Serial Communication between Arduino and Bluetooth Module (Hc05) via Android Device

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Abstract— **The main aim of this paper is to manifest and perform serial communication between arduino and the Bluetooth module. Here the connectivity department consists of the connection between arduino nano board and the Bluetooth module. Generally in the modern day scenario Bluetooth and wifi serves as the main platform of sending and the reception of data with the help of which we can send and transmit the data in different formats from one device to another device .On the other hand if we are going to send data over a large network the question arises in the data security and for this data security purpose it can be assumed that not all the data can be received at the receiver side at the same time and apart from this some data can be lost in the process of transferring the streams of data from one device to another device. The main goal of this paper is to provide high reliable communication between arduino and Bluetooth such that any kind of android device can be connected with the board to send and transfer data from one end to the other end. The contrasting thing about serial communication in case of parallel communication is that in case of serial communication only one set of data is being transferred from one end to the other end while parallel communication is simply the vice versa of the earlier one. .The design of this paper is done with the arduino board and the uploading of the program involving the style of sketchbook is done with the help of arduino software .Nowadays as the technology advances we need high ended reliable fast communication network to transmit the data from one channel to the other channel and for this we need system to be built in such a way it provides high security, configurability and reliability. These are the main features of this paper and depending on these features the paper work is done.**

Index Terms— **Bluetooth, arduino, serial communication, parallel communication.**

I. INTRODUCTION

Today in the modern day scenario we want reliable transmission of data and the reliable transmission of data can be provided with the help of wifi and Bluetooth module. Nowadays the wireless Communication becomes a spectrum by which we can send innumerable data stream from one channel to the other channel. The system involves the transmitter part and the receiver part which are used for transmitting and the reception of data. The Bluetooth module used here is HC05 which is a four pin Bluetooth module which is used for the interfacing purpose with that of the arduino board . This board is chosen because of its high demand and availability in the market . The Bluetooth which we are using here take care of short range of

distance i.e. within this short range the data can be transmitted from the arduino board to any device which is the main step of having serial communication. With the help of this we can have highest rate of communication and also the arduino nano board can serve as a Bluetooth module which can work to transmit the data providing higher relevance and security. Conceptually speaking IOT refers to the INTERNET OF THINGS which is used for the interfacing purposes between the software and the hardware platform. There is no direct relation between arduino and IOT but with the help of arduino board we can make innumerable IOT PROJECTS .Arduino is a small microcontroller board which is used as a hardware device for the IOT projects and it is used for controlling and regulating purposes. Arduino is a small microcontroller board which is used to implement the concepts of IOT. Normally if arduino is kept in the gateway and we want to communicate with the arduino from another then for communication purpose the best way is with the help of wireless technology and also with the help of sensors. The sensors are used for the sensing purposes and they are used as a part of the project and with the help of different sensors the measurement of temperature, humidity and all other things become easier according to the user point of view. Arduino board which is used as a hardware board for the IOT can be used for the cloud computing purposes. Generally Bluetooth offers short range of distance in transmitting the data from one device to another device but in relevance of this if we want to send the data from one device to the other device considerably zigbee can be used for this purpose. Arduino serves as the platform of hardware configuration and whereas the main media of transferring the data can is served with the Bluetooth module and apart from this the coding for manipulation is done in the arduino software environment which is a simple IDE environment used for uploading the sketches. Nowadays android phone has a quite efficient demand in the market due to its high superior manifestation in the market compared top the earlier operating systems which were expired now due to the modern day motivation and the innovation in the technology department. With the help of the pairing between arduino and the Bluetooth module we are going to send the data whereas this part acts as a transmitter one and the android acts as a receiver part to receive the data .Here in case of transmission and the reception of data the default baud rate is considered which is in the range of 9600 and the password protection is required which is used for the encryption of the data and the reason behind this is to provide high ended data security for the user in transferring data from one device to the another device. The settings are default when we are going to use our operation and the setting can be changed during our modification.

