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Infra-Red Search and Track System

Abdelrahman Ahmed Abdalmajed Bakheet[1], Dr. Eltaher Mohamed Hussein[2]
[1]Control Engineering, Alneelain University, Khartoum, Sudan
[2]College of Engineering, Sudan University of Science & Technology, Khartoum, SudanFaculty of Engineering, Alneelain University, Khartoum, Sudan

Abstract: Tracking is a process of determining the current and past locations of a unique item or property. It used to detect and locate targets when they moved and report new position. Another approach is to report the arrival or departure of the object and record the identification of the object, the location where observed, the time, and the status. This approach leaves the task to verify the reports regarding consistency and completeness. It used in many fields whether it was industrial, martial, environmental studies, etc. In this thesis the concept of Infra-Red Tracking System (IRST) is addressed. First the system is analyzed, the system has been simulated using Proteus, and then it has been implemented using appropriate components.
Key word: IRST, FOV, Objects Tracking, Infrared Homing, Reflectance, Emissivity.

I. INTRODUCTION

Following the way of moving articles is a movement of a long history. Individuals in antiquated social orders used to track moving prey to chase and sustain their kids, concocted approaches to track the movement of stars for route purposes, and to foresee occasional changes in their surroundings.

Question/target following alludes to the issue of utilizing sensor estimations to decide the area, way and attributes of objects of intrigue. A sensor can be any measuring gadget, for example, radar, sonar, laser, camera, infrared sensor, mouthpiece, ultrasound, or whatever other sensor that can be utilized to gather data about items in the earth.

An infra-red pursuit and following (IRST) framework (some of the time known as infra-red locating and following) is a strategy for recognizing and following items which emit or reflect infrared radiation. IRST is summed up instance of Reflected infrared (RFLIR), i.e. from forward-looking to all-round circumstance mindfulness. Such framework are dynamic (infrared _ radiation and discovery), which means they give out radiation from their own infrared radiation, similar to radar

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An infra-red hunt and following (IRST) framework (once in a while known as infra-red locating and following) is a technique for distinguishing and following articles which emit or reflect infrared radiation. IRST is summed up instance of Reflected infrared (RFLIR), i.e. from forward-looking to all-round circumstance mindfulness. Such framework are dynamic (infrared _ radiation and discovery), which means they give out radiation from their own infrared radiation, similar to radar [1].

The average targets of protest following are the assurance of the quantity of goals, their indistinguishable, and their states, for example, positions, speeds and for some situation their elements. As in Figure 1.

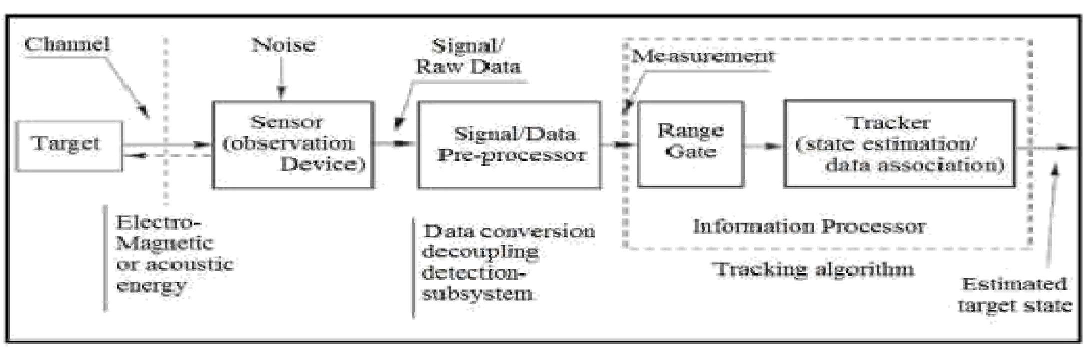

Figure 1: Typical object tracking system.

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A. Thetracking system consists of [2]
1) An object or objects to be tracked.
2) A sensor which measures some aspect of the object.
3) A signal processor.
4) An information processor.

Infrared inquiry and track (IRST) frameworks are wide field of view reconnaissance frameworks are wide field of view observation frameworks, intended for independent hunt, location, following, grouping and prioritization of potential targets.

