Visvesvaraya National Institute of Technology (VNIT), Nagpur

Embedded Systems (ECP-403)

ENDSEM

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Contents

Experiment-1: ENDSEM

Question: An ATM System: Consider an ESP32 based system to perform ATM alike operation for digital transactions. Let the initial account balance be Rs. 25000 to be permanently stored and updated from EPROM memory. For withdrawals only following denominations and number of notes availability are to be allowed: Rs. 2000 (Qty. 5 nos), Rs. 1000 (Qty. 10 nos), and Rs. 500 (Qty. 10 nos) or their multiples with no cap on withdrawal amount as long as the balance is available. Following specifications are to be considered. Utilize touch pins 0-9 and touch buttons to enter the login credentials and other inputs from the user. You are free to configure the touch pins as per your approach. [CO-3,4,5]
(a) A user is to be registered on ESP32 system with his/her phone number via Telegram/ WhatsApp/ Signal bot. When /login command should generate a 2 digit randomly generated OTP and send to user via bot. OTP is to entered using ESP32 touch pins for authorization and verification. [15]
(b) Once authenticated a user is allowed to enter the amount to be withdrawn using the touch pins. The denominations to be chosen as per the availability. The remaining balance and amount withdrawn to be displayed in the serial monitor/ bot after every transaction. Balance should also be available with the bot command /balance. [10]
(c) Update the balance (each denominations) on ThinkSpeak cloud using numeric widgets. [5]
(d) Any value addition to the system.

