SIXTH SENSE ROBOT FOR THE COLLECTION OF BASIC LAND SURVEY DATA

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Abstract— *The manual surveying of land and plots is a tedious and tiring job, especially in India, where we use the same technology that has been used for decades. Although there have been improvements in the equipments, but the main idea or the working principle remains the same. Current methods of manual land survey are labour intensive, time consuming, demand skilled labour and a lot of high - priced hardware equipment. A sixth sense robot in most cases are an efficient solution. They can be used to obtain basic land survey data such as measurement of length of plot, altitude difference between certain parts of the plot and temperature-pressure measurement of the surrounding area. In this paper we present a novel sixth sense robot, that is controlled by object recognition algorithm instead of remote control to reduce the learning curve for control of robot. To reduce labour force and minimize hardware components, sensors would be placed on the robot body, to extract accurate and repeatable results. Sensors used are ones that are available in abundance, therefore significantly reducing the overall cost of the robot. The data gathered by the robot can be viewed in real time, hence reducing time for conduction of the process.*

Keywords—Arduiono Uno, Object recognition, sensors, land surveying, sixth sense robot

I. INTRODUCTION

Surveying or land surveying is the technique, profession, art, and science of determining the terrestrial or three-dimensional positions of points and the distances. A land surveying professional is called a land surveyor. These points are usually on the surface of the Earth, and they are often used to establish maps and boundaries for ownership, locations, such as the designed positions of structural components for construction or the surface location of subsurface features, or other purposes required by government or civil law, such as property sales. Surveying works with elements of geometry, physics, engineering, programming languages, and the law. Surveying has been an element in the development of the human environment since the beginning of recorded history. The planning and execution of most forms of construction require it. It is also used in transport, communications, mapping, and the definition of legal boundaries for land ownership, and is an important tool for research in many other scientific disciplines.

Techniques for Basic Land Surveying:

- Distance measurement
- Levelling (Height measurement)
- Basic surrounding environmental data(Temperature/Pressure)

Possible Errors when Conduction of Surveying:

- Gross errors or blunders: Errors made by the surveyor during the survey.
- Systematic: Errors that follow a consistent pattern. Examples include effects of temperature on a chain or EDM measurement.
- Random: Random errors are small unavoidable fluctuations.

Importance of Land Surveying:

Surveying is important and most of us depend on it so as to ensure order in the physical world around us. Surveyors play an integral role in land development, from the planning and design of land subdivisions through to the final construction of roads, utilities and landscaping.

The planning and design of all Civil Engineering projects such as construction of highways, bridges, tunnels, dams etc. are based upon surveying measurements. Moreover, during execution, project of any magnitude is constructed along the lines and points established by surveying.

II. LITERATURE SURVEY

IMAGE RECOGNITION INVOLVED IN CONTROL OF SYSTEM

Image recognition, in the context of machine vision, is the ability of software to identify objects, places, people, writing and actions in images. Computers can use machine vision technologies in combination with a camera and artificial intelligence software to achieve image recognition. Image recognition is used to perform a large number of machine- based visual tasks, such as

- Labelling the content of images with meta-tags.
- Performing image content search and,
- Guiding autonomous robots, self-driving cars and accident avoidance systems.

A camera feeds image data into a sensing device that is connected to a computer. Once the object has been interpreted, the computer executes the command correlated it.

It is essential to use a convenient interface that is natural for humans. The design of the interface must consider ergonomic aspects and must not hinder the work of the operator. The interface has to be unambiguous for both the robot and human operator.

A) **Kadnar Snehal, Deshmukh K, et al. [1], Image Grabbing by using Sixth Sense Technology**-paper appears in International Journal of Engineering Research & Technology(IJERT)in the year 2014 focused on-In image grabbing by using sixth sense technologies we convert the real world into digital world

B) **Siddharth S. Rautaray, Anupam Agrawal [2]- Real Time Gesture Recognition System for Interaction in Dynamic Environment**-paper appears in science direct. The development of user interfaces influences the changes in the Human-Computer Interaction (HCI).

C) **Shilpa Choudhary [3]- Sixth Sense Technology in Image Processing**-paper is published in International Research Journal of Engineering and Technology (IRJET) on 2019.

D) **Aakanksha Chopra, Natasha Narang[4]-A Study on-The Sixth Sense Technology and Its Various Security Threats.** Paper published in International Journal of Information & Computation Technology on 2014. This paper focuses on and makes us aware with the sixth sense technology which provides an integration of the digital world with the real world.

