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Detection and Avoidance of Objects Robot with Internet Connectivity and Signal Strength-Based Location Tracking

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Abstract— This paper presents an object detection and avoidance robot with location tracking and internet connectivity capabilities. The robot is equipped with a hardware module that detects the highest frequency rate of radio wave signals and sends the detected signal, then from color sensors to the object avoidance robot to take a decision in search of the best signal strength. The robot moves forward in search of a better signal strength, then stays back if the signal is stronger or retreats if it is weak. When the signal strength is strong at a location, the robot informs the user of its current location and provides internet connectivity through a single-band dongle with a SIM card reader. Additionally, if the user wants the robot to return to the user's location, it backtracks the path with the help of an object detection and avoidance algorithm, whereas the user can track its activity. The proposed system has the potential to improve location tracking by object detection and avoidance in various applications, such as surveillance, search and rescue missions, military operations, and internet tracking connectivity for handicapped people in open spaces or remote areas. The proposed system here is used to track network signals and is predefined with an object detection and avoidance algorithm.
Keywords- object detection and avoidance, signal strength, internet connectivity, radio wave signals, location tracking, Arduino Uno.

I. INTRODUCTION

The integration of robotics and wireless technologies has led to the development of numerous advanced systems with various capabilities. Nowadays, the usage of the internet has become more widespread in all parts of the world. This paper presents a novel robot system that combines object detection, avoidance, location tracking, and internet connectivity features. The robot uses a hardware module that detects radio wave signals and sends the signal strength data to the object avoidance algorithm, which decides the robot's movement to find the best signal strength.

The proposed robot system can provide location tracking with high accuracy, as it moves towards the areas with stronger signals, and informs the user of its current location using an internet-enabled single-band dongle with a SIM card reader. The robot's movement can also be tracked by the user, providing a useful tool for surveillance, search and rescue missions, and military operations. Here both the figures 1(A) and 1(B) represents the sequence of working algorithm used in this model.

Furthermore, the figure 1(A) and figure 1(B) shows that the robot's object detection and avoidance algorithm enable it to backtrack its path to the user's location if required. The location tracking system consists of GPS and GSM modules. The GPS module is used to track the robot's location, and the GSM module is used to provide internet connectivity through a single-band dongle with a SIM card reader. The algorithm (fig 1(A) & fig 1(B)) ensures that the robot avoids obstacles

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The proposed robot system's capability to provide internet connectivity can be particularly useful for handicapped individuals in remote areas, enabling them to access the internet without physical assistance. The robot can search for areas with the strongest signals and establish a connection, providing a new level of accessibility and freedom for individuals with limited mobility.

Overall, the proposed robot system presents a new approach to location tracking, object detection, avoidance, and internet connectivity that can have significant applications in various fields. The integration of these features in a single robot provides an efficient and reliable tool for tasks that require accurate location tracking, object detection, and internet connectivity in challenging environments.

