

Implementation of an Automated System to Control Machine Through IP

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Abstract— This paper presents a technique to operate any kind of machine in automated way through IP. That obvious means user can operate their required machine from any kind of distance. To user this system will provide as a P2P device controller, where user can plug any types of machine and can trigger via IP. Again in our system we are controlling over IP so in a single time multi user control issue also can be avoided. In implementation phase our target machine was only water pump as it may need to control from any kind of distance.

Keywords— Arduino; CDMA; GSM; IP; P2P; Wi-Fi/ Ethernet shield– Arduino;

I. Introduction

An automated system is system where input is provided and a device or machine carries out a process to produce output [1]. The concept of “automation” has existed for many years. It began with a student connecting two electric wires to the hands of an alarm clock in order to close a circuit of a battery and light bulb. Later, companies developed automated systems of their own [2]. The advantages of automated system are, process information much more quickly than humans, can do the same task over and over again without getting bored, needing breaks or making mistakes, can do very detailed work and follow precise instructions without error, can work in places where it would be unsafe to put a human, get more done than humans but cost less to operate, and can be reprogrammed to do different tasks [3].

These days IP based solution is become a very popular technique to get control over a system. The evolution to IP based solutions helps to implement of access control systems in far more smart way which also capable to resolve various limitations of existing traditional system and carry additional functionalities. That’s why in our research we explore this technique to implement an automated system to control any type of machines.

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IP based machine control system could be the fastest, broadest and easiest technique where the control interface could be any smart device (mobile, laptop, tab, etc.) which is ease of carry. In this system control is obtaining through IP to maintain the communication in between user and server and as well as server and machine. User will provide the instruction to server like trigger on or off of the machine by user’s choice or according system specific time schedule. Once server receives the instruction from user it will verify the user access and for each and every authorized user it will carry the instruction to load controller (machine). In our project we have performed experiments on water pump according to user’s provided instruction. In fig. 1 the whole system structure chain is provided where communication between two users, server and three target machine is represented. Here user1 is authorized to communicate with machine 2 and machine 3; and user 2 is authorized for machine 1. The duty of server is to create the common platform for all of these clients.

User 1 can direct machine 2 and machine 3 over P2P [4] means user 1: machine 2 and again user 1: machine 3. Same communication is applicable for user 2: machine 1. Therefore it’s quite clear that without authorization one user can’t access machine of others. This authorization process is maintained by the server.

The remainder of this paper is organized as follows. Section 2 introduces the related literature in this domain; Section 3 presents methods and process for the automated System to Control Machine through IP-based Solution. Software and Hardware interface are present in Section 4 where Section 5 presents the limitations and further improvement on this development.

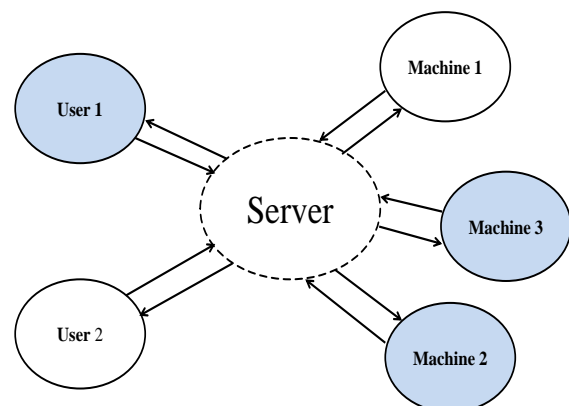


Fig. 1: SYSTEM STRUCTURE CHAIN

II. Related Literature

In [5] authors has implemented such system via Cellular Mobile Telephony that required to give a phone call to the system mobile phone then will receive an output from the mobile vibration motor. This output voltage will go to the Microcontroller ADC pin as an input. When provide 1 call to the system mobile phone then the vibration motor will give 4 times output repeatedly. This output will go to Microcontroller as an input and for 4 times inputs Microcontroller give an output to the output pin. This output will go to the Relay and the Relay switch will be on. Then the motor will start to pump water. Again when give a call to the circuit mobile phone then the input go to the Relay then the Relay switch will be off and as a result the motor will be stopped pumping water. The block diagram of this system is given in fig. 2.

There are several limitations exist in this project are: a) system dependent mobile phone battery need be charged always; b) mobile phone connection must be valid; c) mobile operator company network must have the coverage in that area; d) Most importantly this system can't handle multi-user control issue in a single time.