BUILDING THE ROBOT

A robot is a machine, especially one programmable by a computer capable of carrying out a complex series of actions automatically. Robots can be guided by an external control device or the control may be embedded within. Robots may be constructed on the lines of human form, but most robots are machines designed to perform a task with no regard to their aesthetics.

Modern robots can be of types:

- Mobile robot
- Industrial robots(manipulating)
- Educational (interactive) robots
- Modular robot
- Collaborative robots
- Service robot

A) **Leo Louis [5]- The working principle of an Arduino and Using it as a tool for Study and Research.** Paper published in International Journal of Control, Automation, Communication and Systems (IJCACS) on 2016. This paper explores the working principle and applications of an Arduino board.

B) **MHA Hamid, AH Adom et al. [6]- Navigation of Mobile Robot Using Global Positioning System (GPS)**, published in Signal Processing & its Applications. CSPA 2009. 5th International Colloquium, April 2009. This project shows that the mobile robot navigation using GPS module can be built using combination of RC truck between GPS and sonar sensor.

C) **D. B. Kadam, Y. B. Patil, et al. [7]- Arduino Based Moving Radar System.** Paper published in International Journal of Innovative Studies in Sciences and Engineering Technology (IJISSET),2017.

D) **Parneet Dhillon, Dr. Harsh Sadawarti [8]- A Review Paper on ZigBee (IEEE 802.15.4) Standard.** International Journal of Engineering Research & Technology (IJERT), 2014.

III. OBJECTIVES

A sixth sense robot controlled using image recognition algorithms for the collection of basic land survey data such as measurement of length of plot, altitude differences in certain parts of the plot, and temperature-pressure measurement of the surrounding area.

a) Sixth sense robot for the reduction of hardware components such as external controller and to reduce overall cost of conduction of basic land surveying.

b) Measurement of length of plot using sensor components such as GPS module.

c) *Measurement of altitude differences on the land to be surveyed can also be achieved using a pressure sensor module.*

d) *Additional environmental data can also be obtained using sensor module i.e. temperature and pressure measurements for determining environmental conditions of the land.*

IV. PROBLEM DEFINITION

- *Labour intensive methods:* We require a minimum of 3 to 4 able bodies that have to be present at the survey site at all times.
- *Need of skilled labour:* Experienced labourers are required to handle the equipments and the data that is collected has to be precise, with humans there comes a chance of unpredictability in the accuracy of measurements being taken.
- *High cost of equipment:* The equipments that are currently used are expensive.
- *Use of many hardware components for survey:* Along with the high number of skilled professionals that need to be present, there is also a need for lot of specific equipments such as, tripods, tapes, engineers chain, level staff, measuring pole. They are also fragile and need to be handled with a lot of care
- *Time consuming process:* Lot of time is spent in setting up the equipments with its fixtures making sure the equipments have no zero errors or reading errors.

And for a large plot of land where the survey has to be divided into portions, it is impractical to carry these equipments all around

V. MOTIVATION

Image processing is a growing field with many uses and it is important to obtain knowledge of it for the further growth of academic knowledge. Uses of image processing are many such as, to reduce the use of extra hardware and reduce the learning curve for controlling a robot. Most land surveying does not mandate the use of extensive calculations and equipment. Therefore, there is a need for a cheap and optimized system for conduction of basic land surveying

VI. PROPOSED SOLUTION

- Use of sixth sense robot to minimize hardware components and reduce learning curve for control of robot.
- Use of sensor components to obtain basic land surveying data and to reduce need of skilled labour to operate specific equipment currently used in land surveying.
- Using easily accessible components reduces the overall cost of device used.
- Using a robot to obtain real time values reduces the time for overall conduction of process.

VII. PROPOSED FLOW CHART

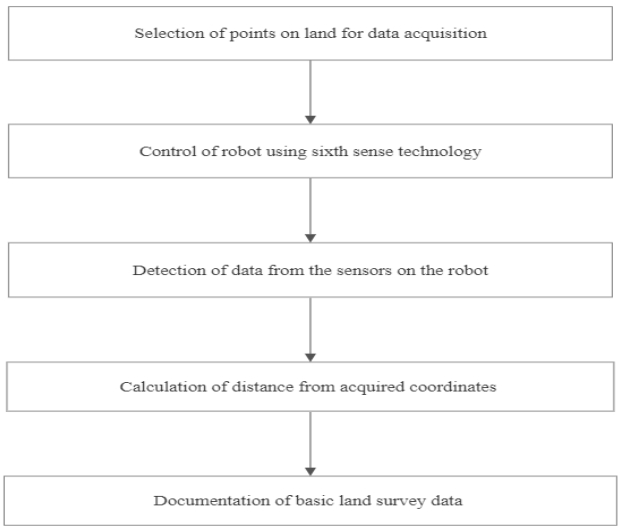


Fig.1 – Flow Chart of Procedure

As is shown above the above flow chart. The steps involved in getting the basic land survey data include- selection of points on land, controlling the robot, acquiring data by the sensors and documenting it.

