Automatic E-Surveyor based on NMEA Data

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***Abstract*--We propose a device which is equipped to measure area of a plot using geo location. Such a device will ease the effort in measuring large areas as it's still done by humans which is a time consuming process. The device is equipped with a GPS module, and based on the pre marked coordinates it is possible to calculate the distance between the two points. The GPS Modules like Neo6M/Neo7M are preferred because of its low power consumption.For computing a Raspberry pi is used in the device, which act as the central unit. The readings are displayed in an LCD screen. We can customize the functions of the device using a keyboard as input.**

Index Terms*-- *Raspberry pi, GPS module, geo location, Neo6M/Neo7M

I. INTRODUCTION

Collecting and measuring the information about the area by using global positioning devices help and ease the process of wide arealand surveying.

Automatic e-surveyor relates generally to surveying instrument which having a GPS module and based on the coordinates at any two points it is possible to calculate the distance between those points. The conventional land surveying methods aretime consuming for a wide area surveying. This paper proposes a suitable wide area land surveying device based on NMEA data from GPS module.The National Marine Electronics Association (NMEA) has developed a standard that defines the interface between various marine electronic equipment. The standard specification permits marine electronics to transfer information to computer and to other marine equipment. GPS receiver communication is defined within this specification. Most computer programs understand and expect data to be in NMEA format in the case of real time position information. This surveying instrument uses the global positioning system (GPS) measurement for determining the location of terrestrial site that is not necessarily within a line-of-sight of the surveyor. The device uses a GPS signal antenna which receives geo location and mathematical calculations are done by using Raspberry Pi. GPSmodule like Neo 6M/ Neo 7M which is used having low power module. A Raspberry Pi 3 model b+ which is the central unit that acquires the geo coordinates and programmed the calculation on to the Raspberry Pi to determine the area from the surveyor's location to the selected points. The Raspberry Pi 3 model B+ is the latest product in the Raspberry Pi 3 product range. Python version 3.0 language used to program Raspberry Pi to achieve our needs for this device. The device is a portable device and can be easily attached to any other equipment. It is one of the major advantage of the proposed device.

II. BLOCK DIAGRAM OF THE PROPOSED DEVICE

Raspberry pi is the brain of the device and it acquires information from GPS module and input switches. An LCD display is used to show the readings. Raspberry pi is programmed using the python 3.0 programming language.

The switches are used to customize the device as per our need. LED notifications also there to indicate different actions.

The GPS module acquires the geo location at a point on the press of a button andthe data include the complete PT (position, time) solution computed by the GPS receiver. We could measure the distance between two points by using the geo location at those points. The LCD screen displays the results which are the distances between the points and total area of the plot. The device does not need a line of

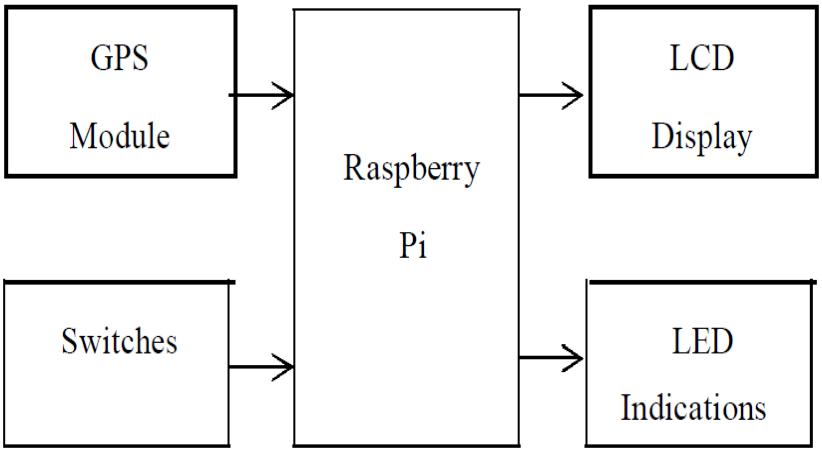

Fig 1: Block Diagram

sight for measuring the distance which is the main advantage.

III. HARDWARE AND SOFTWARE CONFIGURATION&CIRCUIT DIAGRAM

The working of the device is based on the GPS information gathered from GPS module.The basic idea is that the distance between two points on the surface of earth can be found by using the GPS location of the two points. The hardware interface for GPS units is designed to meet the NMEA requirements.The NMEA data from the GPS module can be converted and can be utilized in our system. The device is operated with the help of some buttons. We can customize the device with those buttons to satisfy our need for the particular area and shape of the area. By using the button 1 on the device we could select a predefined definite shape of plot and to confirm the shape button 2 is pressed. Then the third button is pressed for acquiring the GPS location of the current location of the device. Like this we

could find the location of any points on any terrain. The interface speed of the system can be adjusted but the NMEA standard is 4800 b/s with 8 bits of data. All units in an equipment that support NMEA should support this speed.We could find the distance between two GPS location by using the equation given by

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A = sin (dlat/2)**2+cos(lat1)*cos(lat2)*sin(dlon/2)**2
C= 2*atan2 (sqrt(a),sqrt(1-a))
Distance = R*C
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Then using corresponding equations for the selected shape we can calculate the area of the plot. The distance between each pair of points and the total area of the plot are shown one after another respectively. All the calculations are done by Raspberry Pi through python programming it.

