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ARDUINO BASED SMART ROBOT

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Abstract—The robot is used in major industries to reduce the human effort and also for security reasons. In existing system the user of this robot cannot operate from long distance and doesn't have obstacle detection facility. The Camera is not present in the existing system so it is difficult to identify the position of the robot. So to improve the flaws in the existing system, the smart robot is developed which can be controlled from a long distance. The reason for using smart robot is to operate the robot in the areas where the humans cannot reach. This project is designed as smart robot which consists of two section, they are robot section and monitoring section. Microcontroller are interfaced with temperature sensor, obstacle detector, proximity sensor, IR sensor, camera, LCD, motor and ZigBee.

In robot section the temperature sensor helps to detect the field temperature to avoid the fire accidents. If room temperature exceeds the set point the robot sends an alarm signal to the operator. The sharp IR obstacle detector helps to detect any obstacle that comes in the way of robot. The robot automatically stops once it detects any obstacle and it waits for user commands. The program which is loaded into the microcontroller makes the robot to stop if it detects any obstacle. The proximity sensor helps to detect metal and picks the metal using magnetic field which is contained in the proximity sensor. The proximity sensor also acts as an electro magnet. IR sensor is used to detect the robotic path. The program is loaded into the microcontroller which controls the IR sensor and makes the robot to move in the right path.

A Camera is mounted on the robot to identify the position of the robot and also for security purpose. The LCD display is used to indicate the temperature. The driver circuit is used to operate motors. The motors are used to operate the wheel which moves the robot. The monitoring section consists of a ZigBee, MAX232 and PC. In order to operate the robot, the user has to make a command from the PC. ZigBee receives command from the PC and makes the robot to move. The commands will make the robot to either go in forward, backward, left or right direction. Thus with the help of this technology the robot is controlled using PC, commands receive through ZigBee, irrespective of the distance from the robot.

Keywords— Arduino Uno, Robot, Transmission, Reception, ZigBee, IR sensor

I. INTRODUCTION

An embedded system (Arduino) is designed to perform one or a few dedicated function**,** often with real-time computing system. It is embedded as a part of a complete device often including hardware and mechanical part of a contrast, a general-purpose computer, such as a personal computer, is designed to be flexible and too meet a wide range of an end-user features and facilities. Embedded system control many of the common devices which we use today. Embedded systems are controlled by a main processing core that is typically either a microcontroller or a digital signal

processor [DSP]. Since the embedded is dedicated to specific task, design engineers can optimize it, reducing the size and the cost of the product or increasing the reliability and performance. Physically, embedded system range from portable devices such as digital watches and MP3 players to large stationary insulations like traffic lights, factory controllers are the systems controlling nuclear power plant. Complexity varies from low, with a single microcontroller chip, to very high with multiple units, peripherals and network mounted inside a large chassis or enclosure.

The field of robotics has its origin in science fiction. It took 50 years before the modern technology of industrial robotics began. Early robots were confined to industrial robotics application, doing repetitive tasks like loading-unloading machines, welding spray painting etc. In the last two decades, robots have stepped out of individual applications and ventured into our homes as today there are both hard (physical) robots like manipulator arms, mobile robots etc, and also soft (simulated) robots like vertical characters, virtual reality etc, sometimes simply called 'bots'. For many people it is a machine that imitates a human-like character.

A robot has these essential characteristics.

Given the robot sensors: light sensor (eyes), touch and sonar sensors (hands), chemical sensor (nose), Hearing and sonar senses will give your robot awareness of its environment. A robot needs to be able to move around its environment. Whether rolling on wheels, walking on leg or propelling by thrusters a robot needs to be able to move. A robot needs to able to power itself. A robot might be solar powered, electrically powered, battery powered. The way the robot gets its energy will depend on what the robot needs to do. A robot should be "smarter". This is where programming enters the pictures. A programmer is the person who gives the robot its 'smarts'. The robot will have some way to receive the program so that it knows what it is to do.

