HUMAN ROBOT INTERACTION USING ANDROID AND POINT BUG ALGORITHM

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Abstract: The undertaking that offers with the improvement of a robotic, in a particular board of training bot that is controlled through an android utility. The robotic is constructed in any such manner that it can be controlled each the use of guide keys of a pc and an android software from which the Commands can be transferred to the chassis of the robot the usage of the Bluetooth verbal exchange module. The same may be functional the usage of speech commands on the way to be handed onto the robot the use of the identical procedure. The robot may even behave like a maze the following bot and could continue to maneuver itself in a site or an area that is filled with boundaries without collision into any of them. The impediment avoidance or the maze following will be implemented the usage of the infrared sensors. Sooner or later a line following module is applied in conjunction with the maze following module utilizing integrating fee switch infrared sensors that is also combined with the path locating point Trojan horse set of rules to great the optimum direction from the supply to the target via colliding with the barriers and locating the minimum distance from the source to the target whenever it meets with a collision with any of the barriers. In addition to it the robotic also can be managed the usage of the accelerometer functionalities. The entire assignment is advanced in such a manner that it's far capable of traversing to the target area through avoiding all kinds of boundaries and shifting on an optimized route and main to large results both concerning time and electricity and thereby implementing the modern-day technology as a way to make the device to be controlled using android, Bluetooth, speech and course locating algorithms to introduce intelligence into the manipulate gadget to make suitable selections at a specific instance of time so that the consumer is capable of accomplishing the target place without any sort of interference or assistance from extra aids

IndexTerms: BOT, bug algorithm, Charge Transfer Infrared sensors, IR Sensor, Ultrasonic Sensor.

I. INTRODUCTION

The prevailing world populace scenario is drawing close an increasing faster-growing older society. With the inception of such a circumstance the older humans of the society might be facing a massive quantity of roadblocks in numerous stages in their lives, mobility and relocation being primary trouble. The diverse risks confronted as the outcome of deficiencies related to limb movements and mobility are frequently identified as final results of various nerve-related troubles doubtlessly of a chronic sickness phenomenon. To aid the aging society a potential partial substitute is required which might serve as assistance to the present system composed of nurses and therapists.

Diverse researches associated with the development of potential assistance aids inside the shape of robotic publications or robots are already being explored and sorted which would now not simplest help the elderly category, however, could additionally function a boon for locomotion for the physically challenged human frame system, which typically consists of walker kind robots and numerous sensible manage systems that is an active component of the complete human-robot interaction area.

These robots tend to companion themselves to the solutions to troubles related to the production of complicated and strong programs that complements mobility and locomotion related issues which is an important thing of our everyday lives with better education and mastering talents thereby that specialize in stepped forward performance. The present situation witness amazing progress on this subject in the shape of deployment of robots for ambulatory in addition to assistive robots inside the form of frameworks which can be designed with walker kind architecture or which includes energetic and passive wheels for fixing the problems related to great overall performance or cost-effective implementations.

Moreover the number one challenge of the scientist is to build robotic publications that are prepared with a passive walker type framework to enhance human help which might jeopardize the complete effort mainly due to the following deficiencies within the area related to sizable architecture and operation in indoor surroundings.

Therefore that allows you to beautify a better and higher first-rate of lifestyles and offer an efficient way of countering the above-cited troubles conveniently and compatibility for adding to the existing control systems for assistance an easy robotic guide is being evolved on this challenge which might decorate the overall performance with the minimal expenditure and most functionalities thereby assisting the aged or the bodily challenged person to navigate or move freely in any kind of surroundings quite simply and safety.

II. BACKGROUND AND LITRATURE SURVEY

- **Literature:**

Human-Robot Interaction field primarily is a composite domain of 3 main methodologies which involves design, understanding and, evaluation of robot dependent and designed control systems that can be utilized by humans which gives rise to 2 main categories of the domain based on the type of interaction between the machine and the man as per the following:

- **Remote Interaction:**
In this category7 the man and the robot are not collocated or are not situated in the same time frame or space which makes both the protagonists to operate and control via a medium respectively where the instructions will be passed on and the robot will be carrying out the instructions as per the programmed structure. For example: Mars Rovers has been deployed in space and is remotely controlled by the humans on earth to obtain information from.

