MANIPAL
INTERNATIONAL UNIVERSITY

EEB 3144_INTEGRATED DESIGN PROJECT (CAPSTONE)

DEPARTMENT OF COMPUTER ENGINEERING AND COMPUTER SCIENCE

FINAL REPORT

CAR SPEED DETECTOR

HEWAGE INURIGEEMA MANDULEE JAYARATHNE

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IDP/CAPSTONE PROJECT – MONTH YEAR

Abstract

The ultimate goal of the project is to prevent accidents in campus premises caused by vehicles exceeding the speed limit. This is an important issue, as campus premises are areas where the safety of students and others should be a top priority. To address this issue, the system captures the speed of passing vehicles and displays it, allowing drivers to be aware of their speed and make adjustments if necessary. The system is equipped with 3 IR sensors and an Arduino-based system, which is used to process the data from the sensors and display the speed on a display unit. If a vehicle is found to be exceeding the speed limit, the system gives a warning message to alert the driver to slow down, helping to ensure the safety of those within the university campus.

Supervised By

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MANIPAL
INTERNATIONAL UNIVERSITY

IDP/CAPSTONE (EEB 3144)

DECLARATION FORM (*To be filled by students and get signed from examiners & supervisors*)

Title of the IDP/ Capstone Project:

We hereby declare that above title IDP/Capstone project research is the result of our own investigations, except where otherwise stated. Other sources of information are acknowledged by giving explicit references is appended. This report is submitted to the Department of Computer Engineering and Computer Science, School of Engineering and Computing, Manipal International University as fulfilment of the requirements for the Bachelor of Computer Engineering with Honours completions.

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IDP/CAPSTONE (EEB 3444)

CLEARANCE FORM (*To be filled by students and get signed from examiners & supervisors*)

Title of the Project	Design and Development of Motorcycle Security System with Fingerprint Sensor using Arduino Microcontroller.	
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I hereby declare that I have read this report and in my opinion this report is sufficient in terms of scope and quality and met the project objectives. Also, I approve that the plagiarism level of this report is found to be ____% which is well within the limits (20%) and all the similarity contents are re
-phrased.

Supervisor

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Name & Seal:

Co-Supervisor

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Name & Seal:

Approved by:

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ACKNOWLEDGMENTS

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Abstract

The ultimate goal of the project is to prevent accidents on Campus premises caused by vehicles exceeding the speed limit. This is an important issue, as Campus premises are areas where the safety of students and others should be a top priority. To address this issue, the system captures the speed of passing vehicles and displays it, allowing drivers to be aware of their speed and make adjustments if necessary. The system is equipped with 3 IR sensors and an Arduino-based system, which is used to process the data from the sensors and display the speed on a display unit. If a vehicle is found to be exceeding the speed limit, the system gives a warning message to alert the driver to slow down, helping to ensure the safety of those within the university campus premises.

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CHAPTER 1: INTRODUCTION

1.1 Overview

Lower speed in the university premises limits can reduce the risk of accidents and injuries, especially for pedestrians and bicyclists who are more vulnerable to injuries in collisions with motor vehicles. Lower speeds can make it easier for people with mobility issues or disabilities to navigate the university area. Lower speeds can encourage more people to walk or bike to the university, reducing traffic congestion and parking issues as well as contributing to a more livable community by promoting active transportation, reducing pollution and noise, and making the university a more pleasant place to be.

Behalf of creating an environment like this in the campus premises, we are implementing a Car speed detection system which detects the speed of the vehicles entering the university as well displaying to the driver to make them aware of their speed and warn them if their speed is exceeding 30 km/h

Arduino unendingly reads the inputs from the IR Sensors. Once a car occupying the front of the setup reaches the primary detector, Arduino becomes alert and captures a timestamp the instant the car leaves the primary IR sensor.

Another time stamp is recorded once the car reaches the second IR sensor, and the same process continues to the 3rd IR sensor as well. The major function that is being used to execute the project is Millis () performed by Arduino which is used for capturing the time stamps.

1.2 Problem Statement

The project will display the speed of the vehicles entering the University and give a warning for the driver to let them make their vehicle speed below 3 km/h as a safety measure for the university students walking and passing the main road inside the campus.

1.3 Objectives

i. To enable detection of car speed.
ii. To enable detection of car speed of more than one car.
iii. To display the car speed in a display.
iv. Give a warning if the car exceeds the 3km/h speed limit.

1.4 Scope of project

The scope of the project for an Arduino-based car speed detector using 3 IR sensors includes the design and implementation of circuits using Arduino Uno and IR sensors. To do so, the sketch design of the circuit should be created, and the connection should be done according to the design. The IR sensors should be calibrated for accurate speed detection. Then the code should be determined and written to measure the speed of passing vehicles using the sensors. As for the next step, the speed readings should be displayed on a display and last but not least, testing and debugging of the system to ensure correct functioning.

1.5 Limitations of the Project

The limitations of this project follow;

Accuracy: the speed measurement accuracy may be impacted by factors such as sensor placement, ambient light conditions, and environmental interference. Range: The detection range of the IR sensors may be limited and may not be suitable for measuring high-speed vehicles.

Vehicle Detection: The system may not be able to detect all types of vehicles accurately, especially those with non-standard wheel arrangements or unusual wheel spacings.

Weather Conditions: The performance of the IR sensors may be affected by adverse weather conditions such as heavy rain or fog.

Interference: The system may be susceptible to electromagnetic interference from other electronic devices, potentially affecting its accuracy and reliability.

Cost: The cost of components and materials, as well as the complexity of the circuit, may make this project relatively expensive

1.6 Chapter Summary

The speed detection system is designed to improve safety on campus premises by monitoring the speed of passing vehicles. The system, which consists of 3 IR sensors and an Arduino-based system, captures and displays the speed of vehicles. If a vehicle exceeds the speed limit, the system gives a warning message to alert the driver to slow down. The goal of the system is to ensure the safety of students and others within the university campus. The scope of the Arduino-based car speed detector using 3 IR sensors includes design and implementation of the circuit, calibration of the IR sensors, writing code for speed detection, displaying readings, testing and debugging, and potential for data storage/transmission. The limitations of the project are accuracy, range, vehicle detection, weather conditions, electromagnetic interference, and cost.

CHAPTER 2: LITERATURE REVIEW

2.1.1 Literature Review 1 Example (Speed Detection System for Vehicle)

Lea Yin Mon and Khin Khin Saw (2019) has Designed and Constructed of Speed Detection System for Vehicle. By calculating the speed of a passing vehicle using the time it takes for a signal to travel between two sensors separated by a defined distance, this system is intended to identify an overspeeding vehicle. The concept makes use of an Arduino Uno battery, two IR sensors, and a buzzer. A microcontroller can be used to simply update and modify the timing condition for the vehicle detection system based on the distance between the sensor and speed. The vehicle's speed and the time it takes to go between the sensors are estimated values, and the speed sensed by the sensors is also delayed due to the large spacing between them. The speed limit in this essay is set at 100 km/h. The speed of the vehicle and the amount of time it needs to go between the sensors are calculated, and the result is an approximation. And because the sensors are spaced a great distance apart, the speed detection from them is likewise delayed. More sensors must be utilised if greater speed and timing precision are required. By incorporating a GSM module and a CCTV camera into the circuit, the over-speed detection system can be upgraded.

2.1.2 Literature Review 2 Example (Arduino Car Speed Detector Using Arduino UNO and IR Sensors)

Praveen Kumar (2018) has designed and Constructed Arduino Car Speed Detector Using Arduino UNO and IR Sensors. Using an Arduino board and an IR sensor, a framework for monitoring vehicle speed has been developed. Regarding the safety of the public, a different approach is shown to identify fast vehicles, fine them for violating the rules, or advise the advised specialist to take action. A number of devices to detect reckless driving on public roads have been developed in the past. Many of the approaches involve a lot of human effort and dependence, which makes them challenging to implement. Since a substantial number of accidents were now caused by students driving too fast, we hope to develop a framework in this research for the early detection and warning of unsafe driving patterns. By installing our device in a vehicle, we can determine the speed of the vehicle if it crosses a certain distance. In our device, we use a speed sensor to determine the vehicle speed and an Arduino to display the speed. If the vehicle crosses the speed limit, the device will check the vehicle and suggest a GSM board to send speed data to advised experts, such as parents or other advised individuals

who are determined by the vehicle owner. In this study, the Arduino UNO consists of a physical programmable circuit board (sometimes referred to as a microcontroller) as well as software called IDE (integrated development environment), which runs on your PC and is used to create and transfer PC code to the physical board.