Fig1. Rrelation between arduino and iot

II. HARDWARE AND SOFTWARE PLATFORM

The hardware and the software platform which are used in our project are as follows:

A. *Hardware Board*

Arduino nano board: The schematic which we are using in this project depends on arduino nano board and it is quite familiar with that of the UNO board but one of the basic differences between UNO and NANO is that the NANO board is quiet small compared to that of the UNO specification. The arduino nano board is a

microcontroller based breadboard depending on ATMEGA328P where AT stands for Atmel group. The schematic of arduino nano board is given as below:-
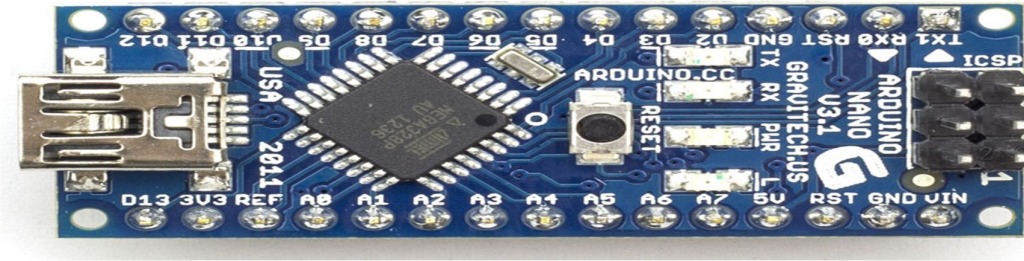

Fig 2. Arduino nano board

Soldless board: The soldless board is used as a connecting of the hardware samples with it with the help of connecting wires and the different interface mechanisms. In this project the sold less board is used to connect the peripherals of the arduino and the Bluetooth module.
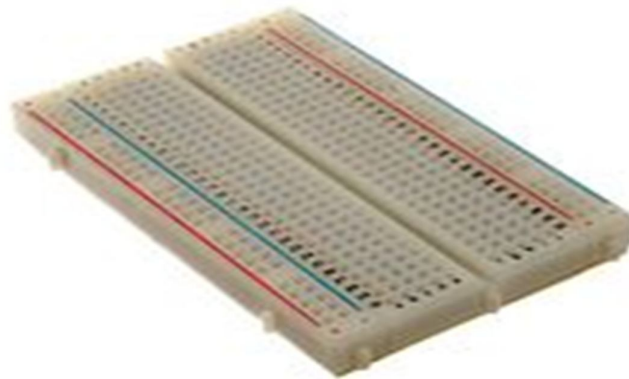

Fig 3. External view of soldless breadboard

Connecting wires: The connecting wires are used to interface between the arduino and alongside with that of the Bluetooth module. The arduino nano board is fixed on the soldless board and the transmitter and the receiver module of the arduino are connected with that of the Bluetooth module to provide high ended reliable and efficient mode of communication. The connecting ends of the arduino board are connected with that that of the Bluetooth module and the connecting parts are explained as below:-

- TX OF arduino is connected with RX of Bluetooth module
- RX of arduino is connected with that of the TX of Bluetooth module
- Vcc is connected to 5V power supply
- Gnd of arduino board is connected with the Gnd pin of Bluetooth module.

The above mentioned are the different connections which are used to interface between arduino board and the Bluetooth module and the main purpose of interfacing is to enhance serial communication between the arduino paired with Bluetooth and the external device. Replacing the connecting wires we can also use jumpers in replace to them to provide good bit of safety for connection purposes.

Arduino software platform: Arduino software part is used to upload the sketch in the environment. The c/c++ sketch consists of two basic functions and these are very important and noteworthy when we are going to interface with the hardware part. The functions are as follows:-
*Setup ():-*This function is called only once when the sketch starts after power on the device. This is used to initialize variables and also to generate input/output pin modes and also the library functions.

*Loop ():-*after setup loop has been called and it is executed repeatedly within the program because with the help of this controlling parameter the code has been executed and unsuccessful compilation is carried forward and executed.

Generally most arduino board contains light emitting diodes and a load resistor connected between pin 13 and ground and this is one of the sole features in connecting the arduino board with the software part.The successful execution of the program can be verified by blinking of the LED and the blinking of the LED proves out to be successful compilation. Another important aspect of arduino software is that it uses PINMODE (), digital write (), and delay () which are provided in the internal libraries and they are loaded in the arduino by the manufacturer.

