Microprocessors for Embedded Computing

An Electronic Scooter Docking Station

GROUP 84

Summary of Responsibilities and Achievements

Group <84> Members:

Name	QM Student Number	BUPT Student Number
Yinze Li	161189147	2016213609
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Zijing Tian	161187800	2016213469
Pengran Wang	161189169	2016213611
Yu Sun	161189228	2016213617

I.   Individual member: Yinze Li (Leader)
Individual member contribution:

Linkage programmer: the design of serial communication.

II.   Individual member: Fan Ding
Individual member contribution:

Testing and hardware constructor.

III.   Individual member: Shiwen Zou
Individual member contribution:

LCD hardware programmer

IV.   Individual member: Zijing Tian
Individual member contribution:

Keypad hardware programmer

V.   Individual member: Pengran Wang
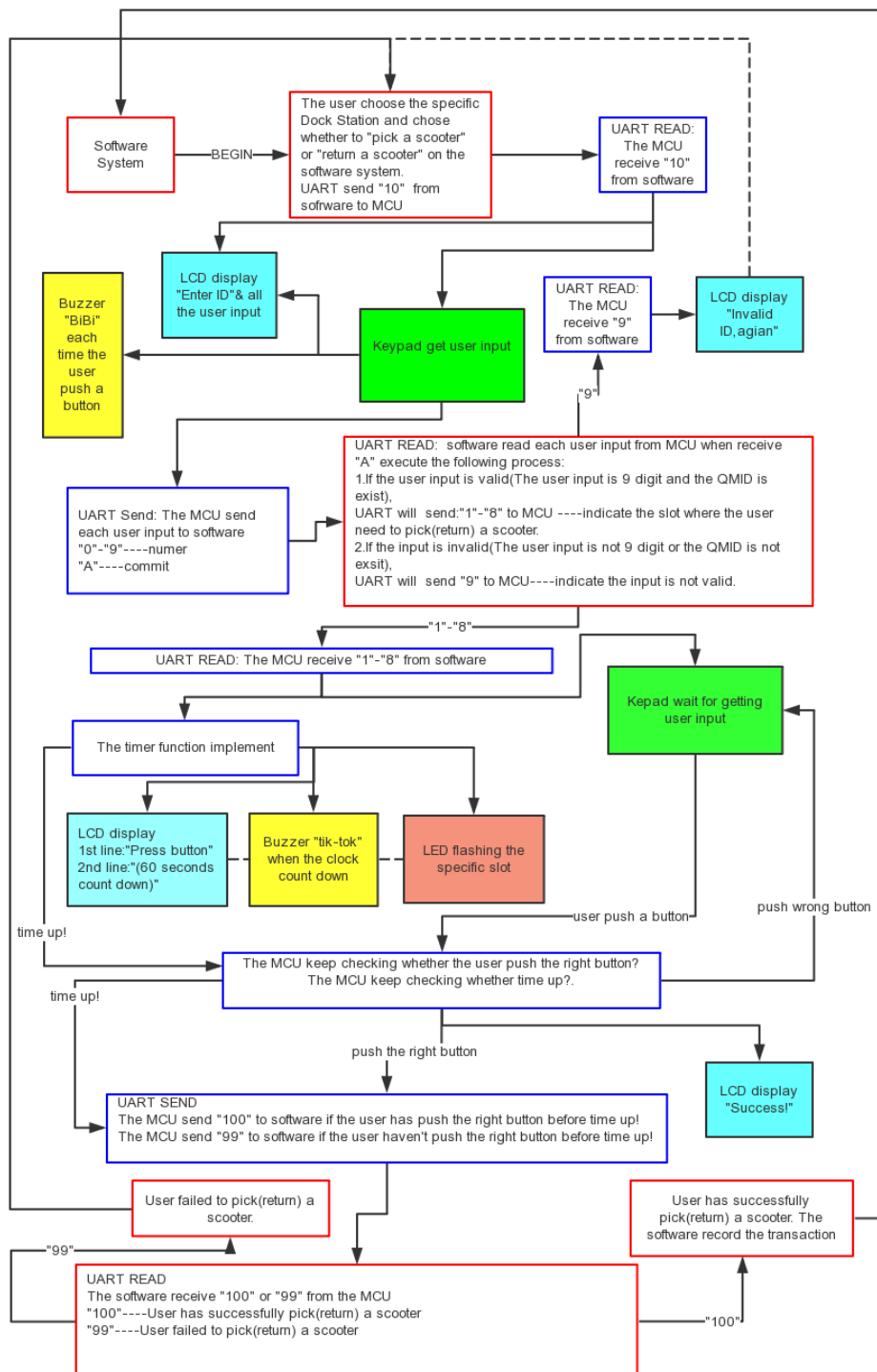**Individual member contribution:**

LED hardware programmer

VI.   Individual member: Yu Sun
Individual member contribution:

Buzz hardware programmer

Chapter 1 The design of Hardware

1.1 The integration designing structure of Hardware

Software System

BEGIN

The user choose the specific Dock Station and chose whether to "pick a scooter" or "return a scooter" on the software system.
UART send "10" from sofrware to MCU

UART READ:
The MCU receive "10" from software

Buzzer "BiBi" each time the user push a button

LCD display "Enter ID"& all the user input

Keypad get user input

UART READ:
The MCU receive "9" from software

LCD display "Invalid ID,agian"

"9"

UART Send: The MCU send each user input to software
"0"-"9"----numer
"A"----commit

UART READ: software read each user input from MCU when receive "A" execute the following process:
1.If the user input is valid(The user input is 9 digit and the QMID is exist),
UART will send:"1"-"8" to MCU ----indicate the slot where the user need to pick(return) a scooter.
2.If the input is invalid(The user input is not 9 digit or the QMID is not exsit),
UART will send "9" to MCU----indicate the input is not valid.

"1"-"8"

UART READ: The MCU receive "1"-"8" from software

Kepad wait for getting user input

The timer function implement

LCD display