2.1.3 Literature Review 3 Example (Reliable system to detect the speed of the vehicle using IR sensors and display the vehicle speed on LCD)

P.Nihanth, P.Sahithi,R.sreeja, Dr Pradhan (2021) has aimed in providing a user-friendly, reliable system to detect the speed of the vehicle using IR sensors and display the vehicle speed on LCD (Liquid Crystal Display) also the system gives the alert through Buzzer if the system detects over speed. The existing model presents an Integrating feature of all the hardware components which has been used and developed in it with Arduino. The Presence of each and every module has been reasoned out and placed very carefully. Hence contributing to the best working unit for "Vehicle speed detection using Arduino and IR sensors" has been designed perfectly. The device provides an automated solution to continuously monitor the vehicle speed and display the vehicle speed on an LCD module and the system is able to give over speed alerts through a buzzer.

2.1.4 Literature Review 4 Example (Vehicle Speed Detection System using IR Sensor)

Prof. Lalit Kumar, Prof.Mahesh Kamthe, Kunjan Kalbhairav, M. R. O. Aswath Prakash, and Rahul More (2020) have designed a Vehicle Speed Detection System using IR Sensor. This circuit consists mainly of Arduino UNO, two IR sensors, a 16x2 LCD and a buzzer. Two IR sensors are kept apart on one side of the road. When any vehicles cross the sensors, the internal timer in Arduino counts the time between the activation of the sensor. Now speed is measured by using a simple formula of distance time relationship. If the Vehicle's speed indicates an over speeding condition i.e. 50 km/h, the buzzer will be triggered and the LED will blink. Then, LCD displays the speed of vehicles. The timing condition for the vehicle detection system must be set, based on the distance between the sensor and speed which can be easily changed and modified using a microcontroller. The calculation of the vehicle's speed and the time taken by it to cross between the sensors is an approximate value. And the speed sensing from sensors is also delayed due to the large distance between the sensors. If more accuracy of the speed and

time is required, a greater number of sensors must be used. The over-speed detection system can be further advanced by using a GSM module and CCTV camera in the circuit.

2.1.5 Literature Review 5 Example (Speed-Sensing Machining using Arduino and 2 IR Sensors)

G. Pavan Kumar, D. N. Chaitanya Chowdary, S. Rohit, and Dr S. Ramani (2021) have designed a Speed Sensing Machining using Arduino. It used 2 IR Sensors models and set them 10cm apart. When the vehicle reaches the main sensor, the IR Sensor is activated. From this moment on, the timer has been started and can still save time until the car reaches the 2nd IR sensor. By imitating the gap in the middle 2 sensors at 5 meters, you will count the speed at which the vehicle has moved from 1st IR Sensor to 2nd IR Sensor as expected to verify the detection in kmph. All statistics and data collection are done in Arduino and therefore the end is shown in the 16X2 LCD display. As this system collects details of the vehicle/speed of the person, accuracy accordingly by displaying on the LCD screen module and also by raising the limit of the speed will result in responding to the control department. The continuous detection system controls the speed of the oncoming vehicle. It has been said, the over-speed detection system can be further advanced by a camera in the circuit**.**

2.1.6 Literature Review 6 Example (A distance sensor and sensor-based speed laser lidar-lite)

Jaime Manuel Cantos Sánchez (2016) has designed a distance sensor and sensor-based speed laser lidar-lite. The basic system is made up of two fundamental elements: on the one hand, has the lidar sensor and on the other, the LCD screen, having between them an Arduino microprocessor, which will be in charge of governing the communication between the elements of the system, as well as to carry out the necessary calculations for the correct operation of it. Once the programming and configuration of the basic elements are finished, will include the child elements. These are a button to change the function and a piezoelectric speaker for alarm in case of danger.

2.1.7 Literature Review 7 Example (Automatic Speed Detection and Reporting System Using Arduino)

Manipriya Vutturi, Susmitha Palle, Sathyam Bonala (2020) have designed an Automatic Speed Detection and Reporting System Using Arduino. This paper is mainly used as a sport check, to control speed near prohibited areas. The system accumulates information on vehicle/human speed (moving objects) by displaying it on an LCD display and if over speed occurs it alerts by giving a buzzer. The designed detection system continuously monitors the speed of the approaching vehicle. The clear representation of the speed detector and the LCD display which gives accurate results are shown and this is more useful than any other equipment.

2.1.8 Literature Review 8 Example (a Vehicle Speed Detection or Vehicle Speed Measurement using IR Sensor and Arduino).

Engr Fahad (2021) has designed a Vehicle Speed Detection or Vehicle Speed Measurement using IR Sensor and Arduino. Vehicle Speed Detection or Vehicle Speed Measurement using IR Sensor and Arduino- In this tutorial, it will measure the speed of the vehicle using an IR sensor, Arduino, and 16×2 LCD. In this project, two IR sensors are used and placed at a certain distance. To measure the speed, distance and time are needed. The first IR sensor will detect whether there are some vehicles present in front of the sensor or not. Then the timer will start and will measure the duration up to the second IR sensor. The clear representation of the speed detector and the LCD display which gives accurate results are shown and this is more useful than any other equipment.

2.1.9 Literature Review 9 Example (Speed radar with Arduino)

Álvaro Barrio Luquero, Sergio García Rosell and Alberto Martín Amengual (2021) have designed Speed radar with Arduino. For this final project of the Embedded System Design subject, a portable speed radar has been developed, which will calculate both the speed of any object that passes in front of it and the distance at which it passes from it. This has been achieved thanks to the purchase of two ultrasonic sensors. It has a set of buttons with which you can program a speed limit so that if you exceed it, activate an audible alarm as well as a light one. It also has a regulator with which we can adjust the range of action of the radar, and of course, an LCD screen that shows the information we need. In addition, thanks to the fact

that it is powered by a USB connection, it can be connected to a socket or other devices such as an external battery and used anywhere.

2.1.10 Literature Review 10 Example (A Car Speed detector using Arduino and IR Sensor)

Microdigisoft (2021) has designed a Car Speed detector using Arduino and IR Sensors. Two IR sensors, an IR transmitter (IR LED), and one IR receiver(photodiode) are placed on the Arduino board. When any vehicle crosses the two-car sensor, both IR sensors are connected to Arduino's internal timer sensor. And then they measure the speed and distance covered by any moving object, displayed on a digital monitor or a 16x2 LCD screen. When the car in front of the setup reaches the first sensor, Arduino is alert and catches the time stamp as soon as the car gets out of the first IR sensor. The timestamp is recorded once again when the car reaches the other IR sensor. Arduino then calculates the speed by assuming a distance of 5m between two IR sensors and shows the effect of a 16x2 LCD display in km/h.

2.2 Summary of Literature Review.

The summary of the literature review is shown in Table 2.1

Table 2.1 Summary of Literature Review.