Requirements: Arduino,ESP 32

```
#include <WiFi.h>
#include <WiFiClientSecure.h>
#include <UniversalTelegramBot.h>
#include <HTTPClient.h>

String apiKey = "ZQYR6FFJ3JWT0UDS";//apikey for thingspeak
const char* server = "http://api.thingspeak.com/update";

// Wifi network station credentials
#define WIFI_SSID "Vikas"
#define WIFI_PASSWORD "9948802638"

// Telegram BOT Token (Got from Botfather)
#define BOT_TOKEN "2124355710:AAFAByPdx-MrJ3SHMNP-HVlsZ77WdKWbl6w"


const unsigned long BOT_MTBS = 1000;// mean time between scan ...
```

```
    messages

WiFiClient client;
WiFiClientSecure secured_client;

UniversalTelegramBot bot(BOT_TOKEN, secured_client);
unsigned long bot_lasttime; // last time messages' scan has been ...
    done

const int ledPin = 2;
int amount=25000;
int twothousands=5;
int thousands=10;
int fivehundreds=10;
int login_status=0;

//function to handle new messages form telegram bot
void handleNewMessages(int numNewMessages)
{

  Serial.print("handleNewMessages ");
  Serial.println(numNewMessages);

  for (int i = 0; i < numNewMessages; i++)
  {
    int a[2];//array for assigning numbers from touch pins for OTP
    int t[25];// array for assigning numbers from touch pins for ...
       money withdrawal
    int total=0; // variable for storing withdrawal amount
    int j;
    int k=1;
    String chat_id = bot.messages[i].chat_id;
    String text = bot.messages[i].text;

    String from_name = bot.messages[i].from_name;
    if (from_name == "")
    from_name = "Guest";
    int r;// variable for storing random two digit number for OTP


    //if we receive /login from telegram bot it will execute ...
       this condition
    if (text == "/login")
    {
          r=random(99);// "random(99)" will generate random ...
             numbers from 0 to 99
          String OTP = "your OTP is "+String(r);
          bot.sendMessage(chat_id,OTP,"");
          while(login_status != 1)
```

```
62              {
63               for(j=0;j<2;j++)
64               {
65                int v2 = touchRead(12);
66                int v1 = touchRead(4);
67                int v3 = touchRead(15);
68                int v4 = touchRead(13);
69                int v5 = touchRead(14);
70                int v6 = touchRead(27);
71                int v7 = touchRead(33);
72
73
74               if(v1<50 && v2>80)
75               {
76                 a[j]=0;
77                 digitalWrite(2,HIGH);
78               }
79               if(v2<30 && v1>80)
80               {
81                  a[j]=1;
82                  digitalWrite(2,HIGH);
83               }
84               if(v1<30 && v2<30)
85               {
86                 a[j]=6;
87                 digitalWrite(2,HIGH);
88               }
89               if(v3 < 30)
90               {
91                 a[j]=2;
92                 digitalWrite(2,HIGH);
93               }
94               if(v4 < 30)
95               {
96                 a[j]=3;
97                 digitalWrite(2,HIGH);
98               }
99               if(v5 < 30)
100              {
101                 a[j]=4;
102                 digitalWrite(2,HIGH);
103              }
104              if(v6 < 30)
105              {
106                 a[j]=5;
107                 digitalWrite(2,HIGH);
108              }
109              if(v7 <50)
110              {
```

```
111                a[j]=7;
112                digitalWrite(2,HIGH);
113              }
114              if(v3<30 && v4<30)
115              {
116                  a[j]=8;
117                  digitalWrite(2,HIGH);
118              }
119              if(v5<30 && v6<30)
120              {
121                   a[j]=9;
122                   digitalWrite(2,HIGH);
123              }
124              else
125              {
126                  digitalWrite(2,LOW);
127              }
128              delay(500);
129
130              }
131              int num=a[0]*10+a[1];// it will store OTP from touch pins
132
133              // This condition will check wheather entered OTP is ...
                     correct or incorrect
134              //if correct this statement will be executed ...
                     therefore login will be succesfull
135               if(r==1)
136               {
137                 delay(1000);
138                 digitalWrite(2, HIGH);
139                 bot.sendMessage(chat_id,"Login succesfull","");
140                 login_status=1;
141                 digitalWrite(2, LOW);
142                 String welcome = "Welcome  " + from_name + ".\n";
143                       welcome += "ATM bot\n";
144                       welcome += "/withdraw : to withdraw money\n";
145                       welcome += "/balance: to check your account ...
                             balance\n";
146                       bot.sendMessage(chat_id, welcome, "Markdown");
147                 break;
148               }
149               else
150               {
151                  digitalWrite(2, LOW);
152                  bot.sendMessage(chat_id,"Entered wrong OTP","");
153                  break;
154               }
155             }
156
```

```
157         }
158       // this condition will show us the balance amount
159       if (text == "/balance" && login_status==1)
160       {
161         String bal="you have "+String(amount);
162         bot.sendMessage(chat_id,bal, "");
163       }
164
165       //this condition is for withdrawing money
166       if (text == "/withdraw" && login_status==1)
167       {
