Determine and Overcome Challenges That Cause Failure in the Automatic Braking System in Driverless Cars.

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Abstract: The self-braking system of cars relies on a remote infrared sensing device. Hence, this research focuses on the applied results of a hand-made infrared remote sensing device and obtains practical results of the efficiency of the remote infrared sensing device that is used now on the self-braking systems, in different weather conditions and the position of the Sun in sky (intensity of Sunray) as well as various variable such as the colour and temperature of the obstacle to improving this device to be able to do its function properly without car accidents, in the meantime the electronic system of the automatic braking system must be connected to the speedometer device of the car to make the car brake at high speeds for obstacle objects from greater distances, and reduce that distance at lower speeds. If the car is at a high speed, even braking the car a few meters away from the obstacle objects may not help to prevent the accident because the car will keep moving and collide with the obstacle objects due to the momentum generated in the material of the car at high speed, where adding a camera and computer and the artificial intelligence program to diagnose objects in the used system could reduce errors and malfunctions and avoid accidents. Considering the light polarization features in the used infrared ray of the automatic braking system via added polarization filter in the emitter and the same sort of filter to the receiver (infrared sensor) to receive the same angle of the polarized infrared ray, to identify the used infrared ray of the same car strictly and separate the rest of received infrared rays either from the artificial or natural sources in the infrared ray sensor.

Purpose: Determine the factors that cause failure in the automatic braking system to improve this device to be able to do its function properly without car accidents.

Method: Collect data concerning the remote infrared sensing device in different weather conditions to improve this system's recently used technique to function properly without car accidents.

Results: The used frequencies in the remote infrared sensing device are greatly affected by the surrounding circumstances because the used frequencies are very close to visible ray frequencies. Therefore, changing the frequencies of the used infrared rays of this system to the longer wavelength could reduce the effects of the surrounding circumstances, and reducing the rates of absorption and refraction rates through different density media could increase the efficiency of the remote infrared ray and improve the efficiency of this device in the automatic braking system, preventing car accidents caused by a failure in this device.

Key words: failure in the automatic braking system, infrared remote sensor, automatic braking system in driverless cars.

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1.0 Introduction: Driverless cars operate independently with little or no human supervision, where they can determine their locations and move independently, completing tasks based on artificial intelligence. There are many companies working in this field, and the expected volume of investment in the global market of autonomous cars will reach 2.3 trillion US dollars by 2030 [1]. For instance, the robot taxis where the start-up Cruise [2] is offering taxi services for people in the United States and deploying a fleet of cars, rigged with sensors and programmed with various navigation algorithms. There are several applications used in driverless cars, such as LiDAR, RADAR, Infrared (IR), Sonar, and Ultrasonic Applications: in this study, we shall focus on Infrared (IR) that is often used in the automatic braking system to investigate its mechanisms, challenges and solutions.[3] I this research we shall focus upon the infrared sensors where it represents the best sensors in driverless cars.[4] In order to develop the recently used system for the autonomous braking system, we have to identify the factors that reduce the efficiency of the remote sensing system by the infrared rays, taking into account weather conditions, natural and artificial resources of the infrared rays, physic characteristics of electromagnetic waves for each frequency and wavelength, and physic characteristics of the material at different temperatures. To identify the factors that undermine the operation of the automatic braking system for vehicles. We must know the electronic circuits used in this system, identify their weak points, and improve them by adding the required accessories that support the operation of these electronic circuits.

We must also know the properties of the electromagnetic waves used (infrared rays) and their spectra, frequencies, and how they are affected by their surrounding conditions to choose the most appropriate frequencies for this system so that the automatic braking system performs its function in the best way possible. Because the way these circuits work is one of the examples of the interaction between electromagnetic waves with the materials in the electronic circuits as well as in the materials of the environment surrounding the electronic system, in this research, we find laboratory experiments and results as well as solutions to avoid any failure in the automatic braking system in driverless cars to prevent car accidents caused by malfunction of parts of this system.

Designing a system of automatic braking should consider the speed of the car, where the higher the speed, creates a greater the momentum in the car, when the car at high speed, the car will remain in motion for a long distance even though the tires stop as a result of braking. In this case, the electronic system of the automatic braking system must be connected to the speedometer of the car to make the braking from greater distances of the obstacles at high speed, and reduce that distance at lower speeds. In the meantime the existence of other sources of infrared radiation interference occur with the radiation used for the self-braking system, and when it enters the receiver sensor, it leads to distorted currents in the sensor outputs that are not proportional to the frequency of the electronic filter designed to allow them to pass. Therefore, adding the features of polarization light to the used infrared ray of the automatic braking system, for the emitter and the receiver for the same angle of polarization could help strongly identify the used infrared ray of the same car and prevent the infrared ray from reaching the sensor.

This will reduce the distortion that occurs in the electronic system of the automatic braking system and reduce the probability of failure. It is important to install sensors to measure the rates of infrared ray in the environment around the car to notify the driver that the automatic braking system of the car is stopped, and he should depend upon himself in braking when it needs, this will also protect car producer companies of prosecutions if any accidents occur due to the failure in their systems, to prevent car accident and protect life of people, also protect car producer companies of prosecutions if any accidents occur due to the failure in their systems.

2.0 The electronic parts in the automatic braking system are: An automatic braking system is an important part of safety technology for automobiles. It is an advanced system, specifically designed to either prevent a possible collision or reduce the speed of moving vehicle, before a collision with another vehicle, pedestrian or an obstacle of some sort. These systems combine sensors, such as radar, video, infrared, or ultrasonic to scan for possible objects in front of the vehicle, and then use brake control to prevent collision if the object is in fact detected. Where the automatic brakes are one of many car safety features and are often integrated with other technology, such as pre-collision systems and adaptive cruise control, in order to activate the brakes in time if the driver fails. [5]

The general idea of parts of automatic braking system [6]: The self-braking system is composed of the following parts: ABS control module [7], brake booster, disc brakes, drum brakes, emergency brake, master cylinder, brake pedal, and wheel speed sensors, but here we shall focus on the electronic parts that cause failure in the self-braking system in the wheels and result in car accidents. It`s the issue of running the electric motor automatically (via the cruise control) via the accessory electronic circuits [9] pushing the piston in the master cylinder the brake fluid sending the pressurized brake fluid to the wheel cylinder located inside the brake drum. This pressure causes the pistons in the cylinder to expand and press the brake shoes against the inner surface of the brake drum, which creates friction to help slow the spinning of the wheels or stop the vehicle.

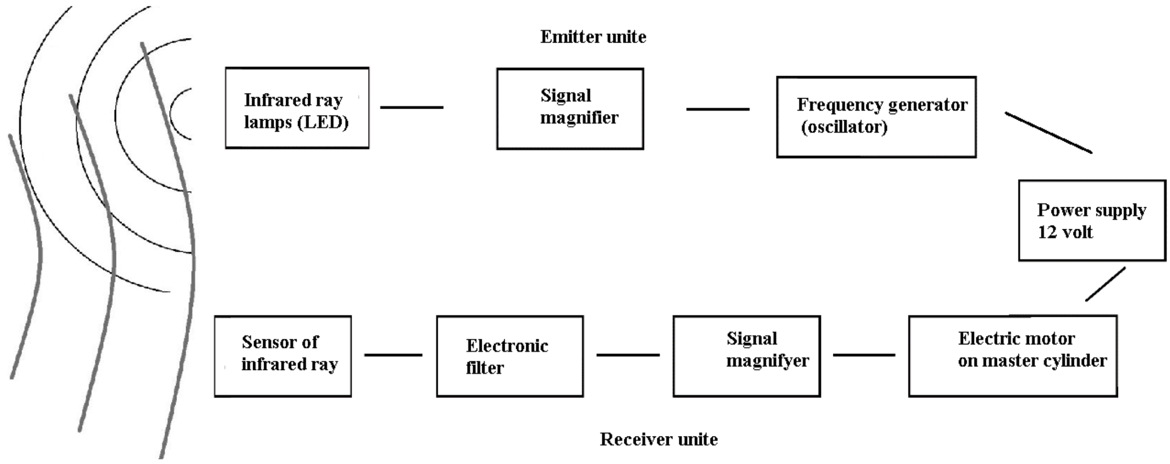
1. Infrared emitters, consisting of LEDs with a specific frequency infrared ray [10], emit certain pulses per second (with a specific frequency of about 10 to 100 hertz or even more), which value the specified identity of the car on the road among the rest of the cars that use the same self-braking system.

