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Design and Implementation of Unmanned Ground Vehicle

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***Abstract*: As of late, India turn out to be third spot to getting risk of fear mongering everywhere throughout the world. Along these lines, it expands the loss of life of common and military individual. In proposed model of unmanned ground vehicle (UGV) equipped for performing mission in basic condition. UGVs can be utilized for some applications where it might be awkward unsafe, or difficult to have a human administrators present. Our framework can dodge hindrance utilizing PIR sensors, the camera used to catch the RGB shading and shading discovery and examination process done by picture preparing system and raspberry pi. It is utilized to interface and control the sensor hubs. Applied savvy "Self-sufficient" related with a machine signifies "a framework that works with no mediation of individual" thus in the present period greater part of the employments are substituted by robots for playing out various undertakings. The speed and course of the UGV are constrained by DC engine. The primary reason for this framework is SLAM (Simultaneous area and mapping systems). For instance, if green shading is distinguished, the objective of the firearm will be put and the weapon will shoot out. Rather than fire arm, we are utilizing pneumatic cylinder.**

***Keywords*: SLAM, Path Planning, Obstacle Avoidance, UGV**

1. Introduction

There are numerous zones on the planet which can be closed as 4D circumstances for example Dull, Difficult, Dangerous and Dirty thus in such circumstances where people can't include themselves, for example, the combat zone which is both troublesome and risky for military faculty. In such situation the essential point is to secure the information of front line which on the off chance that one can attempt to gain physically will be almost outlandish [1]. In this manner, this issue can be fathomed by structuring and actualizing a robot which will design its way self-sufficiently alongside impediment shirking utilizing synchronous mapping and limitation SLAM [2]. This paper can give better answer for this particular issue dependent on the execution of an UGV configuration working independently on SLAM standard [11]. To additionally talk about the exploration required it is especially important to have an essential thought of mechanical autonomy, joints/connects, its kinematics and elements alongside displaying in a specific casing of reference which will be absolutely founded on sensors [10].

Talking about first the Unmanned Ground Vehicle (UGV) it is a sort of robot; a self-governing framework that plays out a few works credited by human utilizing its acumen ability though unmanned ground vehicle UGV is an independent framework that works at the earth surface and here self-governing methods it will design its way without anyone else's input and identify the obstacles all alone [4]. Partner to this one may see different kinds of robots or self-governing frameworks for example Unmanned Aerial Vehicle UAV and ROV Remotely Operated Vehicles which are explicitly intended for dull, messy, troublesome and hazardous condition [12]. Frequently misguided judgment about self-ruling frameworks is that: whom to call robot and whom to call machine and in such manner one should see beneath referenced solidarity to state or name any framework as a robot:

- To sense the information from its condition.
- To perform work self-sufficiently.
- To associate with person.
- To execute the yield without intercession of person.

A great deal of explores have been done on usage of UGV in various surfaces including level, smooth and harsh territories [2]. In this way, these explorations additionally created by thought of harsh territory surface. Omni-directional alludes to capacity to move in multidirection. The mecanum wheels which were created by Swedish creator, Bengt Iron demonstrated the best application in this exploration. The capacity to decrease frictional powers will deliver higher execution to the robot created [3].

Fig. 1. Unmanned ground vehicle

A. Unmanned ground vehicle

An unmanned ground vehicle (UGV) is a vehicle that works while in contact with the ground and without an installed human nearness. For the most part, the vehicle will have a lot of sensors to watch the earth, and will either independently settle on choices about its conduct or pass the data to a human administrator at an alternate area who will control the vehicle

through teleoperation. In view of its application, unmanned ground vehicle will by and large incorporate the accompanying parts; stage, sensors, control frameworks, direction interface, correspondence connections and frameworks reconciliation highlights.

