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UMSIDA
DARI SINI PENCERAHAN BERSEMI

Sistem Pemantauan dan Peringatan Beban Berlebih Motor Listrik 3-Fase Berbasis IoT

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Pendahuluan

Motor induksi tiga fase banyak digunakan dalam industri, namun rentan terhadap gangguan seperti korsleting, overheat, dan overloading yang dapat menyebabkan kerusakan serius dan downtime produksi. Oleh karena itu, sistem pemantauan real-time menjadi semakin penting untuk mendeteksi potensi masalah lebih awal. Dengan kemajuan teknologi IoT dan sensor canggih, sistem pemantauan dapat mengawasi tegangan, arus, serta beban motor, dan memberikan peringatan dini melalui aplikasi seperti Telegram. Penelitian ini mengusulkan sistem berbasis IoT yang terintegrasi dengan machine learning untuk deteksi anomali secara proaktif, memungkinkan tindakan preventif sebelum terjadi kerusakan. Melalui pendekatan ini, sistem diharapkan meningkatkan akurasi deteksi, responsivitas, dan kemudahan pemantauan, sehingga dapat mengatasi keterbatasan sistem sebelumnya dan meningkatkan efisiensi pengelolaan aset industri.

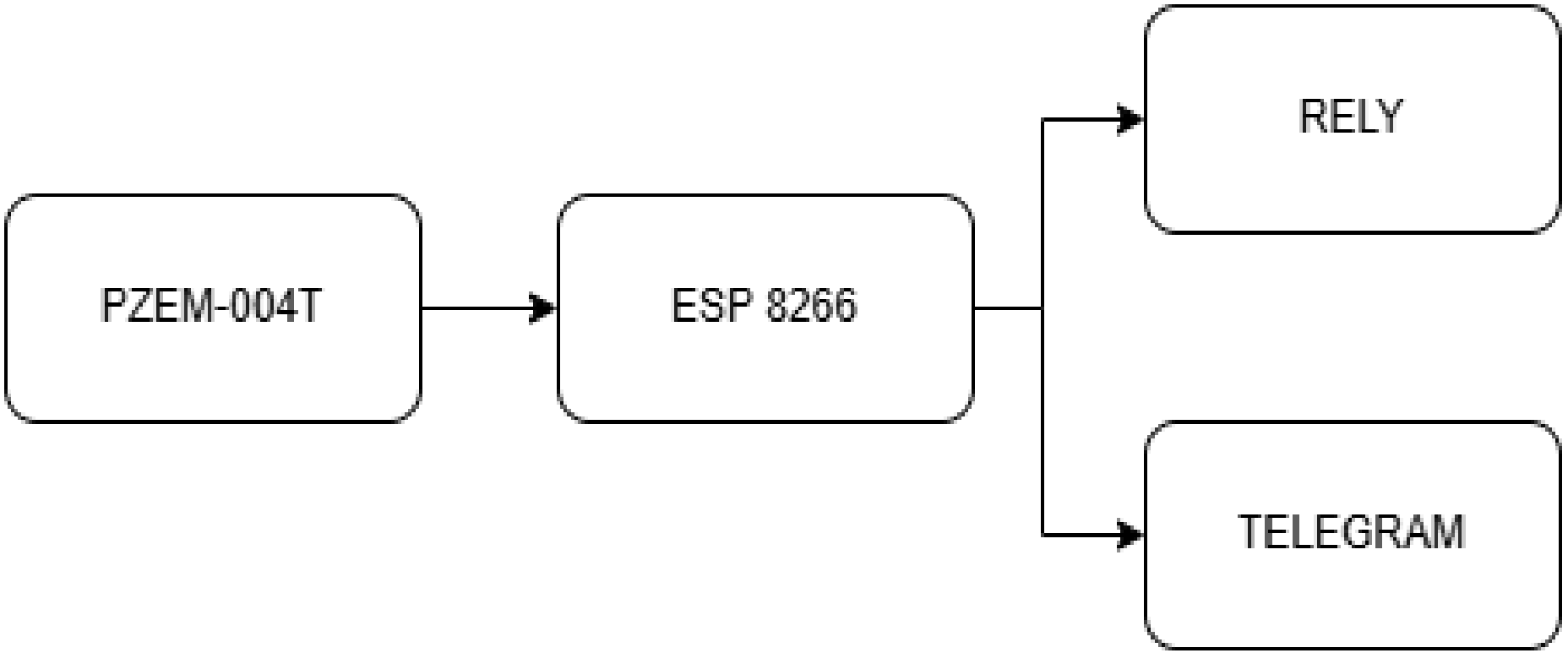
Rumusan Masalah

bagaimana cara meningkatkan efektivitas pemantauan kondisi motor induksi tiga fase secara real-time agar dapat mendeteksi potensi kerusakan lebih awal dan bagaimana penerapan teknologi IoT dan sensor cerdas dapat membantu dalam mendeteksi ketidakseimbangan fasa, lonjakan arus, atau beban berlebih pada motor induksi.