2. The infrared sensor [11] is used on the receiver circuits for infrared rays.

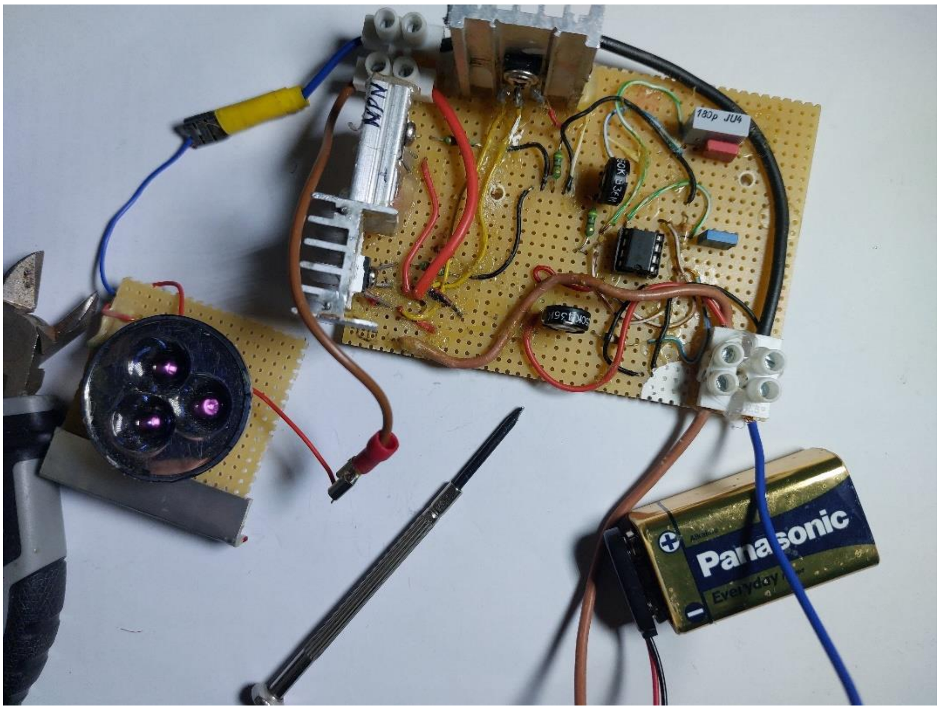
3. An electronic filter [12] allows passing only the infrared ray with the specific frequency used by emitters of the same car (to identify the frequency used for that car when it has been reflected from the surface of the obstacle in the road and not passing only the infrared for the rest of other cars in the road).

4. Electronic signal magnifying circuit to magnify the output signal from the infrared ray sensors to run an electric motor connected to the hydraulic system of the car's braking system.

Parts of the automatic braking system as shown in illustration (1) show how this system works to detect the obstacle via detecting the reflected infrared ray, where the emitter consists of the infrared ray projector (LED lamps), an electrical power source of 12 volts, a frequency-generating unit (the oscillator), and an amplifier unites the magnifying the signal from the output of the oscillator to a high electrical current equal to the amount required to operate the infrared projectors and lenses to focus rays in the desired direction. The receiver consists of an infrared sensor, an electronic filter, a signal magnifier, and an electric motor circuit to run the master cylinder to push the hydraulic fluid into the vehicle's braking system.



The illustration (1) the emitter and receiver parts of the automatic braking system.



The image (1) is an example of the emitter circuit of the infrared ray. Where we find the oscillator (circuit of IC 555) connected to the signal magnifier circuit (of the transistor BD 139) with the infrared LED, we can control the value of the frequency (the number of pulses of the infrared LED) by changing the value of the variable resistance in the oscillator (circuit of IC 555) to be equal to the value of frequency of the cut-off filter to let both circuits work consistently on the same value of frequency.

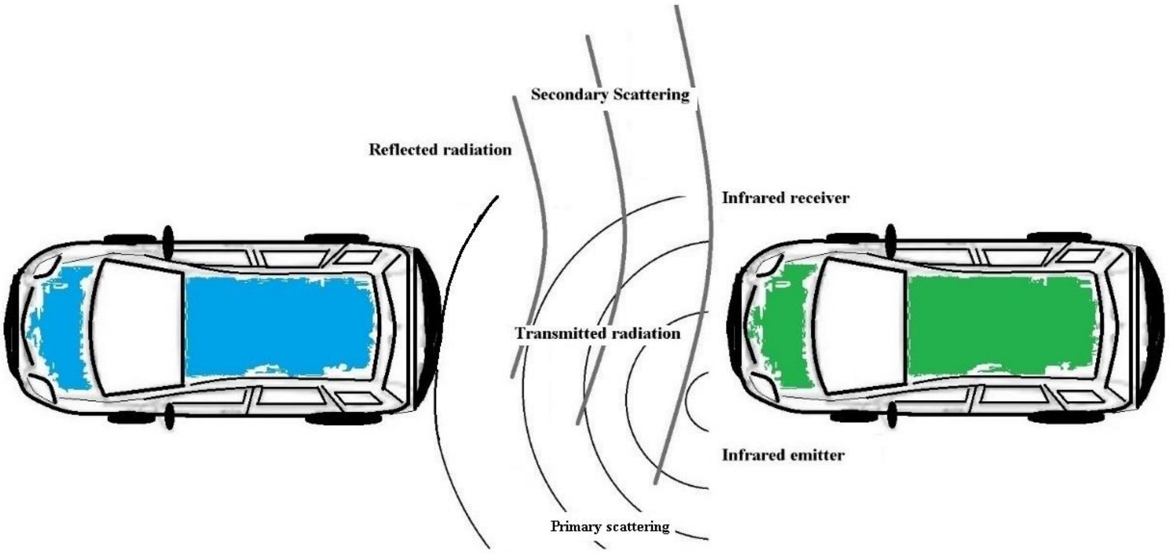
3.0 How the self-braking system works: When an obstacle obstructs the path of the car, the used infrared radiation from the emitter of the car will collide with the obstacle object, and some of that reflected radiation will arrive at the receiver of the car (the infrared sensor), an electrical signal emerges from the sensor towards the electronic filter to identify the used frequency signal of the car. If the electronic filter passes the signal, that means it`s the correct signal used at the frequency of the same car, then the electronic signal will be magnified by the amplification circuit that is connected directly to an electric motor to perform its function of injecting the hydraulic fluid of the hydraulic system of braking system, thus the car stops automatically before making a car accident. As depicted in the illustration (2), several stages of scattering occur for the used infrared rays, where a very small rate is received by the sensor. The reflected part suffers from a second scattering during reflection, where the presence of fog or raindrops will lead to extra scattering of the rays that pass through these raindrops because infrared rays have the same properties as visible radiation [13], where the process of transmitting and receiving infrared rays in the automatic braking system, as the transmitted radiation suffers from scattering, and a small percentage reaches the obstructing object.

Note that the existence of another car that is coming from the opposite direction is also using the automatic braking system, which couldn't affect the braking process of the first car because the filter used for the first car allows passing the frequency emitted from the infrared lamp pulses but not the frequency emitted from the infrared lamp pulses of the second car due to the different pulse frequencies of the second that may only pass through the infrared lamp pulses of the first car that may be reflected from the obstacles or the presence of an obstruction in front of the first car. But receiving two different frequencies at the same time results in mixing them in the sensors and generating confusing electric frequencies from the output of the sensor that may not be able to pass through the electronic filters, and this causes confusion in the automatic braking system of the car because the generated electronic frequency from the output the sensor (the current pulses) of the out-put of the sensor will not be at the same value as the cut-off electronic filter used to recognize the radiation pulses used for the first car, and no signals will come out from the filter to the first car to the magnifying circuits nor the electric motor of the hydraulic system of the car's braking system, therefore the accident will occur even though the entire self-braking system of the first car is working properly.

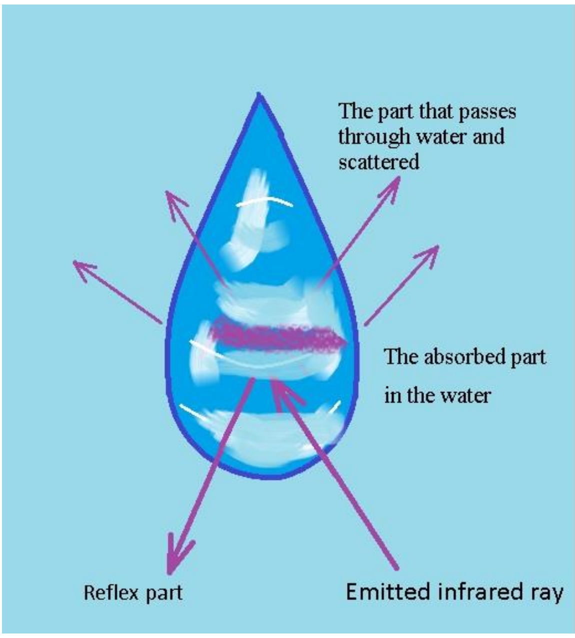
4.0 General reasons cause the failure in the automatic braking system: During the times of sunset, when the percentage of infrared radiation in the sun's rays increases, a high rate of infrared radiation in the sun's rays leads the interference receiver to be mixed with the infrared rays used in the self-braking system, so that the infrared sensor receives two radiations of infrared radiation, one from the sun and the second from the car's infrared ray emitters that are reflected from the object interfering in the direction of the car. This leads to the generation of an almost distorted electrical current from the sensor, and this is not able to pass through the electronic filter that is designated to determine the frequency (emitter pulses) that is used for the system, so the car does not break in the presence of an accident, and an accident occurs.

