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DESIGN AND IMPLEMENTATION OF A WIRELESS MESSAGE DISPLAY SYSTEM

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Abstract
The technology of displaying message is an important part of communication and advertisement. In recent times, Wireless communication has announced its arrival on big stage and the world is going with Smartphone technology. This work describes the design and implementation of a microcontroller based messaging display system. The messaging display system will be interfaced with an android application which will then be used to display information from the comfort of one's phone to an LCD screen using the Bluetooth application interface. The work employs the use of an ATMEGA328p Microcontroller mounted on an Arduino board, a Bluetooth Module (HC-06) and an LCD screen. Most of these electronic display systems were using wired cable connections, the Bluetooth technology used in this work is aimed at solving the problem of wired cable connections.The microcontroller provides all the functionality of the display notices and wireless control. A desired text message from a mobile phone is sent via android mobile application to the Bluetooth module located at the receiving end. The Mobile Application was created using online software called App Inventor. When the entire system was connected and tested, it functioned as designed without any noticeable problems. The Bluetooth module responded to commands being sent from the android application appropriately and in a timely manner. The system was able to display 80 characters on the 4 x 20 LCD within the range of 10m as designated by the Bluetooth datasheet.

Keywords: ATMEGA328p Microcontroller, Arduino board, Bluetooth Module HC-06, App Inventor, LCD screen

1. Introduction

Communication and the need to constantly be in touch with one another are very vital and cannot be over stressed. Communication is a purposeful activity of exchanging information across space and time using various technical or natural means, whichever is available or preferred. Communication requires a sender, a message, a medium and a recipient (Harper, 2013). Due to the present technological development, especially in the field of communication and Wireless network, a lot of applications appeared for the facility of our daily life needs. Such applications include using the electronic screens for Wireless advertisements as a substitute of using normal papers fixed on advertisement board, which is an inefficient cultural habit in addition to be against a clean environment. As engineers we are focused to think of alternative solutions to let information be noticed by others. Furthermore, using such methods spread information all over places such as universities, libraries, banks, supermarkets and the like. The main purpose is to provide the people with suitable information necessary and important in their lives. For example, in the university, it allows the students know about the data and time of their examination, or any other information they need as students.

Over a long period of time people have always tried to pass information across to the public using different means which include sign boards, stop signs, static billboards and notice painted on wood panels or walls as a means of passing information. These methods (traditional signage) used become

boring, monotonous in nature, hard to stand out from the crowd and causes confusion and ambiguity in locating desired areas. Technology today has advanced to such an extent that there has become the need for electronic display systems capable of displaying messages, graphics, logos and moving animation to satisfy all purposes, whether it be for business or domestic use that are sure to capture the attention of any audience. Most of these electronic display systems were using wired connections. The Bluetooth technology used in this paper is aimed at eliminating wired connections.

Raj (2014) worked on GSM based alphanumeric scrolling display system using PIC16F877A microcontroller interface with GSM modem via MAX232 level convertor. Hardware also included DS1307 real time clock, alphanumerical panel and multiple 16×2 character LCD displays and microcontroller coding was done using Embedded C and MpLab. In this research, multiple users were authorized to update notices on the digital notice board. This design can only handle a maximum of 60 characters on the board.

This study was therefore aimed at improving upon what has earlier been done by different investigators in respect to the design and implementation of message display boards by introducing the bluetooth HC-06 which allows a message to be sent wirelessly free of charge.

2. Materials and Methods

The materials and methods used in this work are categorized into Hardware, Software and Implementation. These sections are described below:

2.1 Hardware Section

The hardware utilized in this paper exists in two tiers. The first is the base control station hardware, which consists of a cellphone with Bluetooth connection, which provides the means of communication between the mobile application software and the display system software, which are both discussed in the software section. The second is the messaging display system hardware, which consists of a Bluetooth HC-06 module mounted on an Arduino Uno-board, as well as supporting hardware such as power supply, LCD, and breadboard for the assembling of the components.

Sequential steps in designing the hardware section include:

1. Selection of microcontroller (Arduino),

2. Design of auxiliary components,

3. Electrical connections,

4. Selection of display unit,

5. Design of switching units

In order to achieve the objectives of this study, a number of considerations needed to be made when selecting key pieces of hardware, so as to keep a balance between practicability and specifications.

