M.KUMARASAMY
COLLEGE OF ENGINEERING
NAAC Accredited Autonomous Institution
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ISO 9001:2015 & ISO 14001:2015 Certified Institution
Thalavapalayam, Karur – 639 113.

# HUMAN FOLLOWING ROBOT

## A MINOR PROJECT - II REPORT

***Submitted by***


| | |
|---|---|
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**BACHELOR OF ENGINEERING**

in

**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**

**M.KUMARASAMY COLLEGE OF ENGINEERING**

(Autonomous)

**KARUR – 639 113**

**APRIL 2023**

# M.KUMARASAMY COLLEGE OF ENGINEERING, KARUR

## BONAFIDE CERTIFICATE

Certified that this **18ECP104L - Minor Project II** report **" HUMAN FOLLOWING ROBOT "** is the bonafide work of " **MANOJ R (927621BEC116), MANIKANDAN S (927621BEC113), JEEVA G (927621BEC069), MANIKANDAN SG (927621BEC307)** who carried out the project work under my supervision in the academic year **2022-2023 - EVEN SEMESTER.**

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This Minor project-II report has been submitted for the **18ECP104L – Minor Project-II**

Review held at M. Kumarasamy College of Engineering, Karur on _____

**PROJECT COORDINATOR**

## INSTITUTION VISION AND MISSION

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To emerge as a leader among the top institutions in the field of technical education.

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**M2:** Create a diverse, fully -engaged, learner -centric campus environment to provide quality education to the students.

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**M4:** Render the technical knowledge and skills of faculty members.

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**PEO1: Core Competence:** Graduates will have a successful career in academia or industry associated with Electronics and Communication Engineering

**PEO2: Professionalism:** Graduates will provide feasible solutions for the challenging problems through comprehensive research and innovation in the allied areas of Electronics and Communication Engineering.

**PEO3: Lifelong Learning:** Graduates will contribute to the social needs through lifelong learning, practicing professional ethics and leadership quality

## Program Outcomes

**PO 1: Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

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**PO 3: Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

**PO 4: Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

**PO 5: Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

**PO 6: The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

**PO 7: Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

**PO 8: Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

**PO 9: Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

**PO 10: Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**PO 11: Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

**PO 12: Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

**Program Specific Outcomes**

**PSO1:** Applying knowledge in various areas, like Electronics, Communications, Signal processing, VLSI, Embedded systems etc., in the design and implementation of Engineering application.

**PSO2:** Able to solve complex problems in Electronics and Communication Engineering with analytical and managerial skills either independently or in team using latest hardware and software tools to fulfil the industrial expectations.

| **Abstract** | **Matching with POs, PSOs** |
|---|---|
| HUMAN FOLLOWING ROBOT | PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2 |

# ACKNOWLEDGEMENT

Our sincere thanks to **Thiru.M.Kumarasamy, Chairman** and **Dr.K.Ramakrishnan, Secretary** of **M.Kumarasamy College of Engineering** for providing extraordinary infrastructure, which helped us to complete this project in time.

It is a great privilege for us to express our gratitude to **Dr.B.S.Murugan., B.Tech., M.Tech., Ph.D., Principal** for providing us right ambiance to carry out this project work.

We would like to thank **Dr.S.Palanivel Rajan, M.E., M.B.A., Ph.D., D.Litt (USA)., Professor and Head**, **Department of Electronics and Communication Engineering** for his unwavering moral support and constant encouragement towards the completion of this project work.

We offer our wholehearted thanks to our **Project Supervisor, Ms.K DHARANIPRIYA M.E.,.,** , Department of Electronics and Communication Engineering for her precious guidance, tremendous supervision, kind cooperation, valuable suggestions and support rendered in making our project to be successful.

We would like to thank our **Minor Project Co-ordinator**, **Dr.E.Dinesh, M.E., Ph.D., Associate Professor**, Department of Electronics and Communication Engineering for his kind cooperation and culminating in the successful completion of this project work. We are glad to thank all the Faculty Members of the Department of Electronics and Communication Engineering for extending a warm helping hand and valuable suggestions throughout the project. Words are boundless to thank our Parents and Friends for their motivation to complete this project successfully.

