

DEVELOPMENT OF MOBILE ROBOT FOR MEASURING DISTANCE

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ABSTRACT

An objects distance can be used for dimensioning or level measurement. By doing some mathematical calculations with the output values, we can also measure the speed, and various other physical dimensions. The device also has applications in the field of robotics.

This project describes the design and development of a measuring tool using a mobile robot. At present, contractors are measuring distances using measuring tape, which has few limitations. This includes using another person to marking flags is one example. The Robot Measuring System is designed to measure distances under multiple conditions such as smooth and rough surfaces. An IR Transmitter and IR Receiver are used as the sensors to measure the distances while a program is installed in the Arduino Uno for reading and data collection.

The system designed here is very useful for huge vehicles like trucks, buses etc. It is aimed to measuring the distance covered by the vehicle through an IR sensor, which is essential for vehicles to measure distance.

A Graphical User Interface (GUI) was created using an Android software so that a smart phone within the Bluetooth range can control the robot's movement. An experiment was conducted to test the reliability in terms of accuracy and precision. In order to obtain the accurate result, robot speed must be adjusted based on the surface.

I.INTRODUCTION

1.1 INTRODUCTION

Distance measurement of an object is required in large number of devices. These devices may be small or large and can be quite simple or complicated. Distance measurement has important applications in automotive and industrial applications.

The distance measurement through sensors is useful in detecting obstacles. It is the distance measurement feature that allowed to imagine about autonomous vehicles and robots. The distance measurement application is also used in telecom to measure the power

in the optical signal by using optical power meters (OPM) and also used in industries for commercial transport vehicles. This uses various kinds of sensors and systems.

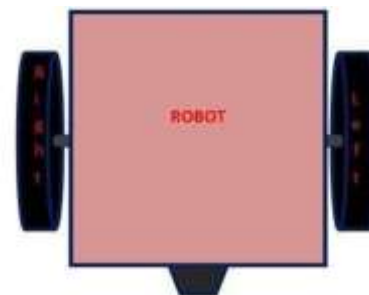


Figure1.1: Distance measurement of mobile robot

In this project we have implemented such a measurement system which uses an IR sensor, Arduino and server motor. IR means of distance measurement is convenient method compared to traditional one using a measurement scale. IR sensors are versatile for the distance measurement and it is quite fast for the common application. The transmitted waves are reflected back from the object and received by the sensor again. This provides for cheapest solution. Any distance measurement application has a sensor circuit and an actuator or display circuit (to perform path change according to the obstacle detection or display the distance reading respectively). In this project we have used IR module to control the robot to demonstrate the project.

1.2 Block diagram:

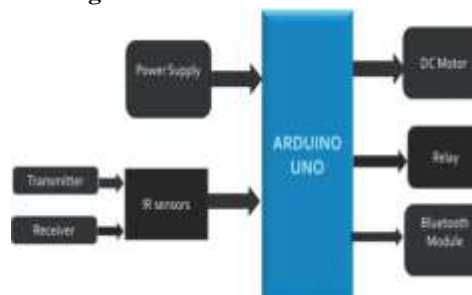


Figure 1.2: Block Diagram of Development of Mobile Robot for Measuring Distance



II. TECHNICAL DESCRIPTION

2.1 Arduino

Arduino Uno is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator (CSTCE16M0V53-R0), a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. You can tinker with your Uno without worrying too much about doing something wrong, in worst case scenario you can replace the chip for a few dollars and start over again.

"Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases.

The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards.

2.2 Bluetooth module

It is used for many applications like wireless headset, game controllers, wireless mouse, wireless keyboard and many more consumer applications. It has range up to <100m which depends upon transmitter and receiver, atmosphere, geographic & urban conditions. It is IEEE 802.15.1 standardized protocol, through which one can build wireless Personal Area Network (PAN).

It uses frequency-hopping spread spectrum (FHSS) radio technology to send data over air. It uses serial communication to communicate with devices. It communicates with microcontroller using serial port (USART). HC-05 is a Bluetooth module which is designed for wireless communication. There are only 4 of the pins required to wire your Bluetooth module, they are VCC (5v), GND, RX and TX. The RX and TX pins are short to the Transmitter and Receiver pins of the microcontroller respectively for serial communication.

