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Design and Implementation of Attender Robot

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Abstract: ***In every field Robots have a scope for their presence and complete the tasks given. The area we are going to introduce robots is educational institutions. For every Educational institution there are Attenders who are being used for taking attendance, passing circulars and calling student/faculty from class rooms. Attender Robot can perform the above tasks in place of human with speed and accuracy. For taking attendance latest process used is Biometric and for circular, calling process attender is being used. After taking attendance it needs to be updated in data base of institution which is another burden work for data base manager of institution. Multiple attenders need to be used to complete circular and calling tasks this is another cost and time consuming process. All these problems can be solved using single Attender Robot. Software we used are Arduino IDE and Python. Programming languages we use are C++ and python. We use two protocols namely Bluetooth and RF for communications.***

Keywords: Attender Robot, Arduino, Python, Bluetooth, RF, Biometric, Attendance, Circular, Calling

1. Introduction

Robots are being used mainly for automation process in all possible fields of life. That automation by robots involves performing repeated tasks continuously. To reduce this repetition of tasks like attendance, circular and calling we have designed a robot that can be used in educational institutions in daily basis. Arduino is the development platform we had chosen for programming using C++. Python is another language we had chosen for automation of attendance process.

2. Literature Survey

Wall following for autonomous robot navigation:

Agnes Imhof, Moritz Oetiker, Björn Jensen published this paper in Applied Robotics for the Power Industry (CARPI), 2012 2nd International Conference on07 March 2013 in IEEE. This paper presents the design of a novel approach to Wall-Following using a single distance sensor. Our concept takes into account distance measurements and odometry information from the robot. This information is combined using a Kalman filter, to estimate the relative position of the robot to the wall. A tracking controller is used to steer the robot with constant forward velocity along the wall while correcting distance errors. Simulations and tests with a real track drive robot are used to validate the approach. The comparison to a conventional two-sensor setup shows comparable precision.

The Bluetooth Based LED Control For Arduino Test Platform By Using Mobile APP:

Yi-Jen Mon published this paper in International Journal of Scientific & Technology Research Volume 4, Issue 06, June 2015. This paper states that, The Bluetooth is a commonly known, convenient and famous communication protocol. In this paper, it is used to control LED mounted on Arduino test platform by using the APP of mobile phone. At first, the control program is completed by Arduino development software environment, and then the Android APP is installed in mobile phone. Finally, by using the Bluetooth of mobile phone, the test platform will be connected. The LED can be controlled by APP of mobile phone. The experiment results are demonstrated the effective performance.

433 MHz (Wireless RF) Communication between Two Arduino UNO:

Fahmida Ahmed, Shakh Md. Alimuzjaman Alim, Md. Shafiqul Islam, KantiBhusan Roy Kawshik, Shafiul Islam published this paper in American Journal of Engineering Research (AJER) e-ISSN: 2320-0847 p-ISSN: 2320-0936 Volume-5, Issue-10, pp-358-362. This paper states that Radio frequency (RF) is any of the electromagnetic wave frequencies that lie in the range extending from around 3 kHz to 300 GHz, which include those frequencies used for communications or radar signals. RF usually refers to electrical rather than mechanical oscillations. However, mechanical RF systems do exist. Although radio frequency is a rate of oscillation, the term "radio frequency" or its abbreviation "RF" are used as a synonym for radio – i.e., to describe the use of wireless communication, as opposed to communication via electric wires. To receive radio signals an antenna must be used. However, since the antenna will pick up thousands of radio signals at a time, a radio tuner is necessary to tune into a particular frequency (or frequency range). This is typically done via a resonator – in its simplest form, a circuit with a capacitor and an inductor form a tuned circuit. The resonator amplifies oscillations within a particular frequency band, while reducing oscillations at other frequencies outside the band. Another method to isolate a particular radio frequency is by oversampling (which gets a wide range of frequencies) and picking out the frequencies of interest, as done in software defined radio. The distance over which radio communications is useful depends significantly on things other than wavelength, such as transmitter power, receiver quality, type, size, and height of antenna, mode of transmission, noise, and interfering signals. Ground waves,

tropospheric scatter and sky waves can all achieve greater ranges than line-of-sight propagation. The study of radio propagation allows estimates of useful range to be made. Our aim is design & implementation a communication bus bar is show communication between transmitter and receiver via Arduino.

From above three papers we had taken the concepts of Wall Follower Robot, communicating through Bluetooth with Arduino and RF transmission of data from Arduino. By combining all these concepts we had developed Attender Robot along by adding file creation using Python.