In our proposed system the dependency on mobile phone totally transferred to Wi-Fi or Ethernet service. Thus issues related with mobile phone aren't our concern anymore in this project. The key point of this project is, it is capable to deal the multi-user access issue in a single time. And to do that in this project we have introduced P2P communication to ensure that in a single time one user can only access the system and in our system only authorize users has the right to access.

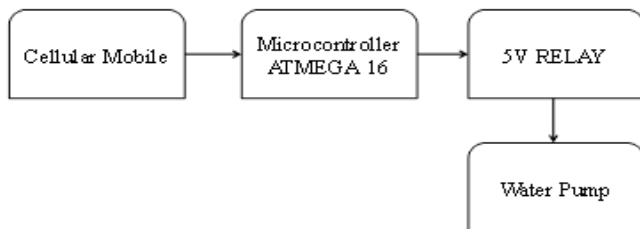


Fig. 2: SYSTEM DIAGRAM STATED IN [5]

III. Proposed Automated System

Our approach automatically control machine through IP and resist unauthorized users access too. To develop this system Arduino Uno R3 [6] is introduced in this project.

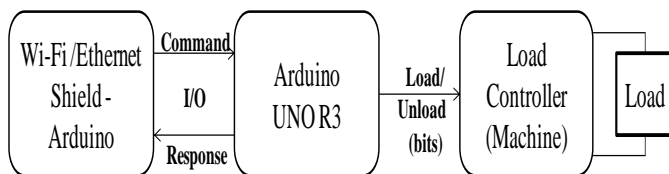


Fig. 3: COMMAND-RESPONSE CHAIN

Using Wi-Fi / Ethernet shield (compatible with Arduino) [7] [8] user sends command to Arduino UNO R3 board vice-versa. In a continuous process then micro-processor send bits to load controller (machine) that is an instruction about to load/unload device. Now if load instruction is true then load

controller will trigger the device. The describe procedure is graphically presented in above fig. 3.

This section will explain the details of our approach, starting with the flowchart and will lead to the system pseudo code. In fig. 4, system starts to proceed with an input, is an instruction/command receives from user via IP. Then server task is, to detect that is user has the access to get control over that requested machine or not. If no then discard the command or cease the connection. And if yes then categorize the system time duration.