Many sorts of scattering occur for the used infrared ray and cause a decrease in the rate of radiation received by the sensor:

1. Scattering of radiation caused during the refraction.
2. Scattering is caused by passing the radiation through different media densities.
3. The absorbed rate of infrared rays (thermal rays) by low energy obstacles.
4. Scattering is one of the basic physical properties of radiation during its release.



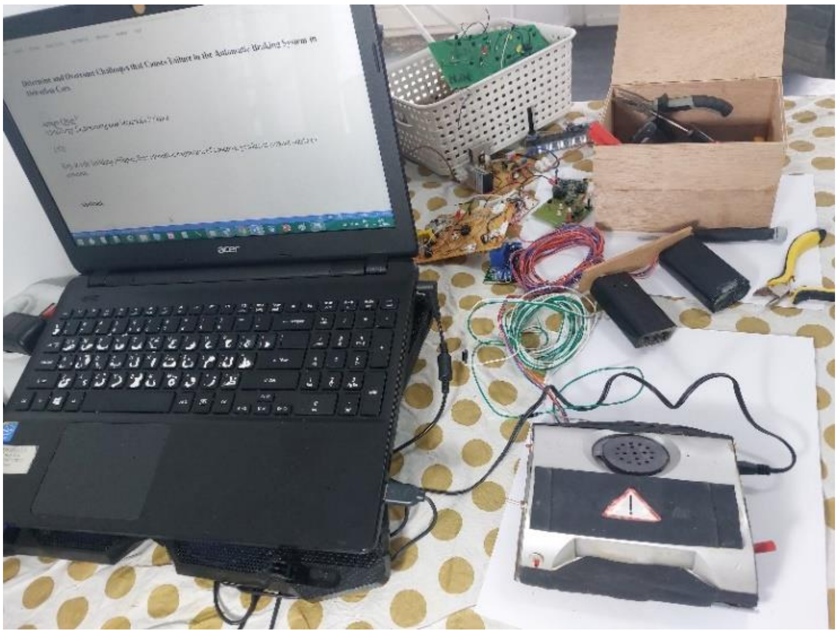
The illustration (2) shows the process of transmitting and receiving infrared rays in automatic braking system, which suffers from many sorts of scattering radiation, such as that caused during refraction, passing the radiation through different media densities, and the absorbed part of infrared rays (thermal rays) by low energy medias and obstacles, as well as the scattering represents one of the basic physical properties of radiation during its release.



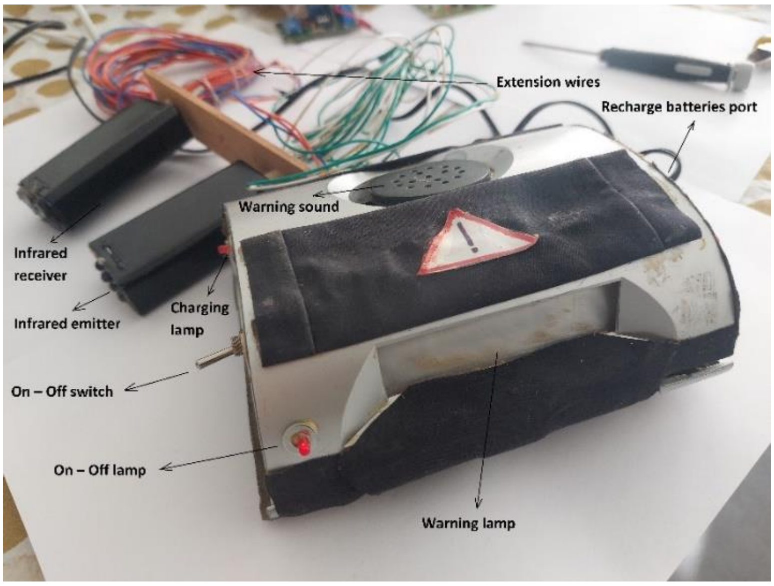
The illustration (3) shows the scattering of the emitted infrared ray during the raining as a reflex part, the part that passes through water and scatters, and the absorbed part in the water.

The handmade device for the infrared remote sensor consists of the following items:

1. Infrared emitting circuit.
2. Infrared sensing circuit.
3. A light and sound alarm circuit.

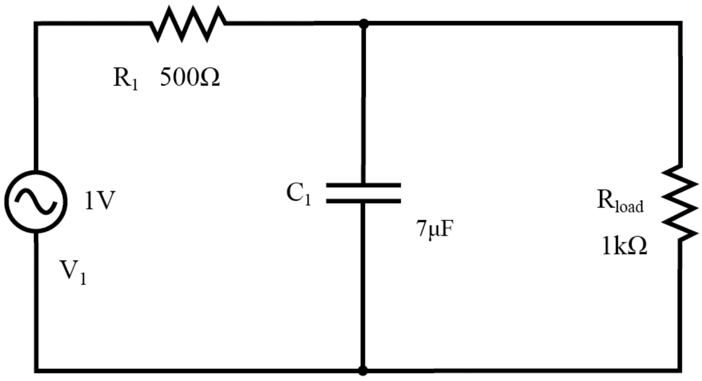


The image (2) the handmade infrared remote sensor.



The image (3) is for the remote sensor that sends and receives infrared rays, the device is made by remote control devices and a handmade infrared detector circuit. The parts used were not manufactured to construct the remote sensing device, but the device works normally. This is the primary device, and working on the second device, remote infrared sensing uses a high-intensity Laser beam and multichannel detection and braking according to the speed of the car.

5.0 Low-pass Filters [14][15]: This circuit of the components of the device is used to cut-off frequencies that do not belong to the installed the device on the car, and in order not to be affected by the rest of the frequencies used by the rest of the devices on the rest of the cars using the same system on the road, where all low-pass filters are rated at a certain cut-off frequency. That is, the frequency above which the output voltage falls is 70.7% of the input voltage. This cut-off percentage of 70.7 is not really arbitrary, although it may seem so at first glance, in a simple capacitive/resistive low pass filter, it is the frequency at which capacitive reactance in ohms equals resistance in ohms. In a simple capacitive low-pass filter (one resistor, one capacitor), inserting the values of R and C from the last spice simulation into this formula, we arrive at a cut-off frequency of 45.473 Hz. When we look at the plot generated by the spice simulation, we see the load voltage well below 70.7% of the source voltage (1 volt) even at a frequency as low as 30 Hz, below the calculated cut-off point, but when the load resistance of 1 kΩ affects the frequency response of the filter, skewing it down from what the formula told us it would be without that load resistance in place. Produces a bode plot whose numbers make more sense, as shown in the illustration (4).

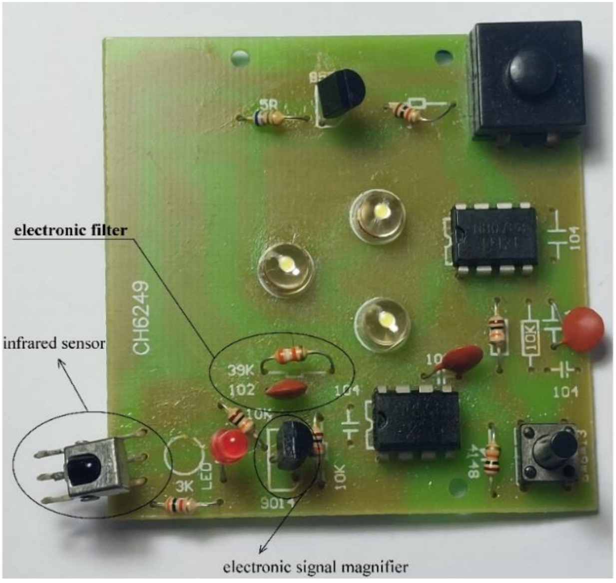


The illustration (4) of the low-pass filters, which determines the frequency that operates in the range of the device, should be equal to the frequency of the emitter pulses used in the same device.

