International Journal Of Health, Engineering And Technology (IJHET) *E-ISSN 2829 - 8683*
Volume 4, Number 5, January 2026, *Page. 1730 - 1777*
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Arduino Uno Microcontroller Programming As A Timer For Hotplate Magnetic Stirrers

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Abstract

Based on the title above, this scientific paper aims to analyze the Arduino Uno programming on the Magnetic Stirrer Hotplate tool with the addition of a timer. The Magnetic Stirrer Hotplate functions to homogenize the solution at a certain temperature, rpm and time. If the set timer has been reached, the buzzer will turn on, which aims to let the operator or user know that the tool has finished mixing the chemicals. The results of the microcontroller programming test on the timer control circuit using the C++ language were successfully carried out and the circuit functioned according to the programming instructions..

Keywords: Arduino Uno, Stirrer, buzzer, RPM.

INTRODUCTION

Progress technology develops with rapidly like can see in catalog product tool laboratory and supporting facilities. The technology used the more advanced but what becomes the constraints is price tools the relatively expensive (Rahman, 2011). Without except for the part laboratory , for fulfil need various examinations are needed equipment laboratory that can do study in a way accurate . One of the type equipment medical equipment used in laboratories namely Hotplate Magnetic Stirrer.

Hotplate Magnetic Stirrer is tools used For stirring and heating solution One with other solutions that aim For make something solution homogeneous with help mixer magnetic bar or stir bar . On some Hotplate magnetic stirrer tool not yet equipped with a timer. Therefore that , in the research This done manufacturing tool stirrer equipped with timer and dial tools this is us too can arrange a number of arrangement speed as well as the heater needed to carry out the mixing process , so that diagnosis can ongoing with efficient and optimal. Magnetic Stirrer Hotplate is tools used For stirring and heating solution One with other solutions that aim For make something solution homogeneous with help stir bar mixer (Ira Isti'anah , 2017).

the Arduino Uno Based Magnetic Stirrer Hotplate "(Frengky, 2022). On tools the Already equipped with timer, however Not yet There is clear discussion about How programming Can running Arduino Uno as timer controller then writer want to perfecting the previous scientific paper with add discussion about Arduino Uno programming as controller timer.

Hotplate magnetic stirrer is one of the tool functioning laboratory for mix , stir something solution or reagent with solution or other reagents so that nature homogeneous and maintain temperature agar solution in accordance desired temperature. A system defined microcontroller as system complete computer including a CPU (Central Processing Unit), memory, clock oscillator, and IO in something series integrated, if part element removed, then this chip will called microprocessor. Crystals do not including in system microcontroller but required in circuit clock oscillator.

The Arduino Uno board is a microcontroller board (development board) using the flexible and open-source ATmega328p microcontroller chip, software and hardware. relatively easy to use so that widely used by beginners until expert. For can Arduino Uno board is used to connect to computer with use USB cable or with adapter or Power Supply 5-12 VDC. Arduino Uno can used For detect environment with read data from various sensors. For example distance, infrared, temperature, light ultrasonic, pressure, humidity and others.

In general, Arduino has 14 Digital pins which can be set as Input or Output and 6 Analog input pins. Become a researcher will inserting a timer into the Arduino Uno program,

Figure 1.1 Arduino Uno

The keypad is part important from something device electronics that require interaction human . Keypad works as an interface between electronic devices (machines) with man or known with the term HMI (Human Machine Interface).

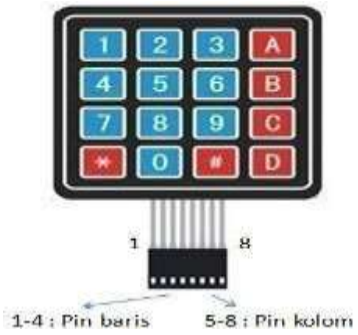


Figure 2 : Keypad

Matrix Keypad is knob arranged buttons in a way matrix (rows x column) so that can reduce use of input pins. As For example, a 4x4 Matrix Keypad is sufficient. using 8pin for 16 buttons.