3. Problem Definition

At present in educational institutions the attendance process is being done by either man power or using Biometric system. For passing a circular and calling student tasks manpower are being used. For doing all these tasks multiple attenders are needed for different tasks like attendance, circular, calling process. Another problem is that a separate burden is being imposed to update the absentees list in institution's data base by the data base manager.

4. Objectives of Project

The main objective of the attender robot is doing the tasks that are being done by an attender. These tasks are divided into three. They are:

1. Attendance taking.
2. Circular passing.
3. Calling a person.

5. Environment

Attender robot has hardware and software environments.

5.1 Hardware Environment:

We have used the following hardware in designing of attender robot

1. Arduino mega 2560
2. Arduino UNO.
3. Bluetooth Module HC-05.
4. RF 434 MHz transmitter receiver module.
5. Ultrasonic sensor.
6. L298N motor driver.
7. 100 rpm DC geared Motors.
8. Wheels.
9. Buzzer.
10. 12v Rechargeable Battery.
11. 9v Batter with DC jack.
12. Male to female and Female to Male Jumpers.
13. Chassis.
14. Computer/ Laptop
15. Android Mobile.

5.2 Software Environment:

We have used the following software in designing of attender robot.

1. Arduino 2. Python

6. Design

The material used in our project is 5mm and 3mm thin plastic fibre plates to form the base and layers of the robot and we have made holes to fibre plate by heating up the iron piece due to that heat the fibre has melted and formed as a hole and we have used some bolts and gum to attach the robot parts Robot case was made with following dimensions:

- Width: 14cm
- Height: 15cm
- Left Width: 20cm
- Left and Right Holder Width: 5cm
- Left and Right Holder Length: 20cm
- Big Holes width: 1.5cm
- Back Box hole width: 5cm
- Back Box hole Length: 10cm

Totally design of robot consists of 9 plates of plastic. In which 1 plate was made of 5mm plastic and remaining all plates were made of 3mm plastic. Four 3mm plates were used for left and right covering of the robot. One 5mm plate was used as bottom of the robot. One 3mm plate was used as middle layer of robot. One 3mm plate was used as top of the robot. Another two small 3mm plates were used at the middle of the robot which was used to hold the middle layer. Following figure shows the drawings that were drawn in order to make the required shapes by using laser cutting machine.

Figure 5.1: Front and Back view of Attender Robot

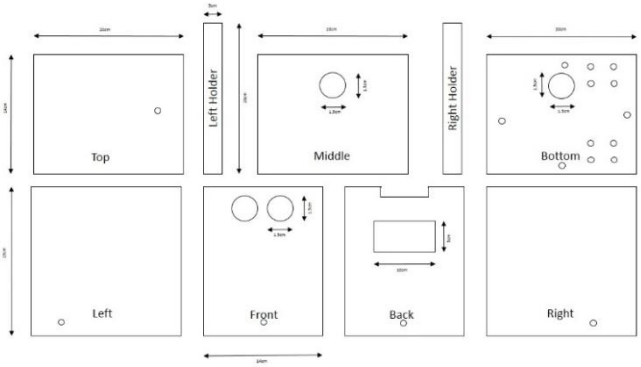

Figure 5.2: Drawings of Attender Robot

7. Implementation

7.1 Block Diagram

This block diagram shows the internal architecture of the robot. The block diagram consists of two units. They are transmitter unit and receiver unit. Figure 7.1 shows transmitter and Figure 7.2 shows receiver part.

In transmitter place the robot is used. Robot has 5 Ultrasonic sensors which are used for wall following task and a Bluetooth for communication with robot. An RF transmitter to send the class name and absentees list to the receiver. A buzzer for indication purpose. A motor driver which is used for driving motors and giving a 5V power supply to all the sensors and RF transmitter and Bluetooth devices.

Arduino Mega was used at transmitter side which is the main development board used for completing every task. All the sensors and input, output devices were connected to Arduino Mega 2560. A 12V 1.3mAH lead acid battery is being used at transmitter by which the motors will be driven through motor driver and therefore sensors get their 5V power supply. A single lead antenna was used at transmitter which is connected to antenna pin of RF transmitter module in order to transmit the data. Two DC motors were used for the moment of robot in all possible directions where the wheels were placed at back part of the robot. A castor wheel was used at front part in order to get a free movement of the robot. First the Bluetooth will be activated then it will wait for the user to get connected and give the task to the robot. Then after receiving the task by the user, robot will go to classes according to the task given and completes the task and returns to the starting point.