# ABSTRACT

Humanoid robotics is an emerging research field that has received significant attention during the past years and will continue to play an important role in robotics research and many applications of the 21st century and beyond. In this rapid moving world, there is a need of robot such a "A Human Following Robot" that can interact and co-exist with them. Because of its human following capability, these robots can work as assistants for humans in various situations and it can also acquire or monitor certain information associated with the human subject. In this project we present a prototype that uses Arduino Uno along with basic sensors such as ultrasonic and IR sensor. All the processing is carried out By the microprocessor while the control of the motors is carried out by the controller. Keeping this in mind, there should be a capacity in the robot to get information from the surroundings while persuing the required object. The primary goal of our work is to design and design a robot that not only tracks the target but also moves towards it while doing the tracking. In order to make things simpler, a unique handmade tag was placed on the person that the robot needs to follow. The main hindrance in this kind of work is that the detection of the target is a sensitive thing to carry out. The robot has to be unique for the robot to recognize it and carry out the objective. The simple tag removes this problem of uniqueness and makes the task fairly easy. A small camera records the video and the processor processes it to extract the desired information from it. Protecting the robot from collision with the object is another problem that needs to be tackled so in order to do this, a sensor is used. This robot can Further be modified by using many technologies such as Bluetooth, PixyCamera etc.

Keywords*: Artificial Intelligence, Human following, Human tracking, Ultrasonic Sensor, IR Sensor, Arduino Micro Controller*.

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# CHAPTER 1

## INTRODUCTION

Robotic technology has increased appreciably in past couple of years. Such innovations were only a dream for some people a couple of years back. But in this rapid moving world, now there is a need of robot such as “A Human Following Robot” that can interact and co-exist with them. The development of robot technology had increased significantly due to industrial, medical and military applications. In various fields with harsh environment such as Underground mining, war-zones, medical, construction, space exploration etc. the work done by one is extremely dangerous. Life of individuals assisting are also put at risks. Tasks performed by humans have its own limitations in many ways. In order to perceive beyond the human limitation in vision, speed, consistency, flexibility, quality e.tc we should make use of robots. A key requirement for these robots is the ability to detect humans and to interact with the non-technical way. The main objective of this dissertation is to make a robot that can help humans with various tasks.. In this project, we present a prototype of a human following robot that uses Arduino Uno and different sensors for Detection and following an object. The Robot must follow the following objectives:

- The robot must be capable of accurately follow a person.
- It should be capable of taking various degrees of turns.
- The robot must be insensitive to environmental factors such as noise.
- The robot must be capable to avoid collision.

# CHAPTER 2

## LITERATURE SURVEY

Ng, Yen Leng, Cheng Siong Lim, Kumeresan "Automatic human guided shopping trolley with smart shopping system. ― When we speak about human following robots, the cardinal issue that needs to be taken care of is the direction finding of the robot. The direction finding should be such that the robot follows the designated subject only and it should not deviate from its path. and technological advancements have engendered many methods which aim to tackle this issue with maximum possible accuracy. The proposed, application a human following shopping cart, has a similar aim. To gain an in-depth knowledge of the various direction-finding methods that can be used for this application, we studied various research papers [1], that have implemented concepts along similar lines. K. Morioka, J-H. Lee, and H. Hashimoto, ―Human-following mobile robot in a distributed intelligent sensor network,Some other research work was also conducted In this regard, Depth imaging was used by Calisi and the Target was pursued by designing a special algorithm .They did a lot of work on object tracking and detection. The biggest advantage of their method was that their algorithm worked in complex environments as well [2]

J. H. Lee, T. Tsubouchi, K. Yamamoto, and S. Egawa, ―People Tracking Using a Robot in Motion with Laser Range Finder and M. Lindstrom and J. O. Eklundh, ―Detecting And tracking moving objects from a mobile platform using a laser range scanner‖, Different algorithms are being developed by the researchers for the detection purposes. Laser was used in one researchto find the style of the moving legs and a camera was used to detect a object or a person. A very simple technique was also used by researchers. In this technique, the person used distance sensors on the robot and the person. These sensors emitted radio waves and were detected by the sensors on the person to be followed. This way the robotfollowed the required target.[3] Later on,Leo Louis in his paper, Working

