

Design and Implementation of Automated Order Picking Smart Trolley

Rishma T¹ and Vandana M²

¹PG Student, Vidya Academy of Science and Technology/ECE, Thrissur, India

Email: rishmat97@gmail.com

²Assistant Professor, Vidya Academy of Science and Technology/ECE, Thrissur, India

Email: vandana.m@vidyaacademy.ac.in

Abstract—Smart trolley is an important Parameter for shopping in many malls or grocery stores. The use of Smart trolley helps us in many ways. The Smart trolley is used to load the goods as well as to load the goods and deliver them to the particular location. This will reduce labour costs and speed up the delivery of orders. Here the Smart trolley is mainly designed for college applications. In educational institutions such as engineering colleges, human interventions are required between different departments to share items such as booklets, exam papers, they need. In common situation, these activities are often performed by human. Due to that condition, items weight and waiting time to be considered on a manual order picking activities. The proposed method deals with these problems and has solutions which includes Infrared (IR) line followers, Ultrasonic sensors, RFID and android application. Here the automated order picking smart trolley collects the ordered items from the storage place by following a line and placing them in the destination. Different departments are identified using RFID technology. The trolley moves on a Pre- marked path determined by the person and detects the objects that comes in its route. The order is received through an Android app called the Trolley App. The Trolley App is designed to allow people from different department users to communicate with each other. The proposed prototype consists of four parts, which includes object detection using ultrasonic sensors, Smart trolley motion using line follower, RFID based different department identification and wireless communication between different department users.

Index Terms— Smart Trolley, Line Follower, RFID, Obstacle detection and Android Mobile Application.

I. INTRODUCTION

The Smart trolleys are currently being used all over the world are simple carrying containers with wheels as extra the added facility. These Smart trolleys do not react in any means to the user and purely serve the purpose of serving carrying the items will to be bought by the person. Here the Smart trolley is mainly designed for College applications. The order picking activities refers to an act of retrieving any ordered items from the storage locations and inserting them with in the needed destinations. In common situation, these activities are often performed by human being. Here the automated order picking Smart trolley collects the ordered items from the Storage location by following a line and placing them in the destination. The smart trolley has a control circuit and can autonomously navigate a pre-marked path without human

intervention. The order picking activities refers to an act of retrieving any ordered items from the storage locations and placing them in the required destinations. Generally, the path is pre-marked and can be either observable like a black line on a white surface with a very high weighted colour. The basic operations of the line follower smart trolley includes capturing the line position with optical sensors mounted at the front end of the trolley, controlling the speed according to the lane condition, and the speed is limited during passing a curve due to the friction of the tire and the floor. Each destination is identified using the RFID technology. Radio Frequency Identification (RFID) is an identification technology that employs radio waves to transfer the identity information stored in RFID tags to RFID readers. The most widely used RFID tag is the passive RFID tag which has no embedded battery but is just powered by the radio waves sent from RFID readers. RFID tags are a type of tracking system that uses 10 digit unique codes in order to identify the different destination. Communication between different departments in colleges can be done very quickly using the android application called the Trolley App. The trolley app is build using the Android Studio software. Android is a mobile operating system developed by Google for mobile phones and other mobile devices. It can run on many different devices from many different users. The android app is developed using android studio software. Android applications must be written in Java programming language. Android Applications cannot be executed using other programming languages. Android Studio is a platform that is needed to build many Android applications, such as the chat app. By using this platform, design, layout and frame work can be incorporated in the application as required. Code can be ,tested, edited and debugged in android studio. The main tools used in android studio are ADB, AVD manager, FlowUP, Vysor.

