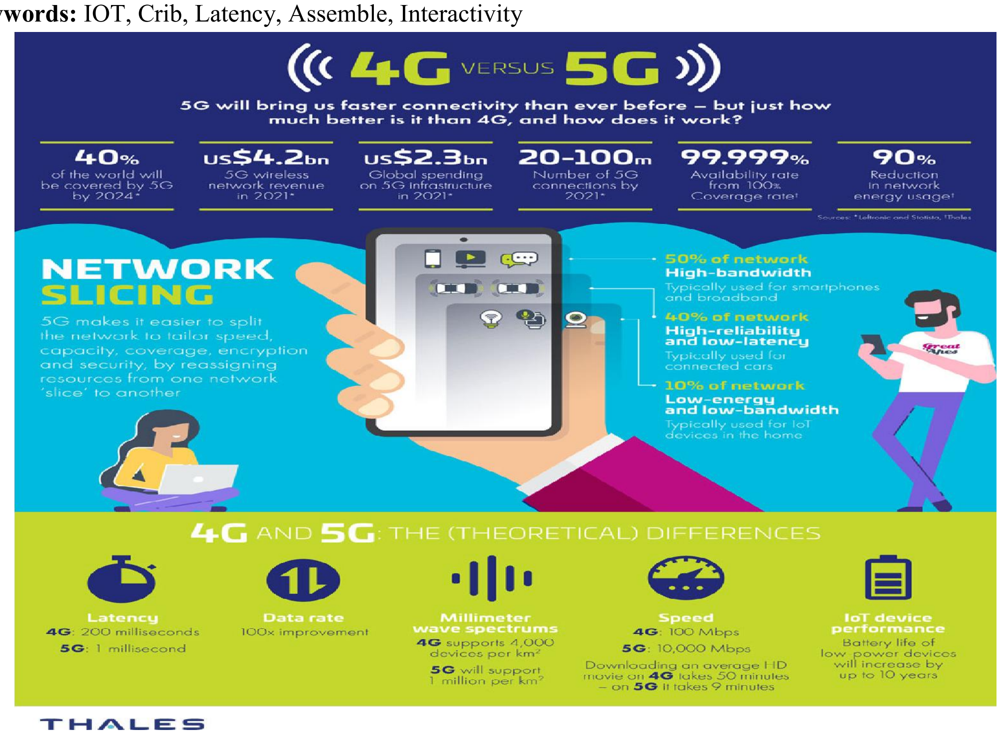
IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 1, May 2024

IOT Based Smart Crib

Renju John[1], Fiza Akbar[2], Naziya N J[3]
CEO Telecom 360[1]
Undergrad S6, Marian Engineering College, Trivandrum, Kerala, India[2]
Undergrad S8, Marian Engineering College, Trivandrum, Kerala, India[3]

Abstract: *The Internet of Things, **or** IoT, gets its name because each device can send and receive data from one another. So it is similar to the actual Internet. However, you need to send and receive data on the Internet. And it only connects two computers. But in IoT, the network is between various devices or things. And they send and receive data without human interference. The number of IoT devices is increasing every day. In 2021, there were 10 billion IoT devices. Currently, the world has over 14.4 billion IoT devices. And after deploying 5G worldwide, this number may rise to over 75 billion*

Keywords: IOT, Crib, Latency, Assemble, Interactivity



I. INTRODUCTION

IOT will make it possible for today's working mother to be present both at home and at work. 5G will provide a faster communication medium; you can expect speeds up to a few gigabits per second. As a result, your devices can coordinate and accomplish tasks faster. In addition, it will provide an ultra-low latency network; according to Verizon, early 5G deployment showed a latency of 30ms. That will help use **IoT devices** to do delicate tasks Finally, because 5G has a high bandwidth, you can connect more devices to it without experiencing quality loss.

In this paper I will explore the concept of a IOT Smart crib[1] an online Automatic baby crib for infants up to 2 years. This latest innovation fully automated IOT crib performs the 360 degree action for the mother for remote baby care by sending an alert to the smart phone, when the kid is disturbed, through a motion sensing IP CAM. After the mother is alerted she has the facility to swing the cradle using a motor swing again ,controlled through smart phone, sing a lullaby through a Wi-Fi enabled speaker , send a chimer to action and make sure the baby is put to rest again thus ensuring the 360 degree infant care.

