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Techpal - A Smart Assistant Robot

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Abstract - *This project presents a sophisticated assistant robot designed to meet various administrative needs within educational institution. The robot handles it without any problems delivery of exam papers, circulars and other documents, increasing the efficiency of administrative tasks. Equipped with the tracking option that the robot uses on board cameras provide real-time monitoring and enhance security measures across the campus of the institute. Inclusion enables automatic control via a mobile application administrator to control the robot remotely for flexibility in their operations. Additionally, the incorporation of line detection technology allows the robot to navigate its surroundings precision, ensuring safe movement without obstacles. This all- a comprehensive solution means a technological leap forward, addressing many aspects of management and security challenges in the educational environment.*

Key Words: Robotics, Real-time monitoring, Line detection technology.

1.INTRODUCTION

The Internet of Things (IoT) refers to the network connected devices that are equipped with sensors, software and other technologies that enable them to collect and exchange data over the Internet. These devices can reach from simple household items to sophisticated industrial ones tools and are designed for communication and interaction each other autonomously, without human intervention. The goal of IoT is to create more connected and efficient world by enabling devices to share information and create intelligent decisions based on the data they collect. IoT devices – also known as “smart objects” – can range from simple "smart home" devices such as smart thermostats wearable devices such as smart watches and RFID-enabled clothing complex industrial machines and transport systems. Technologists even envision entire "smart cities" based on IoT technologies. IoT makes them smart devices to communicate with each other and with each other device with internet connection. Like smartphones and gateways, creating a vast network of interconnected devices that can exchange data and perform various tasks independently.

This can include:

- monitoring environmental conditions in farms
- managing traffic patterns with smart cars and other smart automotive devices
- control of machines and processes in factories
- tracking stocks and shipments in warehouses

The potential applications of the Internet of Things are vast and varied the impact is already being felt across a range of industries, including manufacturing, transport, healthcare, and agriculture. Like the number of devices connected to the Internet. IoT is likely to play an increasingly important role an important role in shaping our world HMI means Human Machine Interface, and as its name suggests, it is a function or a part of a device or system that allows us to interact with that. HMIs are all around us – touchscreens are keyboards all HMI examples!

In an industrial environment, HMIs play a particularly important role with Industry 4.0, or the fourth industrial revolution. In an increasingly digital context, HMIs are becoming irreplaceable as a control plane for industrial operations and equipment on different scales.

2. Literature Survey

Research by ANIKETH GUJARATHI [1] brought that many robots are currently used in industries, homes, military applications, disaster management, etc., all over the world. Advances in robotics have has made life easier for people in many ways and provides with a safer and more efficient alternative to performing tasks which are difficult or time-consuming for humans. Some of the Applications of autonomous robots include cleaning robots like Roomba, delivery robots, autonomous vehicles, and other robots that move freely through physical space without human guidance. To make a robot fully autonomous, the robot must be fully autonomous know your surroundings and must be able to perform actions based on the inputs it receives through various system modules. In order to achieve the status full autonomy, the robot must be able to take information from sensors, perceive surroundings, locate in the world and finally come up with an optimal plan reach your goal. These instructions obtained from the above modules must be integrated by the robot in real time and will be passed to the control node to actually move system in the real world. System piping an autonomous robot.

From ALEXANDER BUCHEGAR [2] Autonomous transport vehicles (ATVs) are designed to operate without the use of a human impact, making them ideal for transport tasks extensive outdoor environments. These vehicles use advanced sensors such as lidar, radar and cameras perceive your surroundings and navigate in complex terrain safe. ATVs can be deployed in a variety of scenarios including agricultural fields, construction sites and industrial complexes, to transport goods and materials effectively. They can follow predefined routes or adapt to a dynamic environment, avoid obstacles and optimize your journeys in real time. In addition, they can be quad bikes integrated with centralized control systems for coordination multiple vehicles, allowing them to collaborate and work together increase overall efficiency. Overall, the quads offer promise solutions for improving transport tasks in large scaling outdoor environments, increasing productivity and reducing the need for human intervention.

By ABRAR[3] During the coronavirus pandemic, using robots to distribute goods can be valuable strategies to minimize the risk of virus transmission. These robots can be equipped with sensors and cameras for navigation indoor and outdoor environments autonomously, he adds goods to customers or places without the need of a person Contact. By reducing human interaction during childbirth the risk of spreading the virus can be significant reduced. Robots can also be used for tasks such as sanitation of surfaces and delivery of medical equipment, further minimize the risk of virus transmission.

Additionally, using bots for distribution can help with maintenance supply chains and ensure that essential goods reach those needed, even in times of blockades and restrictions. Overall, we can say that the use of robots for the distribution of goods during a pandemic can help protect the health and safety of both customers and workers while ensuring efficiency delivery of essentials.