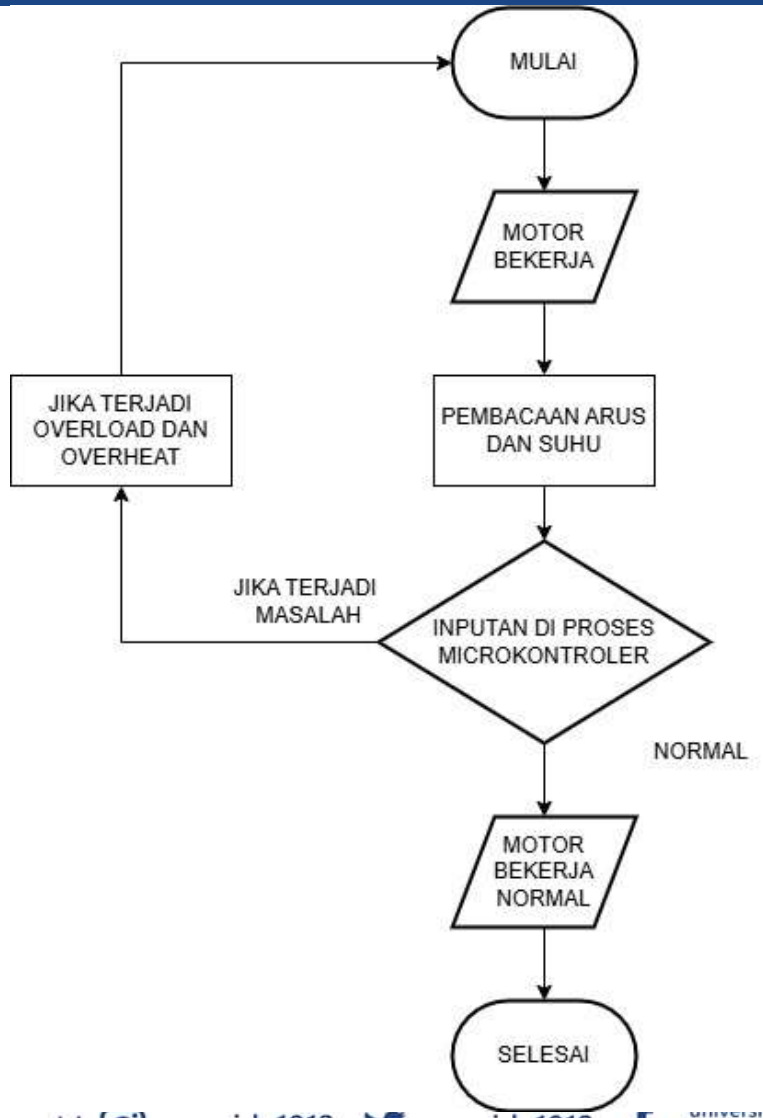
Batasan Masalah

1. Fokus pada Monitoring hanya mencakup parameter utama seperti tegangan, arus, dan beban motor.
2. Teknologi berbasis IoT dengan integrasi ke aplikasi Telegram sebagai platform notifikasi.