Infrared hunt and track (IRST) frameworks are wide field of view reconnaissance frameworks are wide field of view observation frameworks, intended for self-ruling inquiry, location, following, grouping and prioritization of potential targets. Infra-red (IR) is imperceptible brilliant vitality, electromagnetic radiation with longer wavelengths than those of unmistakable light, reaching out from the ostensible red edge of noticeable range at 700 nanometers (recurrence 430 THz) to 1 mm (30 GHz).of the thermal radiation emitted b objects near room temperature is infrared. Infrared is typically measured utilizing a warm identifier, for example, thermopile, which measures temperature change because of assimilated vitality. While these warm indicators have a level otherworldly responsively, they experience the ill effects of temperature affectability, and normally should be misleadingly cooled. Another methodology utilized by warm identifiers is by regulating episode light with a chopper. This allows the detector to measure deferentially between the dark (zero) and light states. Quantum type detectors are often used in the near infrared, especially below 1100nm. Specialized detectors such as alternatively Indium Gallium Arsenide (InGaAs) offer excellent responsively from 850 to 1700 typical silicon photodiodes are not sensitive above 1100nm, as in Figure 2 [3].

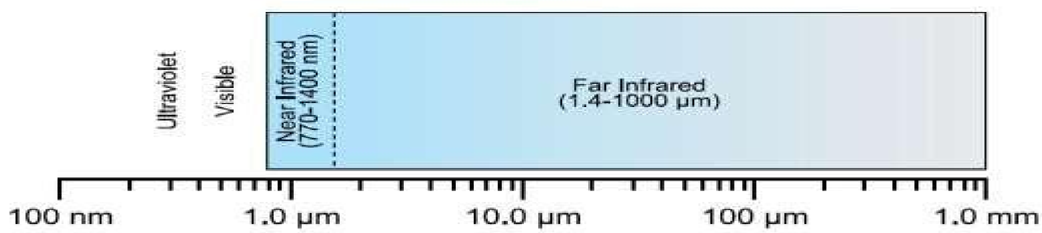

Figure 2: The Infra-Red spectrum.

II. SYSTEM HARDWARE CONSIDERATION

The system was built with two sensors; each one contained the IR transmitter and IR receiver. The main idea was that when an object enters the range of any one of the sensors, the motor turn right or left as microcontroller commands it and determines the distance. The module is shown in Figure 3 and it will be containing of these component:

A. Microcontroller (Atmel 16).
B. Gear motor (DC motor).
C. IR GP2Y0A21YK0F).Sensor (IR Sharp).
D. Ultrasonic ranger (distance measurement).
E. LCD to show information.

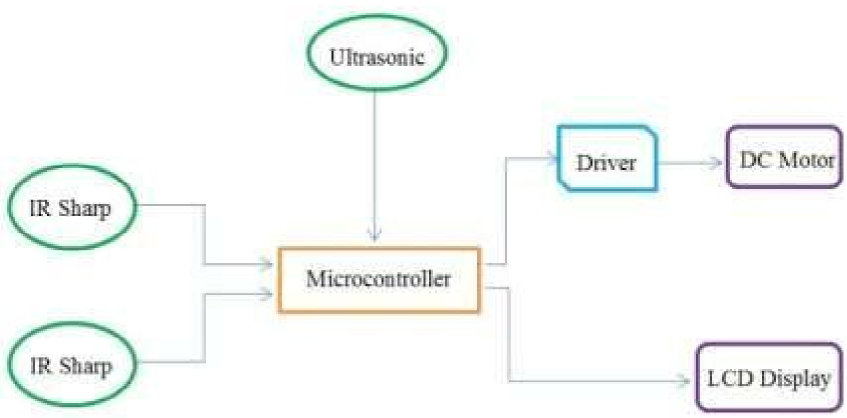

Figure 3: Block diagram of the system

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F. IR sensor

The sensor that is utilized as a part of this venture is dynamic sensor; dynamic infrared sensors comprise of two components: infrared source and infrared finder. Infrared source incorporates a LED or infrared laser diode. Infrared identifiers incorporate photodiodes _ or phototransistors. The vitality radiated by the infrared source is reflected by a protest and falls on the infrared locator as appeared in Figure 4.

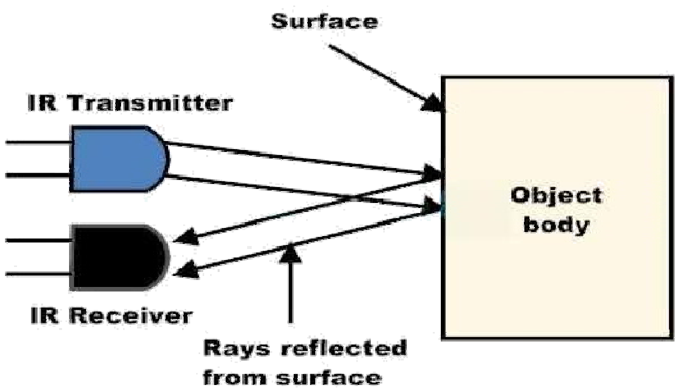

Figure 4: Active IR sensor

Infrared transmitter is a light discharging diode (LED) which emanates infrared radiations. Subsequently, they are called IR LED's. Despite the fact that an IR LED resembles a typical LED, the radiation discharged by it is undetectable to the human eye. Infrared beneficiaries are likewise called as infrared sensors as they recognize the radiation from an IR transmitter. IR revivers come as photograph diodes and phototransistors.

