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Autonomous Multi-Purpose Intra-Logistic Transporter

[1]Deepasundar P, [2]Mohanasundaram P, [3]Agatheeshwarar R

B.E – Mechatronics Engineering
Kongu Engineering College, Erode, Tamil Nadu, India
[1]dsstar@rocketmail.com, [2]shinebeacon@yahoo.com, [3]gatheeshwararrajan@gmail.com

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***Abstract*---- Nowadays, Autonomous carrier vehicles are becoming more predominant for the modern society. Hence designing these vehicles is one of the core fields of automation engineering. In regard to that, our project full-fills an idea of autonomous transportation. This vehicle is a carrier of materials from one place to another place through a fixed lane Path (guide way). It can also act as an easy vehicle for disabled and blind people in their houses. The main carrier consists of a table mounted on four omni-wheeled base which has control unit which guides the direction of the wheels. The carrier has an insert which moves through a guide keyway. Each junction and turning points has proximity sensor which indicates the position of carrier to the controller. The microcontroller is programmed in such a way that it can find the direction that the bot has to move at every junctions. This was programmed by considering the shortest path between the current position and the destination point. The controlled signal is amplified and made to actuate the motor control relays. Carrier bot is operated wirelessly using RF remote which has the position buttons. Those buttons are assigned as the positions. These are the positions that the sensors were built. When we call the bot to a point by pressing the corresponding button it can arrive to that point from any positions and it can autonomously find its way to there and can be sent to any position in a similar way. It can find its applications in a variety of area so as stated as multi-purpose carrier, ranging from hypermarkets to hospitals and libraries to warehouses. In hotels and restaurants it can be employed to serve the food as a servant.**

***Keywords*— Guideways, wireless, autonomous, carrier**

I. INTRODUCTION

The project contains an empirical rule of automation, making its own decision (What-if analysis) in a predetermined manner by microcontroller programming. For instance, if there are six positions in random location, then there will be a corresponding sensor at those positions. These sensors indicate the current position of the carrier and as an input is provided, the signal of each sensor will be automatically generated for the logic of the location to be moved. Here the usage of proximity sensor and keyway for guiding the carrier linearly was made. Hence, a metal rod was placed in the robot for sensing purpose. These play a vital role for movement of carrier in a prescribed method. RF remote was used for the input and the transmission of signals for the transmitter in the robot and the receiver end of the user control. Carrier can be designed in many ways as our wish as it can carry human or a material, luggage.

Fig. 1 Developed Prototype

II. LITERATURE REVIEW

Carriers are being used from olden days for carrying goods without giving full load to the human body. Those have evolved in the modern society which results in the development of many types of carriers ranging from basic two wheeled man pulling carrier to the Airplane. Many evaluations have made for the development in which introduction of IC Engine/Motors created a big trend change. Modern industries were aided with the carriers such as conveyors, overhead cranes, Rails etc,. Usage of conveyors makes the transportation within the building a comfortable and time reducing one. Further, remotely jogged carriers are invented which reduces the physical presence of the operator. Since the modern society is turning towards automation, there grows a necessity for developing a carrier vehicle which gives the end result in an automatic way.

The carrier vehicle design is a very important consideration. Here we have designed a base vehicle on which any type of carrying surface can be attached. This attachment is preferred according to the type of application.

The base is separately identified as four layers carrying layer, controller layer, relay actuator layer and driving motor layer. There are four wheels fitted in the bot which has a peculiar arrangement. Here two motors are fitted with a parallel axis and another two motors are fitted with same arrangement but with axis perpendicular to the axis of other two motors. These four motors are fitted with a special type of wheels to aid frictionless motion called Omniwheels.

III. Design of Bot

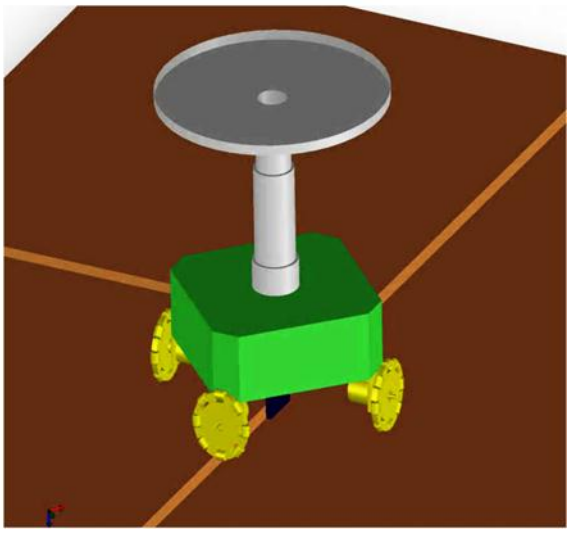

Fig. 2 Pro-e model of the carrier

Fig. 3 Omni wheel

Advantage of using this wheel is that there is no need to turn the base of the carrier to change the direction of the carrier. It aids the efficient use of the bot. The bot is designed to move in a fixed path. This path is defined using keyway. A keyway has to build where the bot has to move. The carrier has an insert which was from the centre of the bot. This insert is inserted into the Keyway and the bot has to move only inside the Keyway. The advantage of using the Keyway is that the bot has to move only in the line of keyway and the bot does not change its path due to external disturbances also. We can assign path with multiple junctions also.