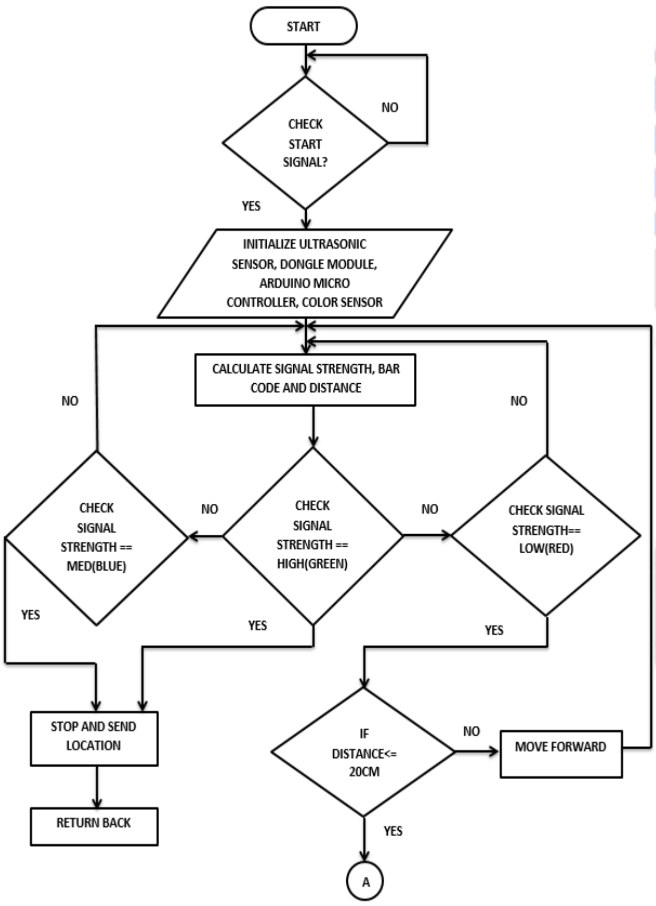

FIGURE 1(A): **Algorithm for the detection and avoidance of object robot with internet connectivity and signal strength – based location tracking.**

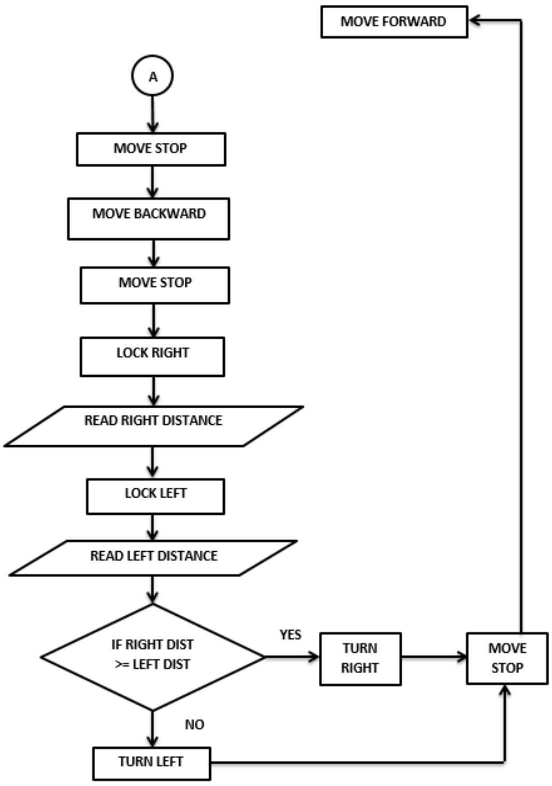

FIGURE 1(B): **Algorithm for the detection and avoidance of object robot with internet connectivity and signal strength – based location tracking.**

II. ROBOT ARCHITECTURE

A. Hardware Module

A radio wave signal detector and colour sensors make up the hardware module.
The radio wave signal detector is a single-band dongle that supports a SIM card. Its module is used to detect the frequency rate of radio wave signals, and it transmits data about the current frequency measurement to a color sensor, which uses it to move the robot around the environment with the aid of an object detection and avoidance algorithm.

Radio waves (AM/FM) operating at specific cellular frequencies make up the transmissions. Decibel-milliwatts, or simply dBm, are units used to measure wave power. They are expressed in negative numbers and are logarithmic. Cellular signals can be as strong as -120 dBm (excellent signal or full bars) or as weak as -50 dBm (very poor signal or a dead zone). The signal intensity doubles every three decibels because it is a logarithmic unit. Otherwise said, a cellular signal strength value of -97 dBm is twice as strong as -100 dBm.

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If your outside signal ranges from:

Signal Strength	General Results
-50 to -79 dBm	Considered **great signal** (4 to 5 bars)
-80 to -89 dBm	Considered **good signal** (3 to 4 bars)
-90 to -99 dBm	Considered **average signal** (2 to 3 bars)
-100 to -109 dBm	Considered **poor signal** (1 to 2 bars)
-110 to -120 dBm	Considered **very poor signal** (0 to 1 bar)

TABLE 1: Signal strength range

The stronger your signal is, the nearer you are to 0 dBm. Since the dBm scale is negative as we can see from the table1, a signal at -100 dBm is substantially weaker than one at -50 dBm.

A good and reliable level is -90 dBm or above. You can take advantage of uninterruptible talks and quick data rates. The majority of people see patchy service and poor reception around -100 dBm. The speed of webpages, videos, and calls fluctuates, and texts take a long time to transmit. Your signal strength is just a paperweight at -120 dBm or lower.
The location tracking system is actually integrated with the radio wave signal detector. The location tracking system consists of GPS and GSM modules. The GPS module is used to track the robot's location, and the GSM module is used to provide internet connectivity through a single-band dongle with a SIM card reader

B. Color Sensor

The color sensor picks up the bar code's color from the single band dongle and transmits it to the microcontroller. The single-band dongle provides the color sensor with information regarding signal strength, which is shown by its frequency measurement. where the signal strength is the main input, and the robot goes in search of the strongest signal.