A. Survey on Existing System

There is a ton of manual activity engaged with the ordinary order picking activities. Human assistance was needed to transfer items from one location to the next location using trolleys in educational institutions. In educational institutions, an app has not yet been developed for different departmental users to communicate with each other and human interventions are required to transfer the items from one location to another location. Conventional order picking process requires manual support for pick and place operations. The weight and size of the items need to be considered when picking up the order manually. The proposed system introduces automated order picking smart trolley. The trolley can carry orders without human interventions and follow the pre-marked line to place orders where needed and automatically detects the destination using RFID technology. It can also reduce the walking time, minimize errors, increase pick rate and reduce labour cost.

B. Proposed System

The line-following order picking smart trolley targets to pursue a route. The path may be as simple as the black line on the floor, direct markers to detect the different specific lines based on IR sensors employed. An efficient automated order picking line follower smart trolley with RFID based room detection is proposed in this paper. The block diagram of the planned system is shown in Fig. 1.

The block diagram of the planned system consists of Adriano mega, IR sensors for line follower, Ultrasonic sensor for obstacle detection, RFID based room detection, Motors for driving the trolley and Android App based wireless communication. The automated order carrying smart trolley is a black line follower which follows the black line. In this Arduino based line follower smart trolley, we have used IR Transmitters and IR receivers. When IR light falls on a black surface, light is fully absorbed and no rays reflected back and then sends the signal to the Arduino mega. Then Arduino mega drives the motor according to the sensor's output. The RFID tags attached to the different departments to be identified. Each tag has its own identification. RFID tags uses 10 digit unique codes in order to identify the departments. RFID reader is attached on to the trolley. Tags contain data and readers detect the tag and process the information from the tags when in particular range. Ultrasonic Sensor senses and calculates the distance of obstacle from the sensor and thereby the trolley gets an information about the absolute position of obstacle or even a moving object. The trolley rings its buzzer when any obstacle is detected on its way. The Android App designed here is named as a Trolley App. By using the android application communication between different department users is possible very quickly. Here the automatic trolley is controlled by a person in the control room, where he receives orders from different departments with the number of packets required by each room. The order is received through the Trolley App with the packet number. The app can be used by the person in control room and owners of the different department users. The main person should only have full access to the trolley and orders. We can see the sent and received messages in real time database and we can view the messages in the database at any time.

