

# 3D Scanner for Real Time Objects

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**Abstract-**3D scanner is a device that analyses a real-world object or environment to collect data on its shape and possibly its appearance (i.e. colour). The collected data can be used to construct digital three-dimensional models. This paper is all about 3D scanner for real time objects by using Arduino and distance measuring sensor. Distance measuring sensor is used to obtain shape of object with low implementation cost. The paper aims to develop the low cost 3 D scanner, which can scan real time object and plot it on computer display, this scanner will be useful in i) 3D printer ii)military application iii)orthotics etc.

**Keywords-** Arduino, Distance Measuring Sensor, Stepper Motor

## I. INTRODUCTION

3D scanner devices examine the real-world environment or objects and collect data on its shape and its appearance. There are many technologies that work behind these 3D scanning devices but every technology has its own advantages, limitations and costs. Today, the most modern innovations in 3D scan technology are being used to provide the best possible solution for a wide variety of needs. These device saves time and money at every point of manufacturing process i.e. from design to manufacturing. These are various technologies can be used to build 3D scanning and it is most popular approach used in 3D data acquirement. It is most convenient technique to transfer the shape from physical word to virtual word. Distance measuring technique is easiest, fast and low cost method in non-contact scanning. This technique will make the product become another popular device in a future .This scanner fire extensive use in the entertainment industry for the production of the game and movies and some other common applications such as industrial designing prosthetics & orthotics reverse engineering etc.

## II. LITERATURE SURVEY

3D laser scanning developed during the last half of the 20th century in an attempt to accurately recreate the surfaces of various objects and places. The technology is especially helpful in the fields of research and design. The first

3D scanning technology was created in the 1960s. The early scanners used lights, cameras and projectors to perform this task. Due to limitations of the equipment it often took a lot of time and effort to scan objects accurately. After 1985 they were replaced with scanners that could use white light, lasers and shadowing to capture a given surface. There are varieties of technologies for digitally acquiring the shape of 3D object as well established classification (Brain curien, 2000) [1] they are divided into two categories of contact & non-contact 3D scanner. (G benet) [6] Proposed system using Infrared sensor for measurement of Distance.

3D geometry using Distance measuring sensors proposed by Tar[5] uses Infraed wave sensors to measure the distance and generate 3D geometry of the sensed objects using the LEDs and photo-diodes . The resolution of the object's heights, orientation and distance will be very low but have a large sensing area of about 1m and it can be increased depending on the type of application.

## III. SYSTEM MODEL

The 3D scanner system can be divided into two parts

- i) Embedded System
- ii) Digital image processing.

Embedded part consist of hardware components like Microcontroller, Distance measuring sensor, Stepper Motors with turntable to rotate the object and threaded rod to move the sensor in vertical direction

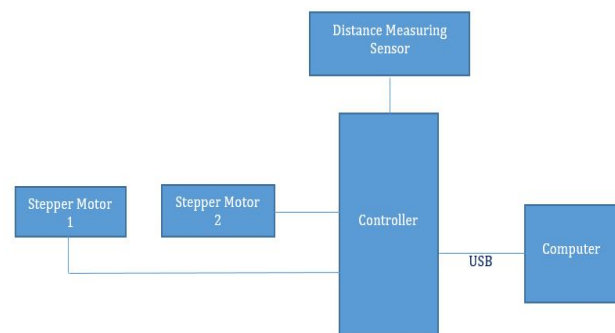


Fig.1:Block Diagram Of 3D Scanner

Distance measuring sensor is reflective type of sensor. It consists of IR transmitter & receiver .IR transmitter transmits infrared signals and IR receiver receives the IR signals which are reflected by an obstacle. Received waves are converted into voltage by sensor. This sensor output is sent to ADC pin of microcontroller for analog to digital conversion. This digital data is used to plot the 3D image by using digital image processing. Motor drivers are used to control stepper motors.