- **Proximate Interaction:**
This type of interaction involves both the robot and the human to be located in the same time zone and space. That is both are collocated at the same time and spatial domain. This type of robot is primarily composed of assistive or service robots that are responsible for aiding the humans for locomotion and mobility. For the ease of understandability7 factors like teleoperations, supervisory control and social interaction forms an inevitable pan of remote interactions whereas individual physical interactions that lead to humanitarian assistance in the form of companions or peers form a part of proximate interaction. There have been numerous ongoing researches that have led to significant results and extraordinary products in the field of HRI. Various modeling algorithms7 strategies and autonomous capability dependent algorithms were analyzed by O. Khatib et al that influence HRI.
Similarly7 DO-U-MI was a nursing robot that was developed to assist the patients in a nursing home to move freely in the environment that is equipped with various obstacles on the way by Heun Keun Park et al. Although the project extremely used fill and easy to handle and use7 it lacks in systems like speech recognition and is comprised of manual control as the primary limitation in such a case. A significant achievement has been obtained by R. Rangarajan et al. where they have developed an intelligent robot that can be controlled via an android application and can roam about freely in any type of environment without colliding in any type of environment. The robotic dog also behaves like a watchdog and can charge all by itself in the presence of light which facilitates efficient human-robot interaction. Arpit Saxena et al worked on the development of an Arduino based robot which can also.

- **Drawbacks of current System:**

The Various researches that are being carried out in this domain face a huge amount of roadblocks primarily due to the below-mentioned categories of deficiencies to counter which the project has been developed focusing primarily with three categories:

- **Portability:**
Several kinds of research that are being finished suffer from the trouble of portability due to the excessive architectural sizes which may result in the whole device becoming very cumbersome. The numerous system within the system are clubbed together to shape the whole framework many which may be extensive in size as compared to other components7 as an example laptops are used as a controlling tool to manipulate the robot and sporting it all of them at the same time as at some stage in the operation perhaps arduous and cumbersome.
The mission that has been advanced in this type of manner that it can be deployed in a clever smartphone and a small boot that might be smooth to use and relocate thereby helping in rehabilitation. Moreover no complicated mechanisms are required for its deployment as it can be used in all types of modern devices, whether it is a tablet or be a smartphone that is capable of supporting an android operating system..

- **lack of Speech Recognition System:**
Some of the systems that are being developed lack the speech or voice control system through which they can communicate with the robot. This is indeed a deficiency and needs to be countered while developing any such control system for the ease of use and user-friendliness where the user can simply operate the robot by simply speaking into the phone and the instructions get executed.

- **Lack of route decision system:**
The various systems that are being developed significantly lacks a route decision mechanism where the robot is unable to make certain decisions that might be able to assist it to follow the minimum distance or the shortest route. There are problems related to localization and discovery of the shortest path to the target which makes the entire system inefficient and deficient in case of path planning and deciding on a route map. The system is incapable of determining the position that has been currently allocated to it thereby making it impossible to reach the target location without colliding with any of the obstacles on the way. The current project that has been developed in such a way that it will be able to reach the target by suitably following a particular line which can be clearly differentiated through a particular color which is not the same as the surroundings.

- **Complex operation techniques:**
Some of the systems that were developed require complex operation techniques that is not of much convenience for any naive user in the first go and demands rigorous Human Robot Interaction using Android and Point Bug Algorithm organization can training for the effective and smooth operation of the entire system. Certain assistance robots which are used for aiding the visually impaired users in order to find their way are embedded with braille scripts that enhance the usability of the application in the physically handicapped perspective. However this poses a possible limitation incases of any other user as the user would have to be trained to use such a system thereby creating a roadblock in order to utilize the entire system and leading to potential delay in its smooth operation. In addition to this, the circuits have complex architecture which is difficult to understand and operate leading to the inefficient working mechanisms and operation techniques.