IV. Sensors and Positioning

Here sensors are used for positioning of the carrier bot. Sensing of the presence of bot at a specific junction aids Tue controller to assign the direction to the destination.

Fig. 4 Sensors interface and position

The sensing is done through metal detection. A metal rod is suspended from the bot. To sense this rod, probity sensors are fitted at every junction. The sensors are fitted such in the floor sign that when carrier moves in the junction the rod has to come near sensor. This can be explained as the coordinate position of the rod from the centre of the carrier should me equal to the offset of the sensor from the junction. The sensors are connected to an encoder and then transmitter through RF transmitter. At great other terminal RF signal is reception best and decoded to get the individual sensor states. Each sensor indicates the position. Thesis further used for the autonomous running of bot.

V. Wireless Operating Mode

The method for all the signal transmissions are wireless, hence huge amount of electrical complexity was reduced. The entire project encloses with three major systems subtitled as Relay control, Microcontroller system and the Remote system. Radio Frequency was used as a major source for signal transmission. The remote system has separate buttons by which the user can select the destination position of their own. The RF transmitter sends the signals to the microcontroller where it gets decoded.

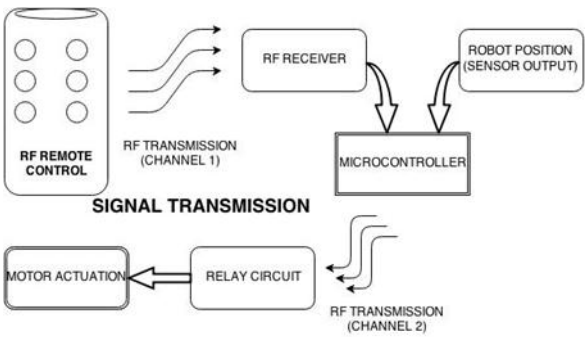

Fig. 5 Block diagram of operation

The decoded signal is used further for processing by the microcontroller. The processed command signal to the carrier vehicle is transmitted with another RF channel. This command signal from the control system enables latch of the relays according to necessary motion of the carrier. Both the RF module works under ASK Frequency of 434 MHz and each of was differentiated by the address pins. By this way the cross matching of signals from the two RF channels are avoided. The second RF channel can be neglected by keeping the microcontroller system in the vehicle itself. For configuring this, advanced positioning sensing systems has to be implemented. The Power source for the carrier vehicle is provided on board which reduces separate power supply lines.

VI. Control of Bot

The carrier is autonomous, which means that the robot can take the control action of its own. For these control actions to take place, it must be pre-programmed according to the path in which it has to operate. The microcontroller is used as a master controller which takes the decision according to the program. The inputs to the controller are the robot position from the sensor and desired position to reach from the user. With these constraints it takes the decision in which direction the motors should be actuated in order to reach the destination. The controlled output signal from the controller is transmitted to the vehicle which will be used to actuate the relay in turn the motor. The motors used here are the DC gear motors. Torque capacity can be chosen according to the desired weight carrying capacity of the carrier.

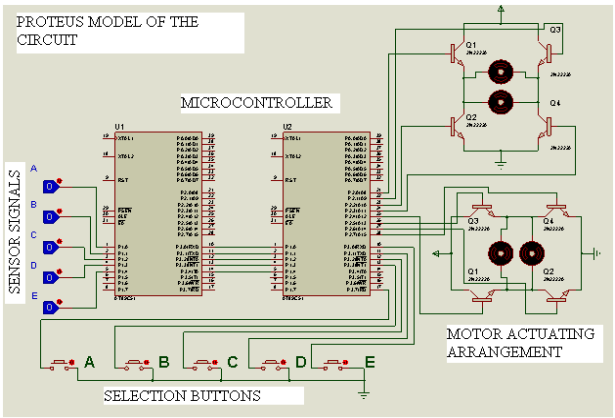

Fig.6 Proteus Model of control circuit

VII. Programming Logic

The Robot is made autonomous by giving the power of taking decision with the required inputs. Those decisions making depends upon the pre-programming done on the microcontroller according to the operating environment. The general programming logic is assigning the motor actuation Fig.7 Prototype path direction according to the selected destination position. As the carrier vehicle arrives at a node, the respective sensor gives out a signal. This signal indicates the position of the carrier at that moment. On receiving the signal the microcontroller will give out a 4 Bit command signal. This command signal was generated for this position initially as the Destination signal was given by the user. As soon as the carrier arrives at that position the command signal for that position to reach the destination will be send to the carrier. Let us take the prototype path as shown in the Fig. and the carrier was initially at A. For instance, let us assume the user gives at a destination position D. The controller receives the signal and gives out the output command. The programming for this prototype path has to be done as follows.