B. Software Domain

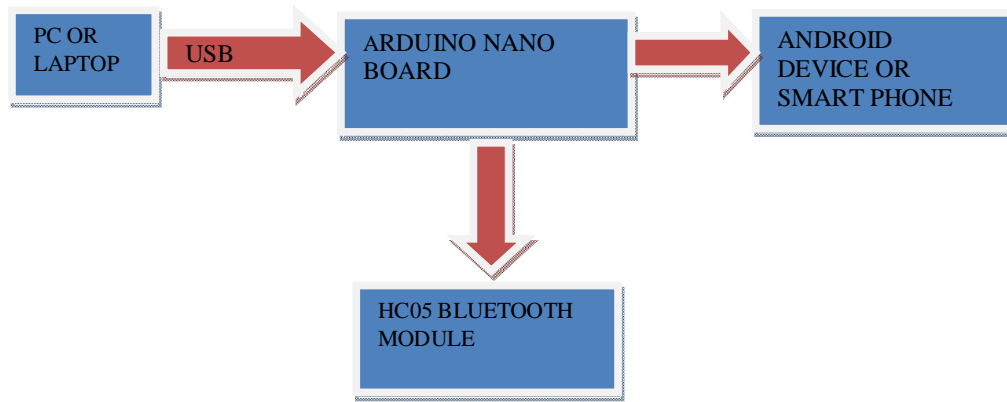- Arduino software platform

III. BLOCK DIAGRAM OVERVIEW

Fig 4. Serial communication

The above block diagram shows the schematic orientation of the serial communication performed with the help of arduino nano board configuration along with that of the Bluetooth module. The main purpose of this paper is to establish pairing between arduino nano board and the HC05 Bluetooth module set and to do this efficient serial communication is done between arduino and the Bluetooth module. The Bluetooth module is used as a wireless module to transmit the data and whereas the receiver part is used for detecting the data. Here the receiver part is considered as the android device which is used for the reception of data in an efficient manner.

The salient features of the block diagram are as follows:-

A. Dextop Connection

Dextop or laptop is used to connect with the arduino board via usb cable where usb cable is used for the interfacing purpose between the computer and the arduino board.

B. Arduino Nano Board

From the figure we can analyse that the arduino nano board is connected with the Bluetooth serial module. The Bluetooth serial module consists of the different configurations including RXD,TXD,GND,VCC,KEY BUTTON and all of these features are useful in programming with that of the arduino board. The connections are done while placing the kit in the soldless board along with the Bluetooth module and apart from this the connections are done with the help of USB cable too connected with the dextop. The arduino nano board configuration is done based on IDE environment and also with the help of arduino software.

Features of Arduino Board:

- Arduino board is build on IDE environment
- Contains leds and the blinking of the leds detect the transmitter and the receiver part.
- Contains the pin setup for analog inputs

- Same for digital input/outputs
- Mini usb jack
- Contains UART TTL which is connected to 5v power supply.
- The operation in arduino nano board can be performed using clock cycle.
- Used for serial communication.
- Contains inbuilt register.
- Can be used for the manipulation of the arithmetic logic unit.
- The debugging purpose can be done with the help of arduino software which is used to upload the sketches.

C. Bluetooth Serial Module

The Bluetooth serial module is used for communicating with the arduino board and after the communication is done between Bluetooth module and arduino board the led will blink in the arduino board showing the full connectivity. The pin should be initialized first when we are going to check the code in the arduino software and after successful compilation we need to upload the sketch in the sketch book providing a detail description about the errors after compilation of the code. The module which we are going to use here is the HC05 Bluetooth module which is high compatible and high demanding in the market compared to other Bluetooth modules. Generally this high ended operations involves more reliability and flexibility in operation compared with the other modules.

Working of bluetooth module: The Bluetooth module is in effective use with that of the distance and the specification of different classes. Bluetooth is used in exchanging the data from one device to another device and for this special purpose we require the classification of different classes and alongside with it the specification of range in meters**.** Generally the Bluetooth module operates in short range meters but compared to Bluetooth zigbee operates in more than high range compared to that of the Bluetooth module.

Applications of bluetooth module:
- Infra red access
- Wireless control and communication
- Wireless Bluetooth headset
- Wireless streaming of audio
- Low bandwidth applications.
- PICONET networks
- PROFNET networks
- High speed accessibility
- MODEM

D. Serial Communication

Serial communication is the process of sending data from one device to another device and this method is Contrasting compared to that of the parallel means of communication. In case of serial communication the data is transmitted sequentially from one device to another device. The synchronization aspect is quiet achievable in serial communication whereas in case of parallel communication it seems to be impractical. The nature of serial communication depends on the Bluetooth methodology and here in case of serial communication the data bits are send serially from one device to another device and the diagram is given below contrasting with parallel communication.