The key pieces of hardware, their functions and the considerations made in their selection are discussed as follows.

2.1.1 Arduino-Uno Microcontroller

In order to complete the research work, a microcontroller is needed and the reasons for choosing the Arduino Uno includes the fact that it is a low power consumption board, these systems provide sets of digital and analog I/O pins that can be interfaced to various extension boards and other circuits. The board features serial communications interfaces, including USB for loading programs from personal computers. For programming the microcontrollers, the Arduino platform provides an integrated development environment (IDE) based on the processing project, which includes support for C and C++ programming languages (Simon, 2011) An important aspect of the Arduino is its standard connectors, which lets users connect the CPU board to a variety of interchangeable add-on modules known as shields (Massimo and Michael, 2016).

2.1.2 Liquid Crystal Display

In order to have quality view of the text a liquid crystal display was chosen because of its availability in wider range of screen sizes than CRTs and plasmas. LCDs don't use phosphors which prevents them from suffering image burn in (Fujitsu, 2011). The LCD screen is more energy efficient and can be disposed of more safely than a CRT. Its low electrical power consumption enables it to be used in battery-powered electronic equipment. It is very compact, light and has low power consumption and very little heat is emitted during its operation, due to low power consumption it has razor sharp image with no bleeding/smearing when operated at native resolution and emits much less undesirable electromagnetic radiation (in the extremely low frequency range) than a CRT monitor.

2.1.3 Selection of Bluetooth Module (HC-06)

For wireless and ease of communication the Bluetooth module HC-06 was used in this work. This module permits any microcontroller with a standard RS232 serial port to communicate with a PC or a Smartphone equipped with a Bluetooth Master module. Bluetooth HC-06 normally works on a master-slave principle. The Master device searchesto pair up with the slave device automatically under specific conditions. There is only point to point communication for modules, but the adapter can communicate with multi-modules (PF, 2014).

The Bluetooth HC-06 is easy to use because of the presence of an LED indicator. The red LED in Bluetooth module indicates the status of the connection: when flashing, the module is in the phase of interconnection with other modules located in the same area. When the LED is ON, it indicates that the module is already synchronized or "paired" with another Bluetooth master module and therefore is ready to transmit and receive information (PF, 2014).

2.1.4 Power Supply Unit

The Arduino board can operate on an external supply of 6 to 20 volts.If supplied with less than 7 volts, however, the pin 5 may supply less than five volts and the board may be unstable (Simon, 2010).If using more than 12volts is supplied, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts which is the reason behind choosing the 9volts battery.

The block diagram of the work is as shown in Figure 1.

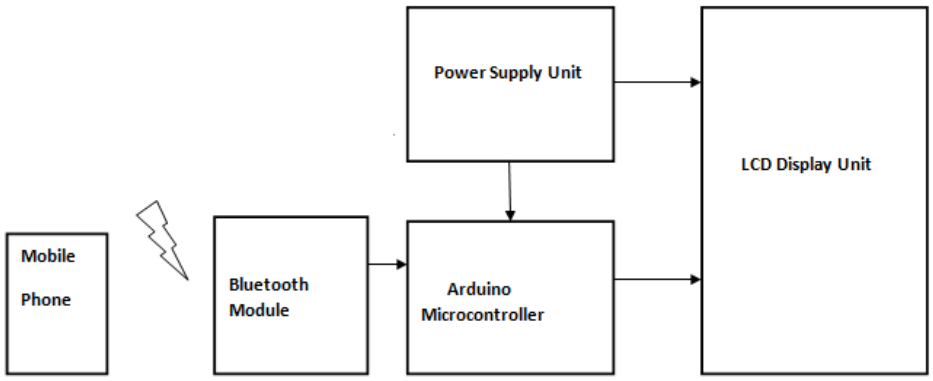

Figure 1: Block diagram of the messaging display system

2.2 Implementation

The connection of the hardware components are highlighted below. To control the LCD 4X20, the connection of the pins were made as in Figure 2, for the connection on the Arduino Uno. Pins 2 to 7, VCC and GND of the Arduino board were used.