VIII. METHODOLOGY

Hardware Setup

Using Arduino board and python programming for the control of robot using object recognition. Initially the required materials and equipment's are taken then design layout of chassis is made to eradicate the inaccuracy of the measurement by the robot. Hence required program is created by using Arduino Uno software and then the created code is then transmitted to the Arduino Uno board. This code is only used for movement of the robot. The code for Image Processing is written in Python, which can detect the motion of a coloured object in the video and accordingly move the robot in that direction. The required driver(motor) is connected to the Arduino to the respective pins given for Arduino.

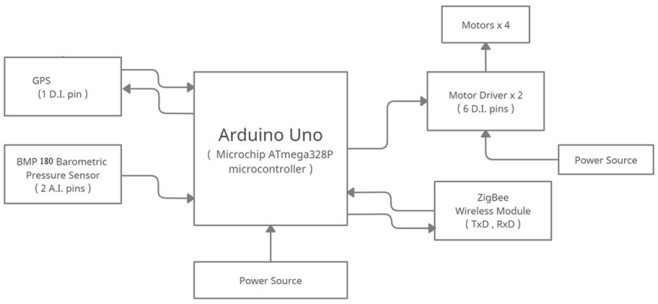


Fig.2 – Block Diagram for Arduino Connections

Robot Movement	Right Motor Movement	RM (+)	RM (-)	Left Motor Movement	LM (+)	LM (-)
Forward	Forward	On	Off	Forward	On	Off
Backward	Reverse	Off	On	Reverse	Off	On
Right	Reverse	Off	On	Forward	On	Off
Left	Forward	On	Off	Reverse	Off	On
Stop	Stop	Off	Off	Stop	Off	Off

Fig.3 – Robot Movement Logic

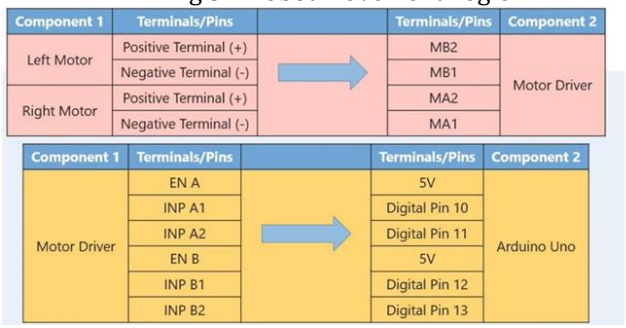


Fig.3 – Robot Connection Schematic

Mobile robots can be equipped with a variety of sensors, enabling the robot to gain some knowledge about its surroundings.

A) BMP180 sensor: BMP180 sensor is designed to measure Barometric Pressure or Atmospheric

pressure. Along with this, it also provides us with temperature readings.

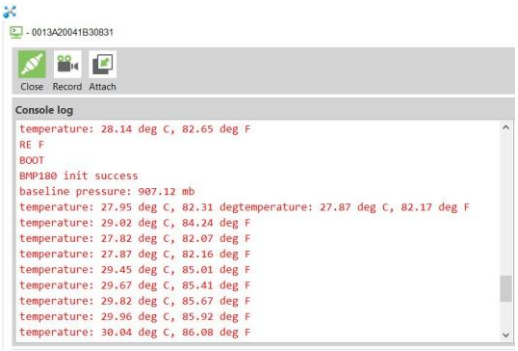


Fig.4 – Readings of BMP180 sensor

B) Ublox Neo GPS-6M: The NEO-6M GPS module is a well-performing complete GPS receiver with a built-in 25 x 25 x 4mm ceramic antenna, which provides a strong satellite search capability. This module gives us the coordinate positional data from which we can calculate distance. It also gives us altitude information.