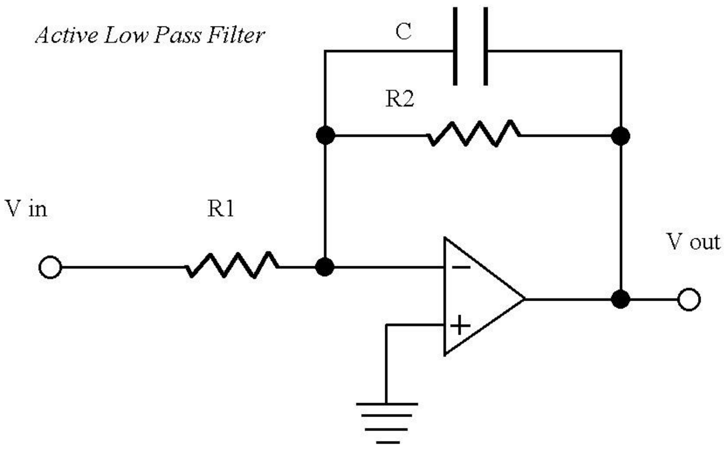
Cut-off Frequency: All low-pass filters are rated at a certain cut-off frequency, the frequency above which the output voltage falls below 70.7% of the input voltage. This cut-off percentage of 70.7 is not really arbitrary, although it may seem so at first glance. In a simple capacitive/resistive low-pass filter, it is the frequency at which capacitive reactance in ohms equals resistance in ohms. In a simple capacitive low-pass filter (one resistor, one capacitor), the cut-off frequency is given as:

$$f_{cutoff} = \frac{1}{2\pi RC}$$

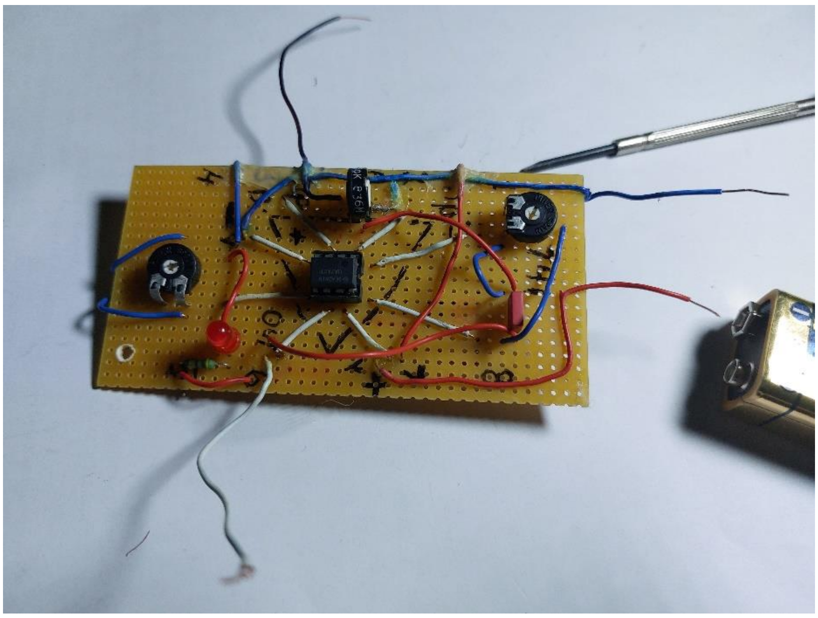
Inserting the values of R and C into this formula, we arrive at a cut-off frequency of 45.473 Hz. We see the load voltage well below 70.7% of the source voltage (1 volt) even at a frequency as low as 30 Hz.



The image (4) shows the receiver circuit, which consists of an infrared sensor, low-pass filters, and an electronic signal magnifier.



The illustration (5) shows an example of an active low pass filter Inverting Op low-pass filter diagram, the IC used is 741 op-amp.



The image (5) for example of low pass filter use IC 471 and variable resistor to change the value of the frequency required in our device.

An active low-pass filter is a filter that passes signals with a frequency lower than a certain cut-off frequency and attenuates signals with frequencies higher than the cut-off frequency.

It must be acknowledged that the automatic braking system for cars relies on a remote sensing system that depending on sending and receiving infrared rays, collects all data about the automatic braking system of cars, the materials used are not manufactured to construct the remote sensing device, but the device works normally after a simple restoration and replacing the batteries with new ones. When the device detect an object, a specific sound is generated and a lamp runs on the front of the device.

6.0 Important information has been collected about the remote sensing system: during checking this device, and this is the collected data from our experiments on the remote sensing system that relies on sending and receiving infrared rays:

1. The best working condition for this device is in cold weather, at night when the complete absence of sunlight for sensing cold objects with white colour in temperature limits lower than 20 degrees Celsius and being able to sense them through a distance of around ten meters.

2. The efficiency of the device drops to 50% during the day when Sun’s ray are at high intensity.

3. The efficiency of the device and the sensitivity (the distance of detection) increase for cold objects and light colours especially after sunset when the Sun’s rays are absent, and that increases much more during the night.

4. The device stops working completely, or a significant disturbance occurs during sunset hours, when the rates of infrared rays increase in the Sun's rays.

5. The efficiency of the device decreases extremely by sensing hot objects by (30-40) degrees Celsius.

6. The efficiency of the device and the sensitivity (the distance of detection) decreases for the dark colour objects.

7. The device's ability stopped completely for hot black colour objects even from a very short distance.

8. Confusion occurs during rain, the device continues to warn when there is nothing in front of it.

These are some footages of the experiment of infrared rays sensing objects:

1. The scene is during sunset, where the devise stopped working completely and is unable to alert for any object.

Image 6

Image 7

In images 6 and 7, the device cannot detect any objects, even in white car during the sunset.

2. After sunset and the absence of sunlight, the device's ability to detect objects is restored.

Image 8

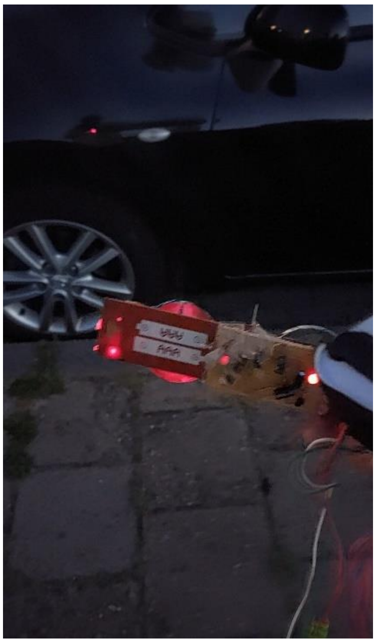
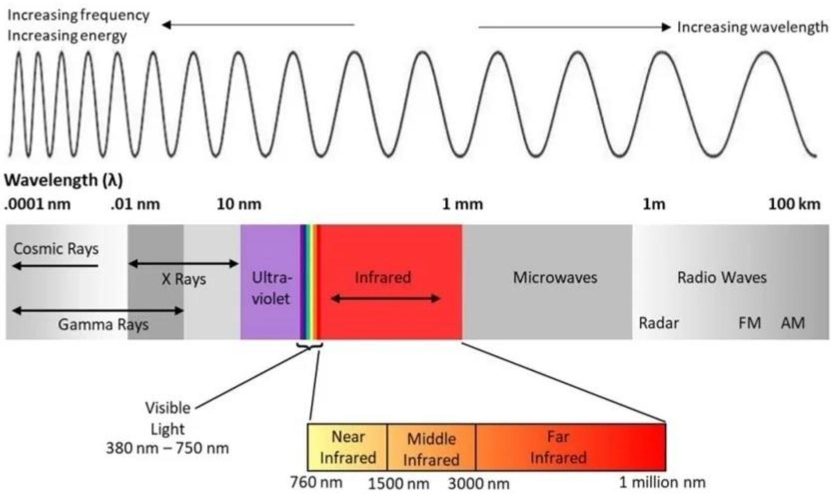


Image 9

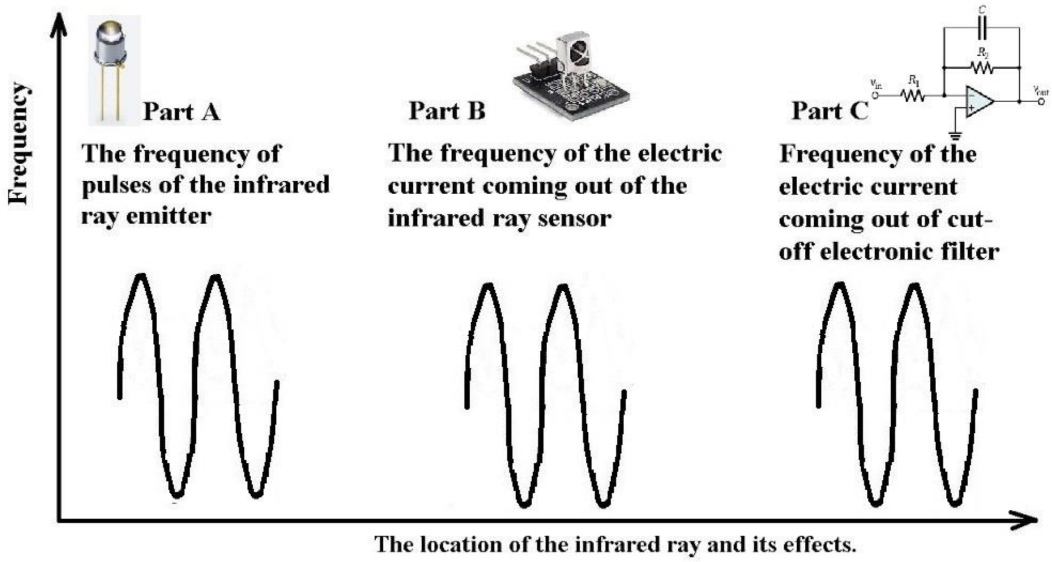
In images 8 and 9, the device is able to detect white objects with high efficiency and the rest of the colours with less efficiency, while being unable to sense black objects at all.