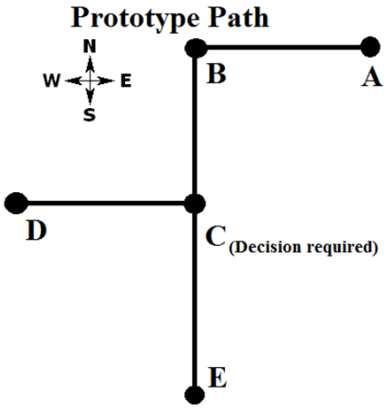

Fig.7 Command signals for prototype path

TABLE 1
Command signals for prototype path

Target	Sensor A	Sensor B	Sensor C	Sensor D	Sensor E
A	STOP	EAST	NORTH	EAST	NORTH
B	WEST	STOP	NORTH	EAST	NORTH
C	WEST	SOUTH	STOP	EAST	NORTH
D	WEST	SOUTH	WEST	STOP	NORTH
E	WEST	SOUTH	SOUTH	EAST	STOP

For this assumption (D as target and A as current position), first WEST command is sent to the carrier. As the carrier reaches B, SOUTH command is sent. After reaching C, WEST command is again sent to direct the carrier to D. When carrier arrives at D, STOP command is sent so as to stop the carrier immediately. By this way the carrier operates autonomously by taking decision. For that we have to teach it initially by doing the programming.

VIII. Areas to be Developed

The proposed model will be a basic for the concept of the autonomous transportation. So, further development is really required for the fulfillment of the comfort. The main area to be modified is the placing of the sensors. For the

replacement, OCR Code readers can be used for tracking the position.

Fig.8 OCR reader and label

For this, software generated OCR labels are pasted on the floor. Each label has unique patterns which represents a single position. Reading of the labels and decoding positions can be done by Image Processing. By using this sensor at each position can be eliminated, no signal transmissions are required and the carrier can be developed as a compact model. This can be taken to the next step by introducing the mapping of the working area and path planning according to the dynamic programming.

IX. Applications

As stated as multipurpose carrier, the application of this system is also a multi-dimensional one. These autonomous systems can be implemented in most of the carrier application. List of some of the applicable areas are stated as follows. The developed model can be used in godowns, where goods handling are made easier by using autonomous systems. In hotel it can be used for carrying food to the tables from the kitchen which eliminated the need of servers. In construction areas, it can be implemented to supply the construction materials to the interior of the building easily. Book handling in libraries and component handling in industries can also be done by this carrier. Household utilization of this robot gives out the easy moving of materials, food, books, clothes etc,. Inside the house. Further development in this area could make a new mode of autonomous delivery of posts, parcels, shipments, etc.

X. Conclusion

The World of transportation is always has some need to be get modernized. Thus the introduction of Robots for transport provides the accurate, safe and less laboured system. It also initiates a new way to artificial intelligence. The BOT of multipurpose can accommodate from the basic applications to particular need of human. It has wider perspective in changing the nature of life to a modern world by transportation. The Working style of was highly sufficient to everyone as it contains the one touch destination. Easy and less time consuming direction change by using multidirectional wheel with innovative arrangement. Reduces the labor requirement in context of less availability provides the rigidity to its daily life incorporation with human.

References

[1] D. Nazzal, A. El-Nashar, *Survey of research in modeling conveyor-based automated material handling systems in wafer fabs*. Simulation Conference, 2007 Winter, 2007 - ieeexplore.ieee.org

[2] Mary Kathryn Thompson, Andrew G. Brooks, Department of Civil Engineering, KAIST, Daejeon, *Considerations for the Design of Automated Urban Transportation Systems*, The Twenty-Third KKCNN Symposium on Civil Engineering November 13–15, 2010, Taipei.

[3] P. J. Egbelu, *The use of non-simulation approaches in estimating vehicle requirements in an automated guided vehicle based transport system*, Material Flow, 1987 - bufaim.boun.edu.tr.

[4] R. Damoto, W. Cheng, S. Hirose, *Holonomic omnidirectional vehicle with new omni-wheel mechanism*, Robotics and Automation, 2001. Proceedings 2001 ICRA. IEEE International Conference on (Volume 1)

[5] http://www.statista.com/statistics/262100/material-handling-market-size-in-selected-countries/

[6] http://www.nbmcw.com/reports/equipment-machinery/18696-trends-and-technologies-in-material-handling-industry.html