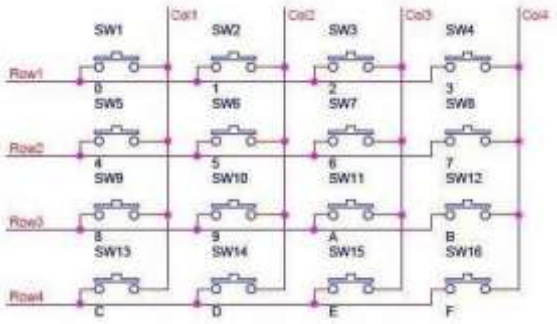


Figure 3 : Track Column And line keypad 4 x 4

Construction 4x4 keypad matrix consists of 4 rows and 4 columns with a keypad in the form of push button switch placed at each cross columns and rows. Series 4x4 keypad matrix consists of 16 push button switches with 4 rows and 4 columns configuration 8 lines which consist of 4 rows and 4 columns the connected with 8bit microcontroller port. The row side of keypad matrix marked with the names Row 1, Row 2, Row3, and Row4 later column marked with the names Col1, Col2, Col3 and Col4. The input and output sides of matrix this 4x4 keyboard No binding, can configured column as input and rows as output or on the contrary. On the Hotplate Magnetic Stirrer Keypad tool , it functions For give setting values for temperature, rpm, and timer.

RESEARCH METHODS

Research design is a guideline or procedure and technique in designing research to serve as a guide for developing a strategy that produces a research model. The type of research used was *experimental*, with design and testing for each predetermined variable. In the process of creating this final project module, the author used several tools and materials. The following is a list of the tools and materials used in designing the module, which can be seen in Table 1.

Table 1 : Tools Which used in design module

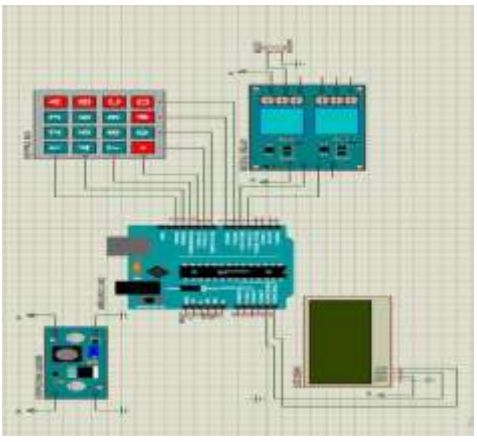
No.	Tool Name	Information
1.	*Brand Toolset* : Local	As Tool help in Module manufacturing and work safety
2.	Laptop *Brand* : HP	As manufacturing device soft And filling program *timer* on Arduino Uno

Table 2: Material Which used in module design

No	Symbol	Material (Component)
1.	U2	Arduino Uno
2.	DS1	I2C20×4 *Display*
3.	BUZ1	*Buzzer*
4.	K1	*4×4 Keypad*
5.	M1	*Relay*

Wiring Diagram

Overall series *timer* controller on the Arduino Uno-based *hotplate magnetic stirrer tool* which was designed and then simplified into a block diagram as in Figure 4



Method Work Block Diagram:

The microcontroller will receive *input* from *the input setting*, which functions to provide *the timer input value*. The microcontroller then gives a command to display the set value on the display. The microcontroller, which functions as a *timer controller*, will operate when the temperature and rpm values have reached the set values. The *timer* will operate until *the timer time* is reached, at which point *an alarm* will sound.

Series *Settings*

Series *settings* designed use *keypad* matrix 4×4 as in Figure 5

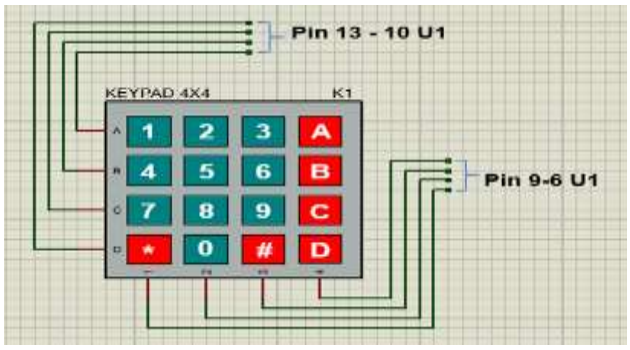


Figure 5: *Keypad Circuits 4×4*

keypad has 8 pins, the *keypad pins* are connected to the Arduino on *pins* 6 to 13. *The keypad* functions to provide input to the Arduino to set the desired temperature. Functions each knob on *keypad* is:

a. Knob Number(1-0) functions to input *numeric data.*
b. Button A serves to enter to Settings Menu
c. Button B functioning for *Rolling* up And lower
d. Knob C functioning For delete data Which in *input* t/ *setting*
e. D button serves to repeat to the initial display .
f. Knob A functioning as RUN.