No.	Author (s) & Year	Title of Research Paper	Variables Studied/ Research Design	Equipment/ Instruments/ Apparatus used for Experiments/Analysis/ Characterization, etc.	Important Findings	Limitations of Study	Research Gap/ Novelty of Research Study
[1]	Lea Yin Mon, Khin Khin Saw (2019)	Design and Construction of Speed Detection System for Vehicle	This system is designed to detect an over-speeding vehicle by computing the speed of the passing vehicle using the time taken to travel between two sensors at a fixed distance.	Arduino Uno Battery IR Sensors x 2 Buzzer	The timing condition for the vehicle detection system must be set based on the distance between the sensor and speed which can be easily changed and modified using a microcontroller. The calculation of the vehicle's speed and the time taken by it to cross between the sensors is an approximate value and the speed sensing from sensors is also delayed due to the far distance which is installed from one to other.	Not having a GSM module and CCTV camera in the circuit	

No.	Author (s) & Year	Title of Research Paper	Variables Studied/ Research Design	Equipment/ Instruments/ Apparatus used for Experiments/Analysis/ Characterization, etc.	Important Findings	Limitations of Study	Research Gap/ Novelty of Research Study
[2]	Praveen Kumar (2018)	Arduino Car Speed Detector Using Arduino UNO and IR Sensors.	Using an Arduino board and an IR sensor, a framework for monitoring vehicle speed has been developed. If the vehicle crosses the speed limit, the device will check the vehicle and suggest a GSM board to send speed data to advised experts.	Battery IR Sensors x 2 Arduino Uno LED Buzzer x2 LCD x 2 GSM Module	LCD module and the system are able to give over-speed alerts through the buzzer. The device provides an automated solution to continuously monitor the vehicle speed and display the vehicle speed.	CCTV Camera	-
[3]	P.Nihanth, P.Sahithi,R.sreeja, Dr.Pradhan (2018)	Design and Construction of Speed Detection System for Vehicle	detect the speed of the vehicle using IR sensors and display the vehicle speed on LCD (Liquid Crystal Display) also the system gives the alert through Buzzer if the system detects over speed.	Battery IR Sensors x 2 Arduino Uno LED Buzzer x2 LCD x 2	LCD module and the system are able to give over-speed alerts through the buzzer. The device provides an automated solution to continuously monitor the vehicle speed and display the vehicle speed.	Not having a GSM module and CCTV camera in the circuit	-
[4]	Prof. Lalit Kumar,	Vehicle Speed Detection	This circuit is mainly consisting of Arduino UNO,	Battery IR Sensors x 2 Arduino Uno	The timing condition for the vehicle detection system must be set, based on the distance between the sensor	Not having a GSM module and	-

No.	Author (s) & Year	Title of Research Paper	Variables Studied/ Research Design	Equipment/ Instruments/ Apparatus used for Experiments/Analysis/ Characterization, etc.	Important Findings	Limitations of Study	Research Gap/ Novelty of Research Study
	Prof. Mahesh Kamthe,Kunjan Kalbhairav, M. R. O. Aswath Prakash, Rahul More (2020)	System using IR Sensor	two IR sensors, a 16x2 LCD and a buzzer. Two IR sensors are kept apart on one side of the road. When any vehicles cross the sensors, the internal timer in the Arduino counts the time between the activation of the sensor. Now speed is measured by using a simple formula of distance time relationship. If the Vehicle's speed indicates an over speeding condition i.e. 50 km/h, the buzzer will be triggered and the LED will blink. Then, LCD displays the speed of vehicles.	LED Buzzer LCD	and speed which can be easily changed and modified using a microcontroller. The calculation of the vehicle's speed and the time taken by it to cross between the sensors is an approximate value. And the speed sensing from sensors is also delayed due to the large distance between the sensors. If more accuracy of the speed and time is required, a greater number of sensors must be used.	CCTV camera in the circuit	
[5]	G. Pavan Kumar, D. N. Chaitanya Chowd	Speed Sensing Machine using Arduino	It used 2 IR Sensors models and set them 10cm apart. When the moving vehicle reaches the main sensor, the IR Sensor is activated. From this moment on, the timer has been started and can still save	Battery Arduino Uno IR Sensors x 2 LCD display	As this system collects details of the vehicle/speed of the person accuracy accordingly by displaying on the LCD screen module and also by raising the limit of the speed will result in responding to the	Camara	-

No.	Author (s) & Year	Title of Research Paper	Variables Studied/ Research Design	Equipment/ Instruments/ Apparatus used for Experiments/Analysis/ Characterization, etc.	Important Findings	Limitations of Study	Research Gap/ Novelty of Research Study
	ary, S. Rohit, Dr. S. Ramani (2021)		time until the car reaches the 2nd IR sensor. By imitating the gap in the middle 2 sensors at 5 meters, you will count the speed at which the vehicle has moved from 1st IR Sensor to 2nd IR Sensor as expected to verify the detection in kmph. All statistics and data collection are done in Arduino and therefore the end is shown in the 16X2 LCD display.		control department. The continuous detection system controls the speed of the oncoming vehicle.		
[6]	Jaime Manuel Cantos Sánchez (2016)	Design of a distance sensor and sensor-based speed laser lidar-lite	The basic system is made up of two fundamental elements: on the one hand, has the lidar sensor and on the other the LCD screen, having between them a Arduino microprocessor, which will be in charge of governing the communication between the elements of the system, as well as to carry out the necessary calculations for the correct operation of it.	IR Sensor x 2 Arduino Uno LCD Display	LCD module and the system are able to give speed alerts through the buzzer. The device provides an automated solution to continuously monitor the vehicle speed and display the vehicle speed.	GSM Module CCTV Camera	-

No.	Author (s) & Year	Title of Research Paper	Variables Studied/ Research Design	Equipment/ Instruments/ Apparatus used for Experiments/Analysis/ Characterization, etc.	Important Findings	Limitations of Study	Research Gap/ Novelty of Research Study
			Once the programming and configuration of the basic elements are finished, will include the child elements. These are a button to change the function and a piezoelectric speaker for alarm in case of danger.				
[7]	Manipriya Vutturi, Susmitha Palle, Sathyam Bonala (2020)	Automatic Speed Detection and Reporting System Using Arduino	This paper is mainly used as a sport check, to control speed near prohibited areas. The system accumulates information on vehicle/human speed(moving objects) by displaying on LCD display and if over speed occurs it alerts by giving a buzzer. The designed detection system continuously monitors the speed of the approaching vehicle	Transmission Section Power supply Arduino Uno LCD display IR Sensors	The clear representation of the speed detector and the LCD display which gives the accurate results shown in this is more useful than any other equipment.	GSM Module CCTV Camera	-
[8]	Engr Fahad	Vehicle Speed Detection or	Vehicle Speed Detection or Vehicle Speed Measurement using IR Sensor and Arduino- In this tutorial, it will measure the	Battery Arduino Uno IR Sensors x 2 LCD display	The clear representation of the speed detector and the LCD display which gives accurate results are shown And this	GSM Module, CCTV Camera	-

No.	Author (s) & Year	Title of Research Paper	Variables Studied/ Research Design	Equipment/ Instruments/ Apparatus used for Experiments/Analysis/ Characterization, etc.	Important Findings	Limitations of Study	Research Gap/ Novelty of Research Study
	(2021)	Vehicle Speed Measurement using IR Sensor and Arduino	speed of the vehicle using IR sensor, Arduino, and 16×2 LCD. In this project, two IR sensors are used and placed at a certain distance. To measure the speed, distance and time are needed. The first IR sensor will detect whether there is some vehicles present in front of the sensor or not. Then the timer will start and will measure the duration up to the second IR sensor.		is more useful than any other equipment.		
[9]	Álvaro Barrio Luquero, Sergio García Rosell, Alberto Martín	Speed radar with Arduino	This has been achieved thanks to the purchase of two ultrasonic sensors. It has a set of buttons with which you can program a speed limit so that if you exceed it, activate an audible alarm as well as a light one. It also has a regulator with which we can adjust the range of action of the radar, and of course, an LCD screen that shows the information we need. In addition, thanks to the fact that it is powered by a USB	Arduino Uno Breadboards Ultrasonic modules HC-SR04 Potentiometer Buzzer 16×2 LCD LEDs Resistors Pushbuttons Cables and Bridges	The timing condition for the vehicle detection system must be set, based on a distance between the sensor and speed which can be easily changed and modified using a microcontroller. The calculation of the vehicle's speed and the time taken by it to cross between the sensors is an approximate value. And the speed sensing from sensors is also delayed due to the large distance between the sensors. If more accuracy of the speed and	GSM Module, CCTV Camera	-

