Bluetooth Controlled Metal Detector Spying Robot

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Abstract: In the current period robots play an important role. The purpose of this project is to design a military robot that will detect the enemy. A robot is controlled through Android Application using a Bluetooth module. To detect the status of the robot, the hardware Arduino UNO microcontroller board is used. This microcontroller will sense and control the object. Arduino is very easy to use, and the program is erasable and allows reprogramming from which multifunctional applications can be designed in a robot. Arduino UNO is interfaced with Bluetooth module through UART protocol. An ultrasonic sensor is employed to detect the space of the thing. For example, Bluetooth, Wi-fi and ZigBee innovation to control other gadgets with the help of improved of present-day innovation and Android Smartphone. Bluetooth innovation means to trade information remotely over a short distance utilizing radio wave transmission including highlights to make straightforwardness, insight, and controllability. In this paper we have planned a robot that can be controlled utilizing an application running on an android smartphone, it sends control by means of Bluetooth which is interfaced to the regulator. The regulator can be interfaced to the Bluetooth module however UART convention and shows movements as per the commands received by android application.

Keywords: Ultrasonic sensor, Arduino UNO, Bluetooth, Metal detector sensor, LCD 16*2, DC Motor, IR Obstacle Detection Module.

I. INTRODUCTION

In the technology World Robotics plays a vital role. Robotics is designed for manufacturing work purposes to reduce Manpower efforts. There are many applications of Industrial Robots it includes Assembly, packaging, & labeling, product inspection, etc. Similarly, there are many applications of robots that are designed in different fields for different purposes. In this current period robots are also used in computers to do manual work. Robots are mostly used for military application robot which can provide the following functionality: Design a robot that will help to seek the enemy. The design of the robot is in such a way that will ease the development with low cost and will reduce the complexity. The robot is controlled using an application on android device. This application will communicate with the robot via a Bluetooth module which will be fixed on a robot. Since most robots in use these days square measure designed for specific tasks, our goal is to someday build universal robots that square measure versatile enough to try to just about something an individual's will and a lot of. humanoid may be a software stack for mobile devices that features associate in operation system and key applications. Humanoid applications give access to a good vary of helpful libraries and tools which will be accustomed build wealthy applications. Humanoid conjointly includes a full set of tools that has developers with high productivity and deep insight into their applications. Bluetooth may be a technology with associate open normal specification for a frequency (RF)- based short vary property technology that changes the face of computing and wireless communication. The data received by the Blue-tooth module from humanoid sensible phone is fed as input to the controller. Thereby, the controller acts accordingly on the DC motors to maneuver within the entire golem all told the four directions victimization the humanoid phone.

II. LITERATURE SURVEY

After numerous surveys of paper, some of the papers were relevant and convenient to design a robot. The following papers show the application of different technologies: Namita Shinde [1] has developed mobile remote control Robocar design. This paper shows an Android application for controlling the robot via Bluetooth. The DC motor is used for variable speed drives. Wireless connection technologies such as WI-FI, WLANs, Bluetooth. Among this technology, Bluetooth is used in this project which will be connected to the motors and other components of the robot. This application is developed in the software Android studio. RC module is the important working unit of these projects which comprises of Arduino chips, two motor drivers, and a Bluetooth module connected to the circuit Manish Korde [2] In this paper the aim to design a project is to develop a robot that will help to detect the enemy. The

main target is on the latest technology of android. The design of the project includes Arduino UNO which will act like a robot. The commands that are received by the Bluetooth module will give the commands to the microcontroller. This work is done using the command according to the code. A wireless camera is used that can record video, click images provide constant video of the laptop via radio AV receiver. The sensor is used to transmit the status to the Android Application. At the night the obstacle is detected using light installed in front of the camera. Yusuf Abdullahi Badamasi [3] In this paper the working principle of Arduino is shown Arduino Board is used in which main components on board are described. The components onboard include US plug, External Power Supply, Reset button Microcontroller, Analog pins (0-5), Digital I/O pins, In-circuit Programmer, Digital & Analog ground pins, Power pin. The software Arduino IDE is used to control the hardware. This paper shows how the application is written and sent to Arduino and output results. E Amareswar [4] This paper shows Multi-purpose Military Service Robot to fulfill the needs of the military, the police, and armed forces. It includes multiple functions that can be used by armed forces, for spy purposes, provides information in a Hostage situation. Miguel Molino [5] This paper includes the design of a robot that detects an enemy through an ultrasonic sensor to detect the distance of the object and make decisions about its trajectory. This paper shows Arduino Program that can work with Fritzing to create the PCB model is possible. It is shown that AI basic features can be included in the robot that will become a solution in technological developments which is of low cost and will be beneficial for the industry. Kanchan Kamble [6] Design of military surveillance Robot. In this paper controlling a robot is done using a Raspberry PI 3 Processor. In this application video surveillance and metal, detection is used to detect underground landmines. Priyanka Yadav [7] War Field Spying Robot with Wireless Night Vision Camera is shown to develop robot vehicle using RF technology which is used to detect an obstacle in the war field. Hitesh Patel [8] In this paper robot is designed using a night vision wireless camera that is operated by an android application and the robot is controlled using the platform of MIT app inverter. M-Selvam [9] In this paper the design of the robot shows wireless communication that controls both wireless communication between mobile robot android GUI application. The main task performed is to make a surveillance robot that can control by android technology, which gives flexible operation of the robot controller. Ananya Bhattacharya [10] In this paper development of a robot that includes a metal detector sensor to detect metallic objects using Bluetooth Communication is moved in a particular direction with help of Bluetooth technology and is controlled by a mobile. Wireless communication is done between robot and Android Application.