7.0 Infrared radiation [16]: Infrared radiation usually goes unnoticed, but it's something you encounter every day. Toasters, incandescent bulbs, and remote controls use infrared energy, as do industrial heaters used in drying and curing materials and medical uses, Infrared radiation is a heating source in saunas as a sort of physiotherapy to treat high blood pressure and arthritis. It's important to note, though, that infrared saunas could be harmful for those with melisma or other skin pigmentation issues. They generally consist of 750 nm to 1,300 nm wavelengths, and this is what a remote control uses to change the channels. There are a three general regions of the infrared frequency: the near-infrared frequency (nearest the visible spectrum), with wavelengths of 0.78 to about 2.5 micrometres, the middle infrared frequency, with wavelengths of 2.5 to about 50 micrometres, and the far infrared frequency, with wavelengths of 50 to 1,000 micrometres.



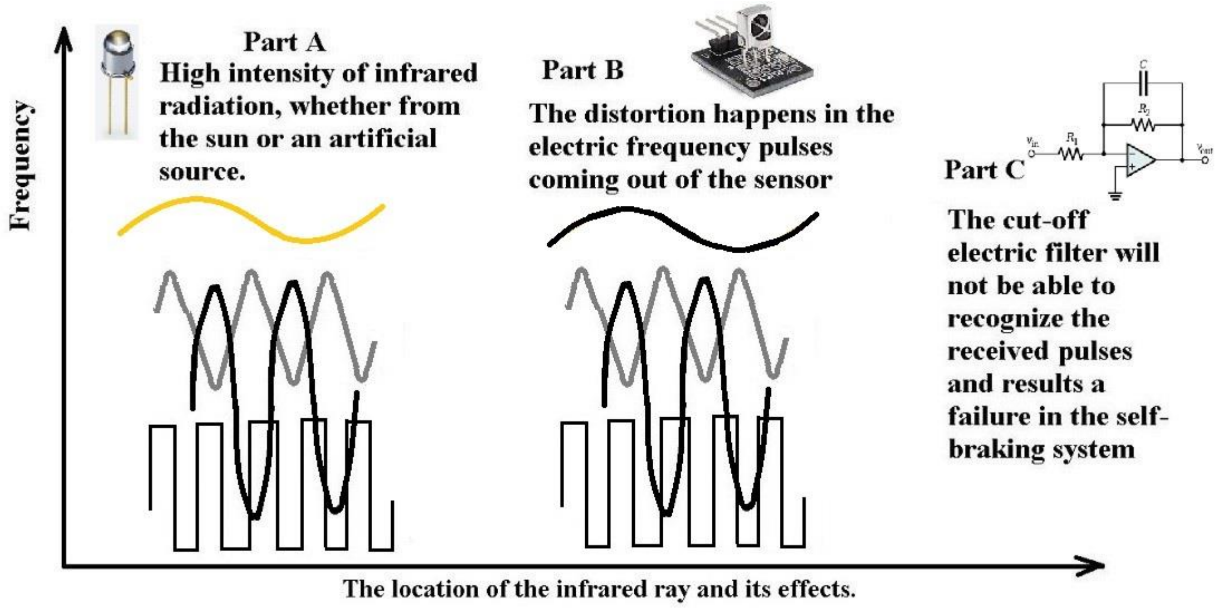
The illustration (6) shows the infrared radiation categories in the electromagnetic spectrum.

Briefly, the circumstances that undermine the efficiency of this system are the hot objects (which emit infrared rays) and the black objects (have the ability to absorb a high percentage of the infrared rays used by the device). Note that the backlights of cars light up in red, so if the front driver applies the brakes to stop his car and the red warning lights turn in the most highly intense, especially if the lamps are of the LED type, they may generate a high percentage of infrared rays capable of disrupting the automatic braking system of the car behind them. Because red radiation, especially that generated by LED lamps, contains a high percentage of infrared rays able to confuse the receivers of the sensors and electronic filters of the car that use automatic braking system behind it via interference, the used infrared ray of the automatic braking system in the sensor creates confusion for the electronic filters of cars with the automatic braking. Whereas it has become common to use electronic circuits that convert direct current into a pulsed current that feeds LED lamps to increase the brilliance of their light or for decorative purposes, this will also create confusion for the automatic braking system.



The illustration (7) shows in part A the frequency of the emitter pulses, which is equal to the frequency of the current coming out of the infrared ray sensor in part B and equal to the frequency of the cut-off electronic filter, this case, the automatic braking system runs successfully.

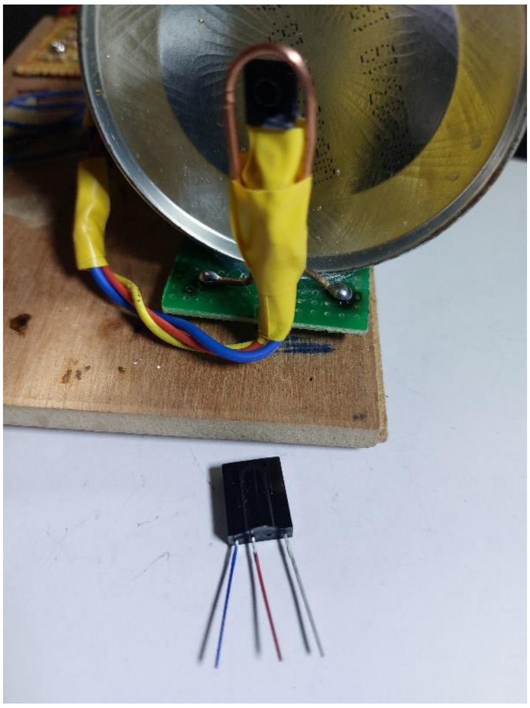
8.0 The effects of the presence of other sources of infrared: Presence of other sources of infrared radiation interference occurs with the radiation used for the automatic braking system, and when it enters the receiver sensor, it leads to distorted currents in the sensor outputs that are not proportional to the frequency of the electronic filter designed to allow them to pass as shown in Illustration 8, this prevents any signal passing towards the magnification circuits or the braking system, causing a traffic accident where the distortion does not include only low frequencies, but rather medium and high frequencies, as well as the electronic filter that uses digital codes such that used in remote control systems.



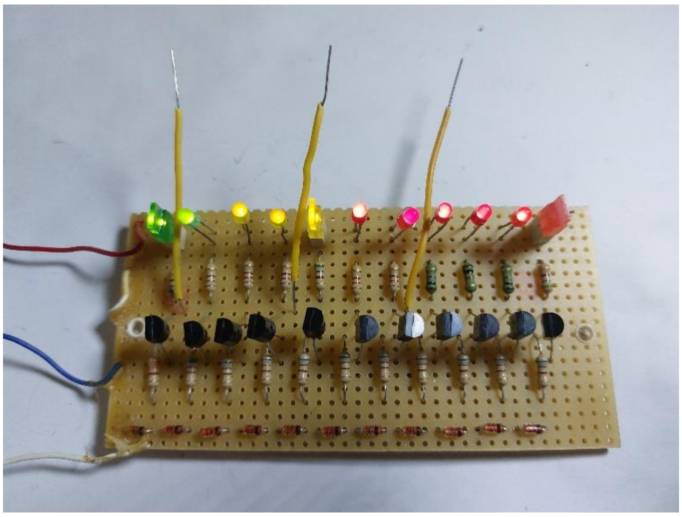
The illustration (8) in the event of a high intensity of infrared radiation, whether it is from the sun or an artificial source (the same type of devices in other cars, or the lights of the red backlight, especially those using red LED lamps with a high percentage of infrared radiation), part B shows the distortion that happens in the electric frequency pulses coming out of the sensor, and the cut-off electric filters will not be able to recognize the received electric pulses, which will result in a failure in the automatic braking system and cause a traffic accident.

