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ARDUINO BASED OBSTACLE AVOIDANCE ROBOT FOR LIVE VIDEO TRANSMISSION AND SURVEILLANCE

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Abstract - *The development of an obstacle avoidance robot is considered as a fundamental step for the development of autonomous or unmanned vehicles. These vehicles are used in various fields like transportation, surveillance, rescue operations where human reach is not possible. It is a futuristic approach and the research towards this unmanned vehicles are extremely useful for the beneficiary of mankind. The objective of the project is to develop an obstacle avoiding robot using a microcontroller and an ultrasonic sensor to detect the object in front of it. This prototype is equipped with an ultrasonic sensor and the distance calculations are done inside the microcontroller. This prototype is also equipped with a wireless camera for live video transmission which can be received by various terminals like smart phones, tablets, PC, etc.*

***Key Words*: Arduino uno, Motor driver shield, Ultrasonic sensor, Servo motor, FPV camera, UVC-OTG, etc.**

1. INTRODUCTION

Robotics develops machines that can substitute for humans and replicate human actions. Robots can be used in many situations and for lots of purposes, but today many are used in dangerous environments (including inspection of radioactive materials, bomb detection and deactivation), manufacturing processes, or where humans cannot survive (e.g. in space, underwater, in high heat, and clean up and containment of hazardous materials and radiation). Robots can take on any form but some are made to resemble humans in appearance. This is said to help in the acceptance of a robot in certain replicative behaviors usually performed by people. Such robots attempt to replicate walking, lifting, speech, cognition, or any other human activity. Many of today's robots are inspired by nature, contributing to the field of bio-inspired robotics. The concept of creating machines that can operate autonomously dates back to classical times, but research into the functionality and potential uses of robots did not grow substantially until the 20th century. Throughout history, it has been frequently assumed by various scholars, inventors, engineers, and technicians that robots will one day be able to mimic human behavior and manage tasks in a human-like fashion. Many robots are built to do jobs that are hazardous to people, such as defusing bombs, finding survivors in unstable ruins, and exploring mines and shipwrecks. The advent of nanorobots, microscopic robots that can be injected into the human body, could revolutionize medicine and human health. They are being used in manufacturing industries some of them are even used in rescue as well as military applications. This system is based on a obstacle avoidance robot. A obstacle avoidance robot is a intelligent device which is capable of finding its path without the control of the human or by means of any remote. This system of obstacle avoidance robot can be used in rescue operations where human reach is not possible or to find the situation inside a disaster affected building or mines. This system can also be used for surveillance and spying activities for Police as well as military operations.

1.1 Objective

An obstacle avoidance robot is a simple device which uses ultrasonic sensors for obstacle detection and they are used in various fields and applications. This system of obstacle avoidance robot is mainly focused on rescue operations in disaster affected buildings where human reach is not possible and also for surveillance and spying operations. This system can be used to check the situation inside a disaster affected areas and to check the presence of any human alive got trapped inside the debris, for example: mines or earth quake affected buildings where human reach is not possible.

1.2 Existing System

In the previous existing systems, the robots were designed by arduino as their processing unit and ultrasonic sensors for obstacle detection but a SD card module is used for data storage which increased the complexity. In some systems a simple 8 bit microcontroller was used. In some systems the overall size of the system wss big and heavy which reduced the overall compactness of the system. In some systems multiple ultrasonic or IR sensors were used for obstacle detection which has less accuracy when compared to ultrasonic sensors. The algorithms used for obstacle avoidance also plays in important role in determining the complexity of the system. A system used fizzy algorithms for obstacle avoidance for the robots used in mines the algorithms were more complex and difficult to understand for the beginners it needs expert assistance. Some systems used high accurate laser sensors for obstacle detection which increased the overall cost of the system and increased complexity and reduces the overall compactness

of the system. Hence the system should have accurate obstacle detection and avoidance and also to provide some extra features like surveillance without reducing the overall compactness of the system with minimal cost.