168          for(j=0;j<3;j++)
169              {
170               int v2 = touchRead(12);
171               int v1 = touchRead(4);
172               int v3 = touchRead(15);
173               int v4 = touchRead(13);
174               int v5 = touchRead(14);
175               int v6 = touchRead(27);
176               int v7 = touchRead(33);
177
178
179              if(v1<50 && v2>80){
180               t[j]=0;
181
182               digitalWrite(2,HIGH);
183               }
184              if(v2<30 && v1>80)
185               {
186                 t[j]=1;
187
188
189                digitalWrite(2,HIGH);
190               }
191              if(v1<30 && v2<30)
192              {
193                t[j]=6;
194
195                digitalWrite(2,HIGH);
196               }
197              if(v3 < 30)
198              {
199                t[j]=2;
200                digitalWrite(2,HIGH);
201              }
202              if(v4 < 30)
203              {
204                t[j]=3;
205                digitalWrite(2,HIGH);
```

```
206             }
207             if(v5 < 30)
208              {
209                t[j]=4;
210                digitalWrite(2,HIGH);
211              }
212              if(v6 < 30)
213               {
214                t[j]=5;
215                digitalWrite(2,HIGH);
216                }
217                if(v7 <50)
218                {
219                   t[j]=7;
220                   digitalWrite(2,HIGH);
221                }
222                if(v3<30 && v4<30)
223                {
224                 t[j]=8;
225                 digitalWrite(2,HIGH);
226                }
227                if(v5<30 && v6<30)
228                {
229                  t[j]=9;
230                  digitalWrite(2,HIGH);
231                 }
232                else{
233                 digitalWrite(2,LOW);
234                 }
235
236                delay(500);
237             }
238
239             String sta = "denomination:2000x"+String(t[0]);
240             Serial.println(sta);
241             String sta1 = "denomination:1000x"+String(t[1]);
242             Serial.println(sta1);
243             String sta2 = "denomination:500x"+String(t[2]);
244             Serial.println(sta2);
245              if (t[0]>0 & t[0]<5 & twothousands != 0)
246              {
247                total = total+ 2000*t[0];
248                twothousands-=1*t[0];
249
250              }
251              if( t[1]>0 && t[1]≤10 && thousands !=0)
252              {
253                total = total+ 1000*t[1];
254                thousands-=1*t[1];
```

```
255
256              }
257              if(t[2] > 0 && t[2] ≤10&& fivehundreds !=0)
258              {
259                total = total+ 500*t[2];
260                fivehundreds-=1*t[2];
261
262              }
263             delay(5000);
264             amount=amount-total;
265             String withdrawn="you have withdrawn"+String(total);
266             Serial.println(withdrawn);
267             String bal="you have "+String(amount);
268             Serial.println(bal);
269             bot.sendMessage(chat_id,withdrawn, "");
270             bot.sendMessage(chat_id,bal, "");
271
272             //code for uploading in thingspeak cloud
273
274             HTTPClient http;
275             http.begin(server);
276             String DataSent = "api_key=" + apiKey + "&field1="+ ...
                    String(amount)+"&field2="+ ...
                    String(twothousands)+"&field3="+ ...
                    String(thousands)+"&field4="+ String(fivehundreds);
277             int Response = http.POST(DataSent);
278             http.end();
279             client.stop();
280             Serial.println("updated in thingspeak");
281             delay(1000);
282
283
284      }
285
286    }
287  }
288
289
290  void setup()
291  {
292    Serial.begin(115200);
293    Serial.println();
294
295    pinMode(4,INPUT);
296    pinMode(12,INPUT);
297    pinMode(15,INPUT);
298    pinMode(13,INPUT);
299    pinMode(14,INPUT);
300    pinMode(27,INPUT);
```

```
301   pinMode(33,INPUT);
302   pinMode(2,OUTPUT);
303   pinMode(ledPin, OUTPUT); // initialize digital ledPin as an ...
          output.
304   delay(10);
305   digitalWrite(ledPin, LOW); // initialize pin as off (active LOW)
306
307   // attempt to connect to Wifi network:
308   Serial.print("Connecting to Wifi SSID ");
309   Serial.print(WIFI_SSID);
310   WiFi.begin(WIFI_SSID, WIFI_PASSWORD);
311   secured_client.setCACert(TELEGRAM_CERTIFICATE_ROOT); // Add ...
          root certificate for api.telegram.org
312   while (WiFi.status() != WL_CONNECTED)
313   {
314     Serial.print(".");
315     delay(500);
316   }
317   Serial.print("\nWiFi connected. IP address: ");
318   Serial.println(WiFi.localIP());
319
320   Serial.print("Retrieving time: ");
321   configTime(0, 0, "pool.ntp.org"); // get UTC time via NTP
322   time_t now = time(nullptr);
323   while (now < 24 * 3600)
324   {
325     Serial.print(".");
326     delay(100);
327     now = time(nullptr);
328   }
329   Serial.println(now);
330 }
331
332 void loop()
333 {
334   if (millis() - bot_lasttime > BOT_MTBS)
335   {
336
337     int numNewMessages = ...
            bot.getUpdates(bot.last_message_received + 1);
338
339     while (numNewMessages)
340     {
341       Serial.println("got response");
342       handleNewMessages(numNewMessages);
343       numNewMessages = bot.getUpdates(bot.last_message_received ...
              + 1);
344     }
345   }
```

```
346 }
```