II. HARDWARE CIRCUIT IMPLEMENTATION

The "ARDUINO **BASED SMART ROBOT**" is designed as a prototype model to detect metal, obstacle, temperature and humidity. The line follower automatically follows the black line and camera is used for monitoring. This project has two sections, the transmitter section and the receiver section. The transmitter section is robot module and the receiver section is interfaced with PC.

A. TRANSMITTER SECTION

The transmitter section of the robot module, the inputs of the transmitter section is the DHT11 sensor, proximity sensor, IR sensor, LDR sensor. DHT11 sensor is used to measure the surrounding temperature and humidity. This sensor includes a resistive-type humidity measurement component and an NTC temperature measurement component, and connects to a high-performance 8-bit microcontroller. The DHT11 sensor is interfaced with the arduino microcontroller at pin D6.

Proximity sensor is used to detect metal. A proximity sensor is a sensor able to detect the presence of nearby objects without any physical contact. A proximity sensor often emits an electromagnetic field and looks for changes in the field. The object being sensed is often referred to as the proximity sensor's target. The maximum distance that this sensor can detect is defined nominal range. The proximity sensor is interfaced with the arduino microcontroller in the pin D7.

IR sensor is used to detect the obstacle. It is a distance measuring sensor unit, composed of an integrated combination of PSD (position sensitive detector), IRED (infrared emitting diode) and signal processing circuit. The variety of the reflectivity of the object, the environmental temperature and the operating duration are not influenced easily to the distance detection because of adopting the triangulation method. The IR sensor is interfaced with the arduino microcontroller at the pin A2.

The LDR sensor is used for line follower. Light dependent resistors or LDRs are often used in circuits where it is necessary to detect the presence or the level of light. They can be described by a variety of names from light dependent resistor, LDR, photo resistor, or even photo cell (photocell) or photoconductor. The LDR is interfaced with the arduino microcontroller at the pin 14-A0 and 15-A1.

