Vol. 1 No. 01 (2022): pp 19-30
e-ISSN: 2828-3090
DOI: https://doi.org/10.54482/SPECTRUM/

VALVE GRINDING AUTOMATIC SYSTEM BASED MICROCONTROLLER

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ABSTRACT

Valve Grinding Automatic System Based Microcontroller is an innovation designed and created to be able to work by converting electrical energy into rotational motion and is also able to overcome mechanical difficulties in regulating manual cleaning movements by hand. The Valve Grinding Automatic System Based Microcontroller provides three choices of rotational speeds of 1500 rpm, 2000 rpm and 2500 rpm with each speed requiring a cleaning time of 3 minutes, 2 minutes, and 1 minute. Testing this tool is done by checking the results of each cleaning from the results of different speeds. From the test results using diesel, it is known that the valve cleaning results do not leak and have met the standards. The stages used in the development of the Valve Grinding Automatic System Based Microcontroller are planning, observation and literature study, tool design, survey of materials and tools, procurement of tools and materials, tool manufacture/assembly, tool testing, tool revision, tool socialization, acceptance survey and finished. Tool making is done in the workshop of the Department of Automotive Engineering, Faculty of Engineering, Padang State University. The team has also published a prototype of a scientific article regarding the Microcontroller-Based Automatic Valve Grinding System in the Journal of Automotive and Vocational Engineering Education (AEEJ) Padang State University.

Keywords: Cylinder Head, Leakage, Microcontroller, Valve Grinding.

1. INTRODUCTION

The use of motorized vehicles as a means of transportation is increasing, as well as many kinds of damage that exist in the engine and for motorcycles, the most frequent is a valve leak in the cylinder head, namely the emergence of a pile of crust attached to the valve seat so that it interferes with the compression process and reduces performance machine [1-5]. The valve and valve seat are the most important devices in maintaining compression density [6-7]. Because the suction and exhaust processes are carried out by the valve and its seat, which will create a gap for air to enter and exit. Compression leaks that occur and very often occur in valves and seats are caused by dirt from free air or soot resulting from the combustion process [8]. The symptoms that arise are reduced engine performance due to less than maximum compression, the engine will die quickly due to unstable engine performance, and wasteful fuel [9-11]. One of the causes of this build-up of scale is due to the entry of oil into the combustion chamber, to overcome this, repairs are needed to overcome the valve leakage, namely valve lapping [12-16].

Clearing the valve will make the valve and valve seat tight again [17]. The cleaning process is actually not only carried out when the motor has leaked, but at the time of manufacture or replacement

of a new valve and valve seat, a cleaning process must also be carried out [18]. With the same goal of preventing leakage in the valve and valve seat.

Based on observations, there is a manual (traditional) way of cleaning the valve, namely by turning the valve handle from right to left and up and down. By using both hands, cleaning takes a long time and is inefficient and not all repair shop technicians can do such cleaning. To overcome the manual process of cleaning the valve so that the valve does not leak and is tightly installed between the valve and its seat properly, a valve screw tool is needed to overcome this problem, namely a Microcontroller-Based Automatic Valve Cleaning Tool. This tool works by converting electrical energy into rotational motion. This valve screw tool is expected to be able to overcome the difficulty in adjusting the manual cleaning movement by hand because this hand movement is not stable so that the results of inaccurate valve cleaning result in uneven valve surfaces and leakage [19-20].

2. LITERATURE REVIEW

2.1 ATMEGA328 (Arduino Uno)

Arduino ATMEGA328 is the most widely used type of Arduino. Especially for beginners, it is highly recommended to use this type of Arduino Uno because there are lots of references that discuss Arduino Uno regarding its use and program. The latest version is Arduino Uno R3 (Revision 3), it has 14 digital I/O pins and 6 analog input pins [21]. This Automatic Valve Cleaning Tool uses ATMEGA328 as a microcontroller. For programming, it is enough to use a USB connection type A to To type B. Same as used in USB printers. See Arduino Uno in figure 1.