explanation and output: On the top of the code i included necessary libraries for this code to work according to the question .And stored amount =25000,two thousand notes =5, thousand notes = 10,five hundreds = next i coded setup module so that esp32 will be connected to internet through WiFi and telegram bot. Next i coded a void loop to check constantly whether it received any command from telegram bot so that it will pass to the "handleNewMessages" function.handleNewMessages" function is the main part of the code if it receives "/login" then a number between 0 to 99 is generated as OTP.with the help of touch sensors in ESP32 we have enter OTP .If the entered OTP is correct your login will be successful or else New OTP will be generated and you have to enter OTP again. touch pins are configured as pin 4 = 0 pin 12 = 1 pin 15 = 2 pin 13 = 4 pin 14 = 5 pin 27 = 7 pin 33 = 8 pin 4 and pin 12 =6 pin 14 and pin 27 = 9

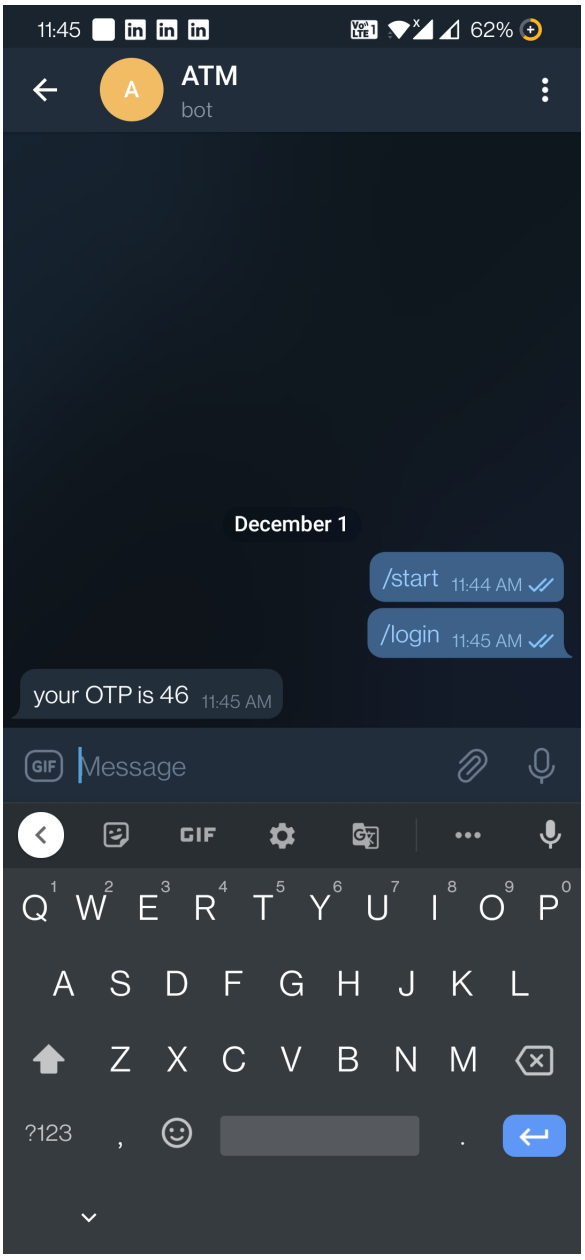
in our case OTP = 46

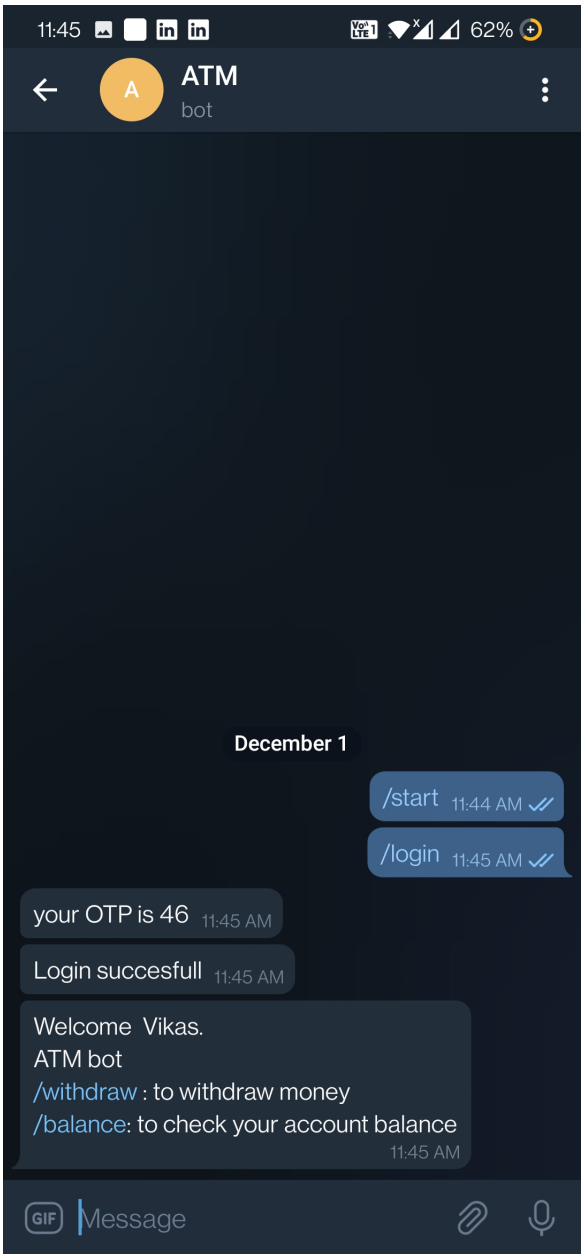
after entering correct OTP telegram bot will reply login successful and give two options To withdraw and to check balance