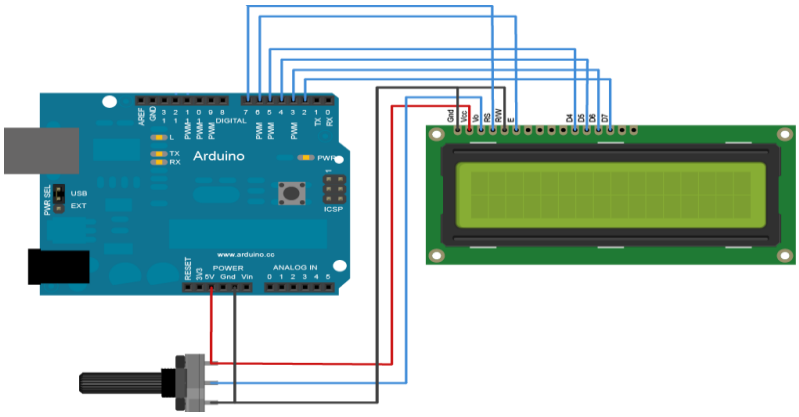

Figure 2: Connection of Arduino Uno and the 4x20 LCD

The Bluetooth module is connected as shown in Figure 3 with the pins 0 and 1 of the Arduino connected to the TX and RX of Bluetooth module respectively and powered by VCC (5V) and GND of the Arduino.

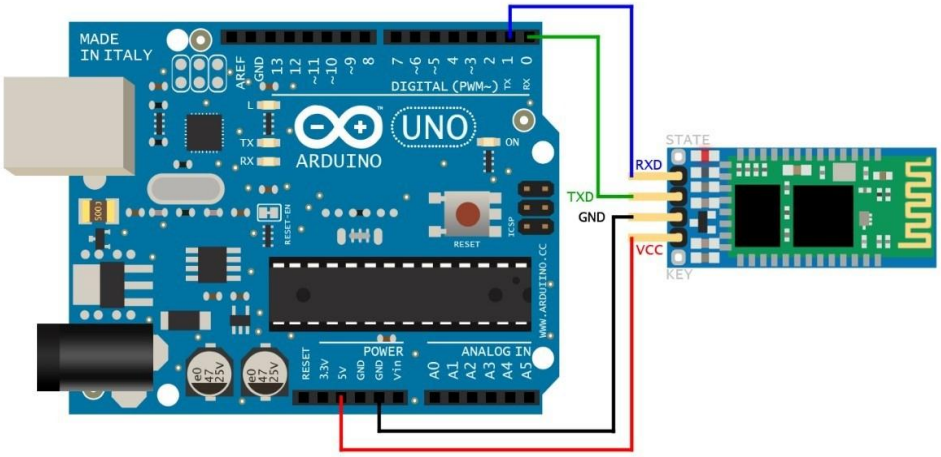

Figure 3: Connections of the Arduino Uno and the Bluetooth module HC-06

The diagram in Figure 4 shows the connection of the complete circuit and makes it clearer.