➢ **Presence of dynamic obstacles:**
The occurrence of sudden and dynamic obstacles in the entire workspace or on the way may lead to poor performance of the entire system and this in turn may create a roadblock in terms of leading to collision. Dynamic obstacles are those obstacles which come in the way or the reference frame of the robot without any prior information, for example moving animals, vehicles etc. or any particular object in motion. It is a cumbersome process of detecting those obstacles and eventually avoiding them because they not only are in state of motion but also it is a complex procedure of determining the velocity and in what angle of deviation the system must take in order to avoid such an obstacle with the minimum amount of failure involved.

III. METHODOLOGY

The system that has been developed involves 5 primarily modules for its deployment:

- **Module 1:**
Android application to control a Boebot The first module involves the development of an android application which comprises 10 functional keys and a decision-based button i.e. yes or no. Out of those buttons, 4 are used to set specific directional instructions to the robot which will make the robot move in 4 particular directions namely forward, backward, left and right. It also has keys named ROBOT, SOFT, HOME, TARGET, etc. which is responsible for triggering the robot to the Robotics lab (predefined position), Soft Computing lab, return to the starting point and go into obstacle detection and avoidance mode and finally follow a line to the target and reach the target location without having to collide with any of the obstacles that might be coming on the way or are pre located. The decision button is used as a limit for a continuation of the obstacle detection and avoidance phase which would continue to operate for at least 40 seconds after which the user is requested for permission to continue with the same phase or terminate. The user will feed in the option and eventually the current mode will terminate and finally will lead to the execution of the required mode.

- **Module 2:**
Integration of Voice Recognition with Module The second module involves the integration of speech recognition functionality to the pre-existing functions. To achieve this goal, Google Voice to Text Application programmers interface is being used which would capture the voice input from the user while the user speaks the instructions to the API and the API in return captures the voice and sends it to the Google cloud databases for the exact match. On finding the match, the corresponding converted text is again sent back to the application where the instruction stored is passed to the robot's brain Via Bluetooth and the robot on receiving the instructions would execute them accordingly which are at par with similar functionalities that are performed in the first module wherein the only difference lies in the type of control which involves speech-based control for module 2 as compared to manual control of module 1.

- **Module 3:**
Combination of Obstacle detection and avoidance mode with line following mode this module involves the construction of the mechanism for obstacle detection and avoidance where the Boebot is integrated with Infrared (IR) sensors for obstacle detection and Charge Infrared sensors (QTI) sensors to follow a certain pre-specified path to the target location which is based on color recognition. Initially when this mode is on it will behave like a maze following robot where it will not collide with any obstacles on its workspace and would traverse freely in an obstacle-filled environment without hitting anything on the way. This mode would continue for almost 40 seconds after which the robot would halt for about 4 seconds to get the new response as a continuation phase or a permanent termination instruction upon which the system will return to the manual control mode. Upon hitting the TARGET button in the application the system will be able to generate a combined mode for obstacle detection and avoidance along with the line following mechanism which would enable the robot to follow a black line until the target is achieved and can detect and avoid the obstacles that might be coming in the way. On deviating away from the black line the QTI sensor that is being fitted in the chassis searches for the line by taking a clockwise shift until 3 seconds and then take an anticlockwise shift until 6 seconds i.e. an 1800 rotation is Human-Robot Interaction using Android and Point Bug Algorithm organization can take for searching the same target path. Hence both the circuits work in a combined manner to reach a particular target location without any collision.