1st line:"Press button"
2nd line:"(60 seconds count down)"

Buzzer "tik-tok" when the clock count down

LED flashing the specific slot

user push a button

push wrong button

time up!

The MCU keep checking whether the user push the right button? The MCU keep checking whether time up?.

time up!

push the right button

LCD display "Success!"

UART SEND
The MCU send "100" to software if the user has push the right button before time up!
The MCU send "99" to software if the user haven't push the right button before time up!

User failed to pick(return) a scooter.

User has successfully pick(return) a scooter. The software record the transaction

"99"

UART READ
The software receive "100" or "99" from the MCU
"100"----User has successfully pick(return) a scooter
"99"----User failed to pick(return) a scooter

"100"

1.2 The design of main functions

1.2.1 The design of serial communication

The baud rate is 9600 and they send 8-bit a time. When the MCU boot, it will do nothing until receive 10 (decimal), then it will wait user to input ID number. While MCU read the digit number from buttons, it will also transmit every digit to Java immediately. When user presses "confirm button", MCU will send 10 (decimal) to Java to indicate the ID inputting is finished. Then Java will send 9 (invalid ID number) or 1~8 (the slot to pick up or return a scooter). Then if user picks up or returns a scooter successfully, MCU will send 100 (decimal), 99 if timeout.

1.2.2 The design of the LED (8x8 LED matrix module)

Represent the light for each scooter slot, 8 slots in the station in total.

We use a 8×8 LED matrix module to complete the function of light flash when users want to pick up or return scooters. At each dock, there are eight slots represented by 8 LEDs.

Weconnect LED board with 8051 board at ports--- P1.0, P1.2, P1.3, P1.4, P3.2, P3.3, P3.6 and P3.7. Only the first row of 8×8 LED matrix are asked to flash, which represents the slots at a dock.

When a user wants to pick up or return a scooter. The system will assign an available slot randomly. At the same time, a correspondent LED will flash. After picking up or returning (pressing the button), the flashing LED will be closed immediately.