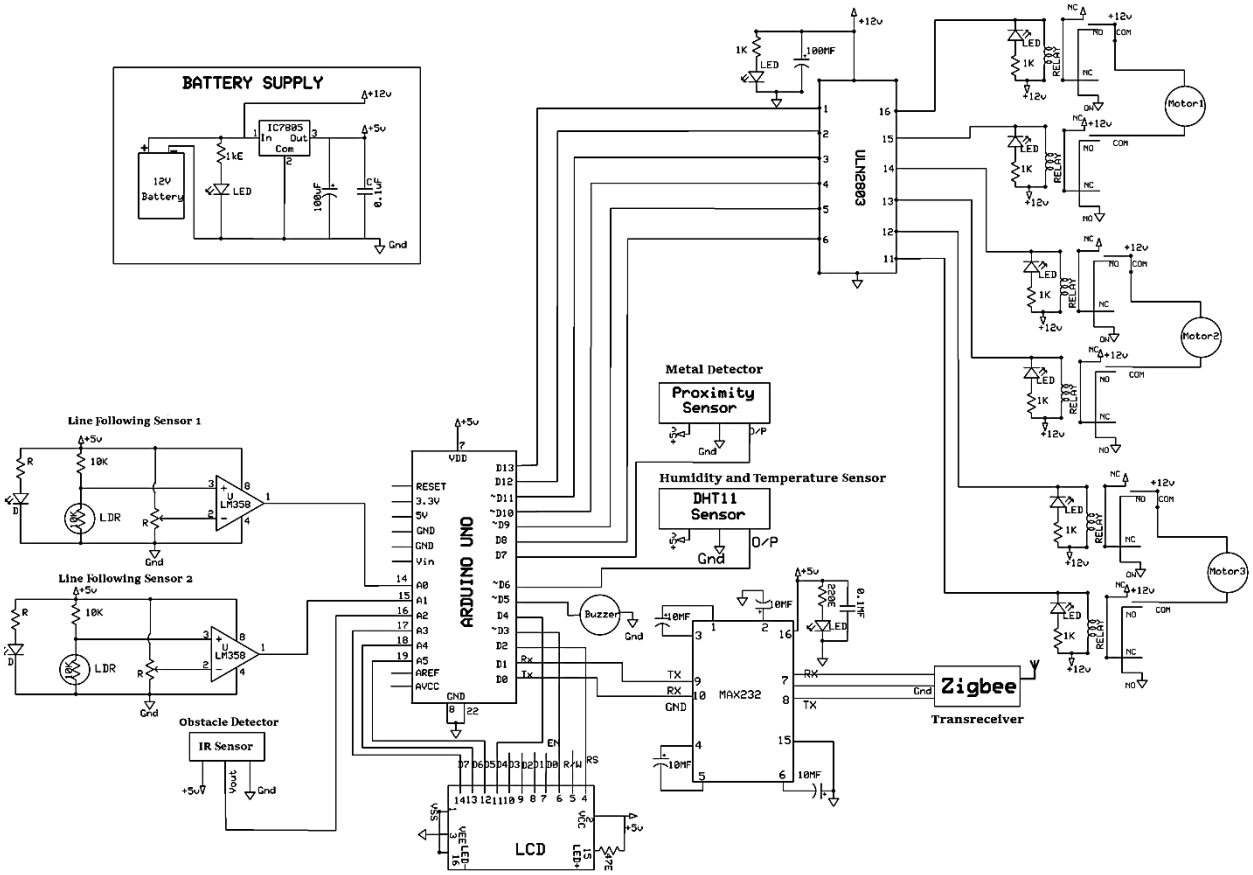

Figure 1. Circuit Diagram of Smart Robot (transmitter section)

The circuit diagram of smart robot is shown in Figure 1(transmitter section). A 16X2 LCD display is connected to the arduino microcontroller at pin A3, A4, A5, D4 and D5. The data's which are taken from the sensors are given to the microcontroller. The proximity sensor output is given to the microcontroller when the o/p voltage produces as logic=1, it confirms that the metal is detected and displayed in the LCD as "1". The DHT11 sensor output is given to the microcontroller when the o/p voltage is proportional to the temperature and humidity, the value of temperature in Celsius and the value of relative humidity is displayed in the LCD.

The robot's motion is made by two DC motors. The motors are connected to the microcontroller, control the motion of the robot in forward/reverse and left/right directions, the commands for the movement of the robot is transmitted from the PC using zigbee transmitter. A serial data communication standard is used to communicate the commands from the PC, programmed using the Arduino programming software.

The camera is connected with a DC motor for 360 degree angular rotation for a wide range of the field of view of the robot environment as it moves. The camera is used for image acquisition and video streaming. The camera AV signals, which are taken is transmitted to the PC with the help of an RxTx through the antenna.

All the data's which are sensed are transmitted through the zigbee transceiver interfaced with the robot

B. RECEIVER SECTION

The receiver section has a zigbee module which receives the data transmitted from the transmitter section. The DHT11 sensor data, proximity sensor data, IR sensor data, LDR sensor data are received in the PC. The PC is interfaced with the com port, using RS2332 serial data communication standard and the transmitted signals are displayed in PC. The PC receives the serial data through the "HYPERTERMINAL" and displays the data's, in the new window. The PC uses the "AURDINO SOFTWARE PROGRAMMING" program as the front end tool robot motion control.

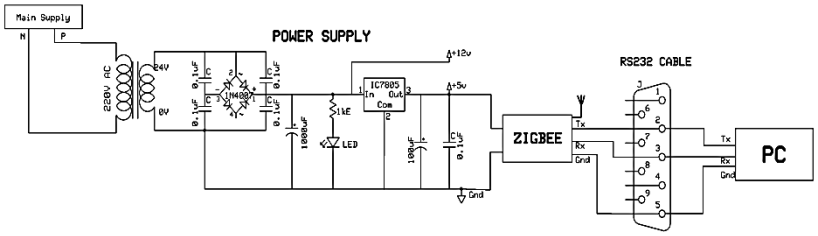

Figure 2. Circuit Diagram of Smart Robot (receiver section)

The circuit diagram of smart robot is shown in Figure 2(receiver section).The AV signals which are transmitted through the antenna from the camera are received at the receiver section with the help of a RF receiver and tuner. The AV signals will be tuned for the required frequency to display the images and the video. The AV signal is displayed in the PC with the help of "HONESTECH TVR 2.5" driver which is installed in PC. The driver provides a frame grab of the currently received videos and images. The driver stores both the videos and images which are taken by the camera.