No.	Author (s) & Year	Title of Research Paper	Variables Studied/ Research Design	Equipment/ Instruments/ Apparatus used for Experiments/Analysis/ Characterization, etc.	Important Findings	Limitations of Study	Research Gap/ Novelty of Research Study
	Amengual (2021)		connection, it can be connected to a socket or other devices such as an external battery and used anywhere.		time is required, a greater number of sensors must be used.		
[10]	Microdigisoft (2021)	How to make a Car Speed detector using Arduino and IR Sensor in proteus?	Two IR sensors, an IR transmitter (IR LED), and one IR receiver(photodiode) are placed on the Arduino board. When any vehicle crosses the two-car sensor, both IR sensors are connected to Arduino's internal timer sensor. And then they measure the speed and distance covered by any moving object, displayed on a digital monitor or a 16x2 LCD screen.	Arduino Uno IR Sensor x 2 10k potentiometer x 2 16x2 LCD Display Module Connecting terminals Power Supply	When the car in front of the setup reaches the first sensor, Arduino is alert and catches the time stamp as soon as the car gets out of the first IR sensor. A timestamp is recorded once again when the car reaches the other IR sensor. Arduino then calculates the speed by assuming a distance of 5m between two IR sensors and shows the effect of a 16x2 LCD display in km/h	GSM Module, CCTV Camera	-
	Our project		The system keeps two times taken by the speed of the vehicle in crossing two fixed distances (10cm - the distance between each sensor) from three sensors. When the vehicle passes through each IR sensor, the respective IR sensor activates. It continuously checks	Arduino Uno IR Sensors x 3 LCD display	We hope the clear representation of the speed detector and the display which gives accurate results are shown and this is more useful than any other equipment.	Wifi Module, CCTV Camera	The research gap is the lack of effective speed detection systems on campus premises and the current systems in place may not

No.	Author (s) & Year	Title of Research Paper	Variables Studied/ Research Design	Equipment/ Instruments/ Apparatus used for Experiments/Analysis/ Characterization, etc.	Important Findings	Limitations of Study	Research Gap/ Novelty of Research Study
			the digital readings of the IR sensors. It uses the time taken for the vehicle to pass from one sensor to the next to calculate the average speed of the vehicle. This is done by subtracting the time taken for the vehicle to pass from one sensor to the next. The average speed is then calculated by dividing the distance by the average time taken. The speed limit has been set in km/hr and checks if the velocity of the vehicle exceeds the speed limit. The average speed is displayed on a display. If the vehicle's speed is greater than the limited speed (30 km/h), Then the display will display a warning message as "Exceeded the speed limit. Slow Down!".				be fully reliable or accurate in detecting and warning drivers who exceed the speed limit, resulting in potential accidents and harm to students and others. This project aims to fill this gap by providing a more accurate and efficient speed detection system that uses multiple IR sensors.

2.3 Chapter Summary

Overall, this chapter includes various studies or research done based on other people who have done similar projects or studies. This enables a higher understanding of what this project would require and the obstacles that may arise and how to approach it. In this chapter, so far it has been discussed various projects done as Vehicle Speed Detectors using the main components as 2 IR sensors and the Arduino. It has been seen that some projects such as Arduino used the GSM module to advance their basic design into giving a warning message to your phone. We conclude after reviewing these projects as each and every above-mentioned project used 2 IR sensors for their design but in our projects, we will advance the basic design by another IR sensor which we also need to need to advance our algorithm into two-time values which makes the calculation of the speed of the vehicle more accurate which reduced the limitation mention by Prof. Lalit Kumar, Prof. Mahesh Kamthe,Kunjan Kalbhairav, M. R. O. Aswath Prakash, Rahul More (2020) in their project for Vehicle Speed Detection System using IR Sensor [4]. The research gap or novelty of this project could be the lack of effective speed detection systems in school zones. The current systems in place in universities may not be fully reliable or accurate in detecting and warning drivers who exceed the speed limit, resulting in potential accidents and harm to students and others. Our car detection system aims to fill this gap by providing a more accurate and efficient speed detection system that uses multiple IR sensors and an Arduino-based system to process and display the speed of passing vehicles. The system also gives a warning message to drivers if they exceed the speed limit, helping to ensure the safety of those on the campus premises. This project's novel approach and solution to this issue could potentially lead to a reduction in accidents and improve safety on university premises.

CHAPTER 3: DRAFT METHODOLOGY

3.1 Overview

The system will be an Automated Speed Detection System using Arduino Uno and IR sensors. In this system, IR Sensors are the main part of the circuit design that detects the speed of the vehicles. The system keeps two times taken by the speed of the vehicle in crossing two fixed distances (10cm - the distance between each sensor) from three sensors. When the vehicle passes through each IR sensor, the respective IR sensor activates. It continuously checks the digital readings of the IR sensors. It uses the time taken for the vehicle to pass from one sensor to the next to calculate the average speed of the vehicle. This is done by subtracting the time taken for the vehicle to pass from one sensor to the next. The average speed is then calculated by dividing the distance by the average time taken. The speed limit has been set in km/hr and checks if the velocity of the vehicle exceeds the speed limit. The average speed is displayed on a display. If the vehicle's speed is greater than the limited speed (3 km/h), Then the display will display a warning message as "Slow Down!".

3.2 Block Diagram

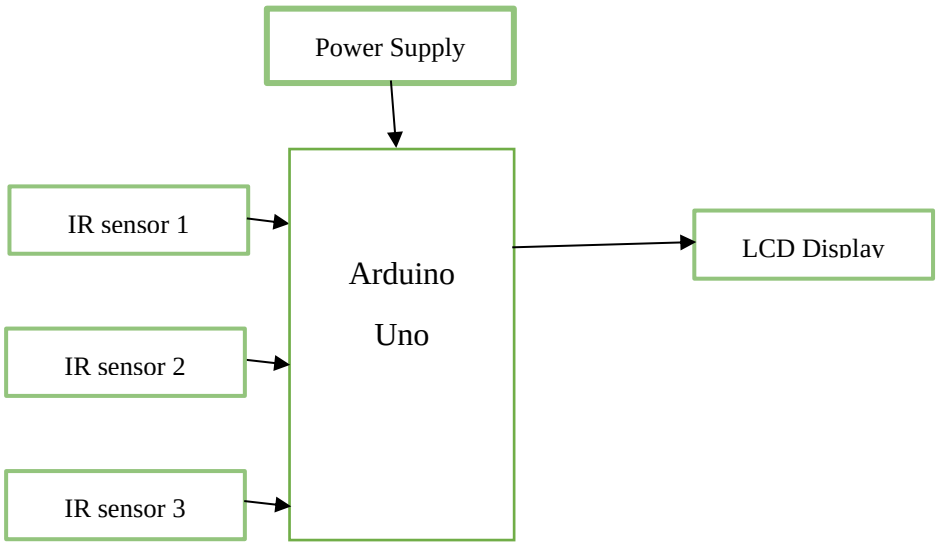

Figure 3.1: Transmitter block diagram.