From the block diagram it is visualized the schematic behavior of parallel and serial communication. From the above figure we observe that there are two mediums present which are responsible for exchanging the data i.e. the transmitter side and the receiver side. The transmitter side is used to send the data and whereas the receiver side is used to receive the data in serial form. Here in case of serial transmission medium the MSB and LSB are present where MSB part is the receiving side and LSB part is the transmitting side. In parallel bit communication the data bits are send parallelly from one device to another device and whereas in serial communication the data bits are send serially from one device to another device providing faster means of communication. Serial communication is more active compared to that of parallel communication in which the data bits are send from the transmitting to the receiver side and whereas in case of serial communication the synchronization is faster compared to parallel communication.
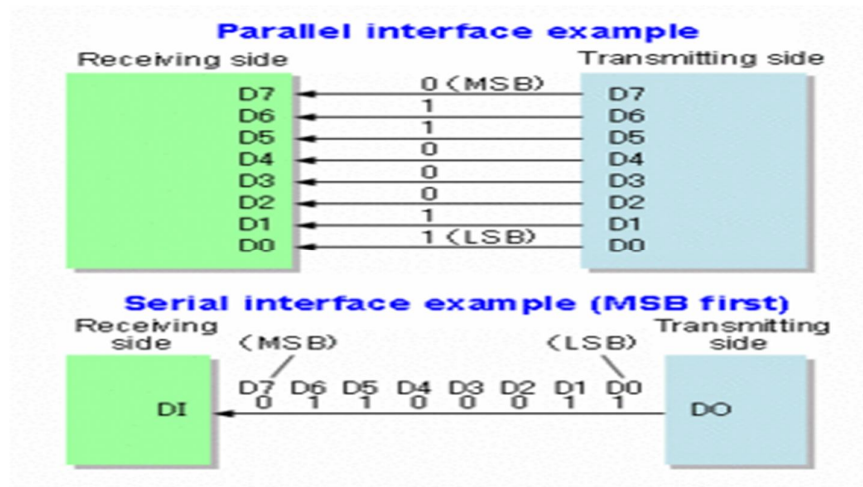
Fig 5. Serial communication interface

IV. STEPS FOLLOWED IN GETTING THE RESULT

STEP 1:-arduino nano board atmega 328 versions fitted in the sold less bread board.
STEP 2:-connecting HC05 Bluetooth module on the breadboard for interfacing purposes.
STEP 3:-connecting the pins of arduino nano board with that of the Bluetooth pins and the connecting parameters are getting as follows:-
RX connected with the TX pin.
TX is connected with that of the RX pin.
Vic is connected to 3v-5v power supply.
Gnd is connected with end terminal
With the help of these things the verification and compilation is achieved
STEP 4:-Downloading the arduino software from the arduino website.
STEP 5:-uploading the sketch in the arduino software
STEP 6: before uploading the software the transmitter and the receiver parts are disconnected and the sketch is uploaded.
STEP 7:-once successful compilation takes place the blinking of LED occurred.
STEP 8:-The blinking of LED can be controlled with the help of arduino software.
STEP 9:-The android phone is the receiver part and with the help of these we can get the information from the arduino board.
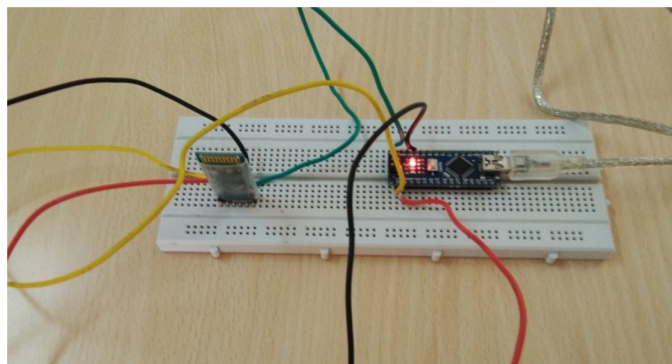
V. EXPERIMENTAL RESULTS

Fig 6. Experimental results

VI. APPLICATION

- Used in real time application projects
- Used for obstacle avoidance phenomenon
- Can be used as a messege sender protocol
- Can be used for home based automation system
- Cable fault recognition system

VII. ADVANTAGES

- Less cost
- Comes with an open source IDE environment
- Arduino software is well suited for the beginners
- Can be used with all the types of windows environment compatible with it
- Easy in interfacing purposes

VIII. CONCLUSION

The main view of the paper illustrates the serial communication achieved between the arduino nano board and the android mobile device. With the help of this communication the buildup is done between the device and finally we can establish serial communication between the two devices. Once the setup is being established and the pairing is done with the mobile phone then we can see the notification coming in the mobile phone and with the help of this we can obtain the data send from the board and also the configuration of LED can also be controlled with the help of arduino board.

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