III. METHODOLOGY

The motive of this methodology is to design a successful architecture and system of a robot that will accomplish all the design requirements. At initial stage we decided to design a spying robot. We studied the background work in this field. While studying on this field we came to know many drawbacks as well as limitations and decided to overcome them. After analyzing the problem, we decided to implement new technology by including the metal and ultrasonic sensors along with the Bluetooth technology. We also decide to implement the advanced smartphone technology by operating the robot via. Android Application. Design of Components are described as follows: Bluetooth Module- Bluetooth module HC-0 is used that will transmit the commands to a microcontroller that are received from the Android Application. Arduino UNO Board- Robot is operated by a microcontroller which is programmed with the help of software i.e. Arduino. When two devices are connected, commands are sent to the Bluetooth module and it transmits the command to the Arduino UNO microcontroller.

Sensor- Sensor is used to detect an obstacle, the buzzer alerts the user by LED which is connected with the sensor.

An Android Application on mobile phone will control the robot by giving the commands. As the mobile phone will act as a remote controller for the robot. A simple block diagram is shown in Figure 1 below.
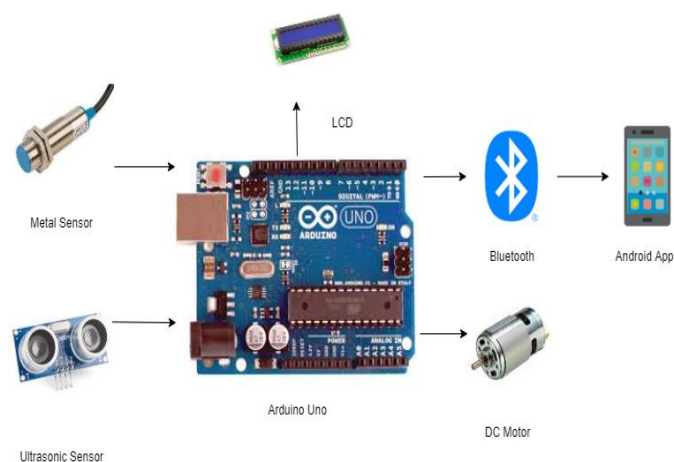

Fig.1 Connection Model

IV. WORKING ON THE PROJECT

The metal detector robot works on the basis 5-volt power supply by using Arduino UNO Controller. The purpose of this robot is for military security. Arduino UNO is the heart of the project which works on 5VDC. It controls the overall circuit to give desired output for provided input commands. In this implemented hardware design metal sensor is used. A metal sensor detects the presence of metal nearby. Metal sensors are useful for finding metal objects. They often consist of a handheld arm to hold, with a sensor

probe which can be swept over the ground or other objects. This is very useful for the military area. Next by using an ultrasonic sensor we can measure the distance by utilizing ultrasonic waves. The sensor head transmits an ultrasonic wave and takes the wave reflected from the destination and ultrasonic sensors measure the distance to the target by measuring the time difference between the radiation and response of the wave. We can see an overview of the model from Fig.1

Command for DC motor

Case 1: Forward

Case 2: Reverse

Case 3: left

Case 4: right

Case 5: stop

The robot works and navigates as per the above commands.

Next use an LCD (16X2) display to display every result from the sensor. The LCD is connected to the Arduino Uno board. Bluetooth is used for controlling the robot.

In this way, the system work is based on Arduino UNO Controller, sensors, DC motor, and LCD (16X2).