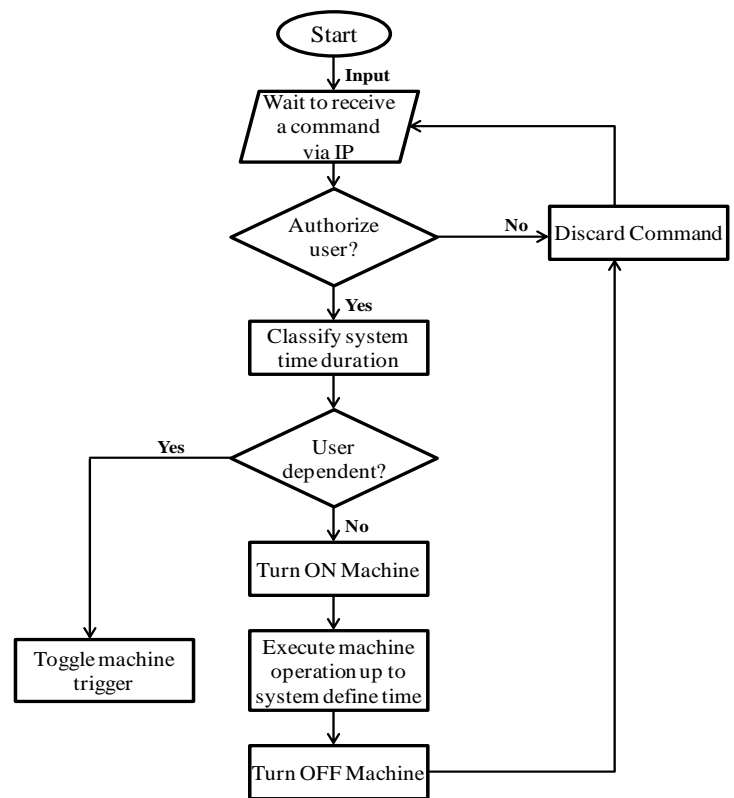


Fig. 4: FLOW CHART OF AUTOMATED MACHINE CONTROL SYSTEM

Henceforth it's required to check the user dependency. Because in our system we left a scope to operate machine by manually and will be decided in this step. Finally if not user dependent then machine will be turned on and will continue execution up to system defined time. At the final stage, once the instruction completes the execution then will discard comment or close the communication with the user and will wait for further instruction from user-end. Pseudo codes are given in fig. 5.

```

VAR _COMMAND, _TIME_SPAN, _LOAD_MACHINE = FALSE, _IN_LOAD = FALSE
WHILE TRUE
  _COMMAND = GET_IP_COMMAND()
  IF IS_USER_AUTHENTICATED THEN
    IF USER_DEPENDENCY THEN
      IF ! _IN_LOAD THEN
        _LOAD_MACHINE = TOGGLE
      END_IF
    ELSE
      IF ! _LOAD_MACHINE THEN
        IF ! _IN_LOAD THEN
          _IN_LOAD = TRUE
          _TIME_SPAN = GET_TIME_SPAN( _COMMAND )
          _SET_TIME( _TIME_SPAN )
          _START_TIMER(FUNCTION(){
            _IN_LOAD = FALSE
          })
        END_IF
      END_IF
    END_IF
  END_IF
END_IF
WEND

```

Fig. 5: PSEUDO-CODE OF PROPOSED SYSTEM

IV. Software and Hardware Interface

User interface to control the machine is used here is simply a web interface placed in fig. 6. In this Web interface 4 buttons are placed where 3 are timer buttons use to set a range of time duration (such as 300s, 180s, 60s) and another is start-up button use to trigger the machine. To send the user actions from this web interface Wi-Fi or Ethernet service is required.

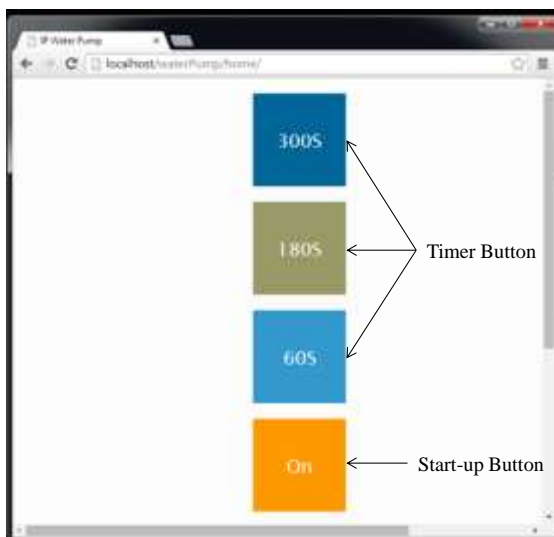


Fig. 6: WEB INTERFACE FOR USER

Load controller part (in fig. 7) contains Arduino, set of buttons, and water pump; where in presence of Wi-Fi/Ethernet Arduino is receiving the instruction from user-end via

IP and then proceed action based on that. Switch is placed to keep the scope of manually turn on or off the machine. Currently the system has been developed for dc to dc and dc to ac load control that can deal with maximum 220 volt, 50-60 HZ.

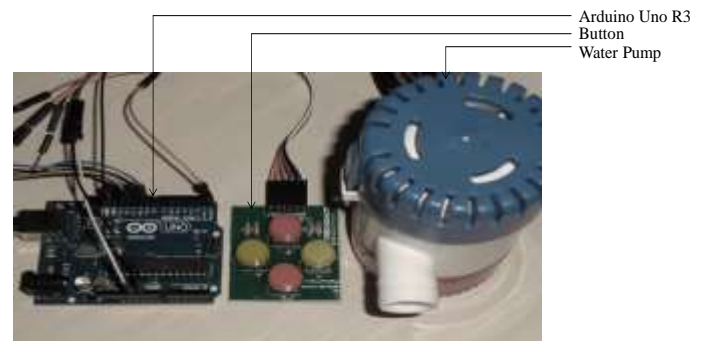


Fig. 7: HARDWARE INTERFACE

v. Limitation and future work

This paper presents a technique to operate any kind of machine via IP that can operate from any kind of distance and can control multi user control issue in a single time. For communication P2P mechanism is followed throughout the system. That ensures that without proper authorization user will not be able to access any of target machines.

In this approach, Internet service is mandatory which implies a continuous service cost. And most importantly if system lost the internet connection user will lose the control over machine too.

In future work the effort will be to minimize the runtime cost by switching Wi-Fi network to telephony network. In our next step we will try to make this project under GSM (Global System for Mobile Communications) and CDMA (Code Division Multiple Access) coverage to ensure the system usages in mass scale.

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