Self-Contained Localization of Small-Sized Ground Robotic Vehicle

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Abstract- *It is often important to obtain the real-time location of a small-sized ground robotic vehicle when it performs autonomous tasks either indoors or outdoors. We propose and implement LOBOT, a low-cost, self-contained localization system for small-sized ground robotic vehicles.*

LOBOT provides accurate real-time, 3D positions in both indoor and outdoor environments. Unlike other localization schemes, LOBOT does not require external reference facilities, expensive hardware, careful tuning or strict calibration, and is capable of operating under various indoor and outdoor environments.

LOBOT identifies the local relative movement through a set of integrate inexpensive sensors and well corrects the localization drift by infrequent GPS Technology .The controlling becomes easy with wireless technology by graphical user interface is easy to find out various parameter and graph of some parameter.

Keywords- GPS, ARM Processor LPC2138, Power Supply, Sensors.

I. INTRODUCTION

Small-sized ground robotic vehicles have great potential to be deployed in situations that are either uncomfortable for humans or simply too tedious. For example, a robot may become part of industrial operations, or become part of a senior citizen's life, or become a tour guide for an exhibition center. The robot is kept as small as possible to allow access through narrow passageways such as a tunnel.

To fulfill these missions, the robotic vehicle often has to obtain its accurate localization in real time. Considering the difficulty or impossibility in frequent calibration or the management of external facilities, it is desirable to have a self-contained positioning system for the robot: ideally, the localization system should be completely integrated onto the robot instead of requiring external facilities to obtain the position; the system should work indoors and outdoors without any human involvement such as manual calibration or management. Meanwhile, the cost is expected to be as low as possible. Unpleasantness: Robots perform many tasks that are tedious and unpleasant, but necessary, such as welding.

There exist various localization schemes for ground robotic vehicles. These techniques normally utilize GPS, inertial sensors, radio signals, or visual processing. GPS often becomes inoperable in certain environments such as indoors or in wild forests. Additionally, the GPS operations consume power quickly. As an alternative, a localization system may use various waves including electromagnetic waves of various frequency.

II. LITERATURE REVIEW

The first industrial modern robot was the unimates developed by George Devol and Joe Engelberger in the late 50's and early 60's. Engelberger formed unimation and was first to market robot and has been called the father of robotics. Modern industrial arm has increased in capability and performance through controller and language development, improved mechanisms, sensing, and drive systems. In the early to mid 80's the robot industry grew very fast.

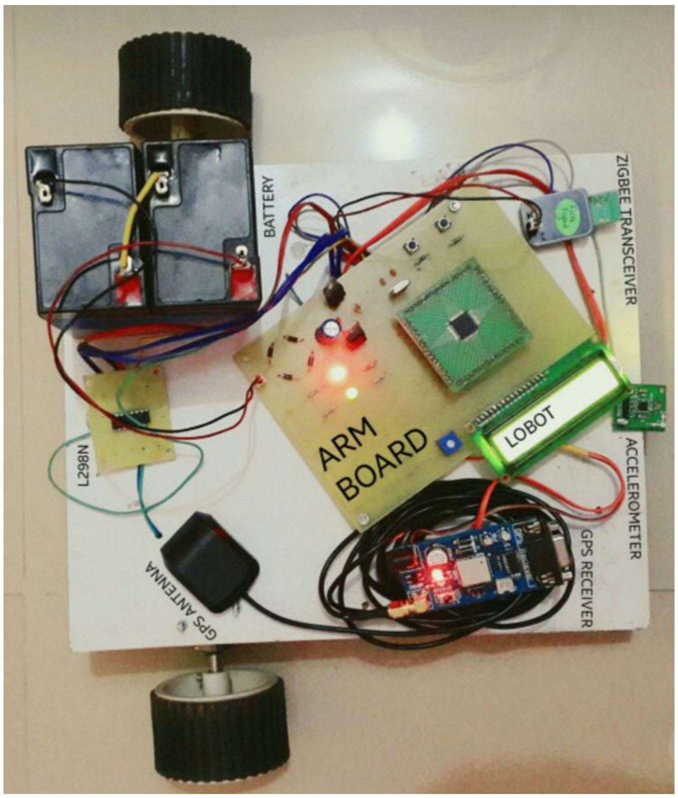
VISION-BASED MOBILE ROBOT LEARNING AND NAVIGATION:

It was developed in 2005. This research develops a vision-based learning mechanism for semi-autonomous mobile robot navigation. Laser-based localization, vision-based object detection and recognition, and route-based navigation techniques for a mobile robot have been integrated. Initially, the robot can localize itself in an indoor environment with its laser range finder. Then, a user can teleoperate the robot and point the objects of interest via a graphical user interface. In addition, the robot can automatically detect potential objects of interest. The objects are automatically recognized by the object recognition system using Neural Networks. If the robot cannot recognize an object, it asks the user to identify it. The user can ask the robot to navigate back autonomously to an object recognized or identified before. The human and robot can interact vocally via an integrated speech recognition and synthesis software component. The completed system has been successfully tested on a Pioneer 3-AT mobile robot .