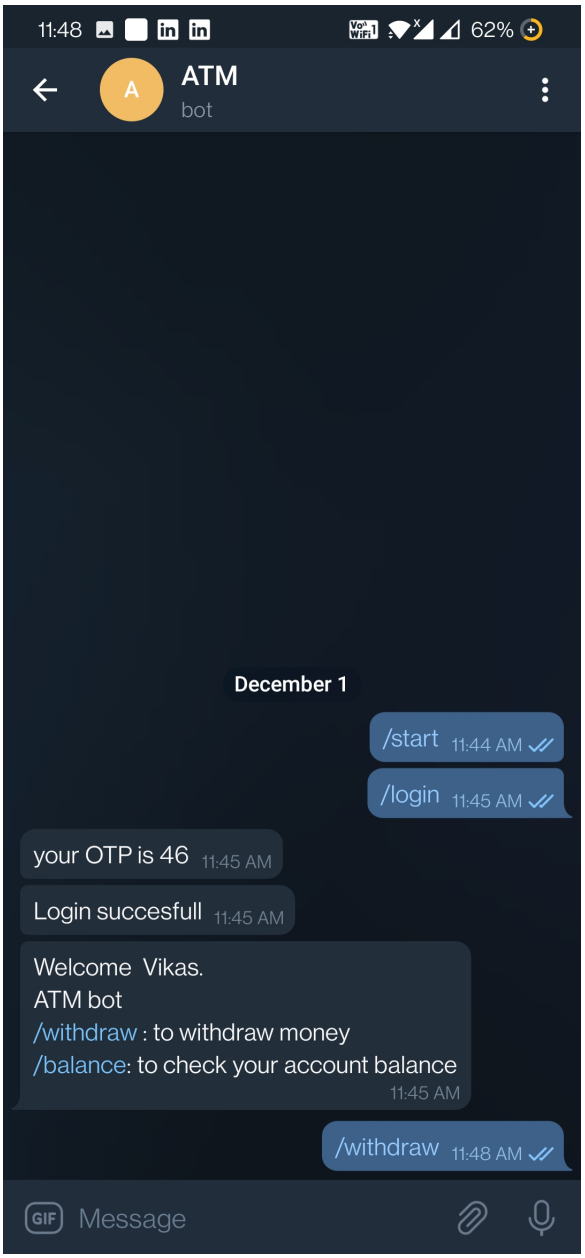
if we choose withdraw we have to enter denominations as per the availability we have withdrawn 1 two thousand note and 1 five hundred note telegram bot will reply total withdrawn amount and balance amount