Hardware Design

➢ *Arduino UNO Controller*

Arduino is an open-source platform that is easy to use on hardware as well as on software. It is a microcontroller board of ATmega328P. Arduino UNO occupies 14 digital input and output pins .6 pins can be operated as PWM output, 6 pins as analog inputs, 16 MHz ceramic resonators, a USB attachment, a reset button, a jackscrew, and an ICSP header. It works on 12V. The board can be provided with power each from the DC power jack, the USB connector, or the VIN pin of the board. The WiFi Module is a self-sustaining SoC with a combined TCP/IP protocol stack that can provide admittance to a WiFi network. Sciences, doing cool stuff with system and elements. Arduino is an Embedded System Devices that got very popular in the maker's community due to its unrestricted and open-source creation.

➢ *Metal Sensor*

Metal detectors work by broadcasting an electromagnetic field from the sensor to the ground. Any metal deep down will retransmit an electromagnetic field of its own back to the sensor. Usually, metal detectors can identify different metals such as iron, copper, aluminum, tin, nickel, brass, and lead. We have to fix the device that only transmits a specific electromagnetic field to detect the target metal. The metals that are not extremely conductivity of electricity estimated as non-metal or non-detectable objects.

Most metal indicators can identify objects about 4-8″ i.e. (10 - 20 cm) deep. In perfect conditions, a mid-range metal detector can transfer 12-18″ (30-45 cm) underground.

➢ *Ultrasonic Sensor*

As the name means, ultrasonic sensors cover the distance by using ultrasonic waves. The sensor front transmits an ultrasonic wave and accepts the reflected wave from the target. Ultrasonic sensors estimate the distance to the destination by estimating the time between the radiation and acceptance. The ultrasonic sensor range is 40 to 70 kHz. The frequency defines range and resolution the low frequency produces a great sensing range. The sensor transmits a high-frequency pulse, of 20 kHz to 200 kHz range, to listen to an echo. The pulsation is transmitted in a cone, which is 6° at the top. Ultrasonic sensors work with sound waves, identifying obstacles is not influenced by as many circumstances.

➢ *DC Motor*

The DC motor is the motor which converts the direct current into the mechanical work. It works on the principle of Lorentz Law, which states that "the current carrying conductor placed in a magnetic and electric field experience a force".

➢ *LCD (16x2)*

An LCD is an electronic display module that uses the fluid crystal to produce an apparent image. The 16×2 LCD is a very primary module commonly used in circuits. The 16×2 changes a display of 16 characters per line in two such lines. In this LCD each character is presented in a 5×7-pixel model. Insert your LCD screen into the breadboard

2. Identically insert your potentiometer.

3. Connect 5v and GND from Arduino to the +ve & -ve ports on the breadboard.

4. Connect pins 1 and 16 from the LCD screen to the negative port.

Different Types of LCD Panels

● Twisted Nematic LCDs are the most usually manufactured and applied types of monitors that crossed a wide range of applications.

● IPS Panel Technology.

● VA Panel.

● Advanced Fringe Field Switching.

A 16x2 LCDs display 16 characters per line and there are 2 such lines. In this LCD each character is presented in a 5x7 pixel matrix. This LCD has two registers, they are Command and Data. Register Select (RS): decides whether an instruction RS = 0 i.e (to set up the display) or exact data RS=1 is sent. RW=0 i.e Read/Write writes to the LCD. When RW=1; It Reads from the LCD. A factory reset does not delete the monitor's language setting. After you perform a factory reset, you will need to re-enter your method settings they are contrast, brightness, etc.

Software Design

The main components that we are going to focus under software designing are Algorithm building, developing the Android application and finally detection of the metal component. By using the advanced technology of an Android smartphone, we achieve are desired goals. The details of each software component are as given below.

➢ *Algorithm*

The general algorithm has the main steps to accomplish the general tasks, which are "start", "stop" and "detection of metal". The program will begin with the "start" step where the Bluetooth module HC-05 connected to Arduino Uno will pair with the android application. The robot moves as per the instruction, given by the Android Application. During this step, the robot moves, and the metal detector checks if the object is a metallic object or not by passing it over the metal detector. In case, if a metallic object is countered by the metal detector, a beep sound will be produced by the beeper, and the movement of the robot can be stopped. Otherwise, the robot will continue to move until it detects any metallic object, or if it detects a metal object the movement robot will be stopped Pseudo Code:

$$1 - OrderVar_{Computer} \rightarrow UltrasonicFunc_{Robot}$$
$$2 - UltrasonicFunc(OrderVar_{Computer}):$$
$$\quad a) \, sendFunc() \rightarrow UltrasoundVar$$
$$\quad b) \, waitFuc() \, to \, confirm \, sound \, receiveing$$
$$3 - DistanceFunc(sending_{time}, receiving_{time}) \rightarrow DistanceVar$$
$$4 - DistanceVar_{Robot} \rightarrow DistanceVar_{Computer}$$
$$5 - if(DistanceVar < 30cm):$$
$$\quad a) \, AutoStopFunc_{Robot}()$$
$$\quad b) \, SendAlarmFunc_{Robot}()$$