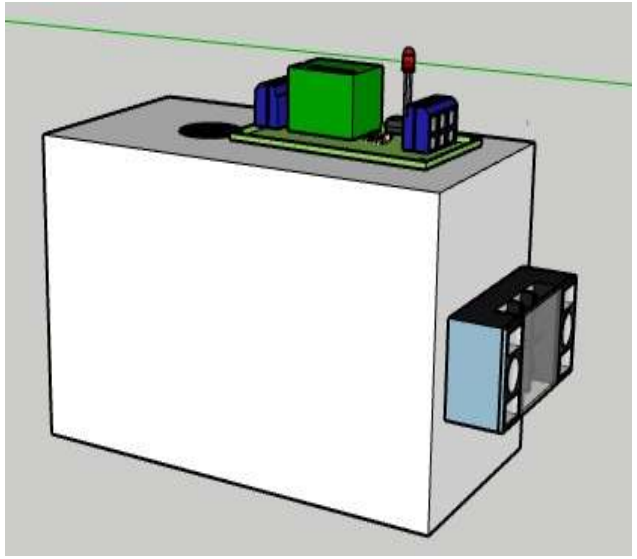
Blok Diagram Rancangan Alat

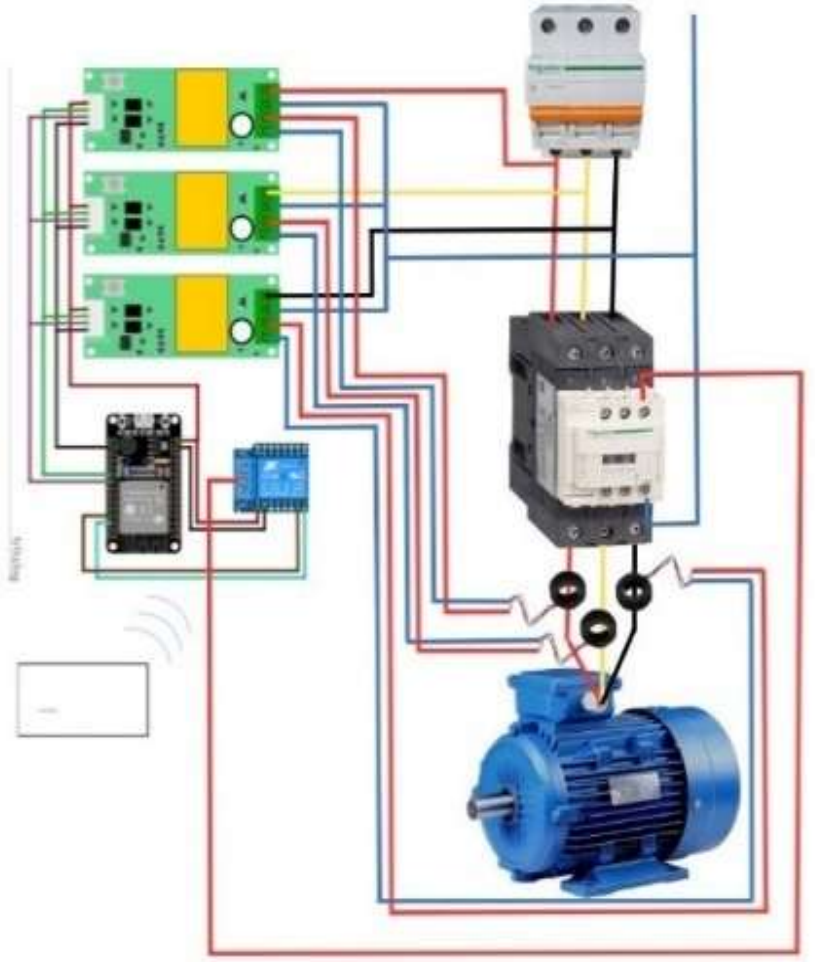


Flowchart


MULAI
MOTOR BEKERJA
PEMBACAAN ARUS DAN SUHU
INPUTAN DI PROSES MICROKONTROLER
JIKA TERJADI MASALAH
JIKA TERJADI OVERLOAD DAN OVERHEAT
NORMAL
MOTOR BEKERJA NORMAL
SELESAI