2.3 lm567 IC

In simpler terms the IC LM567 IC is a tone decoder chip which is designed basically for recognizing a specified frequency band, and activating the output in response to the detection. Needless to say this chip can be used for a number of different applications, the

most common being in the field of remote controls, and security systems.

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2.3.1 Pinout Working and Specifications

Referring to the ICLM567 internal configuration diagram, the pinout functions of the IC may be understood from the following points. Pin#4 and Pin#7 are the positive (VDD) and the negative (VSS) supply input respectively for the IC.

Pin#3 is the sensing input of the input, which is used for detecting a given phase-locked loop frequency, in other words this pin will lock-on with the matching center frequency which may be set inside the IC through a pair of external RC network.

Pin#5 and 6 are used for creating the center frequency by setting up the values of R1, C1 as required, and this frequency is used by the sensing input pin#3 to lock-in and create a logic zero at pin#8 which is the output pin of the IC.

Pin#8 is normally logic high and becomes logic zero as soon as a matching frequency is detected at pin#3 of the IC.

Pin#1 and pin#2 are used for ensuring proper filtration of the involved frequencies so that the IC does not create any false output due to any existing spurious or stray noise interferences.

2.4 relay

Relay is an electrically operated switch. It consists of a set of input terminals for a single or multiple control signals, and a set of operating contact terminals. The switch may have any number of contacts in multiple contact forms, such as make contacts, break contacts, or combinations thereof.

Relays are used where it is necessary to control a circuit by an independent low-power signal, or where several circuits must be controlled by one signal. Relays were first used in long-distance telegraph circuits as signal repeaters: they refresh the signal coming in from one circuit by transmitting it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations.

The traditional form of a relay uses an electromagnet to close or open the contacts, but other operating principles have been invented, such as in solid-state relays which use semiconductor properties for control without relying on moving parts. Relays with calibrated operating characteristics and sometimes multiple operating coils are used to protect electrical circuits from overload or faults; in modern electric power systems these functions are performed by digital instruments still called protective relays.

2.5 dc motor

A DC motor is any of a class of rotary electrical motors that converts direct current (DC) electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current in part of the motor.

DC motors were the first form of motor widely used, as they could be powered from existing direct-current lighting power distribution systems. A DC motor's speed can be controlled over a wide range, using either a variable supply voltage or by changing the strength of current in its field windings. Small DC motors are used in tools, toys, and appliances. The universal motor can operate on direct current but is a lightweight brushed motor used for portable power tools and appliances. Larger DC motors are currently used in propulsion of electric vehicles, elevator and hoists, and in drives for steel rolling mills. The advent of power electronics has made replacement of DC motors with AC motors possible in many applications.

2.6 IR sensor

IR sensor is an electronic device, that emits the light in order to sense some object of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. Usually, in the infrared spectrum, all the objects radiate some form of thermal.