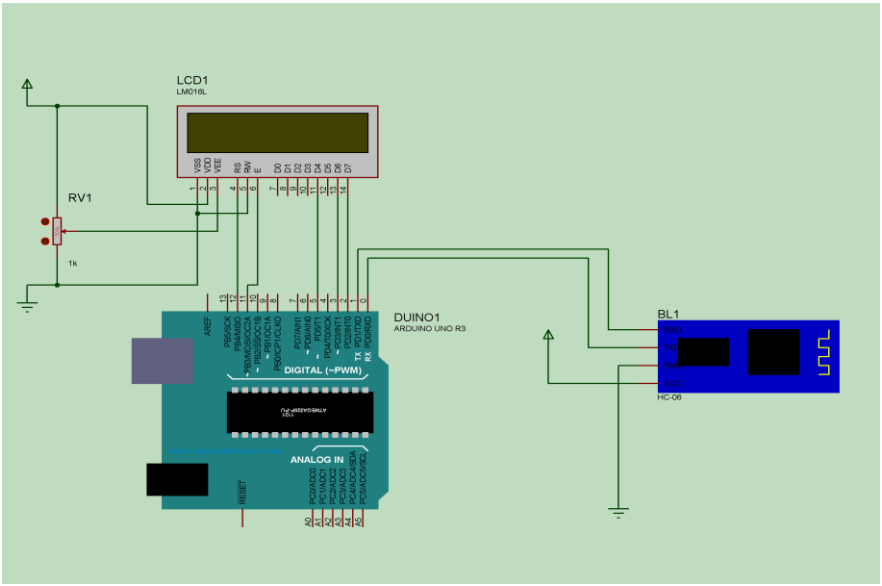

Figure 4: Complete connection of the circuit

2.3 Software Section

The software used in this work consists of two parts. The first is the code for communication between the Arduino Bluetooth and the mobile phone and the second is the mobile application used to send the text from the mobile to the LCD screen.

2.3.1 Establishing Communication between Arduino Bluetooth and Mobile Phone

Arduino programs are written in C++. The Arduino IDE comes with a software library called "Wiring" from the original Wiring project, which makes many common input/output operations much easier. Users only need define two functions to make a run able cyclic executive program:

- setup (): a function run once at the start of a program that can initialize settings
- loop (): a function called repeatedly until the board powers off (Simon, 2011).

2.3.2 Mobile Application

The implementation of the MobileApplication was created using online software called AppInventor. The AppInventor is a web application developed by Google Labs in association with MIT. It is an application for those who are unfamiliar with traditional programming and Google Labs was based on research of educational computing, that is the reason of its simplicity (Hidalgo, 2015). The image of the code that was implemented for the application of mobile communication and Android is shown in Figure 5.This application will be responsible for sending a text from a mobile phone to be displayed on 4X20 LCD.

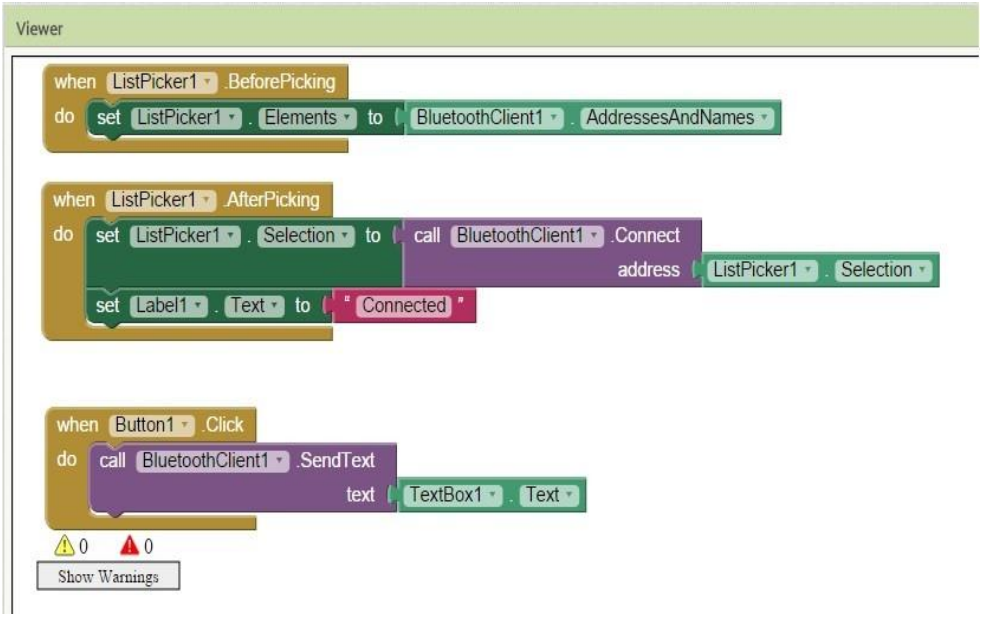

Figure 5: Implementation of the mobile application

The flowchart of the System is shown in Figure 6.