In receiver unit we use only 3 components. That are one Arduino UNO, RF receiver and a PC or computer. The RF receiver was connected to Arduino UNO and it sends the data to Arduino UNO that it receives from the transmitter. The RF receiver gets its needed 5V power supply from the Arduino UNO itself without any extra power supply. Arduino UNO was connected to the PC through an A to B type USB cable by which the Arduino UNO writes the received data from RF receiver to PC. Arduino UNO gets its power supply from the PC itself through the USB cable by which it was connected to the PC.

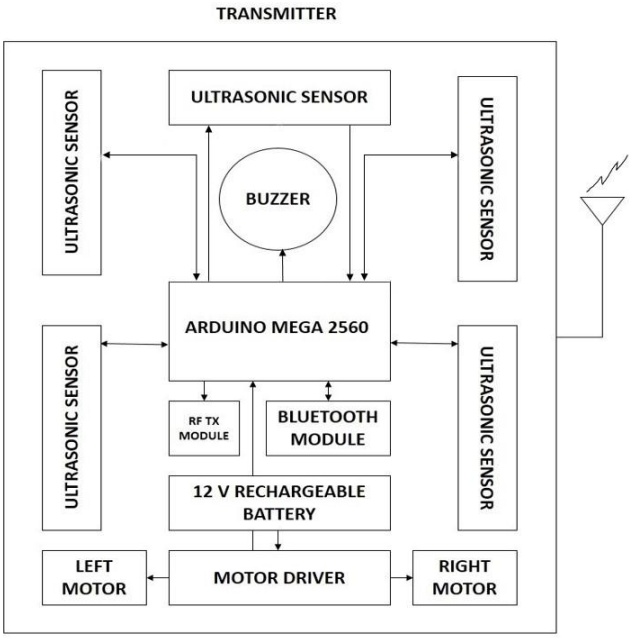

Figure 7.1 Transmitter

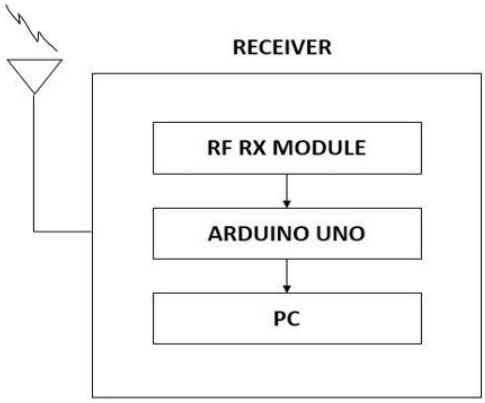

Figure 7.2 Receiver

7.2 Working

Below flowchart of Figure No.7.3 is the transmitter's flow chart. First the robot will be turned so that every device will be turned on. Then user should connect to. They are:

1. Attendance
2. Circular
3. Calling

User should select any of the options by sending the option number to the robot using the app 'Bluetooth Terminal app' by which user is connected to robot. Then robot will check the options validity. If the received option valid then the specific task will be performed.

- If '1' was received then 'Attendance' task will be performed.
- If '2' was received then the robot will send the user a message to send the circular that need to be passed, after that the classes number list will be taken from user to which circular need to passed. After taking the circular and class numbers 'Circular' task will be performed.

- If '3' was received then robot will send the user a message to send the calling person name or roll number who need to be called, after that the class number will be taken from which person need to be called. After taking the person details and class number 'Calling' task will be performed.

After completion of the task given to the robot, it will initiates the 'reachhome' process.