Infrared photodiode are unique in relation to ordinary photograph diodes as they identify just infrared radiation. The standard of IR sensor functioning as a protest identification sensor can be clarified in Figure 4. An IR sensor comprises of an IR LED and IR photodiode; together they are called Photo-Coupler.

At the point when II transmitter emanates radiation it achieves the protest and a portion of the radiation reflect back to the IR recipient. In view of the power of the gathering by the IR recipient, the yield of the sensor is characterized [4].

G. Ultrasonic Ranger

Ultrasonic sensors (otherwise called handsets when they both send and get, however more by and large called transducers) chip away at a rule like radar or sonar, which assess properties of an objective by translating the echoes from radio or sound waves separately. Dynamic ultrasonic sensors produce high recurrence sound waves and assess the resound which is gotten back by the sensor, measuring the time interim between sending the flag and getting the echoes to decide the separation of a question. While, Passive ultrasonic sensors are essentially amplifier that recognizes ultrasonic commotion that is available under specific conditions. The officer of the objective is dictated when slacking between

transmitted heartbeat and the got resound. So microwave and ultrasonic frequencies are utilized as a part of radars as appeared in Figure 5 [5].

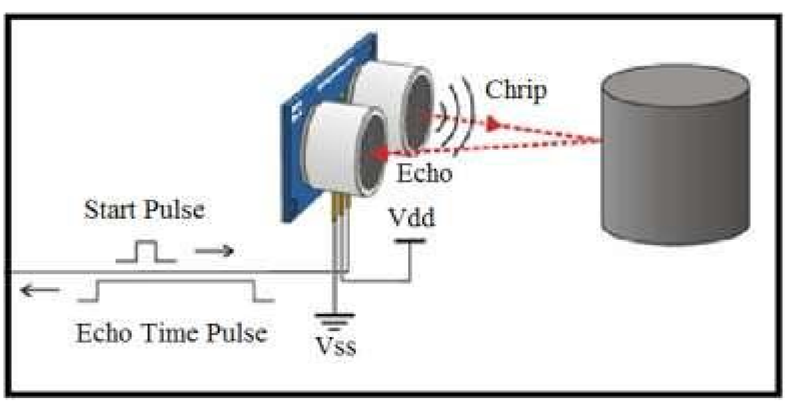

Figure 5: Ultrasonic working principle

III. SYSTEM IMPLEMENTATION AND TESTING

The system was built using feedback theory that consists of two sensors to determine the location of the object. Using infra-red sensors the electromagnetic radiation of the transmitter reflected from the object and sensed by the receiver. To locate and track the object two IR sensors were built up in a motor, then the motor turn left and right as the object moves. Then the result will be shown in LCD display. The system is shown in Figure 6 has microcontroller which the code was installed on. The top of the motor there is a small board contains two IR sensors in the two edges and ultrasound sensor in the middle of the board as is shown in Figure 7.