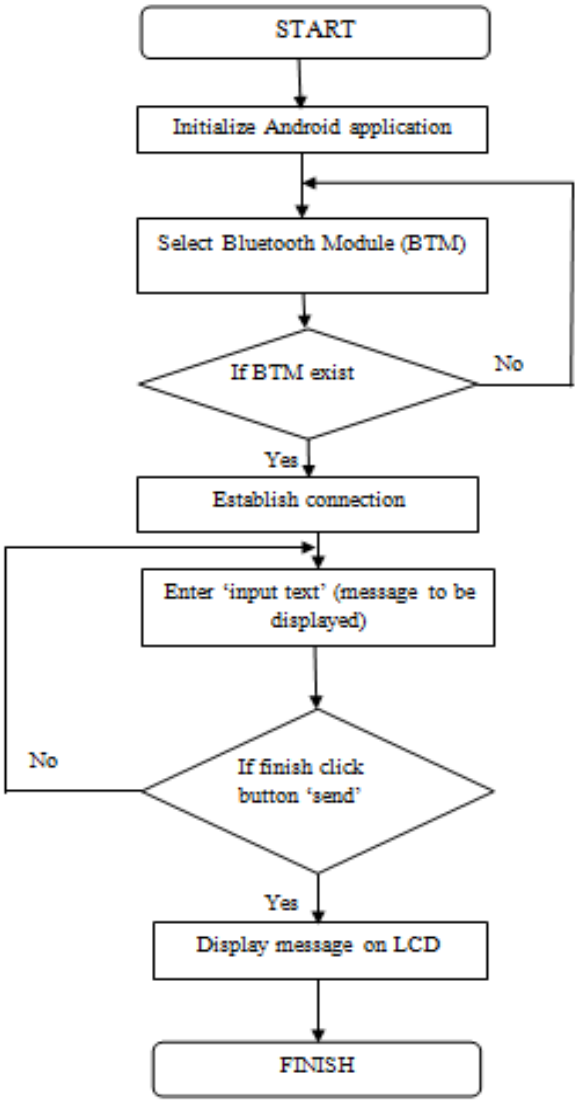

Figure 6: The flow chart of the designed system

3. Results and Discussion

When the entire system was connected and tested, it functioned as designed without any noticeable problems. The Bluetooth module responded to commands being sent from the android application appropriately and in a timely manner, it was able to display the information as shown in Figure 7.The system displayed 80 characters on the 4x20 LCD within the range of 10m as designated by the Bluetooth datasheet.

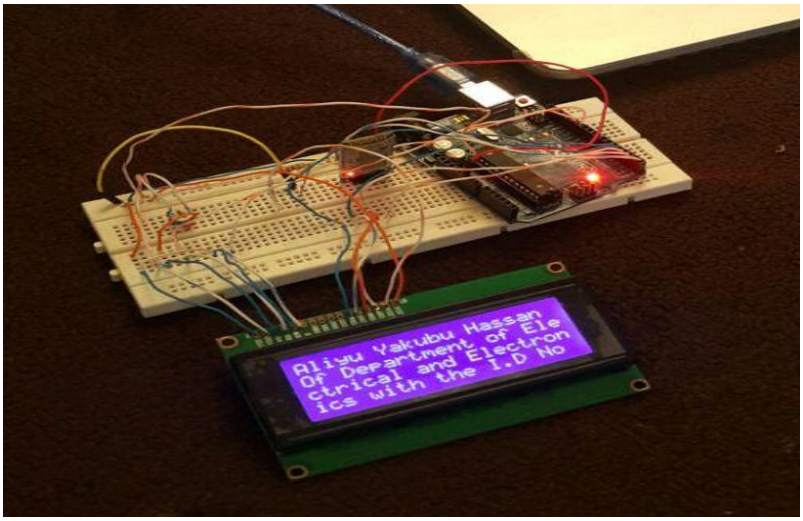

Figure 7: The Message Display System

4. Conclusion

A Bluetooth based message display system was carefully designed and implemented in this work. The design proved to be efficient and cost-effective. After successful implementation, messages sentfrom an android mobile phone via the mobile application were received by the Bluetooth module andconsequently, the messages were instantly displayed on the LDC display. The design was implemented via a wireless network which eliminates both the unnecessary wired connections and the task of manual reprogramming of the microcontroller whenever a new message has to be displayed.

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