2.7 flowchart of the project

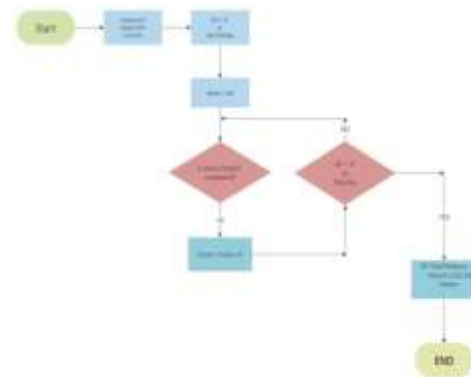


Figure 2.1: Flowchart of Development of Mobile Robot For Measuring Distance

III. CIRCUIT DIAGRAM

3.1 CIRCUIT DIAGRAM

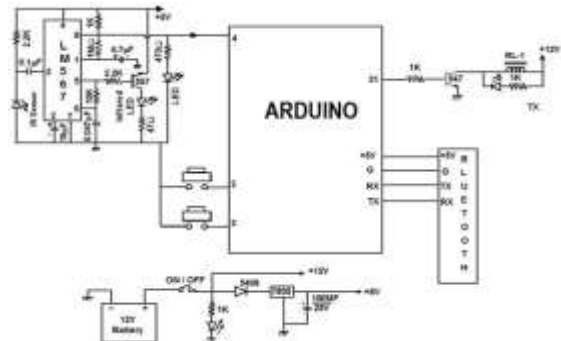


Figure 3.1: Circuit Diagram

3.2 RESULTS

All the objectives of the project had been fulfilled and designed successfully and thus this project is able to design a mobile robot to measure distance. The hardware part includes a DC motor for the rotation of the wheel and movement of the robot, IR sensors for detecting and counting the distances, three wheels robot, On and off switch, Bluetooth module HC-05 and Arduino Uno Module.

The IR Tx and IR Rx LED's will start to count when the wheel is rotated. The distance will depend on how many rotations were completed by the wheel. When the sensor detects black and white LED's, it will count one

centimeter(1cm). After that , the value will convert and display on the mobile screen .

Figure shows the Graphical User Interface (GUI) display in Android smartphone. By using the GUI, user able to control the movement of the robot using Android smartphone within Bluetooth range. There Are two commands to control the mobile robot, one command is to start the robot and another command is to stop the robot.

3.3 PHOTOS



Figure 3.2: Project kit Without Power Supply

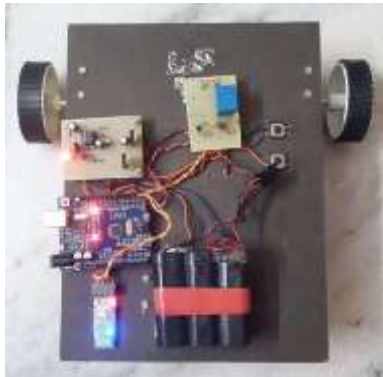


Figure 3.3: Project kit With Power Supply



Figure 3.4: Measured distance displayed on the Bluetooth module on mobile screen

3.4 ADVANTAGES

- 3.4.1 Low Cost
- 3.4.2 Increasing Accuracy
- 3.4.3 Increasing Productivity
- 3.4.4 Modest in size
- 3.4.5 High Repeatability

3.5 DISADVANTAGES

- 3.5.1 It is used for small range of distance
- 3.5.2 Effected by smoke, dust, fog and hard objects like walls and doors

3.6 APPLICATIONS

- 3.6.1 Remote Sensing
- 3.6.2 Odometer Distance
- 3.6.3 Flame Monitors
- 3.6.4 Optical Power Meters
- 3.6.5 Missile guidance
- 3.6.6 Pedometer

IV. CONCLUSION

Now-a-days developments of mobile robot have been popular in research field. Measuring of distance between one point to another point still using conventional measuring method which still using of measuring tape. Conventional measuring tool is produced using a metal strip with straight estimation markings.

This type of measuring tool is often stiff, and require extra manpower or a marking flag to complete the measuring tasks especially for long distances. Our project was focused on the design and development of a measuring tool using a wheel robot. The designed wheel robot is able to improve the existing conventional measuring tool. It capable to measure the distance using and to provide an accurate measurement.

The project work " DEVELOPMENT OF MOBILE ROBOT FOR MEASURING

DISTANCE" has been designed, developed and tested successfully. Through this study, the designed system was tested at different areas. For the demonstration purpose, a prototype module was constructed and the results are found to be satisfactory. Since it is a prototype module, a simple module was constructed, which can be used to measure the distance using Mobile Robot.

4.2 FUTURE SCOPE

The information that is collected by the sensors could be used to measure the accurate distance without errors.



1. We can use humidity sensors in future to measure distance in different environment.

2. Using IR sensor with better specification we can increase the distance measurement range

> Can be improved in terms of range to monitor:

In future we can use this project in several applications by adding additional components to this project. The structure is made strong enough to sustain all possible measurements, though it can be flexible at the same time to adjust wider range of IR sensor.

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