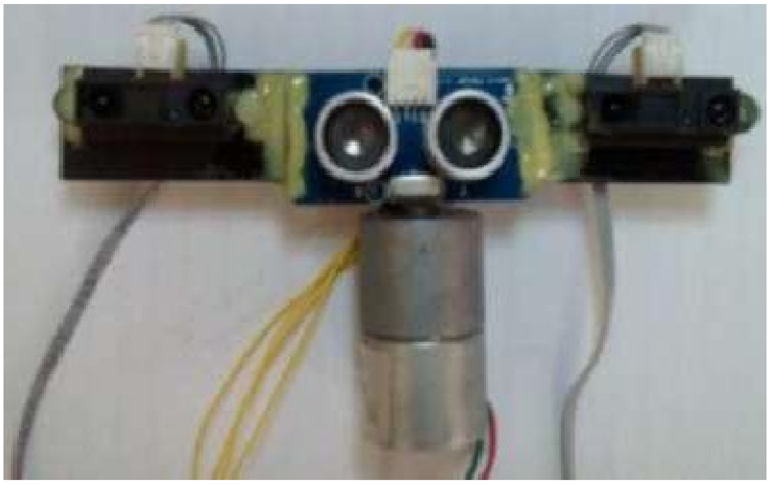

Figure 6: System module

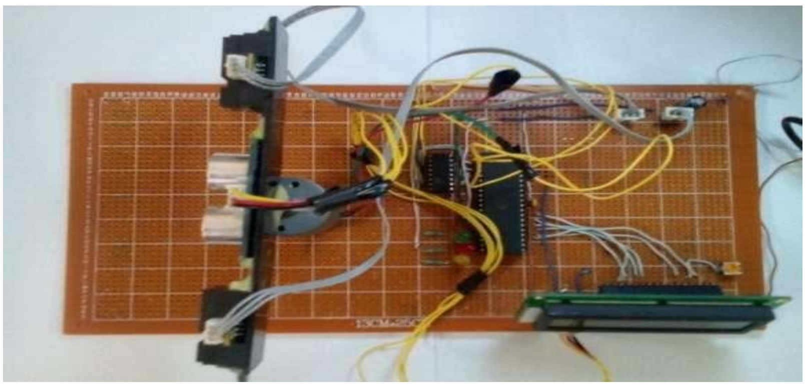

Figure 7: Motor with IR sensors and ultrasound

The motor is connected with microcontroller by driver to match required current of the motor as in Figure 3.16. IR sensors are connected in board A at ADC pin. The motor is connected at port C, and the ultrasound is connected at port D, as in Figure 8.

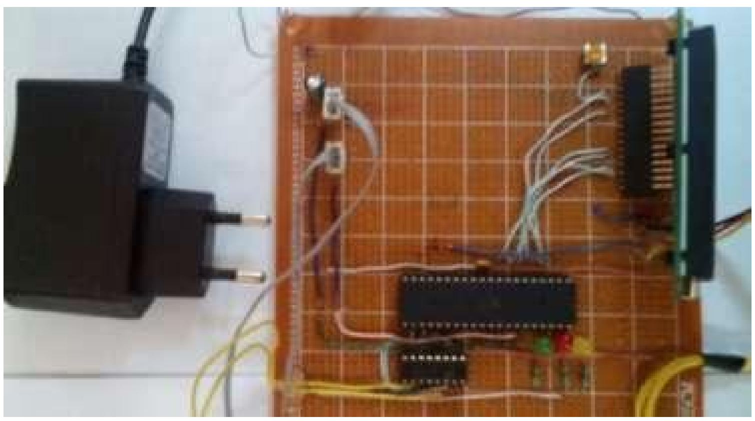

Figure 8: Microcontroller and connection of the system

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IV. SYSTEM SOFTWARE CONSIDERATION:

The system is programmed by Beginner's All-purpose Symbolic Instruction Code (Basic) language, which it is a family of general-purpose, high-level programming languages where its design emphasizes ease of use. The code for this system is organized as a number of functions that are defined within the modules which they are related to. Ideally, this system could be entirely contained within a Proteus simulation, but no result could find from it.

The system is connected as shown in Figure 9. Three LEDs were connected in

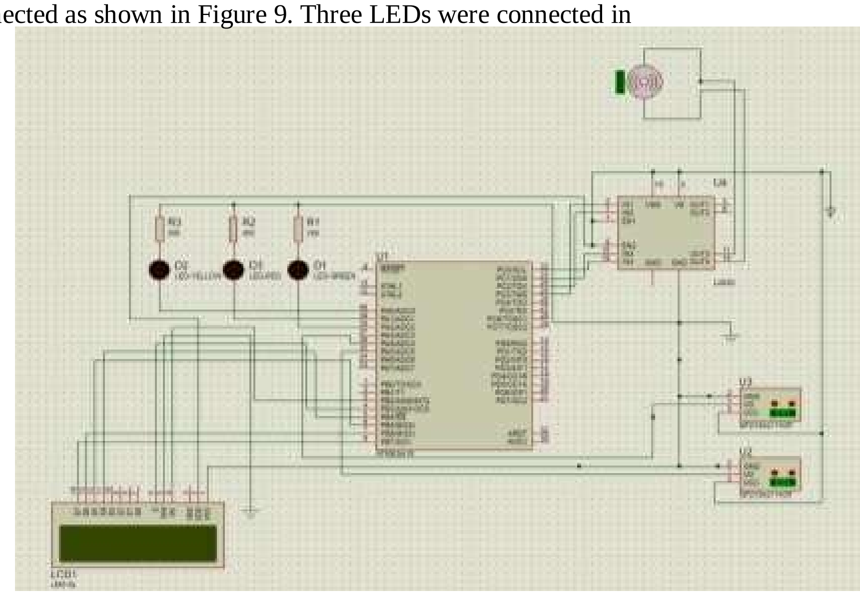

Figure 9: Schematic diagram of the system

port A to indicate and exhibit action. Also in port A the output of the two IR sensors was connected. LCD was connected in port B and a motor with its driver connected in port C. And last port (port D) was connected with the output of ultrasonic ranger. The flow chart of the code is shown in Figure 10.