2. PROPOSED SYSTEM

Proposed solution is conceptually much simple. The Idea behind it is, a providing low cost, less complex, highly reliable and most importantly user friendly to implement as well as handle for man. The proposed consists of a arduino uno (atmega 328p) as its brain and ultrasonic sensor for obstacle detection. The system consists of four motor and the motors are controlled by a motor driver shield which has L293D motor driver and a 74HC595 motor shift register. A servo motor is used to turn the ultrasonic sensor for 180 degree for obstacle detection. The date are processed by the atmega 328p microcontroller and by using a simple algorithm the obstacles are detected and avoided. The system was powered by a 9v power supply. For surveillance or live video transmission purpose the system is been equipped with a FPV (First Person View) camera. For reception of these video signals a UVC-OTG receiver is used to view the video signals in a smart phone or tablet. Proposed system consists of physical or wired medium and also the wired medium.

Advantages of the proposed system

- It will be easy and less risk for the people who are involved in rescue operations.
- Human lives can be saved from the disasters with minimal risk.
- It is useful for surveillance and spying operations for police and military missions.
- It does not need any man power to control the robot as it is capable of finding its own path thus reducing human involvement.
- If further developed it can be used to recognize faces in rescue operations and any form of alert can be given to the personals in the mission.

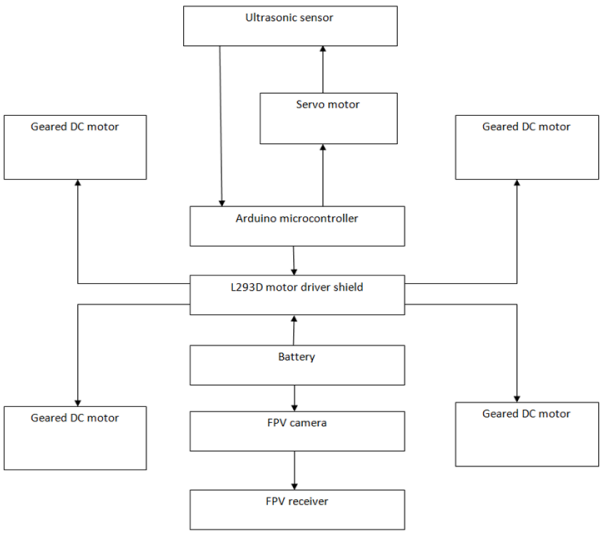

Fig -1: Block diagram of the system

2.1 ALGORITHM AND WORKING PRINCIPLE

When the system is powered on the sensor and the motors are initialised, the ultrasonic sensor reads the distance. The condition if the distance is less than or equal to 15cm is verified, if the condition is false the robot moves forward. If the condition is true the robot stops and move backward and stops. Now the sensor looks right and then left with the help of the servo motor and reads the distance. If the right distance is greater than or equal to the left distance, the robot turns right. If the distance is less than right side the robot turns left. This process is continued in a cycle every time when the robot is powered on.