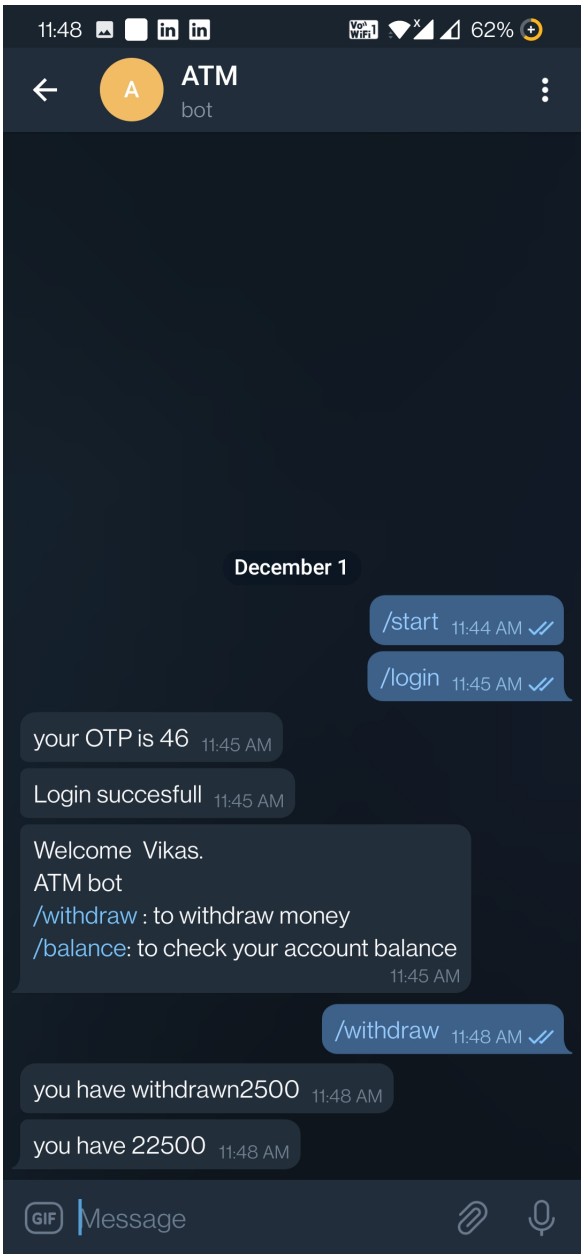
and denominations and balance will be updated in thingspeak cloud and serial monitor

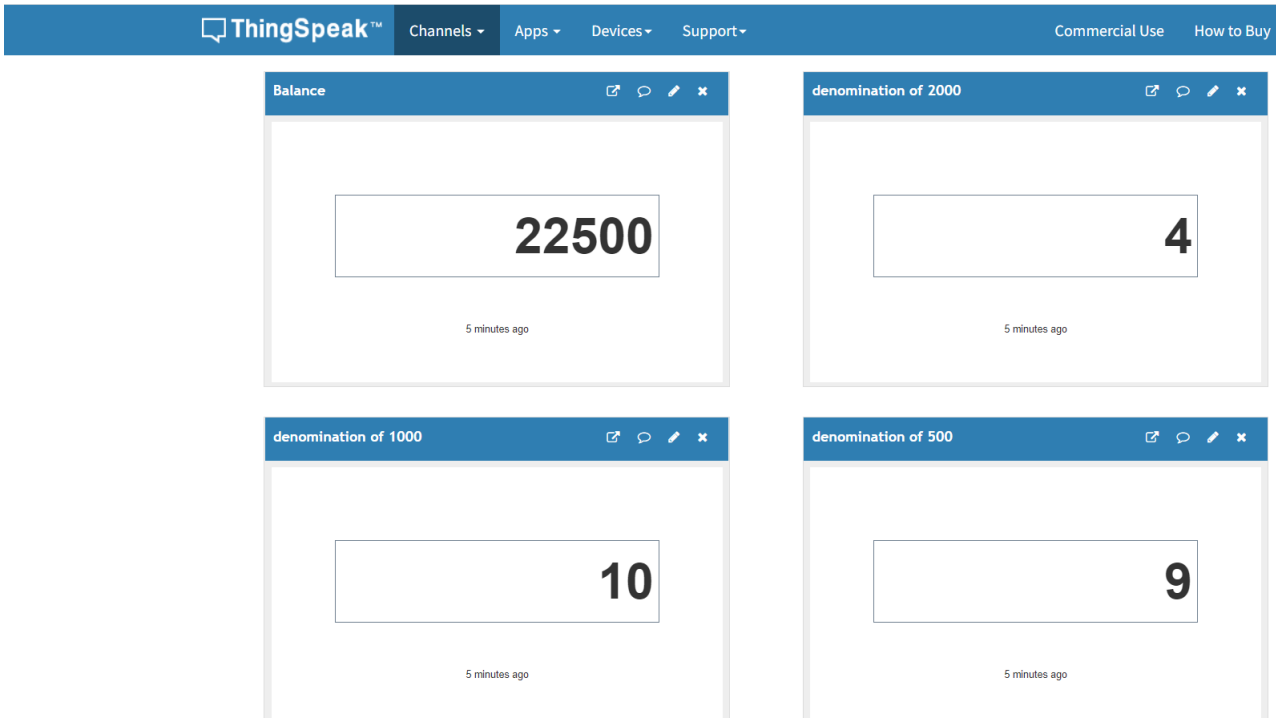
youtube link :https://youtu.be/59SU5uIzxEg