Rangkaian Perangkat Keras & Desain Alat



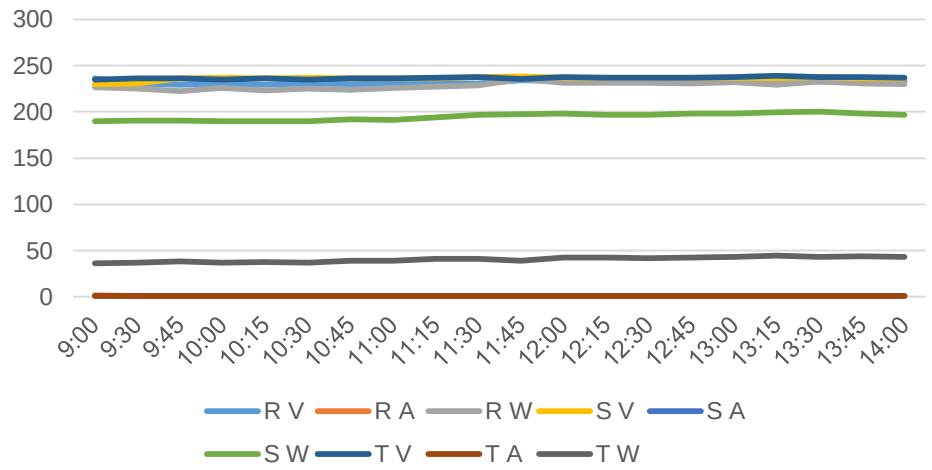


Notifikasi pada telegram

Pengambilan Data Telegram

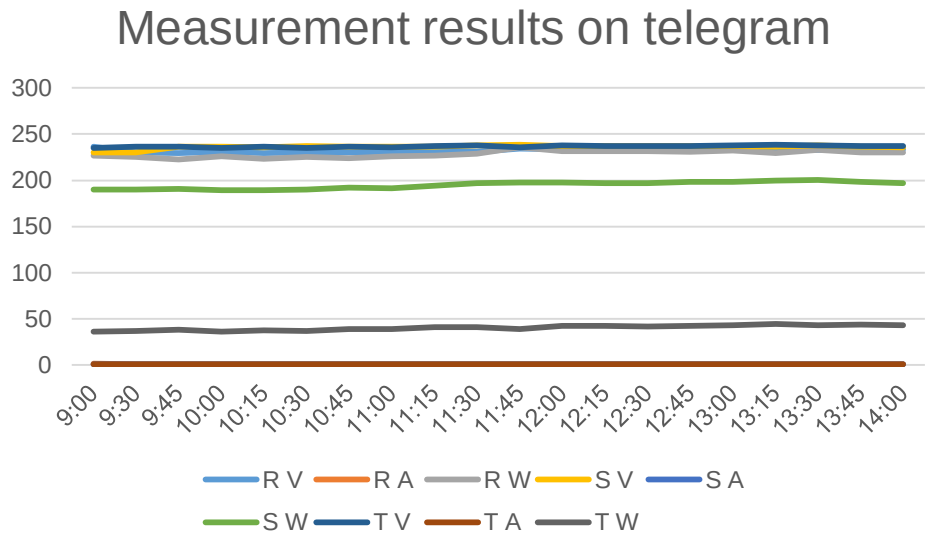
Time	R			S			T		
	V	A	W	V	A	W	V	A	W
9:00	236.4	1.3	226.4	230.4	1	190	234.8	1.11	36
9:30	230.5	1.03	225.4	230.5	1	190.3	236.6	1.11	37
9:45	229.6	1.01	222.4	236.3	1.01	190.8	236.5	1.11	38.4
10:00	230.6	1.02	226	236.7	1	189.6	234.9	1.1	36.5
10:15	229.7	1.02	223.2	236	1.01	189.6	236.3	1.11	35.4
10:30	230.5	1.02	225.2	236.9	1	190	235	1.11	37.1
10:45	230	1.02	224.2	236.5	1.01	191.8	236.6	1.12	39.1
11:00	231.1	1.02	226	236.3	1.01	191.2	236	1.11	38.9
11:15	231	1.03	227	236.3	1.02	194.4	237.1	1.12	40.8
11:30	230.8	1.03	228.7	237.6	1.03	196.7	237.8	1.14	40.9
11:45	234	1.06	235.9	238.7	1.03	197.4	235.5	1.13	39.1
12:00	233.3	1.04	231.8	237.1	1.04	197.9	237.7	1.13	42.5
12:15	2370	1.04	231.8	237	1.04	197	237	1.13	42.5
12:30	233.5	1.04	231.8	237.3	1.04	197	237.3	1.12	41.8
12:45	232.9	1.04	231.1	236.9	1.04	198	237.2	1.13	42.7
13:00	233.7	1.04	232.1	236.8	1.04	198.2	237.6	1.13	43.2
13:15	232.8	1.03	229.6	236.6	1.05	199.4	238.8	1.13	44.5
13:30	233.2	1.05	233	237.5	1.05	200.2	237.8	1.14	43.4
13:45	233.7	1.03	230.5	236.3	1.04	198.5	237.4	1.13	44
14:00	233.4	1.03	230	236	1.04	196.9	236.8	1.12	42.9

