SAMSON INTERNATIONAL PLC

JSR WASHING MACHINE

INITIAL PROJECT PROPOSAL

CONFIDENTIAL

TEAM OCULUS

DEPARTMENT OF ELECTRICAL AND INFORMATION ENGINEERING

FACULTY OF ENGINEERING

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VERSION: 1.0

2021.12.19

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EXECUTIVE SUMMARY

Samson International PLC (SIL) is in the process of automating selected internal operations and productions as a measure of enhancing efficiency. Accordingly, the company has collaboratively joined with Oculus, a team of consultants from the Faculty of Engineering, in progressing with effective solutions. Whilst SIL is expecting an automated or semi-automated solution to cater the manual process of the existing Jar Sealing Ring (JSR) washing machine. In summary, 'scope' of the document has elaborated the proposing system to improve the productivity of the process.

Oculus, the team of consultants will provide an initial design for the development process of the system and to get it deployed for the use of the SIL. Once the solution is approved, the project will be funded, and all required hardware components will be provided by the company to implement the project.

In this project, a system will be designed on the existing JSR washing machine by leveraging water flow and time control functions. The solution could be explained as a modification that measures or provides an indication of the water usage, state of the washing process, the temperature readings, and records processed data of the machine.

This document is the initial proposal for the project design that needs to be approved from the company for the project initiation.

1. PROBLEM STATEMENT

The overall washing process of the JSR washer is a manual process which vastly affects the efficiency and the quality of the products. The overall washing process consists of a number of alternating washing cycles of hot and regular water, respectively. During the process, it is required to control the water level in each of the hot and regular water washing cycles, control the temperature of hot water, control the duration of each cycle, track the number of washing cycles, and resume the washing process in case of an interruption.

In the existing system, an operator assigned to monitor the washing process, who is responsible for controlling most of the operations. Thus, the number of washing cycles to complete the washing process, the duration of one cycle, and resumption of an ongoing washing cycle/process in case of an interruption depend on the operator. Further, there are no records on past operations. It affects efficiency of the process in terms of consumption of power, water, and time and most importantly the quality of the product.

According to the quality standards, the water temperature of the washing process should be kept at a desired level in order to get the best outcome. The hot water source of the washer is a boiler in which the temperature can fluctuate during the washing process. Hence, it is important to take the temperature readings in order to ensure it is within the standard.

Currently, the water level is estimated by manual observation via naked eye of the operator. The manual estimations may always consist of a significant degree of error which leads to water wastage or an improper washing process.

As there is no mechanism to track the status of the washing process, it is nearly impossible to resume the process in case of an interruption. Further, due to the unavailability of past records, it is difficult to make decisions to improve the performance of the washing process in terms of cost and product quality.

As a safety precaution, it is necessary to ensure whether the outer drum is properly closed at the starting point and throughout the washing process. However, there are no functional indicators for this in the existing system.

2. SCOPE

Washing Process

In the washing process, there are alternating washing cycles with hot and regular water. The inner drum rotates at a constant speed for a predefined duration in each cycle. The washing process completes after a predefined number of alternating cycles. There are three important tasks in the washing process.

1. Temperature measurements

It is required to obtain an accurate reading of the water temperature to maintain it at favorable level for the target items being washed. Accordingly, it is required to get the temperature readings, record, and display it at the front panel.

2. Water level management

The appropriate water level should be maintained inside the drum throughout the washing process. Further, the water usage should be measured and recorded.

3. Controlling the washing process

The parameters such as cycle duration and number of cycles of forward and backward rotation or the inner drum should be controlled by the control unit. Further, the state of the washing process should be tracked in order to automate the washing process and to resume the operation in case of an interruption. Further, important indicators should be displayed in the front panel.

3. PROPOSED SYSTEM

Above mentioned problems are addressed with following features.

Features

1. One time operation:

No need to operate the system for every cycle throughout the process.

2. Water level measurement:

Measure the water level and calculate the water volume and display.