Arduino Uno Circuit

The microcontroller circuit is designed using Arduino Uno as shown in picture 6. Arduino functioning as controller series electronic and to keep program the series that has in the program.

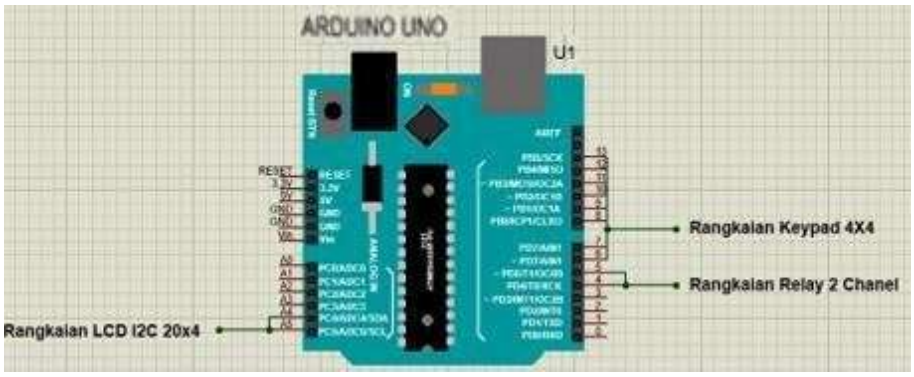


Figure 6 Arduino Uno circuit Source:

The microcontroller receives input data in the form of temperature value *settings from the setting circuit* via port B pins 13, 12, 11, 10, 9, 8 with the *software system* on the Arduino, then when *the keypad* is pressed, the microcontroller receives a logic 0 signal. Next, the LCD will display input data from the microcontroller via Port C pin A4 to pin 3 SDA and Port A5 to pin 4 SCL. Then the microcontroller outputs data to the relay via port D pin 5 to pin IN2 and port D pin 4 to pin IN 1 to activate the alarm via the buzzer.

Series *Display*

display circuit is designed using a 20×4 LCD as shown in Figure 7. The *display circuit* receives data from the microcontroller output to display the temperature (C◦), rpm and *timer value settings* . The circuit input from A4 and A5 Arduino to SDA and SCL on the LCD. SDA and SCL function to send data and GND and VCC as voltage suppliers .

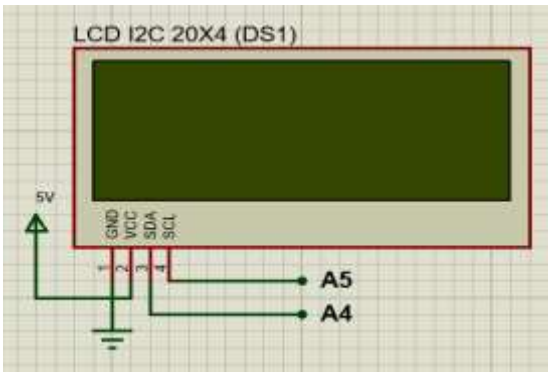


Figure 7: Series *Display*

Series Alarm

Series Alarm designed use Relay2 channel And *Buzzer* Like on Figure 8

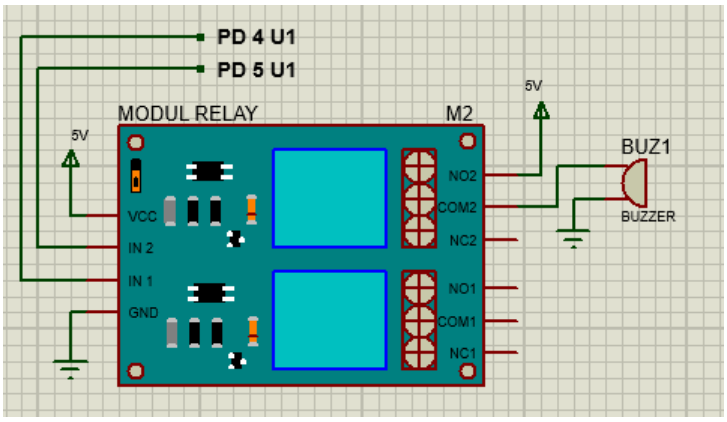


Figure 8: Series Alarm Source: proteus

The Relay Module is activated from a logic signal originating from the Arduino *port* D (PD5). When the logic on PD5 *pin* 5 is 0, module relay No active, The relay contractor is in *the Normally Open (*NO*) position* and *the Buzzer* is not connected to the mains voltage. Meanwhile, when the logic of PD5 pin 5 is 1, the relay will be active and the terminal *Normally Open* (NO) become *Normally Close* so that *Buzzer* connected to voltage nets And *Buzzer* will sounds.

