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Structure Detection and 2D Modeling

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***Abstract*:** The objective of this paper is to provide a 2 dimensional coverage of an area by using a scanner. The scanned area is then mapped onto a virtual two dimensional space in the computer which provides users and analysts with unlimited options of performing operations on the structure. This project was uses an autonomous rover to scan the enclosure it is kept in. This rover moves till it has scanned each corner of the room.
Providing such smart functionality is essential in a restricted environment, especially for efficiency of resource utilization.

***Keywords*:** *Microcontroller - Arduino Uno, Ultrasonic sensor - HCSR04, 2d structure detection, Graph analysis, Arduino IDE Software.*

I. INTRODUCTION

We are in an age which calls for analysis and design as services of paramount importance. Keeping this in mind we have developed a project which takes care of both of these services.

Our project provides data which provides a fantastic design of the real environment onto the virtual environment reducing the dimension of height. Second we have analysis. After the 2d map is made, we have a gigantic scope of analyzing the generated structure in various dimensions. Such a feature is essential in this era of big data. Hopefully this project will be a great boon in areas like surveillance and exploration.

II. LITERATURE REVIEW

The most advanced technology carrying features that we have tried to incorporate into this paper are present in rovers for space exploration. These rovers contain panoramic cameras, thermal cameras and alpha particle spectrometer and magnets to provide various readings of the space travelled. [1]

Other applications close to this paper are that of using a laser scanner on a mobile robot which finally makes a vrml model to display the scanned environment. This is an effective utility.

Other references made were from [2], [3], [4], [5] in which various 3d modeling techniques are used using images as sources. Existing applications which utilize this concept are the rovers used in mars. The rovers have cameras which give a photographic view of the environment. This does provide visual aid but is not enough for navigational analysis.

Structure detection robots are a common architecture project which use heat sensors to detect humans or use ultrasound to detect any obstructions. The application of such systems are that the robot can avoid a crash. But there is no future utility of the information that the robot detects.

III. PROPOSED SYSTEM

In the proposed system enhancement of the capabilities of an obstruction detection robot are made. It can detect structures and map them to an internal data structure which can be later utilized to model the environment.

The proposed system promises to solve the problems of unreachable corners of enclosures of buildings or any structure for that matter. It has many modules which will be described as follows:
Sensor module – This module uses the ultrasonic sensor to detect obstructions and reflect them back to the sensor. It's basically a transceiver. This is the back bone of our project.

Servo Motor – This component is used to rotate the sensor mounted above it 180degrees. In one sweep we collect all the obstructions within a radius of 200cm.

Wi-Fi Module – This module sends a collective data of a sweep to the central server. It behaves as a client and utilizes the esp8266-01

Mapper Module – This module is present at the server. It is a software which is smartly calculates and adjusts the distance moved by the rover and distance of the obstructions from its position.

IV. COMPONENTS

Microcontroller – Arduino UNO

Arduino is an open source tool for making computers that can sense and control more of the physical world than your desktop computer. It's an open-source physical computing platform based on a simple microcontroller board, and a development environment for writing software for the board. Arduino can be used to develop interactive objects, taking inputs from a variety of switches or sensors, and controlling a variety of lights, motors, and other physical outputs. Arduino projects can be stand-alone, or they can communicate with software running on your computer (e.g. Flash, Processing, MaxMSP) the boards can be assembled by hand or purchased preassembled; the open-source IDE can be downloaded for free. The Arduino programming language is an implementation of Wiring, a similar physical computing platform, which is based on the Processing multimedia programming environment.

Ultrasonic sensor - HCSR04

Ultrasonic sensors (also known as transceivers when they both send and receive, but more generally called transducers) work on a principle similar to radar or sonar which evaluates attributes of a target by interpreting the echoes from radio or sound waves respectively. Ultrasonic sensors generate high frequency sound waves and evaluate the echo which is received back by the sensor. Sensors calculate the time interval between sending the signal and receiving the echo to determine the distance to an object [6].

