Obstacle Detection Car System

A project report submitted in partial
fulfillment of the requirements for the

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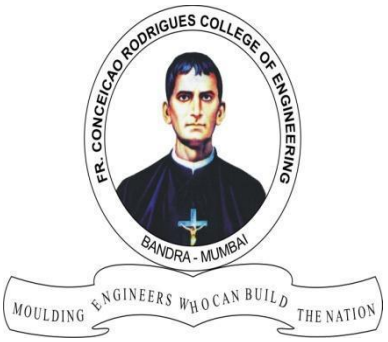

DEPARTMENT OF COMPUTER ENGINEERING

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This work is dedicated to my family.
I am very thankful for their motivation and support.

INTERNAL APPROVAL SHEET

CERTIFICATE

This is to certify that the project entitled **"Obstacle Detection Car System"** is a bonafide work of Lloyd **Louis (9522), Eshank Bele (9525), Hansel D'Silva (9535)** and **Emin Joy (9546)** submitted to the University of Mumbai in partial fulfillment of the requirement for term work submission of Mini Project 1- A Second Year Computer Engineering**.**

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APPROVAL SHEET

Project Report Approval

This project report entitled **Obstacle Detection Car System** by **Lloyd Louis, Eshank Bele, Hansel D'Silva and Emin Joy** is approved for the Term work submission of Mini Project –1 A, Second year Computer Engineering

Examiners: 1. _____

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Date:

Place:

DECLARATION

We declare that this written submission represents our ideas in our own words and where others' ideas or words have been included, we have adequately cited and referenced the original sources. We also declare that we have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission. We understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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ABSTRACT

The main objective of this project is to design a car based on Arduino. It's a four-wheel vehicle that can detect obstacles using its ultrasonic distance sensor and steer itself away from the said obstacle. This car system also integrates a feature to be driven via hand gestures. It aims to help the self-driving system, in order to avoid obstacles and keep the driver safe.

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CONTENTS

GLOSSARY

UNO – Spanish for ‘one’

IDE – Integrated Development Environment

IR – Infrared Rays

CMOS - Complementary Metal-Oxide-Semiconductor

ADXL – Accelerometer Sensor

Ferroelectricity - Characteristic of certain materials that have a spontaneous electric polarization that can be reversed by the application of an external electric field.

IC – Integrated Circuits

DC – Direct Current

RFID – Radio Frequency Information Devices

nRF24L01 – A Communication Module which usually works as a receiver and a transmitter

Chapter 1
INTRODUCTION

The motive of our project is to fabricate an **'Obstacle Detection Car System'** which backtraces its path on detecting an obstacle in its path and chooses an alternate course of path, determined by the ultrasonic sensor mounted on the front of the car.

For the proper detection of the obstacle, the ultrasonic sensor must be kept clean and must be free of any dirt in the crevices of shield of trigger pin; and also all the parts must be handled with utmost care, since the internal wirings are fragile and even a slightest manhandling can cause damage to the sensor and microcontroller.

An Adhoc network is established between the ultrasonic sensor, servo and DC motors which functions in a synchronous and coordinated manner for the desired autonomous functioning of the car system, by virtue of the data exchanged between the sensors.

Chapter 2
LITERATURE SURVEY

TITLE OF THE RESEARCH PAPER	AUTHORS	YEAR OF PUBLISHING	SYNOPSIS
1) Infrared Sensor Technology	C. Marshall T. Parker T. White	1995	1. This paper discusses the uses of IR imaging for both military and commercial uses. 2. This paper talks about the addition of new technology to IR sensors- like Silicon microbridge microbolometers, Ferroelectric and pyroelectric hybrids PyxDelectlics - which make these IR sensors cheap and affordable. 3. This paper discusses the advantages, some of them include Lower unit and life cycle cost, Reduced power consumption, smaller size and reduced weight and Chopperless operation. 4. It gives us an overview of the systems and specification of the IR sensors that we plan to use.
2) Hand Gesture based Remote Control for Home	Utpal V. Solanki	2011	1. This paper discusses the use of infrared sensor technology to control Appliances.