RESULTS AND DISCUSSION

Hardware design cannot function without software. Therefore, once the hardware planning is complete, supporting software is developed to facilitate its operation. The software is written in C++ to provide instructions to the Arduino Uno. Before writing the software, a flow chart is drafted to outline the procedures for running the program as intended. This section manages everything from defining inputs and outputs (port initialization) to ensuring the data processing aligns with the design.

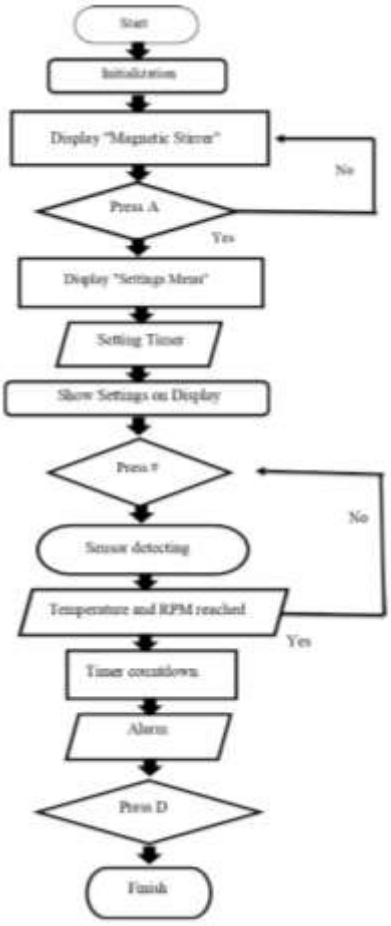


Figure 9 : Flowchart Timer

When the device is first powered on, the system initializes the pins to be used, and the display shows the initial screen: 'MAGNETIC STIRRER'. Afterward, press the 'A' button to enter the timer setting menu, then input the timer setting using the keypad to set the device's operating duration. Next, press the '#' button to 'RUN'; the program will then start the heating process and RPM control. The sensors will detect the temperature and RPM; if the preset temperature and RPM are not reached, the system will return to the Setting Menu. If successful, the timer will activate and begin counting down to zero. Once the timer reaches zero, the alarm will sound. Finally, press the 'D' button to deactivate the alarm. After the entire programming process is completed, the program is tested and the *timer circuit is analyzed* to see whether the system is working properly or not.

Program Initialization

Initialization is the first step in a program. It aims to define all variables, ports, pins, data, and other devices connected to the microcontroller and activate the required *libraries . The results of the initialization program can be seen in Figure 10 as follows:*

Figure 10 : Results Program Initials
Source: Personal Documents

Program Appearance Beginning

After initialization, the next step is to design the program used for the initial display of the subprogram which aims to display writing the beginning on the LCD. As for results Which obtained from The initial display program can be seen in Figure 11 as follows:

Program Input Settings Timer

input setting subprogram provides timer input. When the temperature and rpm are reached, the timer will count down. This subprogram works by scanning all keys on the keypad. To set the temperature, the keypad is scanned for numeric values. The results obtained can be seen in Figure 12 as following

Figure 12 : Results Program Source Settings

Program Alarm

An alarm subprogram is created to inform the operator when the timer that has been set has finished. The alarm is activated when the timer value has been reached. reach 0. As for results from program alarm can seen on Figure 13 as following :

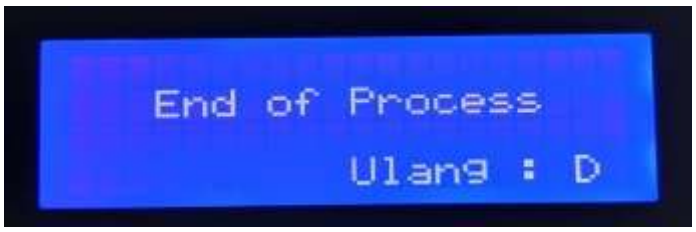


Figure 13: results program alarm.

CONCLUSIONS

From the results of the design of the Arduino-based Hotplate Magnetic Stirrer tool that has been implemented, the following conclusions can be drawn: Timer Controller Tool on Arduino-Based Hot Plate Magnetic Stirrer One has Work in accordance with Which in plan according to its function, namely accelerating the homogenization of the solution according to the timer determined based on the program that has been created.

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