3.3 Flowchart

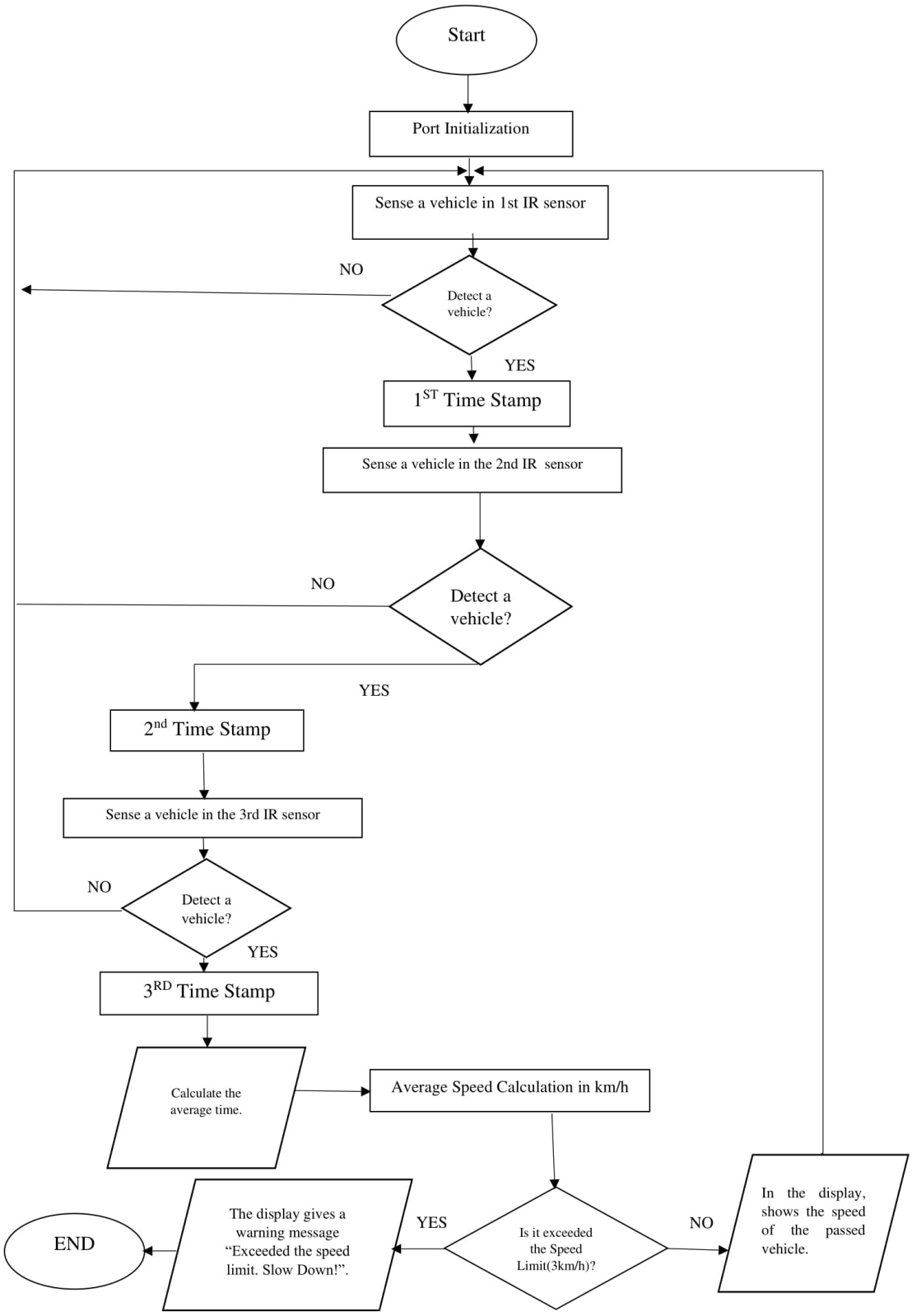

Figure 3.2: Flowchart of the system

3.4 List of Components Used.

Arduino Uno

IR Sensors x 3

LCD display

3.4.1 infrared (IR) sensor

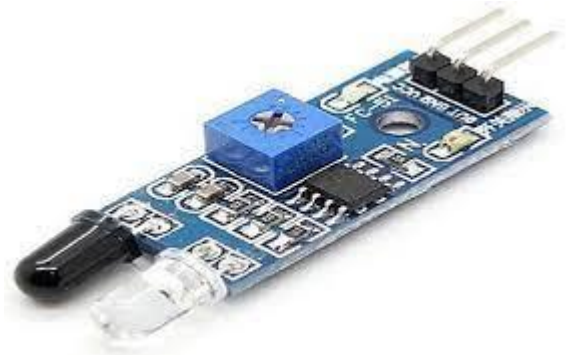

Figure 3.4: Infrared (IR) sensor

An IR (Infrared) sensor is a device that detects the presence of objects or changes in the environment using infrared radiation (IR) technology. IR radiation is electromagnetic radiation with a wavelength longer than visible light, but shorter than microwave radiation. IR sensors are used in a variety of applications such as remote controls, burglar alarms, motion detectors, and other sensing and control systems. IR sensors consist of an IR detector and an optical lens that focuses the IR radiation onto the detector. The detector generates an electrical signal in response to the IR radiation, which is then processed by the control circuitry to determine the presence or absence of an object or a change in the environment. IR sensors are used in both industrial and consumer applications and are widely available in different configurations and sizes to meet various application requirements.

3.4.2 Arduino Uno

Figure 3.5: Arduino Uno

The Arduino Uno module is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins, 6 analogue inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header, and a reset button. It is typically used for building digital devices and interactive objects that can sense and control physical devices. The Arduino software (IDE) makes it easy to write code and upload it to the board.

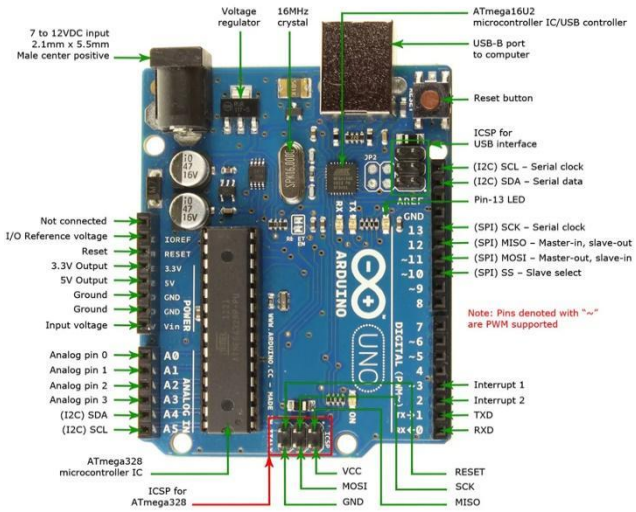

Figure 3.6: Arduino Uno structural diagram.

3.4.3 LCD I2C Display

Figure 3.9: LCD I2D Display

The LCD (Liquid Crystal Display) is a type of display commonly used with Arduino boards to display text, images, or graphics. The display consists of a matrix of pixels that can be turned on or off to display characters and symbols. To use an LCD display with an Arduino board, you'll need to connect it to the board's pins and use software libraries to control the display. The library provides functions for initializing the display, setting the cursor position, writing text or graphics, and controlling the backlight. With the help of these libraries, using an LCD display with an Arduino is relatively straightforward.

3.5 Division of Tasks in the project.

Table 3.1: Division of Tasks in the Project

Members	**Designed Task**
Inuri	● Documentation, Create Prototype and Presentation
Raul	● Documentation, Create Prototype and Presentation

3.6 Simulation of programming Results.

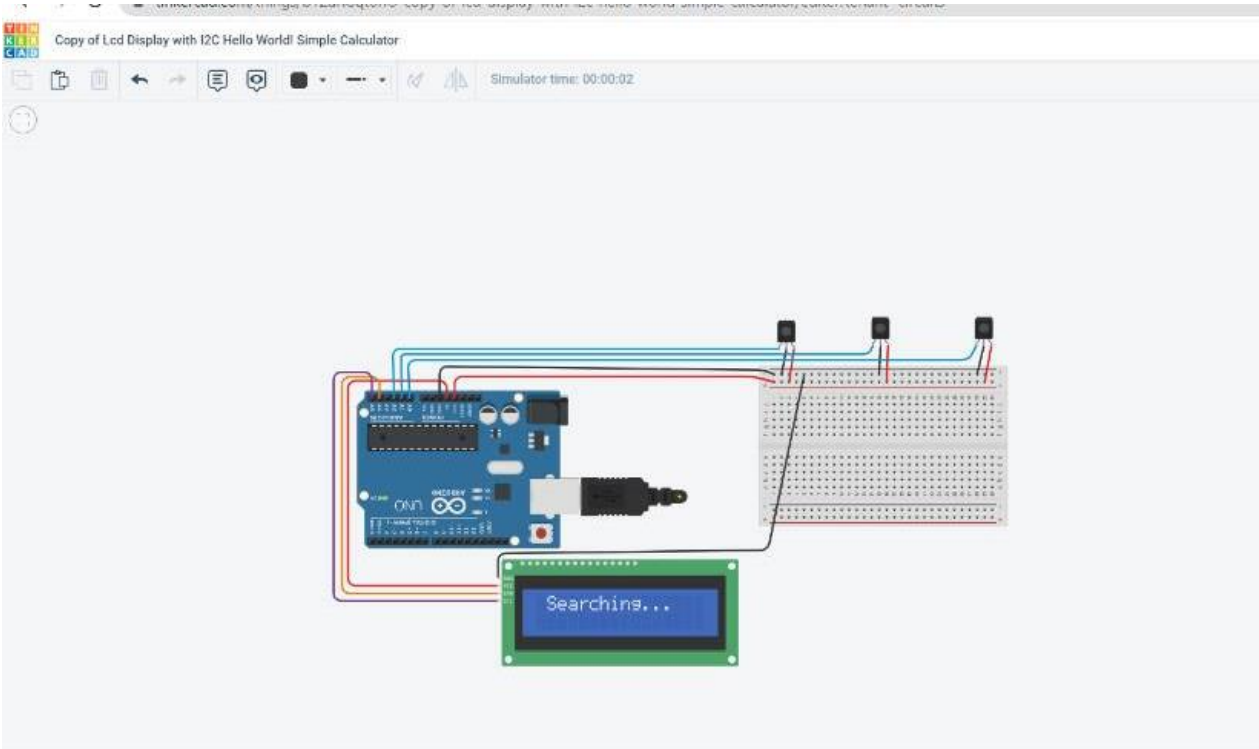

Figure 3.18: Tinkercad simulation software result.