3. Hardware Components

a. Arduino Uno

Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller (MCU) and developed by Arduino.cc and originally released in 2010. The microcontroller board is equipped with sets of digital and analog input/output (I/O) pins that can be interface to various expansion boards (shields) and more circuits. The board has 14 digital I/O pins (6 capable PWM output), 6 analog I/O pins and is programmable with Arduino IDE (Integrated Development Environment), over USB type B cable. It can be powered by a USB cable or a cylindrical connector that accepts voltages between 7 and 20 volts, such as a rectangular 9-volt battery. It has the same microcontroller like Arduino Nano board and the same headers like the Leonardo board. Hardware reference design is distributed under Creative Commons Attribution Share-Alike 2.5 license and is available on Arduino Website. Layout and production files for some versions hardware is also available.

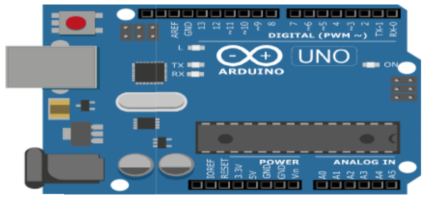


Fig-1 : Arduino Uno

b. Ir Sensor

An IR sensor is a device that uses infrared technology for detection objects or changes in the environment. IR sensors can detect a wide range of physical properties such as temperature, movement and proximity. The IR sensor is an electronic device which detects the IR radiation falling on it. Proximity sensors (used in touchscreen phones and edge-avoiding robots), contrast sensors (used in a number of robot followers) and obstacles counters/sensors (used for counting goods and during break-in alarms) are some applications involving IR sensors.

Fig-2: IR Sensor

c. L293d Motor Driver

A motor driver is an integrated circuit chip that is typically used to control motors in autonomous robots. The motor driver acts as an interface between the Arduino and engines. The most commonly used motor controller The ICs are from the L293 series as L293D, L293NE, etc. These ICs are designed to control 2 DC motors simultaneously.L293D consists of two half H-bridges. H- the bridge is the simplest low signal control circuit rated motor current. We will refer to the engin Driver IC only as L293D. The L293D has 16 pins.

d. Bluetooth Module

The Bluetooth module can be used over a short distance wireless communication, which can be divided into Bluetooth module and Bluetooth voice module according to its use. The Bluetooth module is the basis chipset with integrated Bluetooth functions and which can be used in a wireless network transmission. We used bluetooth in our project module to send data to the bot to achieve its goal destination. The HC-05 has two operating modes, one is data mode in which it can send and receive data from other Bluetooth devices and another is AT Command mode where you can default device settings

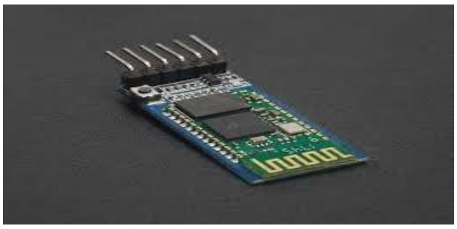


Fig -3: Bluetooth Module

e. Finger Print Module

A fingerprint sensor is one type of sensor used in a fingerprint detection device. These devices they are mainly built into the fingerprint detection module and is used for computer security. Main features this device mainly includes accuracy, better performance, robustness based on an exclusive fingerprint biometric technology. Otherwise, both fingerprint sensors readers are extremely safe and convenient devices for security instead of a secret word. Because the password is easy to scan and also hard to remember. So better use a fingerprint reader or a USB-based scanner biometric software for authentication, identification and authentication that allows your fingerprints to be performed similar to digital passwords. These passwords cannot be forgotten, lost otherwise alienated.

Fig-4: Finger print module

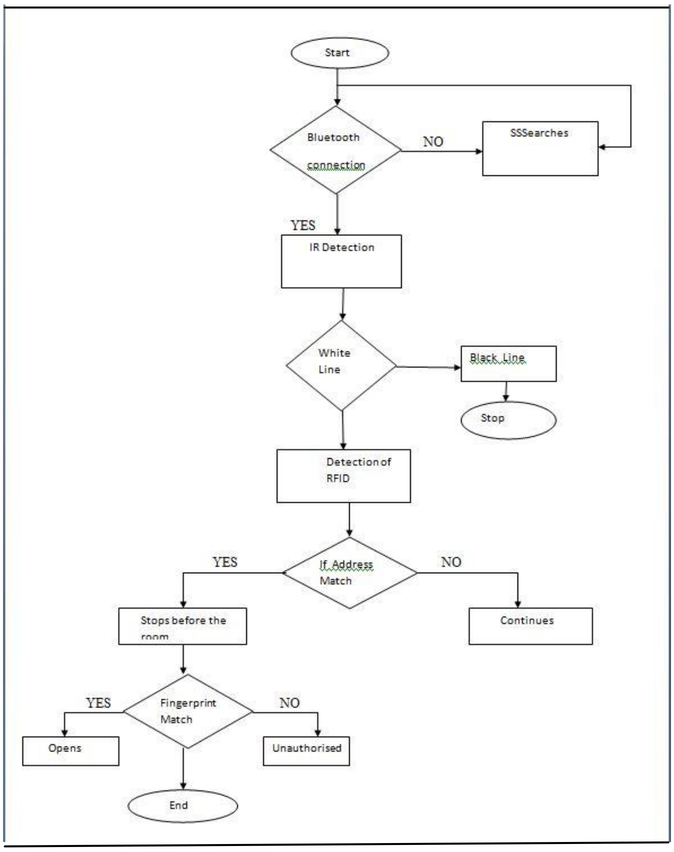
f. Liquid Crystal Display

LCD (Liquid Crystal Display) is a type of flat display which uses liquid crystals.