1.2.3 The design of the LCD (1602 LCD display)

Represent the screen of user messages

- When the MCU receive 10 and wait user to enter user ID, it will show a message "Enter ID" at first row and every digits user inputs at second row on LCD.

- When the MCU receive 9 which indicate the ID is invalid, it will display a message "Invalid ID, again".

- When the MCU receive 1~8, it will display a message "Press Button" at first row and count down by second (60, 59, 58…) at second row.

1.2.4 The design of the Keypad (4x4 Keypad)

Represent the input of the student id number

When entering the ID number, button s1~s9 represent 1~9, button s10 represents 0, button s11 represents "confirm".

1.2 The design of extra function

### 1.2.1 The design of the Buzzer (on board)

The buzzer will alarm in following for circumstances:

1. Users press buttons to input their ID number

2. Indicating the ID number is invalid

3. Tik-tok while count down 60 seconds

4. Users pick up or return a scooter at incorrect slot (press incorrect button)

1.2.2 The design of the time count down(1602 LCD display)

The LCD will display 60 seconds count down until the user successfully pick or return the scooter

Chapter 2 The design of Control Software
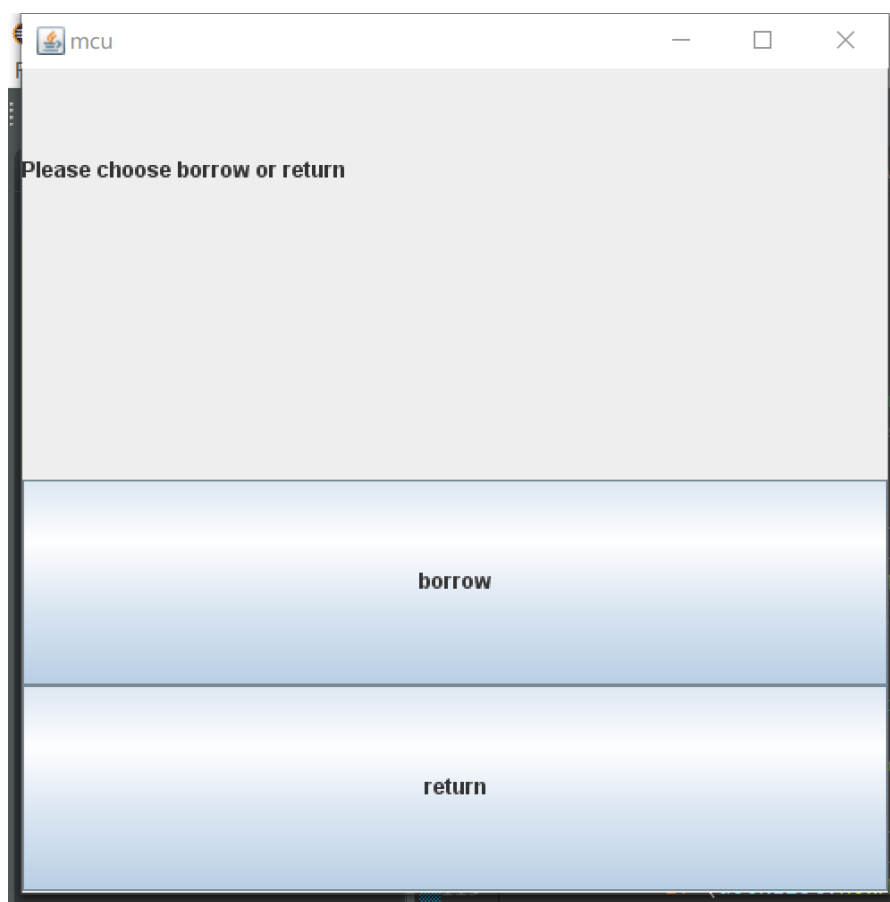
When a user select a dock to return or pick up a scooter, he will see this GUI. As this GUI starts, it will open and initialize the serial port to MCU board, and wait for selection.

Once the user choose to borrow or select a scooter, the Java program will check if the dock has available scooter or empty slot, if there is no available scooter or empty dock. The program will generate a hint and let user to choose another dock station. Otherwise, Java will send a byte '10' to indicate it's time to get the user's ID number.