3. Temperature measurement

Measure the temperature and display.

4. System log

System log consists of date and time, session number, water level, temperature, water volume per each cycle, session duration, number of sessions per day and error log for debugging purposes. Can get the system log via SD card.

5. Safety switch:

Prevent the hazards if accidently open the outer drum.

6. User friendly environment

Users can easily adjust important parameters of the washing process using controllers for the smooth operation of the system. The operator can see the system status parameters such as remaining time and cycles in a particular session.

4. HARDWARE SETUP

When automating the washing process, it is required to upgrade the existing system by adding new hardware features. The main components of the upgraded hardware setup can be described as follows.

1. Upgraded Washer

The existing washer will be automated and added a temperature sensor, a water level sensor, and a limit switch to obtain the inputs for the controller.

2. Motor Control Panel

Control the motor driven direction either forward or backward direction and start stop activity.

3. User Interface (LCD display)

Get the sensor readings, user inputs and display the status of the process on the screen.

5. PROPOSED SYSTEM ARCHITECTURE DIAGRAMS

Block diagram of the proposed system is illustrated in Figure 1.

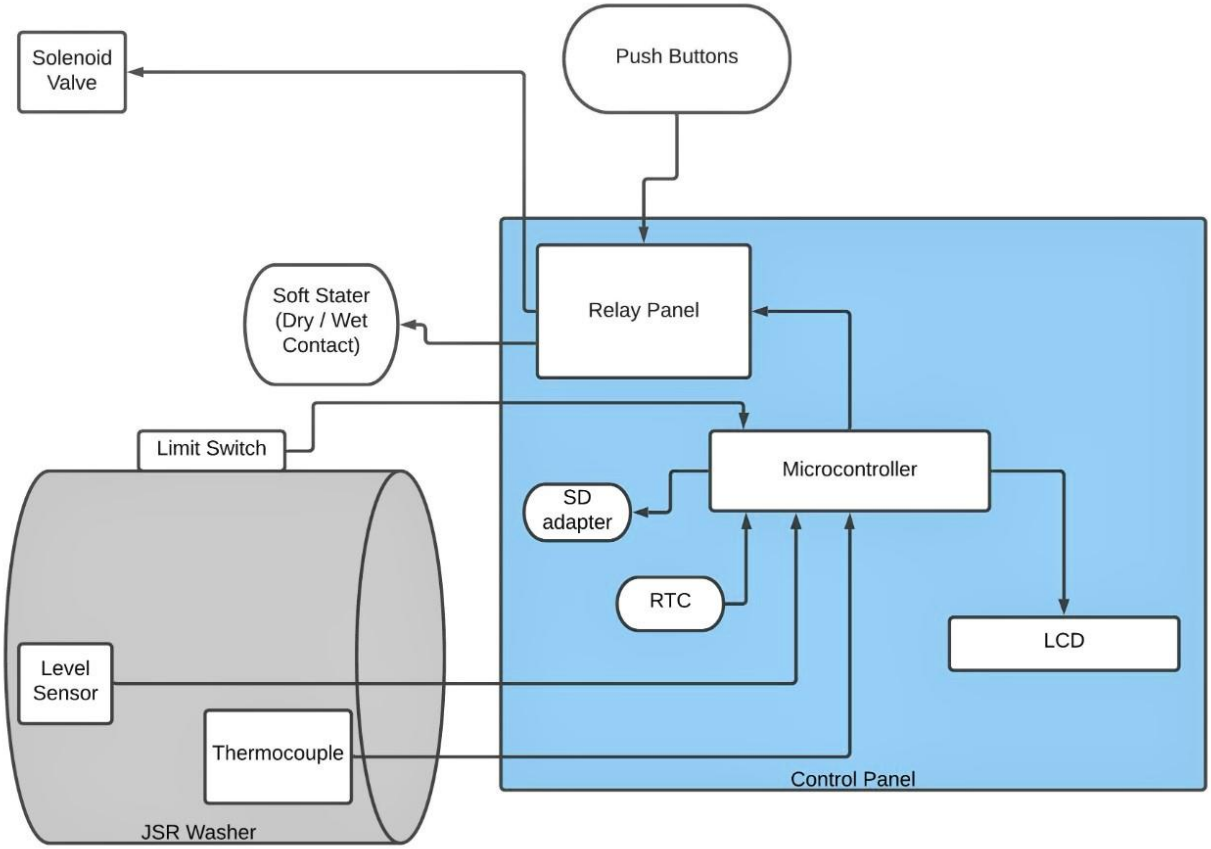

Figure 1: Overall Block Diagram

Table 1: Functionality of each block in Figure 1

#	Component	Functionality
1	Thermocouple	Measure the water temperature inside the inner drum.
2	Level Sensor	Measure the water level inside the inner drum.
3	LCD	LCD display; show temperature reading, water volume inside the drum, date and time, countdown time of the cycle, remaining number of cycles
4	Solenoid valve	Control the flow of both the hot and regular water into the washer
5	SD adapter	Transfer data files to a SD card
6	Limit switch	Indicate whether the outer drum is properly closed.
7	RTC	Real Time Clock - Obtain the date and time

The proposed control panel is shown in Figure 2 and elaborated in Table 2.

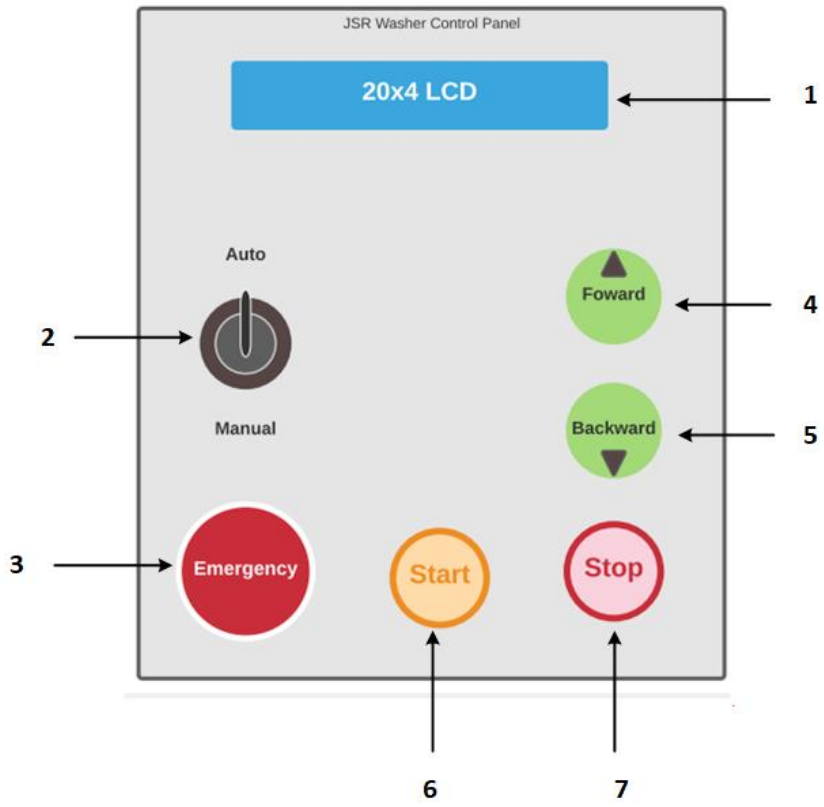

Figure 2: Control panel

Table 2: Component and Functionality of Figure 2

#	Component	Functionality
1	LCD display	Display the status of the process and functionalities
2	Auto/Manual selector switch	Transfer the operation into Auto/ Manual mode
3	Emergency	Stop the system operation in case of any emergency
4	Forward push button	Rotate the inner drum to the forward direction
5	Backward push button	Rotate the inner drum to the backward direction
6	Start push button	Start the washing process
7	Stop push button	Stop the washing process