Measurement results on telegram



Pengambilan Data Multitester

waktu	R			S			T		
	V	A	W	V	A	W	V	A	W
9:00	229	1	229	236	1.02	240.72	236	1.11	261.96
9:30	230	1	230	236	1.01	238.36	235	1.11	260.85
9:45	230	0.99	227.7	235	1.02	239.7	235	1.1	258.5
10:00	230	1	230	236	1.01	238.36	236	1.11	261.96
10:15	231	1	231	236	1.02	240.72	236	1.11	261.96
10:30	230	1	230	236	1	236	237	1.11	263.07
10:45	231	1	231	236	1	236	237	1.12	265.44
11:00	231	1.01	233.31	236	1.02	240.72	239	1.13	270.07
11:15	233	1.02	237.66	237	1.04	246.48	237	1.14	270.18
11:30	233	1.02	237.66	238	1.05	249.9	236	1.14	269.04
11:45	233	1.03	239.99	236	1.07	252.52	238	1.14	271.32
12:00	233	1.03	239.99	237	1.03	244.11	237	1.14	270.18
12:15	233	1.03	239.99	237	1.03	244.11	237	1.12	265.44
12:30	233	1.04	242.32	237	1.04	246.48	237	1.13	267.81
12:45	233	1.04	242.32	237	1.03	244.11	238	1.13	268.94
13:00	233	1.05	244.65	237	1.04	246.48	238	1.14	271.32
13:15	233	1.05	244.65	237	1.04	246.48	237	1.14	270.18
13:30	234	1.05	245.7	237	1.04	246.48	237	1.14	270.18
13:45	233	1.04	242.32	236	1.03	243.08	237	1.13	267.81
14:00	233	1.03	239.99	236	1.02	240.72	236	1.12	264.32


Measurement results on telegram
300
250
200
150
100
50
0
9:00
9:30
9:45
10:00
10:15
10:30
10:45
11:00
11:15
11:30
11:45
12:00
12:15
12:30
12:45
13:00
13:15
13:30
13:45
14:00
R V
R A
R W
S V
S A
S W
T V
T A
T W

Hasil dan Penjelasan data

- Hasil penelitian ini berhasil mengembangkan sistem monitoring beban lebih berbasis IoT pada motor listrik 3 fasa menggunakan sensor PZEM-004T dan integrasi dengan platform Telegram yang mampu memonitoring parameter kelistrikan secara real-time, mengirimkan notifikasi otomatis, dan memutus aliran listrik secara otomatis ketika terdeteksi kondisi yang tidak aman. Hasil pengujian menunjukkan bahwa pembacaan tegangan cukup akurat dengan selisih rata-rata 1,235V (fasa R), 1,025V (fasa S), dan 1,075V (fasa T) dibandingkan dengan pengukuran multimeter, begitu juga dengan pembacaan arus yang relatif akurat dengan rata-rata error 0,0275A (fasa R), 0,012A (fasa S), dan 0,006A (fasa T), meskipun terdapat perbedaan yang cukup besar pada pembacaan daya, terutama pada fasa T dengan rata-rata error mencapai 226,3385W. Untuk penelitian selanjutnya, disarankan untuk mengintegrasikan teknik pembelajaran mesin untuk analisis prediktif kegagalan motor, memperluas pengujian dengan berbagai jenis beban industri (beban dinamis, beban impulsif, dan beban non-linier), dan mengembangkan sistem redundansi untuk meningkatkan keandalan. Meskipun sistem telah berhasil menjalankan fungsi monitoring dan proteksi, masih diperlukan kalibrasi ulang untuk meningkatkan akurasi pengukuran daya, pengujian lebih lanjut untuk memastikan keandalan sistem, serta penyempurnaan pada aspek pembacaan daya yang masih menunjukkan ketidakseimbangan yang cukup signifikan, namun secara keseluruhan sistem ini memberikan kontribusi yang penting dalam meningkatkan keamanan dan efisiensi monitoring motor listrik 3 fasa di industri.

Kesimpulan

Secara keseluruhan, data yang diambil dari ketiga sumber tersebut menunjukkan konsistensi dalam pengukuran parameter penting seperti tegangan dan arus, meskipun ada perbedaan kecil dalam detail desimal. Sistem ini menunjukkan kemampuan yang baik untuk memantau kinerja pembangkit listrik tenaga surya dalam berbagai kondisi waktu, memungkinkan pengguna untuk memantau secara akurat dan efisien melalui aplikasi Blynk serta melalui MPPT, karena perbedaan nilainya tidak terlalu jauh.

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Trimakasih…


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