Motor Drivers consist of H bridge circuit it is electronic circuit that enables a voltage to be applied across a load in either direction. These circuits are often used in robotics and other applications. It allows Stepper motors to run forward or backward. In this system microcontroller acts as brain of system which controls both stepper motors, convert voltage sensor values into digital and send this data to PC with serial monitor by using USB.

Digital image processing is use of computer algorithms to perform image processing on digital images. It allows a much wider range of algorithms to be applied to the input data and can avoid problems such as the build-up of noise and signal distortion during processing. In this system digital serial values are used to plot 3D image on display by using an algorithm

#### IV. WORKING

3D scanner is a device which examines the real time object. The concept of 3D scanner which measures distance of various portions of objects from particular axis is shown below. In this arrangement object is placed on turn table which is above the stepper motor 1. This motor rotates the object by 360 degree in some number of steps, for every step sensor takes reading. After one complete rotation of an object motor moves sensor upward by one pitch and vertical threaded rod is connected to the axel of stepper motor 2 which provides vertical direction to the sensor. Motor controllers are used to drive motor.

The L297 Stepper Motor Controller is primarily intended for use with an L298N or L293E bridge driver in stepper motor driving applications.

It receives control signals from the system's controller, usually a microcomputer chip, and provides all the necessary drive signals for the power stage. Additionally, it includes two PWM chopper circuits to regulate the current in the motor windings.

With a suitable power actuator the L297 drives two phase bipolar permanent magnet motors, four phase unipolar permanent magnet motors and four phase variable reluctance motors. Moreover, it handles normal, wave drive and half step drive modes.

In this way the setup of two stepper motor works .

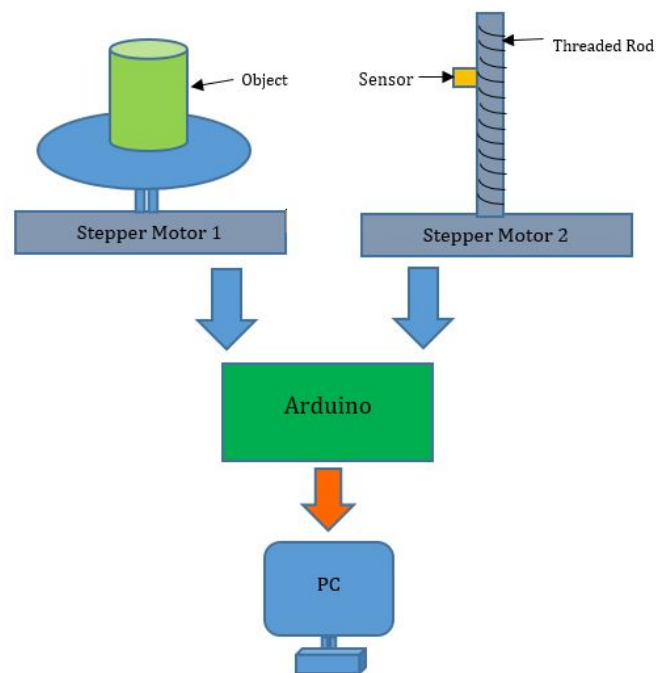


Fig 2: System implementation

Distance measured by the sensor is in the voltage form which is given to ADC pin of the controller to convert voltage into distance all these distance value are pass to the pc by using serial monitor these data will give to MATLAB for plotting of 3D object .The microcontroller is programmed by an embedded C in such way that the data sensed by an distance sensor at each point of step is in voltage form which is converted into digital form by ADC this data send serially by microcontroller. The data of serial monitor is given to MATLAB for plotting 3D object. In this way the set-up is work.

For construct the 3D image of the object we are going use MATLAB software. the data which are serially transmitted by the controller are stored as a matrix and are plotted by using 3D algorithm. This process takes place with very high speed as the data is transmitted continuously and image is constructed as soon as the data is received by the MATLAB software. In case of interrupt occurs in between we have to restart the scanning process. The stepper motor rotates at a fixed angle and rotates till 360 degree for each n degree rotation the sensors obtain distance variation and sends

continuously to the controller and on the other hand both the sensors will also initiate movement to obtain various points of the image and thus to make the plotted image accurate and relevant.