Open Tinkercad and create a new Circuit simulation. Add the components to the Circuit simulation: an Arduino Uno microcontroller, three IR sensors, a breadboard and an LCD display have been added to the circuit simulations. The three IR sensors are connected to the Arduino Uno by plugging them into three different analogue pins (A0, A1, A2). The LCD is connected to the Arduino by plugging it into the I2C pins (SDA, SCL). The IR sensors to the analogue pins on the Arduino, and connect the LCD is being connected to the I2C pins on the Arduino through the breadboard. The code is being written in the Tinkercad Code Editor to implement the car speed detector. The code involves using while statements to detect the car's passage through each sensor and calculating the time it takes for the car to travel between each sensor. The code is being uploaded to Arduino. The car speed detector is tested by running a simulation in Tinkercad. A car passing is simulated by the sensors by using the Tinkercad tools to provide a signal to each sensor. The speed is being observed of the car displayed on the LCD. The LCD display is given 3 outputs such as the velocity is higher than 3 km/h, the speed

and message “Slow Down”; lover than 3km/h, the speed and no vehicles is being detected, the message “Searching”.

3.7 Simulation circuit diagram.

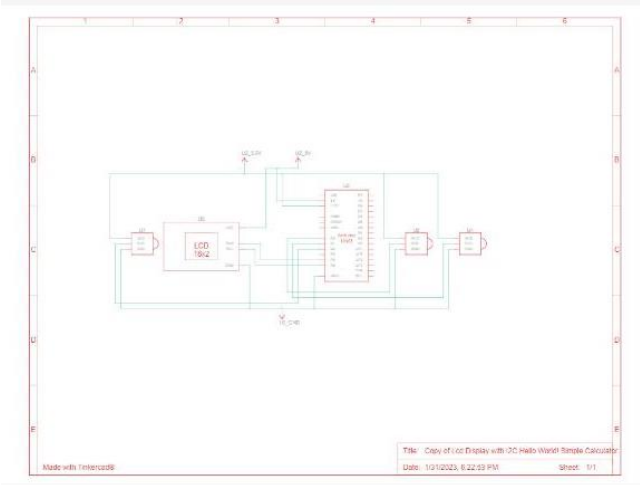

Figure 3.19: Circuit Schematic Diagram.

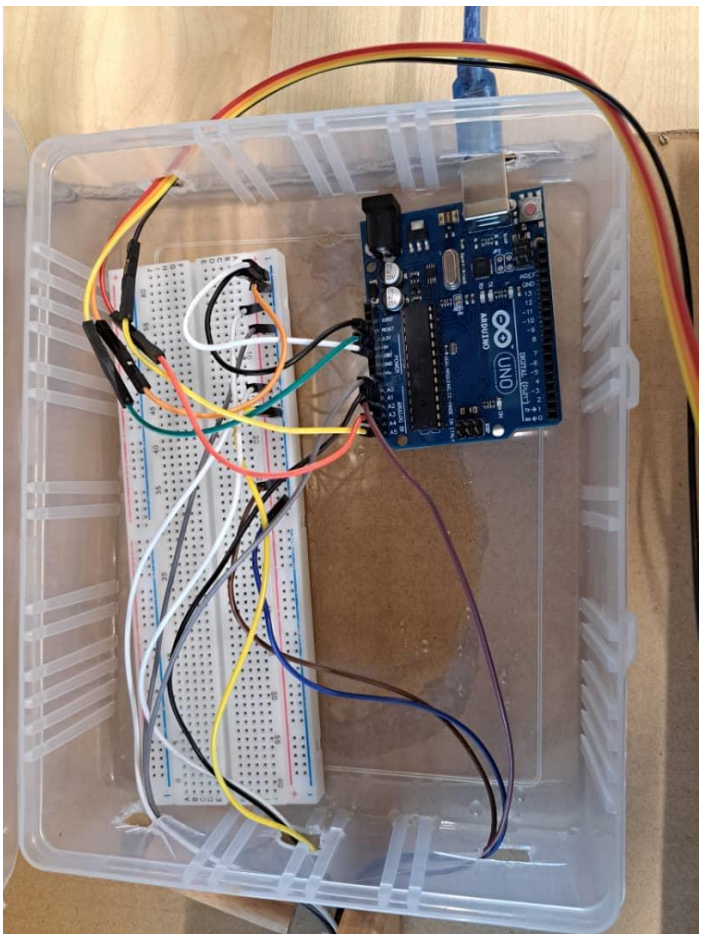

Figure 3.20: Arduino Hardware Connections.

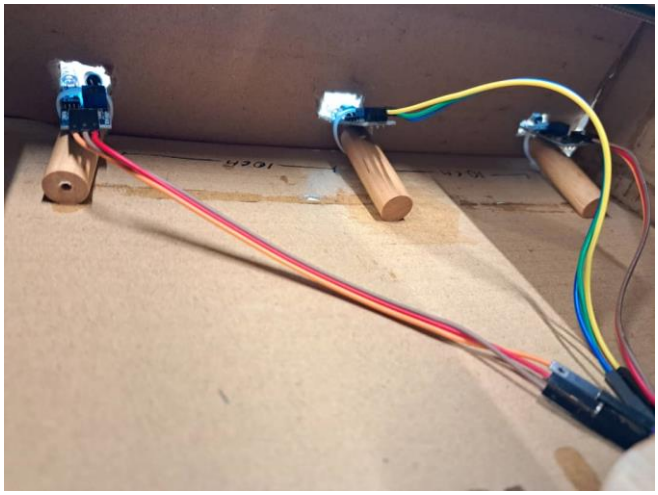

Figure 3.21: IR Sensor Hardware Connections

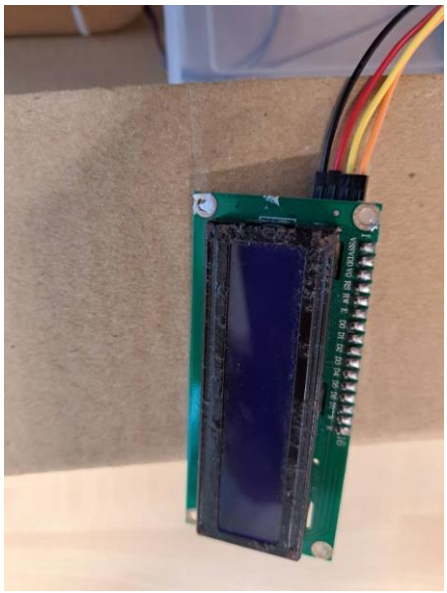

Figure 3.22: LCD Display hardware Connections.

Velocity > 3 km/h

Velocity < 3 km/h

When a vehicle is not detected

Figure 3.23: Circuit simulation result in LCD Display.