➢ *Android Application*

Android is a very familiar word in today's world. Millions of devices are running on Android OS and millions are being developed every day [4]. **Android Studio** is an application that is used to develop the android application that controls the robot. The first phase of application design goes through the writing the code as per our requirements. The second phase is coding for connecting the Bluetooth of our device with robot.

In this app development, the **Android Studio** provides a versatile opportunity to develop a customized application that starts with establishing a Bluetooth connection by searching the available Bluetooth devices and make pair with them. For robotic movement, a character is assigned for each operation such as Forward- "F", Backward- "B", Left- "L" and Right- "R".

➢ *Detection*

As the metal sensor detects any obstacles, there are two situations to detect obstacles and calculate the distance. In the first scenario when obstacles are located in the front of the robot pathway and the detector would send an alarm if the robot revealed a metal. Besides, the robot detector will self-stop and then gives a signal to the computer. The computer will send the command to the robot, and that will run a function in the robot, and the detector will operate the three Ultrasonic sensors step by step, and send the proceeds to the computer, and the computer will show which the best way to navigate. This mechanism is used to identify obstacles in a way as well. This method is most important for detection, deactivating, extracting, and demining. The detector can discover the most suited route if there is more than one path in the mapping area it will send results to the computer to make the best decision in a particular way.
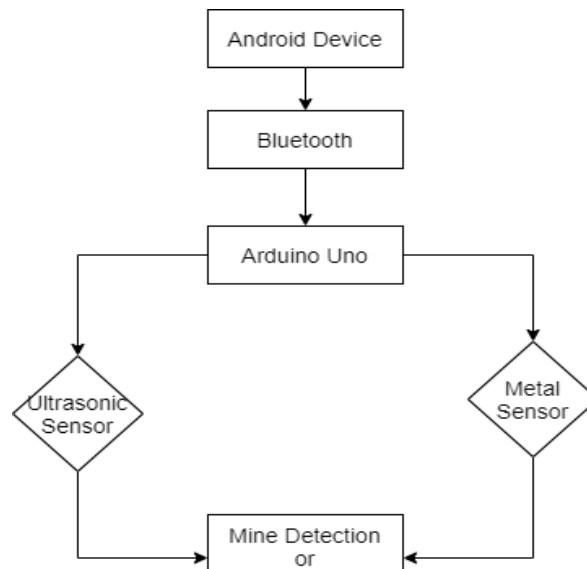
V. FLOW CHART OF PROPOSED METHOD

Fig.2 System Work Flow

From Fig.2 we can observe that the robot is develop and designed which is capable of detecting the metal using an android application. Bluetooth device is interfaced with the control unit for sensing the signals that are transmitted by the android app. The data is transmitted to the control units that guide the robot in different directions. A microcontroller (ATmega328P) is used as a control device in the project. Distant operation is accomplished by any smartphone with Android OS, upon a GUI (Graphical User Interface). We applied the HC-05 module to pair the Android application with the robot. Communicating end uses an android application device through which commands are conveyed to the robot. At the receiver end, these commands are used for controlling the robot in any direction such as forward, backward and left, or right. The motor driver L293D IC is interfaced with the control unit that operates the motor. Serially transmitted data from the android application is collected by a Bluetooth receiver interfaced to the microcontroller.

VI. CONCLUSION

Android is a mobile phone system that can build a strong remote-control system. While developing such a system we need to communicate with the robot, this software requires a Bluetooth link. The Multi-Purpose Military Service Robot is built to facilitate secure two-way communication between the Android phone and the robot in such a way that its needs can be fulfilled by the military, police, and armed forces. It has numerous implementations which can be found in diverse situations and environments. It can, for instance, be used for military purposes by the armed forces in one region, while it can be used for surveillance purposes in another. The mines can also be disposed of once detected by the robot.

VII. FUTURE SCOPE

This project can be enhanced in the future by implementing new and advanced technologies. By adding the suspension to the robot will help in traveling through an uneven surface. We can add new sensors e.g., a gas sensor (MQ2 Gas Sensor) and also a robotic arm that will easily pick and move the object from one place to another. Also, solar cells can be added instead of the regular battery for continuous power production.

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