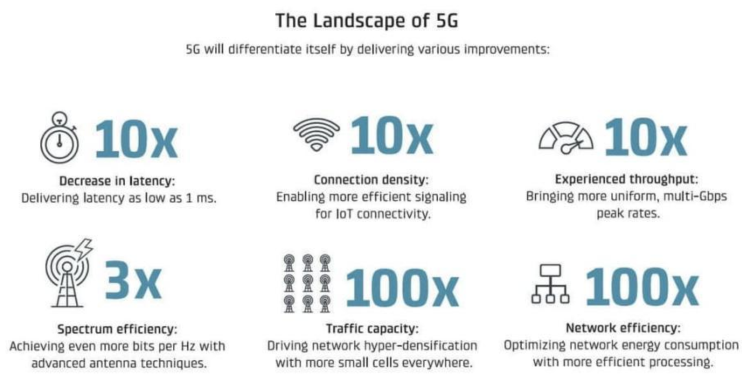


Figure 1: The 5G Environment

II. MATERIAL AND METHODS

The methodology requires large test coverage. The commercial success of the crib is linked to its ability to be compatible with many new and old smartphones and tablets. Because of fragmentation, it is not easy to build an IoT that can work well across a variety of different mobile operating systems and smartphones with different hardware components. As a result, it is important to test on many devices or configurations to find bugs that result from fragmentation. It is also essential to test all functionalities and the usability of the IoT and software to obtain an accurate report of the quality of the connectivity (object to software, software to object, and behaviour in case of interactions The Mobile IoT technologies LTE-M and NB-IoT[3] were designed for 5G but rolled forward to work in 4G. LTE-M and NB-IoT were designed for efficiency for devices that use less data in the prototype like Wi-Fi switches, and are suited for devices that have modest data requirements, but need a long battery life and comprehensive coverage. The commercial success of thus crib is ultimately tied to its performance, which is dependent on how quickly it can communicate with other IoT devices; wi.fi switches Wi-Fi speakers, smartphones and tablets, software in the form of its app or website, and more. With 5G, data-transfer speeds will increase significantly and the theoretical latency is only of the order of 1ms which is critical in infant care.

III. ASSEMBLING THE IOT BASED CRIB METHODOLOGY

The Engineering Test Bed operates as elaborated below:

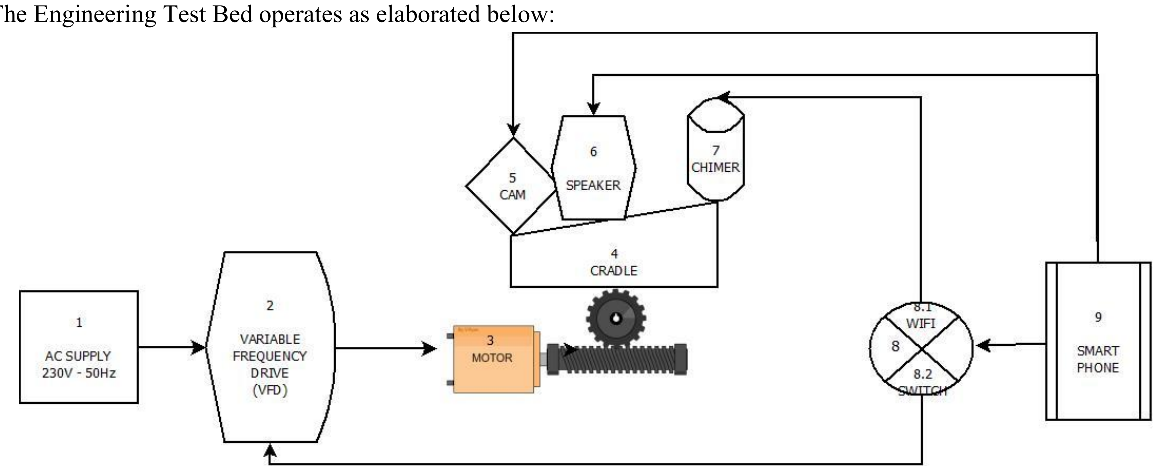


Figure 1: Engineering Assemble

The cradle is made of solid pine wood with white colour which minimizes distractions for the infant, promoting a calm and focused environment conductive to sleep. Designed ground elevation is provided to attach the swing motor to the bottom of the wooden ridge. Unlike conventional cribs the characteristic wooden ridge is not fixed to the crib. This ensures the infant's safety and comfort by minimizing any potential risks of overheating due to oscillatory motion of the crib. A motion sensing camera placed at Position (4) features PTZ with 4 MP resolutions for the mother to see her infant closely. Camera integrates an inbuilt microphone and speaker, facilitating two-way communication from any remote location via network connectivity. It boasts advanced motion detection analytics, enabling it to detect and track motion within its field of view. With pan and tilt functions, the camera autonomously tracks objects or individuals in real-time.

A two port Wi-Fi switch which is connected to 2 devices:

- **The chimer and**
- **The VFD**

Both Devices are controlled by the master device (smartphone (9)). Automated Baby chimer placed at (7) features elements crafted entirely from environmentally friendly hypoallergenic felt, coupled with hypoallergenic fillers. The conscientious choice of materials prioritizes the health and well-being of the baby, ensuring a safe and comfortable environment. The mother can conveniently control the baby chimer through the Wi-Fi switch. A Variable Frequency Drive (VFD) placed at (2), is incorporated into the system which regulates the speed and torque of the motor by adjusting the frequency and voltage of the electrical input. This allows for precise control over the motion of the wooden ridge ensuring smooth and consistent movement according to the desired speed and acceleration requirements.

An electric motor placed at (3), coupled with a worm gear mechanism, drives the motion of the wooden ridge.This setup efficiently transmits the necessary torque to set the ridge in oscillatory motion. The worm gear's design enables it to generate sufficient torque to turn the ridge at the required angular speed, ensuring smooth and controlled movement as needed for optimal functionality. This entire arrangement mimics an angular simple harmonic motion. The worm gear controls the oscillatory motion using a designed gear ratio. A Wi Fi Speaker placed at (6)can be seamlessly controlled via a smartphone application (9). The speaker operates wirelessly through the Wi-Fi switch (8), allowing the mother to manage audio playback without any physical connections such as AUX cords or USB cables.

List of IOT Devices

Device	**Master Control**
AC Motor (3)	Wi-Fi Switch
Chimer (7)	Wi –Fi Switch
Wi-Fi Speaker (6)	Smart Phone App
Motion Sensing IP Cam (5)	Smart Phone APP

The Engineering bed is thus summarized by 4 IOT devices 2 controlled by Wi-Fi switches and 2 controlled directly by the smartphone APP.