Principle of Arduino and using it as a tool for study and research tells us that Arduino is a open source microcontroller which can be easily programmed erased and reprogrammed at any instant of time. The Current advanced uses of Arduino also include: Arduino AutoBilling Shopping Trolley, Arduino Fire Detector & Extinguisher Bot, IR Vision Snake Robot-Arduino.[4] R. Munoz-Salinas, E. Aguirre, and M. García-

# CHAPTER 3

## EXISTING SYSTEM

So far a lot of research has been done on the kinds of robot that fall into the category of the “Assisting Robots”. People have used different logics and alogs to implement their design. All of their primary focus has entirely been on the design of robots that follows the target.Laser sensor is used by Burgard in his tour guide robot for human tracking . LRF was incorporated by D. Schulz to perform the „following“. Using the above mentioned process, they performed the information linking for the detection. Nicola, Husing used a technique for pointing out the different styles of movement by using LRF. This information was fused with the information obtained by the camera .Depth imaging was used by Songmin Jia to carry out the detection. The model of a person was determined using the depth imaging . The particular style of clothing was used by Mehrez Kristou. He used a multidirectional camera. LRF was also incorporated by him in the design A research was conducted by Wilhelm with the focus on the color of the particular person’s skin. Information from different sensors was also used by him in the research.Some other research work was also conducted in this regard, Depth imaging was used by Calisi and the target was persued by designing a special algorithm. Ess and Leibe carried out the same work. They did a lot of work on object tracking and detection. The biggest advantage of their method was that their algorithm worked in complex environments as wwel. Stereo visiion was also carried out by Y. Salih in order to perform the detection. This method enabled him to persue the required target with an effective manner. The combination of different sensors were used by R. Munoz to get the information about the target to be tracked. In addition to using different sensors, he also used stereo vision to get an accurate information. The data of the sensors combined with the information from the camera proved to be very helpful in carrying out the task.Different algorithms are being

developed by the researchers for the detection purposes. Laser was used in one research to find the style of the moving legs and camera was used to detect a particular object or a person. A very simple technique was also used by a research. In this technique, the person used distance sensors on the robot and
the person. These sensors emitted radio waves and were detected by the sensors on the person to be followed. This way the robot followed the required target.