Figure 1. Arduino Uno (ATMEGA328).

2.2 Dynamo (Universal Electric Motor)

In general, electric motors function to convert electrical energy into mechanical energy in the form of rotary power. In a DC motor, electrical energy is taken directly from the armature coil by means of a brush and a commutator. Therefore, DC motors are called conduction motors. It is different with AC motors, in AC motors the rotor coil does not receive electrical energy directly but

by induction as happens in the transformer coil energy so that AC motors are known as induction motors.

Judging from its simple and strong construction, as well as having good working characteristics, this three-phase induction motor is very suitable to be used and applied in this tool. The advantage of universal motors is that for a certain weight, universal motors produce more power than other types. The universal motor produces a large starting torque without excessive current and as the torque load increases, the universal motor slows down. Therefore, the power generated is relatively constant, and the amount of current is still within reasonable limits. Universal motors can be designed to operate at very high speeds, whereas ac motors are limited to 3600 rpm [22].

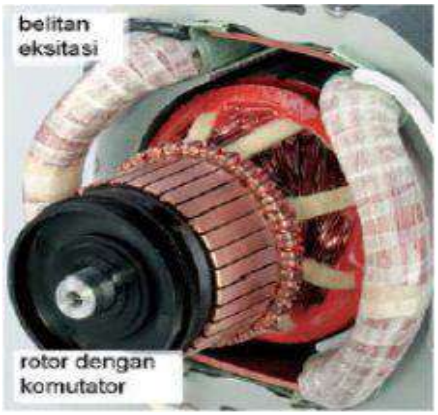

Figure 2. Universal Motor [4].

3. EXPERIMENTAL

Observations are made by looking at the mechanical conditions, which are still a lot of manually cleaning the valves without the help of tools. Very few mechanics use a drill in cleaning because it avoids tilting the valve skid. References regarding the use of the basic components of the Microcontroller Based Automatic Valve Cleaning Device refer to local and international journals and books relevant to the literature study method. The concept and working principle of the tool as a guide for the assembly and manufacture of the tool is carried out after the planning and design of the tool is complete. This microcontroller-based automatic valve cleaning tool was designed using the Adobe Illustrator CC 2018 application by adjusting the layout of all components and the Arduino IDE 1.8.7 application as the program design. The design of the Microcontroller-Based Automatic Valve Cleaning Tool can be seen in Figure 3.

Figure 3. Design of a Microcontroller-Based Automatic Valve Cleaning Tool

The steps or stages used during research and development of Microcontroller-Based Automatic Valve Cleaning Devices are planning, observation and literature study, tool design, survey of materials and tools, procurement of tools and materials, tool manufacture/assembly, tool testing, tool revision, socialization tools, acceptance survey and completion.

4. RESULTS AND DISCUSSION

4.1 Results

Based on the designed design, the Microcontroller Based Automatic Valve Cleaning Tool is programmed for one-way valve cleaning in order to get the best cleaning results. The design of this Microcontroller-Based Automatic Valve Cleaning Tool can be seen in Figure 4.

Figure 4. Display of Design Results of Microcontroller-Based Automatic Valve Cleaner Tool

From the tools that have been created as shown in Figure 4, this Microcontroller-Based Automatic Valve Cleaning Tool is designed with a minimalist design and can be folded so it doesn't take up too much storage space in the mechanical room. This tool consists of several buttons, namely speed buttons (A, B, and C), stop/pause buttons, on/off switch buttons, emergency buttons,

as well as LED indicator lights (red, yellow, green) and an LCD display that can be seen on the screen. figure 5.

Figure 5. Microcontroller-Based Valve Cleaning Tool Button Display

The working system of the Microcontroller-Based Automatic Valve Cleaning Tool is described in detail in Figure 6.

