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Motion Detection and its Applications

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Abstract: Motion detection is a widely used tool in computing applications. Modern day techniques have explored this paradigm vastly, and its applications are equally widespread. Proximity detection is a popular mean of measuring motion. The paradigm of proximity detection is of high importance today. From vehicle collisions, to aided systems, it is used everywhere. Alternatively, in video recognition, changes in coordinates of image framerates can be used to determine on screen motion. This can be implemented using various software

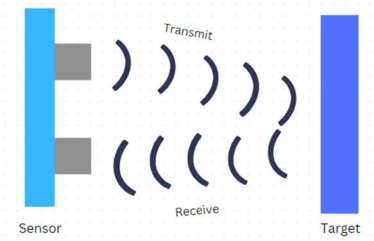
Keywords: proximity detection, Arduino, ultrasonic sensors, vacuum cleaners, smart sensing

I. INTRODUCTION

With the advent of cameras and ultrasonic sensors, their high popularity has led to a lot of enthusiasts and students alike, to put them to use for quite interesting applications.

In this paper, we explore the applications of motion detection via some interesting projects. One of the main projects revolves around Scratch, with the primary focus being the game Fruit Ninja, with the camera module acting as a sensor, to detect motion and then executing commands on it. Another project involved making a face filter using scratch. Using ultrasonic sensors, we have a project with Arduino, using which, we have programmed a vacuum cleaner robot to detect surroundings and avoid collision with any of it. Using ultrasonic sensors, we have made a vacuum cleaner robot, which avoids collision with surroundings and dictates its motion.

Working of Ultrasonic sensor:



The figure above shows the working of an ultrasonic sensor. The sensor consists of a Transmitter and Receiver, the transmitter output an ultrasonic wave which then bounces off a wall. The ultrasonic wave bounces off the wall and is then received sensor.

The ultrasonic sensor measures time between the transmission of the wave and the sensor receiving the wave.

The ultrasonic sensor does not directly output distance instead it used the time measured

The formula to calculate the distance is given by:

D=V*t/2

- D is distance
- V is the speed of sound(340m/s)
- t is time

II. LITERATURE REVIEW

A. *A motion-based object detection method[1]: Chen Zhaoyang, Gao Haolin, Wang Kun*

Target detection & Motion detection is proposed in the paper. Motion detection is done using 2 methods:

1) Inter-frame difference method

2) Background subtraction method

Also, Motion detection is done using the video input. If it has moving targets, then the object detection is done, otherwise object detection is skipped. The environment used for experimentation is 32G memory, Nvidia GPU TITAN-xp, E5-2620 CPU, VS2015, OpenCV3.2.

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B. Development of Wearable and Flexible Ultrasonic Sensor for Skeletal Muscle Monitoring[2]: Ibrahim AlMohimeed, Hisham Turkistani, Yuu Ono

Flexible and wearable ultrasonic sensor for the continuous inspection of skeletal muscle contraction is prepared by the authors. A PVDF polymer film having 110-µm thickness, electrodes and protection/insulation films were used in the sensor. Muscle contraction monitoring was done at the index finger using ultrasonic pulse-echo mode and at forearm using transmission mode by the developed sensors. Advantages of the developed sensors were as follows: lightweight, flexibility, compact size.

C. Multipurpose Robotic car using Arduino based on IoT[3] : Arthi Udayakumar

This study postulates a versatile robotic vehicle that senses fire, harmful gases and detects human using fire sensor, thermistor, gas sensor and PIR sensor which can be controlled by Arduino UNO. The user can control the car remotely. Accurate location of the target defect or sensed thing can be transferred to the websites of the authorized user in remote. The model in this paper can be used in rescue operation such as in coal mine. Other than Arduino UNO; passive infrared sensors, thermistor, fire detecting sensor, gas detecting sensor are used to recognise the elements of an explosive environment, such as poisonous gases and high temperatures and also detects humans trapped.

D. Review Paper on Automated Domestic Vacuum Cleaner Robot[4]: Abhishek Sutar , Ashish S , Gagan Deep K , Prashanth Kumar K M , Prof. Deepthi Raj

Vacuum cleaners have made cleaning less difficult, but they are also bulky, loud, and large. Cleaning your home regularly is now more crucial than ever in light of the Covid-19 pandemic in 2021. The cleaning robot helps to clean and sterilize the floor by switching on. Indian researchers have constructed a mobile robot that is autonomous, based on some of the most significant ideas to emerge in this field over the previous ten years. It is capable of both cleaning and vacuuming simultaneously. The robot can walk in an obstruction-free path thanks to sharp sensors placed on the front panel that can detect obstructions.