C. Object detection and Avoidance algorithm

The robot goes around obstacles and avoids colliding with any items according to the object identification and avoidance algorithm. The Arduino platform is utilised in the creation of this algorithm.
There are many different hardware platforms on which mobile robots in general or obstacle-avoiding robots specifically are constructed. As the platform for the microcontroller and its software counterpart, we have chosen the Arduino board for programming. An open-source platform called Arduino combines hardware (a microcontroller) and software elements.
The microcontroller can read input from sensors in the form of signals and transmit that information to the gear motors so they can act in the environment.
The only way the Arduino microcontroller can function is with the aid of code. This code is written using the open-source Arduino Integrated Development Environment (IDE), which is also used to create the Arduino Uno board (Arduino, 2015). Due to its ease of use and compatibility with all Arduino boards, this software is widely utilised. The C code is written using the Arduino Software version 1.6.5 and then uploaded via a USB wire to the Arduino microcontroller. The application stores the code in a file with the extension “. ino".

D. User Interface

The user interface is a web or mobile application that enables the user to monitor the robot's activity, direct its motions, and interact with it. The user can direct the robot to proceed in a certain direction or request a return to their spot.
The user interface of an object avoidance robot with internet tracking and connectivity plays a critical role in ensuring the efficient and effective operation of the robot. The interface serves as the primary means for the user to interact with the robot and provides real-time feedback on the status of the robot's operation. The interface is designed to be user-friendly, intuitive, and easily navigable, allowing the user to control the robot's movement, monitor its sensors, and view its surroundings.
With the user interface, the robot can connect to the internet and be monitored and controlled remotely from a distance. The interface shows the robot's location, speed, and direction of movement in real time, along with any hazards or obstructions in its route. Also, the user has remote control over the robot's direction, speed, and other settings.
Overall, the user interface for an object avoidance robot with internet tracking and connectivity is a critical component of the system, enabling the user to control and monitor the robot's operation in real-time, regardless of their location. The interface must be designed with the user's needs in mind, ensuring that it is intuitive, user-friendly, and capable of providing the necessary feedback to enable effective operation of the robot.

E. Power Supply

The robot can be powered by a battery, which supplies power to all the sensors so they can act in the environment efficiently.

Overall, the power supply for an object avoidance robot with internet tracking and connectivity is a critical component that must be carefully designed and optimized to ensure reliable and efficient operation of the robot. The power supply must be robust, efficient, and capable of providing the necessary power to drive the various components of the robot, while also being energy-efficient to ensure extended operating times between charges.

In this project, the colour sensor reads a bar code from a single-band dongle and transmits the signal data to a microcontroller. At the same time, an Arduino board will accept input from an ultrasonic sensor, calculate the distance to an obstacle, and control the rotation of a servo motor as an output response, all while connecting the user to the internet.

F. Hardware Components and Assembly

The hardware used to construct the robot is shown in the following block diagram (figure 2), which also explains the relationships between the input and output.