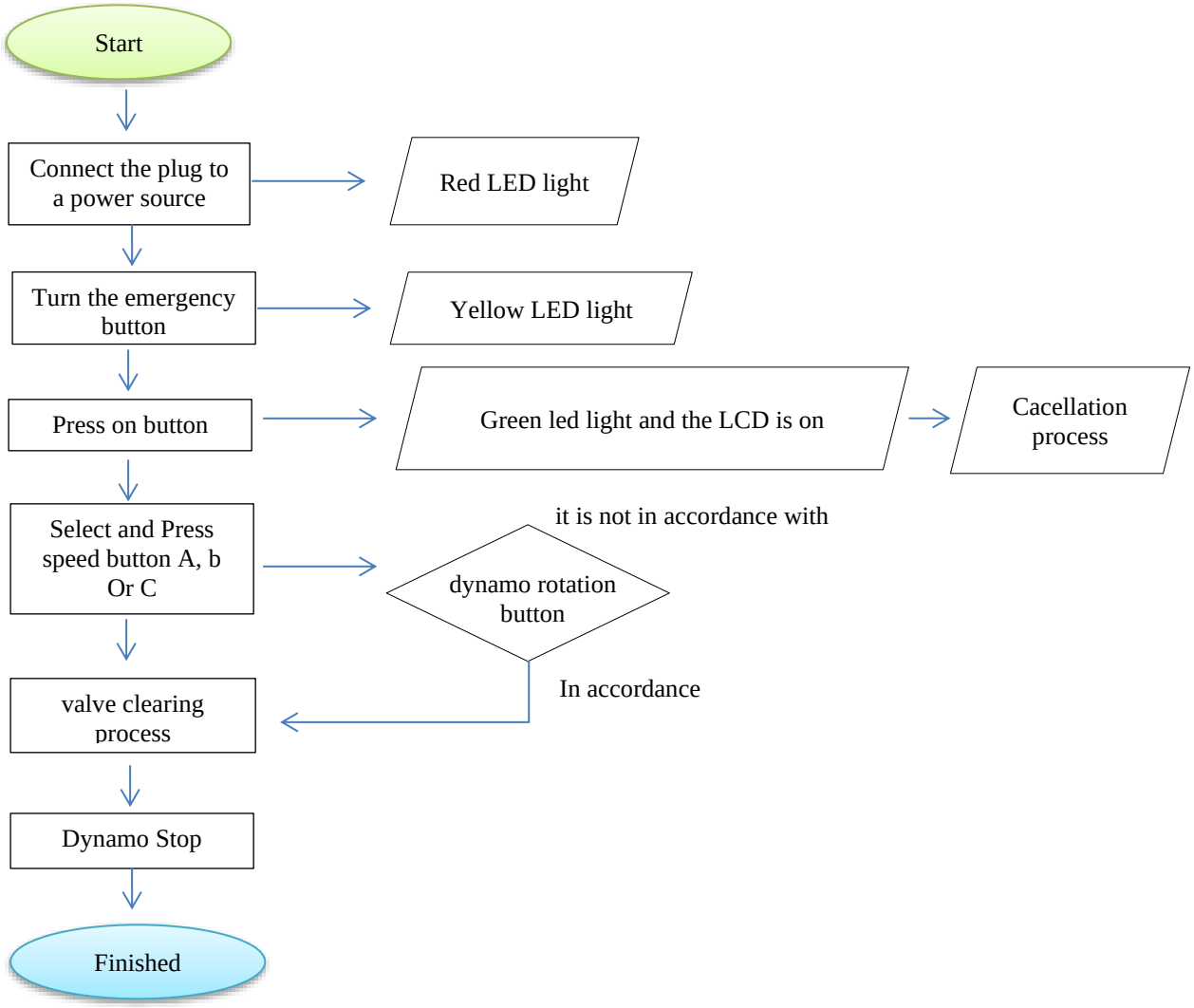

Figure 6. Flowchart of Microcontroller-Based Automatic Valve Cleaning Tool

In Figure 6 it can be seen that if the Microcontroller-Based Automatic Valve Cleaning Tool is connected to an electric current, the red LED will light up. Then the emergency button that is rotated will turn on the yellow LED light. The green LED along with the LCD will light up when the switch button is on. Cleaning using this tool can be selected the speed of the dynamo. The selection keys are buttons A, B, or C with cleaning for 3 minutes, 2 minutes, and 1 minute, respectively. If the cleaning process from the selected speed button is deemed inappropriate, the mechanic can change the tool speed by pressing the stop/pause button and re-select the desired speed button. If the cleaning has been completed, the dynamo of the tool will stop automatically and the LCD will show that the cleaning process was successful. After the design of the Microcontroller-Based Automatic Valve Cleaning Tool is complete, testing is carried out to see the success of the program and the success of the tool's work. The test results of the Microcontroller-Based Automatic Valve Cleaning Tool can be seen in table 1.

Table 1. Testing Results of Microcontroller-Based Automatic Valve Cleaning Tool

Dynamo Speed Button Options	Dynamo Rotation (rpm)	Thought Time (minutes)	Program Results	The Result of Thought
A	1500	3	Success	Not leaking
B	2000	2	Success	Not leaking
C	2500	1	Success	Not leaking

4.2 Discussion

The problem that often happened before was that uneven valve surfaces were often found when carrying out heavy maintenance (overhouling). Usually the mechanics do the cleaning manually, i.e., only by relying on the rotation of the hose that is rotated manually or by hand or the cleaning is done with the help of a tool in the form of a hand drill, this can simplify and speed up the cleaning process because it uses tools [23-27].

With the manual method, the problems that often occur are the old valve skid process, the results are not optimal, and the mechanical fatigue when rotating the hose is easy. Meanwhile, if you use a drill, the cleaning process will be faster but have a bigger impact if something goes wrong. Usually the results of the skir on the cleaning will be tilted and will have an impact on compression leakage in the engine or combustion engine so that the engine cannot start.