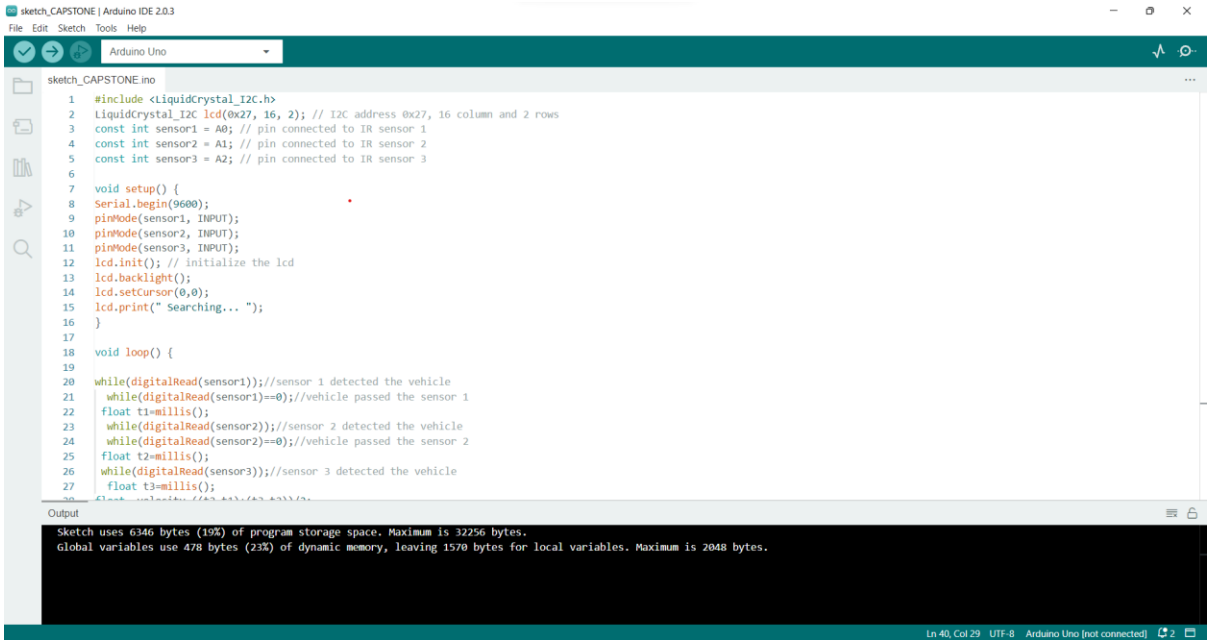

Figure 3.24: Arduino IDE Compilation.

3.8 Complete hardware circuit.

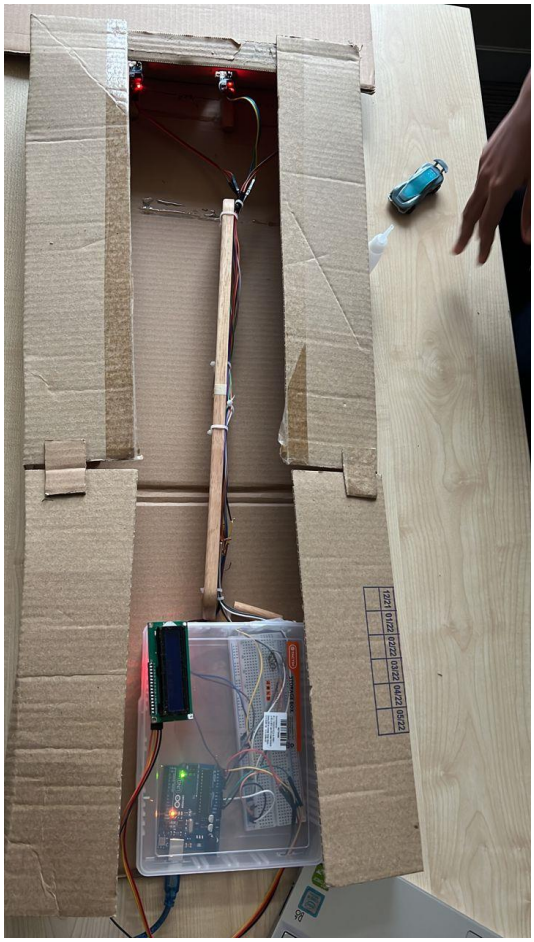

Figure 3.21: Front View

Figure 3.22: Rear View

The hardware prototype for the car speed has been built with electronic devices such as 3 IR sensors, Arduino Uno, LCD display with the breadboard which has been connected according to the circuit diagram. The prototype is presented with a cardboard design which shows as road

and sensors standard 20cm from 1st sensor to the last sensor. All the wires from the sensors go into the main controlling box which includes the Arduino Uno. Top of the system the LCD is placed. It shows the detected vehicle speed. A toy car is being used as an actual vehicle to display the detector's real-life functionality.

3.9 Chapter Summary

This chapter focuses on the project design and development of the prototype of the car speed detector. It includes a detailed explanation of the design with the block diagram, flowchart and the components used in the circuits as well as the software simulation results as well as circuit simulation results. It has been discussed the physical representation of the prototype has a model of a road and 3 sensors places 10cm in distance from each other. The software simulation for the car speed detector is done using tinkercad.

CHAPTER 4: RESULTS AND DISCUSSION

4.1 Overview

According to the three objectives layout, the LCD should be able to display the output according to the respective measurement from the sensors. According to the main analogy, there are 3 LCD results to be gained. “Searching…”, when no detection from the sensors (as for the aetiology, this message is shown until 1st IR sensor detects a vehicle), just the speed of the vehicle in km/h when the vehicle is 3km/h and the speed of the vehicle and message as “ Slow Down” when the vehicle is 3 km/h higher.

4.2 Vehicle under over 3km/h and Discussion.

Table 4.1: Measures of Car & Respective Warning Message

Measurement	1st Trial (km/h)	2nd Trial (km/h)	3rd Trial (km/h)	4thTrial (km/h)	5thTrial (km/h)
Velocity	6.92	6.70	3.10	0.33	0.92

Warning Message	**Slow Down**	**Slow Down**	**Slow Down**	**-**	**-**

Table 4.2: Measures of Car & Respective Warning Message

Measurement	**1st Trial (km/h)**	**2nd Trial (km/h)**	**3rd Trial (km/h)**	**4thTrail (km/h)**	**5thTrial (km/h)**
Velocity	**0.92**	**9.29**	**0.13**	**6.21**	**12.74**
Warning Message	**-**	**Slow Down**	**-**	**Slow Down**	**Slow Down**

Table 4.1 and Table 4.2 shows the output of the car speed detection designed for university premises. As is shown, our system can provide a warning message according to random input it senses from the sensors. The measurement is shown in the LCD in 2 decimal points and according to the table, for all the measurement which is higher than 3 km/h, gives a warning message is given as “Slow Down” successfully.

Figure 4.1: Result Figure

This figure shows the LCD message for a vehicle over 3 km/h. “8.18 km/h “as the measurement for this specific trial for the system is shown. With the Slow Down warning message.

4.3 Vehicle under 3 km/h and Discussion.

Figure 4.2: Result Figure

This figure shows the LCD message for a vehicle under 3 km/h. “0.04 km/h “as the measurement for this specific trial for the system is shown.

4.4 Vehicle isn’t detected and Discussion.

Figure 4.3: Result Figure

As for this figure, the LCD shows “Searching…” until the 1st IR sensor detects a vehicle.

4.4 Problem-Faced and solution.

The main challenge faced in designing this project was figuring out a functional and efficient arrangement of using three IR sensors to ultimately measure the speed of a moving car. This was difficult due to the limited research materials available for using three IR sensors. The solution was found through trial and error, with the goal of finding a suitable code to obtain accurate results.

Initially, the team had planned to use Doppler sensors, but they were too sensitive to sound, which led to inaccurate measurements. The solution was to switch to IR sensors.

The team also initially considered modifying the system to display the measurement results on a computer screen using the HTML front-end, but this proved to be challenging due to issues with the serial port of the Arduino not being recognized by the HTML code. Ultimately, the team decided to stick with an LCD display for simplicity and lack of time.

4.5 Chapter Summary

This chapter focuses on the results and findings obtained from the data collected for this study. Subsequently, analysis was performed and shown in this chapter that the system is functioning successfully establishing its objectives. The main challenge faced in the design was finding a suitable code to obtain accurate results due to limited research materials available for using three IR sensors. The team initially planned to use Doppler sensors but switched to IR sensors due to sensitivity issues. The system was able to provide a warning message (“Slow Down”) for speeds over 3 km/h and display the speed in 2 decimal points on the LCD. The team initially considered using a computer display with an HTML front-end but faced issues with the serial port recognition and ultimately decided to stick with an LCD display.