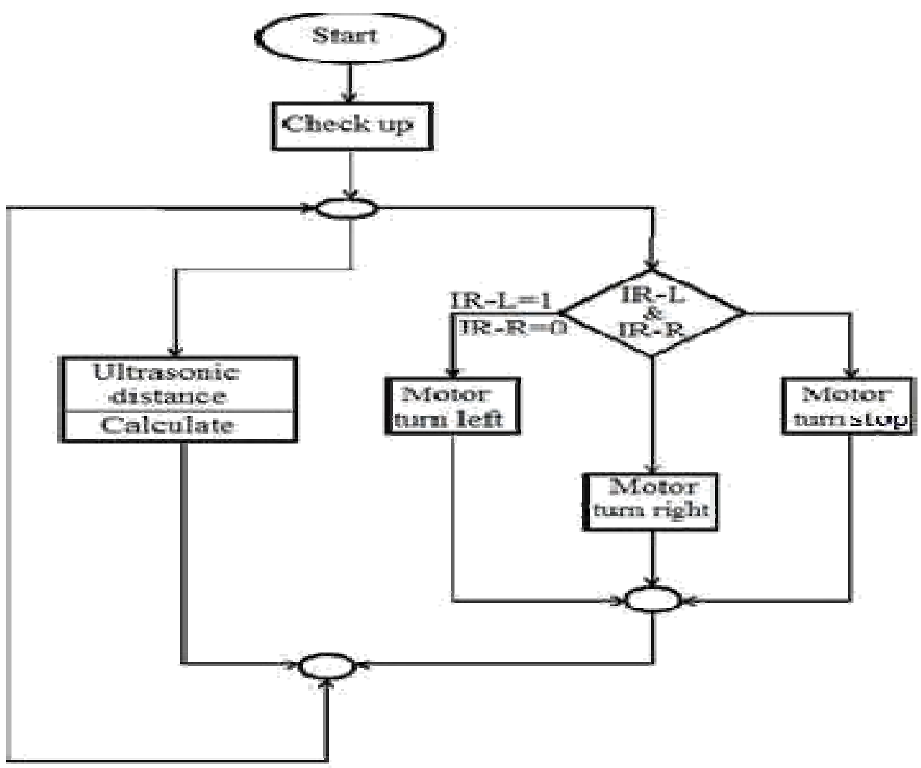

Figure 10: Flow chart of the code

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V. EXPERIMENTAL RESULTS

A number of experiments were done. In each experiment output voltages are measured across the distance by centimeter. Voltages measured using digital and a meter for measuring distance. All units of voltages (V) with volt and the units of the distance is centimeter (cm).

The basic principle is that the output voltage is measured from an IR sensor which is the reflected IR; then by verifying the objects the results to be found and voltages to be measured comes different. The result was written in tables for every material with voltages versus centimeter.

A. Voltages VERSUS distance

To determine the response of the sensor three readings were taken, each 5 cm away from the object. As shown in Figure 11.

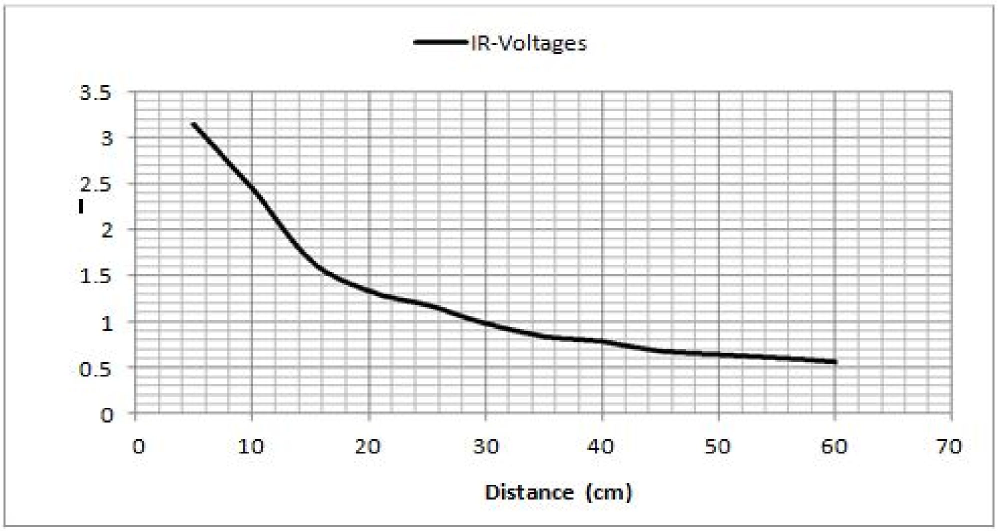


Figure 11: IR-voltage across distance

A. Color Effects

For experiments done on Figure 12; papers with different colors and same sizes were used to measure the effect of the object colors on reflecting IR electromagnetic waves. The distance is fixed at 5 cm and colors used were: white, black, green, dark blue, red, and yellow.