E. Smartphone Controlled Multipurpose Robot Car[5]: Balendu Teterbay, Akshay Bhati, Dr. Abhay A. Deshpande, Ayush Srivastava

A working prototype of a smartphone-controlled robot automobile that can do a range of activities while utilising the least amount of hardware was the main goal of this project. The Arduino UNO was used as the core component. Here, a wi-fi module enables wireless control of the model using a smartphone. With the aid of a mounted robotic arm, this vehicle is capable of picking up objects and detecting obstacles. Additionally, temperature, gas, and fire sensors are employed in conjunction with the Arduino Uno. Additionally, a live feed is supplied to track the progress of the vehicle. Disasters involving fire can benefit from this paradigm. If developed further, this model can also be used to recognize voice as a means of providing instructions to the created vehicle.

III. METHODOLOGY/EXPERIMENTAL

A. Block Diagram of the first Project

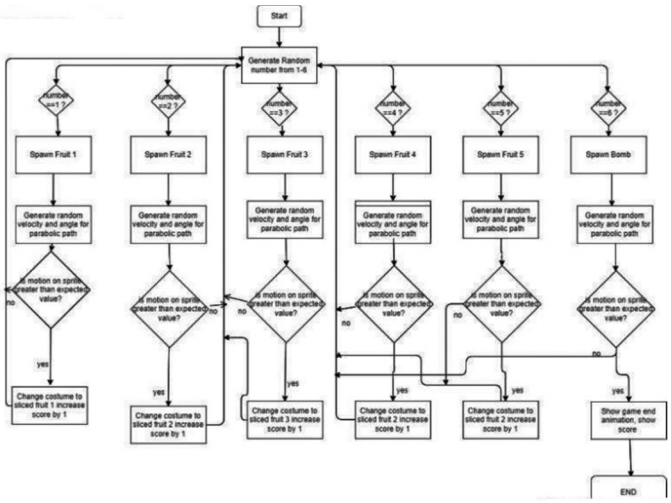


Fig 3.1

B. Testing

For the first project's testing, following are the aspects that were tested:

1) Fruit getting sliced
2) Increase in score
3) Spawned fruit



C. Algorithm of the Second Project

1) Check if distance between robot and nearest surrounding object is greater than specified limit
2) If yes, move ahead and repeat step 1
3) If no, turn by a few degrees, and repeat step 1

D. Testing

The following parameters were involved in the testing

1) Distance at which robot should stop motion
2) Motion after detecting surrounding collision possibility
3) Suction power of fan and motor

IV. RESULT AND DISCUSSION

A. For Project 1

The program is working according to expectations .It meets the following requirements:

1) Fruits are generated randomly
2) They are launched at random velocity in random directions
3) They get sliced when enough motion is applied and exit without deviation if there is no motion/not enough motion.
4) Score gets incremented when a fruit is sliced
5) When a bomb is sliced, game end animation displays, along with score
6) All sounds work appropriately

B. For the Second Project

The program is working according to expectations. It meets the following requirements:

1) Robot stops and evaluates surroundings within expected distance
2) Suction power, although limited, showcases the primary purpose, and can pick up small objects such as paper pieces
3) Motion after possible collision detection is satisfactory, i.e. individual movement of wheels is satisfactory.

V. IMMERSIVE MEDIA

Because it can completely submerge viewers in a setting, immersive media got its moniker. You are not merely watching a picture on a screen when you engage with immersive media. In the world of digital media, the term "immersive" frequently refers to the domain of virtual reality or extended reality. People may interact with content on a different level thanks to immersive media, which comes in a variety of formats. Immersive media can create an experience that enables you to enter a video and interact with the objects therein rather than just watching it.

VI. VIRTUAL REALITY

1) *Virtual Reality:* The most frequently mentioned immersive media format is virtual reality. It entails substituting a digital or virtual environment for a physical one. Through head-mounted displays and sensors, virtual reality completely submerges the user in a digital world.
2) *Augmented Reality:* Augmented reality, also known as AR, places digital content in a physical setting. This makes it possible to improve rather than change your immediate environment.
3) *Mixed Reality:* The actual world and the digital world are combined in mixed reality to create a space where they can coexist. Mixed reality experiences, which allow for a far higher level of interaction than augmented reality, can include things like holograms or holoportation.
4) *3D Content:* You can surround yourself with a certain type of unique image or video using 3D films and photos. This makes it possible to immerse oneself in the material, but there is typically no means to engage directly with the information without a smartphone or other analogous device

VII. ARDUINO

They are created and manufactured by Arduino, an open-source hardware and software project and userbase. Commercial Arduino boards are offered on the official website or from accredited distributors. Commercial Arduino boards are offered on the official website or from accredited distributors. The designs of Arduino boards incorporate a variety of microprocessors and controllers. The boards have a variety of extension boards (called "shields"), breadboards (for prototyping), and other circuits that can be interfaced to the sets of digital and analogue input/output (I/O) pins on the “boards.ino” board designs use a various microprocessors and controllers. The boards have a variety of extension boards (called "shields"), breadboards (for prototyping), and other circuits that can be interfaced to the sets of digital and analogue input/output (I/O) pins on the boards. The boards have serial communications ports, some of which may load applications through USB on select variants.