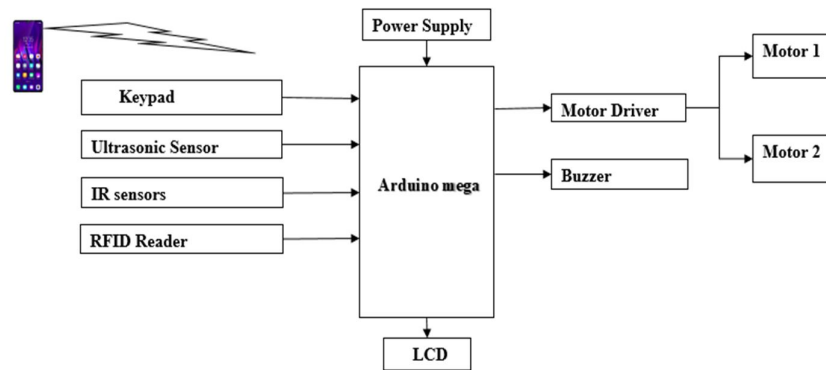


Figure 1. Block diagram of the proposed system

II. RELATED WORKS

The self-driving Emergency Indicating Line Follower with Obstacle Avoiding Robot runs over a specific path with the help of Infrared sensors (IR) and detects the obstacle in the path using the ultrasonic sensor. The robot stops and diverts its path when an obstacle is encountered in its route then tracks back to the original route once the obstacle is overcome [1]. Line follower robot is a type of robot that moves by following a particular line. These robots move by detecting the line in the presence of an IR sensor. These robots have a lot of technical and mechanical issues to move. Also its speed for forwarding and moving on curves is different. TABAR is a line follower robot designed to deal with similar technical and mechanical issues [2]. MRS is a mobile learning platform that enhances class room engagement by creating a responsive platform where students solve problems in an interactive way that communicates solutions directly to their adviser. This is performed through Android based mobile devices, which have interactive activities in which students learn principles of their subject with immediate feedback. This mobile environment is used by the tutor to develop their own interactive activities to be used in the classroom. However, such interactive activities must be developed by AS to be used with MRS. One way to diminish this problem is to allow the MRS to communicate with apps developed by both AI and AS. That way, interactive apps developed by faculty from other disciplines using AI can employ MRS to deploy their activities in the class room. Winston-Salem State University has started developing a Mobile Response System (MRS). MRS is a mobile platform that improves class room engagement by implementing a mobile responsive platform where each students to solve their problems in an interactive way that communicates solutions immediately to their tutor. This is done through Android powered mobile devices. This mobile learning platform is used by the faculty to build their own interactive activities to be used in the classroom [4]. RFID based different location identification can be divided in to 2 category that are tag and reader localization [3].

III. METHODOLOGY

The automated order picking smart trolley consists of Controller, IR sensors, RFID reader and tags, Ultrasonic sensors, Android App based communication platform. The trolley is mainly designed for college application. The automated order picking smart trolley is simple and is very easy to build. By using the android application communication between different department users is possible very quickly. The Android App designed here is named as a Trolley App. A person in the control room can communicate with each other as users in different departments. The trolley is placed in the main room. Once an information is received from Room 1, the trolley follows the line (Line follower – using IR Sensors) from the control room to Room1. 2 IR Sensors are positioned left and right side on the trolley. If the person in control room receives the order through an app, he loads the packets on to the trolley and press the room number of order on the keypad that is attached to the trolley. When the trolley receives the room number, and check the room number is valid or not. If the room number is valid the trolley moves to the required room and if the room number is not valid the LCD displays the invalid room number. The LCD is attached on the trolley for displaying the command. The trolley returns back after waiting there for a defined time to unload. The trolley also detects the objects. The trolley rings its buzzer when any obstacle is detected on its way. RFID technology is used for the different department identification. After unloading the item the trolley turns around and returns to control room.