	Nilesh H. Desai		2. In this paper the author has used an IR transmitter and a camera module (which is used to capture the IR rays). This uses a JAVA processing environment which is a JAVA based programming structure for software. 3. Firstly this setup finds whether the hand is present using the skin detection gesture and then starts using the gesture recognition algorithm and recognises the gesture (using Blobscanner library). 4. To decode the data received from the camera, Arduino based Microcontrollers are used. 5. Instead of using the JAVA processing environment, we have found that the Arduino IDE is more efficient and better. So in this project we have made use of the Arduino IDE software. 6. The only drawback of this paper setup is that the user has to always carry a Laptop/Computer on him to run the software. This

			drawback is removed when we use Arduino IDE.
3) The Working Principle of Arduino	Yusuf Abdullahi Badmasi	2014	1. In this paper, we analyze the working principle of an Arduino. 2. Arduino is both a programmable circuit board and an open source platform for the construction and programming of the boards. 3. Unlike most previous programmable circuit boards, the Arduino does not have a separate piece of hardware in order to load new code onto the board, instead you can simply use a USB cable to upload, and the software of the Arduino uses a simplified version of C++. 4. Application of these boards include Sensor Alarm (which is useful tous in terms of this project) and Capacitance measuring, to name a few.
4) An Ultrasonic Sensor for Distance Measurement in Automotive Applications	Alessio Carullo Marco Pavis	2001	1.This paper describes an ultrasonic sensor that is able to measure the distance from the

			ground of selected points of a motor vehicle. 2.The limitations faced by the sensors due to various factors such as atmosphere, noise and how it affects the reading also have been brought forward. 3. An ultrasonic pulse is generated using a piezoelectric transducer and the echo reflected by the ground is received by another piezoelectric transducer. 4.The sensor contains a noise measurement system and an auto-change facility of the signal that is used to drive the transmitter, thus producing the best accuracy under different conditions.
5) Design and Experimental Study of DC Servo Motor Controller	Ye Wang Xinyu Hu Yongfei Feng Shuanshuang Li	2020	**1.**In this paper, the controller algorithm is designed from the four aspects of current mode, velocity mode, position mode and teaching mode, and three loops are designed, namely current loop, velocity loop and position loop.

			2.In this paper, the controller algorithm is designed from the four aspects of current mode, velocity mode, position mode and teaching mode, and three loops are designed, namely current loop, velocity loop and position loop. **3.Current mode control** **algorithms design:** This control mode is a digital control system which controls the motor to operate at a specified current. **4.Speed mode control algorithms design:** This mode controls the speed of the motor. It has two steps. The transition stage from one stable state to another, in which the speed is mainly determined by the acceleration. The stable operation stage requires the motor speed to have anti-interference ability. **5.Position mode algorithms design**: This mode controls the motor to the specified position. It has two operational stages: a) The

			transition stage of the motor from static motion to designated speed. b) The uniform motion states that the motor runs to the specified position at the specified speed. It is also necessary to test whether the current of the motor is greater than the rated current. **6.<u>Teaching- Training Mode Design:</u>** The teaching-training mode is to allow the user to drag the end of the machine directly, so that the machine can reach a fixed posture and reproduce the trajectory dragged by the user. **7.**The controller circuit will be designed from five aspects: motor drive circuit, encoder isolation circuit, main control circuit, CAN communication circuit and power supply circuit.
6) Gesture-controlled user interfaces, what have we done and what's next?	Moniruzzaman Bhuiyan Rich Picking	2009	**1.**Hand gesture recognition has been achieved with wearable sensors attached to hand gloves which then collected data based on movement of the hands and the fingers and then processed using computers.

			2. With the evolution of open-source software libraries, it is easier than ever to detect hand gestures that can be used under a wide range of applications like clinical operations, sign language, robot control, virtual environments, home automation, personal computer and tablet, gaming. **3.**This paper presents different methods of gesture recognition such as, Hand Gestures Based on Instrumented Glove Approach, Hand Gestures Based on Computer Vision Approach, Color-Based Recognition, Motion-Based Recognition, and so on. **4.**The AdaBoost algorithm is utilized for object detection and movement- based recognition systems. **5.**Conventional interactive methods depend on different devices such as a mouse, keyboard, touch screen, joystick for gaming and consoles for machine controls are some of its applications.

7) Accelerometer Based Direction Controlled Wheelchair Using Gesture Technology	Manisha Devi B.Anil Kumar	2014	**1.**This paper explains the concept of gesture recognition to control a wheelchair (robot). Gesture recognition based on data from an accelerometer is an emerging technique for gesture-based interaction. **2.**The primary goal of gesture recognition research is to create a system which can identify specific human gestures and use them to convey information or for device control. **3.** Instrumented data glove approaches use sensor devices for capturing hand position, and motion. Instrumented Glove based (smart glove) solutions can recognize very fine gestures, e.g., the finger movement and conformation but require the user to wear a glove tagged with multiple sensors to capture finger and hand motions in fine granularity. The ADXL330 is a small, thin, low power, complete 3-axis accelerometer with signal conditioned voltage outputs, all