Surrounding the sensor with a high intensity of infrared radiation from natural resources such as sunlight prevents the weak signal from passing toward the sensor this leads to generating a high-intensity DC from the sensor outlet preventing filters from doing their function properly and getting them out of function, where interfering several rays with the used received ray artificial resources either (the same type of devices in rest of cars, or the lights of the red backlight of vehicles in the road, especially those uses red LED lamps with a high percentage of infrared radiation) distort the received signal prevent them to pass through the electric frequency filter and our original signal will not be able recognized by our used filters causes failure in the automatic braking system a traffic accident. Other sources of infrared radiation interference occur when the radiation is used the automatic braking system, when it enters the receiver sensor it leads to the generating distorted currents in the sensor outputs that are not proportional to the frequency of the electronic filter designed to allow it to pass, this prevents any signal from passing towards the magnification circuits nor to the braking system this causes a traffic accident where the distortion does not include only low frequencies, but rather medium and high frequencies, as well as the electronic filter that uses digital codes such that used in remote control systems, as a result of the interference of the high-intensity infrared rays from the sun's ray with the low-intensity infrared rays assigned to the device, where the first antagonizes and cancels the function pulses of the second function pulses frequency, preventing the filter from sorting the used frequency of the remote control system device.

Important note: Through practical experiences, it has become clear that when the frequency of the infrared LED (pulses per second) is increased, the amount of glowing decreases, and the solution was increasing the voltage of current towards the LED of the emitter to raise the level of illumination. Note that infrared rays are not visible to human eyes, but we can see the glow by using the electronic camera of the mobile phone, while in the traditional case of continuous operation without pulses, the infrared LED emitter needs a certain value of voltage and amps, and the value should not exceed what is specified by the manufacturer to maintain the integrity of the lamp and prevent it from being damaged. Here, laboratory tests should be conducted to obtain data to know the range of voltage and current supplied to the infrared LED for each frequency and to operate the lamps optimally and effectively to do their functions properly.

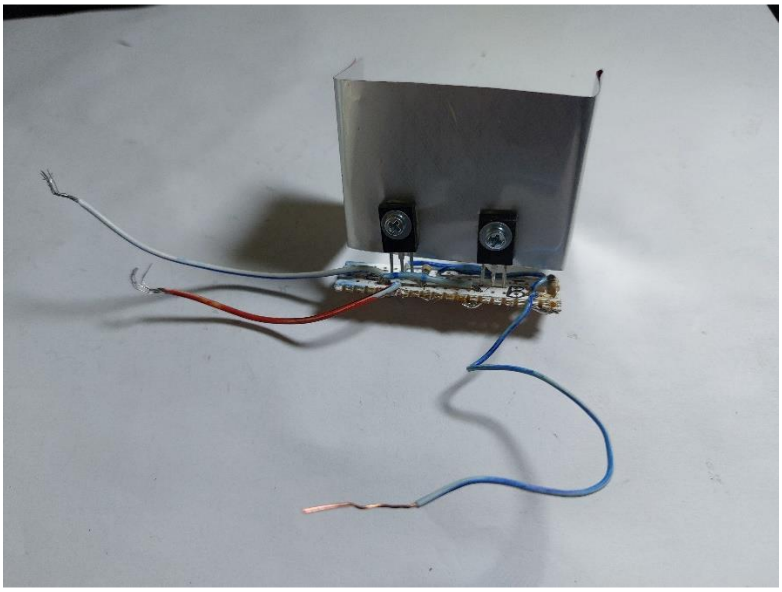


The image (11) is an infrared sensor (TSOP1738 IR Receiver)[17].



The image (12) the LED meter the used transistor in this circuit is BC 547 B).

Also through practical experiences the best way to determine the level of danger on the road is the light LED meter and translate it to the practical state is to connecting the input (base) of the first transistor with the output electric signal coming out of the infrared sensor of the infrared remote sensing device, activates the light diodes in sequence. Thus, the closer the car gets to the obstacle, the received signal becomes stronger, and it will run a larger number of light diodes, where connecting the output of each transistor (collector) as shown in the image (12) to a magnifying circuit and a secondary circuit for specific function. The first group of transistors in the light LED meter specified to driver light warning, the same way the second group of transistors in the light LED meter specified the audio warning, and the third group of transistors in the light LED meter specified to run the relay circuit and the electric motor (via the cruise control) pushing the piston in the master cylinder the brake fluid sending the pressurized brake fluid to the wheel cylinder located inside the brake drum. This pressure causes the pistons in the cylinder to expand and press the brake shoes against the inner surface of the brake drum, which creates friction to help slow the spinning of the wheels or stop the vehicle.



The image (13) shows the transistors BD 139 as a best example of magnifying circuit to run the secondary circuits such as driver light warning, audio warning, and the relay circuit of the electric motor in the master cylinder.

As much as the obstacle is farther away, as much as the ray suffers from scattering, the received signal is weaker, and the electric signal from the output of the sensor is weaker and will run the first group of transistors of the LED light meter, and vice versa, As the obstacle gets closer to the vehicle, the received ray will have a higher intensity, and the electric signal from the output of the infrared sensor will be stronger, allowing it to run the second and third groups of transistors of the light LED meter.

9.0 The sources of the infrared rays which distort the function of the system:

1. Natural resource of the infrared rays: During the sunshine and sunset times a big ratio of the infrared rays of the sun rays will be scattered to the surface of the Earth due to the light diffraction phenomenon, where these big ratios of the infrared rays of the Sun rays will cover the sensors of the infrared rays for automatic braking system, because these scattered infrared rays of the Sun rays are at the same frequencies of the used infrared rays of these cars used by the radar of the driverless cars, that may distort and create a confusion in the functions of the driverless cars system and prevent of detecting objects properly on the roads and finally prevent the automatic braking of these driverless cars to run properly, note that the infrared rays are merely heat rays in the electromagnetic wave spectrum, therefore whenever the weather is cold, foggy, rainy, or snowy, these environmental circumstances of the weather around these driverless cars will absorb big rates of the heat rays (infrared rays) and this will also results failure to detectors of the emitted infrared rays and results failure in the automatically braking system of these driverless cars.

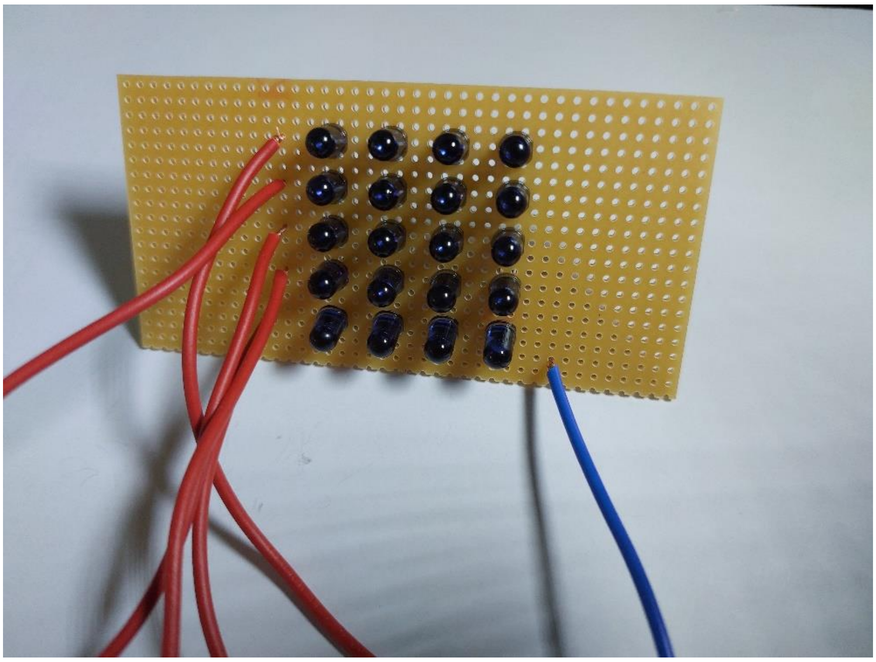
2. The infrared rays from artificial resources: The existence of several infrared radiation interferences either from the same sort of device used for the automatic braking system on the rest of cars or the lights of the red backlight of vehicles on the road, especially those use red LED lamps with a high percentage of infrared radiation), leads them interfering with the used ray in the receiver sensor of our device leads to the generating distorted currents in the sensor outputs that are not proportional to the value of the used frequency of the designed filter preventing signal passing towards the magnification circuits nor to the braking system, where the distortion does not include only the low frequencies, but rather medium and high frequencies, as well as the electronic filter that uses digital codes such that used in remote control systems, this will prevent the original signal to be recognized by used filters and causes failure in the automatic braking system and causes a traffic accident.