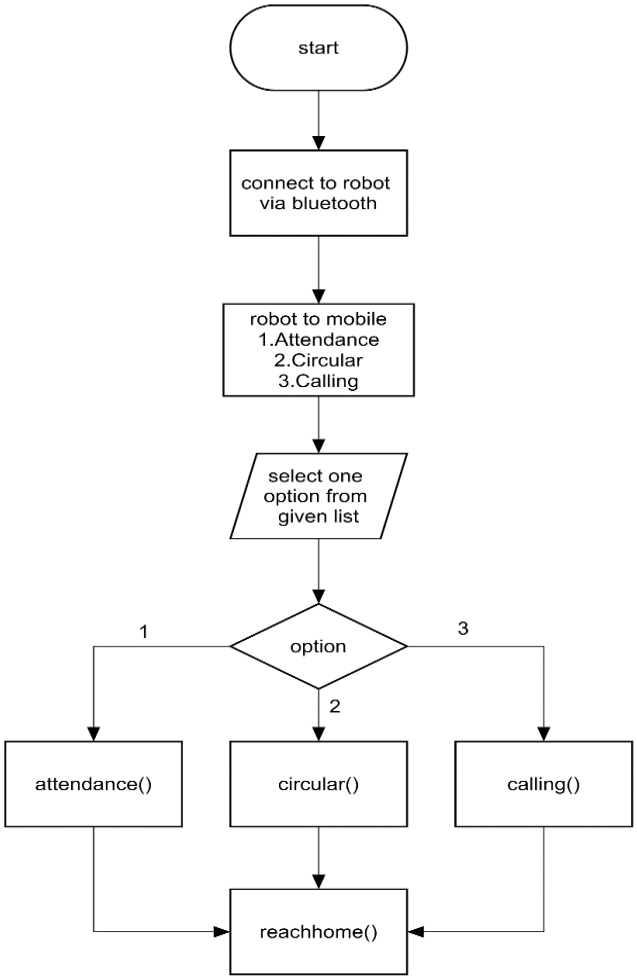

Figure 7.3: Transmitter Flowchart

Below flow chart of Figure No. 7.4 is receiver flow chart. At the receiver side, the RF receives the data from the RF transmitter present at robot. The RF receives the data and write the data in personal computer serially and this task is performed then the connection between the RF transmitter and RF receiver is closed and stops. At personal computer (PC), the data is read from serial port which is written by RF receiver. By using the python programing, which was used in this as code can create a file and append data to file automatically. We can read data by searching in personal computer and we can have the data. This is required for attendance purpose only. For calling and circular tasks the RF transmitter and receiver can't be used. After the process, the task will end at receiver side.

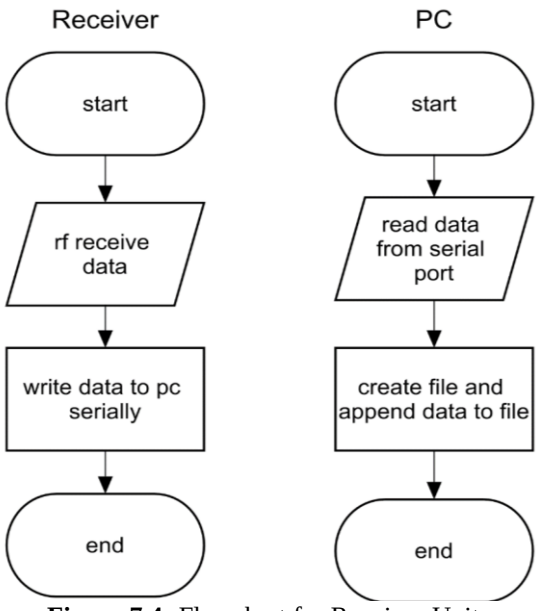

Figure 7.4: Flowchart for Receiver Unit

7.2.1Algorithm for Attendance:

Step - 1: start
Step - 2: attendance
Step - 3: go to class by following wall
Step - 4: connect to mobile
Step -: take class name and absentees list
Step - 6: RF send class name and absentees list
Step - 7: if all classes over then stop otherwise goes to net class
Step - 8: stop

7.2.2 Algorithm for Circular:

Step - 1: start
Step - 2: circular
Step - 3: go to class by wall following
Step - 4: connect to mobile
Step - 5: send circular to mobile
Step - 6: if all classes are over then stop otherwise goes to next class
Step - 7: end

7.2.3. Algorithm for Calling:

Step - 1: start
Step - 2: calling
Step - 3: take class number and person name
Step - 4: go to class by wall following
Step - 5: connect to mobile.
Step - 6: send person name to mobile that the person is being called
Step - 7: end

7.2.4. Algorithm for Reachhome:

Step - 1: start.
Step - 2: wall follow with right sensors.
Step - 3: If front sensor reading is less than 30cm then go to step4 else go to step 2.
Step - 4: Buzzer on continuously.