SEARCH AND RESCUE ROBOT:

This was developed in 2006 the centre for robot assisted search and rescue has developed a search and rescue robot which can be controlled for rescue operations. it edges forward ,climbs over a mound of debris ,then stops. Suddenly the rubber threads shifts from horizontal to vertical, raising the lens into a better advantage point to transmit images .it seems to have a mind of its own, even though every move is guided by a man 10 yards away with a remote control and laptop.

III. SYSTEM DESIGN



IV. OBJECTIVE

To track robot for its position and different effects caused on robot that are displayed on LCD as well as on GUI. We can operate our robot on rough roads and narrow tunnels. Accelerometer sensor senses various impacts on robot.

Following figure shows GUI for Positioning of robot in terms of Latitude and Longitude and as well as impacts on robot sensed by accelerometer sensor.

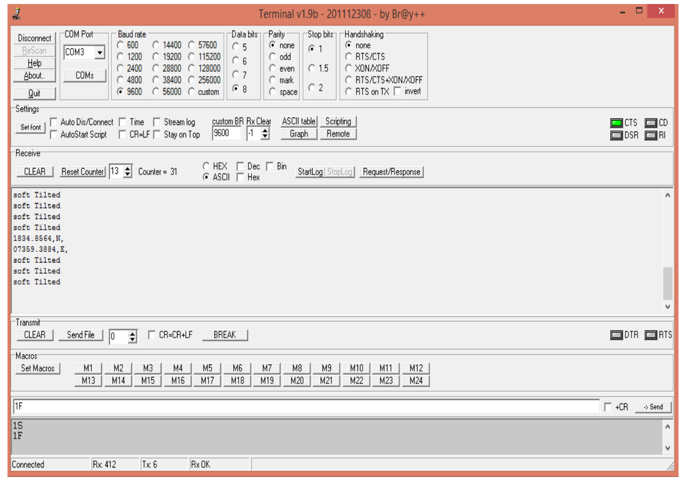


Fig: GUI of Robot

V. BLOCK DIAGRAM

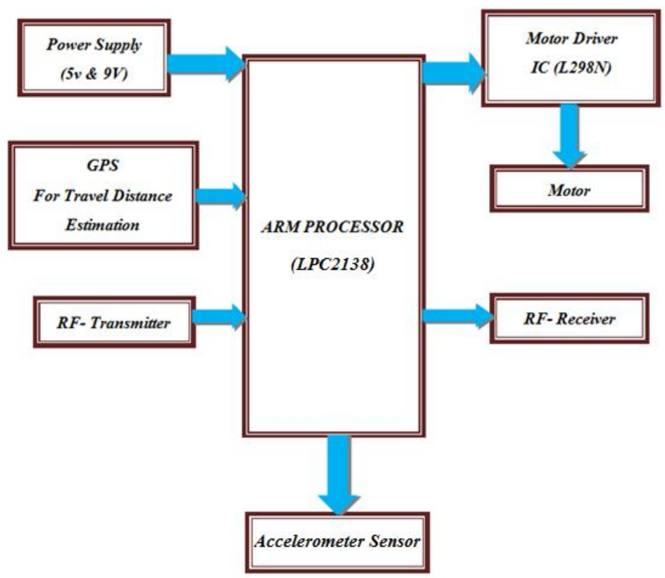


Fig: Block Diagram

VI. POWER SUPPLY DESIGN

The circuit diagram of power supply which gives output of 5V, as only that much is required for microcontroller. Its circuit diagram and designing calculation are given below.