VIII. MOTION DETECTION

Motion detection is the act of identifying any variation in an object's position with respect to its environment or a shift in the environment in relation to an object. Either mechanical or electronic techniques can be used to accomplish it. It was born out of the idea of motion sensing, which is something that all living things do. By keeping an eye on variations in: Infrared light (passive and active sensors), observable light (video and camera systems), electromagnetic energy (radar, microwave and tomographic motion detection), Sound (microphones, other acoustic sensors), Kinetic power (triboelectric, seismic, and inertia-switch sensors), Magnetism (magnetic sensors, magnetometers), Wi-Fi.

IX. CONCLUSION

As a result, we have witnessed inventive motion detecting applications.

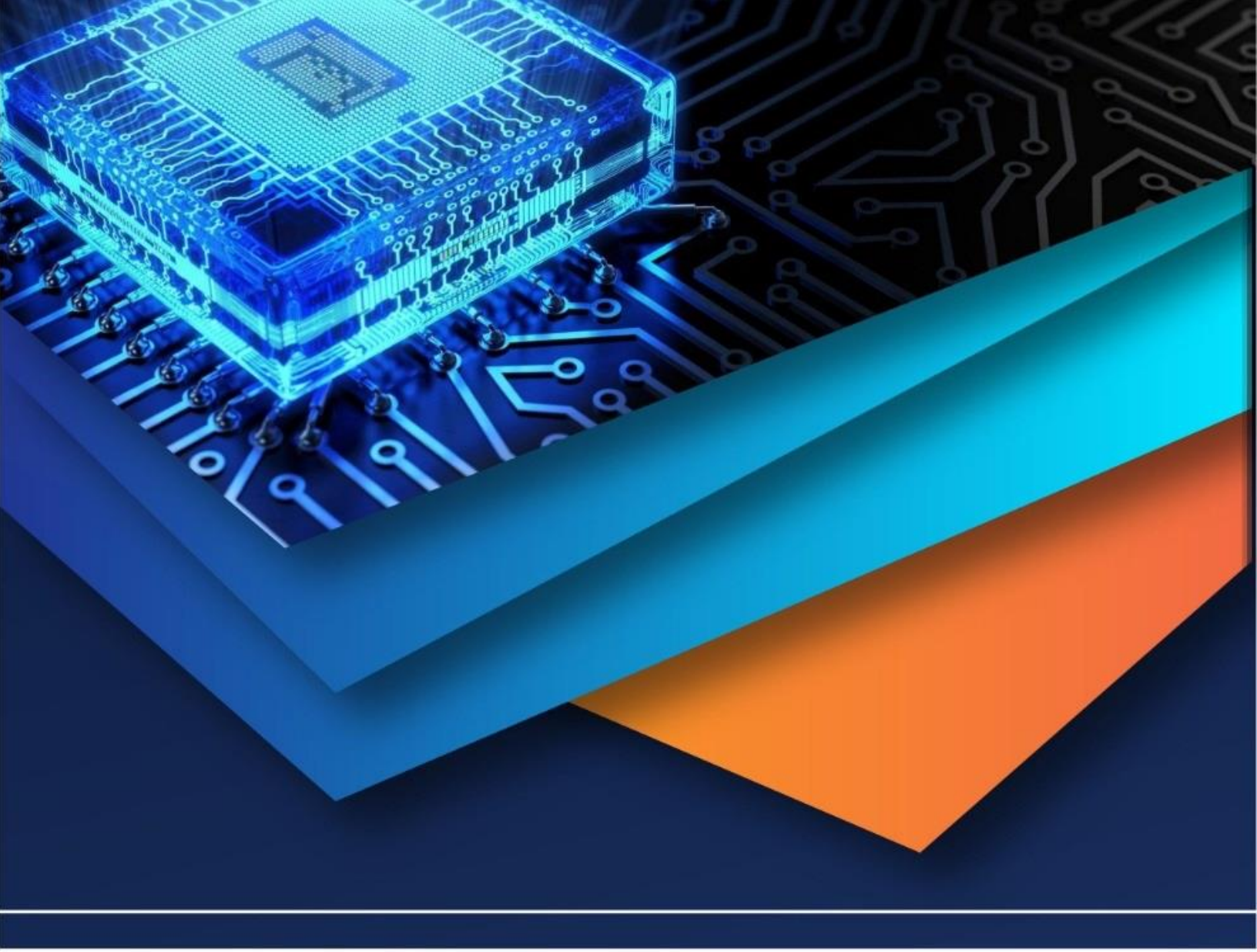
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