III. SOFTWARE IMPLEMENTATION

ALGORITHM AND FLOWCHART TRANSMITTER SECTION

ALGORITHM

STEP 1: Start the program.

STEP 2: Initialize the I/P ports.

STEP 3: Read the data's from the DHT11 sensor, Proximity sensor, IR sensor, LDR sensor.

STEP4: If the outputs of each sensor is 1, then the output for corresponding sensor will be displayed, else go to step 3.

STEP 5: The output data's are displayed in the LCD display.

STEP 6: The output data's are transmitted through ZIGBEE Tx/Rx.

FLOWCHART

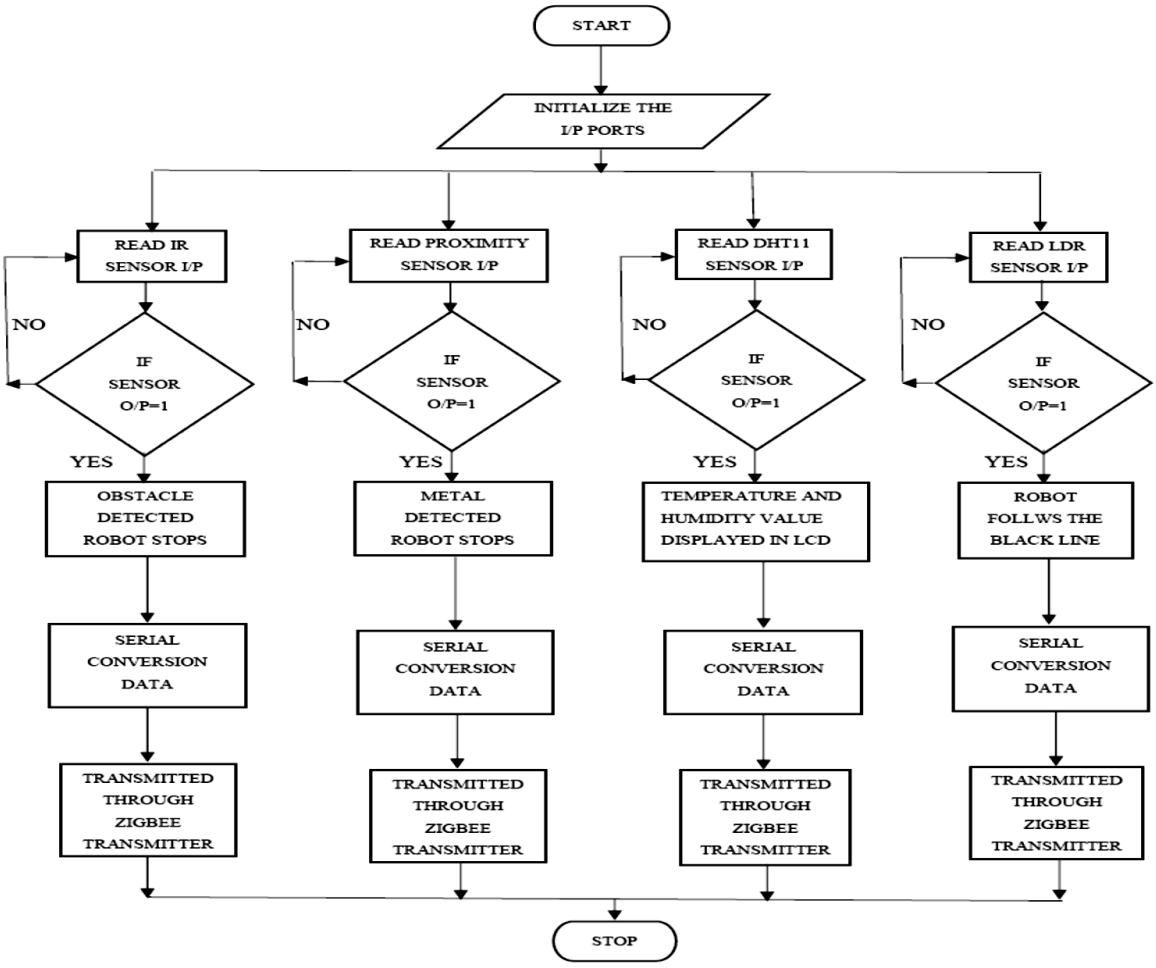

Figure 3.Flow chart of Smart Robot (transmitter section)

IV. ALGORITHM AND FLOWCHART RECEIVER SECTION

ALGORITHM

STEP 1: Start the program.

STEP 2: The data's are received at the control unit with the help of ZIGBEE Rx/Tx.

STEP 3: The ZIGBEE module output is given to the com port of the PC.

STEP 4: The outputs from the transmitter are displayed in the PC.

STEP 5: Stop the program.

FLOWCHART

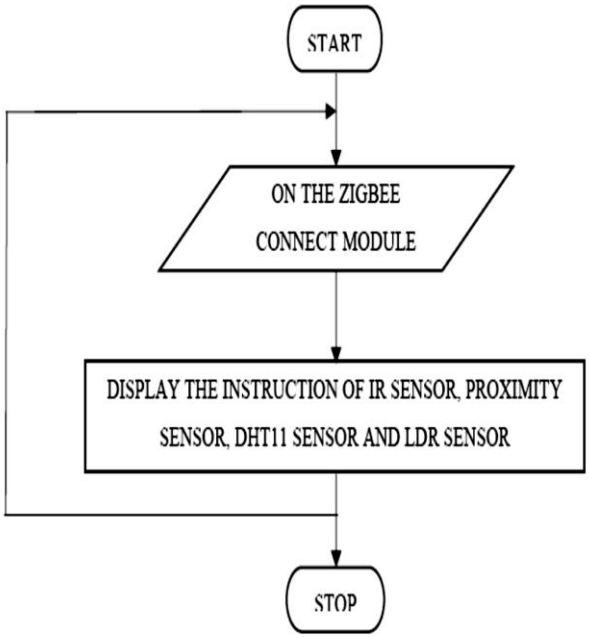

Figure 4.Flow chart of Smart Robot (receiver section)

V. RESULT

The robot thus designed can be used for various purposes. It can be used in industries, for smart application and it is used in areas where human intervention is not possible. It is used for "smarter application" in our day to day lives. These kinds of robots do not cause any kind of disturbances to the surroundings and environment. The movement of the robot is controlled by the command given by the instructor. The remote section unit displays the operation performed by the robot i.e., it displays the command given. The camera used is to capture the surrounding images. As the circuit is easy and simple, it is user friendly. By using different sensors we can manipulate the robot movement and its path is traced safely. The system is controlled by a control unit. In the control unit encoding is done and the encoded signals are sent through the transmitter. At the recover the decoded signals are given as input to the smart robots.

VI. CONCLUSION

The smart robot with wireless camera has been designed in such a way that it can fulfill the needs of the securities. It has countless applications and can be used in different environments and scenarios, while at another application; it can be used to provide up to date information in a hostage situation.

VII. FUTURE ENHANCEMENTS

1. The advanced version of transmitter receiver can be used for transmitting and receiving the data over a long distance.
2. In future it can be implemented in all automation areas to prevent the interruption of humans.
3. This project is directly connected to internet by using zig-bee with Wi-Fi. By using internet we can control the system via remote location. We do not require any simulation tool by using GUI

software... We can also control the device by giving it voice command thereby making it a voice recognition system.

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