2. Literature review

One may find many research papers based on computer vision and Lane detection whereas only few of them deal with non-marked paths [1]. This technique is mostly used for autonomous vehicles [2]. Since one is pursuing for designing and implementing the autonomous vehicle which means this vehicle will be equipped with several number of different sensors which will assist the system to deal with gray scale and segmented images [3]. After going through various road recognition algorithms and approaches one may find majority of them are based on edge detection [4] whereas the approaches based on texture and Gabor wavelets are also available [5]. Discussing the technical term of Path Planning; it is the task of searching the basic actions based on a series of sequence that will lead an autonomous robot to reach its final state whereas discussing in context of robotic rovers, many papers will suggest to represent the environment in terms of map and a set of fan ins (sensor inputs) [3]. Many research publications are suggesting various basic electronic components i.e. GPS, velocity meter, thermometer and manometer etc. whereas PIR Sensor and camera has been suggested for recognition of any hurdle [5]. There is typically one on one mapping of images and image arrays so that location or more technically image space occupancy grid locations can be identified [5]. However, the path or image space planning is basically assumed as a function in between autonomous vehicle and image coordinate which can be easily achieved directly if distance value is known. The addition to this, the common assumption in designing this thing is to assume robot is situated on a flat ground [11]. During a detailed research review one may also come across sequenced route representation which uses the relationship between a target image and camera's current captured image to calculate the correlation [10]. Utilizing this technique one may correlate many things i.e. lane markings, prior vehicle tires or sign boards on tracks [13].

Studying about the behavior of one robot it may follow path from Cartesian space along with incorporation of way points conveyed to it from image space paths which yet not achieved and can be sufficiently a good method [14]. Whereas the path planner is also categorized into 2 subsystems i.e. parallel operation and a common feature extraction based system in order to make design faultless [14]. During the literature review many of the papers refer two proposed methods for hierarchical path planning i.e. Image Space Verification of Global Planning IVG and Fast Local Cylindrical Planning FLCP; both are based on Cartesian coordinate system [8]. In few of the papers proposed one may find a technique that evaluates the fixed set of possible trajectories and assuming the presence of any scene i.e. pedestrian footprints etc. In contrast to IVG and FLCP this technique produces less efficient results [15]. This technique can mostly be found in the papers suggested for designing the vehicle robot for military purposes [14]. One may also come across the term of disparity during studying different research pieces; it simply refers to the 1D displacement of corresponding the stereo image pair which is inversely related to the distance of an observed hurdle [13].

In some of the current publications, the major parameters are computed using Radon transformation using central slice theorem [7]. One of the technical terms is Visual odometer which refers to the process of estimating the 3D motion of vehicle [8]. The algorithm defined for the mentioned term is designed basically to identify the features of interest FOI in each camera frame, estimate depth of each feature (typically using stereo), match features across time frames, and then estimate the rigid body transformation that best aligns the features over time. Since then, a great deal of progress has been made in all aspects of visual odometer [6], In such features of Unmanned vehicle which is controlled or handled by SMS or call with the help of GSM network[1].

3. Existing system

The estimating a proper location of the road area from a single road image plays an essential role in autonomous driving systems and driver assistant systems. Since, the Arduino UNO development board ATMEGA 328P microcontroller has been used for the unmanned ground vehicle. Embedded C language implemented for Arduino UNO. In the existing system Spi camera was used and the image were not clear. In this paper they propose a new road area detection method based on texture orientations estimation and vanishing point detection.

This method first estimates a vanishing point using a texture-soft voting algorithm proposed in our recent study. After that, texture orientations and color information are combined in order to generate a histogram for estimating two most dominant road borders. The road area is defined as a region between the two detected road borders and below the estimated vanishing point. The proposed method has been implemented and tested in 1000 road images which contain large variations in color, texture, lighting condition and surrounding environment.

A. Disadvantages of existing system

- Recently cameras output is what they capture and the rest was left to the poor photographer.
- Custom profile or profile conversion software was a must.