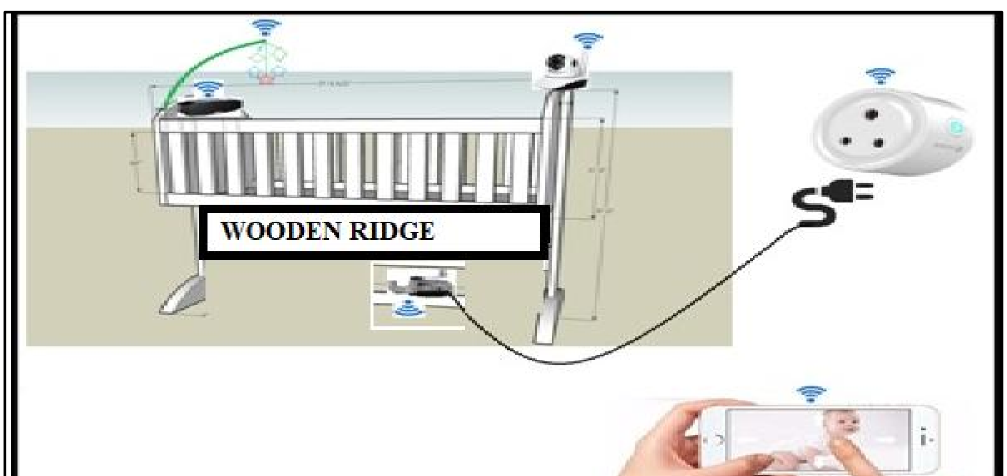


Figure 2(a): Ground Truth Summary Sketch

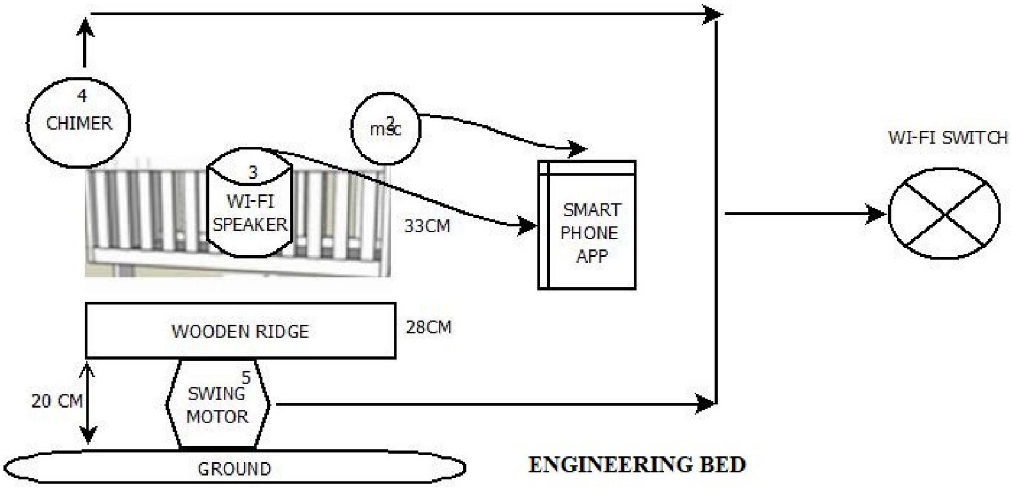


Figure 2(b): Dimensional Analysis

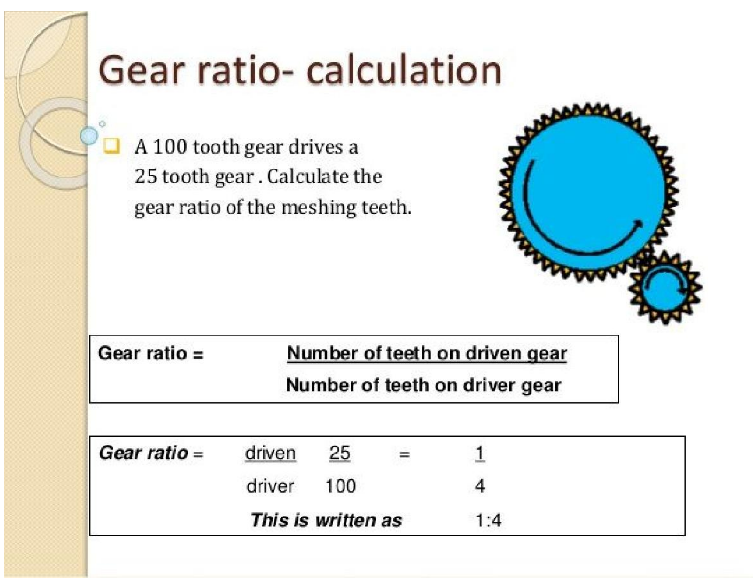


Figure 2(c): Gear Ratio Calculation

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 1, May 2024

Figure 3: Flow line

IV. RESULTS

Interaction in this context of IoT means interfaces which allow people to either monitor or configure IoT devices. The round trip latency was tested in 4G and 5G conditions. The packet delay variations were studied. The error rates were studied under LTE and NR conditions. The tests reported are from **Non standalone 5G Infra** which are the only ones available during the time of performing the test.