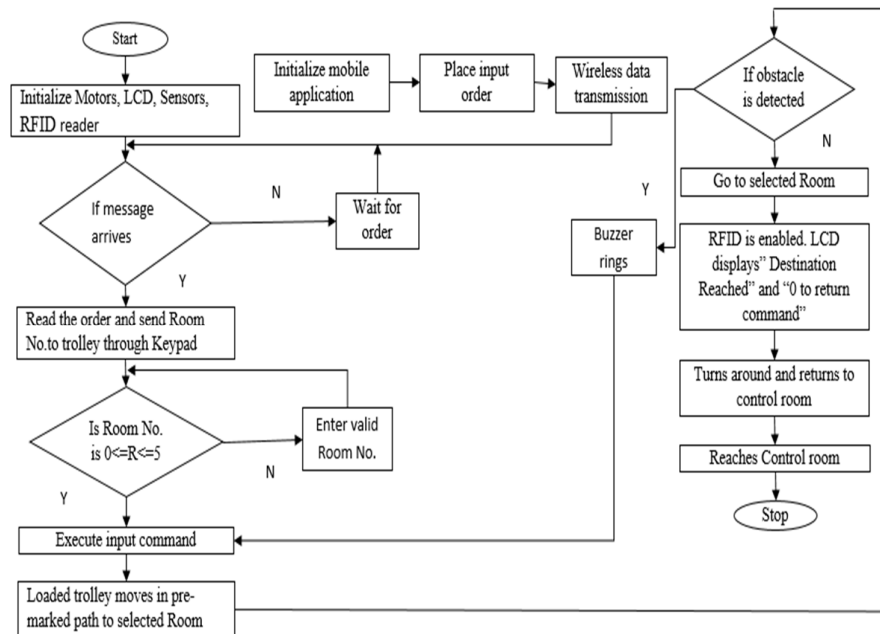


Figure 2. Flow diagram of the proposed system

IV. RESULT AND DISCUSSIONS

The automated order picking smart trolley collects the ordered items from the control room by following a line and placing them in the required destination. The proposed system is based on the line sensors, RFID, obstacle sensor and Android Application based wireless communication. The Trolley App is an Android application built for college purposes to accept orders shown in Fig. 2. The trolley runs over a specific path with the help of Infrared sensors and detects an obstacle in the path using the ultrasonic sensors. Once the ultrasonic detects an obstacle, at a distance less than 15 cm, the trolley rings its buzzer and follows the path specified on the floor. The smart trolley follows the line and easily moves in left, right, forward and backward. We have used two IR sensors namely the left IR sensor and the right IR sensor shown in Fig. 4. The order picking line follower trolley detects a black line by using 2 IR sensors and then transmits the output signal to Arduino. Then Arduino mega drives the motor according to sensor's output. Each destination is identified using RFID technology. The RFID tags with a ten digit unique ID is used to identify each destination. Each destination can be easily identified by the RFID reader attached on the trolley. The android app called Trolley App is a firebase real time database and this app allows you to view messages sent without internet assistance at any time as shown in Fig. 3.



Figure 2. Trolley app home screen

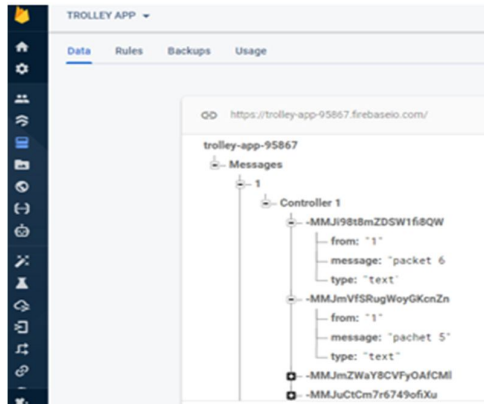


Figure 3. Trolley app firebase

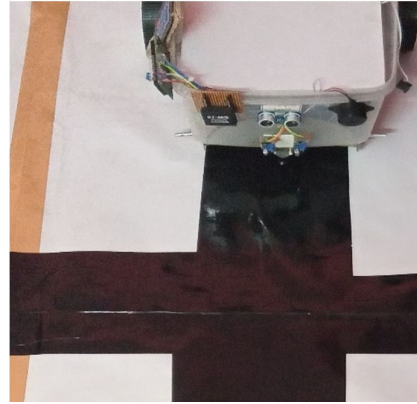


Figure 4. Front view of smart trolley

V. CONCLUSION

The main goal of the developed system was to create an automated order picking smart trolley. The proposed line follower smart trolley comprises of a cost effective and easy to build. The trolley does not deviate from the predefined line, runs perfectly on the path and takes short time to reach the destination. The smart trolley follows the black line precisely and each destination is identified using radio frequency identification method. The Trolley App is an Android application built for college purposes to accept orders that are perfect and accurate.

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REFERENCES

- [1] Prajoona Valsalan and Priyanka Surendran, "Implementation of an Emergency Indicating Line Follower and Obstacle Avoiding Robot," 16th International Multi-Conference on Systems, Signals & Devices (SSD'19), 2019.
- [2] Mehran pakdaman, M. Mehdi Sanaatiyan, and Mahdi Rezaei Ghahroudi, "A Line Follower Robot from design to Implementation: Technical issues and problems," International Conference on Computer and Automation Engineering, 2010.
- [3] T. Sanpechuda and L. Kovavisaruch, "A Review of RFID Localization: Applications and Techniques," in Proc. ECTICON, 2008.
- [4] Fuad M. M. and Deb. D., 2014, "Design and Development of a Mobile Classroom Response System for Interactive Problem Solving," In Proceedings of 26th International Conference on Software Engineering and Knowledge Engineering (SEKE), Vancouver, Canada, July 1-3, 49-52, 2014.