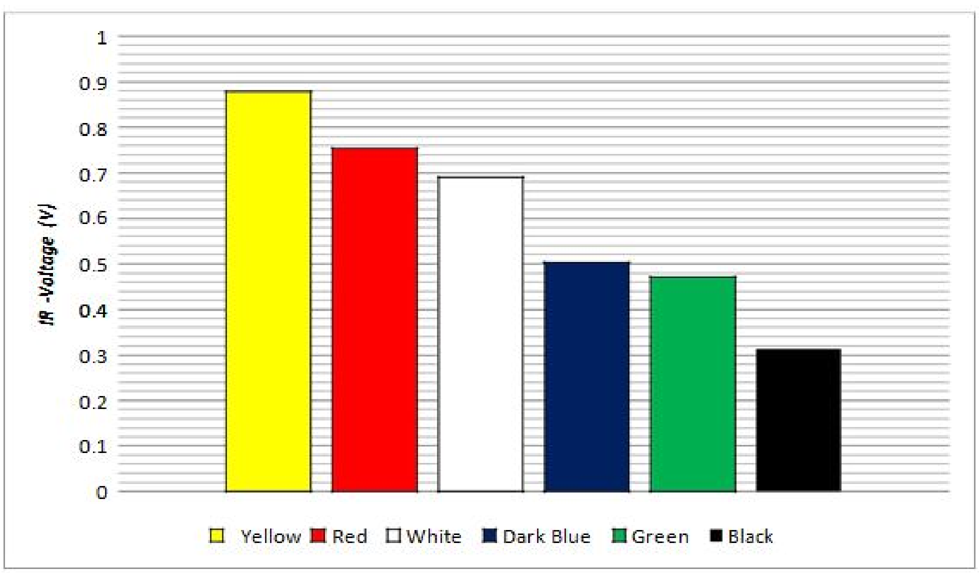
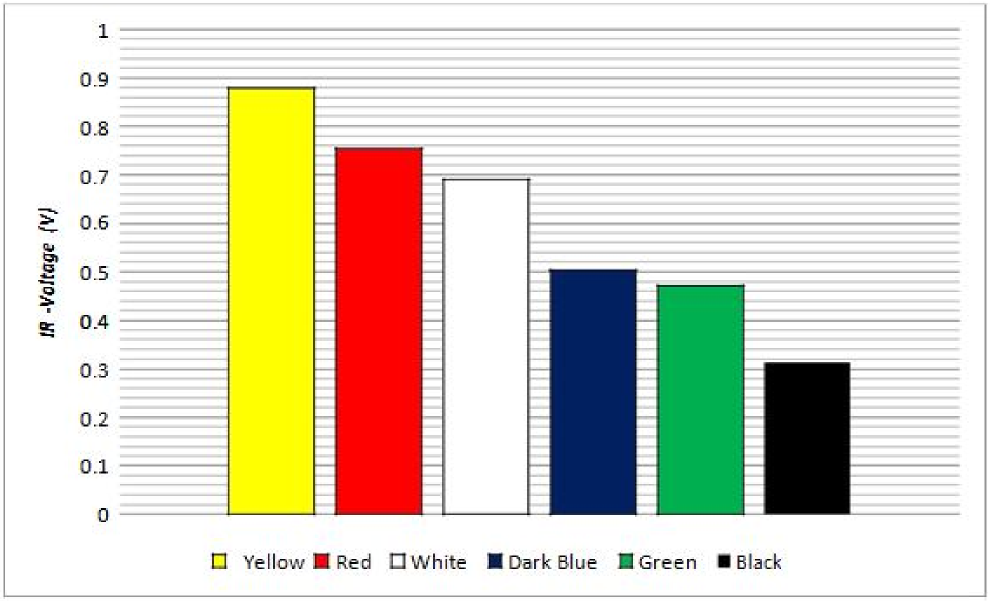


Figure 12: Color effects on reflection

B. Different Material

Figure 13 shows the voltage of output IR sensor which is the reflected IR waves from different objects. It shows the IR voltage (V) versus distance by centimeter for material: Iron and steel, plastic (polyurethane), wood, rubber, and skin of human being. Figure 14 Show differences between two identical materials – brick, but one is fired and one is normal. The chart shows IR voltages (V) versus distance by centimeter.