10.0 The effect of speed on the efficiency of the automatic braking system: The higher the speed of the car, the greater the momentum generated in the car; therefore, when braking the car at high speed, the car will remain in motion for a long distance even though the tires stop as a result of braking. Therefore, the electronic system of the automatic braking system must be connected to the speedometer device of the car to make the car brake at higher speeds over greater distances from obstacles than distances at lower speeds. If the car is traveling at a high speed, even braking a few meters away from the obstacle objects may not help to prevent the accident because the car will keep moving and collide with the obstacle objects due to the momentum generated in the material of the car at high speed. The automatic braking system should consider the speed of the car and distance from the obstacle when deciding whether to brake. For example, when the vehicle moves at a speed of 30 km/h, it should consider the distance from the obstacle around 5 meters to brake, but when the car moves at a speed of 80 km/h, the remote detection system of the vehicle should be able to detect objects (through longer distances from the obstacle) and brake when the obstacle is in distance around 40 meters, considering the momentum of the car that rushes the car to a farther distance when it is at a higher speed to avoid a car accident. Momentum is one of the physical quantities known through classical physics as the product of a body's mass multiplied by its speed [18]. One of the principles of conservation in classical physics applies to momentum, which is the principle of conservation of momentum or the law of conservation of momentum. The units of momentum are kilograms, meters per second kg.m/sec, or kg.m/h. or gram centimetres per second g.cm/sec. It is directly proportional to its mass and speed, as in the following relationship, because momentum is the producer of unit mass and velocity, we can express the momentum of a body with the letter **p**, and it has a proportional relationship to the amount of mass (**m**) and value of speed (**v**), as in the relationship:

$$\mathbf{p = m.v}$$

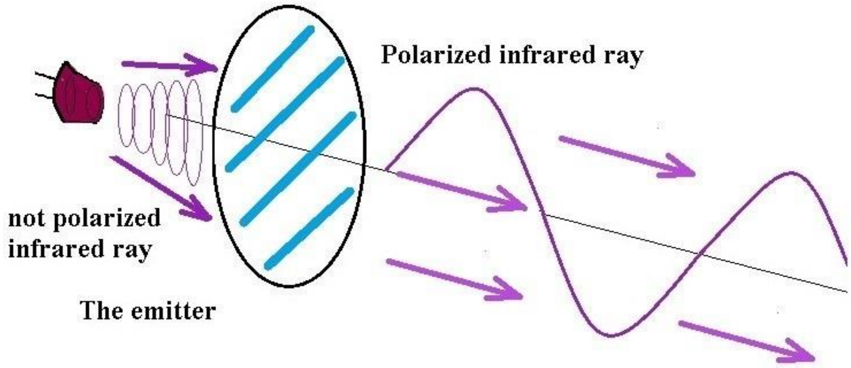
Therefore, when a vehicle with a mass of 1,000 kg moves at a speed of 30 km/h, it will generate a momentum of 30,000 kg/h, but when the same vehicle with a mass of 1,000 kg moves at a speed of 80 km/h, the amount of momentum generated is 80,000 kg/h. Therefore, braking the vehicle at a speed of 80 kilometres per hour will let the vehicle continue to rush toward the incident body, and a collision will occur due to the high amount of momentum generated in the vehicle’s body at the high speed. Here, the designer of the automatic braking system must consider the vehicle's speed and distance from the obstacle to decide whether to brake at suitable distances from the obstacle, and the remote infrared detection system must be able to detect objects for longer distances and brake when the obstacle is approximately 40 meters from the vehicle. The process should occur automatically by linking the sensor system with the vehicle’s speedometer, so that at high speeds the intensity of the infrared radiation increases to reach a range of about 40 meters, and the braking process is performed within the limits of that range. Thus, the automatic braking system should consider the speed of the vehicle and the distance from the obstacle to decide when it should brake. For example, when the vehicle moves at a speed of 30 km/h, it should consider the distance of around 5 meters to brake, but when the car moves at a speed of 80 km/h, the remote detect system of the vehicle should be able to detect objects (through longer distances) and brake when the obstacle is around 40 meters, considering the momentum of the car that rushes the car to a farther distance when it is at a higher speed to avoid vehicle accidents.

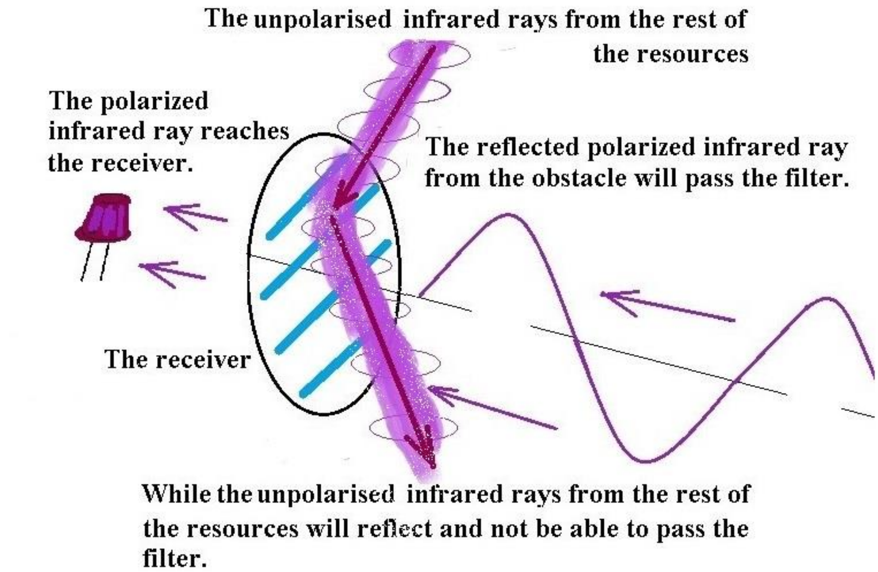
Important note: In case the decision is made to increase the glowing of the infrared LED emitter to reach the rays over longer ranges, the number of infrared LED running should be increased, but not the value of the supplied voltage and current to the infrared LED that was obtained from the producer of the infrared LED or our the results of our practical experiments.



The image (14) shows the best way to control the intensity of radiation without changing the amount of voltage supplied to each infrared ray LED (TSAL6200 Vishay 940 Infrared Emitting Diode, 5mm)[19], as the panel consists of a matrix of infrared ray LEDs, all of the cathodes of infrared ray LEDs of the matrix are connected, and the anodes of infrared ray LEDs are connected in each row. Thus, when the car moves at a faster speed, the electronic circuit in the speedometer connects a new row within the running rows to increase the intensity of the generated infrared ray, and vice-versa, when the speed of the car decreases, the electronic circuit separates electricity from some of the infrared ray LED rows, so the intensity of the radiation generated decreases.

11.0 Using the feature of light polarisation in the automatic braking system: In the definition of light polarization, [19] is a property of transverse waves that specifies the geometrical orientation of the oscillations. Polarized light can be produced by passing unpolarised light through a polarizer, which allows waves of only one polarization to pass through. Some materials have an optical activity that affects light differently depending on the polarization direction used in making polarizing filters. In the meantime, the light also becomes partially polarized when it reflects at an angle from a surface. In quantum mechanics, electromagnetic waves are viewed as streams of particles called photons. The polarization of an electromagnetic wave is determined by a quantum mechanical property of photons called their spin. Where a photon has one of two possible spins, it can either spin in the right or left direction, depending on the direction of its travel. The circularly polarized electromagnetic waves are composed of photons with only one type of spin, either right or left, but the linearly polarized waves consist of photons that are in a superposition of right and left circularly polarized states, with equal amplitude and phases synchronized. Material used in light polarisation [z2]: A polarizer filter is an optical filter that lets light waves of a specific polarization pass through while blocking light waves of other polarizations [20]. It can filter a beam of light of undefined or mixed polarization into a beam of well-defined polarization, known as polarized light. Polarizers are used in many optical techniques and instruments. Polarizers find applications in photography and LCD technology. In photography, a polarizing filter can be used to filter out reflections. The two most common types of polarizers are linear polarizers and circular polarizers. Polarizers can also be made for other types of electromagnetic waves besides visible light, such as radio waves, microwaves, and X-rays. Hence infrared rays have the same physical characteristics as invisible light, the best method of useful polarization to polarize the emitter and receiver of the infrared ray in the automatic braking system is using a thin film polarizer, known as TFPN such as glass substrates on which a special optical coating is applied. Either Brewster's angle reflections or interference effects in the film cause them to act as beam-splitting polarizers.





The illustration (9) shows the effect of using polarization filter with the infrared remote sensing system, the reflected polarized infrared ray from the obstacle will pass the filter to the receiver but unpolarised infrared ray from rest of resources will reflect and not be able to pass the filter toward the receiver.

