As $k \rightarrow \infty, V_k$ produces optimal results at every state of a sensor mote is denoted as state vector $(t, h, p).\, t \in \{t_1, \ldots, t_T\}$ indicate the time of the system . $h \in \{h_1, .., h_H\}$ is a determine of the uncertain state of the nodes at time-step, and $p \in \{p_1, \ldots, p_P\}$ is the amount of energy required to complete the environmental monitoring process. The transitioning probability from state (t_i, h_i, p_i) to state (t_j, h_j, p_j) at the rate $a \in A, p((t_i, h_i, p_i), a, (t_j, h_j, p_j)$, is denoted as $p_T\,(t_i, t_j) p_H(h_i, h_j) p_P\,(p_i, a, p_j)\; where$

$$p_T(t_i, t_j) = \begin{cases} 1\,, if\ i = j = T \\ 1, \quad\ if\ j = i + 1 \\ 0\ otherwise \end{cases}$$

$$p_H(t_i, t_j) = \begin{cases} p_H^{change}\ , if\ i = j \\ 2p_H^{change}, \quad if\ i = H, j = H - 1 \\ p_H^{change}\ if\ |i - j| = 1 \end{cases}$$

$$p_P(p_i, a, p_j) = \begin{cases} 1\,, if\ i = P \\ p_P(a), \quad if\ i = j \\ 1 - p_P(a)\ if\ j = i + 1 \\ 0\ otherwise \end{cases}$$

Thus, p_H^{same} and p_H^{change} be the probability value of certain and uncertain state in environmental status respectively. The rate of energy consumed by DSS is modeled via the reward function and it is calculated as

$$R(t, h, p), a) = \begin{matrix} -\mathrm{R}^{\text{powerout}}\ \ \text{if } \mathrm{p} = \mathrm{P}, \mathrm{t} < T \\ k_R.\, a.\, h\ , otherwise \end{matrix}$$

where k_R is a constant of proportionality

In this research work , MDP is considered as the centralized controller [23] to monitor uncertainty for environmental monitoring via specifying stochastic model with criticality of the information and the energy consumption of the sensor. For each state-action pair (s, a), specifies its “Q”. When the agent perform uncertain management task a in state s, receives reinforcement r and progress to state s', the subsequent keep informed rule is useful:

$$V(s) = \max_{a \in A} Q(s, a)$$

where , $0 < \alpha < 1$, Q values belongs to the optimal values and it is updated an immeasurable number of times. During the this process in MDP, the agent has to construct a transaction among examination and development of the policy with the intention of being learned, i.e., whether to perform the learned policy on a state. This ensures with the intention of the Q-values designed for each and every one states converge faster when compare to existing states in a learning trial.

IV. SIMULATION RESULTS

In order to perform experimentation work in this work prefer an earlier work [24], an emulation platform be able to decrease the improvement time of WSN. The emulation is able to be utilizing through other SnowFort users as well. Set up a network through 16 Telosb motes is illustrated in Figure 2. Mote 1 is considered a base station. The other 15 motes are second-hand designed for information collection and dispersed in an area of 150×130 square meters. The packet sequence number is second-hand in the direction of trace missing packets. When the base station notices the discontinuity of packet sequence numbers, a missing packet is acknowledged. Each and every one raw information is transmitting not including compression. The dimension of the information frame payload is maximized. This setup helps us in the direction of discover a scenario through utmost power consumption.

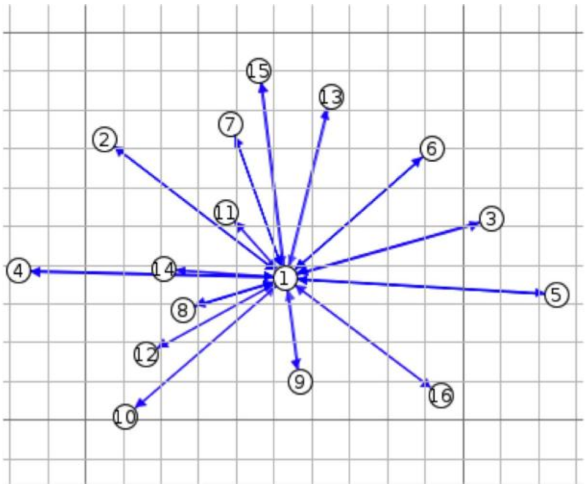

Figure 2: Emulation Topology Mote 1 is a base Station

Power Consumption: Designed for Telosb mote with four operation states such as CPU active, CPU inactive, I_{active} T_{active}