From these problems, the Microcontroller-Based Automatic Valve Cleaner Tool that was created will provide a significant and gradual rotation which will result in the flatness angle of the valve head surface being more perfect. As can be seen in Figure 4, this tool utilizes the rotary motion energy of the dynamo to rotate the valve to produce a constant movement according to the speed setting that will be regulated by the ATMEGA328. This rotation will make the valve surface smoother and will return to a standard shape. The vise will be the position and at the same time the

lock of the cylinder head to be cleaned and the valve will be positioned parallel to the dynamo. The valve will be connected with a special SST (Special Set Tool) which is connected to the dynamo.

The speed of the dynamo on the Microcontroller-Based Automatic Valve Cleaning Tool ranges from 0-10,500 rpm. The speeds used for cleaning are 1500 rpm, 2000 rpm, and 2500 rpm. If the speed is below 1000 rpm, the dynamo cannot rotate to do cleaning and vice versa if the speed is above 2500 rpm, the rotation given by the dynamo becomes unstable. The dynamo rotation at a speed of 1000-2500 rpm will make the valve surface smoother and will return to a standard shape.

As for how to operate when an electric current is connected, the red light indicates the current has been connected. Then turn the emergency button in order to free the current to the main switch and automatically the yellow indicator light will light up indicating the emergency button is free. When current flows into the switch, when the switch is turned on, the green indicator light will light up indicating current telah *standby* di *ATMEGA328* and the LCD screen will also light up, the LED and LCD display can be seen in Figure 7 [28-30].

Figure 7. Display of the tool when the LED and LCD are lit

ATMEGA328 functions as a regulator of dynamo rotation according to the rotation speed and time required. Mechanics can choose one of three button options A, B, or C with each speed of 1500 rpm, 2000 rpm, or 2500 rpm which can be seen in Figure 8.