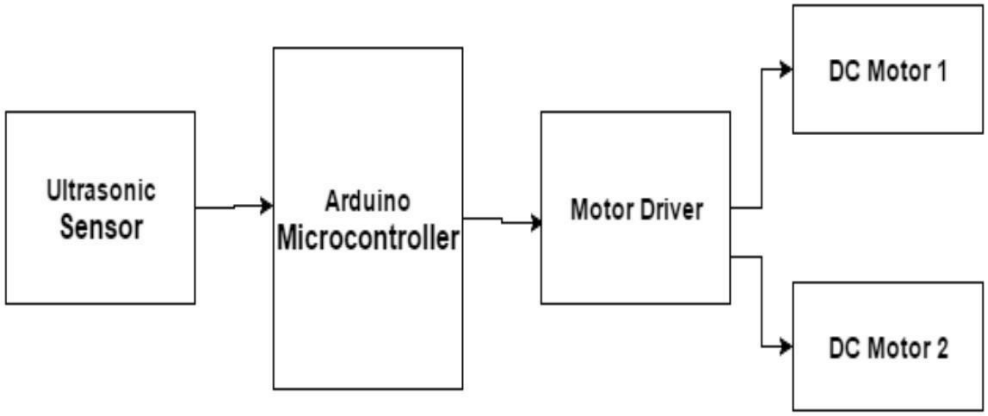
# CHAPTER 4

## PROPOSED SYSTEM

An Arduino-based human tracking robot is used to track a person or a person with a leg movement where the person is moving the robot will follow him or her forward, left, right the robot will detect human movement and properly follow its movements. Using an ultrasonic sensor robot to locate a person and the ultrasonic sensor calculates the distance between the human and the robot also analyzes it. In our project the ultrasonic sensor is mounted on a servo motor which is a direct actuator that allows precise control of angular or linear pposition The Servo motor has a shaft that goes up to 180 degrees .in the servo motor we have an ultrasonic sensor that also moves the servo motor to get the correct position and direction of the moving person.We have also used the gyro sensor also known as the angular rate sensor which is the angular velocity sensor .the gyro sensor is used to detect human movement angles and detects moving body angles at 30, 45., 60, 90, 180 degree respectively. Analyzing and deciding and sense the person moving slowly left, right, forward take the step of following a particular person where he or she is moving in the right direction with his or her moving direction. The main function of the gyro sensor is an angle sensor and control mechanism.Many of the earliest constructions of flower flowers are not used by the PIR sensor .we have used the PIR sensor in our project which is used to detect the difference between living and non-living things. The PIR is an infrared sensor used to detect when a person has entered or exited a range of sensors.

# CHAPTER 5

## BLOCK DIAGRAM



# CHAPTER 6

## CIRCUIT DIAGRAM

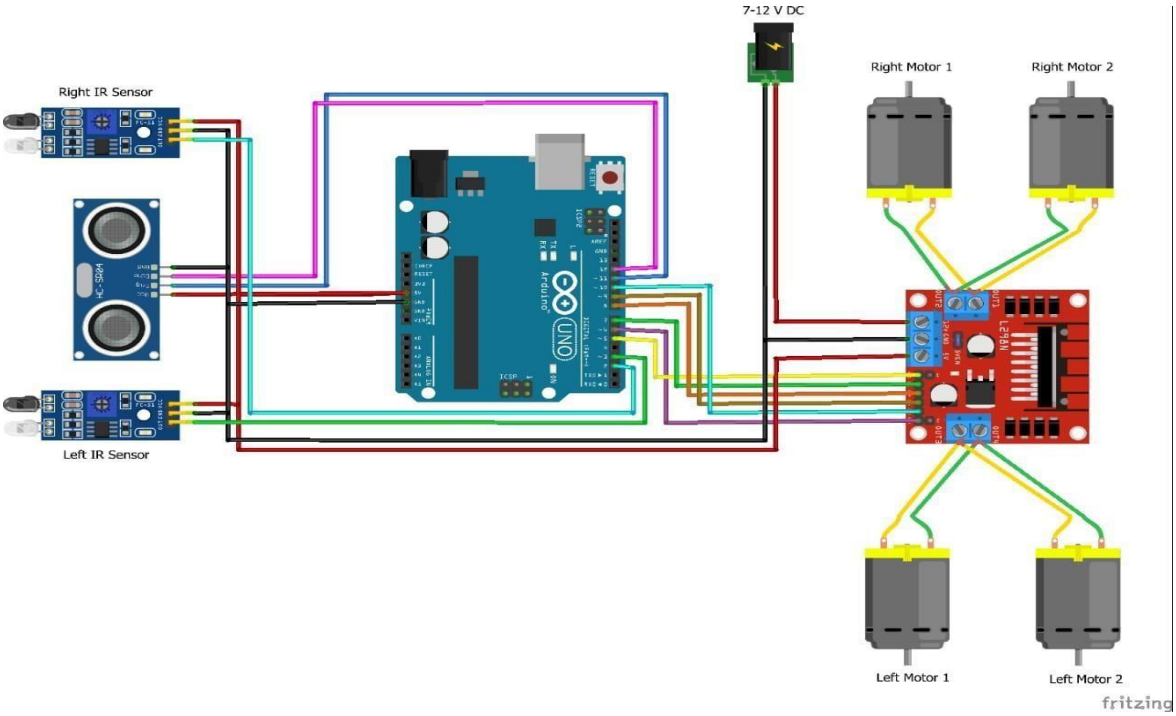



**FIG 6.1-CIRCUIT DIAGRAM**

Our system consists of a four wheel robotic vehicle mounted with a separate microprocessor and control unit along with different sensors and modules i.e. ultrasonic sensor, infrared sensors which helps them to move with respect to people and objects in their surroundings. The above sensors work in unison with each other and helps the robot in its operation and to navigate its path by avoiding the obstacles and maintaining a specific distance from the object. We used ultrasonic sensor for obstacle avoidance and to maintain a specific distance for the object. The ultrasonic sensor works accurately works accurately within a range of 4 meters.