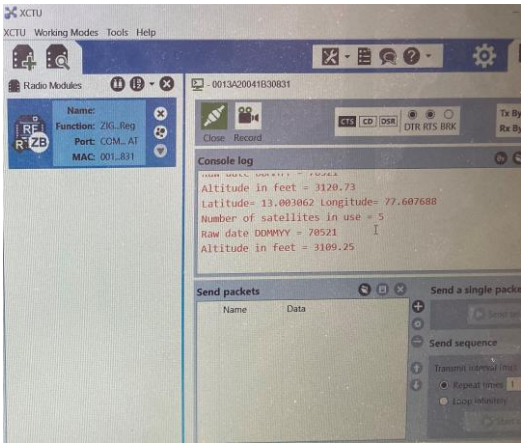


Fig.5 – Readings of GPS module

C) Zigbee Module (XBee module): XBee is a module produced by Digi International mainly use as a radio communication transceiver and receiver. It is mesh communication protocols that sits on top of IEEE 802.15. 4 ZigBee standard. XBee supports peer-to-peer as well as point to multi-point network communications wirelessly with the speed of 250 kbits/s.

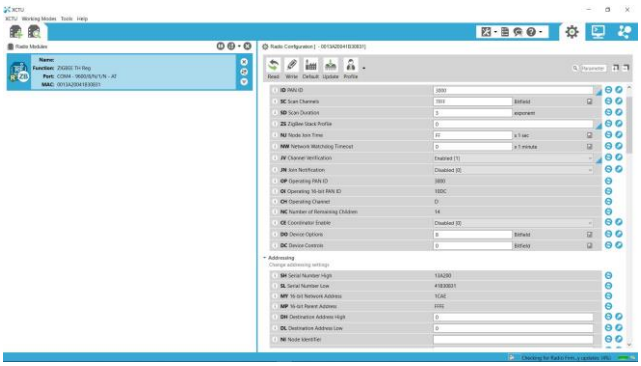


Fig.6 – XCTU software

Software Setup

Software involves the general coding for the integration of sixth sense technology on the robot.

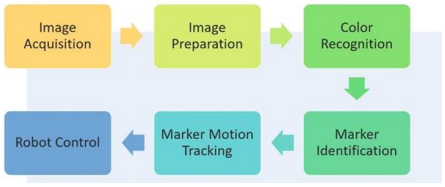


Fig.7 – Basic Sixth Sense Pipeline

Sixth sense technology is a perception of augmented reality concept.
Sixth Sense recognizes the objects around us and displays the information relating to those objects in a real time environment. The Sixth Sense technology allows the user to interact the information through hand gestures. This is a quiet efficient way compared to the text and graphic based user interface.

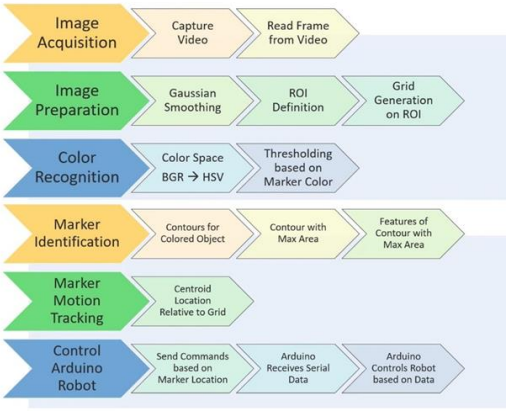


Fig.8 – Detailed Sixth Sense Pipeline

After the robot is created along with the implementation of the sensors, the next task we accomplished was to integrate digital information into the physical world by coding the robot to accept image recognition inputs to turn the basic robot into a sixth sense robot. The programming

language used for this task is python coupled with code used in Arduino IDE.

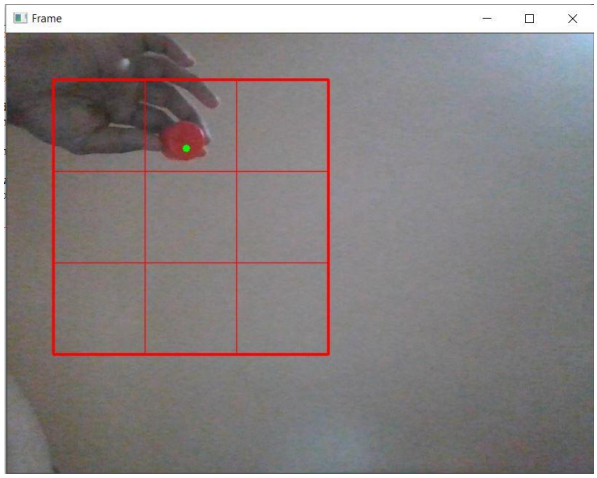


Fig.9 – Camera Input for Gesture and Colour Recognition.