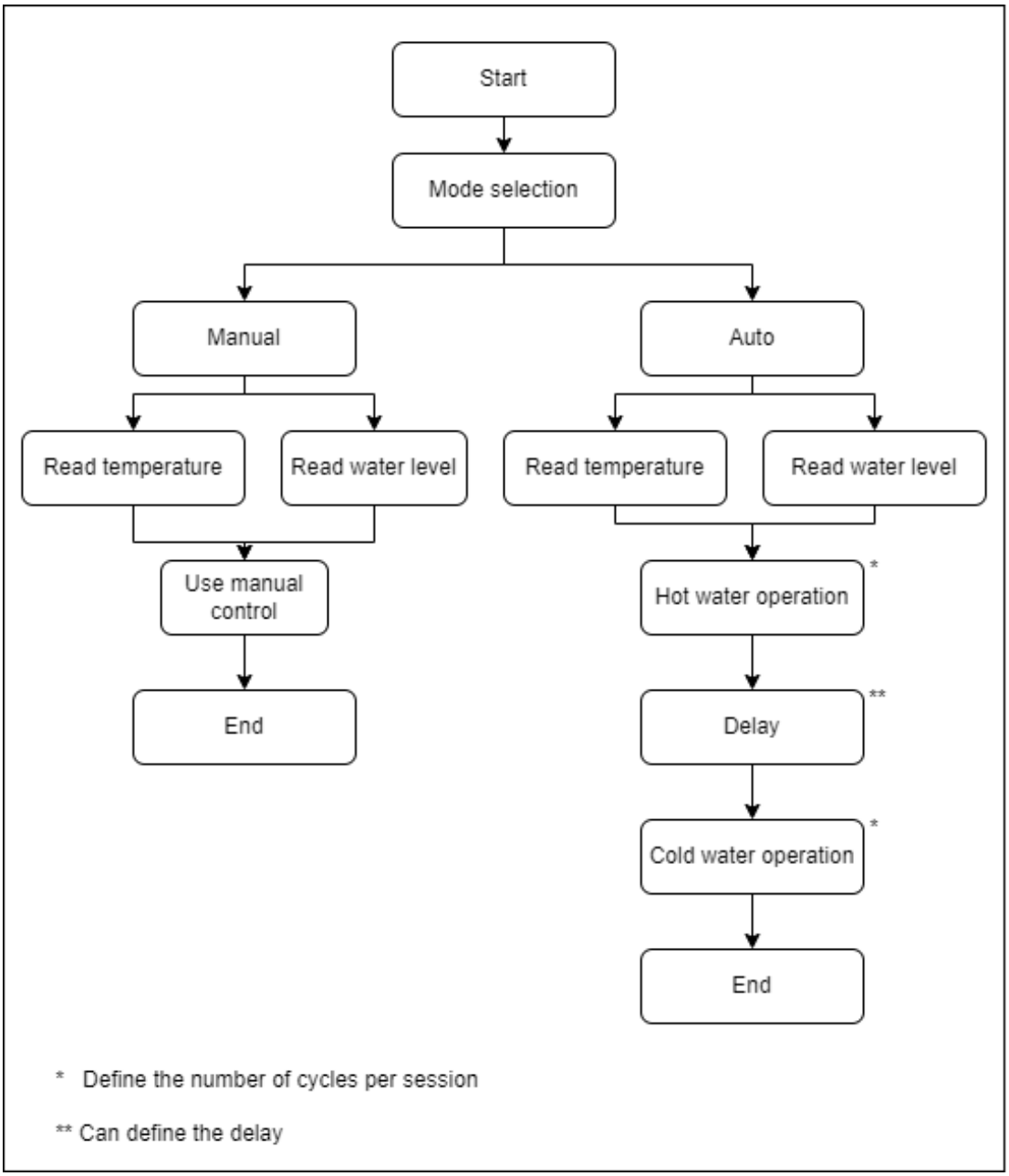

Figure 3: Overall block diagram

Users may choose the mode of operation between Manual and or Automatic modes.