**ArduinoUno**

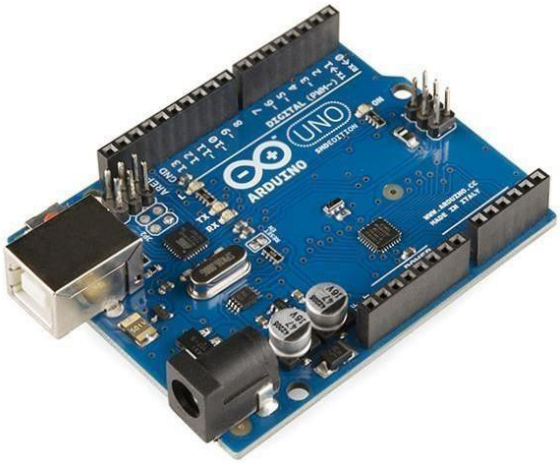



**FIG 6.2 ARDUINO UNO**

It is the brain of our project. It can give all the command to their sub ordinate components which should by operated By the human behavior . And it also give feedback to the other components and human. So that it can be the used as a medium of communication between human and robots & vice versa. . It has specification of 8 bit CPU, 16 MHZ clock speed, 2 KB SRAM 32 KB flash Memory, 1 KB EEPROM.

## DC Motors

**FIG 6.3 DC MOTOR**

DC Motor is a device that converts any form of energy into mechanical energy or imparts motion. In constructing a robot, motor usually plays an important role by giving movement to the robot. Here 4 DC motor are used to drive the robot.

## Motor driver

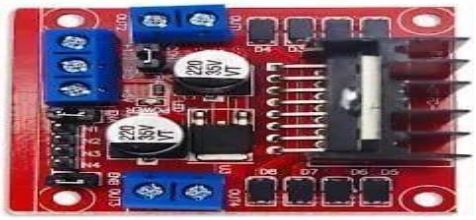


**FIG 6.4 MOTOR DRIVER**

The Motor Shield is a driver module for motors that allows you to use Arduino to control the working speed and direction of the motor. . The Motor Shield can either be powered by Arduino directly or by an external 6V~15V power supply via the terminal input. Here Motor Driver Board is designed to Work with L293D IC.

**Ultrasonic sensor**


**FIG 6.5 ULTRASONIC SENSOR**

An ultrasonic sensor is an instrument that measures the distance to an object usingultrasonic sound waves.The working principle of this module is simple, it sends anultrasonic pulse out at 40kHz which travels through the air and if there is an obstacle or object, it will bounce back to the sensor. By calculating the travel time and the speed of sound, the distance can be calculated.

## IR Sensor

**FIG 6.6 IR SENSOR**

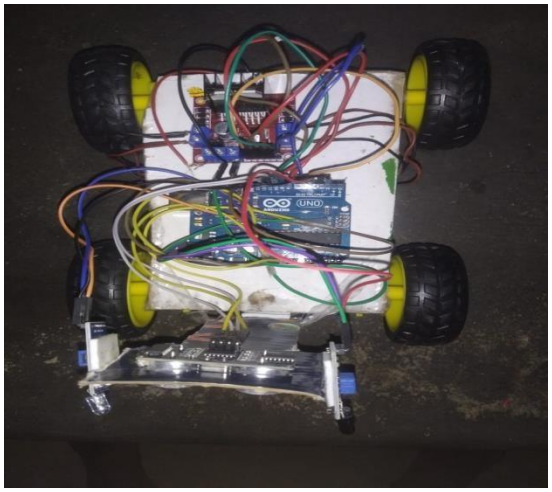
IR sensor is an electronic device, that emits the light in order to sense some objectof the surroundings. An IR sensor can measure the heat of an object as well as detects the motion.Usually, in the infrared spectrum, all the objects radiate some form of thermal radiation. These types of radiations are invisible to our eyes, but infrared sensor can detect these radiations. The emitter is simply an IR LED (Light Emitting Diode) and the detector is simply an IR photodiode

