGHT, INPUT);
pinMode(LEFT, INPUT);

}


void loop() {


delay(50);
 unsigned int distance = sonar.ping_cm();
Serial.print("distance");
Serial.println(distance);



int Right_Value = digitalRead(RIGHT);
int Left_Value = digitalRead(LEFT);



Serial.print("RIGHT");
Serial.println(Right_Value);
Serial.print("LEFT");
Serial.println(Left_Value);



if((Right_Value==1) && (distance>=10 && distance<=30)&&(Left_Value==1)){
  Motor01.setSpeed(120);
  Motor01.run(FORWARD);
  Motor02.setSpeed(120);
  Motor02.run(FORWARD);
  Motor03.setSpeed(120);
  Motor03.run(FORWARD);
  Motor04.setSpeed(120);
  Motor04.run(FORWARD);
}else if((Right_Value==0) && (Left_Value==1)) {
  Motor01.setSpeed(200);
  Motor01.run(FORWARD);
  Motor02.setSpeed(200);
  Motor02.run(FORWARD);
  Motor03.setSpeed(100);
  Motor03.run(BACKWARD);
  Motor04.setSpeed(100);
```

```
  Motor04.run(BACKWARD);
 }else if((Right_Value==1)&&(Left_Value==0)) {
  Motor01.setSpeed(100);
  Motor01.run(BACKWARD);
  Motor02.setSpeed(100);
  Motor02.run(BACKWARD);
  Motor03.setSpeed(200);
  Motor03.run(FORWARD);
  Motor04.setSpeed(200);
  Motor04.run(FORWARD);
 }else if((Right_Value==1)&&(Left_Value==1)) {
  Motor01.setSpeed(0);
  Motor01.run(RELEASE);
  Motor02.setSpeed(0);
  Motor02.run(RELEASE);
  Motor03.setSpeed(0);
  Motor03.run(RELEASE);
  Motor04.setSpeed(0);
  Motor04.run(RELEASE);
 }else if(distance > 1 && distance < 10) {
  Motor01.setSpeed(0);
  Motor01.run(RELEASE);
  Motor02.setSpeed(0);
  Motor02.run(RELEASE);
  Motor03.setSpeed(0);
  Motor03.run(RELEASE);
  Motor04.setSpeed(0);
  Motor04.run(RELEASE);
   }
  }
```