Figure 8. Display of Speed Menu Options A, B, and C

Press one of these buttons then the dynamo will rotate and a special SST will connect the rotation between the dynamo and the valve so that the valve will rotate in the same direction according to the desired valve cleaning standard, the settings made on the ATMEGA328 are the time settings that have been determined in advance which can be seen later. on the LCD screen, namely speed A with a cleaning time of 3 minutes, speed B with a cleaning time of 2 minutes, and speed C with a cleaning time of 1 minute as shown in Figure 9.

Figure 9. Time Display on the LCD During the Cleaning Process at Speeds A, B, and C

The results of testing the Microcontroller-Based Automatic Valve Cleaning Tool can be seen in table 1. From the table it can be seen that the faster the dynamo rotates, the less time it takes to clean the valve. On the speed button A with a dynamo rotation of 1500 rpm, the time needed to clean the valve is 3 minutes, the speed button B with a dynamo rotation of 2000 rpm means the time needed to clean the valve is 2 minutes and the speed button C with a rotation of the dynamo is 2500 rpm. The time required to perform the valve cleaning is 1 minute. Testing is done by checking the results of each

cleaning of the results of different speeds using diesel. From this test, the results of the cleaning of the valve do not leak and have met the standard.

In the Microcontroller-Based Automatic Valve Cleaning Tool, if you want to change the cleaning speed this tool provides a button to cancel or stop the cleaning process so that the mechanic can re-select the desired speed as shown in Figure 10. When the cleaning is complete, the LCD screen shows that the cleaning process is complete successful which can be seen in Figure 11.

Figure 10. LCD Display When the Clearing Process is Canceled

Figure 11. LCD Display When the Cleaning Process is Complete

This tool also prioritizes the safety of the tool as well as mechanics so that if at any time this tool errors or rotates too fast and cannot be controlled by the speed controller (ATMEGA328) and cannot be turned off with a switch (switch), this tool is equipped with an emergency button that can cut off the mains in the appliance.

5. CONCLUSION

The Microcontroller-Based Automatic Valve Cleaning Tool provides significant and gradual rotation which will result in a more perfect flat angle of the valve head surface. From the results of the study, it was found that the faster the dynamo rotates, the less time it takes to clean the valve. This tool is designed with three choices of speed buttons, namely speed button A with dynamo rotation of 1500 rpm with the time required to perform valve cleaning is 3 minutes, speed button B with dynamo rotation of 2000 rpm with time required to perform valve

cleaning is 2 minutes and speed button C with dynamo rotation of 2500 rpm with the time required to clean the valve is 1 minute. Testing is done by checking the results of each cleaning of the results of different speeds using diesel. From this test, the results of the cleaning of the valve do not leak and have met the standard.

REFERENCES

[1] Kusumaningtyas, R. (2021). Maintenance pada Mesin Kendaraan Ringan di Bengkel Nogogeni Garage. https://repository.its.ac.id/id/eprint/86055

[2] NANANG, R. (2019). PENGARUH KERUSAKAN PADA KLEP GAS BUANG TERHADAP KINERJA MESIN INDUK DI MV. VICTORIA 1 PT. LUMOSO PRATAMA LINE JAKARTA. *KARYA TULIS*. http://repository.stimart-amni.ac.id/id/eprint/245

[3] MUHAMMAD, E. M. (2019). ANALISIS KERUSAKAN KLEP BUANG PADA MOTOR INDUK MEREK ANTAI WUXI KM DERAJAT PT. SPIL SURABAYA. *KARYA TULIS*. http://repository.stimart-amni.ac.id/id/eprint/245

[4] Li, X., Ren, P., Zhang, Z., Jia, X., & Peng, X. (2022). A p− V Diagram Based Fault Identification for Compressor Valve by Means of Linear Discrimination Analysis. *Machines*, *10*(1), 53. https://doi.org/10.3390/machines10010053

[5] Loukopoulos, P., Zolkiewski, G., Bennett, I., Sampath, S., Pilidis, P., Duan, F., & Mba, D. (2019). Reciprocating compressor valve leakage detection under varying load conditions. In *Asset Intelligence through Integration and Interoperability and Contemporary Vibration Engineering Technologies* (pp. 405-414). Springer, Cham.