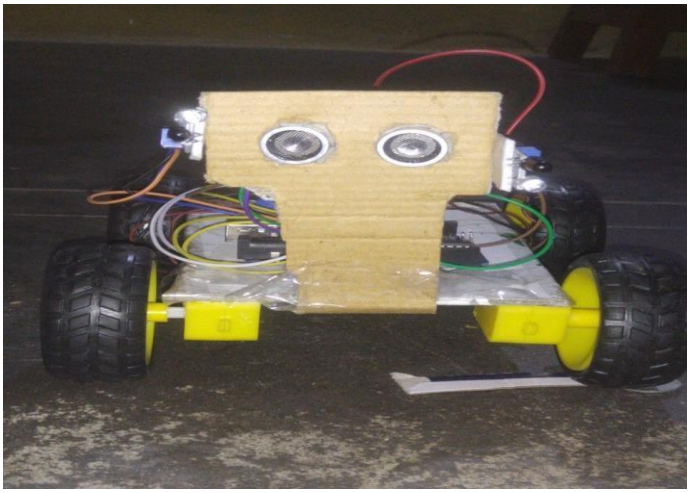
# CHAPTER 7

## RESULTS AND DISCUSSION

We have successfully made the human following robot which is used to follow objects as well as humans. This Robot uses ultrasonic range sensors and Infrared sensors. The test was performed on the both ultrasonic sensor and infrared sensor that the sensor was working accurately within the range of 10 cm. An ultrasonic sensor is used to move the robot forward and backward. Infrared sensors are used to move the robot in the left or right direction accordingly. Then we test the serial communication of Arduino, motor shield, and various motors . Motors Drivers connections got interchanged which was rectified and our robot works perfectly fine.

Looking deeply into environment or our surroundings, we were be able interpret that there is a need of such robot that can assist humans and can serve them. Such a robot can be used for many purposes. With a few modifications, the Robot can act as a human companion as well. The tasks these kind of robots can perform are limitless including assisting in carrying loads for people working in hospitals, libraries, airports etc.





# CHAPTER 8

## CONCLUSION AND FUTURE WORK

A successful implementation of a prototype of human following robot is illustrated in this project. This robot not only have the detection capability but also the following ability as well. While making this prototype it was also kept in mind that the functioning of the robot should be as efficient as possible. Tests were performed on the different conditions to pin point the mistakes in the algorithm and to correct them. The different sensors that were integrated with the robot provided an additional advantage. The human following robot is an automobile system that has ability to recognize obstacle, move and change the robot's position toward the subject in the best way to remain on its track. This project uses arduino, motors different types of sensors to achieve its goal. This project challenged the group to co-operate, communicate, and expand understanding of electronics, mechanical systems, and their integration with Programming.

There are many interesting applications of this research in different fields whether military or medical. A wireless communication functionality can be added in the robot to make it more versatile and control it from a large distance. This capability of a robot could also be used for military purposes. By mounting a real time video recorder on top of the camera, we can monitor the surroundings by just sitting in our rooms. We can also add some modifications in the algorithm and the structure as well to fit it for any other purpose. Similarly it can assist the public in shopping malls. So there it can act as a luggage carrier, hence no need to carry up the weights or to pull that.

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**PAPER ID: I132**

## RECTANGULAR MICROSTRIP PATCH ANTENNA

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*Abstract:* The purpose of this paper is to design a micro strip rectangular antenna in Advance Design System Momentum (ADS). The resonant frequency of antenna is 5.2 GHz. The reflection coefficient is less than -10dB for a frequency range of 3 GHz to 6 GHz. The proposed rectangular patch antenna has been devise using Glass Epoxy substrate (FR4) with dielectric constant ($\varepsilon r = 4.4$), loss tangent (tan $\delta$) equal to 0.02. This rectangular patch is excited using transmission lines of particular length and width. Various parameters, for example the gain, S parameters, directivity and efficiency of the designed rectangular antenna are obtained from ADS Momentum.