8. Results

Figure 7.5: Bluetooth App icon in mobile phone

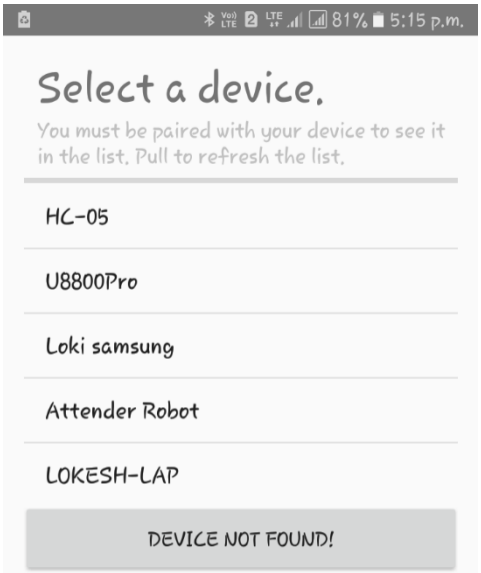

Figure 7.6: Bluetooth App Robot selection

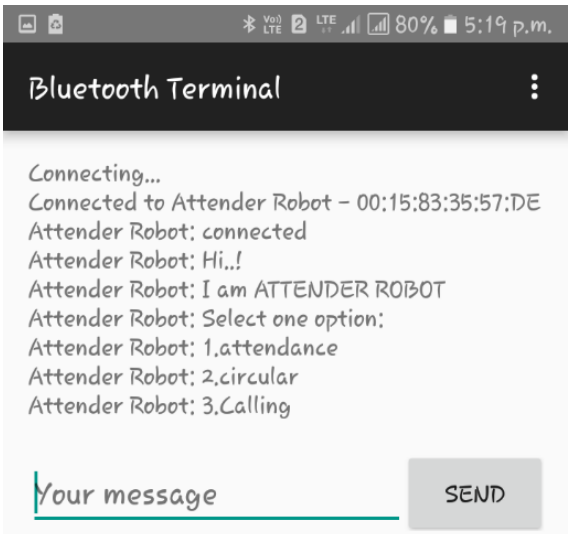

Figure 7.7: Robot sending Options

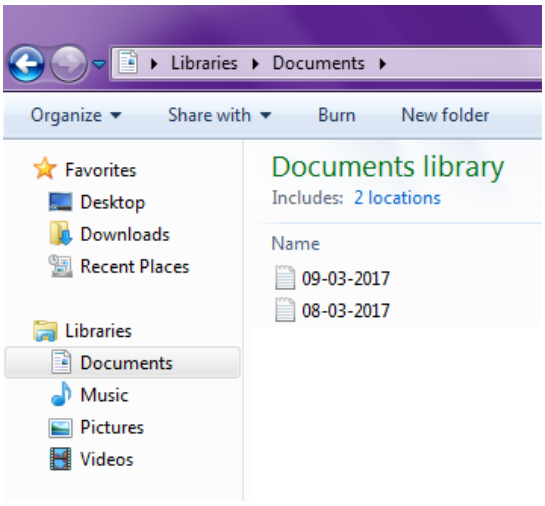

Figure 7.5: File Creation in documents folder with date

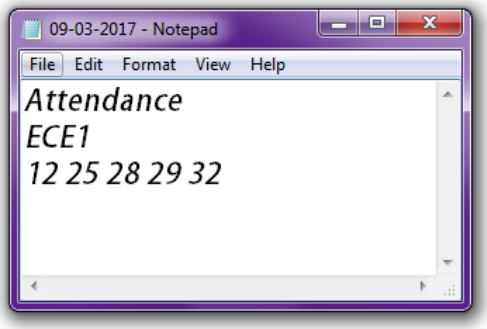

Figure 7.6: Output file with Attendance Screenshot

9. Future Scope

Following are the two major areas where the improvement can be done:

1. For this Attender Robot a camera can be interfaced and that can be used for room detection purpose by Image Processing Techniques which in return removes the wall following process for room detection.
2. The transmission range of the robot can also be increased by using XBEE or long range high power RF transmitter receivers which can cover a long area and more classrooms.

10. Conclusion

- Hence we conclude that Attender Robot had processed every task given by user which are Attendance, Circular, Calling successfully.
- By using this attender robot, the man power can be reduced in the daily routine tasks like attendance taking, circular passing, calling a person in educational institutions.

References

[1] Wall following for autonomous robot navigation by Agnes Imhof, Moritz Oetiker, Björn Jensen published in Applied Robotics for the Power Industry (CARPI), 2012 2nd International Conference on 07 March 2013 in IEEE.

[2] The Bluetooth Based LED Control for Arduino Test Platform by Using Mobile APP by Yi-Jen Mon published in International Journal of Scientific & Technology Research Volume 4, Issue 06, June 2015.
[3] 433 MHz (Wireless RF) Communication between Two Arduino UNO by Fahmida Ahmed, Shakh Md. Alimuzjaman Alim, Md. Shafiqul Islam, KantiBhusan Roy Kawshik, Shafiul Islam published in American Journal of Engineering Research (AJER) e-ISSN: 2320-0847 p-ISSN: 2320-0936 Volume-5, Issue-10, pp-358-362

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