4. Methodology

A. Proposed system

The main objective of the paper is path planning and following it accurately by avoiding the obstacles at runtime. In this regard the SLAM technique base UGV will always start

from a fix station and end up to its destination/goal as prescribed by the coordinates. The Suggested hardware components are mentioned.

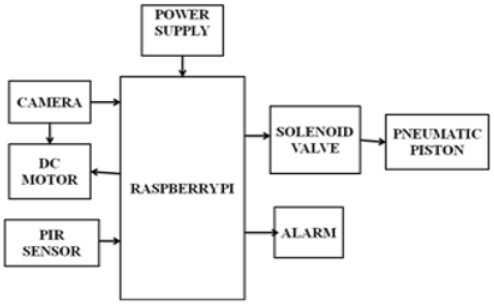

Fig. 1. Block diagram

- Raspberry PI Controller
- Camera
- DC Motor
- PIR Sensor
- Pneumatic piston
- Solenoid valve
- Buzzer
- Power supply

Whenever any input coordinates are provided to UGV it will always follow a specific procedure which is divided into two phases as mentioned below: x Phase A (Planning & Mapping) and x Phase B (Path Following Obstacle Avoidance) Keep Discussing Phase A which assumes that the UGV is at rest and begins its journey from origin applying some specific coordinates x/y; it will generate some distance value through two-point distance formula and this will further feedback to decision maker i.e. raspberry pi controller which will later on compare it with the already fed range and simultaneously the value from ultrasonic sensors will also read the feedback (In case of obstacle only) these both computed values will enable our board which will provide signals for the tracked vehicle and sooner each motor will be driven separately so that UGV may cover some distance. Simply phase A is planning of Path and mapping the computed values so that desired output signal can be generated for the motors in order to be at defined position in frame. Moreover, the second phase is path following and obstacle avoidance which is quite easy if one has programmed the phase A in a good manner. One of the easiest ways suggested here to sense the presence of objects is using ultrasonic sensor HC SR04. Moreover, the HMC5883L is the most common chip for compass capability. This chip module is available at a number of online retailers. The output of this sensor is then feedback to the controller so that the motion of UGV can be optimized accurately.

5. Software

IDLE is Python's integrated development and learning environment. IDLE has the following features:

- Coded in 100% pure python, using the tkinter GUI toolkit
- Cross-platform: works mostly the same on windows, Unix, and macOS
- Python shell window (interactive interpreter) with colorizing of code input, output and error messages.
- Multi-window text editor with multiple undo, python colorizing, smart indent, call tips, auto completion, and other features.
- Search within any window, replace within editor windows and search through multiple files (grep)
- Debugger with persistent breakpoints, stepping and viewing of global and local name spaces.
- Configuration, browsers, and other dialogues.

A. Menus

IDLE has two main window types, the shell window and the editor window. It is possible to have multiple editor windows simultaneously. On windows and Linux, each has its own top menu. Each menu documented below indicates which window type it is associated with. Output windows, such as used for Edit=> Find in files, are a subtype of editor window. They currently have the same top menu but a different default title and context menu. On macOS, there is one application menu. It dynamically changes according to the window currently selected. It has an IDLE menu, some entries described below are moved around to conform to Apple guidelines.

6. Conclusion

Execution of self-ruling way arranging and deterrent shirking utilizing synchronous mapping and confinement SLAM calculation is a significant simple way out for managing 4D's circumstance as referenced. This as well as notwithstanding this it will likewise distinguish an interloper or hindrance and reposition itself so that can be come to at wanted area. The calculation procedure of SLAM gives an esteem included point in recommending this UGV which is one its sort when contrasted with other concentrated research papers referenced and talked about in writing survey. The control of such UGV winds up less demanding if x/y directions can be given remotely which is recommended for future work. The general system and cost of the proposed UGV makes it less demanding to end up a market item as this UGV can be utilized in both in entryway and out entryway conditions.

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