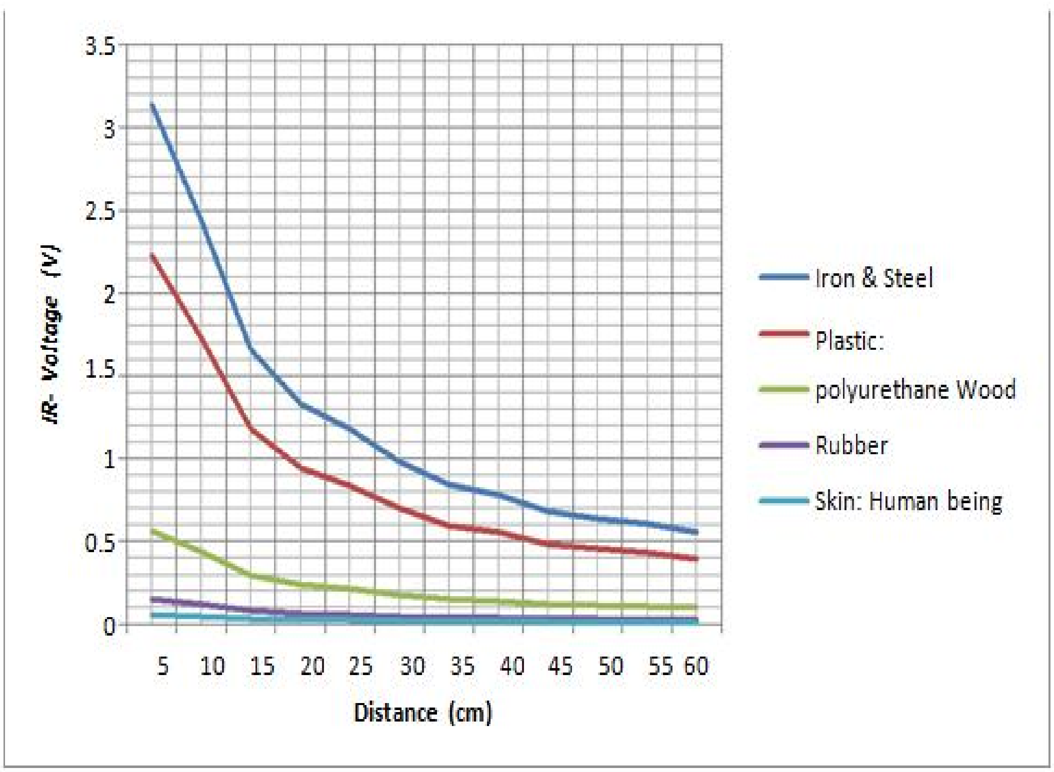


Figure 13: IR-voltages for different material

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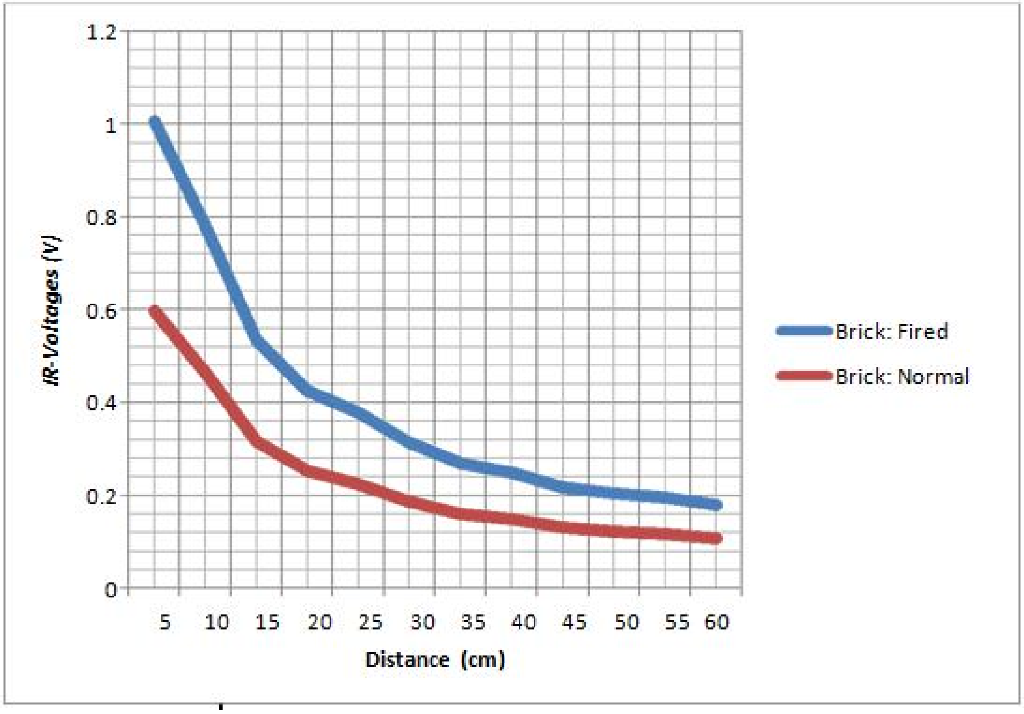

Figure 14: IR voltages for normal and fired brick

VI. CONCLUSION

In Figure 11 the output voltages from IR sensor decreases when object moves away from the sensor. That refers to a loss increases when distance is increased.