Systems typically use a transducer which generates sound waves in the ultrasonic range, above 18,000 hertz, by turning electrical energy into sound, then upon receiving the echo turn the sound waves into electrical energy which can be measured and displayed.

Wi-Fi Module – ESP8266

The ESP8266 Wi-Fi Module is a self-contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your Wi-Fi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi

networking functions from another application processor. Each ESP8266 module comes pre-programmed with an AT command set firmware [8], meaning, you can simply hook this up to your Arduino device and get about as much Wi-Fi-ability as a Wi-Fi Shield offers. The ESP8266 module is an extremely cost effective board with a huge, and ever growing, community.

Servo Motor

A servomotor is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration. It consists of a suitable motor coupled to a sensor for position feedback. It also requires a relatively sophisticated controller, often a dedicated module designed specifically for use with servomotors.

Servomotors are not a specific class of motor although the term servomotor is often used to refer to a motor suitable for use in a closed-loop control system [7].

Servomotors are used in applications such as robotics, CNC machinery or automated manufacturing.

A. Architecture Design

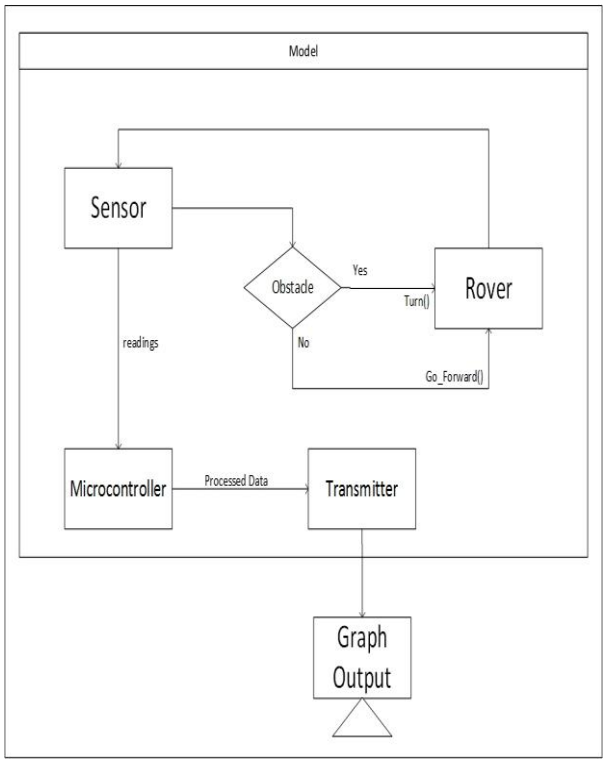

Fig. 1. Architecture Design

B. Result

All the modules were first tested in isolation. We first made servo motors run. Then tried working with the ultrasonic sensor. There were some issues with the sensor coming too close (2cm) to an obstruction. Finally we tested the Wi-Fi module.

Wamp server was used. Data received was ensured to be accurate and authentic. This was done by controlled testing in a measured environment. Finally a combination all components was made for system testing.

CONCLUSION

Final work in this paper can be utilized to scan 3d enclosures to map them to 2d virtual images. This feature has allowed to analyze enclosures and perform algorithms on them.
The limitation of this system is that it cannot capture 3d maps.

Finally an improvement in the system is that it can have 3D distance measurement to incorporate algorithms on 3d maps.

References

[1] http://www.cse.wustl.edu/~furukawa/papers/iccv_2015.pdf
[2] http://mars.nasa.gov/mer/overview/
[3] https://homes.cs.washington.edu/~xren/publication/du-ubic11-interactive-mapping.pdf
[4] ftp://ftp.cs.washington.edu/tr/2011/02/UW-CSE-11-02-02.PDF
[5] www.aass.oru.se/pub/tdt/NIROS/niros1_appendixB.pdf
[6] http://playground.arduino.cc/Code/NewPing
[7] akizukidenshi.com/download/ds/towerpro/SG90.pdf
[8] http://www.instructables.com/id/Arduino-Ultimate-
[9] Obstacle-Avoiding-Robot/?ALLSTEPS