			on a single monolithic IC. For serial transmission the encoder is used and the RF Transmitting antenna is used with 433MHZ frequency. The wheelchair is operated due to the Dc motor. We need two HBridge and one H-Bridge has four transistors for motor operation. **4.**The hardware setup is done which shows input part that is interfacing of gesture recognition module and accelerometer to CMOS 089C52 controller
8) Hand Gesture Recognition for Human Computer Interaction	Aashni Hariaa Archanasri Subramaniana Nivedhitha Asokkumara Shristi Poddara Jyothi S Nayaka	2017	**1.** The basic goal of Human Computer Interaction is to improve the interaction between users and computers by making the computer more receptive to user needs. **2.** The overall system consists of two parts, back end and front-end. The back end system consists of three modules: Camera module, Detection module and Interface module Camera module This module is responsible for connecting and capturing input

			through the different types of image detector Detection module This module is responsible for the image processing. The output from camera module is subjected to different image processing techniques such as color conversion, noise removal, thresholding following which the image undergoes contour extraction. Interface module This module is responsible for mapping the detected hand gestures to their associated actions. **3.** The input image, which is in RGB color space, is cropped to a size of 300 * 300 pixels. It is then converted into a gray scale image. Thresholding is applied to obtain a binary image from the gray scale image
9) Application of Safety using Communication	Tom asz Hejczyk	2014	**1.** This addresses the issues of security of passengers. For this purpose an innovative solution for

modules as an integrated intelligent system	Bartłomiej Wszołek Adam Gałuszka Jakub Młyńczak		the implementation of collision and threats detection modules. **2.** Most often they are based on the use of ultrasonic sensors, containing microcontrollers that precisely control the entire process of generation, detection and measurement. **3.** In view of the safety functions performed by the collision and threats detection module, the project takes into account the redundancy of accelerometers. The project explains the need of installing more collision and threats detection modules – separate for front and rear of a vehicle **4.** We use the same concept in our obstacle detection car where we are using range sensing to avoid collision of our car.
10) Data Glove: Internet of Things (IoT) Based Smart Wearable Gadget	Anand Nayyar Vikram Puri	2016	**1.** With IoT, any object can mark its entry into the Internet via different tagging technologies like NFC(Near-Field Communication), RFID(Radio-Frequency

			Identification Devices) and Barcode. **2.** IoT, when combined with varied Sensors, facilitates varied objects to come closer and formulate an Adhoc Network to share information; and using this network, we aim to build a data glove to drive our car based on gestures. **3.** In the transmitting section (Data Glove), the analog values generated by the sensors are converted by the ADC in the Arduino Nano (main processing unit on the glove) and sent forth to the receiver section by the nRF24LF01, which is a 2-way RF communication module. **4.** The real-time values sent forth by the nRF24L01 are accepted by the Arduino UNO, which is the main processing unit on the receiver(car system), and calibrate the car accordingly.

. Gesture Recognition Approach For any system the first step is to collect the data necessary to accomplish a specific task. For hand posture and gesture recognition systems, different technologies are used for acquiring input data. Present technologies for recognizing gestures can be divided into vision based, instrumented (data) gloves.

Chapter 3
PROBLEM STATEMENT

Project Objectives:

- To create a car system that can detect obstacles automatically and avoid crashing into them.
- To integrate a mechanism to drive the car system via hand

This project is being implemented because, in this modern world where technology and innovation keeps on upgrading, there are cars which will become fully self-driving in the future.

Most of the accidents that occur on road is mainly due to either negligence or human error. Although the car system that we build aims at being driven via hand-detection and gestures; we imagine a bigger picture of cars being able to detect road signs and pedestrians and act accordingly.

Our project aims to create a car system that can detect obstacles and avoid them, either by stopping or by taking a different path. And, the major motivation to take up such a topic is because we wanted to explore our interest in the field of IoT, and expand our horizons.

Chapter 4
PROJECT DESCRIPTION

Hardware/Software required in this project:

- ARDUINO IDE (*requires a Pentium 2 266 MHz processor and 128 MB of RAM, windows 8 or above.)
- Arduino UNO.
- Servo Motors.
- Wheels, Jumper Wires.
- Ultrasonic Sensors etc.
- Communication Module
- Arduino NANO
- IR Sensor

Some of the main parts are described below:

1. Ultrasonic sensor: An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves, and converts the reflected sound into an electrical signal. Ultrasonic waves travel faster than the speed of audible sound. Ultrasonic sensors have two main components: the **Transmitter** (which emits the sound using piezoelectric crystals) and the **Receiver** (which encounters the sound after it has travelled to and from the target).