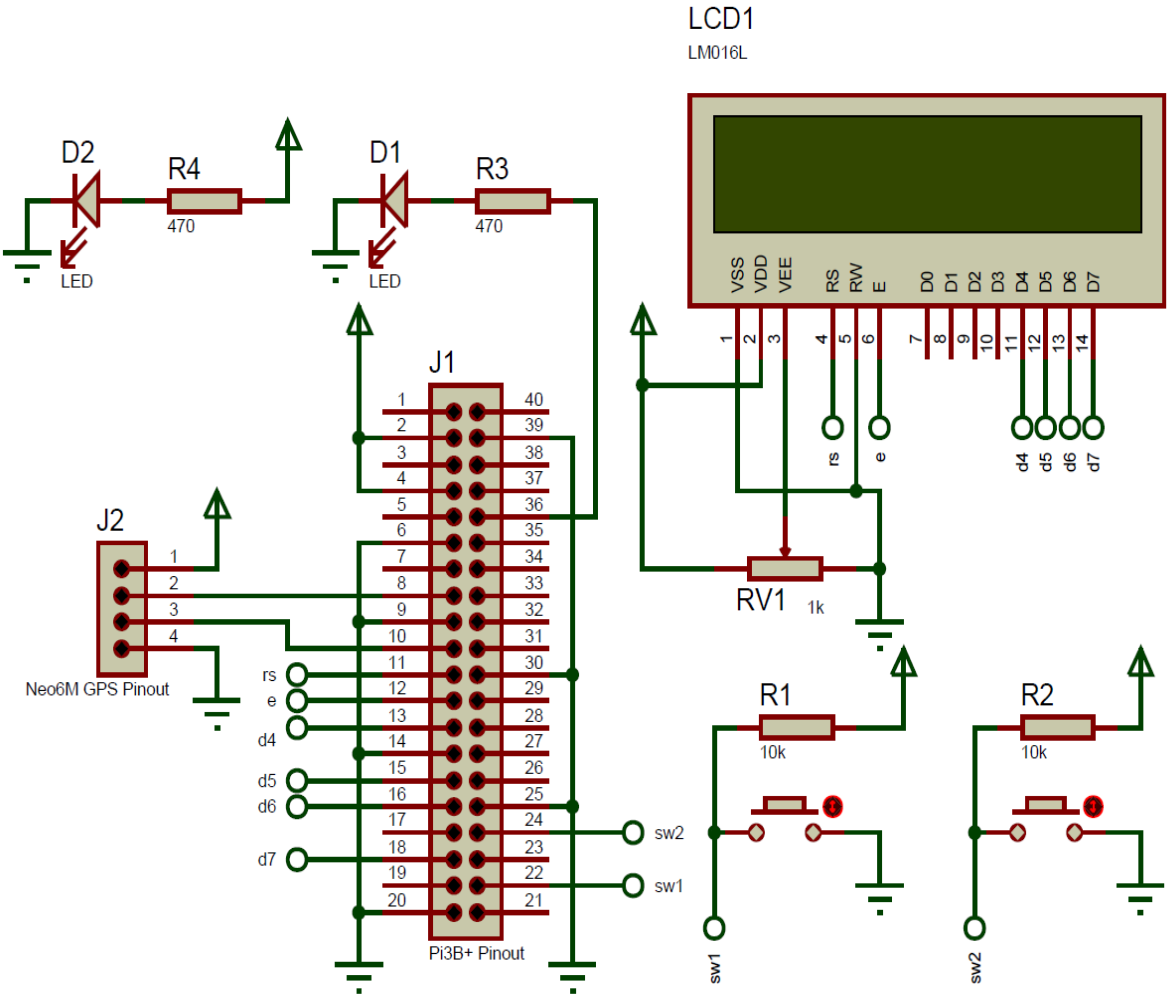

Fig 2: Circuit Diagram

IV. SCOPE OF THE DEVICE

The current and conventional wide area land survey methods are having bulky equipment and are time consuming processes. This would make more difficulties during wide area land surveys on tough difficult terrains like a forest. The original idea of measuring and calculating the distance between two points has been progressively revolutionized by means of NMEA data.

The device can be upgraded by providing a remote controlled rover mechanism for the ease of use in tough terrains or we can

provide a drone mechanism. The device can be attached to any other devices to improve them. By using this device we can avoid the problem of need for line of sight to measure the distance on other devices.

For now we are working on adding barometer and compass module into the device. The barometer gives the sea level at a point on the earth surface based on the atmospheric pressure difference, so that we could calculate the height difference between two locations and also by using this data we could calculate the slope of the plot and also to level the surface (how much soil is needed to remove or add to the plot to make the plot into a level surface). If we add compass module we can do compass survey in which the position of an object is located using angular measurements.

V. CONCLUSION

This paper describes the design and working of a device which can be used to measure the area of a plot by using NMEA data from a GPS module. The programs that acquire real time position information understand and

expect data to be in NMEA format.This device overcome the need for line of sight which is required for other conventional and current methods. The data like position, time solution computed by the receiver antennaand based on the coordinate's data from them it possible to calculate the distance between two coordinates. Raspberry Pi is used for the processing of data and to customize the device to provide the desired result.The results are tested on outdoor conditions and verified.

VI. REFERENCES

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