If the user is invalid to pick up or return a scooter, the Java program will generate a message and transmit byte '9' to MCU board and let it know he is invalid. Otherwise Java will give a number of 1
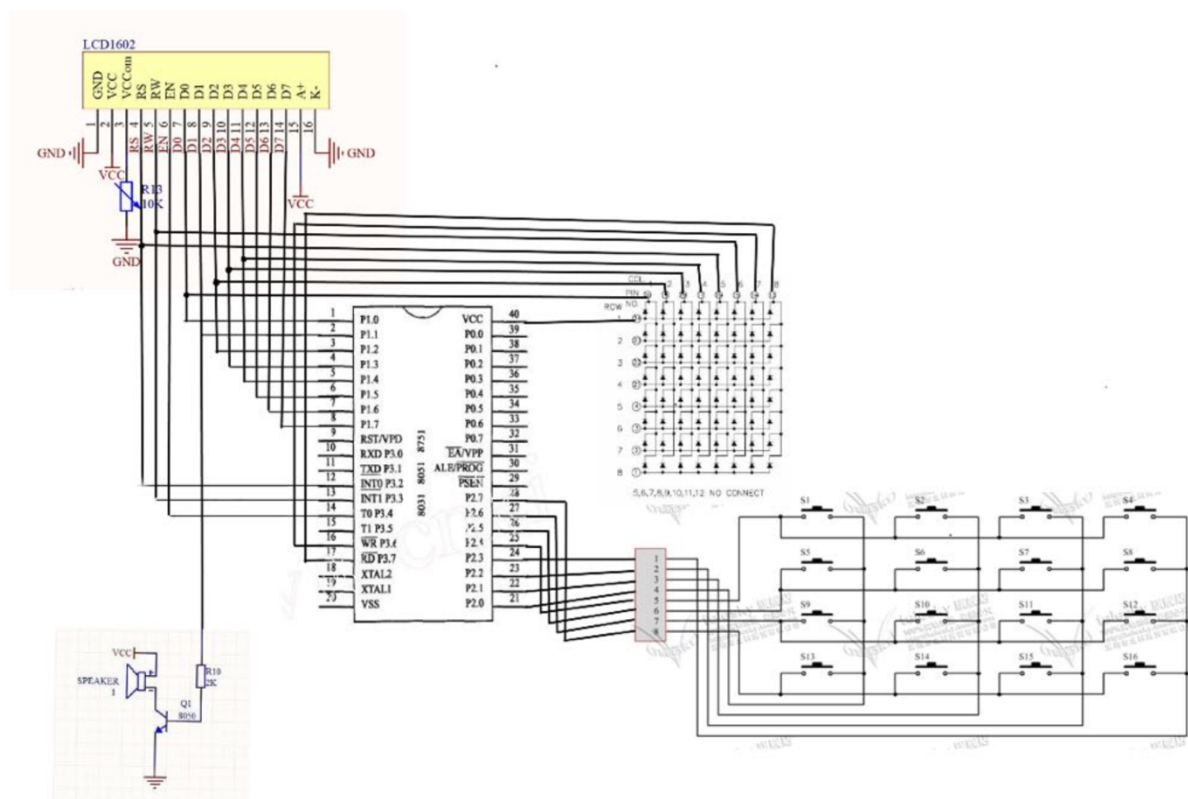
to 8 to indicate the number of slots for returning or picking up a scooter. Then Java program will keep hearing MCU, if it receive byte '100', which means the user successfully picks up or returns a scooter, then Java will generate a transaction to record and change the user's state.

Appendix

Reference

[1]. RXTX library: http://rxtx.qbang.org/wiki/index.php/Main_Page
[2]. RXTX Windows binary: http://fizzed.com/oss/rxtx-for-java
[3]. Handouts for class sessions
[4]. The 8051 Microcontroller and Embedded Systems Using Assembly and C (2 nd Ed) by M. A. Mazidi, J. G. Mazidi and R. McKinlay

Circuit diagrams

circuit diagram of our design