Abstract — The study titled “Controlled Environment and SMS Monitoring System for Pampanga Agricultural College Chicken Egg Farm Coop” was mainly concerned with the development of a system that will aid in maintaining the required temperature in the Pampanga Agricultural College (PAC) chicken egg farm which is either controlled by a computer with microcontroller devices or remotely via SMS. With the requirements of having a specified range of temperature to be maintained, the system was deemed to regulate the chicken egg farm temperature by switching on/off the cooling fans and the heating bulbs depending on the weather. A time-based music function was also integrated in the system in order to minimize the stress of the chicken during the time of laying eggs in their environment.

The study aimed to develop a low cost system that will improve the production of egg as well to minimize mortality rate of the chicken layers. This was done by maintaining the ideal room temperature needed by the chicken providing reliable report and real time control of system devices through SMS technology and available Open Source Microcontroller unit devices such as the Arduino MCU.

Keywords — agriculture, controlled environment, coop, design, efficiency, experiment, poultry management

I. INTRODUCTION

Agriculture is facing a challenge as well as an opportunity as doubling food production by 2050 is needed due to population growth [18] and a goal that imposes improving productivity [20]. Indeed, from a world perspective, we already are in crisis with one person out of seven starving [5]. But this is not a desperate situation as technology can support productivity as it was the case in Eastern and Southern Africa bananas [16]. As an example, [17] proved for Kenya, the importance of good farming practices to improve performance.

The topic is important as, in 2009, world chicken farms were estimated to be a 50 billion dollars market of which 9 billion from USA, 6 billion in Europe and 7 billion in China. Applying engineering processes to poultry farming may help to maximise the benefit to human kind in terms of cheaper and plentiful availability as well as contribute to the growth of the economy.

Throughout the years, there have been many technological innovations that were introduced to the world for a wide variety of problems. But there has not been so much technological change as the ones that occurred in the previous decades. From automobiles, computers, communication devices, to machines that facilitate the workings of the household to the industry, automation has become a prevalent fixture in societal development. The farming industry was using half of the population at the beginning of last century and now it provides only 3% of all jobs, due to automation and robotic [12], [6]. To keep on competitiveness improvement, focus must be put on a value chain approach [3] and appropriate use of technology.

Automation is defined as the use of machines, control systems and information technologies to optimize productivity in the production of goods and delivery of services. The correct incentive for applying automation is to increase productivity, and/or quality beyond that possible with current human labor levels so as to realize economies of scale, and/or realize predictable quality levels. In the scope of industrialization, automation is a step beyond mechanization. Whereas mechanization provides human operators with machinery to assist them with the muscular requirements of work, automation greatly decreases the need for human sensory and mental requirements while increasing load capacity, speed, and repeatability. Automation plays an increasingly important role in the world economy and in daily experience. Automation poses to be the solution to the low productivity resulting from the failure to control the heat, light and ventilation inside a chicken coop. A low cost automated light and cooling system is deemed to be a potential answer to the need to have a system that would allow for the control of the heat, light and ventilation that goes through the controlled environment for chicken coop.

II. SYSTEM SPECIFICATIONS

This paper presents a prototype of a system in order to automate the poultry management. It is two-parts: hardware, and software. The hardware specifications included the following:

- Temperature Sensor (2 pcs)
- Rs232 cable (2 pcs)
- 220 volts relay switching device (3 pcs)
• Arduino Microcontroller Unit
• Speaker
• Cooling Fan
• Bulbs
• Extension chords
• Cellular Phone with USB Cable

The project used the software “Visual Basic 6.0” because of its compatibility and was used primarily in the system development process. The software specification for the prototype also includes the following:
• Windows XP (32-bit)
• Visual Basic for XP
• Visual Studio for XP
• Temperature devices driver
• RS232 to USB converter drivers
• Motorola Phone kit installer
• Input32
• MySQL Database

III. PROCESS SPECIFICATIONS

A block diagram for the overall design process of the system was developed to make it easier for the researchers to construct their project and also to have a basis in creating a proposed system represented in Fig. 1.

![Block Diagram](image)

Fig 1. Block Diagram

IV. METHODOLOGY

Once each components hardware and software installed, an experiment was designed in order to determine if controlled environment can have an impact on productivity as well as mortality, compared to natural setting.

V. SUMMARY OF FINDINGS

The T1 which is the experimental group having a controlled environment as evaluated has a mean of 53.20 while the T2 which is under the natural environment group has a mean of 49.83. Comparing both results of the controlled and natural environment of the two (2) coops, T1 is significantly higher than T2 of 1% in terms of egg production. In addition, by looking at the chicken layers’ mortality rate, within the thirty (30) day period, T1 had a mean of 0.00 while the T2 had a mean of 0.20, and as to interpret, there are two chicken layers who died in the natural environment and none from the controlled environment. Statistical analysis (t-test) found that there is a minor significant difference between the two group in terms of chicken layers’ mortality but also made and impact on the egg’s production.

VI. CONCLUSION

After considering the physical design of the hardware, as well as the installation of the devices, the Controlled Environment and SMS Monitoring System for Pampanga Agricultural College Chicken Egg Farm Coop was successfully developed and implemented. The system was able to acquire reliable and stable data to monitor the temperature of the coop with the use of temperature sensor than, can be controlled with the use of SMS technology and devices such as cooling fan and bulb. Furthermore the system was able to maintain the required temperature in raising layers which is 25-32 °C which resulted to a higher production of eggs and prevent mortality of layers.

VII. RECOMMENDATIONS

Based on the findings of the study and on the conclusion arrived at, the following are recommended:
1. The researcher strongly suggests that the proposed system shall be implemented to control and monitor chicken coop.
2. Additional cooling fans and bulbs should be installed to make the proposed system more effective.
3. Training or seminar pertaining to the proposed system for project manager, faculty in-charge, farmers and college students is encouraged for optimum performance and utilization of the features offered by the said system.
4. Quality cables, equipment, and voltage regulator to should be used to make the proposed system more efficient.

This paper should be of interest not only to farmers looking for best practices in agriculture but also for several groups according to Kumar [10]:
• The policy-maker groups, who decide on resources allocation and investment for efficiency increases;
• The associations of agriculture and rural development to develop their expertise on improving various processes
• NGO and other development practitioners seeking for new available technologies
• Researchers to orient their efforts to important areas which require research efforts.

Educational and training organizations who needs information of the lessons learnt by past experiments.
As a final though, many studies showed the importance of empowering women and disseminating this technology thru women might be more effective [13].

REFERENCES