CHAPTER 5: CONCLUSION AND RECOMMENDATION

5.1 Conclusion

In conclusion, in this project, the main functionality of the Automated Speed Detection System is to monitor and control the speed of vehicles in university premises zones to prevent accidents and ensure the safety of students and others. The system uses 3 IR sensors and an Arduino-based system to calculate the average speed of passing vehicles and display it on an LCD display. If a vehicle exceeds the speed limit, a warning message "Slow Down!" is displayed to alert the driver to adjust their speed, thus promoting safety on the university campus. The system is designed to take time stamps from each sensor one after the other. the input taken from the 2nd and 3rd is not going to be valid unless there is an input from the 1st sensor. We are willing to modify the system by adding Camara to take a picture of the number plate of the vehicle and a Wifi module to send the measurements to the phone. In the future, the system can be advanced to use in the real life with an expanded budget.

Table 5.1: Objective achievement table.

Objectives	Achieved/Not Achieved	Justifications
To enable the detection of car speed	Achieved	
To enable the detection of car speed of more than one car	Achieved	
To display the car speed in a display	Achieved	
Give a warning if the car exceeds the 3km/h speed limit	Achieved	

5.2 Recommendation.

In the future, the project can be improved with the use of an ESP32 Camera module which utilizes the OV2640 sensor. This compact and low-power camera can capture images or videos and be controlled through the ESP32's parallel camera interface or the SCCB. It's commonly used in IoT projects to capture images of speeding vehicles. Adding a WiFi module such as the Arduino Uno WiFi or the ESP8266WiFi Module can also allow for sending the speed measurement data to a phone via the WiFi network.

5.3 Chapter Summary

This chapter concludes with a conclusion of the entire project putting the closure for the project achieving the ultimate objectives and adding the future recommendation for the project. The project is done for the scope of university premises for the ongoing vehicle around campus. The system can be modified for the real-life scenario advancing the original system by adding a Wi-Fi module and a camera taken as future recommendations to advance this system.

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Appendices A: Budget

Product	Quantity	RM
Solderless Breadboard	2	8.20
Arduino Uno	1	45.90
IR sensor	3	9
16 x 2 LCD Display	1	12.99
Male to Male Jumper Wires	A set (40 wires)	3.20
Battery Clip	1	0.50

Total	**-**	**79.79**

Appendices B: Gantt Chart

Activities	Weeks													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Proposal Presentation (Supervisor +Examiner))														
2. Proposal Report) (Supervisor +Examiner)														
3. IDP Final Report (Supervisor)														
4. IDP Final Report (Examiner)														
5.. Oral Presentation (Supervisor)														
6. Oral Presentation (Examiner)														
7. Log Book & Continuous Interaction (Supervisor)														
8. Poster Presentation (Supervisor)														

Appendices C: Codes

```
#include <LiquidCrystal_I2C.h>
LiquidCrystal_I2C lcd(0x27, 16, 2); // I2C address 0x27, 16 column and 2 rows
const int sensor1 = A0; // pin connected to IR sensor 1
const int sensor2 = A1; // pin connected to IR sensor 2
const int sensor3 = A2; // pin connected to IR sensor 3

void setup() {
Serial.begin(9600);
pinMode(sensor1, INPUT);
pinMode(sensor2, INPUT);
pinMode(sensor3, INPUT);
lcd.init(); // initialize the lcd
lcd.backlight();
lcd.setCursor(0,0);
lcd.print(" Searching... ");
}

void loop() {

while(digitalRead(sensor1));//sensor 1 detected the vehicle
  while(digitalRead(sensor1)==0);//vehicle passed the sensor 1
 float t1=millis();
  while(digitalRead(sensor2));//sensor 2 detected the vehicle
  while(digitalRead(sensor2)==0);//vehicle passed the sensor 2
 float t2=millis();
 while(digitalRead(sensor3));//sensor 3 detected the vehicle
  float t3=millis();
float  velocity=((t2-t1)+(t3-t2))/2;
  velocity=velocity/1000;//convert millisecond to second
  velocity=(0.2/velocity);//v=d/t
  velocity=velocity*3600;//multiply by seconds per hr
  velocity=velocity/1000;//division by meters per Km

   lcd.clear();                 // clear display
   lcd.setCursor(2,0);
   lcd.print(velocity);
   lcd.print(" Km/h   ");

   // Set the speed limit in km/hr
const int SPEED_LIMIT = 3.0;

// Check if the car has exceeded the speed limit
if(velocity > SPEED_LIMIT) {
// Print a message if the car has exceeded the speed limit
  lcd.setCursor(2,1);         // move cursor to   (2,1)
  lcd.print("Slow Down");     //print the warning message
}
// Wait for 500 milliseconds
delay(500);
}
```

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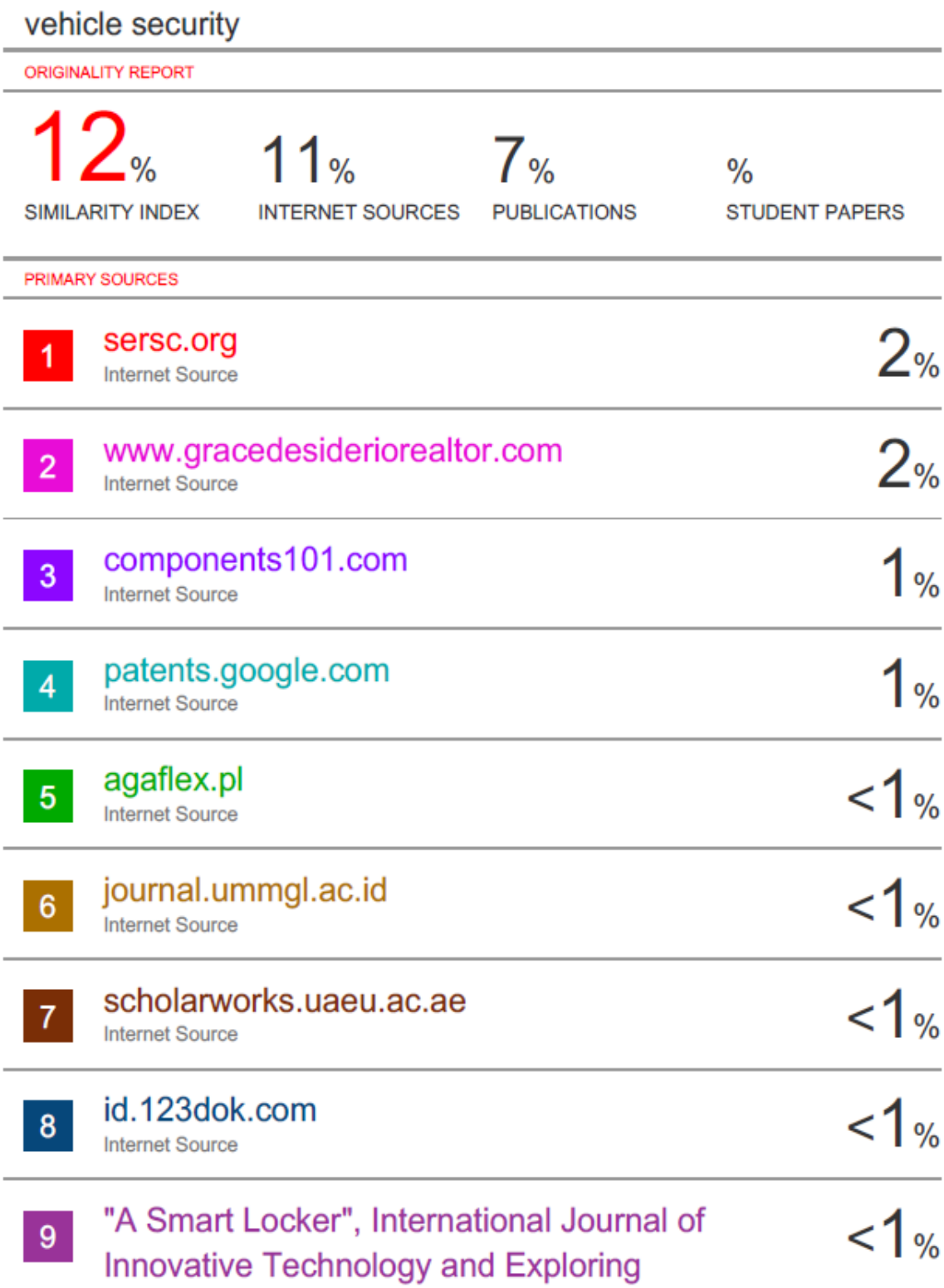

vehicle security

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