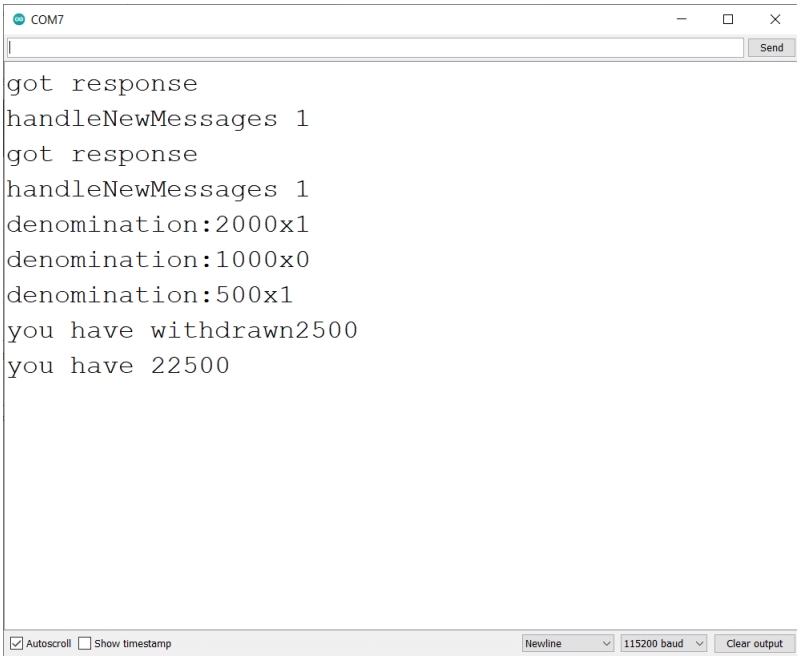

11:45
62%
ATM
bot
December 1
/start 11:44 AM
/login 11:45 AM
your OTP is 46 11:45 AM
Message
GIF
Q W E R T Y U I O P
A S D F G H J K L
Z X C V B N M
?123


11:45
62%
ATM
bot
December 1
/start 11:44 AM
/login 11:45 AM
your OTP is 46 11:45 AM
Login succesfull 11:45 AM
Welcome Vikas.
ATM bot
/withdraw : to withdraw money
/balance: to check your account balance
11:45 AM
GIF
Message


11:48
62%
ATM
bot
December 1
/start 11:44 AM
/login 11:45 AM
your OTP is 46 11:45 AM
Login succesfull 11:45 AM
Welcome Vikas.
ATM bot
/withdraw : to withdraw money
/balance: to check your account balance
11:45 AM
/withdraw 11:48 AM
Message


11:48
62%
ATM
bot
December 1
/start 11:44 AM
/login 11:45 AM
your OTP is 46 11:45 AM
Login succesfull 11:45 AM
Welcome Vikas.
ATM bot
/withdraw : to withdraw money
/balance: to check your account balance
11:45 AM
/withdraw 11:48 AM
you have withdrawn2500 11:48 AM
you have 22500 11:48 AM
GIF
Message


ThingSpeak™
Channels
Apps
Devices
Support
Commercial Use
How to Buy
SB
Balance
22500
5 minutes ago
denomination of 2000
4
5 minutes ago
denomination of 1000
10
5 minutes ago
denomination of 500
9
5 minutes ago


COM7
Send
got response
handleNewMessages 1
got response
handleNewMessages 1
denomination:2000x1
denomination:1000x0
denomination:500x1
you have withdrawn2500
you have 22500
Autoscroll
Show timestamp
Newline
115200 baud
Clear output