DOI: https://doi.org/10.1007/978-3-319-95711-1_40

[6] Nugroho, E., & Saputra, D. (2017). Pengaruh Arah Variasi Putaran Dan Tumbukan Terhadap Performa Hasil Penyekiran Menggunakan Mesin Skir Klep. *Turbo: Jurnal Program Studi Teknik Mesin*, *4*(2).

DOI: http://dx.doi.org/10.24127/trb.v4i2.71

[7] Widodo, S. (2018). *Perancangan Engine Mini Bike Dengan Menggunakan Motor Bensin* (Doctoral dissertation, Institut Teknologi Nasion al Malang).

http://eprints.itn.ac.id/id/eprint/275

[8] Johansyah, J. (2018). *Modifikasi Engine dan Sistem Pengereman Honda Grand Menjadi Motor Grasstrack* (Doctoral dissertation, ITN Malang).

http://eprints.itn.ac.id/id/eprint/226

[9] Suyadi, A. P., Putro, W. D., & Mesin, E. A. J. T., "Penerapan Elektro Pneumatik pada Alat Bantu Sekur Katup Menggunakan Gerak Linier Silinder Pneumatik yang diubah menjadi Gerak Rotasi", Rekayasa Mesin, 13(2), 2018.

[10] Hadiwijaya, L. (2020). RANCANG BANGUN DAN STUDI EKSPERIMEN MESIN SKIR KLEP SATU ARAH PUTARAN YANG DISERTAI TUMBUKAN DENGAN VARIASI PUTARAN MOTOR. *Techno Bahari*, *7*(1).

[11] Hidayat, E. N., & Cahyanudin, B. D. (2021, November). UPAYA MENGHINDARI KERETAKAN DALAM SILINDER LINER PADA MESIN UTAMA 2 TAK TYPE AKASAKA 6EU37LA DI MT. SC DISCOVERY XLVI. In *Prosiding Seminar Nasional* (Vol. 3, No. 1, pp. 1-6).

http://repository.pip-semarang.ac.id/id/eprint/3071.

[12] Skivenesvåg, J. (2021). *Ignition of high-pressure hydrogen releases–Experimental study of impinging and non-impinging releases through a fast-acting valve, with and without a burst disc downstream of the valve* (Master's thesis, The University of Bergen).

https://hdl.handle.net/11250/2833242

[13] Nugroho, E., & Saputra, D., "Pengaruh Arah Variasi Putaran Dan Tumbukan Terhadap Performa Hasil Penyekiran Menggunakan Mesin Skir Katup", Turbo: Jurnal Program Studi Teknik Mesin, 4(2), 2017.

[14] Fulmali, S. M., & Chadge, R. B. (2012). Need of lapping machine for valve component: a case study. *Modern Engineering Research*, *2*(6), 4609-4612.

[15] Divya, S., Pavithran, R., & Vijay, S. (2019). Engine Valve Lapping. *Int. J. Res. Eng. Sci. Manag*, *2*(5), 2581-5792.

[16] Kumar, M., & Das, M. (2022). Effect of optimum process parameters in rotational-magnetorheological poppet valve polishing. *Materials and Manufacturing Processes*, 1-14. https://doi.org/10.1080/10426914.2021.2016818

[17] Zhang, Z., Dong, Q., Lu, J., Gao, R., & Yang, F. (2020, May). Cause Analysis and Preventive Measures of Cavitation Corrosion of Diesel Engine Exhaust Valve Seat. In *IOP Conference Series: Earth and Environmental Science* (Vol. 508, No. 1, p. 012190). IOP Publishing.