$$E_{total} = E_{active} + E_{inactive} + E_{TX} + E_{RX} + E_{Sensor}$$

$$= V\_supply \times (I_{active} T_{active} + I_{inactive} T_{inactive} + I_{TX} T_{TX} + I_{RX} T_{RX}) + V_{Sensor} I_{Sensor} T_{Sensor}$$

$$= T_{total} P_{total}$$

$$= T_{total} \times (P_{active} + P_{inactive} + P_{TX} + P_{RX} + P_{Senso}$$

where $E_S, P_S,$ and I_S is represented as energy consumption, the power, and the current utilization, in the operation status S correspondingly, V_{supply} represented as the deliver voltage, which characteristically is 3 volts, V_{Sensor} is represented as the make available voltage of sensor by means of the pin of mote, and TS is represented as the time continue in the process status S with active status, inactive position, transmission (TX) position, receipt (RX) position and sensor. In adding together, $T_{total} = T_{active} + T_{inactive}$. The power consumption of together I2C and ADC sensors is represented as E_{Sensor} . For sensors, the development time T_{Sensor} is T_{total} . evaluate the performance of proposed and existing methods in two major ways. In initial step of the work measure the performance of the schemas in terms of the communications, power expenditure and synchronization performance. Subsequent, measure network performance using Packet Drop Rate (PDR),

$$PDR = \left(1 - \frac{Number\ of\ packets\ received}{Number\ of\ packets\ transmitted} \times 100\%.\right.$$

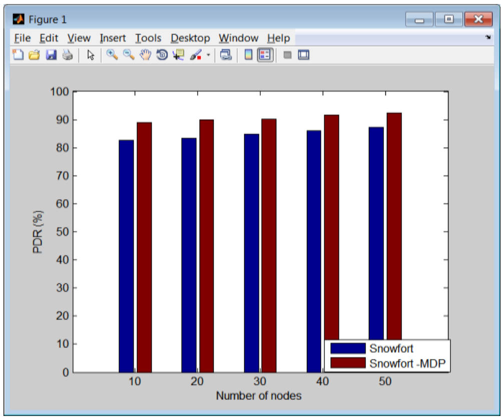

Figure 3: PDR vs Methods

Via the repeating experimentation work in several times, the PDR of proposed MDP schema and existing SnowFort is determined , it shows that the proposed MDP methods attains high, when compare to existing SnowFort. Designed for applications necessitate higher accuracy. Figure 3 shows PDR results between, proposed SnowFort –MDP and SnowFort system is able to support up to 54 motes on 32Hz in the simulation configuration. In simulation configuration, the PDR of proposed SnowFort -MDP is 92.37 % in NS2 emulation and SnowFort is 87.28 % for 50 nodes results are shown in Table 1.

Table 1: PDR vs Methods

No. of nodes	PDR (%)	
	Snowfort	Snowfort -MDP
10	82.56	88.91
20	83.27	89.82
30	84.85	90.21
40	86.12	91.51
50	87.28	92.38