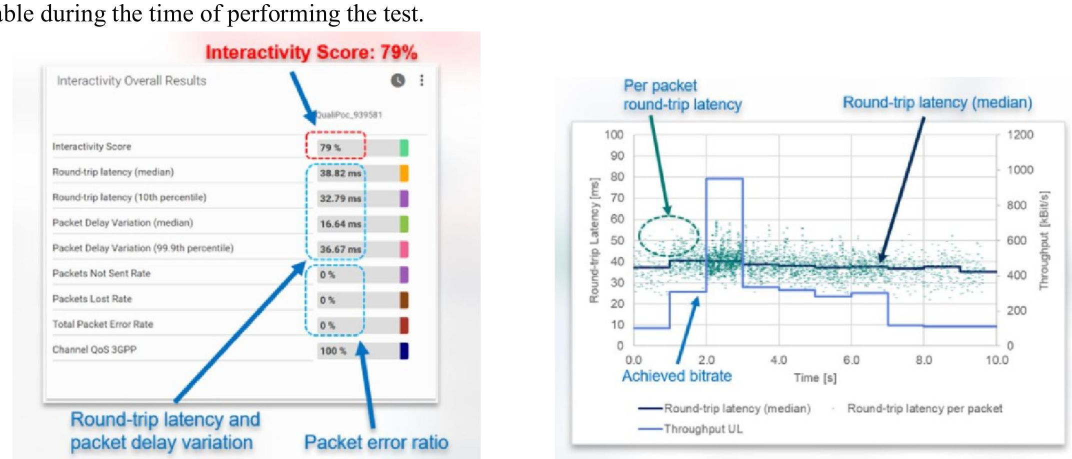


Figure 4(a): Interactivity Scores 4G-LTE

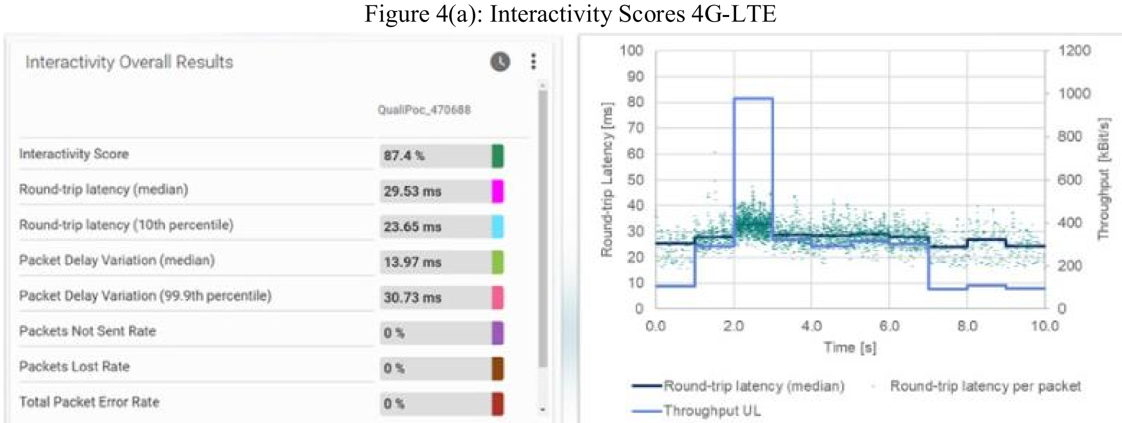


Figure 4(b): Interactivity Scores 5G-NR

V. DISCUSSION AND CONCLUSION

5G indicated interactivity scores of **87.4% over 4G 79%.**

5G is 25% more expensive than wired broadband for the 30 Mbps and 100 Mbps plans. This will reflect in the commercialisation of the product where the average cost of the assemble will be higher in the 5G environment currently.

Speed	Jio GigaFiber	Jio AirFiber
30 Mbps	Rs 399	Rs 599
100 Mbps	Rs 699	Rs 899
300 Mbps	Rs 1499	Rs 1499
500 Mbps	Rs 2499	Rs 2499
1 Gbps	Rs 3999	Rs 3999

Table 1: 4G vs 5G Cost

Product	Cost(Rs)
Compact Cradle	4750
IP cams	2000
Wi Fi Switch	1000
Wi Fi Speakers	1000
Swing motors	1500
Total	10250
Price Point	13325

Table 2: IOT Cost components

The cost of assembling these IOT device and add a 30% mark-up for distribution an average customer will shell out Around Rs 13,500/- for this **IOT operated Crib almost 3 times a standard Crib cost.**

The theoretical latency of 1 ms is far from achievable given the Non Standalone 5G Infra available currently.11 ms latency has been reported in Jio Air fibres. **The best values under Non standalone 5G is around 20 ms.**

REFERENCES

[1] V. Delipkumar and S. Jayalakshmy, "Baby Cradle Monitoring And Control Using Arduino," International Journal of Information And Computing Science, vol. 6, no. 3, pp. 409–413, 2019.