## V. RESULTS AND DISCUSSION

The following figure 3, shows the 3 D image of cylinder in MATLAB .Result of this paper is to build an effective 3D scanner in low cost. This type of 3D scanner can be used for 3D printing and various future applications. By using low cost sensor and Arduino controller we can build low cost 3 D scanner which is able to produce accurate shape of an object.

The cost of this product is very low as compared to the other available market product and cost required for manufacturing is also low. Hence for small scale industry, this product is more beneficial

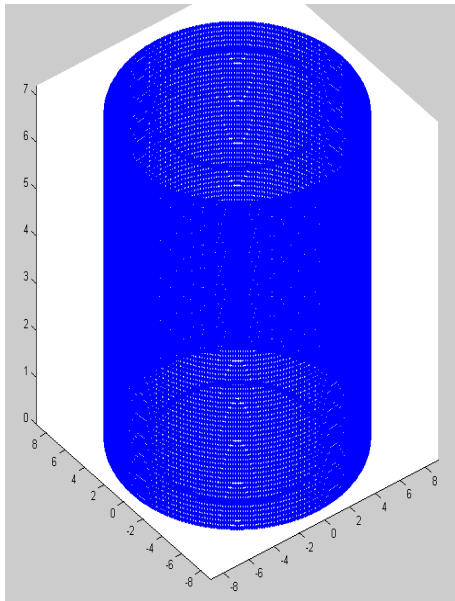


Fig. 3 – Output of MATLAB

## VI. CONCLUSION

3D laser scanning equipment senses the shape of an object and collects data that defines the location of the object's outer surface. This distinct technology has found applications in many industries including discrete and process manufacturing, utilities, construction, archaeology, law enforcement, government, and entertainment. The main advantage of system is low cost components. This system has wide range of applications.

## VII. ADVANTAGES

- 1) Quickly capture all of the physical measurements of any physical object
  - 2) Save time in design work
  - 3) Capture engineering optimizations inherent in manufactured parts
  - 4) Utilize modern manufacturing on parts that were originally manufactured before CAD
- Compare “as-designed” model to “as-built” condition of manufactured parts

## VIII. APPLICATIONS

- 1) **Hollywood movie makers and video game animators** regularly use 3D scanning and 3Dprinting for characters and special effects.
- 2) **Hospitals and dental labs** use these types scanning devices to create digital models body parts and teeth in order to make perfectly fitting prosthetics and dentures.
- 3) **Museums and galleries** use 3D scanners to make replicas of everything from artifacts and statures to dinosaurs.
- 4) **Architects and Designers** can avoid spatial conflicts when remodelling anything from factories and schools to houses and bridges by using a laser scanner to scan and plot the existing construction, then creating a Building Information Model (BIM) to remodel virtually.
- 5) **Aerospace engineers** can scan anything from large wing pieces to small bolts in order to retrofit parts or improve future designs
- 6) **Automobile customizers** use 3D scanning to scan the existing part of a car that they want to customize, ensuring that the customization piece will fit seamlessly.
- 7) **Jeff Dunham, ventriloquist**, uses 3D scanning and printing to create custom "talking" hot rod, according to an [article](http://www.3Dwrs.org) posted on [www.3Dwrs.org](http://www.3Dwrs.org).
- 8) **Hobbyists of all types** use small, inexpensive “hobby” 3D scanners to make everything from tea cups to robots.
- 9) **Surveyors** use 3D scanning to monitor coastal erosion, slope deterioration, buildings, bridges, power stations, refineries, dams, railway infrastructure, topography and more, depending upon what they’re surveying. If it’s solid...they can scan it.
- 10) **Forensics analysts**, whether they are recreating a crime scene or a crash site, 3D scanning helps them determine what happened.

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