➢ **Point Bug Algorithm and its analysis for local path planning:**
Local path planning is being analyzed with a simple bug path planning algorithm called the Point bug algorithm which is a recent design category of the bug algorithms where it is capable of navigating the point of the robot in a plane of unknown environment which is preoccupied with stagnant and stationary obstacles that are of varied shapes and sizes. The fundamental technique of the algorithm is to calculate the succeeding point from a current location in order to reach to a particular location.
The output of the range sensor that is being used is utilized to locate the succeeding point which is primarily the distance from the sensor to the nearest object or obstacle that is available. The sharp change that is observed for increasing and decreasing distance by the reading of output of the range sensor is capable of calculating the ―Sudden change‖ of the distance from the obstacle to the sensor. The distance from infinity to a certain Value or Vice versa can be termed as Ad. The sensor readings for different time intervals i. e. from time interval TN to tn+1 can be termed as the sudden point and is used to determine the Various range of Ad.
A complete rotation of 00 to 3600 is used to survey the entire environment. Initially the robot faces the target and rotates in either left or right direction in order to find any sudden points. While detecting the first sudden point the robot automatically rearranges the previously found statistics of minimum distance as the distance from the current point to the target location which is recorded at definite time intervals.
The readings derived for the 1800 rotations are not taken into consideration as it might result in previously recorded Values.

The robot comes to a halt if there are no readings available even after 3600 rotation as the robot assumes that there are no targets available. The pseudo code of the algorithm is as follows:

While T arget is not reached
If rotation of the robot <=3600
Robot rotates in left or right direction according to
The 11mm position
If a sudden point is observed
If result=1800 rotation then ignore reading//av0iding
Previous point
Else, Get distance from the sudden point to new
Sudden point
Get angle afrobot rotation and move to new point
Record new 11min value
End if
End if
Else
Stop R0b0t//n0 sudden point detected
End if

Algorithm: Point Bug Algorithm and its analysis for local path planning

The algorithm is expected to be having efficient performance even in dynamic environments and has been observed that the lesser number of obstacles the better will be the efficiency. Hence in this way, the shortest route would be generated from the source to the target location.

- **Module 4:**

Integration of the module where the robot will be controlled via accelerometer. In this module, the Boebot will be controlled using the accelerometer where initially in the android interface there will be a checkbox that needs to be clicked to activate the gyro sensors of the android device.
After the activation of the gyro sensors on tilting the phone or the device towards any particular direction the corresponding ASCII codes get transferred to the chassis of the robot and the Boebot would move in that particular direction.

- **Advantages of Proposal System**

1. Data transmit speed is high.
2. It able to go anywhere through GPS.
3. Low cost required.
4. Easy to design and implement.
5. Minimum path finding to reach the destination.
6. No prior training is required as well as manually effort too has been reduced significantly.

- **Expected Result:**

1. After implementing this project we will expect that only authorized person can able to direct the BOT.
2. It will help to go where human are unable to go.
3. The risk related to all things is get reduced due to this BOT.
4. We are able to help the person who is unknown to the new place.

IV. DESIGN AND IMPLEMENTATIO

Data Flow Diagram:

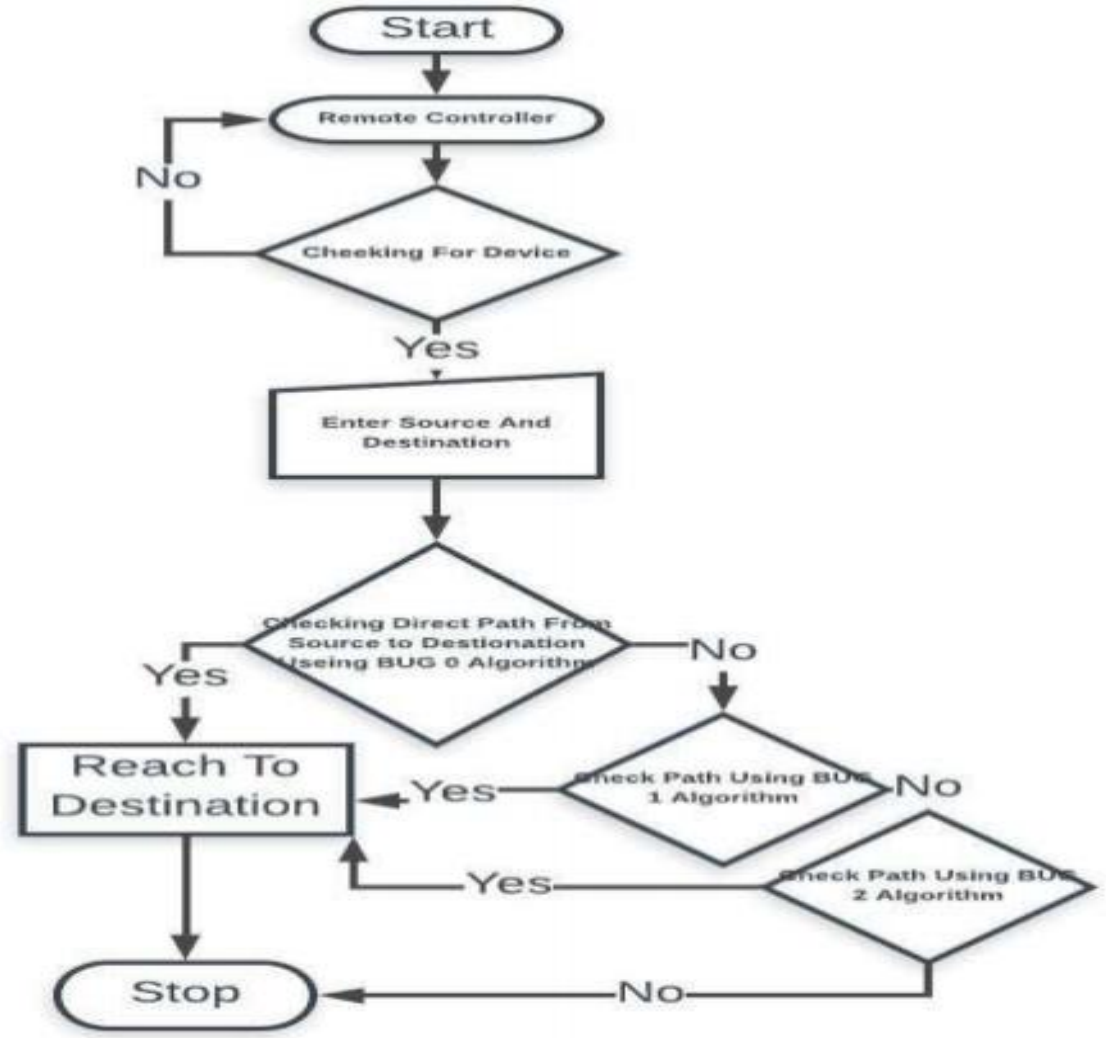

Fig: How System Work

The DFD of the system tell us about when we can guide the BOT at that time the BUG0 algorithm will called and path will find. If an any case the BUG0 algorithm fails to find path at that time automatically the BUG1 algorithm will be called path will find. If any case the BUG1 algorithm fails to find path at that time automatically the BUG1 is called and path will be find.

V. *SUMMARY AND FUTURESCOPE*

This paper is an outcome of the implementation based research work that has been carried out in the Human Robot Interaction domain and can prove to be an efficient mechanism in assisting the aged society as well as physically challenged people to a great extent. Mobility7 locomotion and manoeuvrability becomes a very simple affair when it comes to the working principle of the system that is based on such an efficient and well oriented assistive guides that would incur the involvement of minimum effort as well as matches the requirement of the present world scenario by having advanced and the latest technology for its implementation. The entire application can be used as a day to day utility device as it can be executed on any device that can support an Android operating system. No prior training is required as well as manual effort too has been reduced significantly while using this equipment. It can prove as a boon to the visually impaired up to a partial level as it can be controlled using voice commands as well. It is based on latest technology implementation proving itself to be blessing to make life simpler and hassle free. Future work in the form of optimized mapping algorithms can be introduced in order to improve the efficiency and the performance of the navigation. Extensive work related to luminance affect and ambiguity due to noise during speech recognition process as well as friction related issues can also be carried out to obtain better results. Various optimization techniques related to dynamic obstacles are a potential domain for improvement

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