[2] M. Levy, D. Bhiwapurkar, G. Viswanathan, S. Kavyashree, and P. K. Yadav, "Smart Cradle For Baby Using FN-M16P Module," vol. 2, no. 10, pp. 2018–2020, 2019.

[3] A. F. Symon, N. Hassan, H. Rashid, I. U. Ahmed, and S. M. T. Reza, "Design and development of a smart baby monitoring system based on Raspberry Pi and Pi camera," in 4th International Conference on Advances in Electrical Engineering, ICAEE 2017, 2018, vol. 2018-Janua, pp. 117–122.

[4] C. Lu, C. Wu, and H. Su, "Intelligent Infant Monitoring System Involving a Wi-Fi Wireless Sensor Network," Advances in Intelligent Information Hiding and Multimedia Signal Processing, vol. 81, pp. 269–276, 2018.

[5] P. R. Lejin, M. J. Kuruvilla, George RamachaThykkadavil, and V. Vijai, "Design and fabrication B-care," International Journal for Innovative Research in Science & Technology, vol. 2, no. 12, pp. 56--63, 2016.

[6] R. D. V. M. P. N. Sundarajan, "Analytical Modelling and Design of a Mechatronic Cradle System," International Journal for Scientific Research & Development, vol. 3, no. 10, pp. 475–477, 2015.

[7] A. T. Rachanapalaskar, AkshadaWagh, ShwetaPandey, "Automatic Baby Cradle and Monitoring for Infant Care," Interbational Journal of Advanced Ressearch in Science and Engineering, vol. 5, no. 5, pp. 55–60, 2016.

[8] C. T. Chao, C. W. Wang, J. S. Chiou, and C. J. Wang, "An arduino-based resonant cradle design with infant cries recognition," Sensors (Switzerland), vol. 15, no. 8, pp. 18934–18949, 2015.

[9] M. P. Joshi and D. Mehetre, "IoT Based Smart Cradle System with an Android App for Baby Monitoring," in 2017 International Conference on Computing, Communication, Control and Automation (ICCUBEA), 2017, pp. 1–4.

[10] S. S. Bachhav and N. B. Chopade, “IoT Based Healthy Baby Cradle System,” International Journal of Advance Research and Innovative Ideas in Education, vol. 4, no. 4, pp. 822–828, 2018.

[11] S. Srikanth, P. Ramya, M. Satheesh, G. T. Philip, and K. Vineetha, “Smart Baby Cradle System,” International Journal of Advances in Scientific Research and Engineering, vol. 4, no. 3, pp. 51–60, 2018. 3rd International Conference on Engineering Sciences IOP Conf. Series: Materials Science and Engineering 671 (2020) 012050 IOP Publishing doi:10.1088/1757-899X/671/1/01205014

[12] A. Ide et al., “Starter Kit for Arduino,” Starter Kit for Arduino, pp. 1–86, 2018.

[13] Robotic Solutions, “HC-05 Bluetooth Module User ’s Manual V1 . 0,” User Manual, 2015.

[14] Fuzhou BringsmartintelligentTech.Co, “37GB550 High Torque Electric Motor,” Smart Bring Company. [Online]. Available: http://www.bringsmart.com/pd.jsp?id=128#_jcp=3_9.

[15] A. Williams, Microcontroller projects using the Basic Stamp, 2nd ed. Al Williams, 2002.

[16] J. Perry et al., “L298 H Bridge User’s Manual,” STMicroelectronics, 2000. [Online]. Available: http://www.st.com.

[17] SIMCom, “SIM900 the GSM/GPRS Module for M2M Applications,” GSM / GPRS Module, 2013. [Online]. Available: http://www.propox.com/download/docs/SIM900.pdf.

[18] G. Plaza and C. Road, “SIM 900-RS232 GSM/GPRS Modem- User Manual,” 2011. [Online]. Available: www.rhydolabz.comhttp://www.rhydolabz.com.

[19] S. Series, “SUBMINATURE HIGH POWER RELAY,” SONGLE RELAY. [Online]. Available: www.songlerelay.com.

[20] D. D. Keluarga, “Sensor Kits X40,” Joy-IT, 2017. [Online]. Available: http://sensorkit.en.joyit.ne