Infobot: An Autonomous System for Offline Shopping

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Abstract: Transfiguring the customer expectation requires a ubiquitous range of precision and speed that conventional approaches can’t meet in real time. Recent technological progress in robotics has resulted in developing information bot which can interact with customers and made products feasible to commoditize. The source of information is the wealthiest thing in the world. As a human being everyone will tend to seek information from various sources. The source of information before a certain period of time were only books but now it has experienced a drastic growth. The proposed project facilitates the role of guide robot to locomote from unit to unit in the shopping mall. In most of the shopping malls and organizations, there is no provision to provide information about certain products that are available in the shopping mall itself. It becomes a tedious process to search for a product in the mall. To overcome the situation, people tend to move for online shopping. In online shopping, there will be lot of disappointment like product misplacement, product damage, product with low quality etc., while purchasing the products. To solve this problem a mini bot is introduced in this project that would provide information about the products. The same concept if introduced in organizations it will be quite easier to collect the information about any person or department. The motivation of the project is to design a movable bot which provides the information in all aspects based on user interaction. Thus, the project elicits a wireless operating bot with fast track product navigation in a continual zealous of incumbent based on direct customer choice.

Keywords: Information bot, Internet of things, Radio Frequency Identification, Bluetooth Module.

1. Introduction
A shopping mall is a systematized plaza where everything is encompassed under the same roof with multiserice units. In a shopping mall people will search for a particular shop for so many hours [1]. It is quite difficult to search for the shop in the mall [2]. The major challenge is to find a particular product people will search for it for hours. This problem may be solved when a bot is introduced for providing the information about the products [3]. It can guide the people to the place where the particular product is available in the mall [4]. Henceforth the information bot entirely ensures a local provision of route map for customers to effective use. The same concept if introduced in organizations it will be quite easier to
collect the information’s about any place or any department halls or classes [5]. The motivation of the project is to design the mobile robot which provides the information in all aspects and guide to the place where people tends to go [6]. The main objective of this project is to encourage offline shopping for the people to choose the quality as well as satisfied products. This paper addresses the challenges in employing a robotic system to an information processing task in the crammed environment. The developed interdisciplinary robotic system inquires separate entities within the organisation and emphasize to look into a wide range or group of products in the respective stores based on the people demands within a short duration of time henceforth the bot identifies consumers’ expectations and resolve queries [5]. The information bot is a autonomous system designed to guide people to their destination by providing instructions to the bot using mobile phone [7]. The direction command has been optimized directly by means of Bluetooth module. Moreover, RFID reader and tags are interfaced with the bot to track and identify the defined path [4]. The proposed work empirically highlighting the information processing task and figure out the vicinity of defined path.

2. Mechanism of Design
A dynamic mobile bot is designed to fulfil the objective of this work. It is designed with flexibility and can easily connected to the customers’ mobile through Bluetooth. The AMR app introduced in the work acts as an interface between the customer and the bot. The commands to the bot can be given through this app. The bot gets the direction command from the people and once obtained, it shows them the path, guiding them down [8]. The bot will follow the white line path, the RFID tag sensor is interfaced with the bot and once the RFID tag is sensed the bot will stop indicating that the destination has been arrived. Separate RFID tags are used for each places and shops. IR sensors has been used to follow the white lines. While guiding if there is any obstacle in the way of the bot the obstacle avoidance technique has also been interpreted in the bot. Once the command for the place is obtained the motor gets actuated and moves to the respective place and it waits for the RFID tag sensor to sense the RFID tags and once it is sensed the motor gets stopped indicating the place where the customer wished to go [9].

The setup is broadly divided into three major parts; one is the mechanical setup involving the chassis and the castor wheel. While the second part is the electrical circuit involving RFID reader, Arduino microcontroller, Motor and Raspberry pi and the third part is Electronic devices involving Sensors like IR sensor, PIR sensor, Wifi module, Bluetooth module. The three parts work with synergy to perform the Guiding operation. Once the Voice command from the phone is sent to the Arduino via Bluetooth module, based on the voice command the Infobot take the necessary actions like following the white line and reaches the user interacted voice command [10].

Advantages
- Provides all types of information about the organization/mall in detail.
- Provides accurate guidance to the place where people needs to go.
- People don’t need to wander searching for their destiny.

2.1 Feasibility Study

2.1.1 Economic Feasibility
The proposed project is economically feasible, as all the components are already available and there is no need of fabricating any components. Only thing is that the program is developed for necessary conditions and so it is well economically feasible.
2.1.2 Operational Feasibility
Since the project possess only a simple addition of additional programming into the controller, there is no big complications involved in operation. As once the command is received the bot will automatically move to the respective places. So there is no need of any skilled person to operate the bot.