*Keywords:* Antenna, ADS Momentum, FR4.

**PAPER ID: I133**

## DESIGN OF LOW POWER 1-BIT FULL ADDER

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*M.Kumarasamy College of Engineering, Karur*

*Abstract:* Full adder is the primary logic units in many digital circuits. A novel full adder circuit design has been presented in the article which is based on gate diffusion input (GDI) technique. In previous method, the adder has been designed by XOR-XNOR module. This improves delay, power consumption and computational complexity. In our proposed design, a variety of power reduction techniques will be infused for making efficient full adder design. For that the entire implementation will be performed spice simulation. For validating full adder performance, the parameters like PDP (Power Delay Product) will be measured at standard 90nm CMOS process.

*Keywords:* Full Adder, Gate Diffusion Input, Power Delay Product.

**PAPER ID: I134**

## HUMAN FOLLOWING ROBOT

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*Abstract:* Humanoid robotics is an emerging research field that has received significant attention during The past years and will continue to play an important role in robotics research and many applications of The 21st century and beyond. In this rapid moving world, there is a need of robot such a "A Human Following Robot" that can interact and co-exist with them. Because of its human following capability, These robots can work as assistants for humans in various situations and it can also acquire or monitor Certain information associated with the human subject. In this paper we present a prototype that uses Arduino Uno along with basic sensors such as ultrasonic and IR sensor All the processing is carried out By the microprocessor while the control of the motors is carried out by the controller. This robot can Further be modified by using many technologies such as Bluetooth, Pixy Camera etc.

*Keywords:* Artificial Intelligence, Human following, Human tracking, Ultrasonic Sensor, IR Sensor, Arduino Micro

Controller.

**PAPER ID: I135**

**WEBPAGE DEVELOPMENT ON HALL BOOKING SYSTEM**

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*R.Janapriya*, *UG Scholar*
*V.Jayarisha*, *UG Scholar*
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*Abstract:* "HALL BOOKING SYSTEM" is a web based application that works within a centralized network. This project presents a review on the software program "Hall Booking System" as should be used in an organisation or university, a facility which is used to reserve Halls, cancellation of reservation and different types of route enquiries used on securing quick reservations. MYSQL is built for managing and computerizing the traditional database, Structured Systems Analysis and Design Methodology (SSADM), Data Analytics was adopted. In addition, Angular was used for the front-end of the software while the back end was designed using MySQL, Javascript. It is recommended that despite the present functionality of the designed software, an additional functionality such as the use of E-mail to send Hall Bookings and notifications to the User about status of a bookings and approval and highly authenticated process should be implemented into the system.

*Keywords:* MYSQL, Javascript, angular, SSADM

**PAPER ID: I136**

**VOICE AUTOMATION CAR**

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*Mathavan T*, *UG Scholar*
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*Abstract:* Voice Controlled CAR is a mobile robot whose movement can be controlled by the commander by giving specific voice commands. The speech is received by a microphone and processed by the Bluetooth module (hc-Speech recognition is a technology where the system understands the words given through speech. 05). When a command for the robot is recognized, then Bluetooth module sends a command message to the Arduino. The Arduino analyses the message and takes appropriate actions. The RF transmitter of the Bluetooth can take either switch press or voice commands which are converted to encoded digital data for the advantage of adequate range (up to 100 meters) from the robot. The receiver decodes the data before feeding it to another microcontroller to drive DC motors via motor driver IC for necessary work. This technology has an advantage over long communication range as compared to RF technology. Further the project can be developed using IoT technology where a user can control the robot from any corner of the world. The goal of this project is to introduce hearing AI sensor and also the speech recognition to the mobile robot such that it is capable to interact with human through Spoken Natural Language (NL).

*Keywords:* Speech Recognition, Microcontroller, Arduino, Bluetooth, Android.