Next, we used CATIA software which is software suite for computer-aided design, computer-aided manufacturing, computer-aided engineering, PLM and 3D to develop the model for the chassis. Dimensions used in the software model were carefully taken in accordance with the initial data acquired from the prototype initially created.

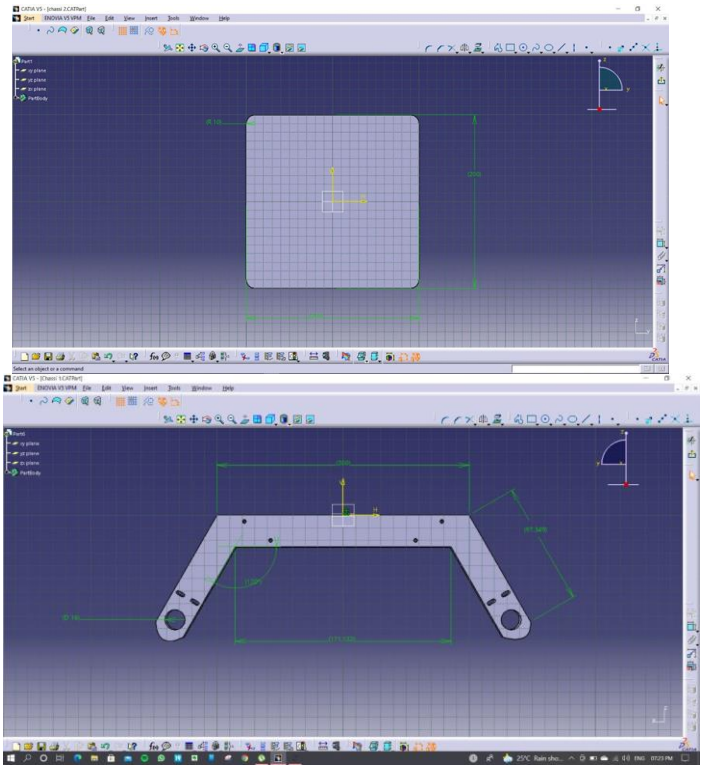
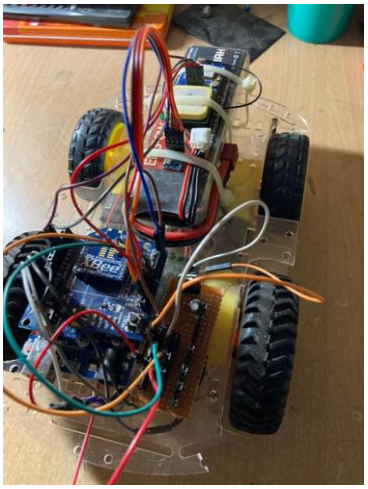


Fig.10 – Model for Robot Chassis

IX. RESULT



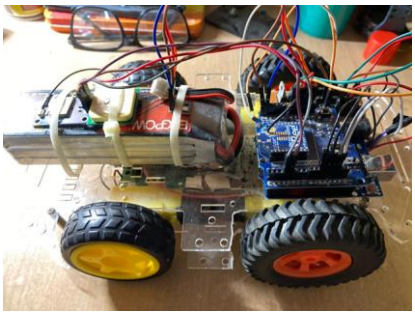


Fig.11 – Picture of robot

The picture above shows the image of the robot along with the different sensors and a centralized power source. The picture presented is of a prototype with a replaceable chassis. The prototype was a means to confirm that the proposed solution was possible to implement.

X. FUTURE SCOPE

With the increasing need to establish maps and boundaries for ownership, locations, such as the designed positions of structural components for construction or the surface location of subsurface features, or other purposes required by government or civil law, such as property sales, there is a significant need to make land surveying techniques more affordable to the lower class. The current techniques used are an inconvenience to a large number of the population base that cannot afford it.

We believe the proposed solution in this paper, when applied on a large scale, can provide a door for implementation of cost efficient methods to survey land for the benefit of future use.

XI. CONCLUSIONS

With the implementation of mechanical components such as the different sensors used incorporated with the capabilities provided by the use of software techniques such as image recognition and sixth sense technology, we can improve the current techniques used for the basics of land surveying.

It is recommended to use the proposed solution where basic land survey data is required for cost effective means and where there is lack of skilled labour available.

Therefore, implementation of cost effective and labour efficient methods for basic land surveying is possible.

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