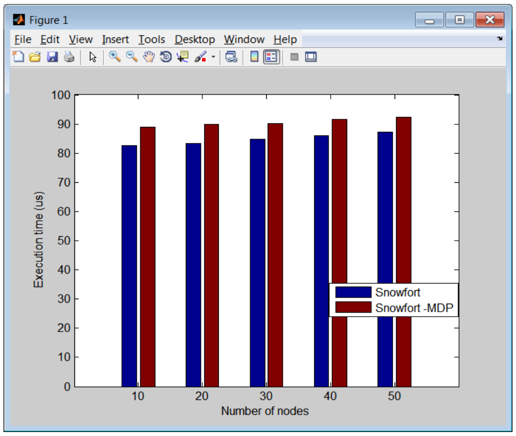

Figure 4: Execution Time vs. Methods

Via the repeating experimentation work in several times, the execution time of proposed MDP schema and existing SnowFort is determined , it shows that the proposed MDP methods attains less average time delay of $58\mu s$, when compare to existing SnowFort. Designed for applications necessitate higher accuracy. Figure 4 shows execution time between, proposed SnowFort –MDP and SnowFort system be able to support up to 54 motes on 32Hz in the simulation configuration. In simulation configuration, the execution time of proposed SnowFort -MDP is $58\mu s$ in NS2 emulation and SnowFort is $56\mu s$ for 50 nodes results are shown in Table 2.

Table 2: Execution Time vs Methods

No. of nodes	Execution time (μs)	
	Snowfort	Snowfort -MDP
10	84	32
20	86	38
30	88	42
40	92	48
50	93	56

The data Compression Ratio (CR) is determined as,

CR=(1−Total number of bits transmitted Total number of bits sampled) × 100%.

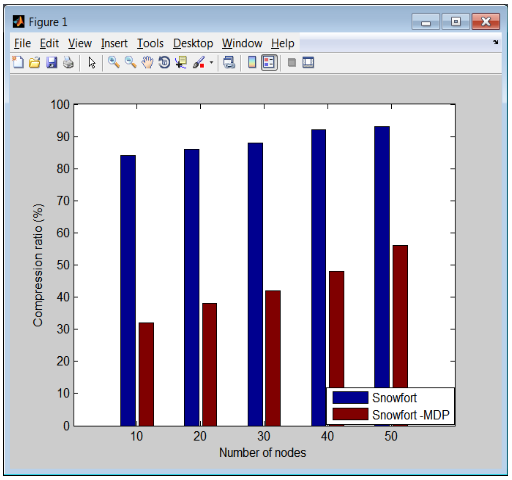

Figure 5: Compression Ratio vs. Methods

Via the repeating experimentation work in several times, the compression ratio of proposed MDP schema and existing SnowFort is measured , it shows that the proposed MDP methods attains a high compression ratio (CR) when compare to existing SnowFort. Designed for applications necessitate higher accuracy. Figure 5 shows Compression ratio between, proposed SnowFort –MDP and SnowFort system be able to support up to 54 motes on 32Hz in the simulation configuration. In simulation configuration, the Compression ratio of proposed SnowFort -MDP is 92.53 % in NS2 emulation and SnowFort is 85.51 % for 50 nodes results are shown in Table 3.

Table 3: Compression Ratio vs. Methods

No. of nodes	Compression ratio (%)	
	SnowFort	SnowFort -MDP
10	84	32
20	86	38
30	88	42
40	92	48
50	93	56

V. CONCLUSION AND FUTURE WORK

In this research work introduce a new Markov Decision Process (MDP) schema for uncertain management in WSN for environmental monitoring and SnowFort is introduced to perform the communication interface between the user and the wireless sensor node at receiver side. Snowfort initiate a novel architecture designed for the incorporation of together a WSN and a Decision Support System, by means of real-time visualization, investigative, and communication over a web interface. In addition the proposed MDP also introduces a time division based communication scheme, TDMA to improve the results of WSN in terms of the reliability and scalability to expand the lifetime. Packet loss minimization is performed through a MDP mechanism with the purpose of integrates uncertainty, and has been experimented via NS2 simulation tool. In addition the proposed work introduces a MDP be able to examine sensor information rates in a WSN designed for environmental monitoring. The controller was able to promise the least amount lifetime of the scheme through changing the decision on which the information is transferred beginning cloud server to sensor node of the environmental information. Future work in WSN environmental monitoring must comprise additional examination addicted to node platforms, the balancing of uneven energy distributions and long-term behavioral learn of scheme in real-world employment. Designed for node platforms, it may exist of exacting concentration to examine hybrid architectures with message communication control is handled centrally.

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