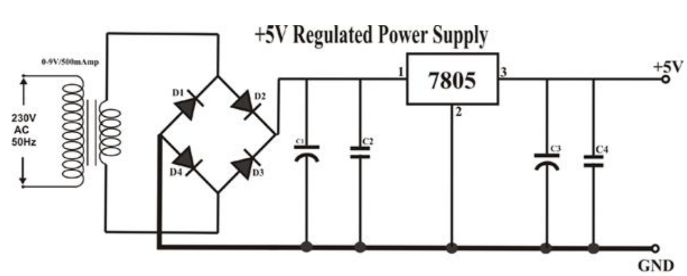


Fig. Regulated Power Supply

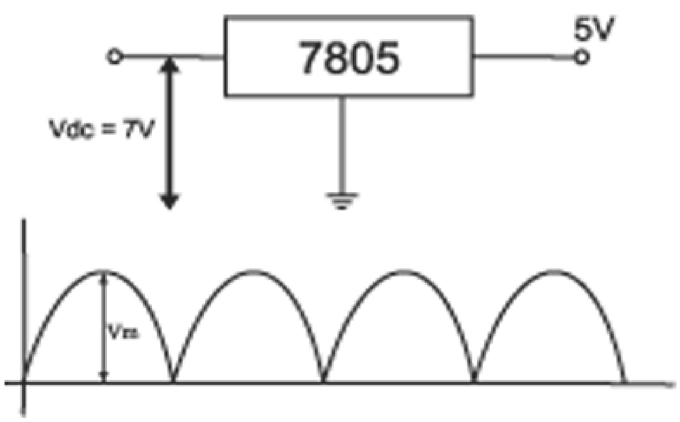
The +5 volt power supply is based on the commercial 7805 voltage regulator IC. This IC contains all the circuitry needed to accept any input voltage from 8 to 18 volts and produce a steady +5 volt output, accurate to within 5% (0.25 volt). It also contains current-limiting circuitry and thermal overload protection, so that the IC won't be damaged in case of excessive load current; it will reduce its output voltage instead.

The advantage of a bridge rectifier is you don't need a centre tap on the secondary of the transformer. A further but significant advantage is that the ripple frequency at the output is twice the line frequency (i.e. 50Hz) and makes filtering somewhat easier.

The use of capacitor c1, c2, c3 and c4 is to make signal ripple free. The two capacitor used before the regulator is to make ac signal ripple free and then later which we are using is for safety, if incase there is a ripple left after regulating, then c3 and c4 will remove it.

POWER SUPPLY COMPONENT DESIGN

Transformer Design:



We require 5V at the o/p of the regulator.

The drop out voltage of the regulator is 2V As per the data sheet)
Vdc = 5+2 = 7V

So at the regulator input, the voltage applied should be of 7V.

According to the formula,
Vdc = 2Vm/Pi

Assuming there is no ripple Capacitor from
Vm= Vdc .pi/2
=7 x 3.14)/2
=10.99V
Vm= 10.99V

During one cycle, two diodes are conducting.Drop out voltage of one diode = 0.7V
Vim = Vm+ 1.4V
=10.99+1.4= 12.39V
Vim=12.39V

Vrms = Vim/sqrt (2)
= 12.39/sqrt (2)
= 8.76V
Vrms = 8.76V

So we select transformer of 9V.
Similarly
Im=Idc x pi/2
Im=400m x 3.14/2
= 628mA.

Irms= Im/sqrt (2)
= 628mA/sqrt (2)
= 444.06mA
Irms = 444.06mA

So we select the transformer of current rating 500mA.

Considering the above transformer rating.

We take the transformer of 0-9V/500mA

TRANSFORMER - 0-9V/500mA Step-down transformer.
RECTIFIER DESIGN:-

PIV of diode = Vm = 12.39V
Im= 628mA

BRIDGE RECTIFIER- So,we select the bridge IC of 1Ampere rating.

ADVANTAGES-

1) The hardware devices LOBOT uses are easily available at low cost.

2) It virtually requires no external devices or external facility management and that it needs no prior information. Unlike other localization schemes such as radio-based solutions, LOBOT does not require external reference facilities, expensive hardware, careful tuning or strict calibration.

3) Additionally, LOBOT applies to both indoor and outdoor environments and realizes satisfactory performance.

VII. CONCLUSION

We propose LOBOT a low-cost, self-contained, accurate localization system for small-sized ground robotic vehicle. It localizes a robotic vehicle with a hybrid approach consisting of infrequent absolute positioning through a GPS. By Bluetooth and RF transceiver it becomes easy for communication and controlling the robot.

We can use Wi-Fi and implement LOBOT in future. Additionally, LOBOT applies to both indoor and outdoor environments and realizes satisfactory performance.

ACKONOWLEGEMENT

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