2.1.3 Technical Feasibility
The technical part is only that the bot consists of controllers like raspberry pi and Arduino. Any additional components like motion sensor, IR sensor, RFID tag sensor, motor is interfaced to the controllers by means of programming. So that the technical term is quite reduced in the bot. Table 1. clearly depicts the required components and descriptions.

| S No | Components        | Description                                  |
|------|-------------------|----------------------------------------------|
| 1    | DC Motor          | 12V, 50Nm, 300 rpm                           |
| 2    | Micro controller  | ATMEGA 328P(ARDUINO)                         |
| 3    | IR Sensor         | 5V DC                                        |
| 4    | PIR Sensor        | 5V DC, Detect motion                         |
| 5    | AND Gate          | IC 7404 high when two input is high          |
| 6    | Motor Driver      | 5V DC L293D                                  |
| 7    | Raspberry pi      | Model 2 ARMv 7 Multicore processor           |
| 8    | Battery & Power bank | 12V, 1.2aH DC                         |
| 9    | RFID Reader & Tags| 125kHz NFC(RC522)                           |
| 10   | Ultrasonic Sensor | 5V 10cm Range                               |
| 11   | Bluetooth Module  | Hc-05 3.3V                                   |
| 12   | Rubber Wheel      | 7cm dia                                      |

3. Modelling and Experimentation

3.1 CAD Modelling
Designing is the most important stage of any product. This machine is designed using solid works software. Initially the part drawings were made according to the dimension specified and then the parts are assembled as shown in figure 1. The reason for choosing solid works over AutoCAD is the fact that it’s ease with working in the former one. Figure 1. clearly depicts the motors actuation step by step.

Figure 1. CAD Modeling of the BoT
3.2 Electrical and Electronic Section
The electrical section consists of microcontroller circuit, RFID circuit, Raspberry pi circuit, Motor Driver circuit and other peripheral circuit. All the circuits are built on a dot board except the microcontroller circuit which is built using a microcontroller development board. Bluetooth Module receives the voice command from the user via mobile phone is sent to Raspberry pi serially via Arduino USB cable. The voice command that is collected serially by raspberry pi is displayed in the monitor. The real time electrical circuit is shown in the Figure 2.

Figure 2. Electrical parts Assembly

Based on the voice Command the mobile robot follow the white line and guide the people to the place they wanted to go. The motor driver circuit is controlled by both the Arduino and Raspberry pi which stops at the respective place based on the detection of RFID tags by the RFID reader. Each Tag is associated with each room or lab in the organization.

3.3 Mechanical Section
The mechanical section as a whole consists of both mechanical components and electronic components integrated. The mechanical section consists of frame or chassis which forms the base of the prototype on which the electrical and electronics system is placed. The mechanical section consists of 3 wheels in total, 1 ball type castor wheel in the front and two rubber wheels at the rear, the axle of the wheels is attached to the DC motor and is fixed to the frame at the rear end. A DC motor along with wheels acts as a drive system. The breadboard and other connected peripherals are placed on the aluminium frame. And the electronic setup is placed over the frame. The complete fabricated setup is shown in Figure 3.

4. Discussions on Working Operations
The main objective of the Infobot is to guide people to their desired destination within its range. To achieve this the information bot substantially uses a series of sensors and actuators as mentioned. The Bluetooth module is connected to ATMEGA 328 which enables the users to set into motion thereby can countermand when the target is reached. Then can avail instructions to the bot using a mobile phone. RFID reader and tags are used to identify the destiny. The IR sensor enables the bot to follow a predefined path. The PIR sensor was incorporated in the bot to detect motions. When a person connects with the bot using mobile phone and intent their implicit destination the Infobot starts to move in a defined path.
Each destination in the region is marked with a RFID tag, the RFID reader is connected to the bot. When the bot reads the RFID tag of the required destination it perpetually stops allowing the user if the destination has arrived. The bot is intended to move in the designated path until either detects a motion using the PIR sensor or else the system gets turned off. When it senses a motion, it prompts the person who is connected to it using Bluetooth to address his/her destination and as a direct result the bot autonomously reach the appropriate destination. Simultaneously the ultrasonic sensors are used to detect obstacles that come in the way of the bot. The dynamic bot possess a source of user interfaced programming with necessary constraints dumped in the microcontroller comprehend to do the respective operation. Notably the robot utilizes multiple instructions integrated in ATMEGA328 microcontroller. DC motors can be controlled simultaneously in forward and reverse directions by using L293D dual H-bridge motor driver. Ball casters provides specific maneuvering abilities. The proposed work banished the dilemma in selecting destinations and complications in obtaining specific information about products within the organisation. Nevertheless, the information bot ensures a safety harness of feasible way in fulfilling customers expectation and it does not require any skilled person to assess information. The fabricated model details are shown in Figure 4 (a), 4 (b) and 4(c).
5. Conclusion
In this work, the Infobot - A guiding mobile robot is modelled and fabricated which helps the people to search for a particular product in a shopping mall or guide them to find a place or a room where they want to go in an organization or an institution. Investigations were conducted in real time in the institution where the visitors can identify the laboratories to validate the system. This autonomous bot can be employed in places where the people wants to recognize the exact place. Thus, this reduces wastage of time in searching a place or a particular product in a vast area. This mobile robot can be further be improved by incorporating speaker and display to interact with the user through AI technology which will answer the queries asked by the customers. Therefore the proposed system could be considered as an autonomous system which can localize indoors. The design can be improved by making it look like a complete robot which provides information and guide them in an interactive way.

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