From Figure 12 objects have same materials but different colors; this due to Light Reflectance Values (LRV) of colors.

Figure 14 shows that there were two identical bricks one is normal and the other is fired. Observation taken was that the fired brick reflects more IR than the normal brick due to emissivity of the fired brick was lower than the emissivity of the normal one. This result is also shown in Figure 13 but with different materials.

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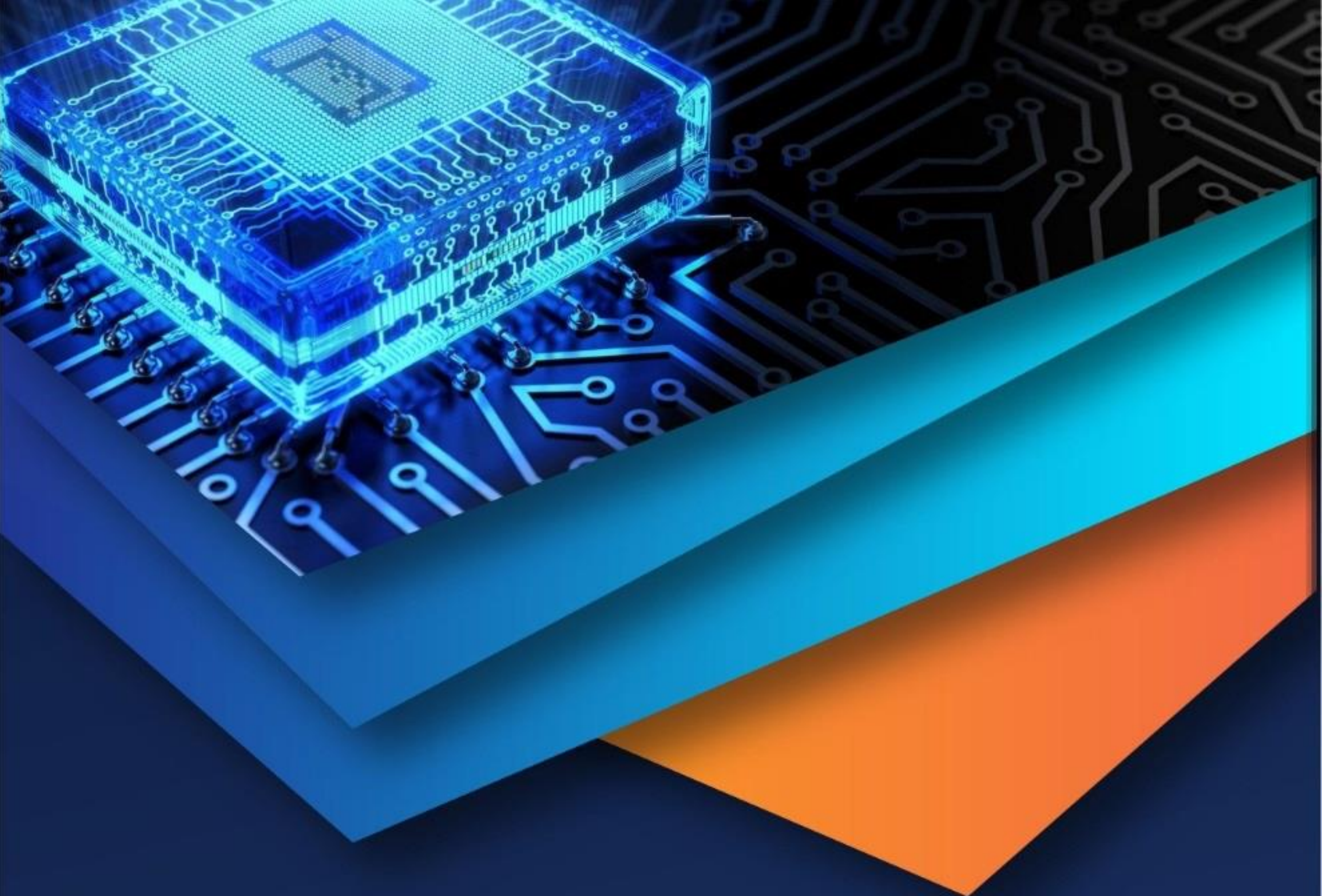

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