Manual Mode: The operator needs to engage with the whole process starting from controlling hot water and regular water inlets, controlling the start and stoppage of drum rotation and controlling the number of hot-regular water cycles.

Automatic Mode: The operator should check the settings on required water levels, temperatures, number of hot-regular cycles, cycle durations etc. and press the start button. The process will continue without the intervention of an operator and will indicate alarm at the end of the washing process or if there is an interruption. This process is illustrated in figure 3.

6. DELIVERY OF SERVICES

The systems will be delivered as hardware deliverable implementing the functionalities listed in Table 1. The deliverables are concentrated into two modules as listed below.

1. Upgraded Washer

Upgrades to the washer will be provided with respect to

- Water level sensing
- Temperature measurement
- Lid closure indication for outer drum

2. Control Panel

Control panel will be provided with

- Controls (water flow, direction of the motor, process parameters)
- Displays (water temperature, date and time, countdown time of the cycle, water volume inside the drum)

The controller will be capable of switching the washing operation between automatic mode and the manual mode.

7. ASSUMPTIONS

This section captures the key assumptions and exclusions for the proposed initial design. Clarification and acknowledgment of assumptions in this section is important to shaping this engagement. Any updates to these assumptions will alter the estimated project approach, staffing level, cost and potentially the timeline.

- Full access to relevant functional, technical and business resources with adequate skills and knowledge to support the Oculus team members.
- Site visits must be allowed for Oculus team members to gather any specific requirement for hardware implementation and testing.
- Supporting hardware equipment should be provided by the company (SIL).
- The company (SIL) would provide a path to engage with other vendors to resolve issues that constrain Oculus team solutions from making timely deliveries.
- Any change/update of specifications will be replaced by any previous requirements or specifications document. Acceptance is always against (and only against) the latest signed off specification.
- Oculus, the team of consultants has assumed there will not be any discontinuation in the full project implementation cycle. If there will be any discontinuation, at any point for any duration by company (SIL), for a reason that Oculus team is not liable, the company (SIL) is liable to pay the cost based on the time the Oculus team spends on the project.
- Team Oculus will be liable to keep confidentiality of the company (SIL) including internal details and process of the system.
- Company (SIL) would cover any project related costs incurred by the team Oculus whilst delivering this project.
- According to the suggestions and feedback of this initial proposal, proposed costing valuation will be changed or not.
- The project scope defined in the Section 1 SCOPE, will be followed for the implementation.
- Team Oculus acknowledges that any task or activity that is not explicitly mentioned under the Section 1 SCOPE of this document is considered as out of scope and may incur additional costs.
- Any changes to the project plan will need to go through a Change Request Management Process and may have an impact on the estimated project approach, staffing level and cost.
- Changes to the scope of work to be delivered must be mutually agreed upon and approved jointly by the Oculus, the team of consultants and Company in writing. The Company must understand that changes to scope may result in additional effort/cost and will necessitate a Project Change Management Process.

- All features that are provided by the system will be reviewed and approved by the Company before delivery.
- All the sketches related to existing machines will be provided by the company including dimensions. Power sockets and water inlets and outlets will remain as previous.
- In addition, the following parameters are used in the solution designing process.

Temperature of the hot water	= 70 ℃
Motor current ratings	= 32 A
Water volume for one cycle	= 50 l

8. TESTING

All the functionalities of the system and the overall performance of the system will be tested.

Table 3: Testing Parameter and Equipment

Testing Parameter	Testing Equipment
Operation mode (auto/ manual)	Auto/ Manual selector switch
Water Temperature	Thermocouple
Water level	Level sensor
Ensure outer drum is properly closed	Limit switch
Display parameters	User interface

9. TRAINING

Training will be provided for end users, technicians upon the direction of the company.

10. OUT OF SCOPE

TBD

11. ESTIMATED TIMELINE

TBD

12. TERMS AND CONDITION

TBD

13. FINANCIAL CONSIDERATION

TBD