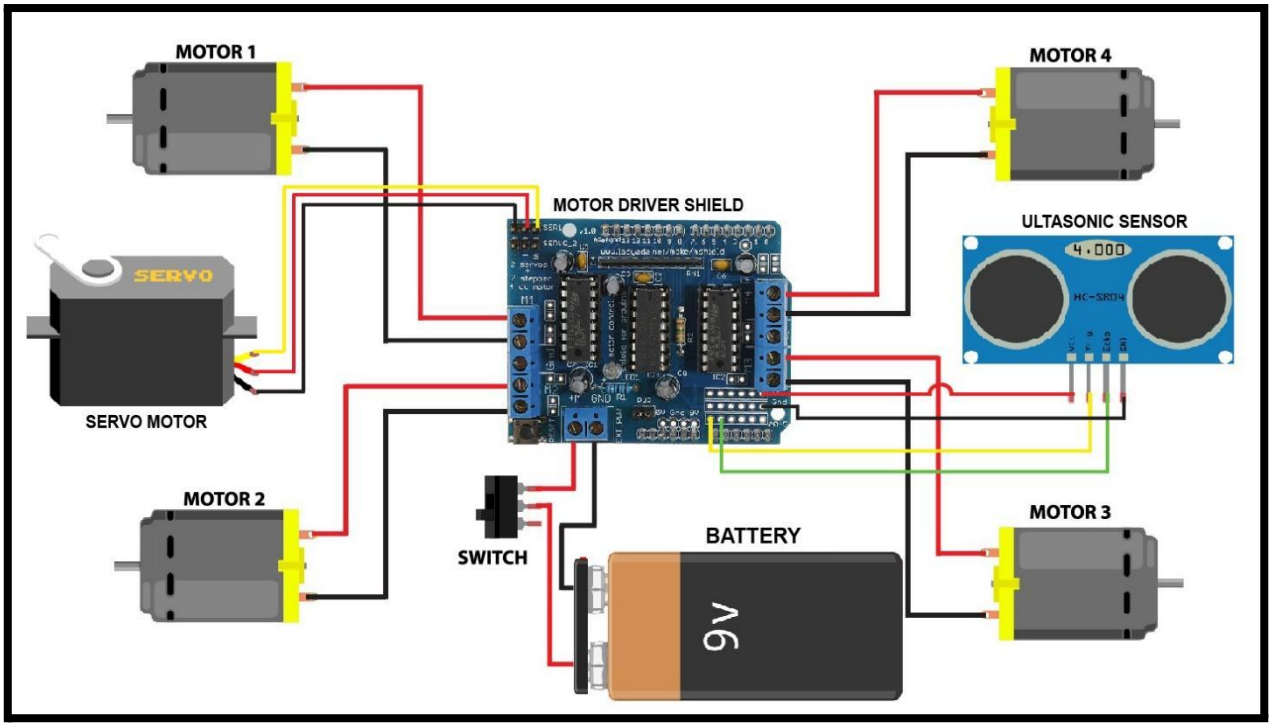
2. Arduino Uno: The Arduino Uno is an open-source microcontroller board. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 13 digital I/O pins (six capable of PWM output), 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable for Arduino UNO.

3. Motor: 4 small motors, that work on a 9V dc battery, are used to provide mobility in the system. They help the car to move forward, backward, left or right.

4. Servo Motor: A motor used to mount the Infrared Sensors and the Ultrasonic sensors.

5. Motor Driver: The Arduino Motor Shield allows you to easily control motor direction and speed using an Arduino. By allowing you to simply address Arduino pins, it makes it very simple to incorporate a motor into your project. It also allows you to be able to power a motor with a separate power supply of up to 12v.

Architecture of the circuit:



Chapter 5
IMPLEMENTATION

Methodology:

The main component in our project is the Arduino UNO. All the other components are linked to this component in one way or another. The Arduino UNO is mounted on the cardboard base. The Motor Driver Shield which regulates the speed and direction of the motors is mounted on top of the Arduino UNO.

The 4 motors are connected to the Motor Driver Shield by jumper wires. The Left motors act as one unit and the Right ones' act as another. By doing so, the car is able to turn on its own spot without needing to move forwards or backwards. The wheels are attached to the 4 motors.

The code on the Arduino UNO is written in the Arduino IDE and is uploaded via a special USB cable. The servo motor, on which the ultrasonic sensors are mounted, is attached at the very start of the car. This helps in detecting the obstacles easy and efficient. The batter supply needed is a 9V battery which supplies voltage to the board, the Motor driver, the motors, the Ultrasonic Sensors and the servo motor.

Chapter 6
SUMMARY AND CONCLUSIONS

Conclusion:

We have successfully implemented an obstacle detection car which detects obstacles using its ultrasonic sensors and avoids it. The car built by us is an open chassis, with its wires exposed and its base made of Cardboard. The car weighs about 1 kg(or 2.2 lbs) and has a length and breadth of 28.2cm and 14.8cm respectively.

Future Enhancements:

In the next Semester, we plan to add an algorithm that detects ambulances and police, vehicles based on the sound of the siren of these vehicles, and gives path to these vehicles. Thus we plan on creating an traffic following system, which if implemented at a much bigger stage later on, will be beneficial to this innovative and rapidly growing world of technology.

Chapter 7
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