LCD is its primary form of operation. LEDs have a large a various sets of use cases for consumers and businesses, as they can be commonly found in smartphones, television computer monitors and. LCD instrument panels were large leap in terms of the technology they have replaced, which includes light emitting diodes (LED) and gas-plasma displays. LCD displays allowed displays to be much thinner than cathode ray tubes (CRT) technology. LCDs consume much less power than LED and gas displays because they work on based on the principle of blocking light rather than emitting it. Where LED emits light, liquid crystal in LCD creates image using backlight. As an LCD, they replaced the older ones display technology, LCDs began to be replaced new display technologies such as OLEDs.

Fig- 5: LCD

4. Flow Chart

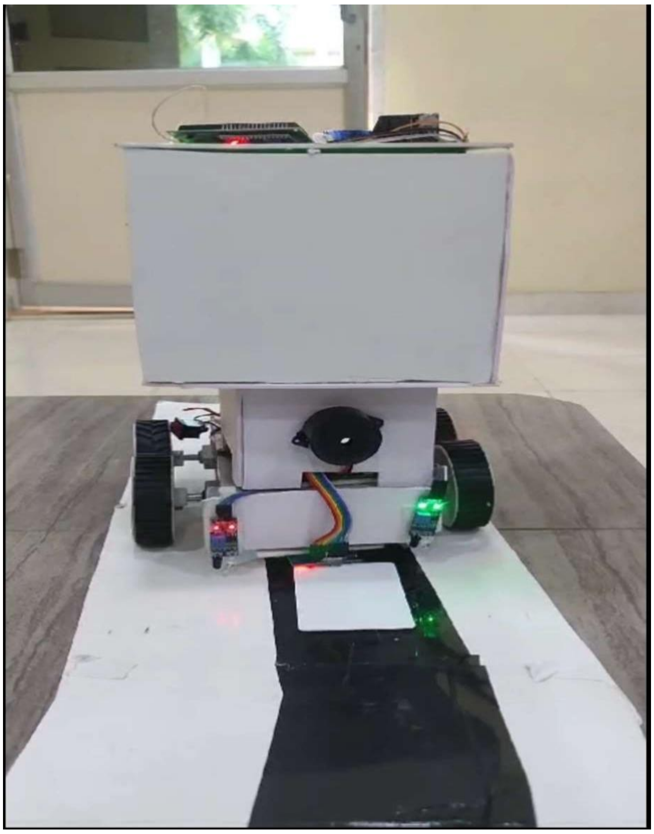


For a line-following robot, an IR sensor detects contrast between the line and its surroundings by emitting infrared radiation light and reflection measurement. This allows the robot precisely follow a pre-defined path or line. Sensor it detects changes in reflectivity and helps the robot adapt to it direction accordingly to stay on track. In the following line robot, IR sensors serve as eyes of the system, detection contrast between the line and its surroundings These are configured in an array across the width of the robot sensors emit infrared light onto the surface and measure intensity of reflected light. Calibration ensures their sensitivity is fine-tuned for line-to-line resolution and non-linear regions exactly. To mitigate the consequences ambient light, sensors can use filters or modulated IR signals. Sensor feedback is essential for robot control system that adjusts the speed and direction of the robot on sensor data. Algorithms involving feedback mechanisms such as proportional or PID control fine tune robot movements to stay on course. Additionally, integration with other sensors allows the robot to navigate complex environment while maintaining a precise line following, showcasing adaptability and robustness of these systems.

5. Working

If the left and right infrared sensors are on top of white color, then moves forward. If Right sensor detects black and the left sensor detects none black line, then the robot will turn in the right direction. If left. The sensor detects black and the right sensor does not detects any black line, then the robot turns left direction. If both IR sensors detect the Black line robot movement stops. When we send data to 1 robot goes to room #1 and identifies the rfid tag at room from the RFID reader present in it. The robot stops at room and makes a buzzing sound and a person in the room should be authorized to collect papers. If the fingerprint corresponds to the data present in the fingerprint the module opens the box and the person can pick it up papers and boxes are automatically closed after 2 seconds. After pressing the reset button and entering data 2 to robot, goes to room #2 and process continues.

6. Results



7. Conclusion

Our project, Techpal – a smart assistant robot, handles the delivery of circulars, papers, which it reduces human effort and improves efficiency across educational institutions. And it can work autonomously, which eliminates the need for a constant supervision. All in all, Techpal- Smart Assistant the circular delivery robot represents the cost effective and efficient solution for education Institute.

8. Future Scope

Delivery robots could become more adept navigating complex environments, such as a crowded environment city streets or indoor spaces using advanced sensors and Al algorithms.

Using LORA or Zigbee we can control from long distance too.

For Surveillance we can add ESP32 Cam from which we can follow the movements of the robot mobile and adds more security along with it fingerprint authentication.

9. Acknowledgement

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