The substrate for the film can either be a plate, which is inserted into the beam at a particular angle, or a wedge of glass that is cemented to a second wedge to form a cube with the film cutting diagonally across the centre, the most common filter named Mac Neille cube [21]. Thin film polarizers are inexpensive and provide two beams that are about equally well polarized. Strongly recommended to use the features of polarisation of light in the used infrared ray of the automatic braking system, where if the emitted ray was polarised vertically or at a specific angle (via the added Thin film polarizers), the same sort of filter should be added to the receiver (infrared sensor) to receive the reflated infrared ray from the obstacle at the same angle of the polarization of the emitter, to identify the used infrared ray of the same car strictly, and to separate the rest of the received infrared rays either from the artificial or natural sources in the infrared ray sensor, may rise the efficiency of the used infrared remote sensing device and the automatic braking system to do its function properly.

12.0 Discussion: There are several remote detection systems, via ultrasonic or electromagnetic waves, but we focus this study on the infrared ray and its challenges and solutions to prevent accidents caused by the failure of this system, which causes loss of life, property, insurance companies, and automobile manufacturers. When verifying the components of this system, its components, and its mechanism of operation, its weak points can be known through applied experiments. They will be able to overcome the conditions that prevent this system from performing properly, and also after full knowledge of the physical properties of infrared radiation and the behaviour of materials in the environment surrounding the car towards this radiation, it became obvious through this research that the best efficiency of the infrared remote-sensing device is sensing objects in white, and its efficiency reduces for objects in other colours where it cannot detect black objects. It is strongly recommended that all car producers all car producers consider this issue and add accessories to their cars in white or metallic to be detected easily by the infrared ray remote-sensing detectors (even cars in black) to avoid car accidents due to the failure of this system to detect dark-coloured objects, especially black ones on the road. Because we are dealing with infrared rays as a fundamental factor the device relies on mainly in the emitter and receiver, while temperature represents one of the infrared spectra, this confuses the efficiency of your system; therefore, we should develop it to be able to overcome these challenges. Considering the car's mechanics and the momentum generated during its speed, increasing the speed of the car leads to an increase in the value of the momentum in the material of the car, so when the car brakes at high speed, it remains in motion for a long distance toward the obstacle even though the tires stop during braking. Therefore, the electronic system of the automatic braking system should be linked to the car's speedometer so that the car can brake at the appropriate distance from the incident object at high speeds, which is greater than the distance that the car should brake at low speeds. For instance, if the car is traveling at a high speed, even braking a few meters away from the obstacle objects may not help to prevent the accident because the car will continue to rush and collide with the obstacle objects due to the high momentum generated in the material of the car at high speeds. Because at a speed of 30 km/h, the momentum generated in the body of the car is low,, it may be sufficient to brake within five meters of the obstacle objects, but at a speed of 80 km/h, a high amount of momentum will be generated, pushing the car towards the obstacle objects a longer distance. Here, the infrared detection system of the car must be able to detect objects over longer distances to brake when the obstacle is about 40 meters away from the car, and the distance must be greater for higher speeds. This may greatly help in stopping the car at the right time to avoid accidents. Adding a camera, computer, and artificial intelligence software to diagnose things in the system being used in the can may reduce errors, malfunctions, and accidents. While there are many developments in self-driving car systems that even contain artificial intelligence software to diagnose objects such as the human faces of cars and the rest of objects, It`s very important to install sensors to measure the rates of infrared rays to notify the driver that the automatic braking system of the car is temporarily stopped and he should depend on himself to brake when it needs it. This will also protect car producer companies from prosecution if any accidents occur due to the failure of their systems.

13.0 Conclusion: The reasons behind the failure of the automatic braking system in driverless cars are due to many reasons, including:

1. Weather conditions: Because these used rays should reflect to be received by the sensors of these automatic braking cars to send an electronic signal to the central computer of the car, then it should be understood that the car should brake or steer immediately, but if the weather was cold, rainy, fog, or snowy around these cars, that would absorb and scatter big rates of the used infrared rays from the front radar, thus there would not remain sufficient amounts of these emitted infrared rays to be reflected to return to the sensors, thus these cars would not be able to detect objects behind, and unfortunately, accidents would occur due to the failure in the automatic braking of the driverless cars.

2. resources of the infrared rays: During the sunshine and sunset times a big ratio of the infrared rays of the sun rays will be scattered to the surface of the Earth due to the light diffraction phenomenon, where these big ratios of the infrared rays of the Sun rays will cover the sensors of the infrared rays for the system of the driverless cars, may distort and create a confusion in the functions of the system of driverless cars and prevent detecting objects, where the existence of several infrared radiation interferences either from the same sort of device used for the self-braking system on the rest of cars or the lights of the red backlight of vehicles on the road, especially those use red LED lamps with a high percentage of infrared radiation), leads them interfering with the used ray in the receiver sensor of our device leads to the generating distorted currents in the sensor outputs that are not proportional to the value of the used frequency of the designed filter preventing signal passing towards the magnification circuits nor to the braking system, where the distortion does not include only the low frequencies,

14.0 The suggested solutions: The most important issue is to change the features of the used infrared of these cars to make it difficult to be absorbed and scattered by the weather circumstances around and to have different features than features of the infrared rays of the sun:

1. Using the long wavelengths of infrared rays (far infrared) used systems of these cars may prevent any confusion that could occur due to the existence of the infrared ray of the Sunray during the sunshine or sunset, and this may also reduce the absorption rates due to the cold weather circumstances such fog or scattering via raindrop in the air between the car and the obstacles, such as the part far infrared in the 300 nm to 1 million nanometres in the electromagnetic spectrum, where the physics feature of visible light drops, because we should keep only the feature of reflection in the used ray and reduce the rest of features such as the absorption and fraction, to guarantee our used rays to transmit to the obstacle and get reflected with lowest rats of scattering to increase the rate of received red ray in the sensor. This will increase the rates at which the infrared rays are received by the sensors and, finally, will increase the efficiency of the automatic braking system for these cars because, as the wavelength used is longer, the physics characteristic of visible drop absorption will be affected by the mentioned circumstances.

2. Consider sunset and sunshine time in our schedule to prevent or reduce the use of automatic car braking systems during these times, while the rates of infrared rays increase externally with the sun during sunset and sunshine time.

3. Add the features of polarization of light in the used infrared ray of the automatic braking system, where if the emitted ray was polarized vertically or at a specific angle (via the added filter), the same sort of filter should be added to the receiver (infrared sensor) to receive the infrared ray at the same angle of the polarization, to identify the used infrared ray of the same car strictly, and to separate the rest of the received infrared rays either from the artificial or natural sources in the infrared ray sensor.

4. Use a high intensity of the infrared rays in these automatic braking systems of driverless cars to increase the rate of receiving infrared rays from obstacles.

5. Increase the sensitivity of the receiver's sensors and their electronic circuits in the system to detect any ratio of reflected rays from the object in their way on the roads, despite the large amounts of absorption and scattering due to the cold weather circumstances.

6. The automatic braking system should consider the speed of the car and distance from the obstacle when deciding whether to brake. For example, when the vehicle moves at a speed of 30 km/h, it should consider the distance of around 5 meters to brake, but when the car moves at a speed of 80 km/h, the remote detection system of the vehicle should be able to detect objects (through longer distances) and brake when the obstacle is around 40 meters, considering the momentum of the car that rushes the car to a farther distance when it is at a higher speed to avoid a car accident.

7. Adding a camera, computer, and artificial intelligence program to diagnose objects in the system could reduce errors, malfunctions, and accidents.

Considering these issues during design, the automatic braking system of cars may prevent any failure that may result in accidents by overcoming the challenges of the surrounding features that always change according to the weather and the rate of red rays in the environment.

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1. Solving the Modern Cosmic Conundrum via Our Traditional Physics Concepts.

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3. Qualifying Earth's Nature to be able to face the Latest Developments of the Climate Changes.

4. The Observation of the Dark Matter of the Universe through the Concept the Theory of Relativity.

5. Determine Material of the Gravity Particles and Understand the Mechanism of the Universe Gravity Fields.

6. The Effects of the Cosmic Rays upon Earth's Climate Changes to Generate Storms, Winds, Hurricanes and Tornadoes.

7. The Effects of Physics Properties of the Water in the Extreme Circumstances upon the Extraordinary Phenomena in the Nature.

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2. Study to Make the Easiest Design of System able to extract Drinking Water from The Sea Water via Solar Energy and Earth's Gravity Force.
3. Study of using Microwaves Application to Search for Raw Materials Underground for Extraction and Industrial Purposes.
4. Converter of Hydrogen Bond Energy.
5. Using Laser Ray System to Measuring the Surface Tension Energy of Liquids inside Glass Tube.
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