DOI:10.1088/1755-1315/508/1/012190

[18] Kusuma, M. R. W., Apriaskar, E., & Djunaidi, D. (2020). Rancang Bangun Sistem Pembersih Otomatis Pada Solar Panel Menggunakan Wiper Berbasis Mikrokontroler. *Techné: Jurnal Ilmiah Elektroteknika*, *19*(1), 23-32.

DOI: https://doi.org/10.31358/techne.v19i01.220

[19] Kasrani, M. W., Fattah, A., & Rini, Z. S. (2019). Perancangan Alat Makan Dan Minum Pada Peternakan Ayam Petelur Secara Otomatis Berbasis Mikrokontroler. *JTE UNIBA*, *3*(2).

https://jurnal.fte.uniba-bpn.ac.id/index.php/JTE/article/view/37.

[20] Buwarda, S. (2021, March). Otomatisasi Hybrid Kehandalan Kandang Ayam Berbasis Mikrokontroller ATMega328. In *Seminar Nasional Komunikasi dan Informatika*

[21] Siahaan, A. P. U., Aryza, S., & Nasution, M. D. T. P., "Arduino Uno-based water turbidity meter using LDR and *LED* sensors", 2018.

doi: 10.14419/ijet.v7i4.14020

[22] Pramudhita Cahyo, W. A. H. Y. U., "Analisa Pembebanan Motor Universal Dengan Menggunakan Dua Sumber Tegangan AC Dan DC", Doctoral Dissertation, Politeknik Negeri Sriwijaya, Palembang, 2014.

http://eprints.polsri.ac.id/id/eprint/369

[23] Sanjaya, H., & Zainul, R. (2016). Sintesis dan Sifat Elektrik Film Tipis ZnO-ITO dan Al-ITO Dengan Teknik Spin Coating Melalui Proses Sol Gel.

[24] Zainul, R., Isa, IM, Hasyim, N., & Prima, B. (2019). Sensor Elektrokimia: Prinsip dan Aplikasi.

DOI:10.31227/osf.io/nz8v5

[25] Zainul, R., Oktavia, B., & Dewata, I. (2017). Studi Dinamika Molekular dan Kinetika Reaksi pada Pembelahan Molekul Air untuk Produksi Gas Hidrogen.

DOI: 10.31227/osf.io/unrt4

[26] Awalliyah, A., Ikhwan, H., Nugiasari, V., & Zainul, R. (2018). A Review Prinsip Dasar Milling Dalam Sintesis Material.A

Doi: 10.31227/osf.io/9xsqe

[27] Liza, Y. M., Yasin, R. C., Maidani, S. S., & Zainul, R. (2018). Sol Gel: Principle And Technique (A Review).

DOI: 10.31227/osf.io/2cuh8

[28] Cahyono, D. N. (2017). *Sistem Pembersih Sensor PH Otomatis Berbasis Robot ARM Dan Stabilizer PH Pada Proses Treated Water Di PT Petro Jordan Abadi* (Doctoral dissertation, Universitas Muhammadiyah Gresik).

http://eprints.umg.ac.id/id/eprint/2204

[29] Ahmad, A., & Ikhlas, M. (2020). Sistem Membuka Pintu Dengan Ketukan Bernada Menggunakan Mikrokontroler Atmega328. *J-SAKTI (Jurnal Sains Komputer dan Informatika)*, *4*(2), 368-378

http://dx.doi.org/10.30645/j-sakti.v4i2.228

[30] Mochtiarsa, Y. (2016). Rancangan kendali lampu menggunakan mikrokontroller ATMega328 berbasis sensor getar. *Jurnal Informatika SIMANTIK*, *1*(1), 40-44.

https://www.simantik.panca-sakti.ac.id/index.php/simantik/article/view/6