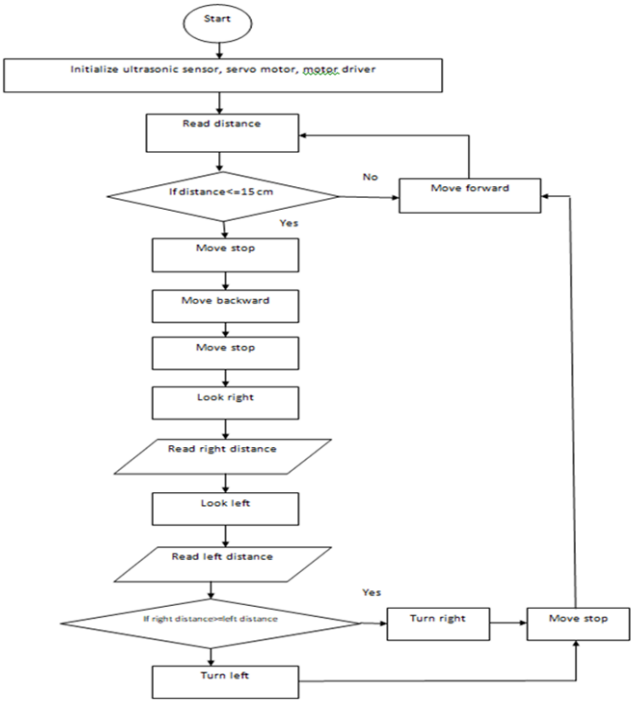

Fig -2: Flow chart of the system

The ultrasonic sensor continuously detects the obstacles in front of it with the help of the servo motor. The combination of the ultrasonic sensor and servo motor creates a hemisphere of angle 180 degree. The sensor measures between 0 – 180 degrees. The robot takes ten different values at ten different directions in between 0-180 degrees to analyse the situation.

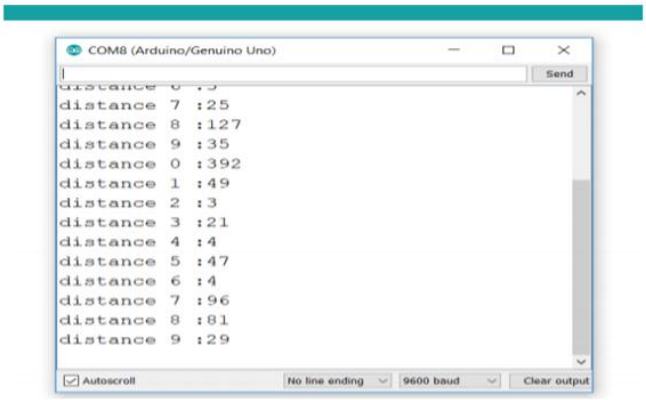

Fig -3: Observation from the ultrasonic sensor

The maximum RPM of the motor used is 100 RPM and the diameter of the wheel is 7cm. The robot is in motion until the object comes to a distance of 15 cm. The robot can be further developed to increase the accuracy around corners. Now out of 30 obstacles the robot detects and avoids 28 obstacles successfully within the given threshold distance of 15cm.

Accuracy = (no. of trails/ total no. Of trails)*10

= (28/30)*100

= 93.3%

Fig -4: FPV camera image

The FPV camera can transmit the video footage to a range of 1.8-2.4 kilometers under normal circumstances.

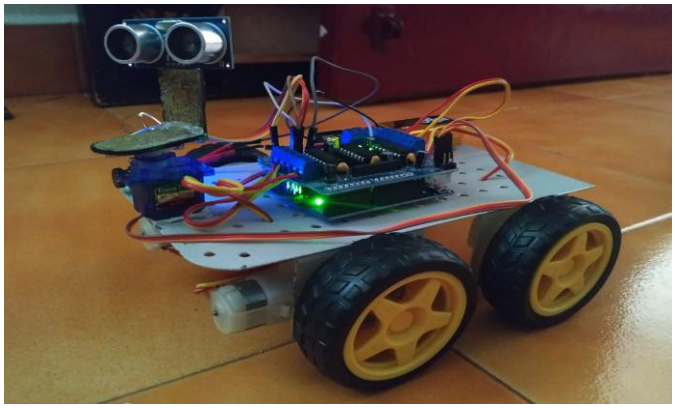

Fig -5: Image of the robot

3. CONCLUSION

Thus the obstacle avoidance robot is constructed with a accuracy percentage of 93.3%. This robot can be further developed in the future by adding better image sensors and integration of artificial intelligence for human face detection. The accuracy can be increased by using LIDAR sensor which is a 3D mapping sensor which can turn this into autonomous vehicles or even for military operations and other rescue operations and it can be used as a spy robot.

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