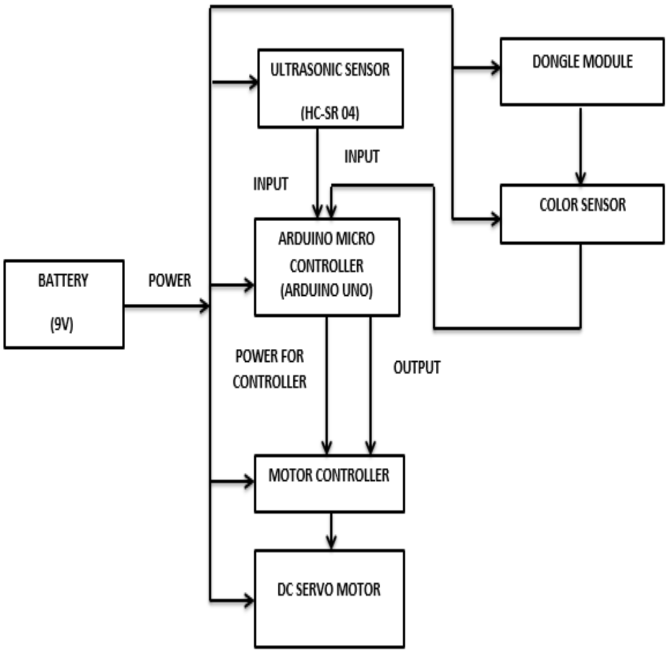

FIGURE 2: Block diagram

III. RELATED WORK

A. A Wireless Aontrolled Robot with an Obstacle,Edge Detection and Avoidance

The wirelessly operated obstacle and edge avoidance robot is employed for the purposes of detecting obstructions or edges and preventing collisions or falls, respectively. This robot is self-sufficient. The integration of numerous sensors in accordance with their function is necessary for the construction of an obstacle-avoidance robot. The main requirements for this autonomous robot are the detection and avoidance of obstacles and edges as well as wireless control. Using on-board infrared and ultrasonic sensors, the robot in this task gathers information about its surroundings. Moreover, the Bluetooth module HC-05 allows for control of this autonomous robot.

B. Internet Connectivity tracking through the SIM and GPS module

SIM808 Bluetooth Compatible GSM/GPRS/GPS Development Board with GPS Antenna (Arduino and Raspberry Pi Compatible) is a development board; with SIM808 module which makes you able to use GSM communication and GPS features with your Arduino or Raspberry Pi. With this module, you can send and receive SMS; trace a location and you can even build your own cell phone. SIM808 module on-card functions as GSM communicator and GPS receiver.

IV. PROPOSED SYSTEM

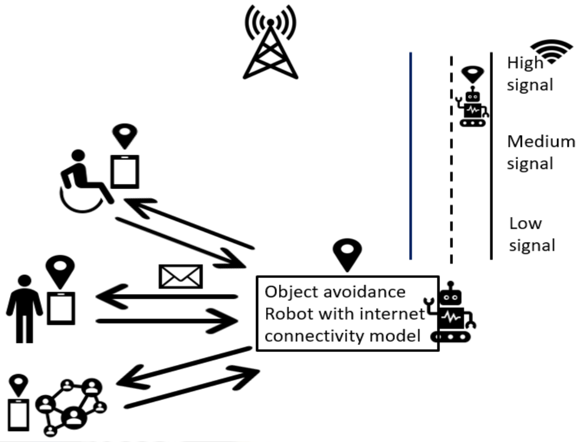

FIGURE 3: Proposed Model

In the proposed system, each colour for the bar code is produced based on the signal strength of the internet to detect the strength of the internet. The colour sensor then receives the colour signal as an input, processes it, and sends it to the microcontrollers so they can act in an unbiased environment. While at the same time, the robot senses its surroundings using ultrasonic sensors as an input to move through it using an object recognition and avoidance algorithm.

The user may then simply communicate (figure 3) with the robot using an interface once the robot sends them its location after determining the optimal signal strength for them in a large remote area or in locations like a forest. Even if the user tells the robot to back off, the robot nevertheless follows the user's intended retreat route. They can access the robot's present signal strength, speed, and location via the user interface to control it.

Thus, this project helps the user detect the best signal strength, location tracking, and internet connectivity in an unavoidable environment using an object detection and avoidance robot.

V. CONCLUSION

In conclusion, the presented object detection and avoidance robot with location tracking and internet connectivity capabilities provides an innovative solution to improve location tracking in various applications. By detecting the highest frequency rate of radio wave signals, the robot can move forward in search of a better signal strength and inform the user of its current location while providing internet connectivity through a single-band dongle with a SIM card reader. The backtracking feature of the robot, with the help of an object detection and avoidance algorithm, provides a reliable way for the user to track the robot's activity and retrieve it if needed. This proposed system has the potential to significantly enhance surveillance, search and rescue missions, military operations, and internet tracking connectivity for handicapped people in open spaces or remote areas.

Moreover, the proposed system's implementation has demonstrated its ability to track network signals with predefined object detection and avoidance algorithms. Future work on this research could involve improving the robot's object detection and avoidance capabilities in dynamic environments or exploring the robot's potential to track other types of signals or perform other tasks. Overall, the presented robot's capabilities and potential applications make it a promising solution for enhancing location tracking and providing internet connectivity in various scenarios, opening the possibility of developing similar systems for other use cases.

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